PROBLEMS

OF **applied geography**

II

Geographia Polonica 3

PWN–Polish Scientific Publishers

Contents of first volumes of

GEOGRAPHIA POLONICA

Vol. 1

11 papers devoted to the present status of geography in Poland and 3 papers giving the results of research. List of Polish geographers, geographical institutions and geographical periodicals. 262 pp., 20 Figures.

Vol. 2

34 papers prepared by Polish geographers for the XXth International Geographical Congress in London, July 1964. They represent various fields in geography and deal mainly with geographical problems of Poland. C. 280 pp., c. 100 Figures.

Vol. 3

Problems of Applied Geography II. Proceedings of the Second Anglo-Polish Seminar at Keele—Great Britain, September 9–20, 1962. Co-edited by the Institute of British Geographers (co-editor of the volume Professor Stanley H. Beaver). 21 papers by British and Polish geographers, c. 260 pp., c. 70 Figures.

Vol. 4

Methods of Economic Regionalization. Materials of the Second General Meeting of the Commission on Methods of Economic Regionalization, International Geographical Union, Jabłonna—Poland, September 9–14, 1963. Editor of the volume Professor Kazimierz Dziewoński and Assoc. Professor Andrzej Wróbel. Reports, communications and discussion. C. 260 pp., c. 20 Figures.

Subscription orders for the

GEOGRAPHIA POLONICA

should be placed with

EXPORT-IMPORT ENTERPRISE
RUCH

Warszawa, Wilcza 46, Poland
Cables: Exprimruch, Warszawa

Geographia Polonica 3

Problems of Applied Geography

II

Geographia Polonica

3

INSTITUTE OF BRITISH GEOGRAPHERS
INSTITUTE OF GEOGRAPHY • POLISH ACADEMY OF SCIENCES

Problems of Applied Geography

II

Proceedings of the Anglo-Polish Seminar
Keele, September 9–20, 1962

PWN—POLISH SCIENTIFIC PUBLISHERS
WARSZAWA 1964

Editors of this volume

STANLEY H. BEAVER
LESZEK KOSIŃSKI

Printed in Poland (D.R.P.)

CONTENTS

FOREWORD

The first Anglo-Polish Seminar was held in Poland in September 1959, and the papers read and discussed at those meetings were subsequently published under the title "Problems of Applied Geography". At the conclusion of the Seminar a resolution was passed stressing the value of the mutual exchange of opinions and points of view, and agreeing to hold a further meeting in Great Britain after a suitable interval of time.

The second meeting took place at the University of Keele in September 1962; it was organized by the Institute of British Geographers, with the cooperation of the Institute of Geography of the Polish Academy of Sciences, and with generous financial help from the Frederick Soddy Trust. The officials of the two Institutes upon whom most of the organization devolved were Dr. Osborne on the British side and Mr. Werwicki on the Polish side.

S. H. BEAVER

Leader of the British Delegation

The Polish members of the Seminar are deeply appreciative of the hospitality afforded to them by their British colleagues, in London, at Keele and other University Centres, and would like to express their gratitude for the friendly atmosphere in which the whole meeting was conducted. They would also like to return thanks for the handsome gift of British maps which each member of the group received.

S. LESZCZYCKI

Leader of the Polish Delegation

LIST OF PARTICIPANTS IN SECOND ANGLO-POLISH SEMINAR

GREAT BRITAIN

1. Prof. S. H. Beaver, University of Keele
3. Prof. T. H. Elkins, University of Sussex
4. Prof. A. E. Smailes, Queen Mary College, University of London
5. Prof. M. J. Wise, London School of Economics and Political Science, University of London
6. Dr. E. Brooks, University of Liverpool
7. Mr. A. A. L. Caesar, University of Cambridge
8. Mr. R. A. French, University College, London
9. Dr. S. Gregory, University of Liverpool
10. Dr. H. C. K. Henderson, Birkbeck College, University of London
11. Mr. D. Herbert, University of Keele
12. Mr. G. North, University of Manchester
13. Dr. R. H. Osborne, University of Nottingham
14. Mr. H. B. Rodgers, University of Manchester
15. Mr. W. M. Williams, University of Keele
16. Miss Joan M. Kenworthy, University of Liverpool
17. Dr. Margaret C. Storrie, Bedford College, University of London

POLAND

1. Prof. S. Leszczycki, Institute of Geography, Polish Academy of Sciences, Warszawa (P.A.N.), Warsaw University
2. Prof. K. Dziewoński, P.A.N., Warszawa
3. Prof. R. Galon, P.A.N., Copernicus University, Toruń
4. Prof. Maria Kielczewska-Zaleska, P.A.N., Warszawa
5. Prof. J. Kostrowicki, P.A.N., Warszawa
6. Prof. A. Wrzosek, Jagellonian University, Kraków
7. Dr. Sylwia Gilewska, P.A.N., Kraków
8. Dr. A. Kukliński, P.A.N., Warszawa

9. Mrs. Wiesława Różycka, Institute of Town Planning and Architecture, Warszawa
10. Mr. J. Szczepkowski, Regional Planning Bureau, Bydgoszcz
11. Mr. A. Werwicki, P.A.N., Warszawa
12. Dr. A. Wróbel, P.A.N., Warszawa

THE REPORT OF THE MEETING

The Polish and British members of the Seminar assembled on the evening of Sunday, September 9th, at Canterbury Hall, W.C.1, one of the Halls of Residence of the University of London. The proceedings were opened with a speech of welcome by Professor S. H. Beaver, Vice-President of the Institute of British Geographers and leader of the British delegation, after which Mr. J. R. James, Chief Planner in the Ministry of Housing & Local Government, gave an address on some major problems of Town & Country Planning in England and Wales.

On Monday, September 10th, the Seminar visited the Ministry of Housing & Local Government in Whitehall, where Mr. James, Dr. E. C. Willatts and other senior members of the staff talked informally about the planning process and about an exhibition of maps and plans showing various aspects of the Department's work. These included some of the published and other national planning maps on the scale of 1 : 625,000 designed to show for the whole country, e.g. the physical background, land use pattern, economic resources and the distribution of population and its trends of change.

Other maps showed the up-to-date position in the control of the outward growth of major cities through the policy of defining and confirming Green Belts and protecting the surrounding countryside and of the protection of a considerable portion of the remoter countryside by means of the creation of National Parks and the designation and confirmation of other tracts as Areas of Outstanding Natural Beauty, which together with Green Belts, now safeguard about 23% of the whole country.

The method by which the local planning authorities control development was demonstrated by means of typical Development Plans for a rural county and the Town Map and Programme Map for a county borough. These are prepared by the local planning authorities and become the operative framework for development control after they have been officially approved by the Minister.

The programme designating and developing New Towns, of which two have already been completed and ten others are at various stages of construc-

tion in England and Wales was shown, with the aid of plans, lay-outs and photographs.

At luncheon the members were the guests of the British Council at its headquarters, and the afternoon was free for private visits or sightseeing. In the evening dinner was taken at the National Liberal Club by kind invitation of Mr. E. G. Godfrey.

Tuesday 11th was occupied by the journey from London to Keele. Taking advantage of the motorway M1, a speedy traverse of the succession of vales and scarps in the Tertiary, Cretaceous and Jurassic formations was followed by a brief halt in Coventry—just time enough to see the exterior of the new Cathedral—and a continuation to Birmingham University. Here, after a short lecture by Mr. M. B. Stedman on the re-development of the city and a lunch at which the party was entertained by Professor D. L. Linton, President of the I.B.G., the party was conducted on a short tour of the re-developed central areas. The final part of the journey lay through the industrial district known as the Black Country to Wolverhampton, and across the agricultural plain of mid-Staffordshire, to Keele, on the edge of the North Staffordshire coalfield. In the evening, in the elegant, richly decorated ball-room of Keele Hall, the central building of the University of Keele, Professor Beaver gave an illustrated lecture on the Potteries district.

On Wednesday 12th the first group of papers was read and discussed. The morning was devoted, under the chairmanship of Professor Beaver, to the discussion of methodological problems, with papers by Professor Leszczycki and Professor Wise. In the afternoon, with Professor Leszczycki in the chair, papers by Professor Dziewoński, Dr. Kukliński, Professor Smailes and Professor Elkins, on the theme of urbanization and industrialization were discussed.

In the evening, with Professor Edwards in the chair, Messrs. Herbert and Williams read a paper on methods of urban study, with particular reference to Newcastle-under-Lyme and Hanley.

On Thursday 13th Professor Beaver conducted the party on a tour of the Potteries coalfield and its conurbation, during which features of the cultural landscape shown in the lecture were demonstrated. At the conclusion of the tour, tea was taken in the garden of Professor Beaver's house on the University campus. In the evening the Vice-Chancellor of the University of Keele, Dr. H. M. Taylor, held a reception in Keele Hall for the members of the Seminar.

On Friday 14th the meetings were under the chairmanship in turn of Professor Dziewoński, Professor Smailes, Professor Wise and Professor Galon. Papers on small towns by Professor Kielczewska-Zaleska and Professor Edwards were followed by one on migration within Great Britain by Dr. Osborne.

In the afternoon, two papers on urban functions, by Mr. Wróbel and Mr. Werwicki, were discussed. The members then adjourned to another hall

in the University, where an exhibition to illustrate planning in the County of Stafford had been mounted by courtesy of the County Planning Officer. The exhibition was introduced by Miss Mary Burns, Research Officer in the County Planning Department, who explained the functions of the Department and commented on the many maps and photographs which were displayed.

The evening session was devoted to agricultural topics with papers by Professor Kostrowicki and Dr. Henderson.

On Saturday 15th, under the chairmanship of Professor Edwards and Mr. Caesar, the first group of papers lay within the field of applied physical geography. Professor Galon spoke on hydrological studies in Poland, Dr. Gregory on the water resources of north-west England, Mrs. Różycka on physiographic studies in town and country planning, Miss Gilewska on the changing physical environment of Upper Silesia. In the next session, with Professor Wrzosek in the chair, two papers on regional planning were discussed, by Mr. Rodgers on north-west England and by Mr. Szczepkowski on the lower Vistula valley.

Sunday, 16th, was occupied by an excursion to the Shropshire coalfield, led by Professor Beaver. This area may be described as the "cradle" of the Industrial Revolution, for it was at Coalbrookdale that Abraham Darby first smelted the local iron-ore with coke made from one of the local coal seams, in about 1709. The site of Darby's works is now a museum of industrial archaeology, which the party visited. Physically the area is interesting because of the great gorge of the river Severn, which was cut by the overflow from a large pro-glacial lake; the deep incision provided many transport problems, especially for the early canals, and the party walked up one of the inclined planes by which, a hundred years ago, the boats were hauled up from the river to the plateau level. The coalfield is now largely worked out, and many ancient spoil-heaps remain, covered with grass or trees and now almost a natural part of the landscape. There are no iron smelting works left, though there are numerous metal-fabricating and engineering works. In the middle of the field is the area designated for the "New Town" of Dawley. This will take overspill population from Birmingham, and will re-develop a large area which is at present a mixture of industrial villages, poor farms and derelict land.

For the next three days the party made a rapid tour through northern England, via the Cheshire Plain, Merseyside, the Lake District and the northern Pennines to Durham.

The first stage of this journey lay across the Cheshire Plain, with its rich dairy-farming, to the salt-fields and chemical works of Northwich, where the brine-pumping, and both old-fashioned and modern salt and chemical works were seen, together with the navigable river Weaver and the remarkable vertical boat-lift by which it is linked to the Trent & Mersey Canal.

After a brief glimpse of the lower Mersey at Runcorn, the new road

bridge was crossed, and Liverpool University was reached for lunch. In the afternoon, under the guidance of Dr. R. K. Gresswell, the journey was continued across the plain of west Lancashire, passing through the elegant residential and holiday town of Southport and across the rich agricultural lands between here and Preston, comprising first the drained peat lands, with their black soils and intensive vegetable cultivation (mainly salad crops) and secondly the glacial till soils which provide fine dairy pastures. Preston is an outpost of the Lancashire cotton industry, and a great engineering centre and communications focus. An undulating drift-strewn plain, mainly in grass farming, stretches as far as Lancaster, and then the road winds round the head of the Kent estuary to the small seaside town of Grange-over-Sands, where the night was spent.

The journey on September 18th from Grange-over-Sands to Durham provided opportunities of seeing a diversity of the landscapes of northern England including some of the finest scenery of the country.

To Penrith the route made a south to north traverse through the Lake District, a National Park where the amenity value of the countryside is now safe-guarded against unseemly building and economic development. Passing by Windermere, Rydal Water, Grassmere and over the Kirkstone Pass (450 m) to Ullswater and thence to Penrith, the route gave views of ribbon lakes and mountain tarns with scenic contrasts between the rounded, well-wooded Silurian sedimentary rocks and the craggy fells on the Ordovician volcanics.

Turning east from the Lake District the well-farmed Vale of Eden, with its hummocky, drumlin landscape, was crossed to climb the Pennine escarpment at Hartside (576 m) and the moorland road was followed to Alston, a market town and old lead mining centre at 300 m. Thence the road up Nentdale and over the watershed to descend Allendale provided further examples of the moorland plant associations, dales farming, and numerous residual features of past lead mining activity.

A detour was made north across the Tyne valley to the frontier of the Roman empire as marked by Hadrian's Wall. A stretch of the Wall was followed on foot west of Borcovicium where it surmounts the crags of the great Whin Sill escarpment along the northern flank of the Tyne Corridor. The Tyne valley was crossed again at the abbey town of Hexham to approach Durham by Lanchester and the Browney valley. Approaching the coalfield an excellent view was obtained of the great steel works of Consett, established in 1840 on its western edge—the only surviving steel works sited actually on the coalfield, where it persists on an inland site using imported ore.

In the evening Professor G. H. J. Daysh, of King's College, Newcastle, gave a lecture on the North-East "Development Area" and its backround. The party was entertained to dinner by Mr. L. Slater, a former head of the Geography Department in Durham and now Master of University College.

This College is housed in the mediaeval castle of Durham, which protected the great Cathedral, overlooking the loop of the deeply-incised river Wear; the members of the Seminar spent two pleasant nights within these ancient walls.

On September 19th a very full programme under the guidance of Mr. M. R. G. Conzen included a visit to the Team Valley Trading Estate. This was established before the war as part of the campaign to reduce unemployment in the north-east industrial region and to inject new industries to balance the hitherto one-sided industrial structure which had depended over-much upon coal-mining and ship-building. Since the war it has greatly expanded and has a wide variety of manufacturing industries. After lunch at King's College, Newcastle, a launch trip down the river Tyne, to its mouth, past the great shipyards, provided one of the highlights of the excursion. Rejoining the coach at South Shields, the afternoon tour took us via Sunderland and the East Durham plateau, largely arable but studded with large collieries, to the New Town of Peterlee, which was established in 1948 to provide new and better houses for miners; the attempt of the town to attract new light industry has so far not been very successful, and many of the workers who are not miners have to commute to Hartlepool, Durham or Middlesbrough.

On September 20th the party returned by coach to London, under the guidance of Professor K. C. Edwards. Almost the entire journey was made along the A.1, the "Great North Road", crossing the southern part of the Durham coalfield to the great railway town of Darlington, through the Northallerton "corridor" between the Pennine foothills and the Jurassic scarp of the North York moors, crossing the river Aire at Ferrybridge and passing through the "concealed" part of the Yorkshire coalfield, by-passing Doncaster.

Lunch was taken at Eaton Hall, a training college for teachers near Retford, and the route continued southwards to Newark, near which a short diversion was made to visit the cemetery which contains the graves of several hundred men of the Polish Army and Air Force, including that of General Sikorski.

From Newark to London the route lay across the strike of the geological formations, and a succession of scarplands was crossed, first the Lias clay vale of Belvoir, then the Middle Lias escarpment, beyond which lies Grantham, then the wide belt of Jurassic limestones and ironstones, followed by the Oxford clay vale (with its concentration of brick works near Peterborough) and the edge of the Fenland, the Greensand escarpment and the vale of the Gault clay, and then the Chalk escarpment of the Chiltern Hills. The "New Town" of Stevenage was seen from the by-pass road, and the route also passed the New Towns of Welwyn and Hatfield, before entering the suburbs of London.

The proceedings concluded with an evening reception at the Polish Embassy, and the members dispersed on the following morning.

RESOLUTION APPROVED BY THE PARTICIPANTS IN THE SEMINAR

The Second Anglo-Polish Seminar in Applied Geography, meeting at the University of Keele in September 1962, resolves as follows:

1. THAT the proceedings of the Keele Seminar shall be published, if possible before the I.G.U. Congress of 1964;
2. THAT the third seminar shall be held in Poland, at a place to be decided later, in the year 1966, and that on this occasion a larger membership shall be permitted for the visiting delegation;
3. THAT because of the considerable and rapid advances in the field of applied geography, and of the part which such studies are playing in town and country planning in both countries, an application shall be lodged with UNESCO for the recognition of the Seminar as a permanent organization for east-west cultural co-operation, with meetings every four years, phased half-way between I.G.U. Congresses;
4. THAT the topic of the third seminar shall be "Advances in the Methods and Techniques of Applied Geography".
5. THAT votes of thanks be accorded to the Vice-Chancellor and the authorities of the University of Keele, who provided accommodation and hospitality, and to the Soddy Trust and to the Royal Society, whose generous contributions of funds enabled the Institute of British Geographers to organize and to finance the Seminar.

THE POTTERIES — A BRIEF SUMMARY

Stanley H. Beaver

(1) The coalfield

The Potteries coalfield covers about 100 square miles (260 km²); it is triangular in shape, with its apex pointing northwards. On the north-eastern side it is bounded by the outcrop of older (Namurian)rocks; on the north-western side the boundary is mostly a strong fault which throws the Coal Measures (Westphalian) down to the west beneath the Triassic rocks of the Cheshire Plain; the southern limit is indeterminate, since the syncline pitches southwards and the Coal Measures pass under a deep cover of Triassic rocks, but effectively the boundary is the scarp of the Bunter Pebble Beds (Triassic) which wrap round the coalfield on the south-eastern, southern and south-western sides.

The coalfield is not a simple structure. The main syncline runs from the apex, about 4 km east of Congleton, in a SSW direction to beyond Keele; but it is much disturbed by large faults running NNW-SSE (the Newcastle and Apedale Faults), and its western limb is complicated by a sharp anticlinal, just to the east of the boundary fault (Fig. 1).

Within the coalfield several stratigraphical subdivisions are significant:

(Westphalian)

- (Morganian) Upper Coal Measures
  - Keele Beds—red and purple sandstones and mudstones
  - Newcastle Beds—buff sandstone
  - Etruria Marl—purple mudstone (brick and tile clays)
  - Blackband Group—shales with coals, ironstone, and fireclays.
- (Ammanian)
  - Middle Coal Measures—shales with coals, ironstones, pottery clays and fireclays.
  - Lower Coal Measures—shales and sandstones, few coals.

The mineral resources of the coalfield are thus considerable.

(a) *Coal.* This is a rich coalfield, with an aggregate of 42 m of coal in about

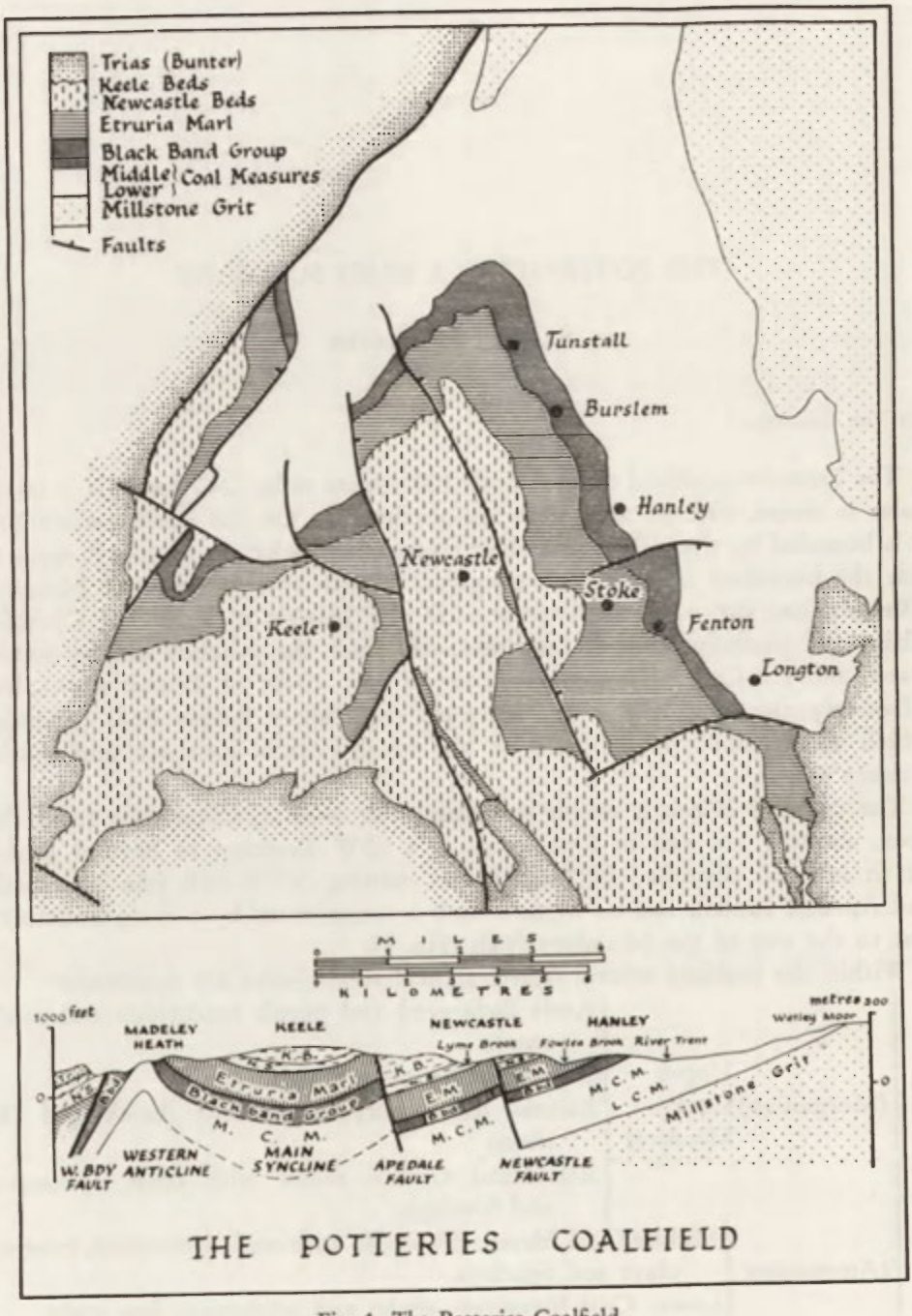


Fig. 1. The Potteries Coalfield

30 seams, though only half this number are regularly worked. A wide variety of coal types is produced, but two of major significance are the "long flame" coals which were until recently the mainstay of the pottery industry, and the coking coals which have contributed much to the growth of the iron and steel industry and which are perhaps the most important reserve for the future. Fifteen shaft mines and a number of small drifts or adits (known locally as "footrails") produce between them some 6–6½ million tons of coal a year.

(b) *Ironstone.* Two varieties of ironstone occur, but both are essentially siderite ($FeCO_3$) or "clay-ironstone". The "clayband" type, with metallic iron content 25–40%, occurs in the upper half of the Middle Coal Measures, in thin seams or as beds of nodules, from a few centimetres to one metre or so in thickness. The "blackband" type occurs in the Blackband Group at the base of the Upper Coal Measures. The seams commonly overlie coal seams, and the ironstone contains coaly matter sufficient to enable the ore to be calcined without the use of coal; the iron content is around 40%. Though both types were extensively worked in the past, and though extensive reserves probably remain, they are no longer economic to mine, and the local iron industry depends on lean ironstones from the Jurassic rocks of the East Midlands and on richer ores imported from a wide range of foreign countries.

(c) *Pottery clays and fireclays.* Clays suitable for the making of coarse earthenware are frequent, especially in the upper part of the Middle Coal Measures and in the Blackband Group; and it was upon these clays that the local pottery industry was founded. In addition, refractory clays (fireclays), used for the manufacture of salt-glazed sanitary ware such as sewage pipes, for the lining of the kilns and for the manufacture of saggars (the containers in which the pottery wares are placed for firing in the old-fashioned bottle-shaped kilns), are found, usually underlying coal seams in the Blackband Group.

(d) *Brick and tile clays.* The Etruria Marl yields enormous quantities of clay for the manufacture of common building bricks (usually red in colour), engineering bricks ("Staffordshire blues") and red or blue tiles for flooring and roofing. The industry is a declining one, however, for the blue bricks have been largely displaced by the use of concrete as a structural material, and concrete roofing tiles are taking the place of clay tiles (just as, a century ago, clay tiles began to displace slate roofs). Bricks are also made from clays occurring in the Middle Coal Measures.

Outside the coalfield proper, the outcrop of the Bunter Pebble Beds yields vast quantities of *sand and gravel* for building and concrete-making. The quartzite pebbles are extremely tough and non-porous, and the crushed and graded gravel is of very high quality, much in demand outside as well as inside the Potteries district.

(2) The land surface

In general the Potteries coalfield is bounded by ridges of high ground: on the north-east, Brown Edge and Baddeley Edge are scarped ridges of Millstone Grit; on the north-west, the western anticlinal fold corresponds to a fairly sharp ridge, steepest in the north, where, at Mow Cop, the Millstone Grit is pinched up in the core of the fold; on the south and south-east, the Bunter scarp overlooks the coalfield. Within the coal basin, however, the synclinal fold does not, except at the northern end (Biddulph) correspond to a valley; and the main drainage lines run from NNW to SSE, following the strike of the rocks on the eastern limb of the syncline. The existence of two strong faults—the Newcastle and Apedale Faults (the latter having a maximum throw of about 600 m)—is partly responsible for the pattern, since these strike-faults cause the repetition of the outcrop of the relatively soft Etruria Marl which has been eroded into valleys. In order from east to west the valleys are the Head of Trent, the Foxley Brook, the Fowlea Brook (the most important) and the Lyme Brook. Owing to the westerly dip of the beds each of these valleys has a tendency to be asymmetrical, with the right bank steeper than the left.

(3) The conurbation

The North Staffordshire town-cluster comprises the six towns (Tunstall, Burslem, Hanley, Fenton, Longton and Stoke-upon-Trent) which form the City of Stoke-on-Trent, together with the adjacent Borough of Newcastle-under-Lyme and the smaller townships to the north—Kidsgrove and Biddulph. Apart from the two northern outposts, the others fall into four types: (i) the three northern Potteries towns, Tunstall, Burslem and Hanley, occupy ridge-top sites on the interfluve between the Foxery and Fowlea valleys; this interfluve corresponds exactly with the outcrop of the Blackband Group, and it was from this geological formation, together with the upper Middle Coal Measures which lay immediately to the east, that the clays and coals for the early pottery industry were obtained, so that potteries clustered thickly in the growing towns; (ii) the two southern Potteries towns, Fenton and Longton, grew up as ribbon settlements along the main road from Newcastle to Derby, just where this road crosses the outcrop of the Blackband Group and the upper part of the Middle Coal Measures—where, as before, the raw materials and fuel were readily available for the potteries; (iii) Stoke-upon-Trent, which has given its name to the whole city, lies in a hollow, at the junction of the river Trent and the Fowlea Brook; here the main Newcastle–Derby road was crossed in the late 18th century by the Trent and Mersey Canal and in the mid-19th century by the North Staffordshire Railway, both

of which ran up the Fowlea valley, and so Stoke became the communications centre, with only a few canal-side potteries; (iv) the ancient borough of Newcastle-under-Lyme, founded early in the 12th century as a garrison town and market centre, in the valley of the Lyme Brook, has had an entirely different and non-industrial history. It became a road focus and agricultural market, and the Industrial Revolution passed it by, for since it lies on the Upper Coal Measures (the "concealed" coalfield) it had no surface outcrops of coal or pottery clay, and it played no part at all in the growth of the pottery industry. But by reason of its high and well-drained site (mostly on the sandstones of the Upper Coal Measures), with no coal mines and no potteries, no liability to subsidence and no atmospheric pollution, it became a residential area for the wealthier potters in the late 19th century, and these same factors have contributed to its considerable expansion, especially to the north and to the south, since the First World War.

(4) The industrial structure

The population of the North Staffordshire industrial region in 1961 was about 376,000, made up as follows (with 1931 and 1951 figures for comparison):

Table 1. Population

Administrative areas	1961	1951	1931
City of Stoke	266,000	275,000	276,000
Newcastle Borough	76,000	70,000	55,000
Kidsgrove Urban District	20,000	16,000	14,000
Biddulph Urban District	14,000	11,000	9000

Much of the expansion of Newcastle, Kidsgrove and Biddulph has clearly been at the expense of Stoke, which has actually lost population during the last three decades.

The insured working population numbers almost 200,000 of whom 75,000 (38%) are females.

Table 2. Employment in the Potteries Conurbation
(Ministry of Labour figures for 1962)

Locality	Male	Female	Total
Stoke	94,969	60,331	153,300
Newcastle	17,810	11,315	29,125
Kidsgrove	6460	3052	9512
Biddulph	2829	1026	3855
Total	122,068	75,724	197,792

A comparison of this table with the previous one shows clearly that the number of jobs available per head of population is much lower in Newcastle and in Biddulph than it is in Stoke and Kidsgrove, which are more heavily industrialized; the consequence of this is a large amount of commuting into Stoke from the residential areas on the periphery of the conurbation.

The following table sets out the principal occupations in the conurbation with the numbers employed:

Table 3. Employment in Potteries Conurbation 1962
(thousands)

	Male	Female	Total
A. Extractive Industries			
Mining & quarrying	18·1	0·4	18·5
B. Manufacturing Industries			
Ceramic industries	26·1	31·5	57·6
Metal manufactures	7·6	0·4	8·0
Engineering & electrical goods	6·7	4·4	11·1
Chemicals	1·5	0·3	1·8
Food & drink	2·5	1·7	4·2
C. Service Industries			
Building	13·4	0·6	14·0
Distributive trades	7·9	9·3	17·2
Professional services	4·4	10·4	14·8
Transport	7·3	0·9	8·2
Total	122·1	75·7	197·8

Within the ceramic industries group, almost all the "pottery" trades (i.e. china and earthenware) are in the city of Stoke (in which the china section of the industry has a noticeable concentration in Longton); but over one third of the brick and tile workers are in Newcastle. Of the 15 large coal mines in the field, 10 are in Stoke and 4 in Newcastle. The "metal manufacture" comprises the great integrated iron and steel works at Etruria (the "Shelton" works), a smaller blast-furnace and foundry plant at Goldendale, and several other iron foundries. Amongst the largest individual units in the engineering group are Rist's wire & cable factory in Newcastle, employing some 4000 people. The "chemical" group includes the manufacture of oxides, paints and other colouring materials for the potteries, and also coke ovens.

Smaller industries of note include the Michelin rubber tyre factory, employing some 5000 people in Stoke; and the textiles, clothing and tailoring group, employing some 2800 people (nearly half of whom are in Newcastle, where there is a cotton spinning mill and a fairly long tradition of textile manufacture).

(5) The ceramic industries

The ceramic industries fall into ten main groups: (1) china and porcelain, (2) earthenware "crockery", (3) ceramic tiles, white or variously coloured for walls, bathrooms, fireplaces, etc., (4) sanitary ware, white or coloured, for bathrooms and lavatories, (5) electrical porcelain (insulators etc.), (6) saggar-making, (7) refractory bricks, (8) salt-glazed sewage pipes, (9) bricks, common and engineering, (10) flooring and roofing tiles.

The raw materials used include china clay and china stone (from the St. Austell granite district of Cornwall), "ball clay" (a re-deposited china clay of Tertiary age from Dorset and Devonshire), felspar (mainly Swedish), flint (mainly from the chalk deposits of S.E. England and Normandy), fireclay (local or from other Midlands coalfields), and the red Etruria marl for bricks, for flooring and roofing tiles and for red-bodied ware such as glazed tea-pots.

Pottery has been made in North Staffordshire from Roman times. By the mid-18th century a flourishing domestic craft existed, centred on the village of Burslem; the craftsmen were subsistence-farmers who made coarse earthenware from the local clays, fired in small bottle-shaped kilns using the local coal. In the latter part of that century, however, in part under the influence of such master potters as Spode and Wedgwood (who introduced Cornish china clay into the district and so made possible the development of a fine china industry), the industry became concentrated in factories, almost all of them set up in the villages which soon became small towns. Wedgwood himself migrated from Burslem to a new and virgin site, which he named Etruria, alongside the newly-constructed canal, where china clay could be brought in by boat; but few of his contemporaries followed his example and most preferred to remain in the growing towns where coal was more readily available.

By 1800 the distribution pattern of potteries in the six towns was more or less complete, and it has changed little during the last century and a half. The potteries are still within the built-up area of the towns, where they immensely complicate the planning of urban re-development. One very considerable change, however, has taken place, and that is the substitution of gas and electricity (and occasionally oil) for the long-flame coal which has hitherto been the mainstay of the industry (and which incidentally was responsible for making the Potteries one of the worst areas in the country for atmospheric pollution.) Continuous firing of tunnel-ovens has replaced the intermittent coal-firing of the bottle-shaped kilns, which are thus disappearing from the landscape. In the late 1930s, when between 80 and 90% of all the ware was coal-fired, there were over 2000 bottle-ovens in Stoke-on-Trent; at the end of 1962 only 70 of these remained, and the percentage of coal-fired ware had dropped to 9% in the case of the first or "biscuit"

firing to 1% for the second and subsequent firings (the "glost" stage or firing of the glaze and the various firings which may take place after the ware has been decorated). Thus the whole "cultural landscape" of the Potteries is changing very rapidly, and the smoke pollution problem is now confined to the emanations from the brick and tile works (which still use coal-fired beehive-shaped kilns) and from the iron and steel works and foundries.

Bibliography

[1] Cope, F. Wolverson, "The North Staffordshire coalfields", in Sir A. Trueman (ed.), *The Coalfields of Great Britain,* Chapter XI, London 1954.

[2] Moisley, H. A., "The industrial and urban development of the North Staffordshire Conurbation", *Trans. Inst. Brit. Geog.* 17, (1951), 151–165.

[3] Beaver, S. H., "A geographical agenda for North Staffordshire", *N. Staffordshire Jour. of Field Studies,* 3, (1963), 1–16.

[4] Beaver, S. H., "The Potteries, a study in the evolution of a cultural landscape", *Trans. Inst. Brit. Geog.* 34, (1964).

TOWN AND COUNTRY PLANNING IN ENGLAND AND WALES—A BRIEF SKETCH OF SOME MAJOR PROBLEMS

John R. James

The Minister of Housing and Local Government is responsible to Parliament for all town and country planning in England and Wales, but he has delegated his powers for the preparation of plans to the 145 Counties and County Boroughs. These local authorities prepare their own Development Plans and submit them for the approval of the Minister at least once every five years. The plans look twenty years ahead and are drawn to the scale of 6 inches to the mile (1:10,560) for towns and 1 inch to the mile (1:63,360) for county districts.

In the making of these plans the professional staff of the Ministry advise the local authorities on central government policy. The main elements in this advice are the population targets for each plan, the industrial policy which is controlled by a system of licences (Industrial Development Certificates), the main road network on which the Ministry of Transport makes grants, and technical questions such as distribution of workable minerals, quality of agricultural land, layout of central and residential areas, density, etc.

The key control is population. The picture is one of sustained growth. Natural increase in England and Wales during the period 1961–81 is expected to be about 6 millions; and a further million immigrants, at least, are expected from Scotland and abroad. The rural areas are stable or declining; the coalfield and textile towns are not retaining their natural increase, and the really big growths are taking place in the Midlands and the South-East. The most dynamic areas are on the fringes of the great cities, London and Birmingham in particular, where there is high natural growth and also a meeting of two waves of migrants—one from less fortunate parts of Britain and the other from the densely built residential districts of the inner cores. This last movement, the product of greater individual wealth and growing car ownership, is very powerful. During the past ten years most of the rural districts around the large cities have increased their populations by 20 to 30%.

The control of land use in these fringing areas is primarily one of preven-

tion. The concept of the "green belt" has been introduced in which very little new building is permitted, but where many of the open space deficiencies of the growing urban population are being met. In the case of London the Minister has already approved a Green Belt of 840 square miles, and the local authorities are seeking to extend it to 2000 square miles. Development which is stopped in the green belt must take place beyond it, or in specially selected towns within it. The British policy is to build new towns and to expand old ones, taking out new industry to match the new homes. Again in the case of London, eight new towns, started after the war, are already two-thirds complete. They are built to a pre-determined size.

The future is clearly one where a new pattern of human settlement is emerging, best described as a city region. Its boundaries are always pushing outwards under population pressure, greater wealth, heightened mobility, and the social needs for more and more living space. Within it, the old built-up core, new towns and expanding old towns are not to be seen as self-contained organisms but as specialist and inter-dependent parts of a highly articulated region. But unlike the American pattern of development it is hoped to retain the sharp distinction between built-up and open country.

During the coming twenty years a further $3^1/_2$ million people are expected to live in south-east England. This will call for a giant programme of planned dispersal and a new series of new and expanded towns, much larger and further distant than the first series, if London is to be restrained to its present population of 8 million people. There has now been sufficient experience to demonstrate the social and economic success of the new towns policy.

APPLIED GEOGRAPHY OR PRACTICAL APPLICATIONS OF GEOGRAPHICAL RESEARCH

Stanisław Leszczycki

The term "Applied Geography", *La Géographie Appliquée, Prikladnaja Geografia, Angewandte Geographie, Geografia Applicata, Geografia Stosowana*— has become very fashionable in recent years. It has been used however for a long time[1], at least since the end of the 19th century [2, 21].

It has appeared in many geographical publications issued in France [23, 27, 31, 33, 47], Great Britain [42, 43], Canada [13, 18, 29], Poland [24, 25, 26, 38] and elsewhere. For example the report of the first Anglo-Polish Seminar was entitled "Problems of Applied Geography" [35]. This report has been well reviewed and widely distributed, but the reader can only guess just what the editors understood by the title. They gave no explanation of the term used. I think however, that having used the term "Applied Geography" in the title of our report, we are obliged to give an explanation of what we have understood by this term. That is the reason why I have chosen the problem of the idea and the scope of applied geography, as the topic of my talk at the Second Anglo-Polish Seminar. I am quite aware that my opinion in this matter will not be shared by all, and that it is not backed by sufficient proof, but in spite of that I shall try to present my views simply to invite discussion and to set the ball rolling.

For some years now I have been reading quite a few books and articles having in their titles the term "applied geography", but I have met only insufficient arguments to support the use of this term. It is common at present to identify applied geography with the practical application of geographical research to national, social, business, military and other needs and, above all, to physical and regional planning [17]. This does not seem to me to be right. That was the reason why at the beginning of 1962, in the Polish

[1] Since, this article is not aimed at presenting a full history of applied geography, the bibliography is but a skeleton, and the publications quoted have been given as examples. A good review of literature has been prepared by M. Phlipponneau [11].

Geographical Review (*Przegląd Geograficzny*) I presented my views on the general problems of applied geography and I gave the characteristics of the best known publications which have appeared on this subject since 1959[2]. Therefore I shall not bore you with detailed repetitions of the argumentation presented therein.

I would like briefly to present my own opinion on applied geography and especially on the following two problems:

(1) the application of geographical research to practical purposes, with the possibility of three different approaches,

(2) applied geography as a branch of geography or as a new trend in the development of geography.

Even in ancient times scientists were interested in the application of the geographical research. It was mentioned for instance by Strabo, who expressed the wish that his seventeen-volume *Geographika* would help the emperors to administer and govern the Roman Empire, and to find an appropriate policy for their relations with barbarian peoples. Similar ideas on the application of scientific research can be found in the works not only of ancient geographers but also in later geographical writings up to the nineteenth century at which time geography emerged as a science. In the last years of the nineteenth century, and especially in the twentieth century many geographers have carried on research of an applied nature. Some of them were justly proud when the results of their research were taken into account by governments or by social organizations in their policy making or when they served as the basis of the economic development of certain areas.

Thus in the whole history of the development of geography we can trace the application of geographical research, but a special development of this type of research has taken place after World War I and more recently after World War II. In France a special stress was put on the practical applications of physico-geographical research to France, to its particular areas or to the former French colonies. In England under the influence of L. Dudley Stamp, geographers started special research projects for physical and regional planning and have concentrated their efforts on the problems of rational land use, distribution of industry, migrations, urban development and so on. This means that in England a stress has been put on applied research in economic and human geography.

American geographers [28, 39] have concentrated on the questions connected with current economic, political, social, and military problems. For example some of their work has been aimed at helping in the planning of

[2] After this article was prepared a number of new publications have been issued. I have also got acquainted with some other publications formerly published. These facts, however, do not change my essential views on applied geography. The bibliography on the subject is much more extensive than the list of publications formerly prepared.

the network of schools, motorways, airports, shopping centres (store sites) [3], as well as helping in the development of metropolitan areas, in the distribution of recreational areas etc. Also in many other countries, as e.g. in Germany [9, 30, 41], Belgium [49], Norway [20], Austria [6], Switzerland [8, 50], Italy [44] research projects within applied geography were undertaken. They concerned various geographical problems discussed with a view to meeting practical social needs. Most of them dealt with geographical research carried out for the needs of physical and regional planning. Sometimes regional monographs were prepared with this in view. This has raised discussion on the relation between regional and applied geography [1, 32].

At the meetings of the Section on Applied Geography held during the 19th International Geographical Congress in Stockholm, in 1960, 22 papers on various subjects were read [37]. In result of the debates a resolution was taken to establish a special Commission on Applied Geography [34].

In recent years, we observe in the countries of South America the development of applied geography, mostly under the influence of French geographers. Publications on this subject appeared in Brazil [10, 45] and Argentina [7]. Special centres of applied geography were established at the French universities (Strasbourg, Rennes) [22, 46, 48]. In spite of these facts little attention has still been paid to theoretical bases of applied geography and even to some generalizations and systematization of this branch of science.

Neither can such generalization be found in the Soviet or Chinese geographical literature nor in the geographical literature of any country belonging to the socialist camp, because in these countries geographers have taken a practical approach in their research work which emphasizes the application of geographical research to the needs of society, while rather neglecting the theoretical approach to these problems. In these countries, although many important results in this field were likewise achieved, geographers have felt no need to discuss the concept of applied geography, or the theoretical base for its existence, because the connection between the science and life has always seemed to them so obvious [12, 16].

Taking all this into account, it seems to me worthwhile to try to summarize the current views on the scope and the methods of applied geography.

I think that recent developments in the sphere of applied geography require some systematization and generalization. There are two ways to systematize applied geographical research and to establish its limits:

(1) according to the various divisions, branches and specialities of geographical research, and

(2) according to the different areas of social and economic life in which these studies can be of service.

In the first case it is necessary to classify applied geographical studies according to the various divisions of geographical sciences. First of all they

can be classified according to the four main divisions of geographical studies: (1) physical geography, (2) economic geography (this term is used in Poland to cover the area taken in by human, political, cultural and economic geography in England), (3) regional geography and (4) cartography[3]. Then, if necessary, the more detailed classification of applied geographical studies may follow the further division of geographical sciences into particular branches: for instance in physical geography: geomorphology [4, 5], hydrography, climatology, geography of soils, biogeography; and in economic geography: population geography, settlement geography, industrial geography, geography of agriculture, geography of transportation and geography of services. More detailed classification is also possible: for instance according to specialities: in settlement geography: urban geography and rural geography, and in agricultural geography: geography of forestry, geography of fisheries etc.

The classification of all applied geographical research carried on up to now, and of the methods used by it, gives us a long list of all the possible applications of geographical studies, and the scope of such applications.

Instead of this systematization of applied geographical studies based on the divisions and branches of geographical sciences there exists also another possibility. The systematization may be based on a classification of the different areas of social and economic life, in which they can be useful. One thinks of areas such as population policy, industry, agriculture, forestry, transportation, trade and commerce and various services such as municipal, educational, public health, and so on. Thanks to such a systematization, a detailed list of all applied geographical studies will be obtained, comprising also the methods used. This will allow us to establish the scope and field of those studies.

Still another approach, the regional one, is possible. It was pointed out by M. Phlipponneau [31]. Complex studies can be organized for the countries having particularly unfavourable geographical conditions, for arid and semi-arid zones, for humid tropics, arctic and subarctic zones, or for underdeveloped countries. I quite agree with this regional approach to applied geographical studies and it seems to me that such an approach will enable us to systematize these studies, to establish their fields, and to make some generalizations. However, to achieve this goal we shall need further and more detailed studies.

In connection with the planning of the development of small towns in Poland many detailed and systematic physiographic studies of these town areas were made. These studies supplied quantitative results which could be

[3] In other divisions of geographical sciences as e.g. in the history of geographical sciences, in historical geography, in mathematical or astronomical geography, it is impossible to make direct use of scientific research for practical purposes.

directly used by urban planners. They brought not only many practical results but thanks to them a new speciality of physical geography has been created, namely "urban physiography" [36]. It has a definite subject of research, its own scope, and its own precise methods. This development of anurban physiography, far from creating, by its practical preoccupations, any burden for scientific geography, actually contributed to the development of physical geography [40].

I think, however, that we can carry our generalization even further. In order to achieve it, we must find out what are the characteristic features common to all applied geographical studies. I see four of them:

(1) The practical purpose of the research. Owing to the fact that the results of the research are to be used directly by the people who use them, this research must employ special methods and the results ought to have the character of responsible scientific opinions worked out by experts. Since these geographical studies are sometimes requested or commissioned by some existing organization or institution, which means that the client or consumer of the geographical research is definitely known, to fulfil their aim geographers will have to employ in their work the terminology already in use in the various areas of national economy to which such an organization or institution belongs. Therefore geographers ought not to make efforts to create a new terminology of their own.

(2) The practical purpose of these studies requires the elements of evaluation to be introduced into the research and into its results. The evaluation of the studied phenomena from the point of view of the practical application of applied studies is the characteristic feature of all applied research. This characteristic feature allows us to differentiate applied research from research in general which is often merely limited to the statement of facts leaving their evaluation to the reader.

(3) The practical purpose of these studies requires that all their results be presented quantitatively, that is in numbers. That is the reason why the quantitative methods, so well developed now in the American geography, ought to prevail in such studies.

(4) As all applied studies must take into account the future and the possibilities of further development, they ought to give perspectives and be cast in the form of a scientific forecast.

These four characteristic features warrant the statement that applied geographical studies are different from classical geographical studies, that the scope of their interest—from the point of view of the problems studied, as well as he methods used—is narrower than that of geographical studies in general. I am afraid, therefore, that Pierre George's [14, 15] opinon and also that of many other geographers stating that research in applied geography does not differ in its very nature from classical geographical studies, except

its more or less clearly defined goal, and that the majority of geographical studies ought to be directed to the solving of practical problems do not seem to me to be quite correct. Such an approach makes indistinct the difference between applied geographical studies and classical geographical studies. At the same time the adherents of this approach, warning a geographer against his entering into the further stages of implementation of his postulates, tend to limit the role of a geographer to his defining only the diagnosis of a phenomenon (area). It seems to me that the opinion which considers applied geography as analogous to applied mathematics, applied physics, applied mechanics and other applied sciences—is much more reasonable. This approach assumes that applied geography exists in the framework of geographical sciences and that its field is narrower than that of geographical sciences as a whole.

* * *

I would like to consider another problem: can applied geography be distinguished from other divisions of geographical sciences, and what are the criteria required for this purpose?

As I have already mentioned, applied geographical studies are often carried on for a previously known client or institution which in requesting a certain research project hopes that this subsidized research will bring a solution to the problem in question. This fact determines the purpose of the research and, on the other hand, the methods used depend on the given aim. The research is expected to give an answer to a concrete problem, its evaluation and perspective.

Another point of view may also be assumed. Applied geographical studies are not always commissioned. The research is not limited to studies ordered by institutions but is undertaken by geographers themselves who knowing that this kind of research may have an important practical value for the state, the nation or a certain group of people, start the research without any commission or definite client. It has often happened in the history of geographical sciences that thanks to the initiative of some eminent geographers some applied research has been undertaken. First of all these studies dealt with some more complicated sectors of social and economic life, which presented a complex scientific problem whose solution required the application of complex and heterogenous methods. In order to solve such a problem, geographers were at time compelled to go beyond the (at that time) traditional field of geography and to look for new methods required by the particular problem involved.

Recently many similar studies have been carried on. They are sometimes undertaken in order to meet some important political, social or economic needs. I shall quote some examples.

(1) Every country needs to maintain strong defenses. These defenses are the task of its military establishment. The solution of many complicated problems involved there often requires the help of geographical studies belonging to different branches of geography. All these studies deal with a concrete territory, and their aim is clearly defined; taken as a whole they constitute a special branch of geography usually called military geography. The characteristic features of this kind of research allow us to consider military geography as an entity and as a branch of applied geography. Military geography is well developed in the Soviet Union, the United States, Germany and some other countries.

(2) Geographical studies connected with tourist travel and recreation have a similar character. These problems have grown steadily in importance from the social point of view. These studies are very complex: they include not only research dealing with aspects of natural environment valuable for recreation and tourist travel, such as landscape or climate, dealt with by physical geography; but they also contain anthropogenic aspects valuable for recreation or tourist travel, from the point of view of culture, as well as such phenomena as recreational trips, economic problems connected with the services for the tourists and the social and cultural problems which result from tourist and recreational travel. This last group of problems belongs to cultural and economic geography. But as all these studies, economic as well as physical, aim at solving but one complex problem, they can be considered as a special branch of applied geography, namely recreational geography which can boast of important achievements in many countries.

(3) Probably the same approach could also be applied to the problems of public health services. A geographer concerned with these problems must deal with the people and their resistance to certain diseases, with the natural and social conditions which contribute to the spread of contagious diseases, with conditions of balneotherapy and climatic treatment, acclimatization of human races, etc. All these problems, considered together, form the field of medical geography which, of course, is not merely confined to the problem of the distribution of diseases. Medical geography, understood in this way, may be considered as a branch of applied geography. The huge scope of the problems encompassed by medical geography, as well as the methods used by it, will allow the geographer to play a greater role in this field, alongside the biologist and the physician.

(4) Finally, I would like to mention an example which seems to be the most important and the best known. There are the geographical studies undertaken to meet the needs of physical and regional planning, or to work out the programme for the regional development of a certain territory. Physical and regional planning are complex in their character. They are concerned with a concrete area, that is with a concrete sector of the Earth's crust.

Geographical studies for the purpose of physical and regional planning are applied in their character, because they aim at working out a perspective plan to meet the needs of a continually growing population. Such a plan usually comprises all investment outlays connected with production, transportation, and with material as well as cultural services. The geographical studies involved in this have a very wide range, are tentatively directed to their goal, use appropriate methods suited to produce results which could be directly used by planners. All these studies form a complex and are not merely "applied", but also regional; they form a certain whole which constitutes a branch of applied geography, namely, planning geography. This type of applied geographical research has been carried on for many years in many countries.

The number of such examples could, no doubt, be multiplied. A similar approach could also be applied to the problems of controlling a country's affairs, to foreign trade, etc.

All the examples mentioned above have some characteristic features in common. All these geographical studies put a special stress in their research: (1) on finding out the most rational use of all the resources of the geographical environment, in order to meet the needs of a given society, and (2) on working out proposals of adequate organization forms which would allow the society to control its geographical space. These two characteristics allow us to delineate the nature of applied geography and to determine its fundamental goals.

Some geographers will, perhaps, prefer another approach. They will, perhaps, consider applied geography as a new fashionable trend in geographical research. This trend may be treated much as the trends towards regional geography or systematic geography were treated in the past. In the 19th century the trends towards concentration on physical geography to the detriment of human geography, or *vice versa*, had a similar character. In the history of geography there were many trends which greatly contributed to the development of geography as a whole, in spite of the fact that these trends were not accepted by all geographers. In any case, the trend in geographical studies known as "applied geography" comprises a certain concept which allows us to consider applied geography as a special division of geographical sciences, distinct from the other divisions. It differs from them because of its different approach expressed in the scope of the research, in its aims, in its results containing the evaluation of the facts, and also in the special methods it uses.

I think that the importance of applied geography compels us to reflect on this subject. The development of applied geography may be of considerable advantage to the geographical sciences taken as a whole. It may, among other things, contribute:

(1) to strengthen the authority of geography as a science because its results will be formulated precisely, quantitatively, and will have the character of a responsible scientific opinion worked out by experts and sometimes of scientific prognosis of future developments;

(2) to enlarge the possibilities of employment for geographers as specialists, not exclusively in the realm of education, but also in many other fields. This enlargement of occupational possibilities will result from the more precise determination of their profession and the scope of their knowledge;

(3) to increase the subsidies for geographical studies because the subsidizers will derive practical advantages from the scientific research carried on by geographers;

(4) to make the scientific generalizations in geographical sciences and their theoretical foundations more solid, more precise. This will result from the continuous confrontation of the theoretical assumptions and the effects of geographical research on life, since they will be verified in practice.

All these advantages are so promising that it is worthwhile to give more attention to the development of applied geography in the future.

Bibliography

[1] Allix, A., "Géographie appliquée et géographie régionale", in: G. Chabot, R. Clozier, J. Beaujeau-Garnier (ed.), *La géographie française au milieu du XXe siècle*, Paris 1957, 289–293.

[2] *Angewandte Geographie*, ser. IV, 1–6 (1911–12), pp. 800.

[3] Applebaum, W. and Cohen, S. B., "Evaluating store sites and determining store rents"; *Econ. Geogr.*, 36 (1960), 1, 1–35.

[4] Armand, D. L., "Znachenye geomorfologii dla selskogo khozyaystva", *Vop. Geogr.* 52, *Prikladnaya Geomorfologia*, Moskva 1961, 11–27.

[5] Bakker, J. B., "Dutch applied geomorphological research", *Rev. Geomorph. dynamique*, 10 (1959), 5–6, 67–84.

[6] Bobek, H., "Geographie und Raumforschung. Grundsätzliche Betrachtungen", *Raumforsch. Raumordn.*, 6 (1942), p. 336.

[7] "La Geografia Aplicada", *Boletin de Gaca Sociedad Argentina de Estudios Geograficos*, 49, Buenos Aires 1961.

[8] Bridel, L., "La géographie face aux taches de l'aménagement du territoire", *Rev. écon. soc.*, 18 (1960), 4, 295–304.

[8] Brüning, K., "Landesplanung, Raumforschung und praktische Geographie, besonders in Niedersachsen", *Jb. Geogr. Ges.*, Hannover 1953, p. 314.

[10] Carvalho, A. and Santos, M., *A geografia aplicada*, Publicaçoes da Universidada da Bahia, Laboratorio de Geomorfologia e Estudos Regionais, 1960, pp. 34.

[11] *Colloque national de géographie appliquée*. Strasbourg 20–22 Avril 1961, Paris 1962, pp. 241.

[12] *Essais de Géographie*, Editions de l'Académie des Sciences de l'U.R.S.S., Moscou et Leningrad 1956.

[13] *La géographie appliquée. Compte rendu d'un symposium tenu à l'Institut de Géographie*

de l'Université Laval du 14 au 19 novembre 1958, Cah. Geogr. Quebec, 3 (1958/59), 5, 5–57.

[14] George, P., *Compétence et responsabilité du géographe.* Statement sent for Colloque de Géographie Appliquée, Strasbourg 1961 (mimeographed).

[15] George, P., "Existe-t-il une Géographie Appliquée?", *Ann. Geogr.*, 70 (1961), 380, 337–346.

[16] Gerasimov, I. P., "Le role de la géographie dans la construction socialiste en U.R.S.S. et les tendances, actuelles de son évolution en Acad. Sciences U.R.S.S.," in: *Essais de géographie*, Moscou et Leningrad 1956.

[17] Gottmann, J. *et al., L'aménagement de l'espace. Planification régionale et geographie*, Paris 1952, pp. 140.

[18] Gottmann, J., "Historique de la géographie appliquée. Une définition, les premières realisations", *Cah. Géogr. Québec*, 5 (1958/59), 8–12.

[19] Grzeszczak, J., "Sprawozdanie z kolokwium w Strasburgu" (On the Symposium in Strasbourg), *Przegl. Geogr.*, 34 (1962) 1, 253–255.

[20] Hansen, J. Chr., *La géographie appliquée en Norvège.* Colloque de Géographie Appliquée. Strasbourg 20–29 Avril 1961 (mimeographed).

[21] Herbertson, A. J., "The teaching of applied geography", *J. Manchr. Geogr. Soc.*, 14 (1898); "Applied Geography", *J. Manchr. Geogr. Soc.*, 15 (1899).

[22] Juillard, E., "Au centre de géographie appliquée de Strasbourg", *Bull. de la Faculté des Lettres de Strasbourg*, 1959.

[23] Juillard, E., "Utilité de la géographie", *Cah. pédagog.*, 13 (1958), 4, 24–25.

[24] Leszczycki, S., "The application of geography in Poland", *Geogr. J.*, 126 (1960), 4, 418–426.

[25] Leszczycki, S., "Geografia stosowana czy zastosowanie badań geograficznych dla celów praktycznych" (Sum. Applied Geography or application of geographical research for practical purposes), *Przegl. Geogr.*, 34 (1962), 1, 3–23.

[26] Leszczycki, S., "Geographical research on behalf of Poland's national economy", *Przegl. Geogr.* 32 (1960), Suppl. 3–13.

[27] Meynier, A., "La géographie appliquée", in: G. Chabot, R. Clozier, J. Beaujeu-Garnier (ed.), *La géographie française au milieu du XXe siècle*, Paris 1957, 281–287.

[28] Nash, P. H., "Recent trends in applied geography in the U.S.A.," *XIX International Geographical Congress, Abstracts of Papers*, Norden 1960, 210–211.

[29] Nicholson, N. L., "Geographers in the civil services of the federal, provincial and municipal governments of Canada", *Cah, Géogr. Québec*, 6 (1959).

[30] Otremba E., "Raumordnung, Raumforschung und Geographie", *Institut für Raumforschung, Informationen*, Bonn 1953, p. 533.

[31] Philipponneau, M., *Géographie et action.* Introduction à la géographie appliquée, Paris 1960, pp. 227.

[32] Philipponneau, M., *Géographie régionale et géographie appliquée.* Livre Jubilaire, 50e Anniversaire du Laboratoire de Géographie de l'Université de Rennes, Rennes 1952, pp. 110.

[33] Philipponneau, M., "La géographie, science appliquée", *Géographie*, 50 (1955), 30–34, 51 (1955), 2–7.

[34] Philipponneau, M., "Intéret de la création d'une Commission de Géographie Appliquée, La Géographie Appliquée au Congrés de Stockholm", Extrait de la Révue *Norois*, 28 (1960), 10–12, p. 11.

[35] *Problems of Applied Geography. Procecding of the Anglo-Polish Seminar, Nieborów, September 15–18, 1959*, Geographical Studies, 25, Warszawa 1961, pp. 148.

[36] Problems in urban physiography, *Przegl. Geogr.*, 27 (1955), 3–4, 489–646.

[37] *Programme Congress sessions in Stockholm 6–13 August 1960, XIX International Geographical Congress*, Norden 1960, Section: Applied Geography, p. 40, 47, 75, 85.
[38] *Przegląd Zagranicznej Literatury Geograficznej* (Review of Foreign Geographical Literature), 1 (1962), pp. 142; 2 (1962), pp. 142.
[39] Rose, J. K., "Geography in practice in the federal government", Washington, in: G. Taylor (ed.), *Geography in the Twentieth Century*, New York–London 1957, 566–586.
[40] Różycka, W., "Physiographic research in town and country planning", *Geogr. Polon.*, 3 (1964).
[41] Schultze, J. H., "Raumforschung und Geographie in ihrer Stellung zueinander", in: *Raumforschung*, Bremen 1960, 37–57.
[42] Stamp, L. D. *Applied geography*, Pelican Book, Middlesex 1960, pp. 208.
[43] Stamp, L. D., "The scope of applied geography", *Proceedings of IGU Regional Conference in Japan 1957*, Tokyo 1959, 89–95.
[44] Toschi, V., "Esperienze di geografia applicata", *G. Econ. Ann. Economia*, 14 (1955), 1–2, 52–68.
[45] Tricart, J., "A contribuiçao do Centro de Geografia Aplicada para a 'Mise en Valeur' do estado da Bahia", *Bd. Baiano Geogr.*, 1 (1960), 3, 35–48.
[46] Tricart, J., "La contribution du Centre de Géographie Appliquée à la mise en valeur de l'Etat de Bahia (Brésil)" *Rev. Enseign. super.*, 2, Paris 1960.
[47] Tricart, J., "Existe-t-il une géographie appliquée?", *Cah. pédagog.*, 13 (1958), 4, 25-29.
[48] Tricart, J., "Les recherches de géographie appliquée de l'Institut de géographie de Strasbourg en A.O.F.", *Rev. Enseign. super.*, 2, Paris 1957, 67–76.
[49] Tulippe, O., "La géographie appliquée", *Bull. Soc. Belge Etud. geogr.*, 25 (1956), 59–113.
[50] Winkler E., "Angewandte Geographie am Beispiel der Ortsplannung Hännenberg", *Geogr. helv.*, 17 (1962), 4, 298–299.

THE SCOPE AND AIMS OF APPLIED GEOGRAPHY IN GREAT BRITAIN

Michael J. Wise

I

As a participant in the memorable meetings at Nieborów in September, 1959, I should like to express appreciation, in which I am sure my British colleagues will join, of the care and skill shown by our Polish hosts in presenting the published record of our discussions in the excellent production "Problems of Applied Geography". The only parts of our proceedings which were not fully reported were those sessions that were conducted, under the influence of beneficent draughts of Polish vodka, in music. The volume was entitled "Problems of Applied Geography", but in fact almost the entire volume was devoted to those aspects of applied geography that concern physical and regional planning. Accordingly it seemed right that, in opening a new series of discussions in applied geography, something should be said of the general scope and aims of applied geography, as it has grown up in Britain. At the same time, I hope also to enlarge a little on certain points raised in the discussions between Professor Dziewoński and myself and reported in the first two chapters of "Problems of Applied Geography" [1].

II

The advice of Strabo that "the geographer should devote himself to what is practically important" was clearly in the minds of the contributors to the Nieborów seminar. In our country, we have recently been reminded by Professor D. L. Linton [2] that "geographers must surely see in the purpose of their work some relation to the current goals of human endeavour and must relate its practice to the needs of the times". It is sometimes thought that the approach of applied geography—essentially the application of geographical techniques and methods to the study of current problems of society—is new, and many think of applied geography as a branch of science

developed since the end of the 1939–45 war. But, in fact, a little enquiry quickly reveals that British geographers have been applying their methods to current problems of society for a very much longer period of time.

Looking back to the end of the nineteenth century, to a time when geography had not yet succeeded in firmly establishing itself as a discipline in our universities, it is possible to find visions of an applied geography in the minds of the subject's principal advocates. Thus, H. M. Stanley, speaking in the Free Trade Hall, Manchester in 1884 on "Central Africa and the Congo Basin; or the importance of the Scientific Study of Geography" drew a picture of geography as a science, a disciplined study, warm and stimulating to the mind, as something more than "collecting maps and books of travel and afterwards shelving them as of no further use... I do not mean by geography (he said) the study of simple topography, the mere knowledge of the delineation of the earth's surface, the relation of one locality to another... but having acquired a technical knowledge of these things, I should like to see a direct application of it to the needs of humanity" [3].

In particular geography came to be viewed as an aid to commercial success: a natural view of an applied geography in an age of expanding industry, of free trade, in which Britain was still developing as a specialized manufacturing nation; for the degree of industrial specialization that could profitably be undertaken depended on the expansion of Britain's world market. This was an age in which the world could still be seen to be extending. Each year brought new traveller's stories, new epics of discovery: each year the margin of the unknown was pushed back, every month the collection of maps of newly surveyed areas in the Royal Geographical Society's collection, at No. 1, Savile Row, grew larger. Stanley's own description of the development of geographical knowledge about Africa, the exploration and assimilation of information in the ninety years that had elapsed since Mungo Park had travelled from the Gambia to the Niger, well illustrates this theme.

"If you look upon a map of Africa, you will find that it is dotted around with names of sea-ports, and landing places, and sea shore villages thickly enough; that here and there, as in the neighbourhood of the Nile and the northern coast of Africa, and at Cape Colony, more or less advance has been made towards the great body and heart of the continent... an area of about 3,000,000 square miles is already contributing its produce and stuffs in exchange for European manufactures. But as Africa contains an area of nearly 13,000,000 square miles, we have a balance of nearly 10,000,000 square miles open for us and yet undeveloped".

A challenge to geography and a challenge to commerce, the one dependent upon the other. It was not only Africa that provided the challenge to apply geography in the interests of industry and trade. Attempting on February 11th 1885 to interest the Manchester Geographical Society in "Our Com-

mercial Opportunities in Western Asia", Mr. Arthur Arnold claimed that "If I can succeed ... the result may be most valuable to civilization and good government, as well as to our commercial interests" [4].

Explore the world, advance the study of geography, and then apply geography to bring stable government to the natives, to inform the manufacturer of likely markets and to promote trade: to speed the inflow of food and raw materials into Britain and the outflow of manufactured goods carried by the merchant fleet to the ports of the world overseas. This was applied geography—crude, if you like, both in its aims and methods but, as the commercial geographies of the period show, effective: an applied geography that played its part in building industrial Britain, in gathering people into the great cities and conurbations which face the modern geographer, applying his skills towards the betterment of the urban environment of Britain, with acute problems. But the nineteenth century geographer was scarcely interested in the inhabitants of the working class districts of Manchester, Birmingham or London: geography was, rather, a subject which could be applied to improving the standards of life of "our neglected and degraded brothers and sisters in far-off lands, and lead us to reach out a hand to lift them out of the dark night in which their existence has been shrouded for so many centuries" [5]. Geography could be applied to further missionary work, spiritual, medical and educational among the peoples of the undeveloped world.

We are inclined to look with a very critical eye upon the geographical work of the nineteenth century, but at least we cannot doubt that it reflected the spirit of the age and showed a clear relationship between "the needs of the time and the objects of geographical study".

III

We move forward a little in time to the first years of the twentieth century, and find the term "applied geography" actively in use. A. J. Herbertson, one of the great pioneers of academic geography in Britain, used the term frequently, and expressed its meaning to be "the collection and collation of geographical knowledge with a view to making such knowledge useful to our commercial geography, and so benefit our commerce" [6]. While the prime aim was to assist the business community, applied geography should also aid the medical man through studies of climate and of population characteristics, the missionary, through the study of human geography, and the soldier and sailor. This was, for Herbertson, one means of justifying the inclusion of geography in the university curriculum: if he could show that society needed geography he could interest the business men with whose money universities and colleges were being establised: he could attract teachers and students, and sell books. He saw applied geography as a special way of looking at geography, a limitation and a specialization of the subject from one point of view. It was

important to train the leaders of society as applied geographers, the politician, strategist, civil servant, engineer and colonial administrator should all be geographically trained. It is a measure of the limits of our success to reflect how few of them are!

A little later, in 1909 [7], Herbertson enlarged his view of applied geography in his Presidential Address to Section E of the British Association at Sheffield. Having first reviewed the splendid progress of geography in the recent past he set out an agenda of tasks which geographers were to perform without delay if they were to meet the needs and challenges of contemporary society. In his agenda we may discern a marked shift of emphasis from "geography applied to commerce". High on his list was the need for regional studies of the various parts of Great Britain to provide a basis of information which could be employed in improving the environment of the people of Britain. Geographical surveys were essential, on such a scale that the national government must assume the responsibility. Geographical methods of analysis had to be applied to data already collected: statistics of agriculture, population and local government needed study from the point of view of distribution. Alas, our population census data are still not adequately collected, analysed or presented in this way. With surveys accomplished, Herbertson believed that it would be possible to go further and to map the economic value and the economic potential of different regions. "Is it too much to look forward to the time when the geographical prospector, the geographer who can estimate geographical values, will be as common as, and more reliable than, the mining prospector?"

But these aims could be fulfilled only when geography had become firmly established in universities, and advances in applied geography must rest, he thought, upon fundamental advances in the techniques of geography itself.

IV

As time passed, during the period between the two world wars, geography became more and more firmly established in the universities of Great Britain and it is interesting to see how far the growth of the subject academically was matched by advances in its application to the needs of the society of the time. To some extent there was, perhaps, a reaction against a geography that soiled its hands with the grease and dust of commerce: geography applied to commerce fell into dis-favour: university geographers were concerned more to establish their academic status than to investigate the worlds of society and exchange.

But certain significant trends may be discerned, leading to achievements upon which most of our present work in applied geography is based. First mention must be made of the spreading recognition of the value of geograph-

ical surveys. The need for regional surveys based upon the detailed study of small areas had been stressed by Herbertson. The idea of regional survey had also been strongly advocated by the biologist, Sir Patrick Geddes [8], using the "valley section" as a teaching device. Geddes' ideas, based in part, at least, upon those of Le Play, drew interest to the relationships between men and environments in cities, and the concept of "conurbation" was coined. In 1918 the Geographical Association set up its Regional Survey Standing Committee and progress began gradually to be recorded in the working out of techniques for regional survey in the very varied and quickly changing geographical conditions of Britain. The usefulness of regional survey as a basis for planning became clearer as public opinion increasingly accepted the need for town planning, "the ordered creation of new urban environments"; and the movement culminated in the regional surveys that formed the bases for the regional plans of town planners such as Sir Patrick Abercrombie in the 1930's and 1940's. Abercrombie frequently acknowledged the fundamental importance of comprehensive geographical surveys as bases for plans [9]. But progress in regional survey during the inter-war period must not be overestimated and Daysh and O'Dell, among others, warned that "the lack of an adequate research basis has led to individualistic short-sighted, and unduly short-term planning proposals, embraced characteristically within lavish publications" [10].

Distinct from regional survey, yet basic to the production of comprehensive regional syntheses, was the advance of techniques in the survey of Land Utilization. Of the importance of the Land Utilization Survey little need be said, for Professor Kostrowicki has already demonstrated how familiar Polish geographers are with Professor Dudley Stamp's achievement [11]. Professor Stamp has himself told the story of the project, begun in 1930, in which he acknowledges his debt to the suggestions of the geographers of the pre-1914 period, and notably to Herbertson [12]. In the Utilization Survey there is to be discerned a clear relation between geographical progress and social needs, for the period between 1930 and the outbreak of war was one in which much of the most favoured land in Britain was being consumed by houses and factories in the great "urban sprawl".

As cities, with their growing sense of municipal pride, adopted town planning schemes, the demand became strong for the application of geographical techniques to the problems of the internal structure of cities and to the relations between city and surrounding countryside. Important advances in these fields were made by many writers but it would probably be fair to say that no individual achieved so much as R. E. Dickinson [13] in establishing methods of study that were to be applied most effectively to the urban problems of post-war Britain. Dickinson successfully adopted concepts developed mainly in Germany and in the United States and showed their application to British problems.

It became clear that cities were not complete entities in themselves, that they could be planned effectively only in the light of a full understanding of the relationships between the city and its service area (or hinterland). From this simple, but fundamental, idea, it was but a short step to a revival of interest in practical regionalism in Britain. It is difficult to value too highly Fawcett's initiatory study of "The Provinces of England" [14]. While political scientists, G. D. H. Cole in particular, participated in this discussion, it is fair to claim for geography the most significant contributions and especially those made in the early years of the 1939–45 war by Taylor [15], Gilbert [16] and others, at a time when interest in planning for post-war reconstruction was at its height. Their contributions have proved their value in recent months when the whole question of a regional division of Britain for planning purposes has been re-opened [17].

So far the emphasis had been mainly on establishing the facts of areal differentiation in countryside and town, on establishing the functional relationships between cities and their supporting and tributary areas, and recording the data on maps. But the Great Depression and the spectre of mass regional unemployment aroused the public conscience. Inescapably, the social distress of the "depressed" areas was contrasted with the prosperity and rapid growth in size and population of London. The establishment of the Royal Commission on the Distribution of the Industrial Population in 1938 was the spur that accelerated work in a new channel of applied geography, in the location of industry. Vigorous discussions took place [21], especially on ideals advanced by E. G. R. Taylor [18–20] and the fundamental studies of Wilfred Smith, S. H. Beaver, G. H. J. Daysh and others began to take a new, practical value.

It has been said that geographers are more valuable to a nation in times of war than in times of peace. Certainly the 1939–45 war produced problems for applied geography on many fronts. Direct applications to the war effort were made in military and naval intelligence work, in applying methods of physical geography to the solution of tactical military problems, in cartographic work, in terrain studies, and in the application of aerial photographic interpretation. The value of the contributions in applied geography to the war effort has been evaluated by R. O. Buchanan [22], and the excellence of his summary may be made an excuse for passing over them lightly here. On the home front, the visible need for the reconstruction of war damaged cities was one of many factors in arousing public interest in the planning of post-war Britain: the government became more fully aware than at any time in previous history of its responsibility for the geographical environment and for what in August Lösch's phrase we may term the "spatial order" of the country. Geographers became established as members of the staffs of the government departments charged with the creation of a planned landscape. In the first years of peace, Acts of Parliament were passed enshrining the

public desire for a planned Britain, especially the Distribution of Industry Act of 1945 and the Town and Country Planning Act of 1947. Applied Geography now came to be concerned mainly with town and country planning problems and by some came to be regarded as the application of geographical methods to these problems.

V

Thus, in the post-war period, applied geography has been concerned principally with the great social needs: the improvement of the environment of Britain to remove the immediate scars of war, to relieve the longstanding housing and landscape problems of industrial areas built during the nineteenth century, and to make an orderly re-adjustment of the geographical distribution of population to meet the changed technical and social values of the 1960's. The post-war period began with great achievements in regional survey by university research groups, for example at Birmingham by the West Midland Group on Post-War Reconstruction and Planning [23], and at Newcastle by the Northern Industrial Group [24] whose work is still continuing. But, without doubt, the most prominent feature of work in applied geography has been the installation of the geographer as a necessary member of the staffs of the national government, in the Ministry of Housing and Local Government, and of local government in the offices of the Local Planning Authorities. Local Planning Authorities are required by Act of Parliament to produce what are essentially geographical surveys as essential parts of their development plans. A new echelon of professional geographers has been created outside the universities, working in government offices throughout the country. We must now face the problem of how best to coordinate the work of the two groups so as to achieve the most effective application of geography in town and country planning. This problem of coordination has recently been under active discussion in the Research Committee of the Royal Geographical Society, but it is not yet solved. One of the issues raised has been the need for university geographers to accelerate the production of basic regional surveys: the need pointed by Herbertson, but not yet fully met.

In emphasis, the work accomplished has shifted a little from that of the inter-war period, thus reflecting the changed social need. Our basic problems remain those outlined at our meeting in Nieborów. To meet them work in industrial geography and in urban geography has been intensified. The radical changes in the distribution of population and employment have been under very active study. Studies in urban geography, particularly of the urban hierarchy and of the service areas of cities, made by Smailes, Green and others [25–27] have blossomed and have recently found direct application to the problem of reorganizing the areas of our units of local government to bring them into relationship with changed geographical conditions.

In discussing post-war trends, however, it may be more useful to discuss some general characteristics of the problems encountered by geography in its application to planning than merely to catalogue achievements.

First, I would place the problem of adapting geographical techniques to the needs of dynamic situations. It has been a common criticism of geographical work in many lands that it treats regions as static and that its maps present flat and unreal pictures of events and situations that are constantly changing. And so we have been concerned to depict accurately the important changes taking place in the distribution of population, employment, and land use. In this way the nature of the problems of a changing Britain can be demonstrated to non-geographers. However, it has been realized that it is not sufficient just to depict change: the responsibility of the geographer is carried further into the realm of explanation. This involves the study of the process of change, and examination of the strength of the forces promoting change. Only after assessment of the relative strengths of the economic, social and technical forces influencing the choices of individuals and concerns in the selection of their location for home and work has taken place, can policies for effective control and direction be formulated [28]. It has become clear that the task of explaining a particular set of distributions of economic or social phenomena is not one that can be left to the economist or sociologist. Thus we must concern ourselves not only with the regional associations of different phenomena but with the understanding of the origins of the distribution patterns offered also by isolated phenomena. In these terms we would agree with the American, Stanley Dodge that "...it is the becoming which is important. What processes have shaped regions, what processes are continuing the elusive transformations, and what are the trends for the future—these are the questions".

Through the study of changes and the processes of change the geographer is inevitably brought face to face with the problem of prediction. It is not enough to depict the face of the country at a particular date nor merely to indicate the changes in progress: he must also attempt a forecast of the geography of the future, for physical planning purposes, of twenty years ahead. It is perhaps true that only at the present time are applied geographers in Britain willing to accept the task of prediction as an essential part of their role: it is a duty that has been forced on them through the successful research work that has led to their assuming positions of responsibility as planners. Much regional planning in Britain has been less successful than was hoped through the failure of assumptions on which the plans were based, notably with regard to population growth. We are led to consider much more closely the precise measurement of trends and changes and the application of statistical methods will assume increased importance in the near future.

Up to the present time geographers in Britain have been fully occupied

in the problem of diagnosis. The analysis of changes in the human geography of the country yields the symptoms, the study of processes and working forces provides the explanations. Can we be satisfied to continue in the role of the diagnostician? I believe not. We must be concerned also with treatment. But unless we first have in our minds a view of the ideal geographical situation to which we are striving, to suffer treatment may be a worse fate for a country than to continue exhibiting the symptoms of disease. Thus we cannot escape from participation in the formulation of new concepts for town and country planning. At the present time we are still basing our planning on concepts formulated in the inter-war or war-time periods: our thinking is organized in terms of "conurbations", "development areas or districts", "green belts". Examination of these concepts against the background of our changing geography reveals their obsolescence: yet there is no general agreement on the new concepts that are to replace them. It is becoming agreed that the system of planning based upon restriction and control of development that has been in use since 1947 must be supplemented by a more positive attitude, in which a clearer picture is given of the geography of society towards which we are striving and adding positive inducements to negative controls. With this in mind, the concept of the "city region" has been rapidly gaining ground and we think in terms of eight or nine city regions of 30 miles or more radius from the central capital, each with an organized hierarchy of employment and service centres set against a well designed rural background. However, before this concept can be universally adopted and applied, urgent studies are needed of the economic structure of individual regions and of the economic inter-relationships of the regions of the country. The standard excuse for the backwardness of such studies in Britain has been the unsuitability of the available economic data, but this excuse may soon cease to be valid.

Geographical solutions are usually presented in regional terms. But in Britain there is no regional level of adminitration for town and country planning. Despite the vigorous advocacy of "planning regions" by geographers to which reference has already been made, the outcome of recent discussions at the political level reveals that it may be a quarter of a century before such regions become practical politics. There are thus two levels of administration—at the national government and at local government levels. Almost all local government areas are too small to permit solutions to planning problems within their own boundaries. Nor can the national government impose solutions. Regional planning must therefore proceed by agreement between local planning authorities and one of the problems of applied geographers working in the Ministry of Housing and Local Government is to find ways and means of bringing about agreement amongst County and Borough Councils and Planning Officers to devise common policies.

This itself would be an easier task were the Ministry of Housing and Local

Government in possession of powers over all the forces influencing the changing geography of our land. But its concern is principally to control land-use. The location of manufacturing industry is controlled by another ministry, the Board of Trade: transport developments, those determinants of locational values, are in the hands of the Ministry of Transport, while numerous other ministries—Agriculture, Power, Defence—also have their geographical interests to defend. There is a lack, at the national level, of adequate coordination amongst the ministries responsible for different aspects of our geography, and this again makes the task of formulating and imposing regional solutions a more difficult one.

In our Nieborów discussions I referred to the problem, under western democratic conditions, of relating economic planning to physical planning. This problem is still a difficult one, but some advance may be recorded since 1959. At that time, as I said, such economic planning as existed was largely short-term and uncoordinated. There is now greater political agreement on the need to provide at least short or medium term economic programmes and to coordinate more closely programmes of investment in agriculture, industry, transport and the social services. A National Economic Development Council has been established for this purpose: its work has only just begun and it is too early to comment on the results. Clearly geographers will be much concerned to ensure the integration of its plans with existing and future aims of physical planning.

One important lesson has already been learned. In the optimistic post-war years it was often assumed that controls on land use and on industrial location were adequate instruments with which the distribution of population and employment could be moulded. But the renewed problem of the growth of London and of the "drift" of population to the south-east have revealed the limitations of this approach and we are now more aware of the salient importance of the careful choice of location for new investment. We are also aware that in our type of democracy there are limits to the extent to which planning can attempt to reverse strong social and economic movements: people are free to move between regions as they wish, and planning will be more effective if it attempts to use and channel popular movements than if it tries to hold untenable positions. Thus we must watch the new Britain taking shape and use the forces of change to evolve a new type of urban environment for an industrialized society.

VI

And now a postscript. It will be evident from what I have said that we do not regard applied geography as a separate discipline: rather it is the choice of problem that is significant. In discussing the post-war period, I have

emphasized the applications of geographical ideas and techniques to problems of town and country planning. We have surveyed land, examined the distribution and availability of resources, mapped changing patterns of population and industry, studied atmospheric pollution, assessed water resources in relation to the changing distribution of demand, examined coastal preservation problems, and many other tasks.

But our society is one which depends on industry and trade for its livelihood. Our economic position was greatly weakened by the war and we have been more than before dependent upon a successful export trade. We have been obsessed by balance of payments problems: more recently, the question of whether or not to enter the Common Market and, if so, on what terms, has been in the public mind.

In these circumstances, and with geography well established in universities, the way has become open for a resurgence of interest in applied economic geography and a rebirth of interest is to be noted in the problems that were set for applied geography in the 19th century. This is, again, an example of response between geography and the contemporary problems of society. Professor Beaver has recently stressed the need for the study of the geographical consequences of the introduction of new processes of production and distribution [29]. There has been a revival of interest in problems of transport. At the London School of Economics, at the request of the aircraft and air transport industries, Dr. Sealy has been applying geographical methods in studies of future markets for air freight and for aircraft [30–32]. Related to problems of trade have been Dr. Bird's studies of the geography of ports, leading to recommendations for improvement of existing facilities [33]. Other industries express interest in geographical methods and studies are in progress.

The methods of studying urban service areas devised by Dickinson, Smailes and Green have also been applied commercially to the study of market areas. A number of firms concerned with market research and advertising employ geographers and an outstanding example of the result is the Marketing Atlas of Great Britain published by Geographia Ltd. and shortly to have a companion Industrial Atlas [34].

Further afield still, as a nation with social and economic interest throughout the world, we find geography applying itself to social problems in the "underdeveloped" lands, in particular those that are or have recently been within the British Commonwealth. The mapping of land utilization in Cyprus [35] and in Gambia, the geographical foundation without which an accurate population census of Ghana could not have been achieved, the examination of the settlement problems of the dry zone of Ceylon, the call by Nigeria for economic geographers for its regional planning teams: these are but four of many examples of demands that stretch the resources of British geography.

It has sometimes been suggested that "applied geography" is nothing more

than a fashionable trend. I do not believe this to be true. There is, in Britain at least, a long history of thought in applied geography and determined efforts have been made for almost a century to fashion a disciplined subject whose work would yield meaningful and purposeful results to the society to which its scholars belonged. The problems of applied geography have not been, and will not be, the same problems at all times. The tasks presented in this field of enquiry vary from time to time and from place to place. The nature of the tasks depends first, on the character of the problems which are specifically referred to geographers by the community and, secondly, on the assessments made by geographers of the best ways in which they can themselves contribute to current social, economic and physical problems. Thus the record of applied geography in Britain shows attention devoted at different stages to problems of commerce, to military problems and to tasks of civic and rural redevelopment—to regional planning.

Professor Leszczycki has suggested two methods for the systematization of studies in applied geography, namely (i) by field, e.g. applied economic geography, applied geomorphology, and (ii) by problem. In my view, which might be widely shared in Britain, it would be more profitable to attempt systematization in terms of problems. This is because many problems, especially those facing us in regional planning, cannot be answered solely in terms of one single field of study, but demand the coordinated efforts of geographers working in different fields. For example, the selection of a site for a new town demands the specialist approaches and applications of geomorphology, climatology, the geography of land use, industrial location study, demographic geography, transport geography, and so on.

But we can continue our methodological arguments at length in the future. I suspect that our immediate need is to demonstrate, even more convincingly than before, the contribution that can be made to our several societies, and to the international society which we hope to bring eventually into being, by the advancement and application of geography. In carrying applied geography into the future, we can at least take example from the existence of an established corpus of work representing the fruits of the labours of many distinguished geographers of past generations as well as of our own day.

Bibliography

[1] *Problems of Applied Geography: Proceeding of the Anglo-Polish Seminar, Nieborów, September 15–18, 1959*, Geographical Studies, 25, Warszawa 1961, p. 148.

[2] Linton, D. L., "Geography and the social revolution", *Geography*, 42 (1957), 13–24.

[3] Stanley, H. M., "Central Africa and the Congo Basin; or, the importance of the scientific study of geography", *J. Manchr. geogr. Soc.*, 1 (1885), 6–25.

[4] Arnold, A., "Our commercial opportunities in Western Asia", *J. Manchr. geogr. Soc.*, I (1885), 29–38; see also remarks of the Bishop of Salford, *Ibid*, p. 46.

[5] Herbertson, A. J., reported in *J. Manchr. geogr. Soc.*, 15, (1899), 58.
[6] Herbertson, A. J., "Report on the reaching of applied geography", *J. Manchr. geogr. Soc.*, 14, (1898), 264–285.
[7] Herbertson, A. J., "Geography and some of its present needs", *J. Manchr. geogr. Soc.*, 16 (1910), 21–38.
[8] Geddes, Patrick, *Cities in evolution*, London 1915, pp. 409.
[9] Abercrombie, Sir Patrick, *Town and country planning*, London 1933, pp. 256, Part II, Chapters II and III.
[10] Daysh, G. H. J. and O'Dell, A. C., "Geography and planning", *Geogr. J.*, 109 (1947), 103–107.
[11] Kostrowicki, J., "Polish land utilization survey", in: *Problems of Applied Geography*, op. cit., p. 45.
[12] Stamp, L. D., *The land of Britain, its use and misuse*, London 1948, p. 507, Chapter I.
[13] Dickinson, R. E., *City, region and regionalism*, London 1947, pp. 327.
[14] Fawcett, C. B., *Provinces of England*, London 1919, pp. 296, and revised edition ed.: S. W. Wooldridge and W. G. East, London 1960, pp. 192.
[15] Taylor, E. G. R. and others, "Discussion on the geographical aspects of regional planning", *Geogr. J.*, 100 (1942), 61–80.
[16] Gilbert, E. W., "Practical regionalism in England and Wales", *Geogr. J.*, 94 (1939), 29–44.
[17] *Change and challenge; next steps in town & country planning*, London Conservative Political Centre, 1962, pp. 64, Chapter XI, 40–44.
[18] Taylor, E. G. R., *Land and plan: basic facts relative to a master plan for Britain*, The Architect & Building News, London 1943, pp. 14 & maps.
[19] Taylor, E. G. R., "The geographical distribution of industry", *Geogr. J.*, 92 (1938), 22–39.
[20] Taylor, E. G. R., "Plans for a national atlas", *Geogr. J.*, 95 (1940), 96–108.
[21] Baker, J. N. L. and Gilbert, E. W., "The doctrine of an axial belt of industry in England", *Geogr. J.*, 103 (1944), 49–72.
[22] Buchanan, R. Ogilvie, *Geography and the community*, Hong Kong University Press 1958, pp. 15.
[23] West Midland Group on Post-War Reconstruction and Planning, *English County*, London 1946, pp. 266. *Conurbation*, London 1948, pp. 288. *Land classification in the West Midlands*, London 1947, pp. 48.
[24] North-East Development Association, *Physical land classification of Northumberland, Durham and part of the North Riding of Yorkshire*, Newcastle-upon-Tyne 1950, pp. 40.
[25] Smailes, A. E., *The Geography of towns*, London 1957, pp. 166, Chapter VII and bibliography.
[26] Green, F. H. W., "Urban hinterlands in England and Wales", *Geogr. J.*, 116 (1950), 64–88.
[27] Carruthers, W. I., "A Classification of service centres in England and Wales", *Geogr. J.*, 123 (1957), 371–385; also *Report of the Royal Commission on Local Government in Greater London 1957–60*, London, Cmd. 1164, 1960, Appendix, Item 8.
[28] Wise, M. J., "Some economic trends influencing planning policies", *J. T. Plann. Inst.*, 46 (1960), 30–39.
[29] Beaver, S. H., "Technology and geography", *Advanc. Sci.*, 18 (1961), 315–327.
[30] Sealy, K. R., *The Geography of air transport*, London 1957, pp. 207.
[31] Sealy, K. R. and Wheatcroft, S. F., *World air freight*, London 1959, pp. 59.
[32] Sealy, K. R. and Herdson, P. C. L., *Air freight and Anglo-european trade*, London 1961, pp. 87.

[33] Bird, J. H., *The Geography of the port of London,* London 1957, pp. 207.
[34] Geographia Ltd., *Great Britain, a marketing and media survey,* London 1961, pp. 24 & Maps; and *A survey of manufacturing industry,* London 1963, pp. 16 & Maps.
[35] Rawson, R. R. and Sealy, K. R., *Land utilization map of Cyprus,* Geographical Publications Ltd., Bude, Cornwall 1959.

URBANIZATION IN CONTEMPORARY POLAND

Kazimierz Dziewoński

Phenomena of urbanization, growth of towns both in number and in size are not anything new in Poland which possesses a long social and economic history and old traditions of urban life. However, the present stage of its town development, although typical and similar to that in other countries, has also some points of interest. For this there are two reasons: first, the present rate of growth is comparatively higher than in most other countries which are passing through the same stage (Table 1); second, there are some very definite planning efforts to control and to direct those important changes. A short analysis presented here tries to establish the character and causes of the present trends of urbanization and to check on the success and effectiveness of the official policies.

I. Growth of urban population in Poland, past and present

The growth of urban population in Poland throughout the 19th and in the 20th centuries, although several times interrupted by wars and social and economic upheavals, was developing steadily and at an increasing rate (Table 2). In the last ten years[1] it has been specially strong and it was the direct result of the planned industrialization of the national economy. In fact, greater growth was observed only in the Soviet Russia in the years 1926–1939, and there its cause in addition to the industrialization, was the collectivization of the agricultural economy. In the years 1950–1960, the increase of urban population amounted in Poland to 450 thousand persons annually, while in the years 1870–1900 it was only 75 thousand. The present increase was practically equal to the total natural increase of population while in the inter-war period it was below 60%, and at the end of the 19th century—below 36%

[1] I exclude from my analysis the years 1945–1950 because at that time the general migrations of population, an aftermath of the war, were much stronger than these due to urbanization. In the statistical data those last are completely submerged by the first.

of the total natural increase. Moreover in years before 1914 about 100 thousand inhabitants (mostly from the countryside) were leaving Poland which means that the emigration abroad was then greater than the immigration from the rural areas to the towns. At present the emigration is practically non-existent, the average number of persons leaving the country being *per saldo* limited to several thousands anuually. Only in the years 1957–1958 the amplitude both of the emigration and of the immigration was definitely larger. In this way the processes of urbanization are at present larger than in the past two different processes of internal urbanization and external emigration taken together.

A French geographer, Pierre George in his book *La ville, le fait urbain a travers le monde*, classified countries on the basis of percentages of urban population. Countries with urban population under 20% of the total population are defined by him as territories of old, agricultural civilizations, where urbanization is just beginning. In the class of from 20–40% of urban population there are the European agricultural countries as well as other countries where industrialization of the economy has already started. In the class of over 40% of urban population George found three separate groups of countries: traditional industrialized states of Western Europe (indices from 40–60%); new countries whose development takes place in form of the growth of new big towns, and finally, the U.S.S.R. where the urbanization is connected with strong industrialization. On this comparative basis it may be stated that in the last ten years Poland has passed from the class of European agricultural states to the class of the U.S.S.R., that is to the class where urbanization is closely connected with new industrialization.

II. Structure of urban growth

However, the present urban growth is heterogenous in its origin and structure. Generally speaking, it is composed of three elements: natural increase, influx from the countryside together with repatriation from abroad and change of administrative status (i.e. change of urban boundaries and creation of new towns). Data collected and published for the years 1950–1959 indicate that natural increase was responsible for 40·9% of the total urban growth; rural immigration for 19·0%, external immigration for about 1·0% and changes in the administrative status for the remaining 40·0%.

The most characteristic of these indices is that of natural increase. Usually it is assumed that the index of natural increase for urban areas is well under the same index for rural areas and in result under the average one for the whole country. This was certainly true for pre-war Poland when the urban index was no more than one half of the rural one (8·4‰ in relation to 16,7‰ in the years 1931–32). But in the post-war years indices for both urban and

Table 1. Percentage of urban population in various countries

Year	U.S.A.	England and Wales	France	Sweden	Denmark	U.S.S.R.	Poland within the frontiers of 1960	Poland within the frontiers of 1937
1850	15·3	50·2	25·5	10·1	20·9	(1851) 7·8	·	13·6
1860	19·8	54·6	28·9	11·3	23·4	(1863) 10·6	·	·
1870	25·7	61·8	31·1	13·0	24·9	·	23·2	16·9
1880	28·2	67·9	34·8	15·1	28·1	·	·	·
1890	35·4	72·0	37·4	18·8	33·2	·	·	·
1900	39·7	77·0	40·9	21·5	38·2	(1897) 11·5	(1900/1897) 26·6	(1900/1897) 25·1
1910	45·7	78·1	44·2	24·8	40·3	·	·	29·7
1920	51·2	79·3	46·3	29·5	44·2	(1917) 15·6	(1921/25) 32·8	(1921/25) 27·2
1930	56·2	80·0	(1926) 49·1	32·5	43·9	(1926) 17·9	(1931/33) 35·5	(1931/33) 32·1
1940	56·5	·	(1946) 53·2	(1945) 42·3	47·4	(1939) 32·8	(1946) 31·8	(1937) 34·5
1950	59·0	(1951) 81·0	(1954) 56·0	48·0	·	·	39·0	—
1960	·	·	·	(1959) 51·0	·	(1959) 47·9	48·1	—

Sources: Gist and Halbert, *Urban Society*, New York 1938;
W. S. Woytinsky and E. S. Woytinsky, *World Population and Production*, New York 1953, p. 124, and others.

TABLE 2. POPULATION AND URBAN POPULATION OF POLAND IN THE YEARS 1800–1960

Specification	1800 estim.	1850 estim.	1870 estim.	1897–1900 Gen. Censuses	1910 estim.	1921–1925 Nat. Gen. Censuses	1931–1933 Nat. Gen. Censuses	1937 estim.	1946 Prov. Census	1950 Nat. Gen. Census	1960 Nat. Gen. Census
A. Poland within the frontiers of 1937. Total population (millions)	9·0	13·6	16·9	25·1	29·7	27·2	32·1	34·5	—	—	—
Urban population in millions	·	·	·	5·0	·	6·7	8·7	·	—	—	—
Urban population in %	·	·	·	19·9	·	24·6	27·4	·	—	—	—
B. Poland within the frontiers of 1960. Total population (thousands)	·	·	17,500	23,748	·	26,618	29,796	32,100	23,930	25,008	29,731
Urban population in thousands	·	·	4100	6321	·	8722	10,588	·	7462	9605	14,112
Urban population in %	·	·	23·2	26·6	·	32·8	35·5	·	31·8	39·0	48·1

Sources: (1) for Poland within the frontiers of 1937—*Encyklopedia Nauk Społecznych* (Encyclopedia of Social Sciences) III. Population Table 13, p. 633. Central Statistical Office. *Concise Statistical Yearbook for 1935.*
(2) for the years 1870, within the frontiers of 1960—compiled by F. Osowski
(3) for the years 1897/1900, 1921/1925 and 1931/1933, within the frontiers of 1960—compiled by K. Pudło-Palonka
(4) for the years 1946, 1960—Central Statistical Office. *Statistical Yearbook 1961*, Table 1 (21)

rural areas were practically the same. It was only in the last few years that the rural index has again gained over the urban one although the difference so far is not as great as before the war (in 1960: 13,0‰ and 16‰). This high natural growth is due to several causes, among which the fall in death-rate—the result of the improvement in sanitary conditions—and the post-war increase in number of births should be mentioned. However, the economic factors should not be omitted. In fact, they are probably the most important. The general rise in living conditions, due in the beginning to the changes brought about by the social revolution and later additionally increased through the great progress in the industrialization of the country, played indeed the decisive role. A specific influence was exerted by the educational policies of the present government. When practically all the costs of education on all levels are covered from social funds, the parents are released from otherwise very heavy financial burdens and worries.

The growth of towns as a result of the influx of rural population was according to the statistical data comparatively small. Part of it is hidden by inclusion under the heading of the change in the administrative status. It was still great enough to take from the rural areas all natural increase of manpower. In future it is expected that this will continue, perhaps even at an increased rate. However, there exist obvious limits to such migrations. At present, in spite of war losses, in Polish agriculture, especially in the central part of the country, there is a very definite underemployment (or hidden unemployment). It has already diminished and with further emigration of rural population the stage will be reached when this underemployment will turn into a labour shortage. The advent of difficulties due to deficits in the manpower will be probably the starting point for stronger mechanization and socialization in agriculture. However, it also means that the importance of this factor of urban growth will diminish in the more distant future.

The most doubtful, although obvious and potent sources of increase in indices of urbanization are the changes in the administrative status, especially in the municipal boundaries. Nevertheless they should not be omitted. At the worst these legal changes were nothing else than a recognition of already established realities. Their inclusion in statistical data has been in fact overdue. The urbanization had taken already place. In the remaining cases the change of the administrative status marks new developments in town construction or at least in urban housing. In future those later cases will easily dominate over all others.

III. The structure of the urban network and its present evolution

This picture of the progress in the urbanization of Poland would be incomplete if the description of general growth of urban population is not

followed by the analysis of the structure of the urban network and its present evolution.

As in all other countries the urban population in Poland is not evenly spread. There is a great diversity of towns and cities of various function, character, status and size. Many geographers have tried to establish certain regularities and to bring some order in what seemed to be at the first glance only an accidental grouping, loosely connected with the road and railroad networks. For that purpose they used one or other among various theories of settlement—of W. Christaller or of A. Loesch, of Homer Hoyt, E. Ullman and Ch. D. Harris or of B. J. Berry and W. L. Garrison, of W. J. Davidovich, and many others. Although in the interpretations of realities observed in smaller areas these theories and related concepts proved to be serviceable and fairly satisfactory tools of analysis, nevertheless for the whole of Poland they fail to provide a reasonable basis of comparison. In fact divergences between regional settlement networks, palimpsests of various historical periods and processes seem to raise certain serious questions as to the validity of their theoretical assumptions.

I have found the most satisfactory tool for analysis on both national and regional level to be the so-called "city rank-and-size rule" as developed by several American sociologists and geographers. This is an empirically established rule and there exist several divergent interpretations of its meaning ranging from the opinion of G. K. Zipf who sees in it the reflection of "unifying (i.e. centralizing) power" to the opinion of B. A. Simon, supported by B. J. Berry and W. L. Garrison, that it is a curve of probabilities of distribution, in fact a result of the law of entropy. Graphs for Polish towns, collated nationally and regionally on double logarithmic scale, according to this city rank-and-size rule, demonstrate rather remarkable regularities and characteristics. First of all the graph for all Polish towns in 1960 has an exceptionally regular shape, forming almost a straight line. According to the probability interpretation of Simon this marks an ideally balanced structure of urban network without almost any influence of strongly deforming forces. In fact, the same graph for 1950 shows some evidences of the underdevelopment (decentralization?) at the left end of the curve. It is a reflection of the destruction of Warsaw and of its uncompleted reconstruction.

N. Ginsburg in his recently published work "Atlas of Economic Development" presented among others some comparative maps of urban population. In particular, the second one deals with the problem of the primacy of the largest city. The measure used is the ratio of the largest city to the total population of the four largest cities in the given country. The data on which the map is based shows that Poland takes the fifth place (after Italy, Saudi Arabia, Bechuanaland, Syria and before Canada, Spain and Yugoslavia) among the countries with the least developed primacy of the main urban centre.

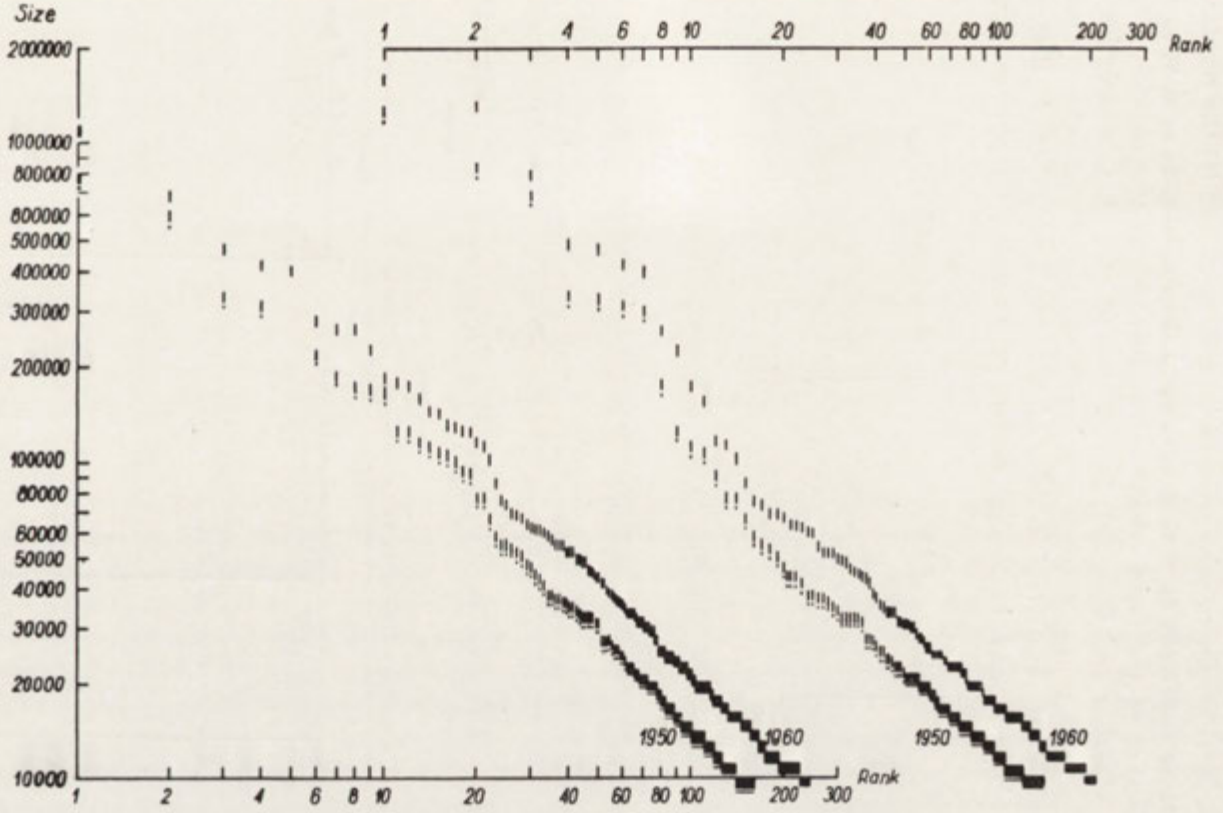


Fig. 1. Classification of Polish towns by rank and size, 1950 and 1960

Note. Curves on the left represent data ordered by administrative units, those on the right data summed together for each metropolitan area or conurbation disregarding their administrative division

The regional graphs may be grouped into three classes: (a) the regular ones characteristic for areas of evenly developed urban network and with slight preponderance of the main urban centre (voivodships of Katowice, Cracow, Poznań, Wroclaw and Szczecin); (b) the skewed ones characteristic for areas where the main urban centre is growing at the expense of others, especially the middle-sized towns (voivodships of Warsaw, Łódź, Gdańsk, Bydgoszcz, Lublin, Białystok and, in smaller degree, of Rzeszów, Olsztyn and Opole);

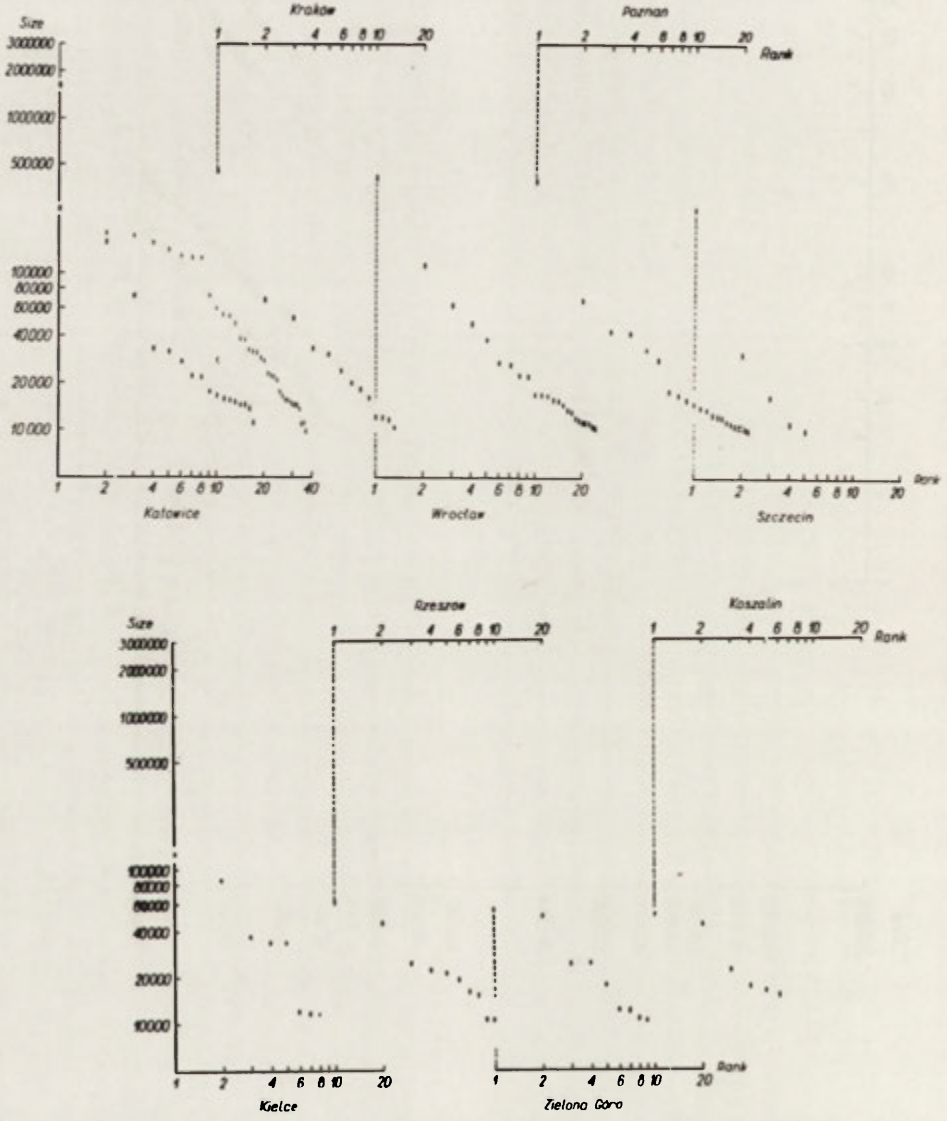


Fig. 2a. Classification of towns by rank and size in each voivodship in 1960. See note to the Fig. 1.

and finally (c) the irregular ones characteristic for areas without clearly crystallized main urban centre (voivodships of Kielce, Koszalin and Zielona Góra). In fact, in these last areas the largest city is not the seat of the voivodship administration. As a result, within the generally balanced urban network certain areas of smaller and greater irregularities may be distinguished.

Geographically, central, eastern and northeastern parts of the country show marked growth of the largest cities at the expense of smaller towns. Areas

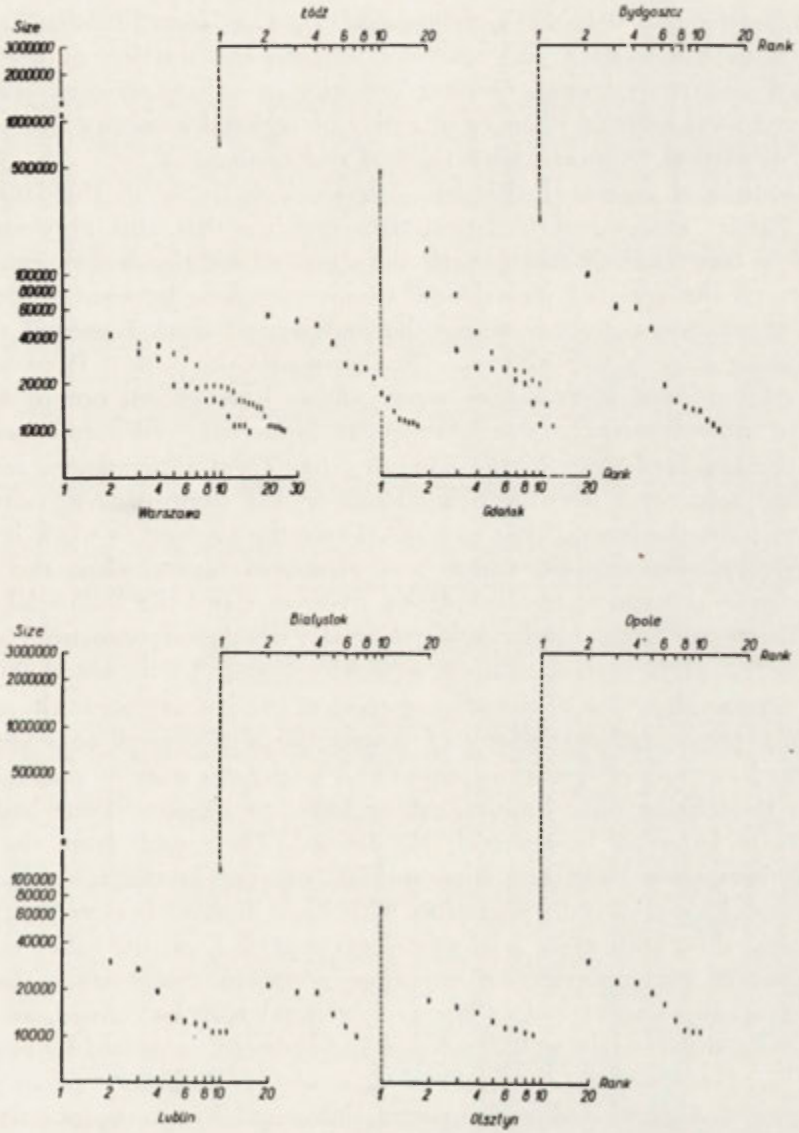


Fig. 2b. Classification of towns by rank and size in each voivodship in 1960. See note to the Fig. 1.

without clearly crystallized main urban centres are located between or on the peripheries of the regions of the well-balanced urban network.

Parallel problems to that of the primacy of the largest city are those of density of towns of various types and classes of importance. This density is however extremely variable. Variability is in fact so big that it is impossible to explain it within the framework of Christaller's theory. For instance, the general density of towns varies by voivodships from 11·6 to 36·8 per thousand km² (average density being 22·7) and the density of towns over 5000 inhabitants from 6·0 to 27·4 (average 12·5). The largest densities are characteristic of the western and southern regions, the smallest of the eastern, northern and central ones. Greater densities of urban network are clearly connected with areas of stronger intensity of regional economy and also with wealth of natural resources, both mineral and agricultural.

An additional aspect of the urban network is found in the journeys to work. Partial analysis of statistical data indicate that this phenomenon is extremely complicated. Along with the cases where the longer journeys to work mark the areas of special type of interrelations between urban settlements, there are other ones where the journeys to work represent only the first, passing stage of urbanization. Usually, where the present large industrial plants concentrated in few and larger centres have grown out of formerly dispersed manufactures and/or even older industrial trades and handicraft, i.e. in the southern parts of the country, they form a permanent feature of the urban settlement. On the other hand, in the south-eastern, central and northern parts the second type prevails. There the journey to work is perhaps a temporary phenomenon, which will vanish in future when the housing difficulties in the towns are completely overcome and the industrial population moves from the countryside to newly developed residential districts. The western parts of the country, especially Lower Silesia are characterized by almost complete lack of the phenomenon of the journey to work.

Among many differentiations of towns the sociological ones should be mentioned as those of special importance. The present state of research allows for the time being only limited, rather loose conclusions. Four basic types of urban societies are however clearly defined. They result from the general division into young and old communities, varying in the age structure of population, its origin and integration. This basic division is clearly connected, on the one side, with great post-war migrations and, on the other side, with migrations of rural population to urban areas. In consequence these four types of urban societies and of towns in general may be defined, as follows: (A) towns comparatively well developed and invested, inhabited by population of stabilized age structure, typical of slow and evolutionary urban growth; (B) towns well developed and invested, inhabited by young population, in majority newly arrived from the countryside, passing through processes of

social integration, with age structure typical of new urban centres; (C) towns underdeveloped and badly invested, inhabited by population forming stagnant urban society, deformed by the emigration of the more active elements (of the age group from 20 to 40 years) and finally (D) the new towns still under construction with mixed population, in majority of rural origin, passing through processes of social integration, with age structure typical for young urban societies. Type (B) is characteristic for almost all towns in the western and northern territories recovered after the war. Type (A) is dominant among larger cities of central and southern Poland, while type (C) prevails among the small rural towns and also among towns of the old industrial district of Łódź. Type (D) is connected with new industrial developments of the last ten years especially in the belt around the Upper Silesian Industrial District and in the southeastern part of the country.

All these differences in the urban network are further complicated by the disparities in the urban buildings, communal equipment and their use. Natural resources as basis for production of the building materials, varying regionally and locally, have deeply influenced the morphology of Polish towns. Areas poor in building stones and richer deposits of clay suitable for brick-making, have preserved traditions of wooden construction in housing right up to the last war. In result their towns are characterized by low and widely dispersed development. These tendencies were greatly enhanced by the historical processes of settlement. At the present moment in spite of great changes brought in by the planned effort in reconstruction of towns, the differences are still easily visible. The towns in the areas of the ancient so-called Congress Kingdom (the central and eastern part of the country belonging from 1815 till 1917 to the Russian Empire) are still poorly equipped and only loosely integrated into coherent urban entities. The towns in southern, especially southwestern industrialized regions are on the whole more densely developed (both in percentages of built-up areas and in heights of buildings) than in any other part of the country but the good quality of its communal equipment and services (sewage, water supply, gas and electric grid, mass urban transport) ensures here satisfactory, sometimes even good living conditions, while industrial towns of central Poland (around Łódź and elsewhere), lacking the necessary communal services, were always characterized by very bad housing conditions.

As already mentioned, the diversified network of urban settlements is changing and the changes are not proportionally or evenly spread. Although there are no areas where urban population diminished (there are however a few sporadic cases of small towns with decreasing population), the whole central part of Poland (the voivodships of Łódź, Katowice, Poznań, Bydgoszcz, Opole and Warsaw) in comparison with the remaining areas is characterized by slower, below the average, rate of growth. This geographical picture of

changes is the opposite (negative) to the picture of changes up to 1939, especially in the 19th century when the progress in urbanization was strongest in the central areas, i.e. in the Upper Silesian Industrial District and around Warsaw, Łódź, Poznań and Bydgoszcz. Moreover, the changes as between towns belonging to particular classes of importance and size varied in different regions. In some, the development of all towns was parallel, in fact balanced, in others, towns of specific class, whether large, middle-sized or small, were growing faster. As a result the final distribution of growth was more diversified than at the first glance would seem to be possible. Generally speaking, the

Fig. 3. Types of urban growth from 1870 to 1931
(according to F. Osowski)

1. Very large increase (4 times and more), 2. Large increase (2-4 times), 3. Average increase (1/2-1 1/2 times), 4. Stagnation, 5. Decrease, 6. New urban centres, 7. Areas of urban depopulation.

proportional growth of towns of all classes was evident in the territories recovered after the war (in some areas the growth of small towns was even stronger than that of larger ones); in the eastern voivodships the urban growth was concentrated to a very high degree in the main city, and the middle-sized

towns developed the most in the south-eastern regions. There were several reasons for these differences. First, the planned industrialization created possibilities of development for specific areas and centres; secondly, the rates of natural growth varied with regions, western and northern ones having the highest indices, finally the differences in housing and generally speaking, in living conditions diversified the attractiveness of various areas and towns.

One additional fact should also be noted. The southern voivodships of Katowice, Opole and, at least partly, of Cracow formed together an integrated economic region and their urban network developed in a characteristically interrelated manner. There, three concentric zones can be clearly distinguished. The central core composed at present of nineteen cities of about 1·5 million inhabitants, forms a classical mining and industrial conurbation—the traditional Upper Silesian Industrial District—already quickly slowing down in its well under the national average, growth. The first ring or belt includes areas of the greatest present development—mining, industrial and urban. This development is not however territorially continuous but takes place in series of middle-sized towns and industrial settlements. Within this area new satellite towns for the overspill population from the central area are under construction. The third zone, the second or outer belt is composed of several large districts all developing around their own large main urban centre of distinct industrial and cultural character. Here the planned industrial development is the strongest and the urban growth also very distinct and well over the average although smaller than within the inner ring.

Similar development takes place in the metropolitan area of Warsaw but there the full stage of decentralized development is not yet reached. So far only two concentric zones can be distinguished—the central core, the city of Warsaw itself, and the suburban zone. But already there are signs of new developments in the outer area—some subregional urban centres such as Plock and Siedlce are showing signs, in comparison to other similar towns, of an increased rate of growth.

The complex processes of urbanization, especially in their geographical structure result from past migrations and are the basis for future migrations. The study of those migrations is not sufficiently developed in Poland. The statistical data are scarce and often confused. The materials of the National Census from 1960 correlating the places of habitation in 1950 and 1960, when published, will certainly add much to our knowledge. Certain conclusions may be reached on the basis of other materials such as data on the journey to work or on the place of origin of students at the universities as well as some monographical studies. We already know that those migrations are more complex than is usually assumed. Parallel to the movements from rural to urban areas there exist strong migrations back to the countryside and between various towns, industrial settlements or agricultural communities. Migra-

tions also take time. This may be observed within such social groups as families, and sometimes involves more than one generation.

A cursory analysis of the geographical distribution of migrations shows that in contemporary Poland there are at least three distinct forms of movements from rural to urban areas. First, we have those migrations which are the consequence and an extension of the post-war resettlement, in particular in the recovered territories. The familial and cultural relations between the places of former and present habitation are lasting, and influence migrations in spite of distances. There exist, for instance, strong mutual migrations, both temporary and permanent, between the voivodships of Wroclaw and of Kielce, Lublin and Rzeszów although all these are not adjacent to the former and are separated by very distinct and attractive migratory area of the Upper Silesian and Cracow Region. The second form of migration is the local one; it is the movement to the developed industrial towns and settlements from the adjacent rural areas. Sometimes the first stage of such migration takes the form of the journey to work. The third form of migration is originated within the areas characterized otherwise by the strong deficit in manpower. There the recruitment has to be organized from more distant places, in particular from those parts of the country where there is still agricultural overpopulation. It should be stressed that this last form is usually an organized one and that economically and socially it is rather costly.

To sum up all these materials and conclusions it is possible to define present trends of urbanization in Poland, as typical for countries of already developed traditions of urban life, passing through a period of a very intensive modern industrialization, characteristic for the planned socialist development of the national economy. However, they are more rational and structurally more balanced that in other countries. This is expressed in limited growth of the main urban centre—the capital, and in the existence and development of numerous large and middle-sized towns as well as in the vitality of small towns. Moreover, there are some specific characteristic elements both in the existing network and its present changes. Those are caused by: (1) the variability of the geographical environment, especially in the distribution of natural resources, (2) the variation in the time of development of the settlements especially from the point of view of the density of the settlement network; this network, based on the distribution of *gród* (burgh), organization dating from early Dark Ages, was fully developed in Silesia already in the 12th, 13th and 14th centuries, in Wielkopolska and in Małopolska as well as in Pomerania between 13th and 14th centuries, in Mazowsze in 14th, 15th and 16th centuries and in Podlasie and Mazury in the 16th or in some areas even in the 18th century; (3) the strong differences in the functions and sizes of towns as between various regions, due to the development of industrial towns and settlements dating from the second half of 18th century right up

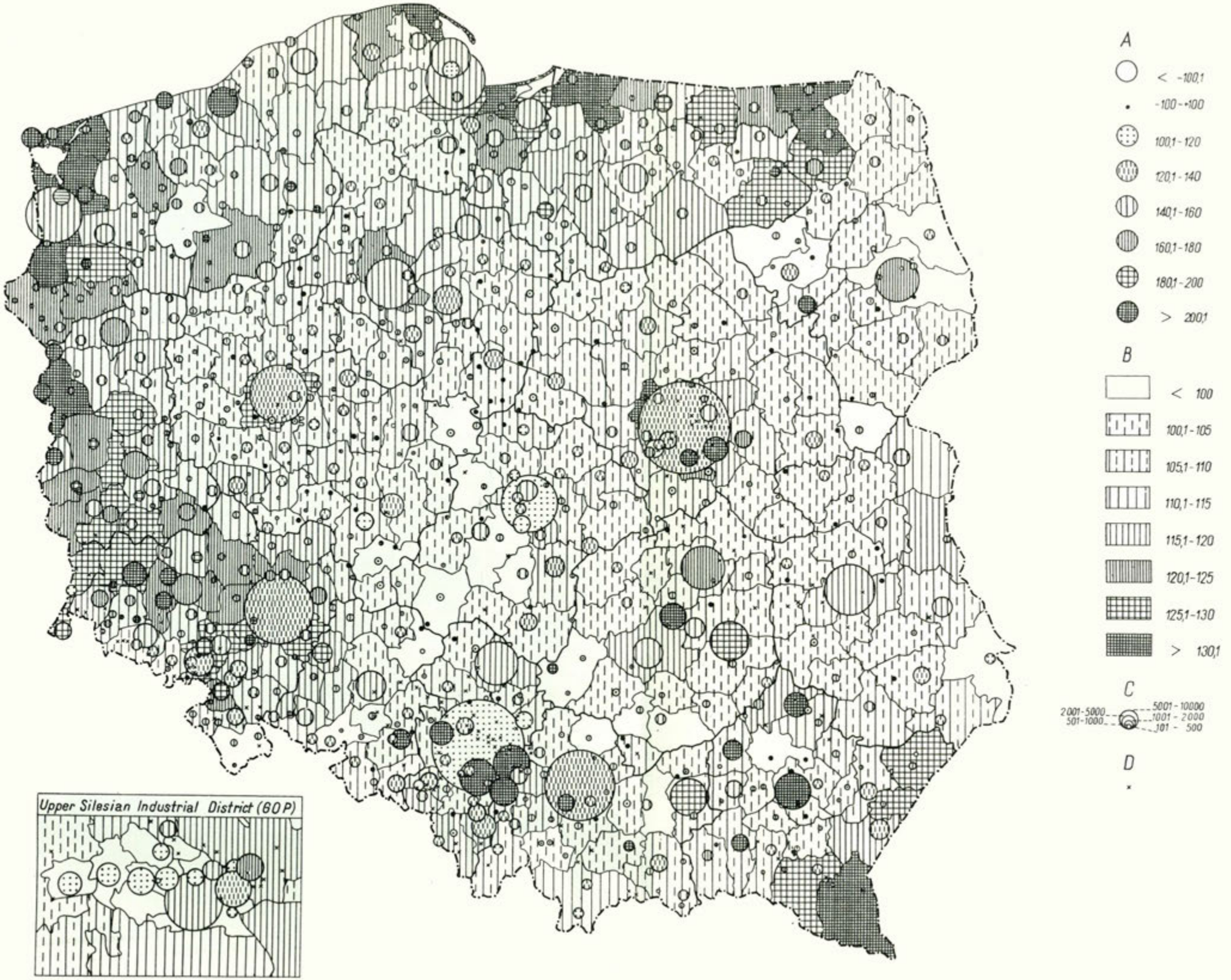


Fig. 4. Changes in urban and rural population from 1950 to 1960.

to the present time; (4) the division of the whole territory of Poland into parts incorporated for about hundred and fifty years between the three states completely different in their political, social and economic structure and life;

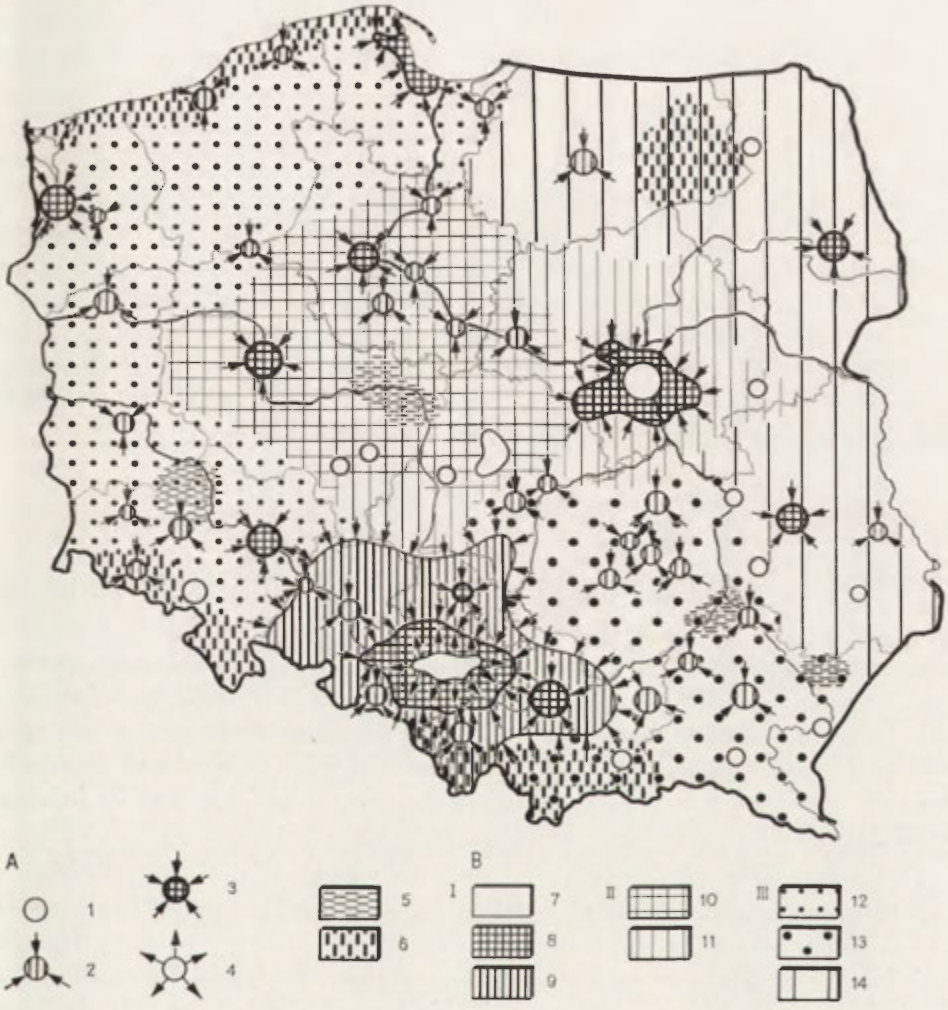


Fig. 5. Processes of urbanization in Poland in 1950–1960

A. Main Urban Centres and Areas

1. Limited growth; 2. Strong growth; 3. Very strong growth; 4. Signs of decentralization; 5. New mining areas; 6. Areas of mass tourism

B. Zones of Urban Growth

I. Areas urbanized: 7. Conurbations, metropolitan areas; 8. Areas of direct deglomeration; 9. Areas of indirect deglomeration

II. Areas of decreasing growth of urbanization: 10. Areas of balanced structure; Areas of deformed structure

III. Areas of strong urbanization: 12. Areas of balanced structure; 13. Areas of growth of middle-size towns; 14. Areas of concentration in the largest town

and finally (5), the differences in the population structure of various parts of the country, resulting from the post-war resettlement and recent migrations.

All these problems find their final expression in the regional structure of the urban network both as existing and as dynamically developing. Certain definite settlement regions and in other cases separate zones of settlements may be distinguished. They are: (I) The Upper Silesian and Cracow Region with already described specific territorial structure; (II) the heterogeneous zone of the slowed down (below the average) urbanization including the voivodships of Łódź, Poznań, Bydgoszcz and Warsaw; in this zone the whole metropolitan area of Warsaw is included; (III) the zone of the great intensity of urbanization, including three different types of areas: (III_1) of balanced development of urban network (the western and northern voivodships); (III_2) of the largest growth of middle-sized towns and limited growth or even stagnation of small towns (the voivodships of Rzeszów and Kielce as well as the eastern part of the voivodship of Cracow), and (III_3) of increasing concentration of urban population in the main urban centre (the voivodships of Białystok and Lublin).

IV. Effectiveness of planning policies in the field of urbanization

The picture of contemporary urbanization of Poland obtained by this analysis involves certain additional questions: to what degree is it a result of planning policies and how far is it due only to spontaneous growth, perhaps even impeded by the planned intervention? To answer these questions it is necessary to describe, at least shortly, the proclaimed aims of planning as well as the means used for their fulfillment and then to confront them with the results obtained in reality, i.e. with the present position and its inherent trends.

The programme of the balanced economic and social decentralization as well as some kind of unification between urban and rural ways of life were—as is well known—among the principal assets of the ideology of early Utopian socialists, such as Owen or Fourier. Here perhaps it should be recalled that the indebtness of Ebenezar Howard in his formulation of the "Garden-city" idea to the Utopian socialists is, I understand, fairly easy to trace. This preference for the decentralized development passed through Frederic Engels to the Marxist socialism. Although in the U.S.S.R. the construction of the socialist society and economy involved the necessity of originally opposed use of a very strong and centralized state organization, the ideological postulate of decentralization was never abandoned and may easily be found in all the statements and plans concerned with the development of national economies

in the U.S.S.R. and after World War II in other socialist countries. However, the need for the existence and preservation of big cities, especially national capitals, was in later times tacitly admitted and in some cases their further development ardently supported. Starting from such ideological basis the Six-year Plan for the Development of Polish National Economy, prepared and approved in the years 1947–1949, contained on one side a very ambitious programme for decentralized industrial development involving complete transformation of many backward areas and smaller urban centres and, on the other, the proposals easily understandable in Polish conditions, for complete reconstruction of Warsaw which as a result of war destruction had been reduced to one-third of its former population and had its central areas and all industrial plants completely destroyed. So already in the plan itself two opposite tendencies were included: for the development of backward or retarded areas and for the very strong concentration of new investments in the capital. As the main and perhaps the only means for the realization of the aims of the plan the erection of new industrial plants was assumed, and all other investments, especially in the services with housing in the first place, were to be secondary, following in the wake of new industries. However, the following years 1950–1955 and later, in which the implementation of the Six-year Plan was undertaken and pursued, brought the necessity of some very serious modifications and corrections in the original concept of the plan itself. First, it was found that the proposed programme of production could be achieved in many cases on the basis of modernization of existing plans, without costly new ones. A very definite tendency to build larger and larger plants was also dominating. Then the general difficulties in organizing big constructional enterprises and finding qualified labour for new factories far from the existing centres led to the revision of the formerly adopted locations. Moreover, the adopted rule that new services, especially new housing are to follow the new industrial developments led to strong pressures for changes in industrial locations on behalf of the existing large towns and other concentrations of industrial population. A good example of such ordered shift is the final location in Warsaw of big steel works formerly foreseen for one of the smaller towns within a radius of about 100 km of the capital. As a result the whole programme for the decentralization of industry and more balanced urban development was seriously reduced or at least transferred to a subsequent period. On the other hand, when it was found that rapid influx of population into the largest industrial and urban agglomerations tends to worsen living conditions and in particular the already very difficult housing conditions, certain means for control of the growth of those cities were introduced. To these belong strict limitations in the admittance to large towns of new inhabitants, establishment of correlation between the number of new jobs and that of persons to be admitted for permanent habitation as well

as a very strong reduction in the number of government offices and officials. Further modifications of policies were connected with the political changes of 1956. General readjustment of proportions in economic plans led to increase in funds provided for the development of services as well as to certain weakening in the application of the rule: new industries first, then the services. This diminished pressure from the existing agglomerations for new industrial developments. Moreover, to correct obvious faults and mistakes of centralized planning it was limited to the macroeconomic problems and many powers and corresponding funds were transferred to regional and local authorities. This evolution, started about 1956, is still continuing although at a somewhat slower rate than was originally provided. At the same time an increase in number of experienced planners led to better prepared, more realistic plans and proposals. However, the awareness that the economic reality of the late years did not conform to the original programme and promises left a certain malaise both among planners and in the whole community. This in turn led to a critical revaluation of aims and means in the field of regional planning which is still at present under discussion.

But in the light of our analysis of the processes of urbanization the results obtained are far from completely negative—in fact they are on the whole positive. The positive assessment of the present position and trends raises a number of important questions, such as: whether in the generally advantageous picture there are no dark shadows and dangerous possibilities for the future? whether changes for the better are big enough? and whether they are stabilized and will last in the ensuing years? Let us start with the first question. Among all changes already described or at least enumerated, only one—in my opinion—should be considered to be negative. This is the growing concentration of population in the main urban centres parallel to the stagnation or limited development of smaller towns, characteristic for eastern parts of the country. It will be quite difficult to counter it within the framework of present policies. With limited funds provided for the improvement of communal facilities and housing as well as for the development of local transport, the concentration of investments is necessary and, in consequence, becomes a rule of thumb followed by the central authorities, which have no time for what are on the whole minor problems, as well as by the regional ones which are rather eager to develop their own capital city. Some may say that with the general improvement and progress in the development of the national economy, investments will become easier and cheaper in future, so that the time of smaller towns in these underdeveloped areas will yet come. But meanwhile the growing disproportions will gain stronger foundations and achieved changes in the urban network will then become irreversible or at least extremely difficult to overcome. This brings us to the next question: although the general trends are on the whole positive, are they big enough?

After all, the observed changes were measured only by relative indices and the differences between those indices were not very large at that, sometimes even quite small. This question is rather difficult to answer as for the assessment of the rate of growth, some measuring standard is necessary. In other words, we should possess some more definite idea of the postulated urban network which will be accepted as the major long-term planning aim. Only then we can measure the rate of progress. It is not my object to discuss here various current opinions, most of them very subjective ones, concerning the ideal, or at least optimal future structure of urban or even settlement network. I will only venture to express my personal opinion that since the present network of Polish towns is in comparison to other countries less centralized and it is widely considered to be advantageous for economic and social integration and development, it should be carefully preserved or even strengthened. From that point of view the present state and trends represent only some kind of precarious balance between centralizing and decentralizing forces. Their stronger stabilization and extension into the future demands careful control of the location policies. These, in turn, more and more seem to depend on improved analysis of all factors involved in planning and mature judgement in decisions.

As a fit conclusion to the whole description of urbanization in contemporary Poland presented in this report, a short commentary on the importance of regional factors in such an analysis seems to be proper. In this description we have arrived at a very complex picture of the geography of urbanization in Poland. The existence of a series of urban regions and zones, the fairly strong regionalization of the processes of urbanization are the facts which should be taken into account in the work on a plan for future development of towns and on an ideal, standard model of urban network for Poland. In formulating what should be postulated it is necessary to take into account also the ways and means by which the proposed goal will be reached as well as the starting point, i.e. the existing state of the network and the trends in form of present processes of urbanization. All efforts to change radically or even completely the present network evolved within the framework of specific geographical environment and as a result of historical development, will lead to less efficient, both socially and economically, and therefore more costly proposals. However, if the whole effort in planning is to be concentrated not on the preparation of the idealistic schemes but on the realistic programmes of improvement and rational development of the existing network it becomes obvious that—in face of the established regionalization of the present urban network and the transforming processes of urbanization—the plan and the policies should be regionally diversified or even regionally evolved and defined. On the national level they should be brought together and coordinated in proper balance sheets. such as of population and manpower, of living condi-

tions, of investment funds, of building organization and materials, and so on. In this way, decentralization of planning will guarantee the proper development of the urban network, preserving the positive sides of the present state and eliminating the negative ones by careful use and direction of the inherent social and economic processes and trends.

PROGRESS AND CHANGE IN THE INDUSTRIALIZATION OF POLAND

Antoni Kukliński

It has been suggested, in a recent paper by S. Leszczycki [3], that there is a need to concentrate research activity in applied geography around definite problems. It is the opinion of the present author that the geography of economic growth should be regarded as one of these focal problems. An example of this approach is to be found in the "Essays on Geography and Economic Development" [2] and in the paper of M. D. Thomas [12].

The main aim of this paper is to contribute to discussion of the geography of industrial growth, the most important process in economic development. The article consists of three parts. The first is an attempt to outline the characteristic features of the three industrial revolutions which have taken place during the last hundred years within the limits of the present territories of Poland. The second part describes the geographical structure of Polish industry in 1960 and examines its place within the world economy. The third part reviews the broad trends in the changing distribution of Polish industry over the thirty-five year period 1946 to 1980.

I. Poland's three industrial revolutions

An industrial revolution may be described as a complex of economic and social changes based on advances in the technology of production, which leads quickly to a marked rise in the general level of development and to a radical change in the structure of the national economy. The progress of such a revolution may be traced by changes in the following indices:

1. The absolute and relative growth of secondary and tertiary occupations;
2. The growth of *per capita* national income and of the share of the industrial sector in its creation;
3. The growth of interregional and international trade coupled with an increase in the relative importance of raw materials in imports and of manufactured goods in exports;
4. The growth of urban population [1].

It is possible to distinguish three distinct stages of economic growth, which may be called industrial revolutions, within the present Polish territory. The first one, "the take-off"[1] revolution, began in the middle of the 19th century when the present territory of Poland was divided between three different states, Prussia, Austria and Russia (Fig. 1). At that time the great agrarian

Fig. 1. Political divisions of the present territory of Poland in 1910

reforms (the abolition of serfdom and the granting of land to the liberated peasants) broke the enforced link between the landlord and the peasant enabling the latter to migrate and so to create an army of cheap labour for the growing industries. Construction of railway lines (which grew from only 1000 km about 1860 to 22,000 km about 1910) created the conditions necessary for the development of interregional and international trade. The industries of the then divided Poland found a place in the growing trade of the period. An important factor in their development was the political

[1] In spite of our critical attitude towards the general direction of thinking presented in the publications of W. W. Rostow [7] some concepts are used in this paper introduced by this author because of their brevity in describing the basic features of some phenomena of economic growth.

division of the territory for this gave each new growing industry access to one of the three "common market" areas of the German, Austrian and Russian empires.

Thus in the last years prior to World War I there were more than a million industrial workers within the present Polish territory (Table 1). The studies of Pounds [5, 6], Straszewicz [9] and Misztal [4] present detailed evidence that the present dominance of the industrial regions of Upper Silesia, Łódź and Warsaw was established in the 50 years prior to World War I.

Table 1. Three industrial revolutions in Poland

Indices	The "take-off" revolution		The "big push" revolution		The achievement of industrial maturity	
	1860	1910	1946	1960	1960	1980†
Population in millions	15*	26*	24	30	30	38†
Urban population in millions	3*	8*	7·5	14	14	23†
Industrial employment in millions	0·1*	1·2*	1·2	3	3	5·2†
Industrial production including depreciation (value added: index numbers to 1946 and 1960 as base years)	no data	no data	100*	550*	100	550†

* Rough estimates of the author.
† Data of the perspective plan.
Sources: *Rocznik Statystyczny 1961* (Statistical Yearbook), Warszawa 1961, and [1, 8, 10, 11].

Table 2. Investment outlays in Poland from 1946 to 1960

Specification	1946–1950	1951–1955	1956–1960	1946–1960	1946–1950	1951–1955	1956–1960	1946–1960
	in million zł. according to 1956 prices				by basic branches in percentages of the total outlays in the national economy			
Total	90,715	210,518	308,158	609,391	100·0	100·0	100·0	100·0
Socialized economy	70,825	202,944	274,611	548,380	78·1	96·4	89·1	90·0
of which:								
Industry	26,443	96,287	127,058	249,788	29·2	45·7	41·2	41·0
Agriculture and forestry	7576	14,719	21,765	44,060	8·4	7·0	7·1	7·2
Transport and communications	16,095	25,786	29,645	71,526	17·7	12·2	9·6	11·7
Trade	2857	7082	9777	19,716	3·1	3·4	3·2	3·2
Communal services and housing	3482	31,086	52,340	86,908	3·8	14·8	17·0	14·3
Private economy	19,890	7574	33,547	61,011	21·9	3·6	10·9	10·0

Source: *Rocznik Statystyczny 1961* (Statistical Yearbook 1961), Warszawa 1961

The period between 1918 and 1939 did not bring basic changes in the volume of industrial activity or in its share in the national economy. Nevertheless, the industry of the reconstructed Polish State (Fig. 2) was partly successful in adapting its output to the demand of the now integrated national market. There was, too, some construction of new plants for the production of commodities which had not been produced in the divided territory in the 19th century. Thus some branches of the machine-tool, electrotechnical, chemical and food industries were established.

Fig. 2. Political divisions of the present territory of Poland in 1937

Most important was the second industrial revolution of the years 1946–1960. The system of socialist planning was able to create the conditions for a "big push" in the advance of our national economy (Table 2). The main result

of this "big push" is that Poland has crossed the threshold of 400 dollars *per capita* national income[2]. This income level is generally recognized as critical and a necessary condition for self-induced economic growth. This means that the Polish economy now generates sufficient capital for investment without prejudice to the volume of commodities and services necessary for present consumption.

The "perspective plan" for the development of Poland's economy in the period 1960–1980 provides for the attainment of the stage which is here called "the achievement of industrial maturity". This third stage of the industrial revolution is characterized by the following main features:

1. The crossing of the threshold of 1000 dollars *per capita* national income.
2. The achievement of a high level in the efficiency of industrial labour. If we put the data for 1960 as 100 the following target indices for 1980 [8] are proposed:
   industrial employment—about 180
   labour efficiency—about 440
   value added by manufacture—about 550
3. The achievement of a relatively high level of *per capita* turnover in international trade.

Some of the main features of the three industrial revolutions described in this first section are illustrated in detail in Table 1.

II. The spatial pattern of the Polish industrial economy in 1959–1960

The data presented in the first part of this study supply a sufficient background for an understanding of Polish industrialization in historical perspective. Table 3 summarizes the progress made so far by illustrating the changing position of Poland among world industries. Let us consider now the spatial pattern of the Polish industrial economy. To establish this pattern five indices were compiled. These are:

1. density of population
2. percentage of urban population
3. industrial employment per 100 km² (the density of industrial employment)
4. industrial employment per thousand inhabitants
5. *per capita* regional income 1959.

These materials were gathered in order to establish two classifications of the 17 voivodships into which Poland is divided. The object of the first

[2] Using data on national income for international comparisons is beset by great difficulties for which there are three important causes: (1) different methods of computation and especially the fact that the services are not recognized as a factor creating national income in socialist countries; (2) different price systems; (3) different methods of computing the relative value of national currencies.

Table 3. Position of Poland in world production

Specification	Percentages	
	1937*	1960
Population	1·6	1·0
Area	0·3	0·2
Total industrial production (estimated)	1·3	1·9
Output of:		
electric energy	0·8	1·2
coal	2·8	5·5
crude steel	1·1	1·9
zinc	6·2	6·9
seagoing vessels		2·5
sulphuric acid	1·1	1·6
cement	1·6	2·0
cotton yarn	1·4	2·0
raw sugar	2·1	2·8
Agriculture		
cereals	4·1	3·2
potatoes	16·8	12·6
sugar beet	3·7	6·6
cattle	1·5	1·0
pigs	2·5	3·3
Foreign trade		
total turnover	0·8	1·2
exports	0·8	1·1
imports	0·7	1·3
Merchant sea fleet	0·2	0·5

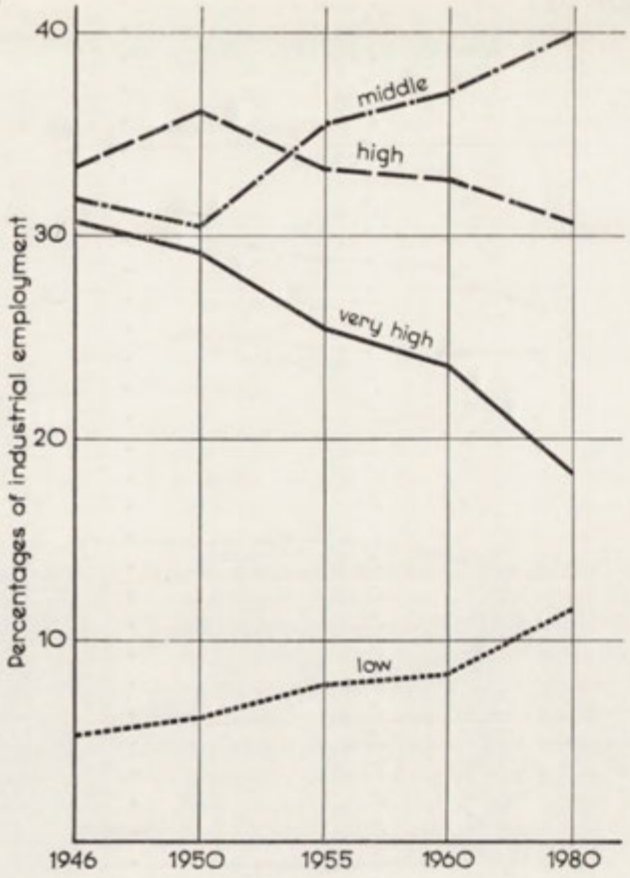
* Within the boundaries of 1937

Source: "15 lat planowej pracy nad rozbudową gospodarczą kraju, liczby i fakty" (15 years of work for the economic development of Poland; Facts and figures), *Gospodarka Planowa* 1961, 3, 3–19.

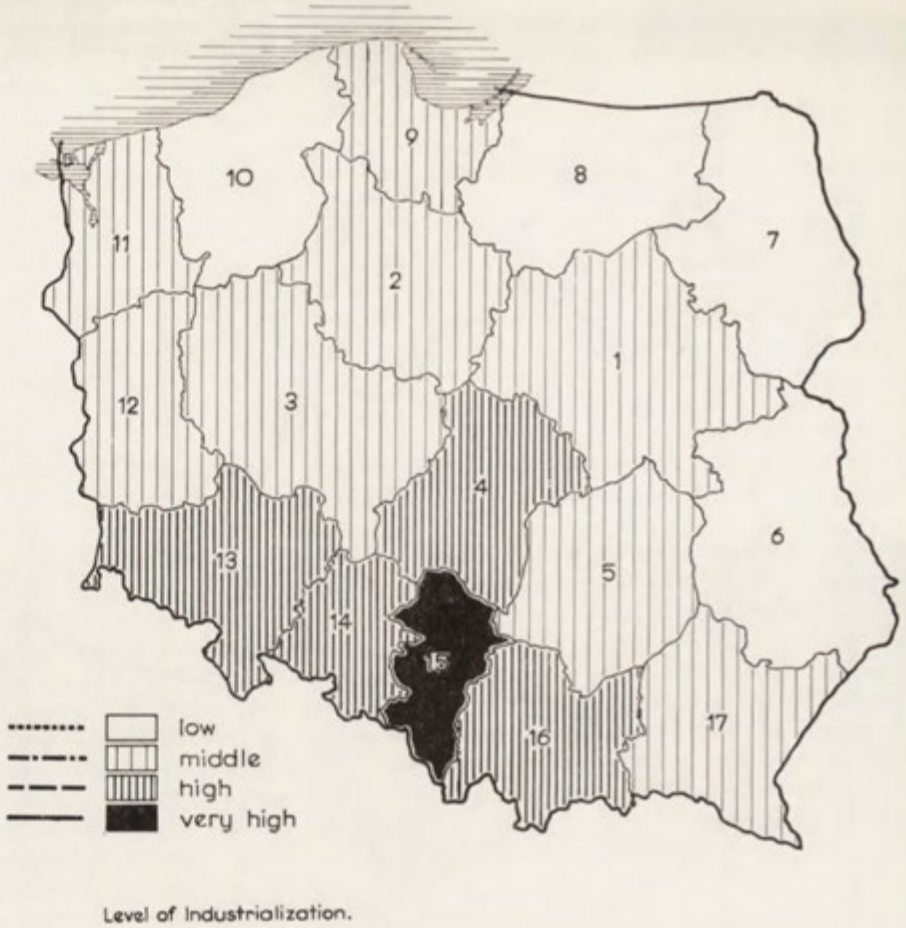
classification is to rank voivodships by level of industrialization (Table 4) as expressed by these indices, while the purpose of the second classification is to reveal the broad regional contrasts in industrial activity. (Table 5). For the sake of our discussion let us call the first classification "economic"[3] and the second classification "geographical", although it must be recognized that both classifications are economic and geographical at the same time.

Let us first consider the economic classification (Fig. 3) in which the indices were compiled in such a manner that they are comparable with the average for Poland. Naturally the results of this analysis are in part a consequence of the set of indices chosen as significant. The exclusion of indices describing the "infrastructure" of invested capital (especially in the transportation network and in communal services) disguises important differences between such

[3] The economic classification was prepared by S. M. Zawadzki

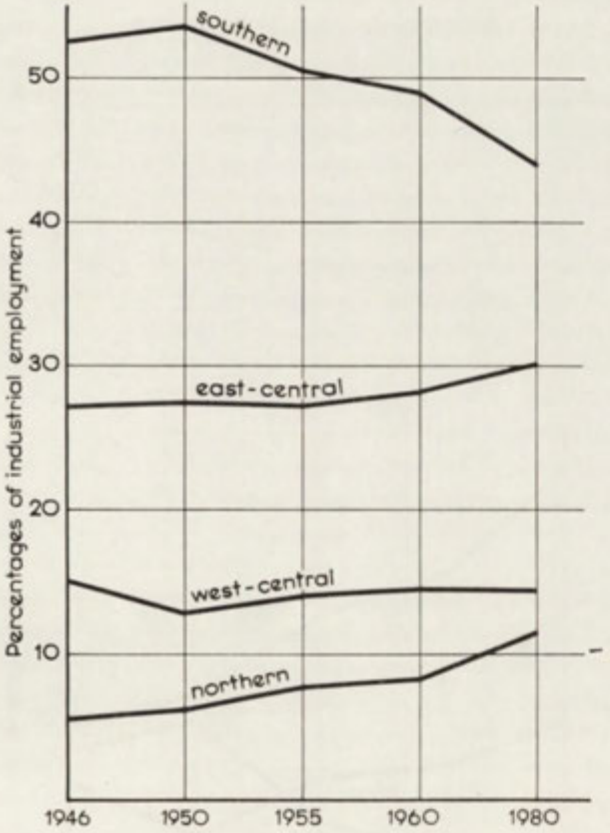


Share of Total Industrial Employment.



Level of Industrialization.

Fig. 3. Economic classifications of voivodships



Share of Total Industrial Employment

Groups of voivodships.

Fig. 4. Geographical classification of provinces

voivodships as Białystok, Lublin, Kielce or Rzeszów and others such as Olsztyn, Koszalin, Bydgoszcz or Poznań. The exclusion of indices describing the level of agricultural production similarly suppresses contrast between the voivodships of Rzeszów, Kielce and those of Bydgoszcz and Poznań. The

Table 4. Spatial pattern of the Polish industrial economy in 1960
(economic classification)

Level of industrialization / Voivodship groups	Density of population per km²	Urban population as % of total population	Density of industrial employment per 100 km²	Industrial employment per 1000 inhabitants	Regional income *per capita* (1959)
Low					
Białystok (7)	50	63	19	37	75
Olsztyn (8)	44	75	19	43	80
Koszalin (10)	40	93	19	46	81
Lublin (6)	76	52	31	40	87
Middle					
Rzeszów (17)	90	50	54	60	86
Kielce (5)	98	56	69	70	82
Bydgoszcz (2)	86	99	73	85	100
Zielona Góra (12)	56	100	54	96	90
Poznań (3)	94	97	77	82	101
Szczecin (11)	62	129	47	76	100
Warszawa (1)	122	112	94	77	111
Gdańsk (9)	117	138	111	95	116
High					
Kraków (16)	166	86	166	100	95
Wrocław (13)	123	127	168	136	103
Łódź (4)	140	109	195	139	106
Opole (14)	102	78	119	116	110
Very high					
Katowice (15)	362	156	800	222	123
Poland—total	100	100	100	100	100

Source: Data of the Central Statistical Office.
* Numbers of voivodships on Figs. 3 and 4.

first are known as areas with a low intensity of agriculture, the latter as areas with a high level of intensity. But in explaining these deficiences of our classification it must be stressed that this classification is based upon the industrial and not the total economy of voivodships.

The geographical classification distinguishes four groups of voivodships: the northern, the west-central, the east-central and the southern (Fig. 4).

Table 5. Spatial pattern of the Polish industrial economy in 1960
(geographical classification)

Regional position		Density of population per km²	Urban population as % of total population	Employment in industry		Regional income *per capita*
				per 100 km²	per 1000 inhabitants	
		inhabitants	%	persons	persons	thousands of zl.
A. Northern group						
Gdańsk (9)	M	111	66·3	1098	99	13·7
Olsztyn (8)	L	42	35·9	187	45	49·4
Koszalin (10)	L	38	44·6	184	48	9·5
Szczecin (11)	M	59	62·2	468	79	11·8
B. West-central group						
Bydgoszcz (2)	M	82	47·8	719	88	11·8
Poznań (3)	M	89	46·8	758	85	11·9
Zielona Góra (12)	M	53	47·9	537	100	10·6
C. East-Central group						
Białystok (7)	L	47	30·1	186	39	8·9
Warszawa (1)	M	116	53·7	927	80	13·1
Łódź (4)	H	133	52·5	1930	145	12·5
Kielce (5)	M	93	27·1	683	73	9·7
Lublin (6)	L	72	24·8	304	42	10·3
D. Southern group						
Wrocław (13)	H	117	61·1	1664	142	12·2
Opole (14)	H	98	37·7	1181	121	13·0
Katowice (15)	VH	343	75·2	7910	231	14·5
Kraków (16)	H	158	41·5	1645	104	11·2
Rzeszów (17)	M	85	23·9	530	62	10·1
Poland		95	48·1	989	104	11·8

L — low; M — middle; H — high; VH — very high — see Table 8.
Source: Data of the Central Statistical Office.

In Table 5 are presented indices for each voivodship together with the results of the economic classification. A summary of these two classifications is given in Table 6.

III. The basic trends of change in the spatial pattern of Polish industry 1946–1980

The data presented in Table 7 establish some interesting changes in the distribution of Poland's industry during the 35-year period under consideration. The most important trend may be described as diminishing disparities

Table 6. The spatial structure of Poland's industrial economy

Geographical groupings	Level of industrialization (the "economic" classification)				Total number of voivodships
	low	middle	high	very high	
Northern voivodships	2	2	—	—	4
West-central voivodships	—	3	—	—	3
East-central voivodships	2	2	1	—	5
Southern voivodships	—	1	3	1	5
Poland	4	8	4	1	17

Table 7. Change in the spatial pattern of Polish industry from 1946 till 1980

Group of voivodship	Percentage of industrial employment				
	1946	1950	1955	1960	1980
By level of industrialization					
low	4·0	4·1	5·8	6·5	11·0
middle	31·9	30·4	35·4	37·0	39·9
high	33·5	36·1	33·4	32·8	30·7
very high	30·6	29·4	25·4	23·7	18·4
Poland	100	100	100	100	100
By regional position					
northern	5·3	6·2	7·8	8·3	11·5
west-central	15·0	12·8	14·0	14·5	14·4
east-central	27·1	27·4	27·2	28·2	30·1
southern	52·6	53·6	50·5	49·0	44·0
Poland	100	100	100	100	100

in the level of industrialization between different parts of our country. It should be remembered however, that during our second industrial revolution between 1946 and 1960 this problem of great regional contrasts in industrial progress did not disappear completely; and the creation of a more balanced distribution of Poland's industry had to be incorporated into the premises of our perspective (i.e. long-term) plan. In the opinion of the present author, it is possible to summarize Polish experience in the industrialization of underdeveloped areas, in the following conclusions. Industrialization is not the only tool, although it is a very important one, in the promotion of economic development. The assumption of our economic policy in the early fifties, that

the total development of the regional economy must follow automatically from the location of a few industrial plants in a backward area, has proved to be incorrect. There are some examples of plants in random or "parachute" locations which failed to give a general stimulus to the economy of the region through the "multiplier effect". Some of these plants have rather high operational costs in comparison with the older plants of the traditional industrial districts. The economic losses on this account are however very small, among other reasons because the non-industrialized areas got a relatively small share of total industrial investment in the period 1951–1960.

Generally it may be said that in backward areas in Poland the second industrial revolution had only a "take-off" effect. The "big push" is to take place within the framework of the perspective plan which will provide the proper setting for the development of backward areas, which was missing during the past 15 years. At the other end of the scale of industrial development there is the problem of the optimum level of development in already highly industrialized areas. In Poland this is expressed in the relative overdevelopment of the voivodship of Katowice, which includes the most important industrial area in Poland, the Upper Silesian Industrial District.

The difficulties characteristic of over-congested areas (air and water pollution, water shortage, the strangulation of the transport system) raise the level of the total costs of industrial production in Upper Silesia. That is why in the last ten years a policy of "passive deglomeration" for this area was adopted. This takes the form of restrictions on new industrial growth which is limited to cases for which a new plant is closely associated technologically and economically with the extraction of coal. Nevertheless there exist numerous industrial plants in which proximity to Upper Silesia is of some importance. Plants of this type have been located in the fringe area around Upper Silesia. This area now forms a very large conurbation, perhaps the beginnings of a "megalopolis", the new large-scale unit of the combined Upper Silesian and Cracow Region.

The basic tendency towards the reduction of regional disparities in the level of industrialization can be traced also in the geographical classification. The most important group of voivodships is still the southern one, but the data of Table 7 reveal a slow, relative decrease of the share of this group in Poland's industrial employment from 52·6% in 1946 to 49·0% in 1960 and 44% in 1980.

The main asset of this group of southern voivodships in industrial development is the existence of deposits of the most important known mineral resources of Poland. But recent years have brought some important changes in the geography of mineral exploitation in Poland. Some large-scale mining has been undertaken in Central Poland, outside the traditional regions of extractive industry. The development of the new industrial region of Konin,

which specializes in the power industry, using lignite as fuel for production of electricity, is most important. According to the data of Table 7 the industrial development of the west-central group is very close to the rate of growth of the country as a whole.

The construction of a pipeline linking the Wołga Oil Region and the industrial centres in Poland, the German Democratic Republic, Czechoslovakia and Hungary has provided the basis for the erection of a big petrochemical plant in Płock which will strongly influence the industrial development of East-Central Poland. But the east-central group did not change its share of industrial employment considerably between 1946 and 1960 and it will gain only slightly in the next twenty years.

The northern group of voivodships is the area of the most rapid relative industrial growth although this group is only moderate in importance if we take absolute figures into consideration. The data of Table 7 reflect the failure fully to exploit opportunities for coastal industrial growth in the years 1946–1960 and this may perhaps continue over the period of our present plans. In the writer's opinion a rapid development of our maritime interests is necessary in order to quicken the industrial growth of the coastlands of the country.

In conclusion, it should be said the targets for 1980 must still be considered as preliminary. Especially in the field of regional development there are at present many problems to be solved. The most important involves the construction of a set of models of the future regional economy of the country. Such models would be an effective tool for the evaluation of the regional perspective plans of different provinces, and at the same time they would facilitate discussion of the locational patterns of industrial activity as a whole as well as of different branches of industry.

Bibliography

[1] Dziewoński, K., "Procesy urbanizacyjne we współczesnej Polsce" (Sum. Urbanization processes in contemporary Poland. An attempt at a synthesis), *Przegl. Geogr.*, 34 (1962), 3, 459–508.

[2] Hartshorne, R., *Geography and economic growth*, Essays on geography and economic development, Chicago 1960, 3–26.

[3] Leszczycki, S., "Geografia stosowana czy zastosowanie badań geograficznych dla celów praktycznych" (Sum. Applied geography or application of geographical research for practical purposes), *Przegl. Geogr.*, 34 (1962), 1, 3–23.

[4] Misztal, S., "Przemiany w strukturze i rozmieszczeniu przemysłu na terenie woj. warszawskiego i miasta Warszawy" (Sum. Changes in the structure and distribution of industries in the city and voivodship of Warsaw), *Przegl. Geogr.*, 33 (1958), 4, 587–618.

[5] Pounds, N. J. G., *The Upper Silesian industrial region.* Indiana University Publications (1958).

[6] Pounds, N. J. G., "The industrial geography of modern Poland", *Econ. Geogr.*, 36 (1960), 3, 231–253.
[7] Rostow, W. W., *The stages of economic growth*, Cambridge, Mass., 1960.
[8] Secomski, K., "Z problematyki perspektywicznego planu rozwoju Polski (na tle programu KPZR)" (Sum. On the problems of the perspective plan of development of Poland. Against the background of the programme of the CPSU), *Ekonomista*, 1962, 2, 231–246.
[9] Straszewicz, L., "The Łódź industrial district.", *Przegl. Geogr.*, 31 (1959), Suppl., 70–91.
[10] Kukliński, A., *Problemy przestrzenne uprzemysłowienia Polski*, Komitet Budownictwa Architektury i Urbanistyki (Spatial problems of Poland's industrialization), Warszawa 1962.
[11] Knyziak, Z., "Inwestycyjne i pozainwestycyjne czynniki wzrostu produkcji przemysłowej w latach 1950–1960" (Sum. Investment and non-investment factors of the growth of industrial production in Poland in 1950–1960), *Ekonomista*, 1961, 5, 1036–1061.
[12] Thomas, M. D., "Regional economic growth and industrial development", *Regional Science Association. Papers*, 10 (1963), 61–75.

THE PROBLEM OF SMALL TOWNS IN ENGLAND AND WALES

Kenneth C. Edwards

In England and Wales distinction between the urban and rural population rests solely on the basis of local government status. The urban population refers to the inhabitants of County Boroughs, Municipal Boroughs and Urban Districts, while the rural population comprises those living in Rural Districts, despite the fact that many of the latter contain large suburban elements belonging to towns which have spread beyond their own local government boundaries. Very broadly, though there are many exceptions, the smaller towns have the status of Urban Districts. Many of these however have populations exceeding 20,000 and include industrial centres of up to 40–50,000 inhabitants, with which this paper is not concerned. For historical reasons numerous small towns, often with only 2000–5000 inhabitants, rank as Municipal Boroughs. These ancient boroughs obtained their status centuries ago when their importance was far greater than at present. There are 136 small boroughs of under 20,000 inhabitants, 49 of them with under 5000. The position is further complicated by the existence in Rural Districts of small urban centres which, under the present administrative system, are too small to justify urban status. Yet such places, in terms of both form and function, are true towns. Southwell in Nottinghamshire, seat of an Anglican diocese since 1884, is a good instance. With a population of 4300, Southwell is a small but significant retail centre with three banks, a grammar school, a hospital, a cinema, administrative offices for the Rural District and several small industries; it possesses, in fact, at least a minimum of the central services and institutions regarded by A. E. Smailes as the essential elements of a town. Cinderford (Forest of Dean, in Gloucestershire) and Lutterworth (Leicestershire) are other examples. Thus in England and Wales the small towns, which for the purpose of this paper are restricted to those of not more than 20,000 inhabitants, fall into three administrative categories: Urban Districts, historic Municipal Boroughs and, in Rural Districts, urban centres which are effectively small towns but without urban status. Their distribution is widespread, both over the lowlands and

in the uplands, though they are more numerous in the lowlands. Here, in the traditional agricultural areas, their pattern of occurrence forms a comparatively close mesh. These "country towns" as they are often called, originated as local market centres and although their market function has long since declined, and in many cases ceased altogether, they remain as small service centres for the surrounding rural population. Some of them also function as the administrative centre of a county, e.g. Northallerton (8700), Sleaford (7800), Trowbridge (15,800), Truro (13,300), Ruthin (3500), Welshpool (6300). Small-scale industries are found in most "country towns", usually concerned with, or related to, the processing of agricultural products.

How many small towns are there in England and Wales? Because of the administrative basis upon which the urban population is classified, it is impossible to state a precise figure. The census of 1961 (Preliminary Report) recorded 556 urban areas, i.e. Boroughs and Urban Districts, each with a population of under 20,000. But many of these Urban Districts, some predominantly industrial and others almost wholly residential, form elements of the great cities and conurbations and in this sense have no separate existence. On the other hand, as we have seen, a number of small towns are without urban status and are therefore omitted from this category in the census.

If, however, we deduct from the total those Urban Districts which belong to the conurbations or lie adjacent to other large cities and substitute for these an equivalent number to represent the small towns without urban status, the result will be a reasonable estimate of the total number of small towns. Thus we may take the 1961 Census figure of some 550 Urban Districts with up to 20,000 inhabitants as representing the approximate number of small towns in England and Wales. These are shown in Table 1, arranged in size-groups for comparison with the Polish towns dealt with in Maria Kielczewska-Zaleska's paper.

Table 1. Small towns in England and Wales and Poland

Size (No. of inhabitants)	Number	
	England and Wales (1961)	Poland (1960)
10,000–20,000	215	130
5000–10,000	163	195
0–5000	172	313
Total	550	638

As shown by Maria Kielczewska-Zaleska, in Poland there are 638 towns of 20,000 inhabitants or less, with an aggregate population of about 4 millions or 26% of the total urban population. In England and Wales the 550 small

towns comprise an aggregate population of 5 millions or 14% of the total urban population. Thus both numerically and as a proportion of the total urban population, small towns are more significant in Poland than in England and Wales. Since such towns are commonly market- and service-centres, this fact reflects the much higher numbers employed in agriculture in Poland than in our country.

Throughout the present century, chiefly due to the continued decrease in the number of people engaged in agriculture and the drift from the rural and smaller urban areas to the larger industrial centres, the country towns of England and Wales have declined in importance. In many cases the population remained static, while in some it actually fell. At the most, growth was only slight and in these circumstances something near to economic and social stagnation prevailed. With restricted opportunities for employment, young people moved to the larger towns and eventually the small centres were left with an increasingly ageing population. With the growth of motor transport, including bus services, some country towns situated at a convenient distance from large cities attracted daily commuters and became dormitory centres but the additional residential population was hardly effective in arresting their economic decline.

The substantial increase in the population of England and Wales since 1939, of 4·6 millions, is chiefly the result of a post-war rise in the birth-rate, although 0·6 millions of the total increase is accounted for by net inward migration from the rest of the British Isles and other countries. This higher rate of population growth is reflected in a general increase of population both in the towns, whether large or small, and in the rural areas. Even so there are many instances in the non-industrial parts of the country of a continued decline in the population of small towns and the adjacent rural districts. Thus in the agricultural belt of eastern England, Downham Market, Ely, Alford, Horncastle, Driffield and Pickering are examples; in the agricultural parts of the west and south-west, Blandford, South Molton, Okehampton, Bromyard and Ledbury; in the uplands of the Pennines, Skipton, Richmond, Alston and Hexham; and in Wales, Caernarvon, Pwllheli, Ruthin, Llandeilo, Presteigne and Knighton. It should be noted that all of these, with the exception of Skipton (13,000), are towns of less than 10,000 inhabitants.

While it is true that during the past decade the majority of small towns have gained in population, in contrast to their relative stagnation in pre-war years, the percentage growth has nevertheless been lower than in the case of larger towns. Thus while towns of 25–75,000 grew by over 10%, those in the size-groups 10–20,000, 5–10,000 and under 5000 grew by only 8·1%, 7·4% and 2·6% respectively. Moreover since these modest increases are due mainly to a rise in birth-rate there can be no assurance that the present figures will be maintained unless an improvement in local employment opportunities

occurs. It is certainly clear that most of the very small towns, i.e. those under 5000 inhabitants, with their ageing population, have shown little signs of growth.

Table 2. Population of small towns of Lincolnshire
(thousands)

Towns	1901	1911	1921	1931	1951	1961
Market Rasen	2·2	2·3	2·1	2·0	2·1	2·3
Alford	2·5	2·4	2·2	2·2	2·2	2·1
Horncastle	4·0	3·9	3·4	3·5	3·8	3·8
Bourne	4·3	4·3	4·3	4·9	5·1	5·3
Sleaford	5·5	6·4	6·7	7·0	7·3	7·8
Barton-on-Humber	5·7	6·7	6·5	6·3	6·2	6·5
Stamford	8·2	9·6	9·9	9·9	10·9	11·7
Spalding	9·4	10·3	10·7	12·6	14·4	14·6
Louth	9·5	9·8	9·5	9·7	11·0	11·6
Gainsborough	17·7	20·6	19·7	18·7	17·5	17·3

In Table 2 the population at each census in the present century is given for ten small towns in Lincolnshire, a predominantly agricultural county of eastern England. It will be seen that the smallest of these have hardly grown at all in the past 60 years and in two cases, Alford and Horncastle, the present population is now less than it was in 1901. A few of the larger ones, with over 5000 inhabitants in 1901, show a significant increase only since the war. Among these Louth and Spalding reflect a small expansion in industrial and commercial activity. Gainsborough, the largest of the group, is exceptional in having long been dependent on the fluctuating trade of a large agricultural engineering works. Only the advent of another type of engineering in the thirties brought some stability to the town, although the fact that its population is less than it was in 1901 is largely due to some workers residing outside the administrative boundary.

The example of Lincolnshire, which can be matched in other parts of the country, affords evidence in support of the view that, in general, small towns today have diminishing opportunities for growth.

Both during and after the war, attention was frequently drawn to the problem of small towns and their future role. Many people expressed the opinion that attempts should be made to revive and expand these towns. Such measures, it was claimed, would assist in the process of de-congesting the large overcrowded cities and at the same time benefit the small towns by providing the necessary stimulus for their revival. Various facts were cited in support of this view. All country towns, even long-decayed market centres, possessed most of the essential urban facilities, e.g. shops, banks,

offices, schools, churches and provision for recreation, albeit on a limited scale. Public utilities such as water supply, gas and electricity were generally available, as also was road or railway transport, or both. Often there were disused or partially-used industrial buildings which could be renovated and utilized for a comparatively small capital outlay. It was further urged that the majority of country towns were attractive places in which to live, usually set in pleasant surroundings, uncontaminated by industrial smoke and dirt.

In practice these arguments represented hopes rather than realities. Apart from the fact that official planning in Britain is faced with problems of greater magnitude than that posed by the small towns, it is debatable as to how far the renewal and expansion of such towns can be made effective. To achieve this the first essential is the expansion of employment opportunities by the introduction of further industry. Only by this means can the drift of population to the larger towns be arrested. In the post-war period, however, industry has on the whole been hesitant to risk capital investment, except on a small scale, in little towns where labour supply is usually insufficient.

Despite the general decline of the small town in England and Wales, the picture must not be exaggerated. Indeed, in recent years many such towns have undergone a pronounced revival, some of them actually entering upon a new phase of growth. This has occurred mainly in two distinct ways, each involving industrial development. In the first case the dispersal of war-time production units to numerous small centres throughout the country, resulted in the building of comparatively small though well-equipped factories in places where they would never otherwise have appeared. Control over labour during the war allowed the successful operation of these widely dispersed units either by the daily transport of workers or even by a temporary shift of population. After the war many of these factories were adapted to peace-time production and formed a permanent addition to the local economy; and as the housing situation steadily improved, these towns, even though their population growth was only slight, were clearly re-invigorated.

Among innumerable examples a few may be cited in order to illustrate the different circumstances which gave rise to renewed activity. At Lutterworth (Leicestershire) war-time premises were built by the government for a large Coventry engineering firm and these, after being extended, have continued in use as a branch factory of the parent company. At Oakham (Rutland) and Alford (Lincs.), Leicester firms have established branch factories for clothing and footwear, and nylon processing respectively, in former war-time units. The nylon factory at Alford was originally a disused brewery. In the case of Lydney (Gloucestershire), a tiny sea-port, a war-time installation of a "heavy" nature was later converted into a trading estate accommodating a variety of "light" industries.

The second and more recent means by which some small towns have

achieved revival is through the Town Development Act of 1952. This Act was a further attempt by the Government, following the New Towns legislation of 1946, to solve the problem of overspill and dispersal of industry in London and the other great cities. It allows for the transfer of population from a large city to a smaller centre, or centres, by mutual agreement between the towns concerned. Thus an "exporting" city may arrange for one or more "receiving" centres to accommodate and employ part of its population. Such "receiving" centres are commonly known as expanded towns. The initiative for promoting schemes under the Act lies with the "exporting" and "receiving" centres themselves but the approval of the Ministry of Housing and Local Government is required before action can be taken. Most of the cost incurred in this form of urban development must be met by the participating local authorities although state aid is granted for particular purposes.

At present about 16 towns in south-east England have made agreements to take part of London's overspill; several towns in the Midlands (e.g. Daventry) and in the west of England (e.g. Weston-super-Mare) have concluded similar agreements with Birmingham, while further north a few have negotiated expansion schemes with Liverpool and Manchester. Inevitably many small towns have been anxious to take advantage of the Act and Birmingham alone has made either partial or provisional agreements with well over 30 urban centres throughout England and Wales. In the great majority of these cases no action has yet been taken and it is likely that most of them will remain as schemes on paper for a long time to come.

So far as the really small towns are concerned, the effects of the Act of 1952 have been disappointing, for most of the agreements have been concluded with "receiving" centres of over 10,000 inhabitants, some of them very much larger. Among those having contracts with London, Swindom had a population of 69,000 in 1951, Wellingborough 28,000, Banbury 19,000, Basingstoke 17,000 and Bletchley 11,000. As expanded towns some of these have grown substantially. By 1961, Swindon's population rose to 91,700, Basingstoke's to 26,000 and Bletchley's to 17,000. Similar proportionate increases, however, occurred in some of the very small towns which entered into agreements with London. Thetford and Haverhill, with populations of 4400 and 4000 respectively in 1951, have each increased by 1000. Daventry (4000 in 1951), a receiving centre for both London and Birmingham, has grown to 5800.

The case of Thetford affords a good instance of the rehabilitation of a small decayed market centre. Thetford in Norfolk is situated 80 miles from London on the main road to Norwich. It is an ancient borough and has a long history as a country market town. Its market functions declined and ever since the end of the First World War have been of little or no importance. A final blow to the town's economy was the closure in the 'thirties of an agricultural engineering works, the only significant source of employment.

Thereafter Thetford stagnated, though rescued from further decline by the presence of British and Canadian air bases in the district during and after the second war.

In 1954, two years after the passing of the Act, Thetford made proposals to re-settle 10,000 Londoners but the project was judged by the Ministry to be too ambitious. A modified scheme to transfer 5000 people from the capital was submitted the following year and was approved. Housing and factories were later set up and in 1959 the first families arrived. They came chiefly from Bethnal Green and other parts of north London. With support from the Norfolk County Planning Authority, Thetford worked enthusiastically for the project and provided factory buildings, including services, in the form of a trading estate. Generous assistance towards the cost of housing, water-supply, extension and other requirements was obtained from the London County Council (L.C.C.), the "exporting" authority. Unfortunately industrial firms have been slow to take advantage of the new opportunities. By the end of 1961, 25 firms (22 of them from London) were active at Thetford, employing, in all, less than 600 workers. Most of them are small concerns with only 10–20 employees, although an engineering firm and a timber-working plant are operating on a larger scale.

The effect of this expansion on the old town of Thetford is already noticeable. As already stated the population has increased by 1000. Shopping facilities have been improved, a Woolworth store has appeared, new schools have been built and plans for the re-development of the town centre are already being implemented.

Much of what has occurred at Thetford can also be seen at Haverhill and Daventry but on the whole expansion under the Town Development Act has been encouraged in very few of our smallest towns. In fact, future policy of the Ministry is more likely to favour the expansion of much larger centres such as those already approaching 100,000 inhabitants. While it must be granted that in the post-war period industrial growth on a limited scale has occurred in many small towns, the process has been most effective, not in the smallest centres, but in those exceeding 10,000 inhabitants and especially in those of over 20,000. The principal factors encouraging such growth are accessibility by road transport, the availability of an initial supply of labour and the presence of buildings suitable for industrial use, together with space for extension. This new phase of activity in country towns has considerably changed their industrial character. Industries are no longer based on locally produced materials, neither do they any longer serve a strictly local market and they employ almost as many women as men. Instead of being closely related to agricultural production, the new industries are characteristically concerned with textiles, clothing, chemicals, plastics and light engineering.

Yet the very small towns, which include the 300 centres with less than

10,000 inhabitants, show few signs of revival. Of the smaller expanded towns it is too early to judge. Some may indeed achieve success, while others will almost certainly languish for lack of financial support and dwindling enthusiasm. It appears that the future of our smallest towns remains problematic.

Bibliography

[1] Baron, S. R. (ed.), *Country towns in the future England*, London 1943 (passim).
[2] Smailes, A. E., "The redistribution of settlement: the development of existing small towns", in Gutkind E. A. (ed.), *Creative Demobilization*. London 1943, vol. II, 216–223.
[3] "The Town Development Act, 1952", *Town and Country Planning*, April 1953.
[4] Weekley, I. G., *The industrial geography of country towns*, unpublished M. A. thesis, University of Nottingham, 1956 (passim).
[5] Buck, H., "Redevelopment of small towns", *Report of Town and Country Planning Summer School*, Town Planning Institute, London 1962, 63–77.
[6] Woods, K. S., "Industrial development in country towns." *Town and Country Planning*, Nov. 1962, 433–435.
[7] Bracey, H. E., *Social provision in rural Wiltshire*, London 1952, pp. 204.

CHANGES IN THE FUNCTIONS AND STRUCTURE OF SMALL TOWNS IN POLAND

Maria Kiełczewska-Zaleska

The problem of changes in the role of small towns as the result of post-war changes in the national economy early became a subject of geographical interest. Numerous monographs on small towns have been prepared in order to define and to describe the processes of change. These studies have shown that in the years 1946–54 small towns passed through a critical stage marked by emigration and a general decline in population. In view of the increasing urbanization of Poland this appeared to be an exceptional occurrence, arousing understandable anxiety. The decline of small towns was related to general changes resulting from the nationalization of industry and trade and from the organization of economic planning under the newly created socialist system. Questions were often asked whether the crisis of small towns is of a permanent character and whether or not the small town is an obsolete socio-economic form which cannot be adapted to new conditions. The problem of stimulating the development of small towns and of adapting them to the changing circumstances soon became the subject of close cooperation between planners and geographers. Geographical studies were undertaken to review the possibilities of economic development in small towns in relation to their immediate neighbourhood and to discover how far and how effectively the resources of their hinterlands are utilized. Such studies showed how the agricultural output of the adjacent rural areas is used, whether this production is on an adequate level, and how its processing and consumption are connected with the small town itself. Consideration was also given to the mineral resources found in the adjacent areas, to what extent such resources had not been utilized, and to what use they could best be exploited. Thus the task of planners and geographers was to find a way out of the crisis in which the small towns found themselves.

Today in 1962, the process of change in the economy and social life of small towns is still the subject of geographical and planning studies. But after a period of some 15 years many symptoms of the crisis are no longer discern-

ible. Emigration has been greatly reduced and some concrete forms of adaptation to the new economic system have been found. In this paper I should like to report on these achievements and to indicate the trends of future development.

Among the 745 towns in Poland in 1960, there were some 638 small towns with a population of under 20 thousand inhabitants. Of these 313 had less than 5 thousand inhabitants, 195 had from 5 to 10 thousand, and 130 from 10 to 20 thousand. Besides these, I shall also deal with the problem of the so-called "degraded towns", i.e. those which have lost their urban administrative status. On the other hand, so-called urban settlements with a specific legal status are not referred to, as they are mainly new industrial settlements or health and recreation centres.

1. Functions of small towns in the past

In order to understand the structure of small towns one must go back to their origin. A dense network of small towns developed in the area of feudal economy. Up to the end of the 18th century small towns in Poland were based on local markets organizing the exchange of agricultural and industrial goods on the simplest level. They were mainly settlements of artisans who were also engaged in agricultural production for their own needs. They supplied landowners and some of the peasants with various artisan products and services. The development of numerous small towns with a relatively narrow domain of activity may be therefore easily understood, especially when the conditions of production and transport under the feudal system are taken into account. One can even assume that the density of small towns served as the basis for the full development of economic life, intensifying the exchange of goods and promoting the growth of handicrafts. Small towns eventually assumed a more complex role and even agriculture played some part in their structure. For instance in 1779 out of the 184 families living in the town of Iłża in the present voivodship of Kielce, 50% of the workers were engaged in agriculture and only 31% in handicrafts. In the town of Myszyniec in the present voivodship of Warsaw, in 1789 there were 23 farmers and 22 artisans, and the situation was similar in other places. The inhabitants of small feudal towns usually possessed plots of arable land in proximity to their buildings, though sometimes these were situated outside the urban area. Thus the amount of cultivated land in small towns was considerable and has remained almost unchanged until the present day.

Agricultural production in small towns was usually connected with other functions, though the latter underwent modifications in accordance with general changes in the economy as a whole. Nevertheless agriculture itself has always been one of the unchanging features of life in a small town. The

first and oldest form of small town inhabited by artisans and farmers had a layout and appearance closely related to the occupations of its people; so farm buildings could be found even near the market-place, as a characteristic feature.

Table 1. Size and area of agricultural land of selected small towns in Poland at the end of 18th century

Name of town	Number of inhabitants	Agricultural land in hectares
Żerków	1574	483
Pakość	3351	517
Pyzdry	3868	759
Iłża	3320	2095
Łosice	2414	2210
Myszyniec	1870	2227

The first great change of functions leading to the creation of a new urban structure took place during the period of capitalist industrialization, which was in turn connected with development of railway transport. Products of small town artisans now had to meet the competition of factory-produced goods at steadily diminishing prices. The functions of commercial intermediaries increased, replacing the productive role of the craftsmen. More and more the small towns became centres of merchants and minor tradesmen. Side by side with the artisan workshops there appeared small shops distributing industrial products brought from larger towns. Thus the small town became included in the wide market area of the large manufacturing centre and local crafts were maintained only on a limited scale. On the other hand, along with the development of various social and communal services for the inhabitants as well as for the population of the surrounding country, the functions of the small town as a local centre were actually increased.

In the second half of the 19th century some factories were built in small towns, mainly small units concerned with food-processing. The industrialization of small towns however proceeded irregularly, progress being greatest where transport facilities were most favourable. In such cases population grew substantially and as a result small towns tended to form characteristic groups according to their size. The majority of small towns in Poland, however, did not experience this phase of industrialization and remained small centres with agriculture, commerce and handicrafts as the leading occupations. In most of them a condition of stagnation ensued, marked by a stabilization of their population. Surplus population due to natural increase was continually transferred to larger towns and cities by migration. At the same time there was a constant influx of peasants from the countryside.

Moreover, in the 19th century and the early part of the 20th, conditions in the small towns came to vary greatly from one region to another as a consequence of the partition of the country. At present, therefore, there are in Poland many types of small towns. Moreover, further changes have taken place since the Second World War, partly because of war devastation and partly because of the transformation of the national economy.

In the first place the extermination by the German Nazis of nearly all the Jewish population dealt a crippling blow to the life of small towns. The Jewish population in Central and Eastern Poland formed a majority of the urban population, engaged in non-agricultural occupations such as small trading and manufacturing. First of all the expulsion and then the extermination of this population during the war put an end to the activity of small towns over a large part of the country. After the war Poland recovered large territories in the West, which comprise one-third of her present area. The German population was either evacuated during the war or transferred afterwards. In consequence many small towns were destroyed, together with the social and economic basis of their existence. This destruction was accompanied by great devastation of buildings and public services, especially in the former German territories. Only in a small part of Poland comprising Eastern Pomerania, Wielkopolska (Great Poland) and a part of Silesia were the small towns preserved undamaged with their population relatively undisturbed and pursuing their previous way of life. In war-devastated towns, with their social life completely disrupted, reconstruction under the new economic system began with the rejection of the previous capitalist basis.

Immediately after the war there began the liquidation of what was now regarded as an excessive development of commercial activities in small towns. Thus innumerable small shops lost the reason for their existence and gave place to a few nationalized shops which employ a much smaller number of people, this being the policy of the new socialist trade organizations. Many shops moreover were transferred to purely agricultural centres, i.e. to villages and hamlets.

At the same time the reconstruction of industry, including the nationalization of all industrial enterprises, led to the liquidation of smaller undertakings, the majority of which had been located in small towns. It was generally considered that the costs of their management and maintenance were uneconomic within the organizational framework of centralized state industry. The introduction of various forms of co-operatives for small crafts has led to the liquidation of many private artisans' workshops. In this first stage of revolutionary changes small towns, having lost their previous basis of existence, hardly succeeded in gaining a new one. So the period 1946–1954 was one of real crisis in the life of small towns. A considerable number of their inhab-

itants, unable to find employment, left for the larger cities and industrial districts.

After 18 years of social reconstruction and the rise of new forms of economic development, a new phase of growth has now reached the small town. The changes have not completely altered its character nor its role within the settlement network. However, it can be said that a new basis of existence for small towns has been established and that they have already adapted themselves to new conditions. Some statistical data provide evidence of this improvement. During the last ten years the number of towns in Poland increased from 706 in 1950 to 745 in 1960. At the same time the number of the smallest towns was reduced by 80. The following table gives a good picture of these changes:

Table 2. Distribution of towns according to their size

Towns according to size	Number of towns		Urban population			
			thousands		% of the total population	
	1950	1960	1950	1960	1950	1960
under 5 thousand	393	313	1066	901	4·3	3·1
5–10 thousand	159	195	1113	1378	4·5	4·7
10–20 thousand	76	130	1034	1797	4·2	6·1
20–50 thousand	50	65	1523	2006	6·2	6·8
50–100 thousand	12	20	832	1262	3·4	4·3
over 100 thousand	16	22	4037	6097	16·4	20·8
All towns	706	745	9605	13441	39·0	45·8

Source: *Rocznik statystyczny 1962* (Statistical Yearbook of Poland 1962), Central Statistical Office, Warszawa 1962.

The reduction in number of the smallest towns, i.e. those of less than 5000 inhabitants, is not evidence of decline, since after 1950 no town was deprived of urban status. On the contrary, urban status was bestowed upon new settlements. Rather is it evidence of development and growth, for by 1960 such towns were passing to the next size-group in terms of population. This is also proof of their having overcome the earlier crisis. Some studies have shown that the percentage growth of the population of small towns within the last ten years was even higher than the average percentage growth of the total urban population. The average annual percentage growth amounted to 6·2% for small towns in the period 1950–54, while for towns in general it was 5·2%. In the years 1954–59 the percentages were 4·8% and 4·6% [1] respectively. These figures indicate that within recent years emigration from the small towns has virtually ceased, thus reflecting their improved economic situation.

[1] Data compiled by B. Wełpa.

2. The present economic bases of small towns and recent changes

A characteristic feature of Polish small towns is their integration of three spheres of economic life, namely of industrial production, agriculture and various service facilities. Depending on the extent to which each of these functions is developed we can distinguish three types of small towns: those in which industry is dominant; those in which agriculture is dominant; and those in which no single function is dominant.

A. *Small towns in which industry is dominant.* In the socialist economy industrial activities are the leading town-making factors. Other occupations increase in proportion to the industrial function. Thus the present growth of small towns and their stabilization has been achieved by the development of small industrial plants and artisans' co-operatives organized by area authorities and organizations, mainly on the voivodship level. Numerous local industries and small workshops, under the control of *powiat* or voivodship authorities, were introduced in order to continue the old tradition of specialized production, using resources extracted in the vicinity. However, this industrialization of small centres has not yet been fully applied to all such towns. This can be seen in Fig. 1. The small towns of an industrial character are marked there by black dots. The industrial small towns are not synonymous with industrial settlements in the narrow meaning of this term. In these towns only about 10% of the inhabitants, that is over one-third of the employed population, are industrial workers or craftsmen. Moreover, these towns are also developed as local centres and their population is engaged in services and agriculture as well as in industry. But the industrial function plays the dominant role and indeed contributes to the full employment of the local manpower. The map shown has been completed on the basis of data for 1956 and is already out-of-date, since within the last few years further expansion of smaller industries has taken place. Nevertheless we may make some general conclusions. The dominance of the industrial function is now specially marked in the larger places, i.e. those of over 5 thousand inhabitants, in the central and western regions of Poland and in the Rzeszów voivodship. The same function is less developed in the small towns of northern and north-eastern Poland. Thus some marked contrasts exist between various parts of Poland. In many cases the percentage of the industarial population is as yet very low, not exceeding 5% of the total population. Most small towns of this kind are found in the voivodships of Szczecin, Koszalin, Białystok, Warsaw and Lublin. Besides the smallest towns, i.e. those under 2 thousand inhabitants, there are also some with over 10 thousand inhabitants, including *powiat* administrative centres which do not possess a more highly developed industrial function. As a rule an underdevelopment of the industrial function in this group of towns results in certain reserves of manpower. These unem-

THE ECONOMIC BASES OF SMALL TOWNS IN POLAND

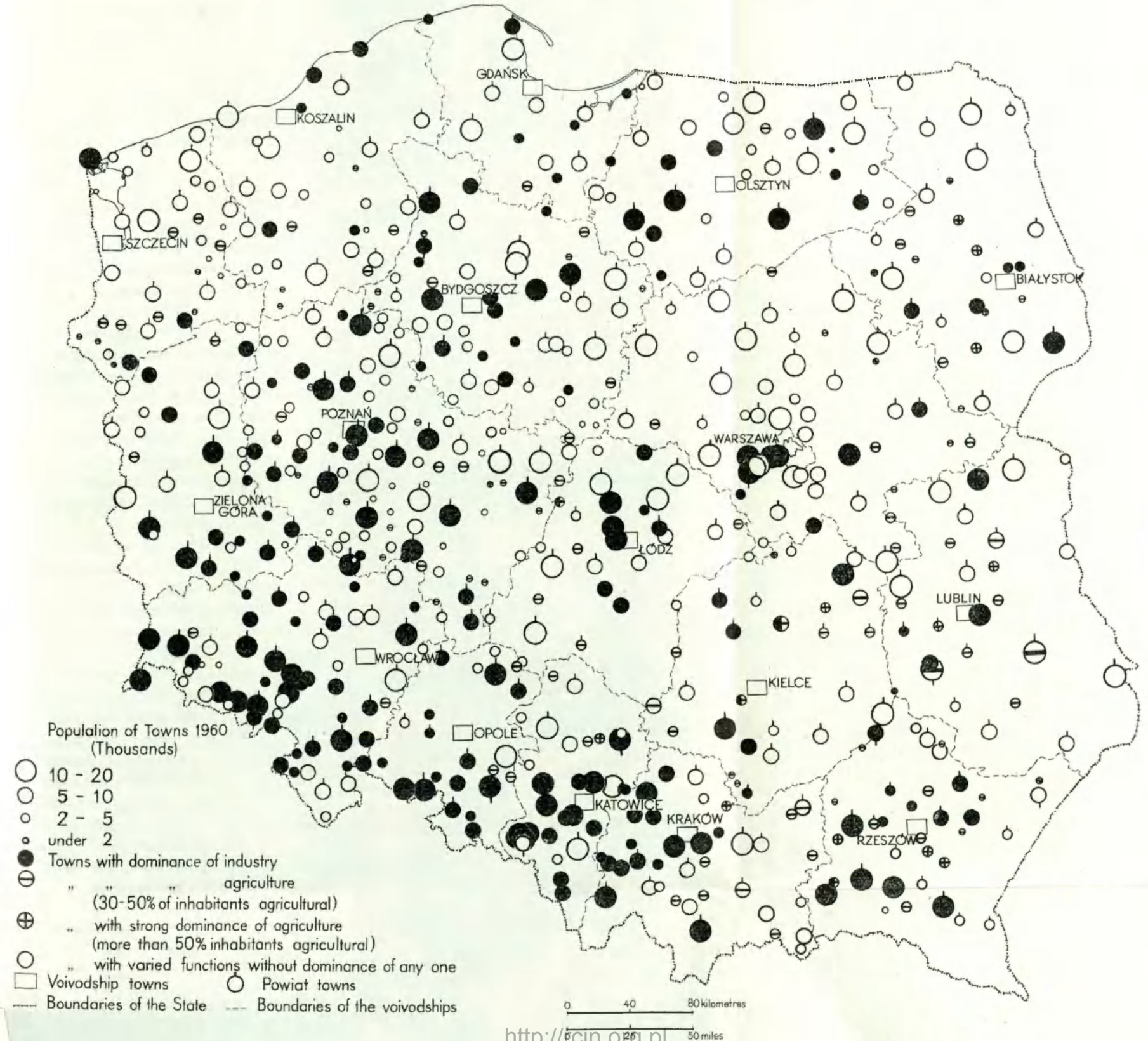


Fig. 1.

ployed must either travel elsewhere to work or migrate. The process of industrialization in small towns is thus well short of its objective, although within the past ten years great progress has been achieved.

Several characteristic trends in the industrial development of small towns can be observed. Among the most important is the use of local mineral resources for industrialization. Clear evidence of this has been gathered recently from studies of some small towns where the crisis was especially severe.

For example, let us take the small town of Iłża situated in the voivodship of Kielce, in the neighbourhood of various rich mineral deposits not yet utilized. New plants for the exploitation of ferruginous sands are under construction. They will employ about 2000 workers from the town of Iłża and from the settlements in the vicinity and will start production next year. This will greatly stimulate the life of this small town and of its hinterland. Already housing including 1250 new rooms has been provided.

Many other small towns have developed under a similar stimulus. It is enough to mention the growth of brown coal (lignite) extraction in the neighbourhood of Konin, of iron ores in Łęczyca, various brown coal deposits and copper ores in the voivodships of Wroclaw and Zielona Góra, and sulphur ores in the Sandomierz region, accompanied in all cases by a great increase of industrial employment. As a result the small towns in these regions have changed considerably in character. The development of production based on local mineral deposits cannot, however, be undertaken in every instance, not all of them having such resources in the neighbourhood. Construction of small brick-kilns, cement works and factories producing both building-materials or prefabricated items for local needs is common but does not promote any striking economic change. On the other hand, the organization of local enterprises for small industries and handicrafts is still very general. Let me cite some examples encountered in recent field studies. In Kałuszyn, a small town in the voivodship of Warsaw, with a population of 2343 in 1950, growing to 2441 in 1960, a shoemaking plant was started in 1959, in a building adapted from an old small-scale electric power station. It employs altogether some 420 workers. In addition, a new tannery employing 20 workers was constructed. Both these forms of production have some tradition in this region and many craftsmen possess a good knowledge of production techniques. The making of building material has developed as well. At present only the problem of the employment of women remains unsolved. However, the erection of a large modern dairy which will give occupation to women, is projected. In spite of the existence of several small industries in the town not all the inhabitants have been able to find employment there. Many of them travel to work in other towns but their number is diminishing and in a few years has dropped from 400 to 142. On the other hand, a special

activity has been developed here, namely the collection from all over Poland of second-hand packing materials, rags and waste-paper which provides employment for an increasing section of the population. Thus economic life has been adapted to new conditions and there are some possibilities for further development, though for the time being Kałuszyn is a centre of local industrial and agricultural production with somewhat restricted prospects.

The growth of the industrial function in small towns is highly desirable and many places strive to obtain additional factories. Centres of over 3000 inhabitants especially need some industrial development in order to maintain their present importance. Small towns are the nearest urban centres to which the surplus of the agricultural population can migrate. The era of large migrations, such as those to the western territories, recovered after the war, as well as to large industrial centres, has already ended. Migrations indispensable for the reduction of overpopulation in the agricultural areas will probably start with the expansion of small towns. Therefore the provision of industrial plants in such towns is an important objective confronting our planning authorities and thus should find its proper place in the planned economy of Poland.

B. *Small towns of complex functions in which no single function is dominant.* The second largest group consists of small towns combining two functions, services and agriculture, in which neither is dominant. While various services play a considerable role in the economy, industrial functions are not strongly developed. They are often centres of local administration at *powiat* level. Small towns in northern and central Poland generally belong to this category. They are marked on the map by small circles (Fig. 1). They occur in all the size-groups: those of under 5 thousand, from 5–10,000 and from 10–20,000 inhabitants. As a rule there are some signs of unemployment, but in most of these towns the processes of adjustment are already well advanced, even if in some respects the symptoms of the earlier crisis, i.e. underdevelopment, have not yet disappeared.

An example is Staszów in the voivodship of Kielce. In 1950 it had 4700 inhabitants, in 1962—6200. The growth of the population was linked with the development of the administrative function, for in 1954 Staszów became the seat of a *powiat* authority and a centre for several new institutions. It is true that up to now 60% of all the officials have travelled daily from a larger town in the neighbouring district, but there is no doubt that development has been greatly stimulated. New schools have been opened, including a boarding school for boys and girls, serving the whole district. New co-operative enterprises have been started, mainly of shoemakers, a form of specialization traditional to Staszów, which in the past had been well known throughout Poland. New units for the making of clothing and leather-goods, as well as

several building enterprises, have been introduced and there is a plant manufacturing concrete products, including telephone and electricity poles. Three new residential blocks and some single-family houses have been built. There are still 800 farmsteads within the town boundary, so that agriculture is an important occupation for a large part of the population. The so-called "Agricultural Circle", concerned with technical improvements in agriculture, as well as in the general economic development of the town, should also be noted. Although no large-scale industrial plant has been located in Staszów, the town has emerged successfully from the complete stagnation of the early fifties. However, not all the opportunities for development have been realized and not all the needs have been met. Thus the exploitation of local limestone and gypsum has not yet begun and there is still no general sewage system in the town. Staszów, like many other small towns in this group, still awaits its fullest development.

C. *Small towns in which agricultural occupations are dominant.* The agricultural towns constitute the third group of small towns. They usually exhibit only a slight development of the usual functions of a local centre, possessing schools, shops, a cinema and a few other facilities. They perform therefore only to a limited degree the functions of a town. Agriculture has remained the main source of income for their inhabitants. In Fig. 1 small towns in which 30% to 50% and more than 50% of the population depend on agriculture are shown separately. The distribution of these towns shows that this type has been preserved in Poland over large areas. There are such towns in the voivodships of Szczecin and Koszalin and they are very numerous in the voivodship of Poznań. However, they prevail in eastern Poland where many, even though they are *powiat* centres, have over half of their population dependent on agriculture, e.g. Bełżyce and Krasnystaw in the voivodship of Lublin; Łosice in the voivodship of Warsaw; Pajęczno in the voivodship of Kielce. Such towns include a considerable area of agricultural land within their boundaries. However, the agricultural town differs from a village. The differences are expressed, most of all, in the size of farms. The towns possess farmsteads, or rather homesteads, much smaller than the average farms in the neighbouring villages. In the town of Biała Rawska, in the voivodship of Łódź, 61·7% farmsteads have less than 2 hectares of area and 25·6% have 2–5 hectares. In the town of Łosice in the voivodship of Warsaw, 38·5% farmsteads have under 2 hectares and 37·2% have 2–5 hectares. In the rural areas the corresponding figure representing the rural farms under 2 hectares is 23%, farms of 2–5 hectares—30%. Even before the war town-farmsteads were unable to maintain the owner and his family, so the small towns showed neither prosperity nor growth and their inhabitants had to search outside for employment.

Adaptation to new conditions after the war has taken several directions, such as travelling to another centre for employment, a practice which in fact occurred before the war. These small towns, however, do not always possess good transport connections so that the journey to work is difficult and in general limited to short distances. In the town of Łosice, for instance, in spite of considerable reserves of manpower only about 10 persons travel at present from the town to work elsewhere. On the other hand, an increasing interest in agricultural activity is taking place. The town inhabitants have begun to intensify their agricultural production and, in view of the lack of land within the town area, to lease fields in the neighbouring villages. Cases of this kind may be noted, for instance, in the towns of Golub, Dobrzyń and Radzyń in the voivodship of Bydgoszcz. The production of onions, for instance, has revived the economic life of Radzyń. This town is situated on fertile wheat-growing soils, yet onions, as an export product, have obtained consistently good prices. The inhabitants, moreover, have leased fields from peasants in the neighbouring villages, and used them for raising vegetables for the market. While it may be said that this is a form of de-urbanization, at least the population of these towns have not lost their livelihood.

Another example of stimulus through agriculture is seen in the growth of the town of Biała Rawska, the population of which increased from 1888 in 1950 to 2500 in 1962, with an accompanying improvement in living conditions. This resulted from a newly organized agricultural co-operative, an enterprise which has taken the place of lands which were formerly divided. Many inhabitants of the town joined the co-operative and, thanks to efficient management and considerable reserves of manpower, the co-operative was able to introduce an intensified system of cultivation by mechanical tillage. Modern agricultural machines were purchased, three large hothouses were built and the members of the co-operative have devoted their efforts to the growing of early vegetables. The latter are now transported to larger towns by trucks owned by the co-operative. Moreover, three brick-kilns and a plant for making concrete prefabricates have been built to supply the needs of the reawakened town. In fact some of the building materials produced are now sold outside. Housing conditions in Biała Rawska have greatly improved with the provision of an estate of single-family houses for the co-operative members, and by new houses erected in the market place.

These examples show how the development of a small town may be achieved even where there is a dominance of agricultural occupations. However, the majority of small towns of this type are still stagnating and survive only in the form of poorly organized agricultural settlements. To fit such towns into a rationally developing settlement network is a major task for the economic and physical planners.

With the reorganization of the network of rural settlements the role of

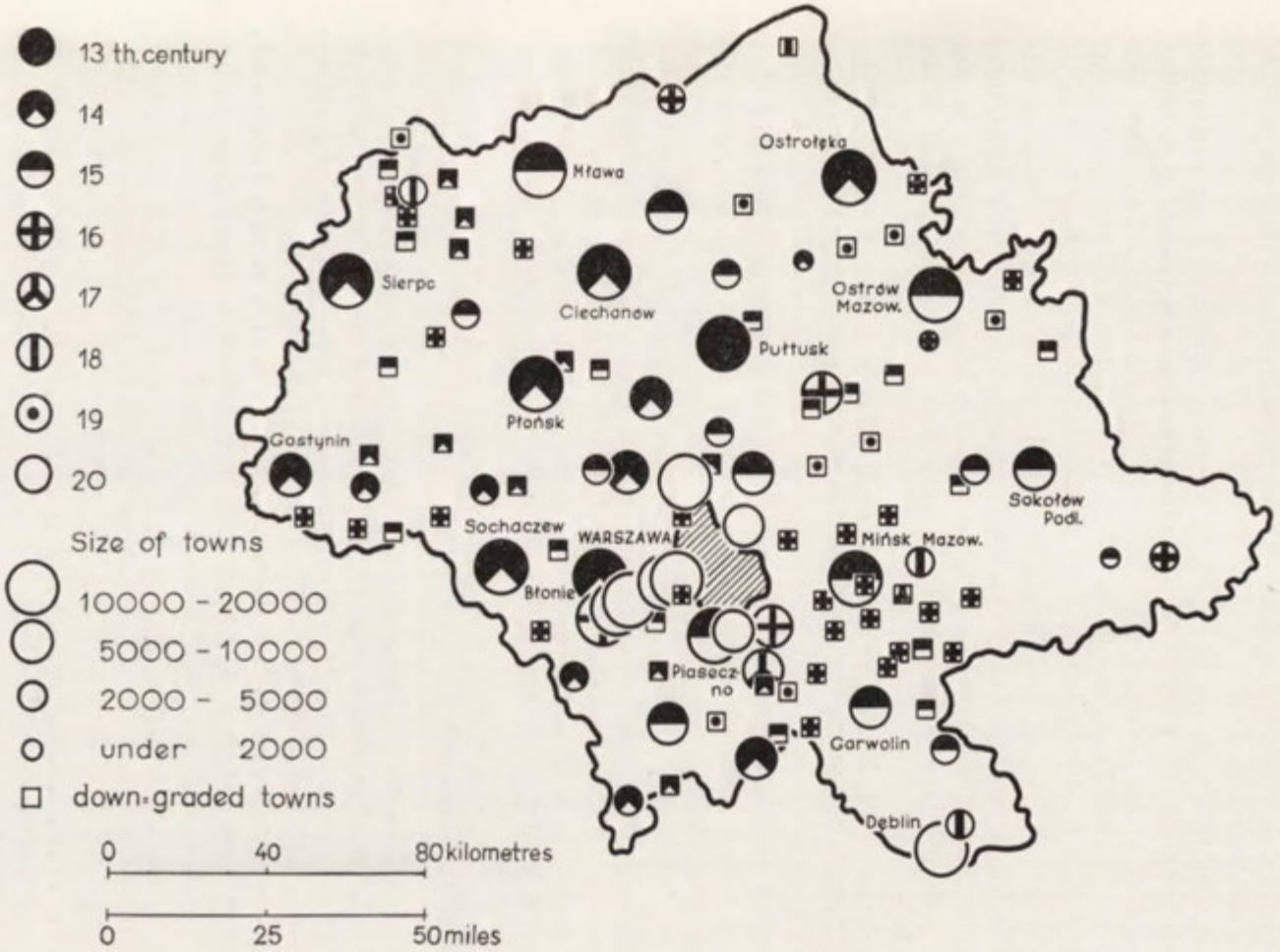


Fig. 2. Foundation of small towns in Warsaw voivodship and their size in 1960

agricultural towns is likely to change and become more important. There is already a tendency to concentrate rural settlements into larger units, and as this process develops the agricultural towns will probably become part of a new settlement pattern.

The small towns shown in Fig. 1 do not fully represent all the settlements of this type, since a number of agricultural towns, deprived of their urban status during the 19th and 20th centuries, should be added to them. For instance, in 1869 in the territory under Tsarist rule alone, 338 small towns were deprived of urban status. These were settlements which, in view of their small population and insufficient fiscal revenue, were considered unsuitable for maintenance as towns. They degenerated into purely agricultural settlements, yet still kept their urban layout with a market place in the centre, the distinctive form of their farmsteads and a few relics of urban functions.

An example of the density of these settlements is shown in Fig. 2. All the former towns existing in the voivodship of Warsaw are marked, but only those which have preserved their urban status are distinguished by circles. As may be seen, a considerable number of towns founded in the 15th, 16th and 17th centuries have lost their status. These are most numerous in the *powiat* of Mińsk Mazowiecki.

After World War II several scores of small towns of this type, heavily depopulated and almost completely destroyed, were unable to preserve their urban status. These were concentrated mainly within the voivodship of Olsztyn and in some of the worst devastated areas of the west. These places, though now degraded, are slowly regaining their former urban functions.

3. Structure of the settlement network

In an analysis of the location of the basic types of small towns, as shown in Fig. 2, certain conclusions as to the structure of the settlement network and its differentiation may be drawn. Moreover, three zones can be distinguished in which the role of small towns is somewhat different.

The eastern zone, including the voivodships of Białystok and Lublin and a part of the voivodships of Kielce, Cracow and Warsaw, is characterized by a great number of small towns in which agricultural occupations are dominant. They belong to the size-groups of under 2000 and 2000–5000 inhabitants. The network of small towns of this area has preserved many important relics of earlier times. These towns did not experience any significant industrial development in previous periods and they have remained without change in this respect until now. The north-western voivodships of Szczecin and Koszalin have a similar urban structure, namely numerous small towns with predominantly agricultural occupations, without any industrial centres.

The urban structure in the voivodship of Poznań is, however, different. This is the second zone. This consists of numerous small towns which are still dependent on agricultural production. They are mainly of extremely small size, generally well under 2000 inhabitants. On the other hand, larger centres with over 5000 inhabitants occur, in which industrial functions have been considerably developed. These towns are also numerous and bear witness to the industrialization of this region both in the era of capitalism and under the present socialist economy. Towns in the voivodships of Poznań and Bydgoszcz include relics (with a characteristic layout of feudal times), although important changes have taken place in later periods.

The third zone includes the industrialized regions of Upper and Lower Silesia, the western part of the voivodship of Cracow and the southern part of the voivodship of Zielona Góra. Here small towns of less than 2000 inhabitants and small agricultural centres have disappeared completely, though they were once typical of these areas. The towns are now larger and the population working in industry plays a dominant role. All those of feudal origin were transformed in the period of industrialization either because they were chosen for the location of industrial plants or because their inhabitants became employed in industry. There is no question of a crisis or even of underdevelopment in these towns.

Symptoms of underdevelopment are still most apparent in the small towns of the first and second zones, i.e. in the eastern and the northern parts of the country. Serious efforts have been made to deal with this situation. For example, plans for decentralizing industries concentrated in Warsaw have been prepared, together with proposals for the industrial development of small towns in the Warsaw voivodship.

Following the destruction which occurred in World War II the rebuilding of Warsaw was speedily undertaken, with special attention being paid to the development of industrial plants. The capital of the country, with its well-developed administrative functions, was to have increased productive capacity so as to develop a more diversified urban society. In fact, however, the post-war growth of productive functions has been overstressed and as a result the various factories and industrial plants seem at present to be too much concentrated upon the capital. A permanent deficit of manpower has developed and people from distant places daily commute to Warsaw. At the same time many towns in the Warsaw voivodship, both large and small, are lacking in industrial plants and so have large reserves of manpower. The concept of decentralization however is slowly gaining ground. This process meets some opposition from enterprises, which endeavour either to remain in Warsaw or to move only to the suburban zone.

An approved plan to move 17 larger plants of centrally administrated industries provides for new locations in the towns of Góra Kalwaria, Żyrar-

dów, Tłuszcz, Nasielsk, Warka, Płońsk, Sochaczew, Garwolin, Siedlce and Nowy Dwór. These centres are situated at a distance of 30–60 km from Warsaw and have good railway connections with the capital. This re-location plan, being limited to the immediate neighbourhood of Warsaw, does not, however, solve the problem of the industrialization of various small towns situated further from the capital. But development of these towns is taken into consideration in a plan for the dispersal of smaller industrial enterprises and craftsmen's co-operatives. These small units, when moved from Warsaw, are to be located, for instance, in the towns of Przasnysz (office articles, joinery), Dęblin (machine components), Sokołów Podlaski (machine tools), Łosice (lime precipitate), Płońsk (furniture), Serock, Garwolin, Sochaczew and Płock (food industries), Wyszków (brewery), Sierpc, Tarczyn, and Ostrołęka. In particular, chemical plants of a noxious character, timber mills and tanneries are to be transferred. Moreover, fruit and vegetable processing and other food industries based on perishable commodities are to be located within areas specializing in that form of agricultural production. Mineral processing, as at Łosice, Kornice and Ostrołęka, is to be based on local deposits. A number of plants located in small towns are to be enlarged and modernized, thus enabling their employment numbers to be practically doubled. Altogether 13 metallurgical plants, 13 chemical plants, 8 timber plants and 17 food plants are involved. As a result of these investments it is estimated that employment in 33 small towns of the Warsaw voivodship will grow during the period 1961–65 by 12,500 workers, most of whom will be in the eastern part of the voivodship.

Conclusion

From this short review of changes taking place in the small towns of Poland, it is clear that the question of their role, as a general problem, has very largely been solved. The economic life of such towns is now far more active. Development in several specific directions has been achieved, as has been illustrated by several concrete cases. The growth of industries based on local mineral resources and on small manufacturing units have been particularly important in promoting economic expansion. The claim that the demographic and economic crisis of small towns has been overcome does not mean, however, that all small towns now possess a sufficient and satisfactory basis for existence. There are many questions still demanding solution. The problem of the rational adjustment of the network of small towns to the process of industrialization and of the creation of a new settlement pattern remains one of the more difficult tasks of planning. For this reason the proper development of the settlement network and the part which small towns should play in this network, must remain under the careful observation of geographers as a proper subject for their studies.

SOME NEW TECHNIQUES FOR STUDYING URBAN SUB-DIVISIONS

David T. Herbert and William M. Williams

The progress of applied geography is dependent in part on the development of new techniques for analysis and measurement. In turn, these techniques must arise from a coherent conceptual system and must be designed to test the validity of general statements. Since such general statements may embrace empirical data and since they may have significant practical consequences or limitations (as in the field of physical planning) it is very desirable that techniques are simple, easily administered and capable of use in widely differing circumstances. This paper describes some new techniques for studying urban sub-divisions, illustrated by the case study of Newcastle-under-Lyme in North Staffordshire.

The Central Area

Newcastle-under-Lyme was chosen as the testing-ground for the techniques described below because of its convenient size and nearness to the University of Keele. It is, however, a small, or perhaps medium-sized, central place and consequently its structure does not exhibit the clear-cut differentiations found in large cities. The central area of the town, with its specific problems of redevelopment and with its relatively complex structure, provides a most suitable starting point for the testing of techniques.

The treatment falls conveniently into three sections: the analysis of the structure of the present-day central area; techniques for studying the evolution of the central area; and planning and redevelopment of the central area.

The Present-day Central Area

The starting point of the analysis is the determination of land use patterns in the field. No attempt was made at this stage to devise a quantitative technique for delimiting the central area, although a possible method emerged during the analysis. The limits were judged subjectively by observation in the field and within the central area so defined, all elements of land use were mapped. It is clear that the more significant elements are those which are

central business in the literal sense, that is retail trade and office functions. These were sub-divided into categories, using the "Census of Distribution" classification with minor changes in the case of retail trade.

A further distinction was introduced at this stage to refine the analysis of retail trade. Use was made of the notion of a "threshold population", developed originally by Berry and Garrison in the U.S.A. [1]. The threshold population of any store is defined as the minimum number of people which must exist within the market area before that store can come into existence. The typology of retail stores used in mapping was aimed at distinguishing between stores with differing levels of threshold population. Due regard was paid to the varying threshold population characteristics of different types of retail store described by Berry and Garrison, while individual elements which other studies have shown to be particularly significant were mapped separately. Clearly, however, cartographic difficulties place limits on the degree of differentiation.

The land use map of the central area (Fig. 1) shows some clear patterns

Fig. 1. Land use in the Central Business District of Newcastle-under-Lyme

of association. Retail trade occurs in one part of the central area and office functions in another. Within the broad category of retail trade there are further clearly discernible patterns of association. Local government offices are dispersed throughout the central area with no apparent relationships with any other functions. But studied alone the land use map is of limited value. It merely shows a distributional pattern of functions which can only be analysed in purely morphological terms. In order, therefore, to provide some understanding of the land use pattern, it is necessary to relate it to some other general aspect of urban structure, such as land value. Land value, however measured, can provide a second base map which can then be compared with land use patterns. In this way the detailed adjustment of land use to social and economic values can be examined. Broadly similar approaches have been used by William–Olsson in his study of Stockholm [2] and by Murphy and Vance in the U.S.A. [3, 4, 5]. In the Scandinavian study an index based on shop rents was developed in order to compare the varying intensities of retail trading in different parts of the city. Murphy and Vance examined the relevance of land values in their study of the structure of the central business district and found that land use in the cities which they studied was in large part an adjustment to land values.

It was necessary, therefore, to find a criterion which would have a similar analytical usefulness to shop rents and land values. Early experiments in obtaining data for turnover and land values proved unrewarding and the material which formed the basis for this second criterion was the Gross Rateable Value from the local government valuation lists. The composition of the Gross Rateable Value and the procedures of the Rate Index technique are fully described elsewhere [6]. It may be noted briefly here that the Value is assessed in two stages. First, account is taken of the physical character of the building and secondly an analysis is made of rents which are freely operating throughout the area. This knowledge is used by Valuation Officers, with a great deal of local experience, to arrive at the final assessments. The Rate Index, which is a precise expression of the second criterion, is the Gross Rateable Value expressed in values per unit area. The Rate Index represents a measure of the social and economic value of any one site within the central area. The Rate Index map for Newcastle (Fig. 2) clearly shows that there are definite patterns of values in the central area of the town. There is a distinct area around the junction of the Ironmarket and the High Street which one might term the Core of highest values: Murphy and Vance attach much importance to locating a Peak Land Value Intersection in their cities and it is at this point that such a Peak Value exists for Newcastle.

The existence of a Core area and of a Peak Value can be explained as arising from considerations of accessibility. In the formative period of the development of Newcastle, this intersection of the Ironmarket and the High

Street became the most important convergence point for traffic routeways. At the present time it retains this quality of optimum regional accessibility and is the point of most intense pedestrian flow within the central area. Bus stopping points and car parking space within the town are within close distance of this intersection. The value which is attached to such high acces-

Fig. 2. Rate index map for the Central Business District of Newcastle-under-Lyme

sibility is thus reflected in the Rate Index map. Relatively less accessibility should logically be followed by lower values and the sensitivity of the Rate Index as a measure of this is shown by the changes of values away from the Core. Lad Lane, for example, is very close to the area of highest values yet shows a markedly lower Rate Index level. Again, there is a gradual decrease in values along the main roads leading into the intersection. These regular variations in the Rate Index therefore reflect the value attached to sites in terms of accessibility. The Rate Index map provides an indication of the relative importance, in terms of social and economic value, attached to the various parts of the central area. Thus, it is only when the Rate Index map is compared with the land use map that the latter becomes really meaningful.

The use to which land is put in the central area can now clearly be seen in relation to economic and social values. The comparison reveals several distributional patterns both in the general and in the detailed aspects of the structure of the central area.

Retail trade is, in terms of the space which it occupies, the most important element in the central area. Moreover, it is the retail trade function which clearly commands the highest valued sites, practically the whole of the Core area and a considerable amount of the central business space peripheral to the Core. This may be explained by the fact that it is the retail trade function which has the highest demands upon accessibility. General access from the regional market area is obtained by location within the central business district of the main centre, but inside this centre the volume of trade is largely conditioned by the potential pedestrian flow before which saleable products may be displayed. No other central business function has such a need for ground floor frontage within the central business district. Moreover, there are important variations within the broad category of retail trade. The area of highest values is characterized by a predominance of stores with high threshold populations. A high volume of trade at a relatively wide margin of profit per article sold would appear to be necessary to enable a business to command one of these very highly valued sites within the Core of the central business district. It would seem that the individual specialist categories of stores within the Core are *the highest representatives of their type* within the market area. By the quality and diversity of range of the goods which an individual store offers, it is able to command the highest selling power in the market area for its category of store. In these terms it is relatively easy to explain any apparent anomalies within this structure. The presence of one retail food store in the Core is a useful example. Since food is in the first rank of necessities its threshold population would be one of the smallest of all. Yet a field study, carried out in 1962 by students of the University of Keele, revealed that this grocery in the Core has a greater range of goods available than any other grocery within the market area. It is thus the highest representative of its type and a greater volume of trade would be expected to compensate for the low margin of profit per article sold.

Generally, however, the categories of retail stores predominant in the Core are those with high threshold populations. There are very many stores, such as food stores, within the central area of Newcastle, especially in the lower valued parts. The proportion which they form of the total services within the main centre appears to be a reflection of a wider regional aspect. Where there is little development of suburban shopping groups or of a network of small centres, then all the shopping needs of the region have to be provided within the main centre.

Office functions, which form the other main group of central business

services, occupy parts of the town with generally lower values of the Rate Index. This may be explained in terms of the locational requirements for various types of office functions. Generally they have far less need for access by the general public than retail trade. Their requirements are rather for

Fig. 3. Rate index map for the Central Business District of Hanley

general access to lines of communication and proximity to allied services. Professional men such as doctors and dentists have no end product of their skill which they can display but rest upon the value of their reputations in order to attract custom. The best location would be, therefore, in amenable surroundings which are easily accessible to the general public and are yet away from the noise and bustle of the shopping area. Some types of offices, such as building societies, do indulge in a great deal of competitive advertising and are found in upper floor sites throughout the central area.

Shops and offices are the essential central business functions but there are many other individual services which display peculiar locational characteristics. Some have been established in their present sites over a long period of time. Local government institutions are not centralized in Newcastle but widely dispersed throughout the central area with little regard to site value. The older public houses, often transformed from coaching inns, tend to persist in sites near the Core, though frequently displaying values below the general level. Other special cases include banks, which are effectively an office function but one needing a high degree of centrality. They require a great deal of accessibility to the general public and need to be near the retail stores which constantly use their services. Again, opticians are professional people yet their business is so organized as to exhibit many of the features of retail trade. Window displays of spectacles, for example, are shown to as large a section of the public as possible. Opticians, therefore, tend to seek locations nearer the Core than do other professional people.

From these examples it will be clear that the Rate Index technique, in conjunction with the detailed land use map, forms a useful basis for the full analysis of the structure of the central area, and also provides the means of studying the particular locational requirements of individual functions. In addition, because Gross Rateable Values are assessed by uniform procedures laid down by the Government, they provide the means of wider regional comparisons of centres. This may be illustrated by comparing Rate Index maps for two of the centres within the North Staffordshire conurbation, Newcastle and Hanley (Fig. 3).

Development of the Central Area

The discussion so far has aimed at providing an analysis of the structure of the central area. It has to be recognized, however, that the central area at any one time represents but one stage in a process of evolution. In order to obtain a fuller understanding of the present day structure, therefore, one needs to study the way in which it has come into being. Logically this could be done by constructing maps for earlier dates which would be comparable with those used in the modern day analysis. In practice, however, this can only be accomplished to a limited extent. Detailed land use maps can be reconstructed from street directories and this has been done for Newcastle for the year 1912 (Fig. 4) [7]. Before this date, however, directories are not available in a form suitable for the construction of maps and therefore a table has been drawn up for the year 1865 (Table 1) [8].

There are two aspects which must be considered in a study of the evolution of the structure of the town centre. The part of the town which is used for central business purposes changes in area and in form. This will be referred

to as areal change. The distribution of particular uses of central business land also changes and this will be referred to as functional change. The dynamic nature of the central business district is one which becomes apparent to any observer. The distribution of particular shops and offices changes over relatively short periods of time. Buildings become vacant, plots are converted and new constructions arise. It is suggested that these changes are ordered rather than haphazard, that there are patterns which can be recognized, and

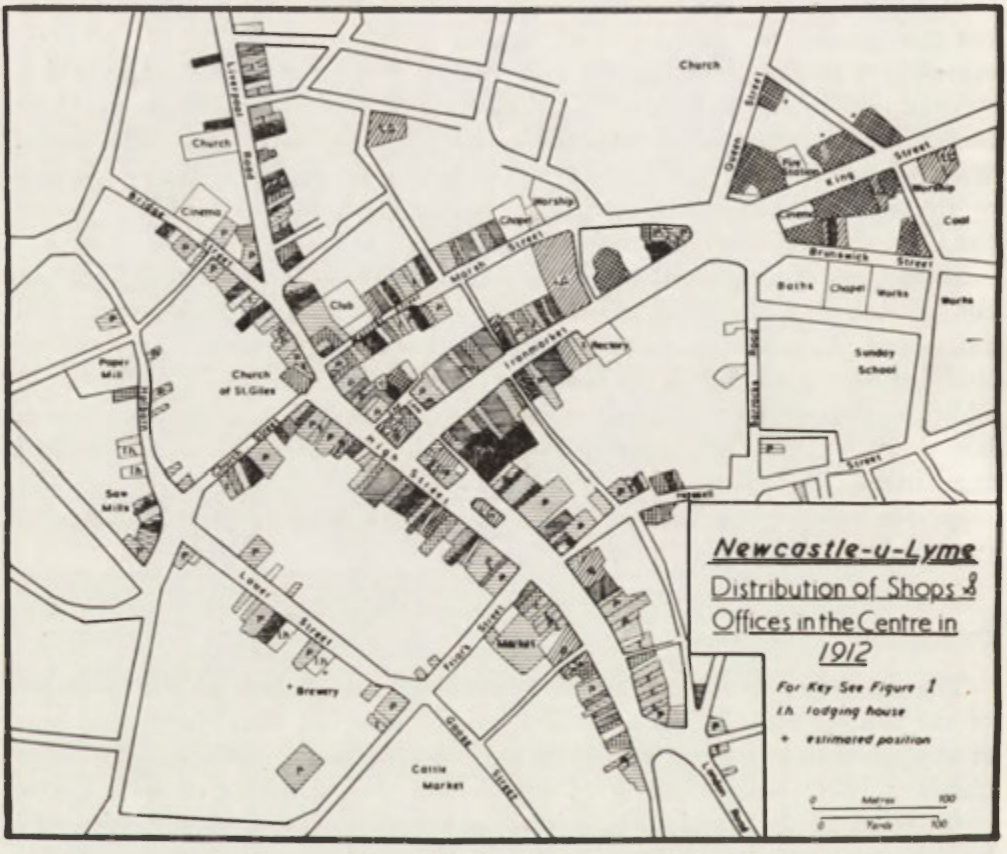


Fig. 4. Land use in the Central Business District of Newcastle-under-Lyme in 1912

that they represent a response to changing social and economic conditions within the region. If a town is increasing in status as a central place, then values will rise within the central area. Changing land use within the central area will come about as an adjustment to this new level of values. Higher central business functions will seek location in the central area as potential threshold populations increase through the expansion of the regional market. The study of the evolution of the central area of Newcastle offers some examples of these patterns of adjustment.

TABLE 1. DISTRIBUTION OF CENTRAL BUSINESS FUNCTIONS IN 1865

Location	Clothing stores	Household goods	Luxury goods	Food stores	Public houses	Departm. stores	Other stores	General offices	Professional offices	Local government	Central government	Banks	Other services	Beersellers	Total 1865	Total 90'
King Street	6			1	1			3	5					1	17	29
Queen Street									2						2	3
Brunswick St.									3						3	15
Nelson Place									2						2	2
Liverpool Rd.	5	1	1	4	2		4			1			2		20	48
London Road					1		1	1	2				2	1	8	17
Marsh Street	1		1												2	12
Merrial Street	4			6	2		1	3	1				1		18	32
Pool Dam			1	2	1			1						1	6	5
Lower Street	3	1	1	5	8		2		1				2		23	27
Goose Street				2	1								1	2	6	6
Church Street	2		1				1							1	5	6
Bridge Street	4				7						1				14	37
Hassell St.	1	1		5	1								3		11	32
Lad Lane			1				1								2	9
High Street	20	5	2	15	7		8		1			1	2		61	75
Ironmarket S.	11	2	1	11	6		3	2	5				2	1	44	44
Penkhull St.	3			13	7		3		1			1		5	33	53
Red Lion Sq.	5			6	3		4								18	20
Upper Green				6										4	10	8

Table 1 gives some impression of the areal extent of the central business district in 1865 and of the distribution of functions within it. The majority of central business functions are found in the area of the Ironmarket and High Street/Penkhull Street. Merrial Street and London Road have significantly fewer services and there are very few in Liverpool Road. Lower Street still has a number of services at this date. Thus central business functions are concentrated in the limited area of the Ironmarket and High Street with some continuing use of Lower Street. There is no strong tendency for segregation of functions in the town of 1865, but it is clear that retail trade predominates throughout the great part of the central area. Most of the more specialized shops are found in the Ironmarket and High Street. Office functions occur throughout the central area but form a majority of services in the King Street and Queen Street district.

Reference to the columns for 1865 and 1907 [9] in Table 1 allows some comparison of the changes in the total numbers of services for different parts of the town. Clearly there was a large increase in the number of central business functions in Newcastle between the two dates. The nature of this increase is such as to suggest both an areal expansion of the central business district and also a rise in the intensity with which streets were used for the location of services. The Ironmarket and the High Street show considerable stability compared with other parts of the central area. The Ironmarket contains the same number of services in 1907 as it did in 1865; the increase in the High Street is not great. The implication is that these streets, which were established as the commercial centre by 1865, were intensively used for central business purposes at that date. The parts of the town which show greatest absolute increases in the number of services were those which are adjacent to, or lead into the modern Core. Thus, Bridge Street and Liverpool Road both more than doubled their number of services. Penkhull Street, which leads into High Street, shows a large increase, as do Marsh Street and Merrial Street. Lower Street remains unchanged.

Figure 4 shows the form which this expansion in services had assumed in 1912 and it is clear that a wide area was being used for central business purposes. There are still no marked areas of segregated retail trade, except perhaps for certain parts of the Ironmarket and High Street. Office functions show clearer concentration in King Street and Queen Street, which is predominantly a professional quarter [7]. It is interesting to note that in 1912 office functions were found at ground floor level throughout the central area. Food stores were not excluded from any part and public houses occurred with great frequency. Banks occupy central positions and local government institutions are established in several sites. Cinemas have appeared but are on the periphery of the area which is used for central business purposes.

A comparison of Fig. 1 and Fig. 4 allows an analysis to be made of the changes in the structure of the central area which have occurred between 1912 and the present day. The rapid areal expansion that took place between 1865 and 1912 has clearly not been continued. The tendency has rather been for the central business district to contain and consolidate itself within the limits indicated by the 1912 map. There has been some territorial re-distribution, such as in Merrial Street, but no evidence of major expansion in any one direction. Indeed, the evidence rather suggests that contraction has occurred. This is evident both from comparison of the two maps and from field evidence. In several parts of Liverpool Road and Bridge Street there are vacant buildings, and many other former shops and offices have been converted to residential use. The Lower Street area shows almost a complete loss of central business functions and demolition has in fact removed a large number of residences as well as business establishments. If there is any trend for

expansion of central business functions observable from comparison of the two maps, then it is along the Ironmarket towards Nelson Place. This offers some comparison with American studies which have traced the direction of central business expansion as being generally towards the highest valued residential districts. In the instance of Newcastle, the Brampton, which has this high residential status, lies just to the north of Queen Street.

Functional changes which have taken place between 1912 and the present day indicate a general replacement within the Core by retail stores with high threshold populations. Some consolidation of the effective Core area is suggested by the changes which have occurred in that part of Liverpool Road which is adjacent to the High Street. Besides this general pattern of replacement, there is evidence of the advent of central business functions and the persistence of established elements. A variety store, Woolworth's, has appeared in the central area; cinemas have become more central in their locations. The banks which have opened since 1912 show a tendency to occupy former office premises in a central position. The banks which were established in 1912, however, show continuity in their sites, as do long established local specialist stores. Again the Guild Hall in the High Street retains its local government function whereas the block at the junction with the Ironmarket has been taken over by retail trade. Offices, including local government, now occupy the upper floors of this block. Some public houses have survived on their sites but clearly many have been replaced. The office quarter at Nelson Place shows changes in structure which have been referred to above. General offices have tended to replace professional offices and Brunswick Street shows some conversion to retail trade.

Areally, the trend in this century has been for the contraction of the central business district. Functionally, the nature of replacement suggests a town which is increasing in status as a central place. Both these general observations and their more detailed aspects may serve as a background to discussion of planning proposals for the central area.

Central Area Redevelopment

Figure 5 shows, in generalized form, the central area redevelopment proposals for Newcastle. The most important single element of this plan is clearly the ring road. Newcastle has always been a busy focal point for road transport and suffers a great deal at the present time from heavy, through-traffic. The main purpose of the ring road will be to divert this through-traffic away from the central area: providing road widening schemes materialize, these are logical ways to by-pass the town centre.

The effect which this road will have upon the central business district is a problem which needs to be considered. It seems unlikely that pedestrian

flow will spread over the ring road and it is probable, therefore, that central business functions will be contained within its limits. There are measures, such as the building of pedestrian subways, whereby the difficulties of large numbers of people wishing to cross the ring road might be surmounted, but

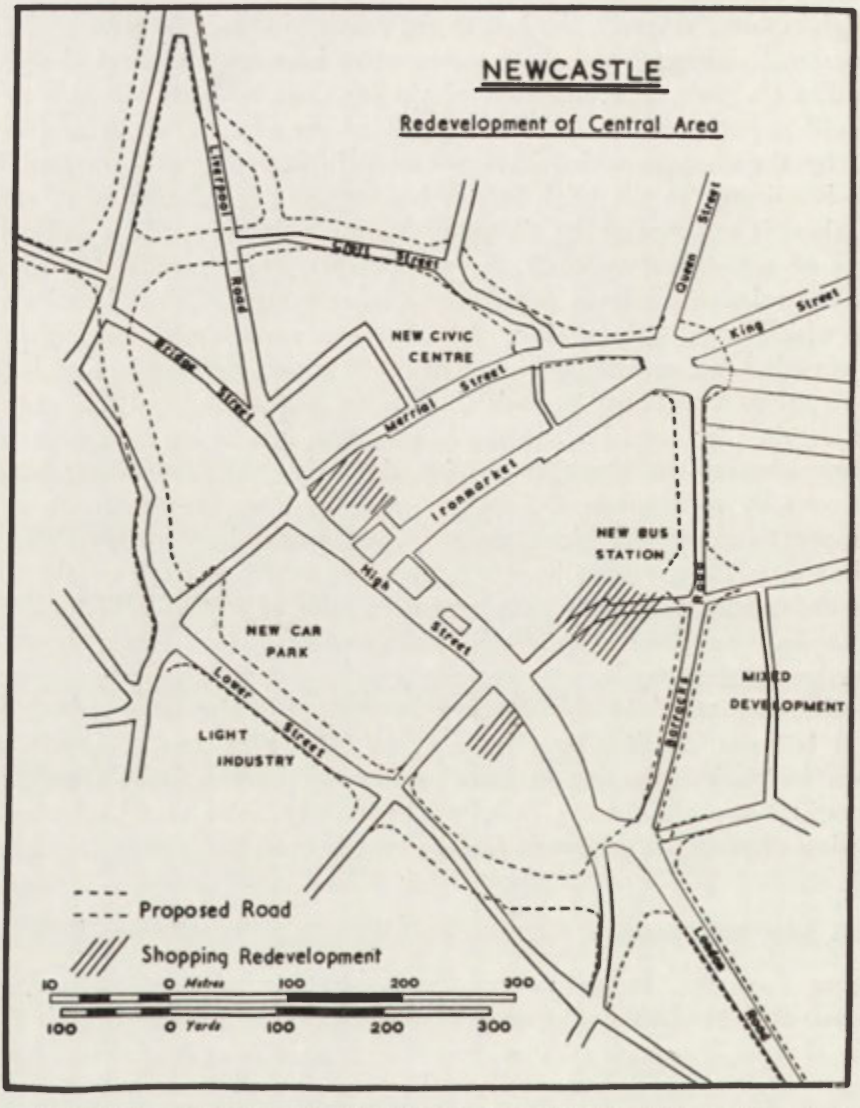


Fig. 5. Proposal for redevelopment of Central Business District of Newcastle-under-Lyme

these are hardly feasible in a town the size of Newcastle. The more compact appearance of the planned centre conforms with the natural trends which have been observed. There are two parts of the town where the ring road cuts

across retail trading areas. One is at the Liverpool Road/Bridge Street intersection, the other at the lower end of the High Street. The fact that the ring road cuts across these areas implies both the demolition of buildings used for retail trade and the creating of barriers at those points. In the Liverpool Road/Bridge Street area the construction of the ring road does not interfere with the natural process of development. Retail trade is contracting in this part of the town. Rather less acceptable is the proposal to develop shopping facilities within the small enclosed area sectioned off by the two parts of the ring road: this has been a part of the town where there has been a steady decline in retail trade. The trend for increasing concentration around the Core means that this is one of the peripheral areas which would suffer a relative decline. It would be too far removed from main pedestrian flow to be part of the central business district proper. It might be argued that it would be fitted to serve as a neighbourhood shopping centre. The proposed shopping section is, however, surrounded by the ring road and the adjacent residential districts are in fact the older nineteenth century terraced rows. These are districts which might be expected to become physically part of the zone of deterioration and areas of potential redevelopment.

The building of the ring road across the lower part of the High Street entails some conflict with natural trends. This part of the town shows some evidence of increasing trade, which is associated with the addition of Woolworth's and a large self-service grocery in recent years, together with the continued existence of the street market. The removal of heavy through-traffic will undoubtedly help this development and much expansion of retail trade is anticipated in the adjacent section of Hassell Street. However, the point at which the ring road crosses the High Street is perhaps the least desirable part, as the street here shows a marked south-easterly slope.

The office quarter will be effectively isolated, although Nelson Place is already a very busy roundabout and both ground and upper floor frontage is used for advertizing by building societies and insurance firms.

One of the more notable internal re-arrangements is the scheduling of the area north of Merrial Street for the new Civic Centre. This will centralize local government and also release more central area space for retail trade. This development reduces the car parking space which is available, although some multi-deck parking is proposed for Lower Street.

The Residential Areas

The successful use of the Rate Index in the analysis of town centre structure to show relationships between land values and differences in function or in the performance of services suggested the possibility of extending the technique to the residential areas of Newcastle. The Municipal Borough had a population

of 76,443 living in 24,233 households in 1961 [10]. The initial assumption was made that variations in land values in the residential areas are expressions of differences in the social structure and the physical environment.

The Gross Rateable Value is assessed for residential properties on the basis of the structure and size of buildings, extent of attached land and the amenities and facilities available in the surrounding district. Each residential property is separately assessed: up to the beginning of 1963 assessments were related to 1939 values, but during 1963 complete re-rating up to 1962 levels will take place. For purposes of comparison—either of individual properties or of districts—the assessment base line is not significant.

Practical considerations of time and labour made the large-scale use of the Rate Index inappropriate for residential areas and it appeared likely on *a priori* grounds that the Gross Rateable Value could be used as it stood. Since the great majority of streets in the Borough have uniform or near-uniform values throughout their length, it was possible to use the street-block as the primary unit, except in those few instances where there were marked differences in value between one group of houses and another within a street. The Gross Rateable Values in pounds per annum were grouped into the four categories 0–19, 20–32, 33–54, 55 and over in accordance with the long-established empirical groupings used by Local Authorities. Although the groups are arbitrary and of different size, their usefulness was quickly demonstrated by sample mapping and their validity was tested by field surveys and by other methods which are discussed below. A map showing the distribution of the four Gross Rate categories was prepared (Fig. 6); this provides a simple but extremely effective base map for further investigation into the social geography of the residential areas of the town.

A comparison of this base map with one showing urban growth (Fig. 7) reveals clearly that the former closely reflects the historical development of the Borough. The older parts of the town around the centre and the coal mining villages to the north and west—at Silverdale, Knutton, Chesterton and Wolstanton—i.e. the areas of characteristic nineteenth century working class housing in terraces, which are now being demolished and re-developed, fall entirely within the lowest values (0–19) in Fig. 6. The large municipal housing estates built in the periods 1920–39 and 1946–61, together with much smaller areas of private enterprise building of the same dates and type, are confined in striking fashion to the second lowest group of values. As Fig. 6 shows, this is the largest and most widely distributed group of residential properties in Newcastle, with its principal areas in the recently built estates of the north and west of the Borough and to the south of the Westlands, together with the inter-war estate at Poolfields. All these areas typify the changing norms accepted for working class housing since 1918.

The areas with values of 35–54 lie mainly in the east of the Borough and

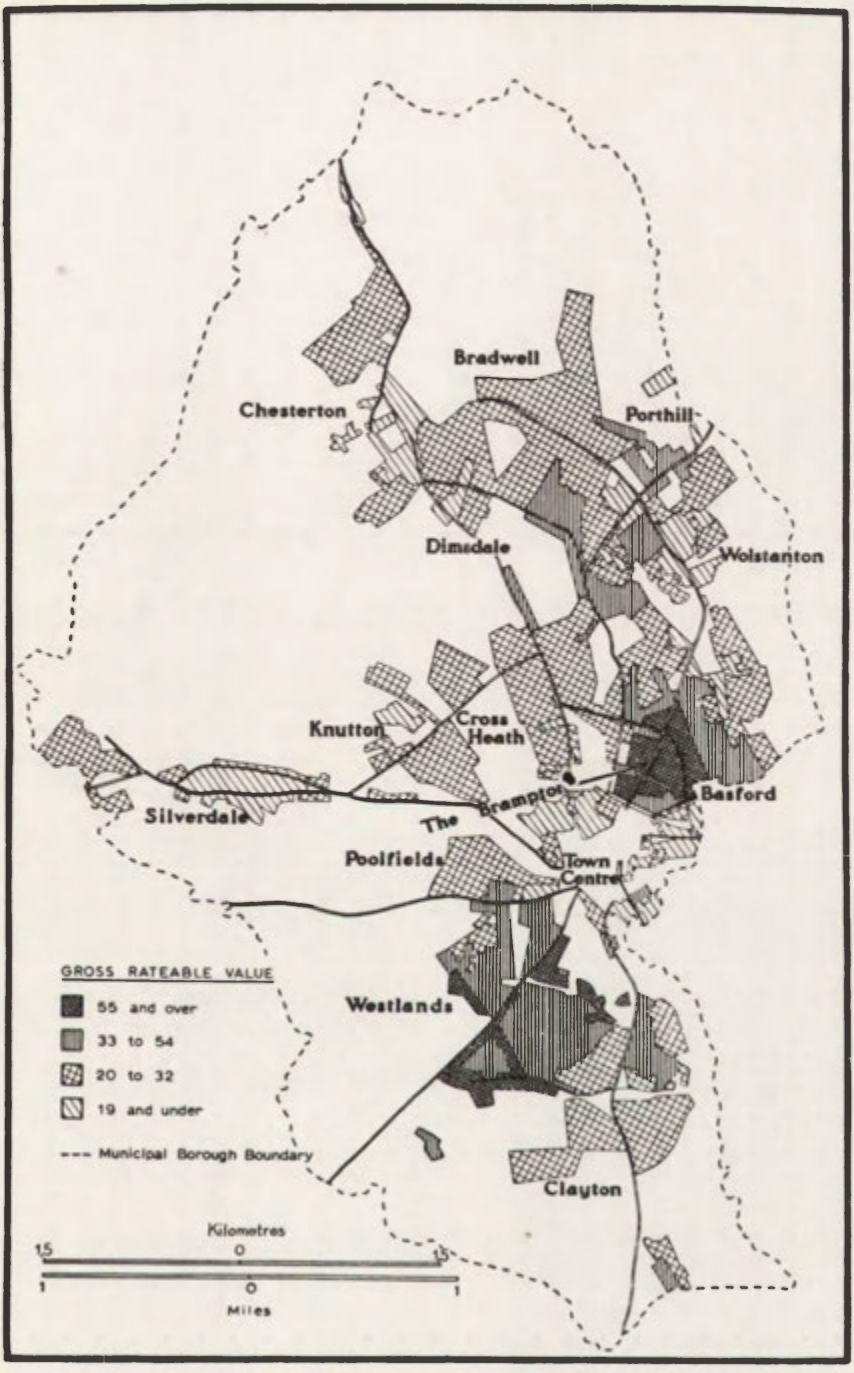


Fig. 6. Gross rateable values within Newcastle-under-Lyme

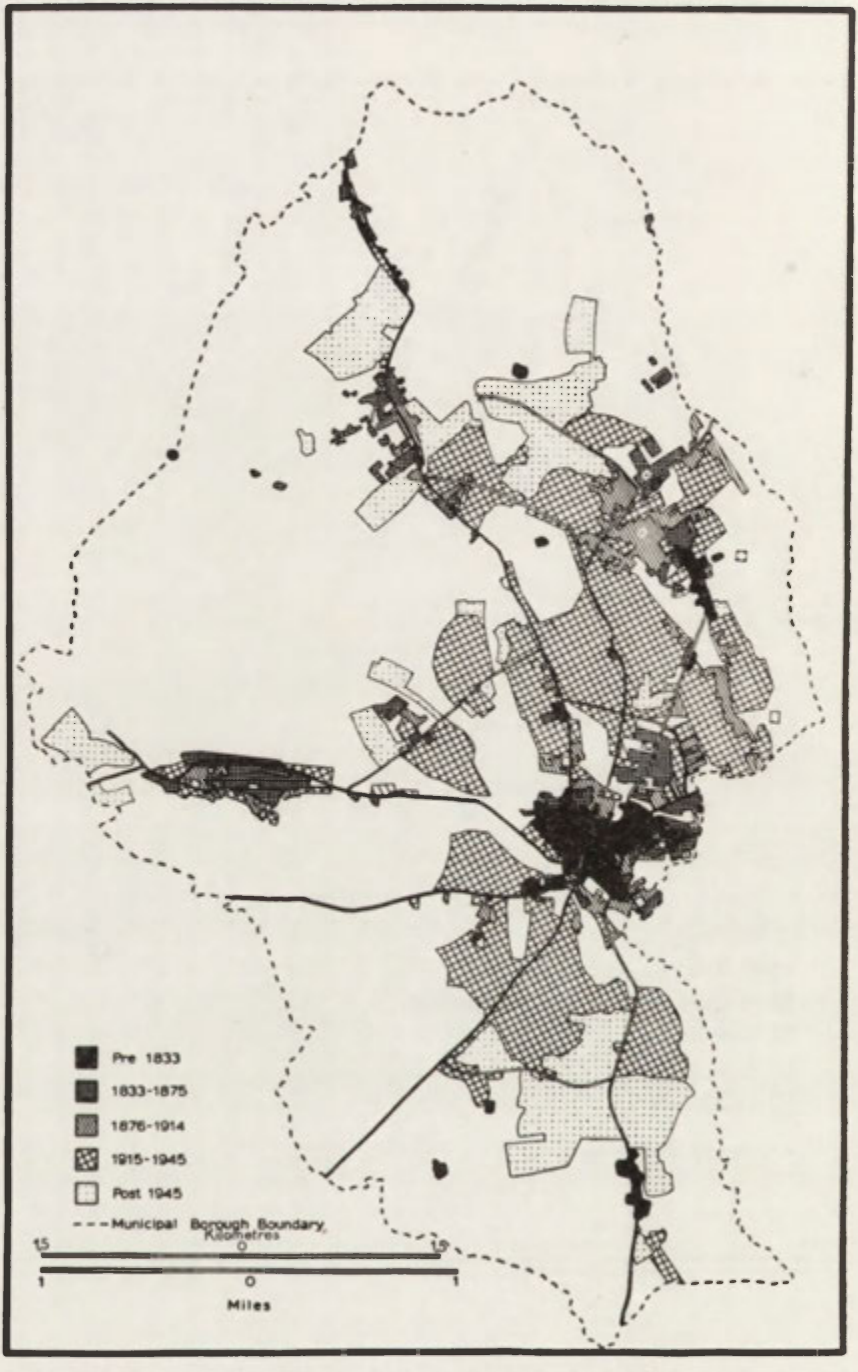


Fig. 7. The growth of Newcastle-under-Lyme

in the Westlands. The former, at Basford, Porthill and Dimsdale, are "superior" residential areas which have retained their high status since they were built for pottery manufacturers in the early nineteenth century. The latter is a pleasant residential district, established at an early date well away from the pollution and dirt of the Potteries. The highest values of all, 55 and over, are found in the Brampton, an easily defined area of large houses in spacious grounds which has kept its high status since the middle of the nineteenth century, and in limited areas of new housing, mainly on the fringes of the Westlands.

The comparison of Figures 6 and 7 has clearly shown, therefore, that the base map reflects the actual processes of urban growth very closely indeed, thereby providing validation in historical terms of the choice of rateable values as a criterion. Different types of housing, built at different times for different socio-economic groups provide a subdivision of the residential areas into what may be regarded as varied urban environments. Seen from this point of view, the areas of the base map are "natural" growths which have a distinct social and economic reality of their own. As such, they might provide a simple and convenient base for more detailed investigations into the social geography of the town, initially through the comparison of areas with similar values and the contrasts between areas of differing values. This can be tested by the use of simple variables, which also provide confirmation of the validity of the original base map.

The choice of variables was influenced by practical considerations and by the general aim of developing simple techniques for investigating the social geography of urban areas. It was therefore essential that the data used were uniform throughout the Borough, that they were readily accessible and did not require elaborate processing before use, and that they could be found in other urban areas. At this stage of the enquiry no attempt was made to relate the variables to a thorough-going conceptual framework; they were chosen on an empirical basis in the expectation that they accurately reflected social differences between groups living in different parts of the urban areas.

The first variable chosen was occupation, which has been widely accepted as a meaningful index of social class and which also has the important advantage of being used by the Registrar General in the Census. As will be shown later, this makes it possible to expand the scope of the investigation by using Census data. If the Rate Value sub-areas in Fig. 7 are "real" units, then clearly there should be a significant degree of correlation between property value and occupational status, so that, for example, the high value areas will contain the residences of "highest" occupational groups, i.e. the "professions", which form the Registrar General's Class I. Since this group is quite sharply differentiated from the great bulk of occupied and retired males by its small size and by a constellation of distinctive social and economic

characteristics, it is particularly appropriate for our purposes. Moreover, professional people can be located without difficulty through directories, year books, associations and other readily accessible sources. They have the disadvantage of being small in total number, particularly in Newcastle, where they formed 2·7% of the occupied and retired males in 1951, as compared with 3·3% in England and Wales as a whole [10]. Many of the professional men working within the Borough live outside it, especially in the pleasant rural areas to the west.

The homes of ninety-three persons in selected professions (doctors, dentists, solicitors, architects, accountants and headmasters) were plotted on a map of Newcastle, together with the two highest Gross Rateable Value categories, i.e. 33 and over, for purposes of comparison (Fig. 8). It will be apparent at once that most professional persons live in the highly valued areas; over a quarter have their homes in the limited areas of the highest value. The few exceptions are mostly general practitioners living in their practices in the low value areas of Chesterton and Silverdale. This simple test, therefore, fulfilled the expectation that people of superior social status by virtue of their occupation live in the highest valued parts of the residential areas.

Since the number of persons in the professions was relatively small, a second variable was needed which gave a much more comprehensive index of high income and high social status. The Telephone Directory provided a convenient source of data: the homes of persons having a private telephone were selected as the variable and the residence of every seventh private subscriber in Newcastle was plotted on a map, which also shows the two highest value areas of the Gross Rate (Fig. 9). Directory entries which showed that the subscriber was engaged in a trade, a profession or in any business activity were excluded from the sample, leaving nearly 400 households in the Borough. It will be seen that there is a very close relationship between the two distributions and that once more the "55 and over" category stands out on the fringes of the Westlands as having a high proportion of subscribers. The Brampton, an area of scattered houses in large grounds, has fewer subscribers, but these make up a significantly high proportion of all dwellings.

Taken together, Fig. 8 and 9 confirm in a straightforward way the reiationship which exists between the high value areas of the base map and the geographical expression of simple criteria of high socio-economic status. A third variable was sought which would provide a complementary relationship between low socio-economic status and the lower categories of the base map. Appropriate and accessible indices appear to be much less common here, but after considering membership of Working Men's Clubs and the homes of juveniles on probation, it was decided to use data relating to welfare agencies. The variable chosen was regular attendance (defined as one visit per month over a period of six months or more) at Child Welfare Centres, and a random

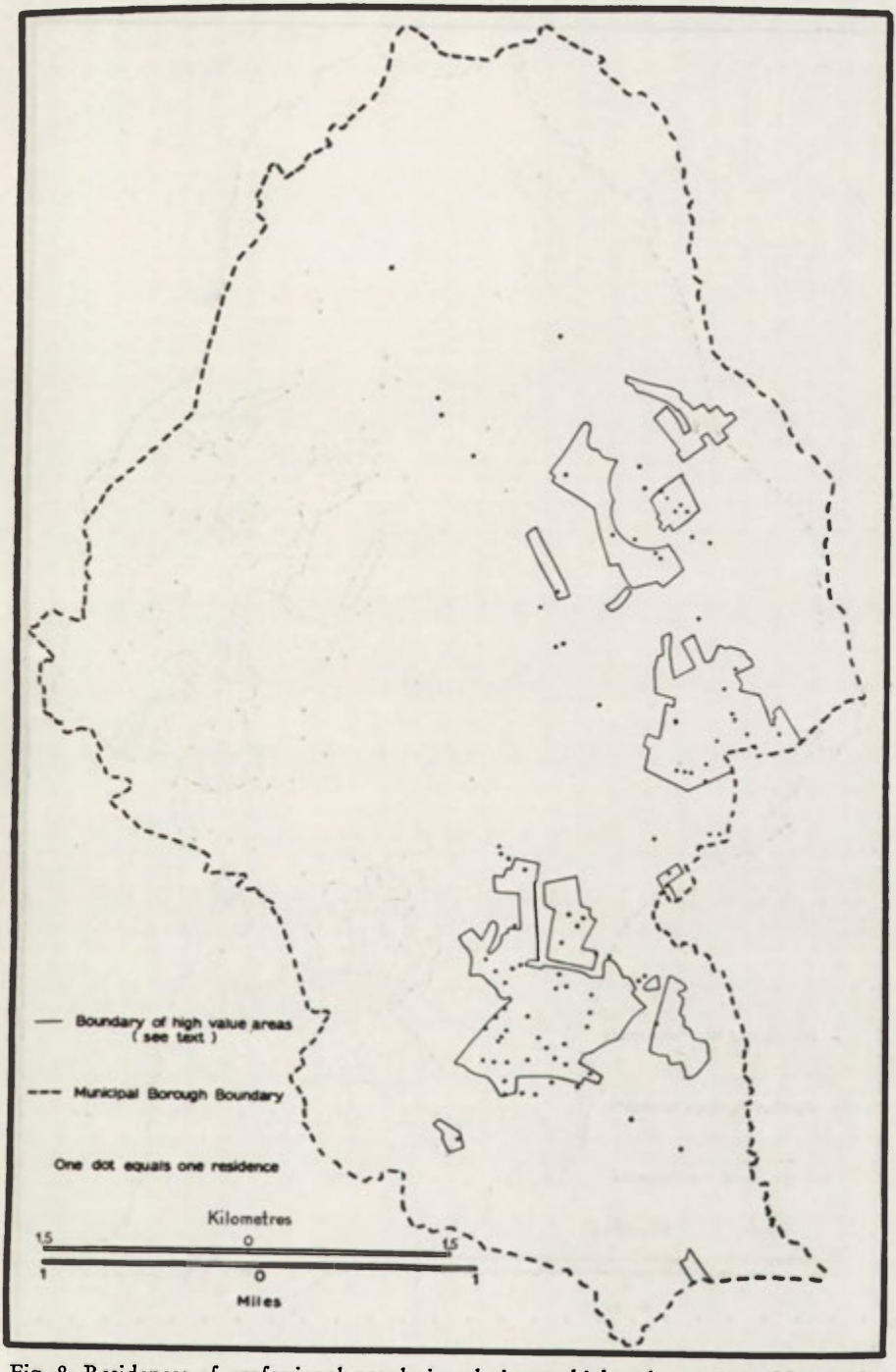


Fig. 8. Residences of professional people in relation to high value areas in Newcastle-under-Lyme

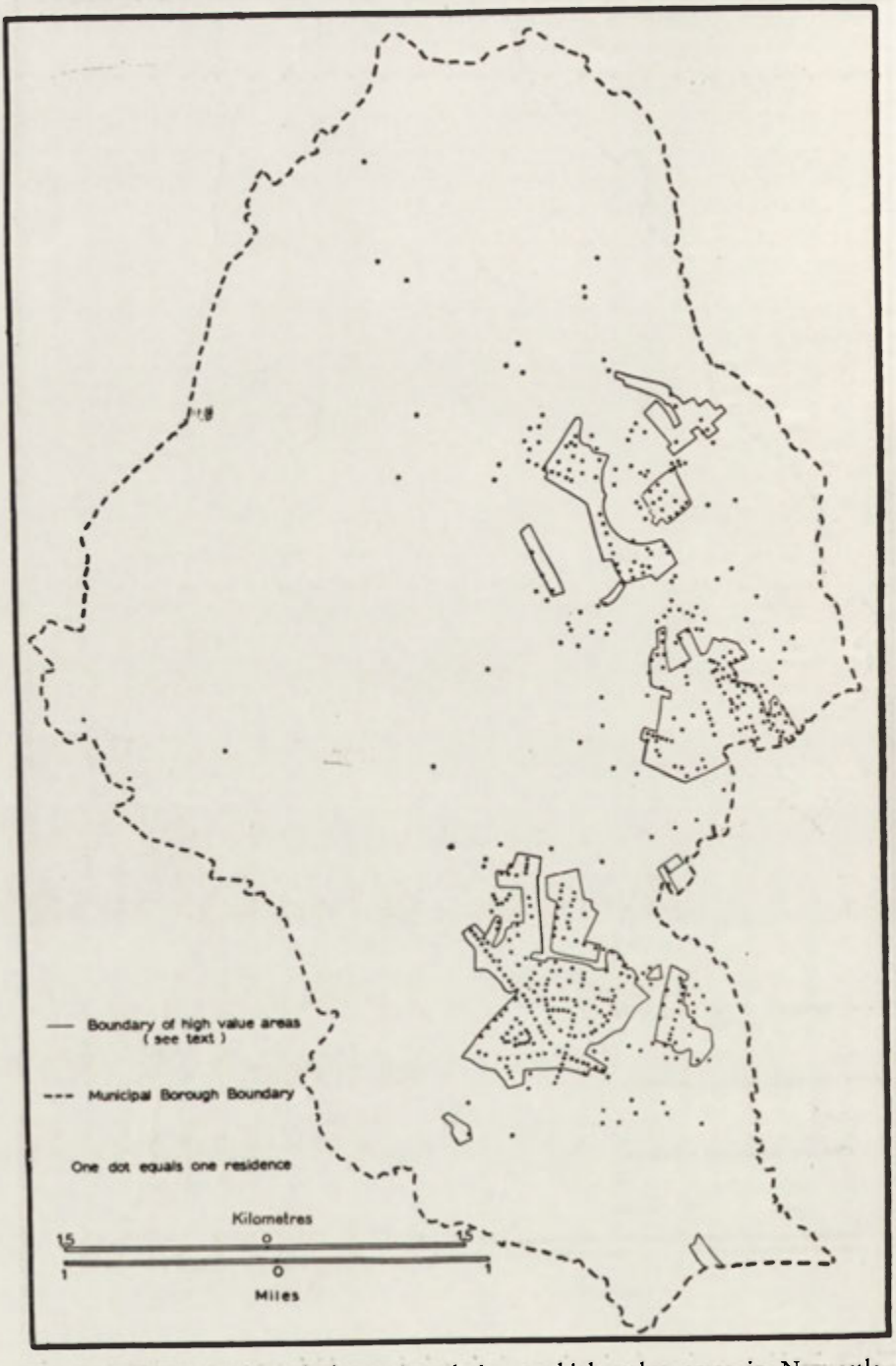


Fig. 9. Residences with telephones in relation to high value areas in Newcastle-under-Lyme

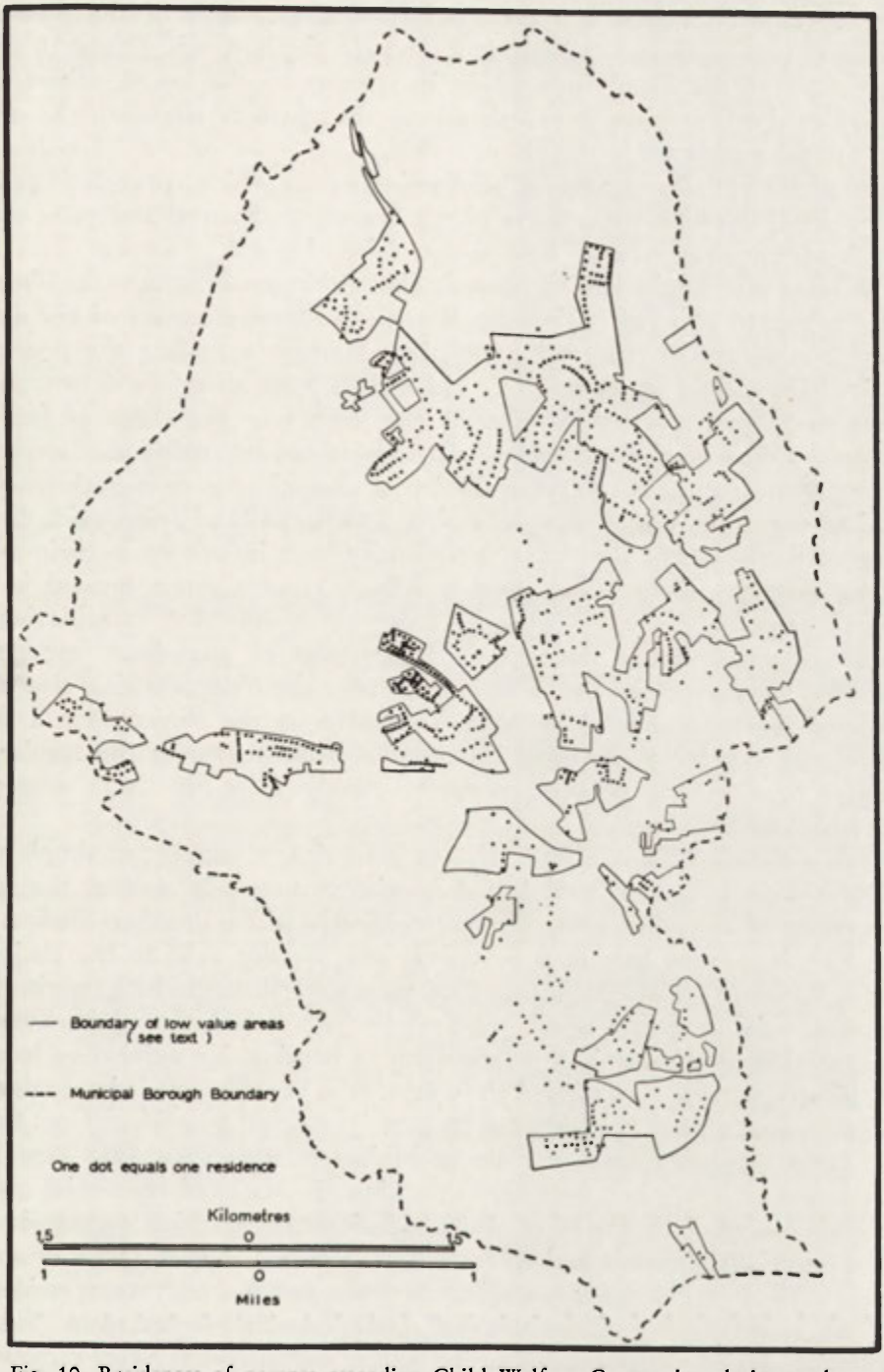


Fig. 10. Residences of parents attending Child Welfare Centres in relation to low value areas in Newcastle-under-Lyme

sample of 140 mothers was extracted from the records of the post-natal clinics at each of the seven Welfare Centres in the Borough. Figure 10 shows the homes of the sample population in relation to the lowest valued areas (0–32) of the base map. It reveals clearly that parents attending the clinics live for the most part in the older working class areas, such as Silverdale and Knutton, or in the newer municipal housing estates which are replacing them. In contrast, the high status areas of the Brampton, Basford and parts of the Westlands have significantly few parents using this public service.

To some extent this striking general relationship masks others: the distribution in Fig. 10 also reflects housing densities and some aspects of the demographic structure of the total population. Mothers attending the post-natal clinics have a child under one year old and they are therefore drawn mainly from the young married couples. In the same way the range of facilities offered by each Welfare Centre, its atmosphere and its setting may attract or deter parents, so that the Clayton Clinic, for example, has on its registers some mothers from the high value areas of the Westlands and from quite distant parts of the Borough; they have undoubtedly been influenced in their choice by its excellent services and good building. Those Centres located in the poorer parts of the urban area have far more difficulty in achieving an attractive public image. Moreover, the purpose of attendance appears to influence the pattern inasmuch as infants from the older working class areas predominate among those brought frequently to the clinics over a short period—usually for vaccination and immunization—whereas the regular attenders over a long period are drawn mostly from the large estates of "Council" houses.

Such differences point to the value of preliminary mapping of simple variables as a first stage in studying the social structure as well as the social geography of an urban area. The three criteria taken together confirm the social reality of the base map groupings and thereby validate the choice of Gross Rateable Values as convenient means of distinguishing territorially between social groups. The sub-areas of the base map are each characterized by general levels of amenity and standards of housing, by social class, income, etc. However, the boundaries of these sub-areas, as well as their internal social and economic organization, change frequently—as will be evident from Fig. 7. The rapid expansion from the old-established nucleus since 1918 represents an enormous change in urban structure. Thus the status of residential areas—whether measured by the Gross Rate technique or by other means—is seen to be essentially dynamic and to be fully understood only in terms of a continuum. The Brampton, for example, was developed as a high status residential area in open country when Newcastle was a small market town (Fig. 7). Expansion during the Victorian period and in the inter-war years surrounded it with smaller houses, while in recent years its southern part has been occupied

by non-residential users moving outwards from the congested town centre. The high prestige value of the area and its large houses have attracted professional groups, such as medical consultants, and branches of major agencies, for example the Milk Marketing Board. This process of change is very like that which had already taken place in King Street, lying between the Brampton and the town centre, where middle class families were replaced by offices and surgeries earlier in this century.

This conversion to non-residential usage must in turn have marked effects upon the residential nature of areas like the Brampton. There is also, however, a strong tendency for an area's established reputation as a high status, purely residential area to persist. In the Brampton this is seen in Sandy Lane, which is furthest removed from the town centre. In the other parts of the Borough which were early established as high status, residential districts (Basford, Porthill, parts of Wolstanton), similar trends are observable. These districts, however, were more closely engulfed in the general urban expansion than the Brampton, so that changes are often further advanced. Non-residential "take-over" of large houses has occurred and the dividing up of former houses into flats is a typical and widespread feature.

Changes of this kind can be measured by comparing base maps for different years and by periodic replotting of simple variables. Each base map is, of course, valid only for a relatively short period. The differences between such maps will be indices of changing physical conditions and also of changing social values. The terrace housing which was the normal accommodation for working class families in the last half of the nineteenth century is now given a low value and is regarded as ripe for redevelopment. The families who occupy such property move to new housing estates, built to new standards, and requiring new habits and patterns of behaviour.

Social and ecological areas

It became evident in the course of developing the techniques described above that there were extremely difficult but interesting problems in relating the results to the existing body of theory concerning urban socio-economic subdivisions. In particular we had in mind the Social Area analysis of Shevsky and Bell [11] and the seminal paper by Form *et al.* [12] comparing social, ecological and demographic areas. It also became apparent that our techniques were essentially preliminary and needed to be followed by other, more detailed investigations. Thirdly, it was realized that while the first two variables—occupations and private telephone subscribers—were broadly ecological and in that respect at least consistent with (if different from) the approach used by many other British urban geographers [14], the third variable was not so much ecological as sociological. It was related to aspects of the social

structure that are not necessarily geographically differentiated, and so makes a somewhat radical departure from the main direction of urban geography in England.

From these considerations the next stage of the research has emerged and a programme has been drawn up which is summarized below:

(a) To examine the detailed socio-economic structure of individual sub-areas determined by the Gross Rate technique, using questionnaires applied to random samples. The first stage in this work has been completed for two contrasting sub-areas.

(b) To plot demographic, occupational and other data from the Census by Enumeration Districts (of which there are over 500 in the conurbation) and to compare the results with the existing analysis.

(c) To test the validity of the Shevsky–Bell Social Area analysis in a modified form, using Census data, and to compare the results with those derived under (a) and (b).

(d) To develop new indices, both ecological and sociological, which can be used in the differentiation of urban sub-areas.

It is hoped that, when completed, this project will provide material for a better understanding of the nature of ecological and social areas and in this way contribute to the social geography of towns and cities.

Bibliography

[1] Berry, B. J. L. and Garrison, W. L., "The functional bases of central place hierarchy", *Econ. Geogr.*, 34 (1958), 145–154.
[2] William-Olsson, W., "Stockholm: Its structure and development", *Geogr. Rev.*, 30 (1940), 420–438.
[3] Murphy, R. E. and Vance, J. E., "Delimiting the C.B.D.", *Econ. Geogr.*, 30 (1954), 189–222.
[4] Murphy, R. E. and Vance, J. E., "A comparative structure of nine Central Business Districts", *Econ. Geogr.*, 30 (1954), 301–336.
[5] Murphy, R. E., Vance, J. E. and Epstein, B. J., "Internal structure of the C.B.D.", *Econ. Geogr.*, 31 (1955), 21–46.
[6] Herbert, D. T., "An approach to the study of the town as a central place", *Sociological Rev.*, 9 (1961), 273–292.
[7] *The Potteries, Newcastle and District Directory*, Staffordshire Sentinel Ltd., Hanley, 1912.
[8] *Keates and Fords, Annual Potteries and Newcastle Street and Trade Directory with Almanack*, Hanley, 1865/66.
[9] *The Potteries, Newcastle and District Directory*, Staffordshire Sentinel Ltd., Hanley, 1907.
[10] *Census of England and Wales (1961), Preliminary Report*, Table 2, p. 30, London 1961.
[11] Shevsky, E. and Bell, W., *Social area analysis*, Stanford 1955, pp. 70.
[12] Form, W. H., Smith, J., Stone, G. P. and Cowhig, J., "The compatibility of alternative approaches to the delimitation of urban sub-areas", *Amer. Sociological Rev.*, 19 (1954), 434–440.

Acknowledgment

We are grateful to the following journals for permission to reproduce some of the text figures: *Sociological Review* for Figures 1 and 2; *Journal of Town Planning Institute* for Figure 3; *North Staffordshire Journal of Field Studies* for Figures 7, 8, 9, 10 and 11.

METHODS OF FUNCTIONAL ANALYSIS IN URBAN STUDIES IN POLAND

Andrzej Wróbel

The term "functional analysis" as used in geography has two meanings; in the more general meaning it denotes the analysis of functions rather than forms. In this sense we may speak about the far-reaching evolution that has taken place in post-war Poland in the whole field of human geography. On the other hand, in the more restricted sense "functional analysis" means the study of the so-called "functional structure of cities" based on the concept of "basic–nonbasic functions". This paper examines Polish studies in the latter field indicating at the same time the necessity to develop them along the lines suggested by the "functional approach" in the more general meaning.

The analysis of urban functions was introduced into Poland after World War II, first in connection with the studies conducted by the town-planning offices under the influence of Soviet literature. Then in 1952 J. Kostrowicki presented the first functional classification of all Polish towns [5]. Since that time the concept of "basic–nonbasic" city functions has been widely applied both in town planning and in geographic studies. Among the latter the most important are the studies of L. Kosiński; his last paper on the subject is a synthesis of Polish work in this field [4].

In this study the author presents the analysis of the functional structure of 70 major Polish cities, based on the figures of employment in the main groups of basic functions; these figures result from the revaluation of the structure of employment data with the use of special percentage indices derived from the previous detailed studies of the functional structure for certain selected towns, which were based on representative sample data taken from the census sheets.

The method used by Kosiński was correct because it is only by the use of such easily available data on the structure of employment that an analysis of the urban functions on a broader scale becomes possible—in contrast to the time-consuming method of field questionnaire. On the other hand his method, by revealing the estimated figures of employment in individual basic

industries, provided more precise information on the functional structure of the towns than numerous studies in which only the structure of employment data have been used.

At the same time, however, this work of Kosiński reached in a certain sense the limit of the explanatory value of the approach to the study of urban functions as used hitherto.

As in other countries, so also in Poland town-planners and geographers began to realize the theoretical limitations involved in the concept of the "basic functions" and the practical difficulties connected with its use. As a result, after the publication of Kosiński's article, no significant papers developing the concept appeared in Poland until recently, when A. Werwicki presented an attempt at a dynamic approach to the study of urban functions, differentiating the "basic functions" and "town-developing functions" in the more exact meaning of the term [6].

It is not intended here to discuss critically all these aspects of the "basic functions" approach, except one very important feature of its application.

Although it has been stated that the economic base "concept provides a view of economic ties which bind a city to other areas" [1], the geographic studies in which the concept has been applied did not develop along the lines suggested by this statement.

The main research target of these studies has been the establishment of the functional typology of towns, whereas the geographical aspect of the problem has almost been omitted; by "geographical aspect" is meant the answer to the question: in respect of what areas does the given town fulfil the given functions?

The research on the last problem has been conducted in Poland so far quite independently of the research on the "functional structure" of towns. It has been concerned either with individual functions [2, 3] or with synthetic indices representing the regional influence of certain groups of urban functions [7]. It should be mentioned here that as a result of the character of the available data, these studies (not taking into account the studies of individual towns) concerned mostly the service functions of towns but did not take up the problem of interconnections in the sphere of material production. The theoretical basis of the assumptions and interpretation of these studies was the concept of a hierarchical system of towns inherent in the central place theory of Christaller and Lösch.

The above-mentioned studies, undertaken in recent years, have provided for the first time the detailed empirical material for at least partial verification of this theory for the whole of Poland, in contrast to the first period of its popularity immediately after the war when various authors presented their concepts of the hierarchy of central places without detailed information about the extent of their regional influence.

Numerous papers have been published, in Poland and elsewhere, questioning the significance of the theory of central places for the study of urban network. It would appear, however, that in Polish conditions its explanatory value is undeniable. On the one hand, in contrast to some countries with a high level of economic development, the process of concentration of the population in large metropolitan areas, which to a large extent are self-dependent bodies in respect of many urban functions, is not yet very advanced in Poland, and about a half of the population still lives in rural areas; neither has Poland achieved a level of economic development where the importance of the factor of distance in the life of society begins to diminish drastically. On the other hand, the same factors, inherent in the socio-economic system, that have somewhat limited the growth of the largest cities, have also ensured that the overlapping between urban spheres of influence in Poland is smaller than in countries with a capitalistic economy. This results from the fact that various "urban functions" are being fulfilled by organizations or enterprises which, in their respective spheres of social and economic life, possess either legal or *de facto* monopoly; these organizations and enterprises delimit the spheres of influence of their subordinated units on the basis of the administrative division of the country.

However, the results of current research on the areal extent of different urban functions, which—as remarked above—have greatly increased our knowledge in this field, confront us at the same time with the really significant but difficult question: how to pass from the statements concerning the hierarchical system of cities in the sphere of individual groups of functions to the more generalized statements on the urban system as such, and to the statements theoretically and practically significant for analysis (and in consequence—for planning) of the process of development of the urban network. With the question so stated, it seems evident that the concept of the system of central places cannot be treated as an analytical device used in isolation from the other methods of urban analysis. It seems particularly fruitful to combine it with the concept of the basic functions of the towns which—applied in isolation—found itself in Poland, as stated above, in a certain impasse.

I would like to present here an example, although not a very sophisticated one, of the application of the analysis of urban functions to the study of the hierarchy of regional centres. It is an attempt to utilize the data included in the tables in Kosiński's paper for the establishment of synthetic indices of the regional importance of the larger Polish towns. A very simple analytical procedure has been here applied, namely the comparison of absolute figures of employment in the basic functions with the exception of the group "industry". The resulting series of data ranked according to the height of this value and graphed on the double logarithmic scale presents a picture

that deviates from the similar graph for towns according to the number of inhabitants, approximating the theoretical distribution expressed by the rank-and-size rule, but rather indicates the existence of a certain hierarchy. (see Fig. 1).

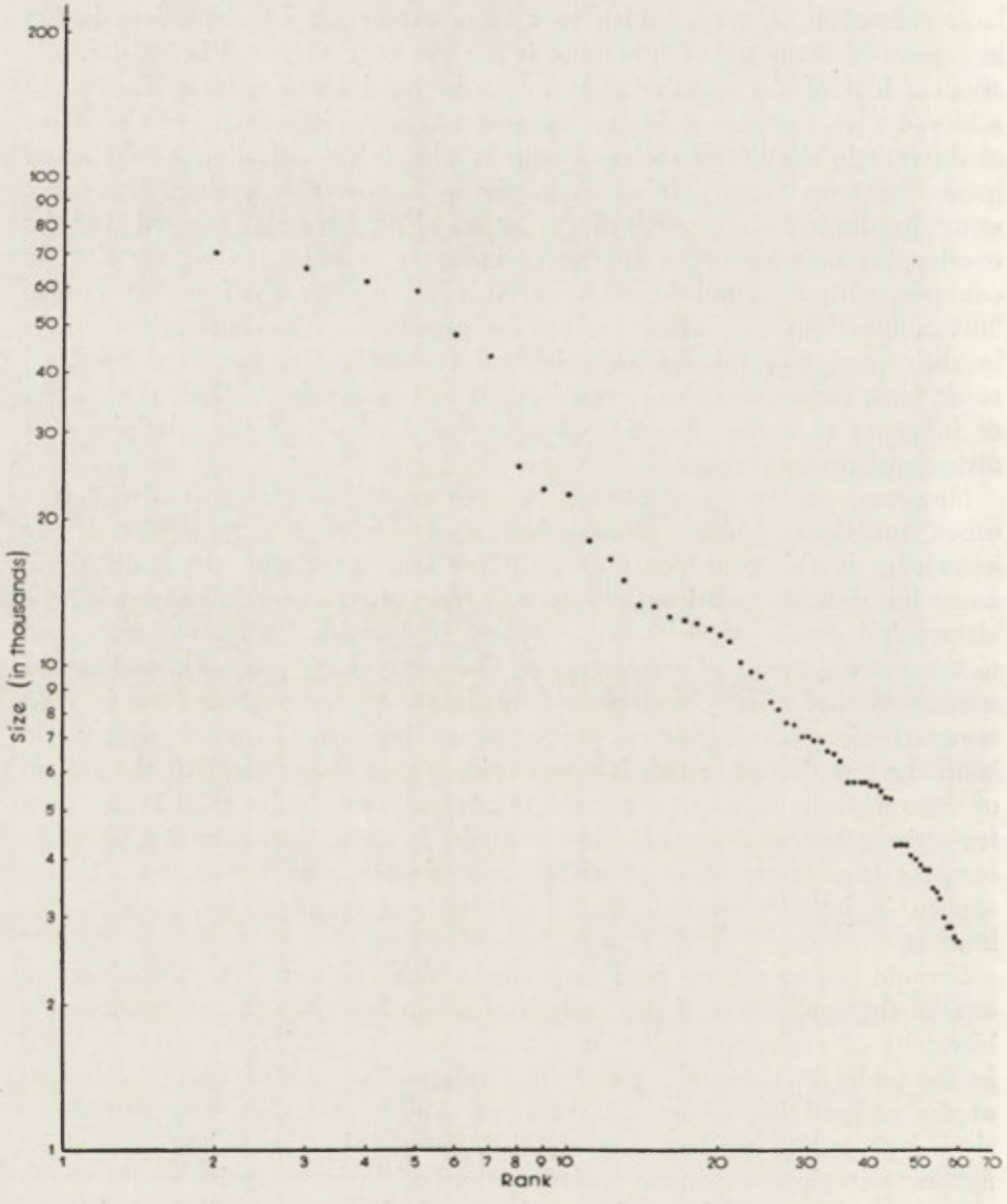


Fig. 1. Fifty-nine largest Polish cities ranked in decreasing order of the size of employment in the "basic" group

Evidently, the method applied here is, as already stated, a very crude one; it is based on the very simplified assumption that the industrial functions are of national character, whereas the remaining functions are regional. This over-simplification could not but lead to certain distortions of reality, some of them easily recognizable as e.g. over-estimation of the regional importance of the coastal cities where the function of sea-trade has been included among the regional functions.

At the same time, the exactitude of Kosiński's key of indices for the division of figures of employment in different branches of economy into "basic" and "nonbasic" functions has been checked and proved to be highly unreliable in the case of the industrial towns situated within greater industrial agglomerations. The resulting errors in estimates did not in fact have a real significance for correct determination of the functional types of towns for which purpose the key has been devised—but they did lead to the overestimation of the regional importance of these towns.

However, all these inadequacies of the method suggest possible ways of further developing the analysis of the functional structure of cities from the point of view of regional approach. Such a development would involve a more detailed break-down of the structure of employment—a break-down taking into account the extent of market areas corresponding to different urban functions to be determined as a result both of the general economic laws relating to the size of market as well as the geographical situation of the given town. Incidentally, such a break-down would fulfill at the same time the requirements of the dynamic approach to the study of urban functions postulated by Werwicki.

Such an analysis, of course, goes beyond the limits of the traditional field of urban geography, being closely connected with the studies of areal interconnections existing in various industries. Moreover, such an analysis requires some very serious preparatory work in order to secure an adequate basis of data.

As to the last problem, vast new possibilities are opened here by the studies now being undertaken in Poland under the auspices of the Committee of Space Economy and Regional Planning, concerning the location of industry and commodity flows. One of these studies, conducted in September 1962, is the detailed examination of commodity shipments by all means of transport; this study will provide abundant data that could serve various analytical purposes among which the question of areal connections of individual cities has been fully taken into account.

The other element important for the same purpose is the introduction of the problem of the supply and demand markets into the detailed questionnaires for individual industrial plants, prepared for the detailed study of the locational problems in the industry.

This interconnection of the analysis of urban functions with the analysis of industry is not limited, of course, to the joint gathering of data. The significant analytical question is here the problem of the effectiveness of industrial investments both from the point of view of economies of the scale of individual industrial plants as well as economies of the scale characteristic for urban industrial complexes of various size.

It could therefore be concluded that the analysis of urban functions conceived as an analysis of the urban network involves a serious enlargement of the field of research as compared with the previous concept of the "basic functions" of towns, and requires the combination of this concept and that of central places with various concepts and methods of analysis of industrial complexes and commodity flows.

Bibliography

[1] Alexander, J. W., "The Basic–Nonbasic concept of urban economic functions", *Econ. Geogr.*, 30 (1954), 246–261.

[2] Dziewoński, K., Iwanicka, E., "Miejsce zamieszkania (pochodzenia) słuchaczy wyższych uczelni w Polsce" (Sum. Places of residence (origin) of students of academic schools in Poland), *Przegl. geogr.*, 33 (1961), 1, 39–52.

[3] Eberhardt, P., Wróbel, A., "Regiony handlu hurtowego w Polsce" (Sum. Regions of wholesale trade in Poland), *Przegl. geogr.*, 35 (1963), 1, 21–29.

[4] Kosiński, L., "Klasyfikacja funkcjonalna większych miast polskich według stanu z r. 1950" (Sum. A functional classification of the larger towns in Poland), *Przegl. geogr.*, 30 (1958), 4, 573–585.

[5] Kostrowicki, J., "O funkcjach miastotwórczych i typach funkcjonalnych miast" (Sum. Basic functions and functional types of towns), *Przegl. geogr.*, 24 (1952), 1–2, 7–64.

[6] Werwicki A., "Changes in the basic functions of towns in Lower Silesia and their influence on urban development", *Geogr. Polonica*, 3, Warszawa 1964, 125–135.

[7] Wróbel, A., "Nodal regions of passenger traffic in Poland", in: *Problems of Economic Region*, Warszawa 1961, 191–198.

CHANGES IN THE BASIC FUNCTIONS OF TOWNS IN LOWER SILESIA AND THEIR INFLUENCE ON URBAN DEVELOPMENT

Andrzej Werwicki

This paper is based on the author's own studies conducted during several years; the problems discussed do not refer to all of Lower Silesia but only to that part which comprises the Lower Silesian Coal Basin (the *powiats* of Wałbrzych and Nowa Ruda), the Dzierżoniów district of textile industries (the *powiat* of Dzierżoniów) and a part of the Lower Silesian district of linen industry (the *powiat* of Kamienna Góra), as well as the rural area of the *powiat* of Świdnica including its towns, centres of machine industry. By taking into consideration areas of different intensity of industrialization and of different industries situated in these parts of Lower Silesia it was possible to establish certain regularities in the development of towns and in the functions of these towns, resulting from the changes undergone by the various branches of industry during the period under discussion.

The functional classification of the towns and urban settlements under investigation is based on the functional structure of the population, surveyed in full for: 1787, 1819, 1849, 1939 and 1960/61 and partly also—in view of the lack of complete data—for 1912. As a result of the necessity of comparing his classification for the different periods and of the dissimilarity in the original numerical data, the author refrained from analyzing professionally active population (suitable data frequently being missing), but rather surveyed the entire population in respect of their sources of sustenance. After dividing the population into a basic and a complementary group, we next distinguish in the basic group the following four principal groups of employment: those engaged in basic industries and handicrafts, those working in basic commerce, those in basic transport, and those in other basic kinds of occupation, i.e. services. In this manner it was possible to define four fundamental functional types of towns: the industrial, the commercial, the transport, and the service type.

In 1787, on the eve of the industrial revolution in England and of the Napoleonic wars—events which enormously affected the economy of the

European continent—a strongly developed domestic linen handicraft industry existed in the area under discussion. In numerous towns and settlements situated in mountainous areas the group of population dependent on this industry dominated over all others, often exceeding 50% of the total population. In other towns the dominating group was that occupied in commerce, mainly the business—an integral part of the linen industry—of buying up the textiles made in the mountain villages.

Political and economic changes during the first two decades of the 19th century brought a marked curtailment of the domestic linen industry and of the trade connected with it; this found its expression, in 1819, in a general decline in the percentage of population living from this kind of work in favour of an increase in the percentage employed in services and in trade not directly linked with industrial production.

The thirty-year period from 1820 to 1850, is of marked significance in the economic life of the area under discussion. Factory production of textiles came into existence, replacing the declining handicraft and cottage industry, as well as other new industries among which pottery played an important role. With the gradual industrialization of the towns and of several larger non-rural settlements, the percentage of the population employed in industry grew considerably. An industrial specialization had become the significant feature of 6 towns (Chełmsko Śl., Lubawka, Nowa Ruda, Radków, Świebodzice and Wałbrzych) and of, at least, 5 settlements (Bielawa, Głuszyca, Pieszyce, Pilawa Górna and Walim); unfortunately, no detailed numerical data are available for localities other than towns.

The next period, from 1850 to 1870, shows economic features resembling those of the preceding period. The only difference is a new and more intense development of coal mining, although this branch of industry did not predominate yet in any of the settlements examined. The lack of data concerning the employment of the populations of towns makes it impossible to establish their functional structure in 1870; this fact is regrettable because this happens to be the period with the highest percentage of workers employed in manufacturing. After this, in this area of Lower Silesia, many of the towns and settlements experienced a reduction in the percentage of population employed in industry caused by the decline in the number of workers in the textile industry resulting from the increasing mechanization of production. In view of the fact that, at that time, the textile industry predominated in this area, this retrenchment brought important changes in the functional structure of the population of the towns examined. A modification in this decline of the percentage of industrial workers suffered by some of the settlements, as well as a subsequent considerable increase in employment in the period from 1870 to 1914, was mainly brought about by coal mining which played a very important role in the further evolution of urban settlements within the area.

An incomplete typological classification of towns and urban settlements undertaken on the basis of the number of persons employed in 1912 in industry and mining showed an industrial specialization for 13 of the 25 towns and urban settlements examined. In some of these the modern mechanized textile industry became concentrated (Dzierżoniów, Kamienna Góra, Walim); a second group comprises the main centres of coal mining which previously had no industry (Gorce and Słupiec); and a third group includes towns like Nowa Ruda and Wałbrzych which maintained their industrial specialization thanks to coal mining.

The economic changes which took place between the First and the Second World War and which, generally speaking, involved the slowing down of the development of productive activities in favour of increased service activities, have led to a marked decrease of employment in industry, mining and handicraft and, consequently, to a drop in the percentage of inhabitants employed in industry. This explains why in 1939 an analysis of the functional structure of the population of towns and settlements reveals an industrial specialization for 4 towns only, the remaining towns and settlements having become predominantly service centres. In some of the latter towns an industry surviving from preceding years shows their relative specialization in industrial production.

As a result of the speedy restoration of the relatively slight damages suffered during the last war, and the adjustment of industry to the economic structure of new Poland, industry again occupied its proper place; the percentage of population employed in industry increased considerably, so that today 19 out of the 25 towns and settlements studied show an industrial specialization. Notwithstanding the fact that in the majority of towns and settlements the absolute number of workers employed in mining, industry and handicraft has increased in comparison with the pre-war period, the pronounced industrial specialization of many towns must also be ascribed to the marked deficiencies in the development of services—a fact that brought great changes in the functional structure of the population.

The entire stretch of time surveyed in our research clearly shows that in the towns and settlements under discussion the changes in the basic economic functions were not very large; they were brought about by the successive changes in economic conditions existing in the region in which these towns and settlements were situated. Even in times of economic depression they maintained unchanged the same degree of specialization as in periods of prosperity.

In spite of minor changes in typology and even smaller changes in the relative functional specialization of the towns examined, the trend on the charts showing the increase in population and the rate of this increase discloses a considerable differentiation in time. The towns with differentiated

functions are characterized by the most uniform and constant increase in population, since in their development they were less affected by obstacles encountered in the various branches of their economy. Any impediment in evolution resulting from economic difficulties in one functional branch was

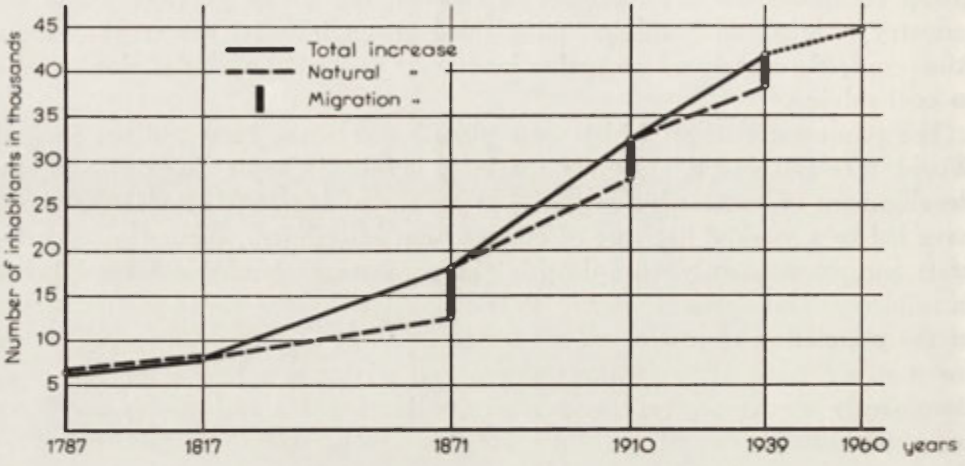


Fig. 1. Population development of Świdnica
(in the contemporary administrative boundaries)*

usually compensated by progress in other branches; thus towns of this type were usually areas with a constant influx of inhabitants from outside. On the other hand, an excessively wide scope of functions of a town—such as was for instance, the case of Świdnica—without a clearly predominating function among them, prevented any rapid increase in the urban population such as occurred in an industrial and mining centre like Wałbrzych during the period from 1837 to 1910; this town, originally less populous than Świdnica, developed a population almost three times larger. Thus, the less complex the functions of a town and the more marked the prevalence of one of the town's functions, the more the growth of the urban population depended on the fluctuation of existing economic conditions in relation to the basic function of the given town. In those towns which, in addition to their predominant productive function, also possessed commercial or service functions and therefore showed a certain functional complexity, the growth of the urban population was mainly dependent on the economic position of the predominant function. Secondary functions merely mitigated the changes brought about by any impediment to the development of the principal function and slowed down the emigration of the population from such towns so that it

* In all the figures no allowance has been made for war time changes in population.

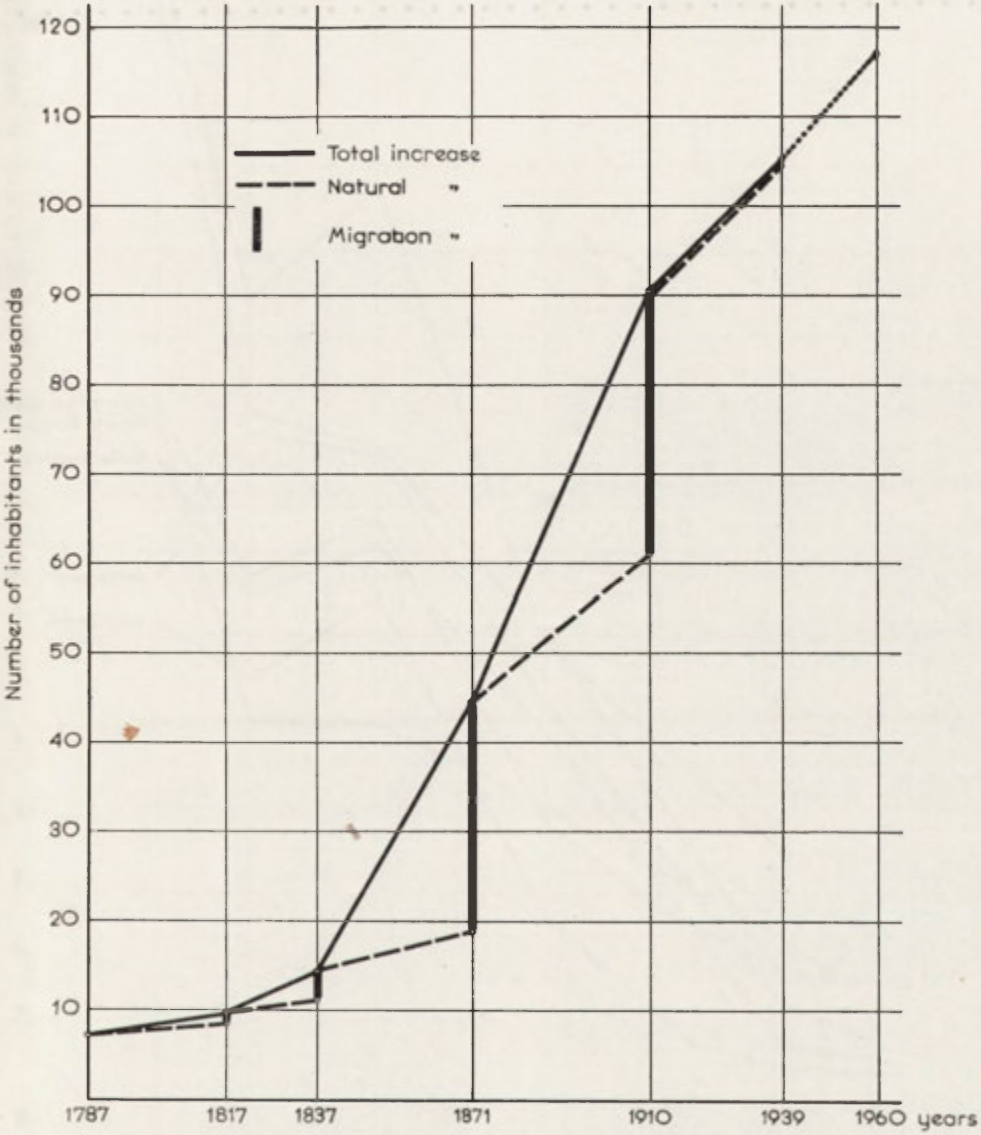


Fig. 2. Population development of Wałbrzych
(in the contemporary administrative boundaries)

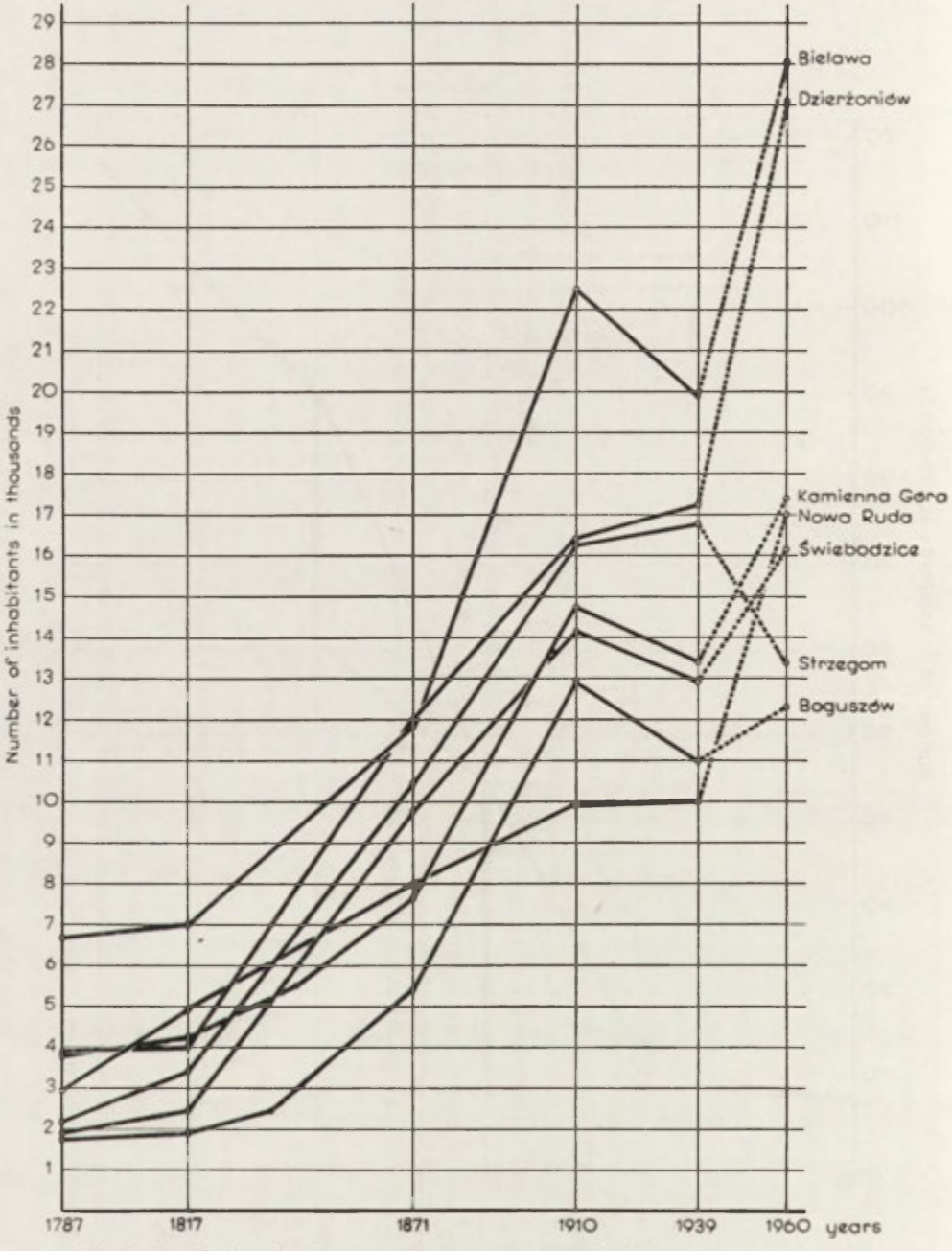


Fig. 3. Population development of *powiat*-towns and other towns over 10,000 inhabitants

(in the contemporary administrative boundaries)

was below the natural increase of population. In towns with specialized functions and therefore developed unilaterally, all changes in the urban population were closely linked with the economic perspectives of the main function: during the period of its expansion these towns or settlements became centres of immigration whereas in periods of depression the emigration was greater than the natural increase, leading to an actual decrease in population. Rarely the slowing in the growth of the urban population led to the complete disappearance of any of the functions and the transfer of the town to a different functional type. More often, the town maintained its functions and continued to be identified with its previous functional type. Even so, within identical functional types there were some towns which prospered while others declined and, again, there were towns with a growing population while in others the number of inhabitants remained stabilized or decreased. This fact made necessary the closer analysis of interrelations between economic conditions in the given region, the functions performed by the towns situated in this region and the various periods of growth in the urban population. Taking into account only those years which showed an influx of inhabitants from the outside, i.e. those years in which the real increase in urban population exceeded the natural increase, and surveying in detail the functions fulfilled by the individual towns, it was possible to establish eight periods of evolution of the towns under investigation:

1. the period up to 1820 in which centres of trade in linen goods and wholesale purchase centres of linen handicraft goods developed,
2. the period from 1820 to 1850—growth of centres of textile manufacturing,
3. the period from 1850 to 1870—development of industrial centres, mainly of the textile and the pottery industry,
4. the period from 1870 to 1918—growth of centres of coal mining and of industries other than textiles,
5. the period from 1919 to 1944—in which centres of the chemical industry developed as well as centres of trade services and communications,
6. the period from 1945 to 1950—evolution of mining centres, factories, trading and service centres,
7. the period from 1951 to 1955—further development of the centres of mining and machine industry as well as of centres of administration and building industries,
8. the period from 1956 to 1960—development of industrial centres outside of mining, and of centres of services and of transport.

Using the term "development" as meaning the increase of work-places in any of the branches of economy, and analyzing the successive economic conditions prevailing in the region under discussion it may be said that during the first period (up to 1820) a handicraft production in the linen industry

and in cotton, including trade in these commodities, was developed,—that in the second period (from 1820 to 1850) this pattern of scattered handicraft production changed into compact manufacturing production, thus leading to the territorial concentration of work places in the textile industry,—and that in the third period (from 1850 to 1870) various new branches of manufacture

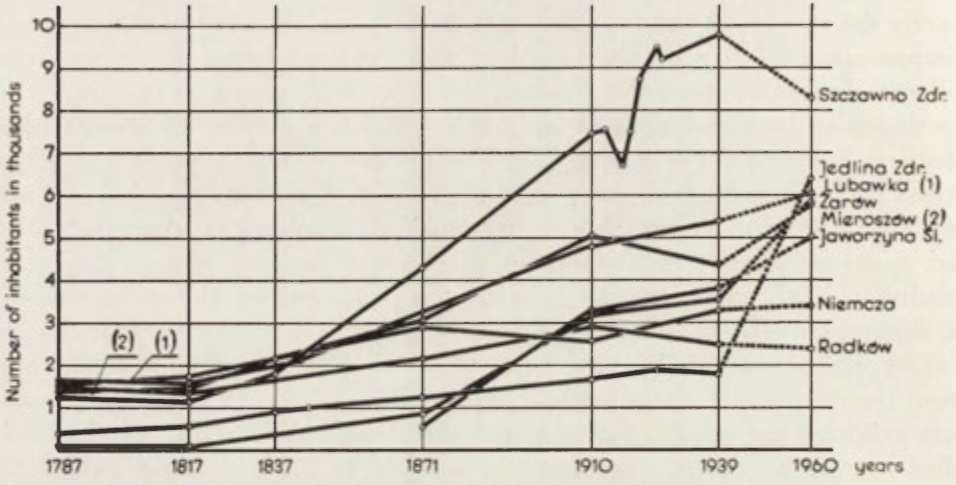


Fig. 4. Population development of other non-agricultural centres
(in the administrative boundaries of 1939)

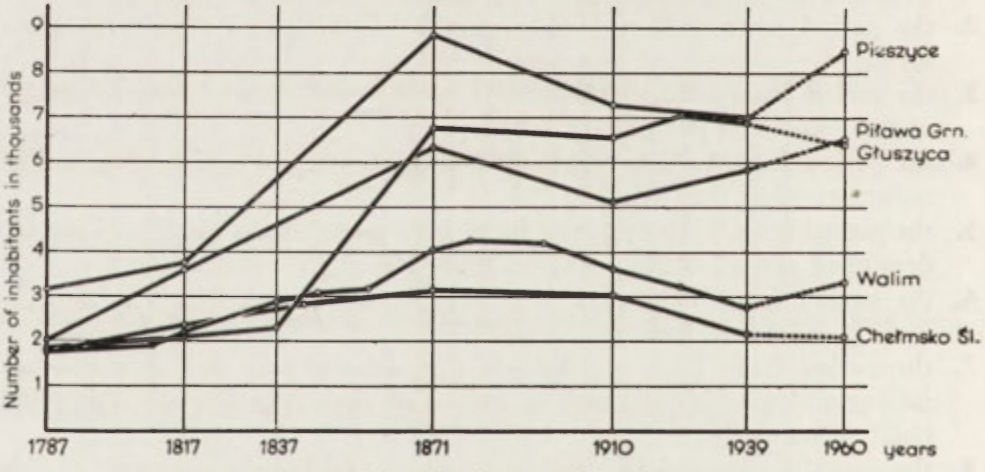


Fig. 5. Population development of textile centres
(in the administrative boundaries of 1939)

developed, especially in the textile industry. After 1870 there started a rapid growth of coal mining and of various other industries, with the exception of the textile industry which at that time was undergoing considerable technical

changes leading to a reduction in the numbers employed. Following the sharp recession in coal mining after World War I, a new period of evolution began for functions of the service type and for the chemical industry. After World War II, practically all branches of productive activities flourished, with a gradual slowing down in the expansion of mining and heavy industries and an accelerated growth in industries producing consumer goods and in services.

The above observations of the economic development and the functional structure of towns on the basis of the successive periods of growth of the examined urban settlements lead to the following conclusion: the only town-creating function, i.e. the function that leads to an increase in the number of inhabitants greater than the natural increase, is that branch of economy which increases employment numerically, thus creating new places of work within the town. Therefore not every branch of the urban economy should be considered to be town-creating simply because according to statistical data it represents the basic function of the town. As soon as the numerical increase of the employment is slowed down, the branch in question ceases to be a town-creating factor, i.e. it loses its power of influencing the growth of the town by attracting people from the outside. If the stagnation in the employment does not lead to the actual decrease in number of the population and therefore to a diminution in its importance, the branch in question may remain a leading factor in the life of the town and may be considered as a basic function

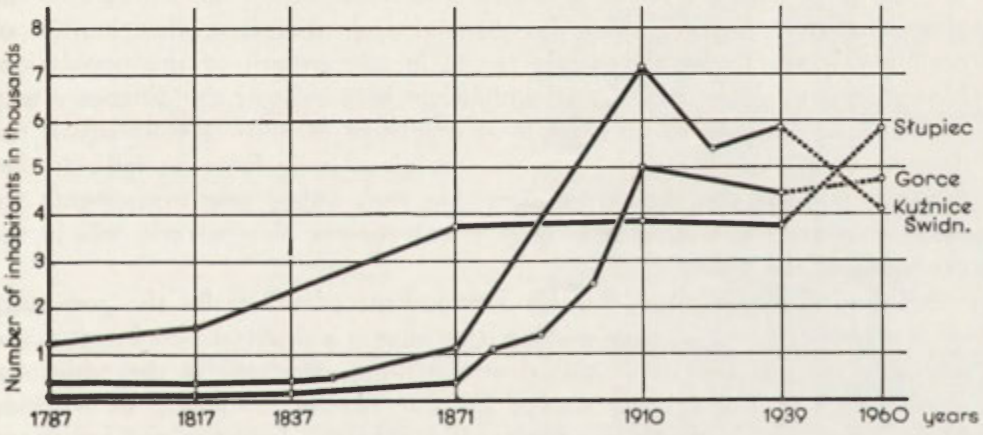


Fig. 6. Population development of mining centres
(in the administrative boundaries of 1939)

of the town. However, in such instances its role becomes static, no longer dynamic, i.e. town-creating. From this point of view it seems appropriate to distinguish between basic functions of the dynamic type and basic functions of the static type which, while sustaining an existing number of inhabitants, fail to cause the urban growth as expressed in the increase of population.

The definition of the dynamic or static type of basic functions of towns or settlements is liable to be of marked importance for planning authorities dealing with the development schemes of towns and making decisions as regards the establishment of new units of production and of services. The materials presented so far have dealt merely with the part played by basic functions in the past. However, it seems advisable to discuss the role which the existing basic functions of some town or urban settlement are likely to play in the near future. From the observations hitherto made it appears that a continuous growth of the population of a town is conditioned by increase in the number of places of work existing in the given town or settlement. First we should consider the labour supply and demand within the given town, whether there are in various branches of the economy vacancies capable of attracting workers from outside, or whether there exists an equilibrium between places of work and workers available or whether there is an excess of workers so that the further increase of population becomes doubtful. This in turn involves the investigation of the number of commuters travelling daily to their places of employment in the town and those departing for outside work since the difference between those commuters illustrates whether the available manpower is sufficient or not. This analysis should be made at least by particular branches of economy and employment.

Whenever this difference is positive, i.e. more workers arrive to work in the town than depart to work outside, the local supply of workers in the given branch is smaller than the demand and, therefore, that branch of economy is apt to be a dynamic factor in the growth of the population. However, it might be *vice-versa*: equilibrium may exist or the difference may prove to be negative so that the local supply of manpower fully equals the demand or exceeds it. In the last case the given basic function fails, at that time, to provide the chance of expansion and, unless new investments are made, increasing the number of jobs, it can merely play a static role in the evolution of the town.

Stressing the role played in the development of towns by the possibility of new employment, actually existing or arising as a result of new investments, we omit the possibilities of this development as affected by the additional employment in the existing occupation due to the shortening of working hours. However, it should be expected that in the industry and transport, i.e. in the main branches of economy, this will be counteracted at least by the mechanization and automation of production. Its role will be important only in commerce and in all kinds of services where the possibilities of mechanization and automation are much smaller. The other source of increased employment omitted is connected with the rise in those standards of living involving increase of consumption of various products and large development of existing and new services.

Establishing the dynamic or static part played by the basic functions in the future development of a town or settlement by no means defines the presumable increase of its population, but merely serves to indicate whether or not favourable conditions exist for such evolution. There are several other factors resulting from the general standard of life of the population that bear ultimately upon the development of a town, such as catering for the economic as well as the cultural needs of the people. An important factor is the facilities available for daily commuting. In countries with a high rate of motor traffic the tendency for homes to be near to the places of work is much less pronounced than it is in Poland where, up to now, daily commuting involves serious hardships. Moreover, only such urban centres are free in their development which can offer housing to newcomers and provide a standard of social and cultural services which is equal or superior to the standard hitherto enjoyed by the expected new arrivals.

It certainly is true that the above conclusions on the part presumably played in the growth of towns and settlements by their basic economic functions are drawn from a historical analysis and are therefore hypothetical and without confirmation in present conditions. They require, therefore, some verification based on improved observations of the growth of towns and settlements. However, the above suggestions may prove useful in anticipating and planning further development of towns and settlements.

MIGRATION TRENDS IN ENGLAND AND WALES, 1901–1951

Richard H. Osborne

Introduction

The changing distribution of population in a country constitutes one of the most important features of its economic and social geography, especially as distributional changes are a geographical repercussion of underlying economic and social factors. From the statistical point of view changes in the distribution of population are, of course, the result of the operation of different rates of growth (or decline) in the various parts of a country. Such local or regional rates of change depend on two chief constituent factors—natural change (dependent, in turn, upon crude birth and death rates) and net migration. To a certain extent the latter also affects the former, since migration can have a great impact on age and sex structures and thus on crude birth and death rates. While significant geographical differences in birth and death rates can, and do, occur, as a result of biological, medical, occupational or sociological factors, it is, nevertheless, true that migration is usually the dominant factor causing population redistribution, although the indirect effect of migration (i.e. the effect on birth and death rates) may cumulatively be greater than the initial, direct, effect.

Most persons migrate for mainly economic reasons, and thus marked employment or income differentials within a country tend in time to lead to a redistribution of the population, especially as the migration of dependents often magnifies that of employed persons. In addition to such economic differentials, there also exist what might be called "amenity" differentials; it is well known, for instance, that retired people, with the necessary means to do so, frequently choose to live on the south coast of England or in other areas that are climatically or scenically attractive. There are also indications that many professional persons favour the south of England and shun the industrial areas of the north. (One result of this is the geographical rationing of school-teachers operated by the Ministry of Education through a system

of local quotas). Studies of migration-motivation have, unfortunately, not been undertaken in England to the same extent as in some other countries.

In the following study attention will be given to internal migration in England and Wales during the first half of the present century. In order to throw light on the spatial mechanics of migration certain fairly simple analytical and cartographical techniques will be used, the necessary statistical data being derived from published census material based on counties. An essential preliminary to this study is, however, a brief description of twentieth-century population changes as seen against those of the nineteenth.

Population changes in modern times

If we look back over the demographic history of England and Wales we can split the last two hundred years into two broad periods. First there was a period with high rates of natural increase (well over 10% per decade), combined with a process of urbanization and industrialization of the population. This period lasted until the early years of the twentieth century, when the population, now over five times that of the mid-eighteenth century, was already three-quarters urbanized. From the point of view of migration the dominant themes were a large outward movement from the countryside to the towns and coalfields (involving important inter-regional as well as local movements) and, at the same time, a substantial net outward movement overseas, despite some partial compensation through Irish and Scottish immigration. Between 1941 and 1921, for instance, England and Wales experienced a net outward movement of about 2·6 million persons [1].

Since the First World War, which broadly coincided with the transitional stage from one demographic period to the next, certain important changes have taken place. The rate of natural increase has fallen very markedly (to about 5% per decade), chiefly owing to a fall in the birth-rate, and the drift from the countryside to the towns has become smaller relative to internal migration movements as a whole, which are now overwhelmingly inter-urban or urban-suburban in character rather than rural-urban. The great reduction in the rural exodus was first noted at the census of 1911. Since then there has been a speeding-up in the pace of suburbanization of the countryside, resulting from greater personal mobility due to the spread of motor transport and to higher living standards.

There have also been important changes as regards the chief regions of net inward migration movements and the chief regions of net outward migration movements. The more rural and less industrialized counties of Eastern and South-western England, for instance, have ceased to be such important sources of outward migrants as they were in the nineteenth century, and some, in

fact, have become areas of gain rather than loss. On the other hand there has been an outflow from certain industrialized and urbanized counties in the North of England and South Wales that were focal areas of inward migration in the nineteenth century but areas of economic depression, or only sluggish expansion, and thus of outward movement, in the period since the First World War [2]. At the same time the pull of the London area—or, more realistically, South-east England—has remained very strong, although simultaneously an intra-regional dispersal has taken place from the built-up counties of London and Middlesex into adjoining counties and beyond. There has also been more migration to the industrial Midlands and a great increase in the movement of retired persons to the south coast of England, from Kent in the east to Cornwall in the west.

As a result of these various trends a so-called "drift south" (and east in the case of Wales) has occurred, and is still continuing [3, 4]. The percentage of the population living in the North of England increased slightly between 1891 and 1921, from 33·5 to a peak of 33·7, subsequently falling to 30·2 by 1961. The percentage for South Wales fell from its peak of 4·6 in 1921 to 3·6 in 1961, with a fall in population between 1921 and 1939 being succeeded by partial recovery. It must be stressed that this drift south has taken place not only in the largely *laissez faire* conditions of the 1920s and 1930s, when the country was haunted by regional mass unemployment, but also in the State-influenced economic conditions of the boom years of the late 1940s and the 1950s, when even the residual "black spots" in the "Depressed Areas" of the pre-war period usually experienced unemployment rates of under 5%.

The character of the external migration balance has changed since the early 1930s. England-and-Wales, or more precisely England itself, has experienced net inward balances of migration in the two most recent intercensal periods, 1931–51 and 1951–61 (although some individual years show losses), in contrast to the outward balances typical of the nineteenth century and the earlier decades of the twentieth. The net loss for 1921–31 was 170,000, while the net gain between 1931 and 1961 totalled 1·1 millions [5]. Large net losses from Scotland and the two parts of Ireland have continued, however, and have, to a great extent, been directed to England. Here it must be remembered that the immigration of persons from the rest of the British Isles (chiefly Scotland and Ireland) and from abroad, including the Commonwealth, has helped to modify the geographical distribution of the population, for the simple reason that such immigrants have not distributed themselves in exact proportion to the resident English and Welsh population, but have tended to congregate in certain parts of the country (e.g. the London

area) more than others[1]. This aspect of migration cannot be dealt with here, however.

Methods of calculating internal migration

In Great Britain there is no system of identity cards or compulsory registration of change of address, such as exists in a number of other countries, and therefore information about internal migration can only be obtained by indirect methods. Details of labour migration can, however, be obtained by analysing the transfer of National Insurance contribution cards, or their former equivalents [6–10]. The official population statistics allow the use of two simple methods for the calculation of migration movements. One method involves comparing the natural increase in a given area for a certain period with the overall population change in the same period, the difference giving the net volume of inward or outward migration. It should be noted that this method reveals nothing about the origins or destinations of the migrants concerned. Such net migration figures, or their percentage equivalents, are usually provided in the census publications. Studies using such material have been made by a number of authors [11–16] and, in addition, the Ordnance Survey has published detailed maps showing migration changes by local government areas for various periods between 1921 and 1947 [17].

The second method, which is the one followed here, is the use of the county-of-birth tables relating to the enumerated population of each county, also published in the census returns. However, full information about county of birth is not asked for at every census (e.g. that of 1961), and in any case a certain number of persons always fail to give their county of birth even when the question is asked. The birthplace tables show the gross movements from county of birth to county of enumeration in respect of the population alive in the particular census year. Net movements can be derived by subtraction, and the total net gain or loss experienced by each county in relation to all the others can be obtained by summation. The resulting figures cannot, however, be related to any definite period of time, except that it is obvious that the greater part of the movements must have occurred in the decades immediately prior to the census concerned. Nor can the method record earlier migration to and from counties other than that of enumeration in the given census year. In time the net balances are affected both by the deaths of the older migrants and by changes in the volume and direction of currents of migration. Unfortunately the method cannot be used for analysing inter-

[1] It can be calculated that at the census of 1951 the London and South-eastern Region held 24% of all English and Welsh persons enumerated in England and Wales, but 38% of the population born elsewhere (excluding persons with birthplace not stated). *Census of England and Wales. 1951. General Tables* (1956). Table 32.

county migration in Great Britain as a whole, for the reason that Scotland has a separate census administration, with the result that no cross-reference is possible between individual Scottish counties and individual English or Welsh counties[2]. For this reason the analysis that follows is restricted to England and Wales only.

The first detailed analysis of internal migration in England and Wales based on the county-of-birth method appeared in the now classic article by Ravenstein, dealing with the census of 1881 [18]. More recently others have contributed to the literature [19–22]. The present writer has published an analysis of internal migration in England and Wales in 1951 and of Scotland in 1851, 1901 and 1951 [23–24]. The study that follows recapitulates the general features of this 1951 analysis of England and Wales, but it also presents for the first time an analysis of the 1901 situation, thus enabling a comparison to be made between these two years. The migration currents of 1901 relate essentially to the latter decades of the nineteenth century, while those revealed for 1951 demonstrate the effect of changes in the direction of migration during the intervening period (as well as the deaths of many of the migrants recorded in 1901). The effects of inter-war depression in parts of the North of England and in South Wales are clearly reflected, and the mechanics of the twentieth century "drift south" are made apparent. At the same time the general diminution of the rural exodus is also demonstrated.

Net migration, 1901 census–counties

In 1901 the enumerated native-born population of England and Wales totalled 31·1 millions (out of 32·5 millions). Of this total 26 per cent, or 8·0 millions, were enumerated outside their native county. The largest volume of net outward migration from any one county was that from Norfolk (147,000). The next highest totals, all of about 100,000, were those lost from four other large and populous counties with a similar markedly agricultural character, viz. Devon, Lincoln, Somerset and Suffolk. The largest net intakes were registered by two leading industrial counties, Lancashire (316,000) and Glamorgan (190,000), and by the three counties encircling the County of London, viz. Middlesex (328,000), Essex (255,000) and Surrey (155,000) (Table 1).

The relative as well as the absolute importance of the county migration movements should also be considered, however. For this purpose a "migration rate" was calculated for each county, this being the percentage ratio of the

[2] The net balances of migration from Scotland and all-Ireland to England and Wales revealed at the 1951 census were, respectively, 349,000 and 548,000. *Census of England and Wales, 1951, General Tables* (1956), Tables 39 and 41.

TABLE 1. NET MIGRATION, 1901 AND 1951—COUNTIES AND MODIFIED STANDARD REGIONS

Regions	1901		1951	
	Numbers	Rate	Numbers	Rate
NORTHERN:				
Cumberland	−49,075	−16·6	−48,491	−15·5
Durham	+68,697	+6·5	−269,826	−16·0
Northumberland	+3602	+0·7	−57,460	−7·1
Westmorland	−19,269	−23·6	−5791	−8·3
York, N. Riding[1]	—	—	+866	+0·2
Total	+3955	+0·2	−380,702	−11·3
YORKSHIRE (E. & W. RIDINGS)[2]:	+82,256	+2·4	−92,986	−2·3
NORTH-WESTERN:[3]				
Cheshire	+18,448	+2·4	+139,235	+13·3
Lancashire	+315,737	+8·3	−242,738	−4·8
Total	+334,185	+7·3	−103,503	−1·7
MIDLAND:				
Hereford	−35,773	−24·2	−11,157	−8·4
Shropshire	−87,237	−27·1	−26,470	−8·8
Stafford	−68,149	−5·3	−137,434	−8·1
Warwick	−11,428	−1·3	+139,502	+8·8
Worcester	+2653	+0·6	+26,967	+5·7
Total	−199,934	−6·4	−8592	−0·2
NORTH MIDLAND:[4]				
Derby	+6649	+1·1	−43,910	−5·2
Leicester	+4947	+1·2	+31,645	+5·6
Lincoln	−110,997	−18·4	−28,881	−4·1
Northampton	−25,372	−7·1	−6861	−1·7
Nottingham	+13,075	+2·7	+51,980	+6·9
Rutland	−9228	−32·3	−3049	−13·7
Total	−120,926	−4·8	+929	(+0·0)
EASTERN:[5]				
Bedford	−34,416	−17·1	+50,602	+21·3
Cambridge	−63,307	−25·2	−2885	−1·2
Huntingdon	−23,666	−29·3	−3084	−4·6
Norfolk	−147,405	−24·5	−56,661	−9·8
Suffolk	−102,158	−21·2	−46,823	−10·0
Total	−370,952	−22·9	−58,851	−3·7
LONDON & S. E.[6]:				
Essex	+254,897	+32·4	+453,635	+30·5
Hertford	−20,302	−7·7	+146,565	+35·5
Kent	+19,676	+2·2	+240,242	+19·6

Regions	1901		1951	
	Numbers	Rate	Numbers	Rate
London	+55,949	+1·4	−1,842,374	−38·6
Middlesex	+328,347	+76·2	+852,160	+69·5
Surrey	+154,822	+32·2	+505,007	+52·8
Sussex	+22,906	+4·1	+207,495	+31·3
Total	+816,295	+10·8	+562,730	+5·2
SOUTHERN:				
Berkshire	−23,357	−8·6	+39,714	+11·9
Buckingham	−49,950	−20·6	+71,976	+25·5
Dorset	−51,609	−20·7	+27,519	+11·2
Hampshire	+40,300	+5·7	+153,053	+14·7
Oxford	−64,046	−26·6	+2818	+1·1
Total	−148,662	−8·7	+295,080	+13·7
SOUTH-WESTERN:				
Cornwall	−67,901	−17·8	+2097	+0·6
Devon	−99,323	−13·5	+20,721	+2·8
Gloucester	−70,945	−10·3	+41,211	+4·9
Somerset	−109,640	−18·1	−7283	−1·4
Wiltshire	−79,085	−22·7	+12,086	+3·5
Total	−426,894	−15·4	+68,832	+2·5
WALES:				
Anglesey	−10,901	−18·0	−3187	−6·1
Brecknock	−11,613	−16·5	−8013	−12·8
Caernarvon	−1676	−1·3	−4845	−3·9
Cardigan	−24,375	−29·0	−7554	−12·7
Carmarthen	−27,729	−17·1	−18,409	−9·9
Denbigh	−11,895	−8·5	−7456	−4·3
Flint	−15,465	−16·2	+18,660	+15·8
Glamorgan	+189,544	+29·5	−138,213	−10·6
Merioneth	−5828	−10·7	−5249	−11·6
Monmouth	+13,599	+5·0	−67,114	−14·0
Montgomery	−23,939	−30·5	−16,494	−26·8
Pembroke	−28,934	−25·0	−17,802	−17·0
Radnor	−10,111	−30·6	−7256	−27·3
Total	+30,677	+1·6	−282,932	−10·1

[1] Figures for 1901 included in Yorkshire (E. & W. Ridings).

[2] Figures for 1901 include Yorkshire (N. Riding).

[3] Excluding North-west Derbyshire.

[4] Including North-west Derbyshire.

[5] Excluding whole of Essex and Hertford.

[6] Including whole of Essex and Hertford.

Compiled from: *Census of England and Wales, 1901, Summary Tables* (1903, Tables XLIV and XLV. *Census of England and Wales, 1951, Country Reports* (1953-55), Table 19.

net migration movement to the total number of natives of the county concerned, whether still living there or not (Table 1). On this basis the highest relative losses were experienced by Rutland (32%) and Montgomery and Radnor (both 31%), followed by Cambridge, Cardigan, Huntingdon, Oxford, Pembroke and Shropshire, with rates of between 25% and 29%. With the exception of Lancashire (8%) the highest relative gains were also achieved by the counties with the highest absolute gains—Middlesex (76%), Essex and Surrey (both 32%) and Glamorgan (30%). Of the fifty-three counties of England and Wales eighteen were revealed as having a net gain from the rest of the country in 1901 and thirty-five as having a net loss.

The complete national picture is shown in Fig. 1. On this map the black discs represent positive, i.e. inward, balances of migration and the shaded ones represent negative balances. The migration rate for each county is indicated by background shading of increasing intensity according to the scale indicated, positive rates being expressed by a system of lines and negative rates by a system of dots. Counties with very small negative or positive rates (less than 2·5%) are not shaded at all.

Counties in South-east England, the North of England and South Wales were areas of considerable gain, while some modest gains occurred in the Midlands. The County of London had a gain of only 56,000, but this was exceeded by the much larger gains achieved by Middlesex, Essex, and Surrey, which, together with the gain by Kent, were related primarily to the growth of Greater London. The gain by Sussex would appear to be due to the growth of its coastal resorts, notably Brighton, while the gain by neighbouring Hampshire was, in part at least, probably due to the existence of Aldershot and Portsmouth with their military and naval personnel, as well as to the growth of Bournemouth and Southampton.

This pull of the London area and neighbouring parts of the south coast is a well-known phenomenon of nineteenth-century England. The great industrial and commercial expansion of the North of England, variously based on coal, iron and steel, heavy engineering (including ship-building) and cotton and woollen textiles, is likewise familiar, as is also the development of the South Wales coalfield and its associated metallurgical activities. It will be seen that all the large industrial counties of the North showed gains, although these were not accompanied by the very high inward rates experienced by Essex, Middlesex or Surrey, and in Northumberland (including Newcastle upon Tyne) the absolute size of the gain was very small. The low inward rate for Yorkshire was possibly related to the inclusion of extensive rural areas in this large county, which, no doubt, generated labour surpluses during the nineteenth century, and the same argument may also apply to Northumberland. Cumberland sustained a considerable loss in spite of its coastal belt of mining and heavy industry, but even so this loss was relatively less serious

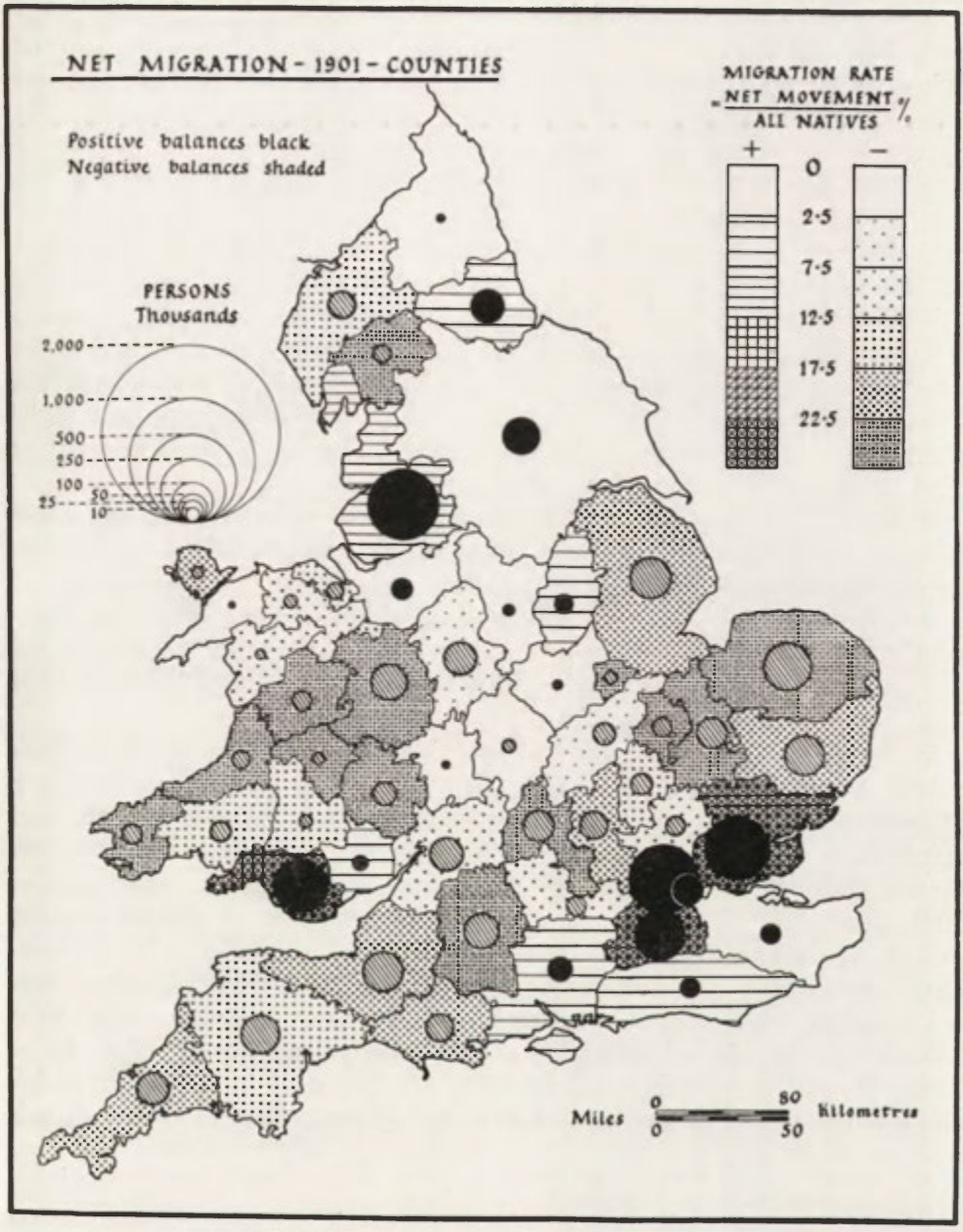


Fig. 1. County net migration balances and migration rates, census of 1901

than that of its more rural neighbour, Westmorland. The counties of Northumberland and Durham, embracing the coalfield of the same name and also the industrial complex of Tyneside, should be considered as one demographic and economic unit and the same may be said of Lancashire and Cheshire. The gain by the latter county was associated to a large extent with the growth of Merseyside towns, such as Birkenhead, and of industrial and residential settlements near Manchester.

In the inner, industrial Midlands there was an interesting contrast between the eastern and western group of counties. While Derby, Nottingham and Leicester, in the east, each showed gains (offset, however, by the loss from Northampton), the western counties of Stafford and Warwick, including the large industrial conurbations of the "Potteries" and Birmingham with the "Black Country", both experienced losses. These were offset only to a negligible extent by the gain in adjoining Worcester[3], also containing a part of the Birmingham–Black Country conurbation.

In Wales large gains occurred in the coalfield counties of Glamorgan and Monmouth, the former having much the higher rate of intake. The remainder of the Welsh counties all experienced losses. These tended to be less severe, however, in the northern counties, with their quarrying and coalmining activities and resort towns, and the same was true of Brecknock and Carmarthen, which both contain small portions of the South Wales coalfield and its associated industrial region.

In the remaining counties of England large losses accompanied by high outward rates were the rule. These counties lay in a solid bloc stretching diagonally across England from Cornwall to Norfolk, with Lincoln and Hereford–Shropshire forming salients flanking the inner, industrial counties of the Midlands. Even those counties containing important urban centres often showed a substantial overall loss. This was true of Gloucestershire, embracing most of the city of Bristol, and Northamptonshire, with its footwear manufacture and iron-smelting. In such instances the migration rates did, however, tend to be lower than in the less industrialized counties. Near London the counties of Berkshire and Hertford also showed rather lower outward rates than other losing counties. This probably indicates the beginnings of the urban expansion that has been so rapid here in the twentieth century.

[3] In 1901 the counties referred to were the Ancient counties, while in 1951 they were the Administrative counties with their associated County Boroughs. The Administrative County of London, corresponding to the metropolitan parts of Middlesex, Kent and Surrey, was, however, separately distinguished in 1901, and the three Ancient counties restricted to their extra-metropolitan portions. In general the two sets of counties correspond almost exactly, but certain differences occur where large built-up areas have developed on the borders of two or more counties e.g. the Birmingham–Black Country conurbation.

NET MIGRATION, 1951 CENSUS–COUNTIES

We now turn to the corresponding map based on the 1951 census (Fig. 2). This shows important changes compared with the 1901 analysis, related on the one hand to the deaths of many of the migrants alive in 1901, and on the other to the emergence of new directions of migration-flow, brought about largely, it would seem, by the economic conditions of the inter-war period, when high rates of unemployment occurred in the North of England (especially in Durham, Northumberland and Cumberland and to a lesser extent in Lancashire and Yorkshire) and in South Wales. This unemployment was related to a fall in demand for the staple products of these areas and to the slow growth of new industries. Conversely, while unemployment was by no means absent in the Midlands and the South, there was a great expansion of light and medium engineering (such as motor-cars) and many consumer-goods industries. Figure 2 suggests the effect on migration of such inter-regional employment differentials, even though these had been very much reduced prior to the 1951 census, owing first to the War and secondly to the greatly improved post-war economic conditions.

By 1951 the number of the native-born inhabitants of England and Wales had risen by 32% to 41·1 million (out of 43·8 million), and 31% of this total (12·8 million, including 2·7 million Londoners) were now living outside their native county, a proportion only a little higher than the 26% of fifty years previously (8·0 million, including 1·1 million Londoners). Twenty-two counties now showed net gains and thirty-one net losses. The largest net loss was that from the County of London, which exceeded 1·8 millions. This was due to the normal process of decentralization typical of all great cities, accelerated in this instance by the effects of the war. Nevertheless the loss was more than offset by the large gains recorded in the neighbouring counties. The next largest losses were those of Durham (270,000) and Lancashire (243,000), the former being the more serious owing to the higher migration rate involved and also because part of Lancashire's loss must have represented short-distance movement into those areas of Cheshire adjacent to Liverpool and Manchester. Cheshire had a large net gain of 139,000, in fact.

Other large losses were those of Glamorgan (138,000) and Stafford (137,000). In South Wales Monmouth's loss (67,000), although smaller numerically, was associated with a higher migration rate than Glamorgan's. Stafford's loss was exceeded by the gain in neighbouring Warwick (140,000) and Worcester (27,000), so that the combined total for these three West Midland counties was positive. Yorkshire is here split into two units—the North Riding and the East and West Ridings combined. The former showed a state of equilibrium, passibly due to the renewed prosperity of Teesside during and after the war, and also to the high ratio of Service personnel in

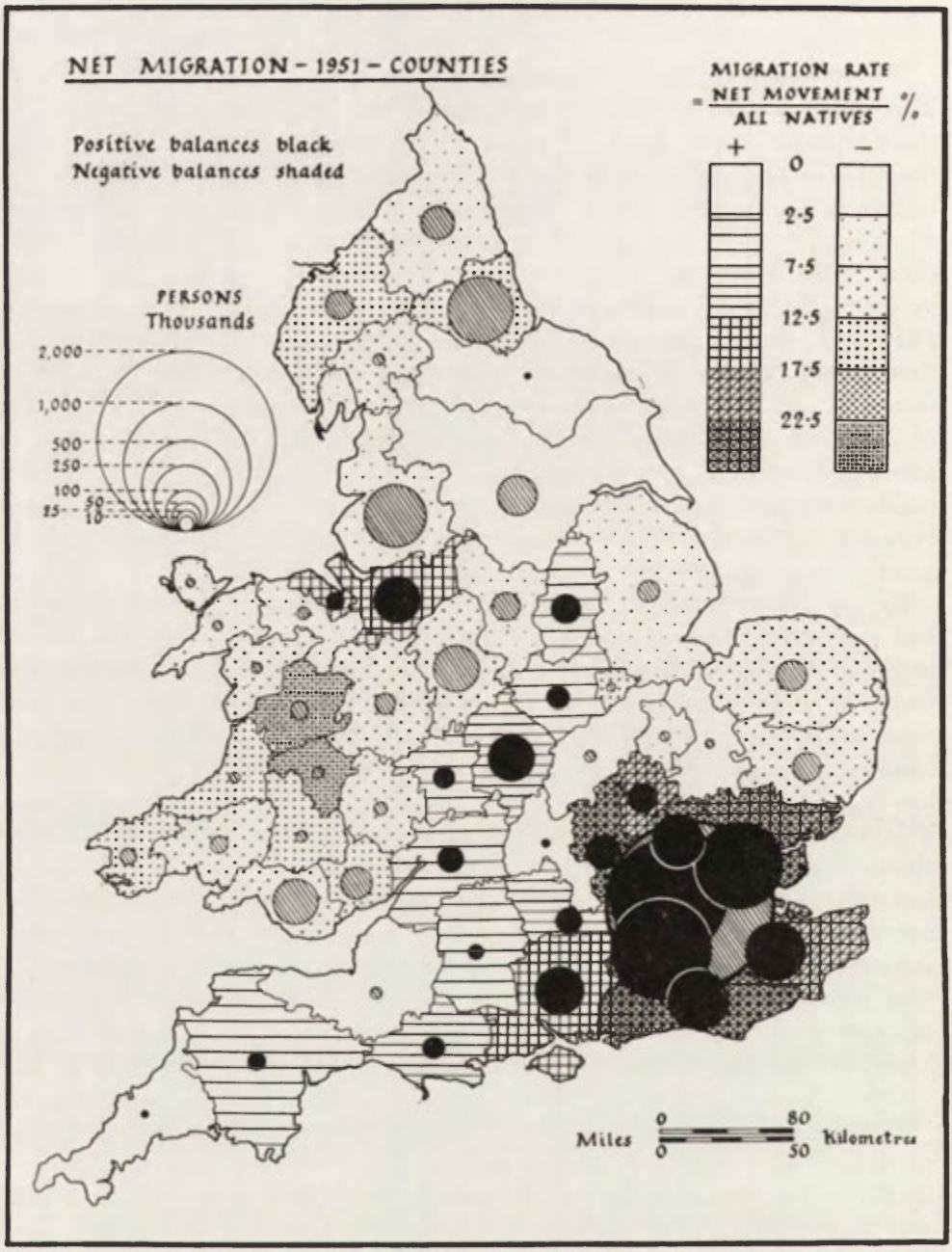


Fig. 2. County net migration balances and migration rates, census of 1951

the area, while the East and West Ridings taken together had a sizeable numerical loss (93,000). The modest rate of gain for 1901 was now replaced by only a modest rate of loss, however. Here the sheer size and economic diversity of Yorkshire were probably significant compared with, say, Durham, as well as the lower unemployment rate than in neighbouring counties of the North during the 1930s. Other losses in the North of England were those of Cumberland (the same in size as in 1901) and Northumberland. Westmorland, while still showing a loss, improved its migration rate.

As regards rates of loss, the highest was that for the County of London (39%), followed by Montgomery and Radnor (each with 27%), and Pembroke (17%). Next came three counties with an important industrial and mining element, viz. Cumberland and Durham (both with 16%) and Monmouth (14%). Rutland also appeared high on the list again (14%). The counties with the largest gains were Middlesex (852,000), Surrey (505,000), Essex (454,000) and Kent (240,000), while the highest rates were those of Middlesex (70%), Surrey (53%), Hertford (36%) and Essex and Sussex (both 31%).

The increased gains by Middlesex, Surrey, Essex and Kent represented to a large extent short-distance migrants from the County of London, as well as persons from the rest of the country. The total net gain by London and these four counties declined, however, from 814,000 to 209,000, and the increased attraction now exerted by what may be called the outlying Metropolitan counties, involving the further growth of towns on the south coast and the expansion of industry to the north and west of Greater London, was reflected in the increased gains by Sussex (207,000) and Hampshire (153,000) and by the emergence of substantial gains in place of losses in Bedford, Berkshire, Buckingham and Hertford. Oxford, with only a very small gain, however, may also be considered as a member of this "outer" Metropolitan group of seven counties. In contrast to the "inner" Metropolitan group there was here a very favourable change in the migration balance, from minus 129,000 to plus 672,000.

In South-west England also, a striking change was apparent compared with 1901. Only Somerset now showed a loss and this was only of very small relative significance. Dorset and Wiltshire admittedly both contained considerable numbers of Service personnel at the 1951 census, but they also contained growing towns like Poole in Dorset, adjoining Bournemouth, and Swindon and other smaller industrial centres in Wiltshire. Devon and Cornwall, like other southern coastal counties, gained population chiefly as a result of the growth of resort towns, which often contain retired persons from other parts of the country. The gain by Gloucestershire was, no doubt, more industrial in character and was probably related to the growth of engineering (especially aircraft manufacture) in the Bristol–Gloucester–Cheltenham districts.

In Wales the large losses from the industrial south were accompanied by reduced losses from the remaining counties. In the north Flint, with its large steel, aircraft and rayon industries, as well as resort towns, showed an interesting contrast as the only Welsh county with a net gain of population. The existence of resort towns may also account for the fairly low outward rates in other counties of North Wales.

In the central belt of English counties stretching from the Welsh Border to the east coast, the 1901 picture did not change quite so markedly as in other parts of the country. The increased loss from Stafford was, as we have noted, more than offset by the combined gain of Warwick and Worcester, associated with the expansion of population in their portions of the Birmingham conurbation and also in the Coventry area (Warwick). The appearance of a loss in Derby can be attributed, in part at least, to the eastward movement of mining families to the newer collieries of Nottinghamshire, which experienced an increase in its gain. So also did Leicester, while Northampton's rate of loss was reduced to a very small percentage. The counties flanking these industrial Midland counties to the east and to the west (Shropshire, Hereford and Lincoln), as well as the eastern counties of Cambridge, Huntingdon, Norfolk and Suffolk, all had geatly reduced losses compared with 1901, their combined total declining from 571,000 to 176,000.

The main changes may be summarized under three headings. First, the increased attraction of population to the twelve counties of what may be called Metropolitan England, their total net gain rising from 685,000 to 881,000. This overall change incorporated a large outward movement from the County of London and also the conversion of losses to gains in a bloc of five counties lying to the north-west of Greater London and extending approximately from the Thames to the Great North Road. Secondly, the loss of population from the industrial and coal-mining counties of the North of England and South Wales, compared with gains fifty years earlier. If we take all the counties of the North of England except Westmorland (i.e. Cumberland, Northumberland, Durham, Yorkshire, Lancashire and Cheshire) and add Glamorgan and Monmouth to these we find that their combined total of outward migrants more than doubled between 1901 and 1951, from 1515 million to 3369 million. During the same period the number of inward migrants to these counties only increased from 2158 million to 2592 million. The net migration balance thus "swung" from plus 643,000 to minus 777,000. Thirdly, the great reduction in the volume and rate of loss from those counties in the rest of the country which were losing population in 1901, or, indeed, the conversion of their losses into gains, notably in South-west England. During the nineteenth century these counties generated large "surpluses" of population, mainly rural in origin, that had to seek employment elsewhere. Following on the national fall in the birthrate, beginning before the First

World War, these surpluses would appear to have been gradually diminishing, possibly assisted by some "ageing" of the population as a cumulative effect of earlier migration losses where these predominantly involved the younger age groups. In the twentieth century the healthier economic condition of many country towns, frequently as the result of industrial development, sometimes provided increased, or at least more diverse, employment, and even induced a rise in the total of inward migrants. The growth of coastal resorts seems also to have been of importance, especially in the South-west. At the same time the deaths of many of the outward migrants alive in 1901 must certainly have further reduced the net migration losses. In some counties relatively large numbers of Service personnel helped to swell the total of immigrants and thus to improve the net migration balance.

In some cases falling or stationary numbers of natives coincided with the improvement in the migration balances. In fact, the natives of thirteen English counties declined in numbers between 1901 and 1951, while in two counties the numbers increased only to a negligible degree. Eight Welsh counties experienced a decline in their number of natives. If we take one fairly typical county from this group—Shropshire—we find that the total number of Shropshire-born persons alive in the whole country declined between 1901 and 1951, from 322,000 to 302,000, while of these the number enumerated outside the county fell from 141,000 to 122,000. During the same period economic conditions in the county sustained an increase in the number of inward migrants from 54,000 to 96,000. The net migration loss thus fell from 87,000 to 26,000 and the outward migration rate from 27% to 9%.

Inter-regional net migration, 1901

We now turn to an analysis of how these major shifts of population were brought about. As a measure of simplification, however, the counties have been combined to correspond as nearly as possible to the "Standard Regions" used for official statistical purposes[4]. The regional migration balances and rates are given in Table 1 and the net inter-regional movements in Table 2. In Figure 3 the net movements between regions are shown as flow-lines, and the total native population of each region, whether still resident there or not, is represented by a disc possessing either a detached (blank) or a superimposed (solid) segment showing, respectively, a net outward or a net inward

[4] The Standard Regions of 1951 have had to be altered as follows. Divided counties have been re-united, with the result that all of Derby here lies in the North Midland Region and all of Hertford and Essex in the London and South-eastern Region. Also it is not possible to include the North Riding of Yorkshire in the Northern Standard Region for the 1901 analysis.

TABLE 2. INTER-REGIONAL NET MIGRATION, 1901 AND 1951

Gain (+) or loss (−) experienced by		Source of gain (+) or direction of loss (−)				
		Northern	Yorks. (E. & W.)	North-western	Midland	North Midland
Northern[1]	1901	—	+12,642	−31,224	+8,702	+3644
	1951	—	−55,375	−44,493	−33,731	−30,255
Yorkshire[2] (E. & W.)	1901	−12,642	—	−71,987	+41,069	+86,255
	1951	+54,375	—	−32,553	−859	−2064
North-western[3]	1901	+31,224	+71,987	—	−100,296	−45,300
	1951	+44,493	+32,553	—	+7,437	−6248
Midland	1901	−8702	−41,069	−100,296	—	−17,316
	1951	+33,731	+859	+7437	—	−11,150
North-Midland[4]	1901	−3644	−86,255	−45,300	+17,316	—
	1951	+30,255	+2064	+6248	+11,150	—
Eastern[5]	1901	−15,883	−37,689	−20,832	−7336	−36,591
	1951	+11,394	+1303	+6682	−1720	−9818
London & S.E.[6]	1901	+15,877	+20,428	+17,472	+59,421	+54,974
	1951	+152,217	+74,414	+115,630	+35,883	+47,851
Southern	1901	+277	−3821	−6153	−8471	−5494
	1951	+34,403	+25,750	+38,198	+20,644	+17,423
South-western	1901	−9534	−15,675	−29,068	−26,811	−10,316
	1951	+17,312	+15,716	+25,307	+11,852	+6530
Wales	1901	−928	−2804	−46,797	+15,748	+470
	1951	+2522	−5298	−4079	−42,064	−13,163

1 Figures for Yorkshire (N. Riding) in 1901 included in Yorkshire (E. & W. Ridings).
2 Figures for 1901 include N. Riding.
3 Excluding N.W. Derbyshire.
4 Including N.W. Derbyshire.
5 Excluding whole of Essex and Hertford.
6 Including whole of Essex and Hertford.

migration balance. (The absence of a segment denotes virtual equilibrium). The angle of each segment corresponds to the regional migration rate; thus a migration rate of 25% corresponds to an angle of 90 degrees. The English and Welsh population enumerated in each Region equals the whole area of its disc minus the detached segment or plus the superimposed segment, as the case may be.

The map for 1901 (Fig. 3) shows a condition of equilibrium in the Northern Region and gains by the North-western (i.e. Lancashire–Cheshire), Yorkshire, London-and-South-eastern and Welsh Regions, the gains by Yorkshire and Wales being relatively small, however. The two Midland Regions and the

Source of gain (+) or direction of loss (−)					Total	Rate
Eastern	London & S. E.	Southern	South-western	Wales		
+15,883	−15,877	−277	+9534	+928	+3955	+0·2
−11,394	−152,217	−34,403	−17,312	−2522	−380,702	−11·3
+37,689	−20,428	+3821	+15,675	+2804	+82,256	+2·4
−1303	−74,414	−25,750	−15,716	+5298	−92,986	−2·3
+20,832	−17,472	+6153	+29,068	+46,797	+334,185	+7·3
−6682	−115,630	−38,198	−25,307	+4079	−103,503	−1·7
+7336	−59,421	+8471	+26,811	−15,784	−199,934	−6·4
+1720	−35,885	−20,644	−11,852	+42,064	−8592	−0·2
+36,591	−54,974	+5494	+10,316	−470	−120,926	−4·8
+9818	−47,821	−17,423	−6530	+13,163	+924	(+0·0)
—	−238,807	−9368	−2187	−2259	−370,952	−22·9
—	−59,736	−11,682	−3743	+8463	−58,851	−3·7
+238,807	—	+168,769	+213,448	+27,099	+816,295	+10·8
+59,730	—	−68,903	+3757	+142,181	+562,730	+5·2
+9368	−168,769	—	+38,185	−3784	−148,662	−8·7
+11,682	+68,903	—	+37,135	+40,942	+295,080	+13·7
+2187	−213,448	−38,185	—	−86,044	−426,894	−15·4
+3743	−3757	−37,135	—	+29,264	+68,832	+2·5
+2259	−27,099	+3784	+86,044	—	+30,677	+1·6
−8463	−142,181	−40 941	−29,264	—	−282,932	−10·1

Eastern, Southern and South-western Regions all had substantial losses, particularly the Eastern and the South-western. The flow-lines show how the segments, i.e. the migration balances, originated. We now see that the large losses experienced by the counties of Eastern and South-western England in the years prior to 1901 represented to a great extent a movement into South-eastern England, i.e. London and neighbouring counties. The counties of the Southern region also participated in this movement, as might be expected, although their combined loss, both absolutely and relatively, was smaller, and, indeed, these counties also gained from the South-west. The region containing London was thus by far the most important destination for migrants from that part of England lying broadly south of a line from the lower Severn to the Wash. This is scarcely surprising, considering the overwhelming size and rapid rate of growth of Greater London during the nineteenth century, especially in view of the almost complete absence of any other really large cities or industrial areas in this part of England.

This general analysis needs some qualification, however; while the largest

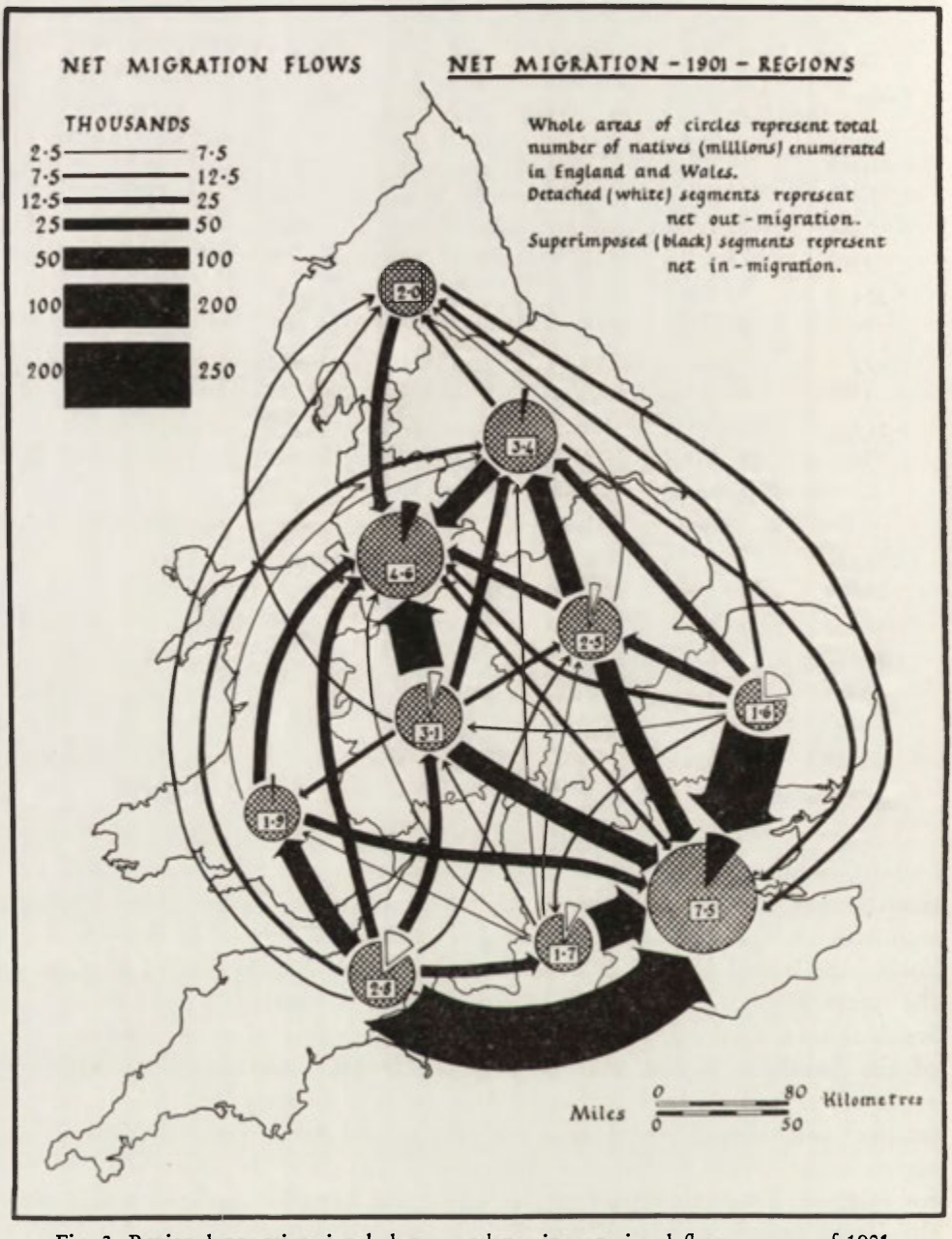


Fig. 3. Regional net migration balances and net inter-regional flows, census of 1901

losses from the East and South-west were to the South-east there were, nevertheless, important subsidiary movements to the Midlands and the North, as well as to Wales from the South-west. At the same time the South-east also drew population from beyond the Severn-Wash line, especially from the two Midland regions and from Wales. The Welsh region, while gaining from the South-west and the Midlands, no doubt as a result of the expansion of the South Wales coalfield and its associated industrial areas, at the same time lost population to the Lancashire–Cheshire region adjoining North Wales. Similarly in the two Midland regions the overall negative balances were aiso the outcome of opposing movements, with the considerable losses to South-eastern England on the one hand and to Lancashire–Cheshire and Yorkshire on the other, being partly offset by inward migration from the regions adjoining on the south and east. Within the Midlands there was, it will be noticed, a slight loss from the western group of counties to the eastern.

Within the North of England the Lancashire-Cheshire region was the greatest focus of inward migration, attracting sizeable movements from both the Northern and Yorkshire regions. Lancashire–Cheshire may, indeed, be usefully compared with the South-eastern region. While the latter gained from all the other regions in the country, the Lancashire–Cheshire region gained from all the others except the South-east, and as regards both its volume and rate of net intake it stood second in importance to the South-east. Here, in fact, is evidence of the nineteenth-century growth of the two ends of the London–Lancashire axis of population, or what has been called the "hour-glass" [25].

Inter–regional net migration, 1951

The corresponding map for 1951 (Fig. 4) shows important changes in the regional balances and inter-regional flows compared with 1901. The three regions constituting the North of England, and also the Welsh region, now appear as net losers of population, the rate of loss being much higher in the Northern Region and in Wales than in the East and West Ridings of Yorkshire and Lancashire-Cheshire. It should be remembered that unemployment rates in the inter-war period were higher in the two former Regions than in the two latter. The two Midland Regions, which were revealed as losing population in 1901, had achieved a state of equilibrium by 1951, and the loss from the Eastern Region was greatly reduced. In the three Regions constituting the South of England the South-eastern Region once more made a gain, although smaller both absolutely and relatively than in 1901. The Southern and South-western Regions made gains, compared with losses previously, and the Southern Region supplanted the South-eastern Region as the Region with

the highest rate of gain and as the Region gaining from all the others in the country.

If we inspect the inter-regional movements responsible for the gain by South-eastern England we find that the chief sources of inward migrants were Wales, the Northern Region and Lancashire–Cheshire, together with a smaller contribution from Yorkshire. Of the three other Regions south of the Severn–Wash line only the Eastern Region remained as an area of net outward migration and even then on a reduced scale compared with 1901. It must be admitted, however, that the presence of Service personnel and the industrial growth of Bedfordshire were important factors. It will also be noticed that the South-east was a net loser of population to the adjacent Southern Region, which includes industrial and residential towns close to Greater London as well as the flourishing coastal cities of Hampshire. If we ignore this movement and the similar one from the South-west, it is clear that the net gains achieved by the three Regions as a whole must be largely attributed to incomers from the North of England and from Wales.

Two marked changes thus took place in the South of England. First, the persons gained by the South-eastern Region altered in origin and character; in the years prior to 1901 they were predominantly persons from the less industrialized counties south of the Severn–Wash line, whereas in the years prior to 1951 they were predominantly migrants from a longer distance, coming from the industrial and coal-mining counties of Wales and the North of England. Secondly, all three Regions constituting the South of England showed a net gain in 1951, with the rather artificial middle Region, i.e. the Southern, attaining the leading position formerly held by the London and South-eastern Region. In the neighbouring Eastern Region the much smaller losses southwards compared with 1901 were partly offset by gains from Wales and the North of England.

Situated between the South and the North the two Midland Regions achieved a state of equilibrium, largely owing to some reduction of their southward losses (although this did not prevent the development of losses to the Southern and South-western Regions) and also to the reversal of the pre-existing outward movement to Wales and the North of England. As regards Wales and the North of England it is clear that the greater part of their losses were due to migration to the South, especially to the South-east, although there were also losses to the two Midland Regions and Eastern England. Within the North of England Lancashire–Cheshire, with the smallest rate of loss, again showed gains from its two neighbouring Regions, while the East and West Ridings, also with only a moderate rate of loss, had an important gain from the heavily-losing Northern Region (including the North Riding of Yorkshire).

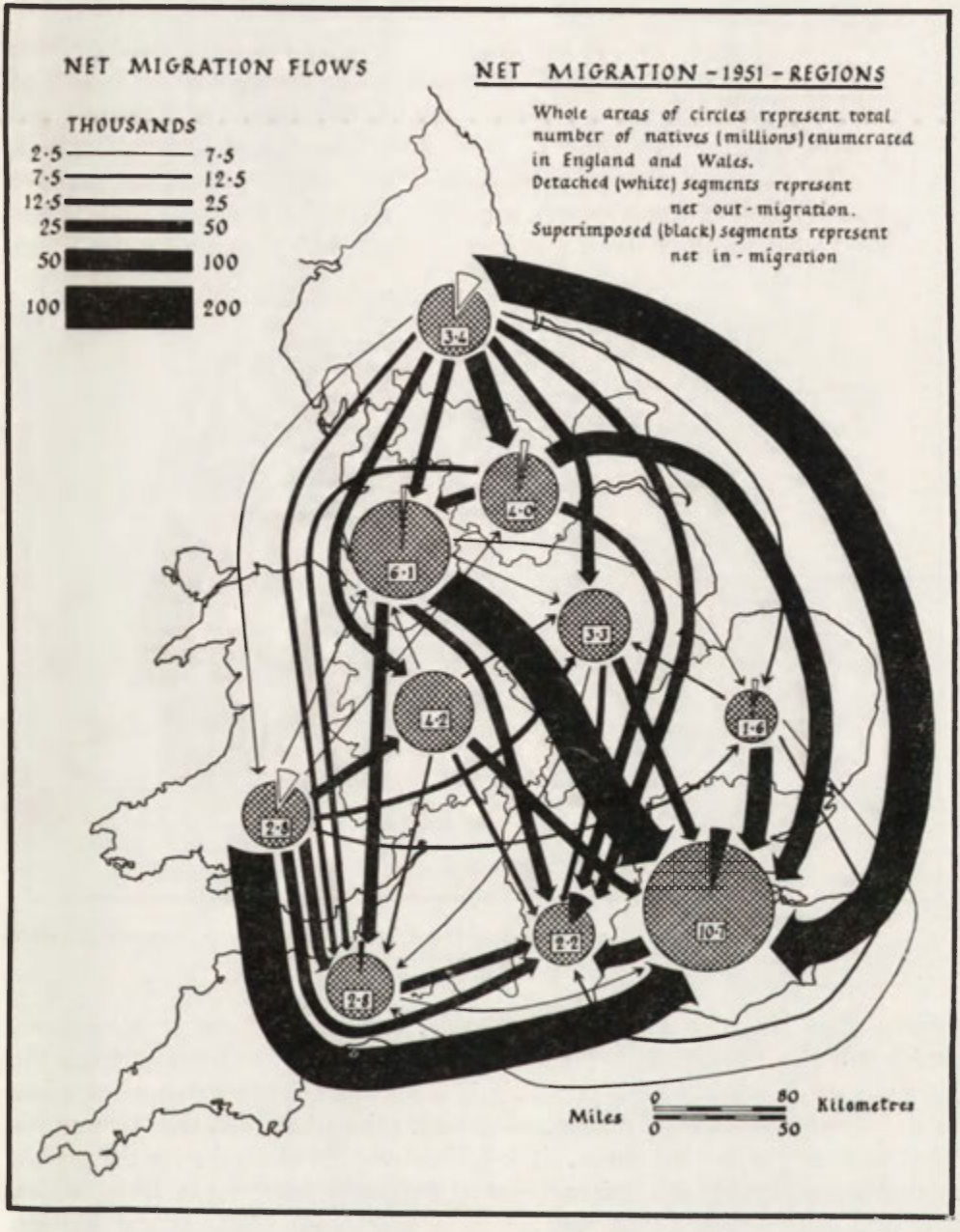


Fig. 4. Regional net migration balances and net inter-regional flows, census of 1951

Summary

Figure 5 attempts to reduce the situations in 1901 and 1951 to their bare essentials. Here the country is split into four major zones, viz. the North of England, the Midlands with Eastern England, the South of England, and Wales. In 1901 there was a large loss from the Midlands and Eastern England, part of this moving northwards (especially from the Midlands, as we have seen) and part moving southwards (especially from the Eastern Region). The gain by the North of England was much higher than the gain by the South

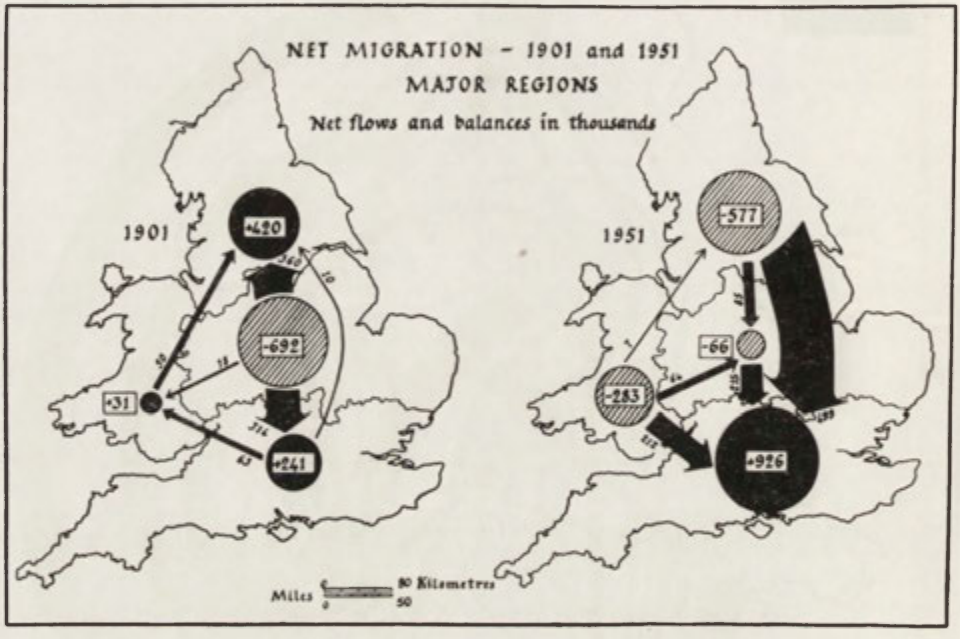


Fig. 5. Major regions–net migration balances and net inter-regional flows, censuses of 1901 and 1951

(where there was also a large internal shift eastwards to the London area), and it will also be seen that there was a very slight net movement from the South to the North. The fairly small gain by Wales was the outcome of a loss to the North of England in conjunction with gains from the other two zones. The 1951 map shows an almost four-fold growth in the gain by the South, as the result of large inward movements from the North and from Wales, together with a very much reduced movement from Midland and Eastern England. The role of the latter zone in effecting a redistribution of population was greatly diminished. Its relatively small loss resulted from the slight excess of an outward southward movement over inward movements from Wales and the North.

TABLE 3. NET MIGRATION, 1901 AND 1951 COUNTY-GROUPINGS

	1901		1951	
	Nos.	Rate	Nos.	Rate
Cumberland–Westmorland	−68,344	−1·81	−54,282	−14·2
Northumberland–Durham	+72,299	+4·5	−327,286	−13·1
Yorkshire	+82,256	+2·4	−92,120	−2·0
Lancashire–Cheshire	+334,185	+7·3	−103,503	−1·7
NORTH OF ENGLAND	+420,386	+4·2	−577,191	−4·3
Derby–Nottingham	+19,724	+1·8	+8070	+0·5
Leicester–Northampton–Rutland	−29,653	−3·7	+21,735	+2·2
Stafford–Warwick–Worcester	−76,924	−2·9	+29,035	+0·8
Inner Midlands	−86,853	−1·9	+58,840	+0·9
Hereford–Shropshire	−123,010	−26·2	−37,627	−8·7
Lincoln	−110,997	−18·4	−28,881	−4·1
Cambridge–Huntingdon	−86,973	−26·2	−5969	−1·9
Norfolk–Suffolk	−249,563	−23·0	−103,484	−9·9
Outer Midlands and E. England	−570,543	−22·9	−175,961	−7·1
MIDLANDS AND EAST ENGLAND	−657,396	−9·3	−117,221	−1·3
Berkshire–Buckingham–Oxford	−137,353	−18·2	+114,508	+13·2
Bedford–Hertford	−54,718	−11·8	+197,163	+30·3
London–Middlesex	+384,296	+8·4	−990,214	−16·5
Essex	+254,897	+32·4	+453,635	+30·5
Surrey–Kent	+174,498	+12·9	+745,249	+34·1
Hampshire–Sussex	+63,206	+5·0	+360,548	+21·1
Metropolitan England	+684,826	+7·4	+880,893	+6·8
Gloucester–Somerset	−180,585	−13·9	+33,928	+2·5
Dorset–Wiltshire	−130,694	−21·9	+39,605	+6·7
Cornwall–Devon	−167,224	−14·9	+22,818	+2·2
South-western England	−478,503	−15·9	+96,351	+3·2
SOUTH OF ENGLAND	+206,323	+1·7	+977,244	+6·1
Glamorgan–Monmouth	+203,143	+22·3	−205,327	−11·5
Central and West Wales	−126,701	−23·3	−75,528	−15·1
North Wales	−45,765	−9·6	−2077	−0·4
WALES	30+,677	+1·6	−282,932	−10·1

Notes: "Metropolitan England" here corresponds to the London- and South-eastern and Southern Regions combined, except that Bedford (Eastern Region) is included (and combined with Hertford) and Dorset (Southern Region) excluded (and combined with Wiltshire in the South-western England grouping). (Dorset, it may be noted, was officially transferred from the Southern to the South-western Standard Region in 1958).

Table 3 represents the county migration balances and rates according to the above system of zones, except that Bedford (the southern part of which has affinities with Greater London) is here regarded as a "Southern" county. These zones are broken down into smaller county-combinations or, in some instances, individual counties. The major and minor county-groupings thus adopted cannot, however, be everywhere reconciled with the system of the Standard Regions, but it may be claimed, on the other hand, that they constitute more realistic demographic-economic units. This alternative system puts forward the idea of a "Metropolitan" group of counties, for instance, and also treats the inner, industrial counties of the two Midland Standard Regions as a separate group.

Table 4 shows the distribution of the population of England and Wales at various dates according to the major county groupings. The changes in the percentage holdings between 1851 and 1901 and between 1901 and 1951 may usefully be compared with the migration figures for the corresponding areas in 1901 and 1951, as given in Table 3.

In conclusion it is important to remember that the facts presented above merely show the outcome of millions of personal migration movements from county of birth to county of enumeration, and the analysis is restricted to persons of English or Welsh birth enumerated in 1901 and 1951. Only net movements have been discussed and these are for large and diverse areas such as counties and regional groupings of them. We can only guess at the individual motivations which initiated these movements; probably they were primarily economic in character, if we exclude what we have called the "amenity" factor.

We can say that the major shifts in the years prior to 1901 were largely movements to the London area and to the industrial districts and coalfields of the North of England and South Wales, and that many of the migrants probably had a rural or semi-rural background. By 1951 the pattern had become superseded by one in which the effects of the economic conditions of the inter-war period were dominant, with persons from the depressed industrial areas of South Wales and the North of England forming the greater part of the volume of net internal migration, rather than persons from the agricultural counties. At the same time the pre-existing area of attraction in South-eastern England widened northwards and westwards to take in the counties of the South generally, and the pull of the industrial Midland counties also increased, with the result that part of the "drift south" was filtered off here. Nevertheless most of the migrational flow from the North "overshot" the Midlands. Thus the South of England decisively emerged as the main focus of internal migration movements. Ironically this position was attained chiefly by drawing population from its competing areas of attraction in the nineteenth century, i.e. the North of England and South Wales.

TABLE 4. DISTRIBUTION OF POPULATION, 1801–1961
(millions)

Area	1801		1851		1901		1921		1951		1961	
	Nos.	%	Nos.	%	Nos.	%	Nos.	%	Nos	%	Nos.	%
North of England	2·20	*24·7*	5·23	*29·2*	10·94	*33·6*	12·78	*33·7*	13·61	*31·1*	13·92	*30·2*
Inner Midlands	1·18	*13·2*	2·39	*13·3*	4·53	*13·9*	5·43	*14·3*	6·75	*15·4*	7·29	*15·8*
Outer Midlands and Eastern England	1·08	*12·2*	1·78	*9·9*	1·94	*6·0*	2·10	*5·5*	2·44	*5·6*	2·57	*5·6*
Metropolitan England	2·49	*28·0*	5·09	*28·4*	10·50	*32·3*	12·19	*32·2*	15·05	*34·4*	16·17	*35·1*
South-western England	1·36	*15·2*	2·26	*12·6*	2·60	*8·0*	2·74	*7·2*	3·31	*7·6*	3·50	*7·6*
South Wales	0·12	*1·3*	0·39	*2·2*	1·16	*3·6*	1·73	*4·6*	1·63	*3·7*	1·67	*3·6*
Rest of Wales	0·47	*5·3*	0·77	*4·3*	0·85	*2·6*	0·93	*2·5*	0·97	*2·2*	0·97	*2·1*
England and Wales	8·89	*100*	17·93	*100*	32·53	*100*	43·89	*100*	43·76	*100*	46·07	*100*

Compiled from: *Census of England and Wales, 1951, County Reports* (1953-5); *Registrar-General's Statistical Review of England and Wales for 1921* (1923), *Census of England and Wales, 1961, Preliminary Report* (1961).

Note: For 1921 the official population estimates have been used instead of the census figures, owing to the fact that the census was taken in June, when many persons were away on holiday.

Bibliography

[1] Carrier, N. H. and Jeffrey, J. R., *External migration: a study of the available statistics, 1815–1950.* Table II. Studies on medical and population subjects, No. 6. General Register Office, London 1953.

[2] Fogarty, M. P., *Prospects of the industrial areas of Great Britain,* London 1945.

[3] Willatts, E. C. and Newson, M. G. B., "The geographical pattern of population changes in England and Wales, 1921–1951". *Geogr. J.*, 119 (1953), 431–454.

[4] Osborne, R. H., "Population changes in England and Wales, 1951–1961". *E. Midland Geogr.*, 15 (1961), 41–50.

[5] *Census of England and Wales 1961, Preliminary Report.* London 1961.

[6] Thomas, B., "The influx of labour into London and the south-east, 1920–1936". *Economica,* 4 (1937), 323–336.

[7] Thomas, B., "The influx of labour into the Midlands, 1920–1937". *Economica,* 5 (1938), 410–434.

[8] Makower, H., Marschal, J. and Robinson, H. W., "Studies in mobility of labour". *Oxford Economic Papers* 1 (1938), 83–123; 2 (1939), 70–97; 4 (1940), 39–62.

[9] Sykes, J., "Location of industry and population". *J. T. Plann. Inst.*, 45 (1959), 126–130.

[10] Sykes, J., "Employment and unemployment in regions and in the development areas". *Scot. J. Polit. Econ.*, 6 (1959), 193–210.

[11] Thomas, B., "The migration of labour into the Glamorganshire coalfield, 1861–1911". *Economica* 10 (1930), 275–294.

[12] Bainbridge, T. H., "Cumberland population movements 1871–1881".*Geogr. J.*, 108 (1946), 80–84.

[13] Cairncross, A. K., "Internal migration in Victorian England". Chapter 4 in: *Home and Foreign Investment 1870–1913.* London 1953, 65–83.

[14] House, J. W., *North-eastern England: population movements and the landscape since the early 19th century.* Dept. of Geography, University of Durham (King's College, Newcastle-upon-Tyne), Research Series No. 1, 1954.

[15] Saville, J., *Rural depopulation in England and Wales 1815–1951.* London 1957.

[16] Lawton, R., "Population movements in the West Midlands 1841–1861". *Geography,* 43 (1958), 164–177.

[17] Ordnance Survey 1:625,000 ("Ten Mile") series: *Changes by migration 1921–1931* (1949); *1931–1938* (1949); *1938–1947* (1954).

[18] Ravenstein, E. G., "The laws of migration". *J. Roy. Statist. Soc., 48* (1885), 167–235.

[19] Trueman, A. E., "Population changes in the eastern part of the South Wales coalfield". *Geogr. J.*, 53 (1919), 410–419.

[20] Redford, A., *Labour migration in England 1800–1850.* Manchester 1926. Chapter 11.

[21] Darby, H. C., "The movement of population to and from Cambridgeshire between 1851 and 1861." *Geogr. J.*, 101 (1943), 118–125.

[22] Smith, C. T., "The movement of population in England and Wales in 1851 and 1861". *Geogr. J.*, 117 (1951), 200–210.

[23] Osborne, R. H., "Internal migration in England and Wales, 1951". *Advanc. Sci.*, 12 (1955), 424–434.

[24] Osborne, R. H., "The movements of people in Scotland 1851–1951". *Scottish Studies* 2 (1958), 1–46.

[25] Smailes, A. E., "The urban mesh of England and Wales". *Trans. Inst. Brit. Geogr.*, 11 (1946), 85–101.

MIGRATION MOVEMENTS IN FOUR INDUSTRIAL TOWNS NEAR ŁÓDŹ, 1959–61

Ludwik Straszewicz

A very marked process of urbanization has taken place in Poland since World War II. Within the fifteen years between the first post-war census of the population in 1946 and the last census of 1960, the urban population of Poland increased from 7500 thousand people to 14,100 thousand people. Undoubtedly part of this increase is due to administrative changes, i.e. the inclusion of adjoining rural areas in towns, or the granting of municipal rights to former rural settlements. Setting aside such changes, we may assume that within the last fifteen years the cities and towns of Poland have gained about five million new inhabitants. In part this is the result of the fairly high birth-rate, but, on the other hand, a considerable part of the additional population of the cities and towns represents immigration from the rural areas. This is borne out, amongst other things, by an examination of the figures of rural population. In the post-war period, in spite of the high birth-rate, the population of the rural areas diminished by about one million [1].

The fundamental town-creating element in Poland is, first and foremost, industry. It is to the development of industrial enterprises that the cities and towns are indebted for their sudden increase in the number of inhabitants. This is particularly true with regard to those settlements which were greatly destroyed during the war and which, after rebuilding, have regained their former economic importance, as well as their former number of inhabitants.

Neither Łódź nor the medium-sized industrial towns which surround it were destroyed during the hostilities, and in the post-war period the local industries have been little extended or not at all. In spite of these facts the population of the towns situated in the immediate neighbourhood of Łódź increased steadily throughout the whole duration of the recent period.

The following paper analyses the population changes which have taken place in some of the industrial towns of the Łódź district, one of the most intensely-industrialized areas of Poland [2]. They are small and medium-sized towns, numbering ten to sixty thousand inhabitants, and they are also highly

industrialized towns in which the number of persons employed in production-processes reaches as much as 40% of the total population, or even more. They fulfil hardly any service functions for their hinterland, while the municipal service institutions are also rather poorly developed.

The four towns which form the subject of the present study are situated in the immediate neighbourhood of Łódź. The largest of them, Pabianice, which has over fifty-seven thousand inhabitants, lies twelve kilometres south-east of Łódź. The cotton industry is concentrated here, but apart from this there are also some fifteen or so enterprises of other branches of industry, namely a pharmaceutical factory, a clothing factory, a factory for electric bulbs, etc. To the north of Łódź its immediate neighbour is the town of Zgierz, with over thirty-six thousand inhabitants, which is a centre of the woollen industry. In addition it contains factories of other branches of the textile industry, as well as a large chemical factory which produces dyes and reagents for the textile industry. On the western side of Łódź there are two small textile towns: Aleksandrów and Konstantynów. These are even more committed to industry since, apart from the textile plants, there are hardly any other enterprises in them. Aleksandrów, which has 12·4 thousand inhabitants, is a centre of hosiery production, and Konstantynów, with 11·3 thousand, of woollen goods production.

These four towns arose and developed on the basis of textile manufacturing, brought to the Łódź district in the 1820s. Both Pabianice and Zgierz were towns as early as the Middle Ages, but in the eighteenth century they declined, and at the beginning of the nineteenth were small settlements numbering only a few hundred inhabitants each, and it was the agricultural population which predominated in both of them. Aleksandrów and Konstantynów were founded as new industrial settlements [3].

All four towns developed on the basis of the industrial enterprises located there, and quite independently of the development of Łódź. Indeed, the development of Łódź acted as a brake upon their development, so that, in spite of the small distance and good transport connections, they cannot really be considered as satellites of Łódź [4].

They were not destroyed in wartime, although their industrial plants suffered somewhat as a result of the policies of the occupation authorities. On the other hand, they lost a considerable part of their inhabitants (Table 1). Thus Pabianice, which in 1939 numbered 51·5 thousand inhabitants, had only 37·1 thousands in 1946. Zgierz was inhabited by 27·7 thousand persons in 1939, but by only 21·7 thousand in 1946. Konstantynów and Aleksandrów had 8·9 thousand and 13·2 thousand inhabitants respectively in 1939, while the figures for 1946 were only 6·7 and 6·9 thousand [5].

Since the cessation of hostilities the population of these industrial towns has grown again. Even though a great many people left these areas, migrating to

the recovered territories, especially immediately after the war (when a considerable number of skilled workers left for the textile centres of Lower Silesia), the population nevertheless rapidly increased, in spite of the difficult housing conditions characteristic of the entire Łódź agglomeration.

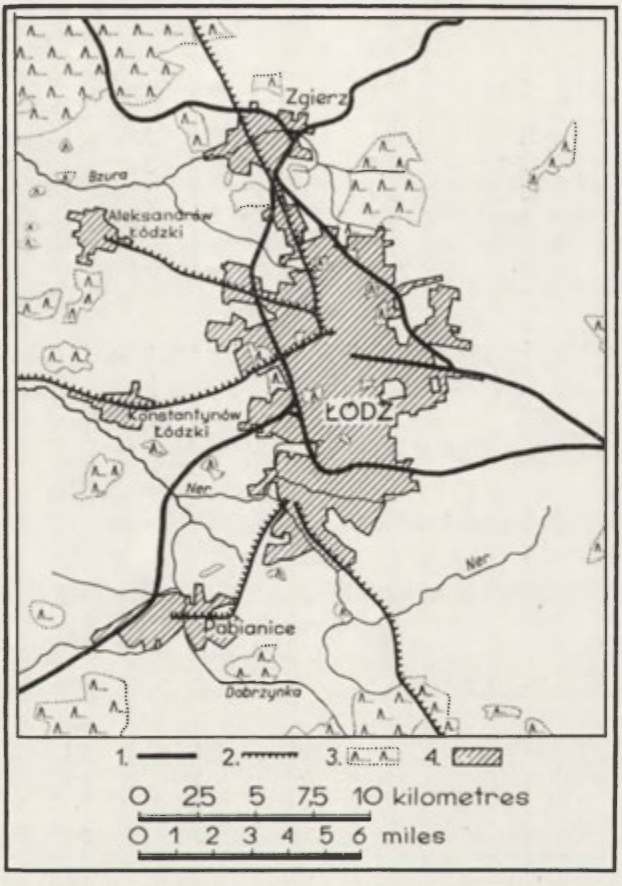


Fig. 1. Industrial towns in the Łódź District
1. Railways; 2. Electric tramways; 3. Woods; 4. Built-up areas

Within the years since the end of the war Pabianice, Zgierz and Konstantynów had passed their 1939 figure of inhabitants, and by the end of 1961 they had far outstripped their pre-war numbers of inhabitants. The only exception was Aleksandrów, the number of whose inhabitants, although growing by nearly 80% in the post-war period, has not yet reached the pre-war level (Table 1).

During the three years 1959, 1960 and 1961 the number of the inhabitants of the four towns increased by 6275 inhabitants. The annual rate of increase in population shows, however, a downward tendency (Table 2). In 1959 it

Table 1. Population changes, 1939–61

Town	Number of inhabitants (thousands)				Percentage increase in 1961 as compared with	
	1939	1946	1956	1961	1946	1939
Pabianice	51·5	37·1	53·1	57·4	54	12
Zgierz	27·7	21·7	32·7	36·9	70	33
Aleksandrów	13·2	6·9	10·7	12·4	79	−6
Konstantynów	8·9	6·7	9·7	11·3	69	27
Total	101·3	72·4	106·2	118·0	62	16

amounted to 2·0%, in 1960 to 1·9%, and in 1961 to 1·6%. It was not the same in all the towns under discussion. The two larger ones—Pabianice and Zgierz—had rates of increase considerably lower than those of the two smaller ones—Aleksandrów and Konstantynów. While in the two larger towns the rate varied between 1·1% and 2·0% annually, in the two smaller ones it varied between 2·3 and 3·5%.

Table 2. Annual rate of total population increase, 1959–61

Towns	Increase (%)		
	1959	1960	1961
Pabianice	1·5	1·6	1·1
Zgierz	2·0	1·8	1·5
Aleksandrów	3·5	3·1	2·3
Konstantynów	3·0	3·0	3·0
Total	2·0	1·9	1·6

These population increases were the result of both natural increase and net inward migration (Tables 3 and 4). In the four towns investigated the rates of natural increase were 0·8% in 1959, 0·7% in 1960 and 0·6% in 1961. These are rates considerably lower than the national urban average for the same years. It is highly significant that in the two larger towns the rates of natural increase were higher than in the two smaller towns. The town of Konstantynów, in particular, was distinguished by a very low rate. On the other hand, the two smaller towns had higher rates of total increase.

As a result of the natural increase within the three years the population of

the towns under investigation increased by 2357. This figure constitutes a mere 38% of the total increase of population (6275). The remaining 62% (3918 persons) was due to net inward migration. The proportions were not the same in all the towns. In Pabianice 49% of the population increase was due to

Table 3. Annual rate of natural increase, 1959–61

Towns	Natural increase (%)		
	1959	1960	1961
Pabianice	0·8	0·8	0·5
Zgierz	1·1	0·8	0·7
Aleksandrów	0·7	0·6	0·5
Konstantynów	0·3	0·2	0·0
Total	0·8	0·7	0·6

natural increase, and 51% to migration; in Zgierz natural increase and migration accounted for 50% each; in Aleksandrów only 20% was due to natural increase, and 80% to migration, while in Konstantynów less than 5% was due to natural increase and over 95% to migration.

Table 4. Annual rate of net inward migration, 1959–61

Towns	Migration (%)		
	1959	1960	1961
Pabianice	0·7	0·8	0·6
Zgierz	0·9	1·0	0·8
Aleksandrów	2·8	2·5	1·8
Konstantynów	2·7	2·8	3·0
Total	1·2	1·2	1·0

It can be clearly seen from the above data that net inward migration played an essential part in the population growth of the four industrial towns. On the other hand, the city of Łódź has, for several years now, been characterized by net outward migration [6].

The migration movements of the population are recorded by the statistical offices [7]. These offices, however, operate only with general figures, the usefulness of which is very limited for purposes of geographical and economic analysis. The problem of migration movements affecting the urban population is studied by the Institute of Town Planning and Architecture in Warsaw [8].

Detailed research on such migration for the Łódź region, carried out by the

Department of Economic Geography of the University of Łódź, makes possible a more precise analysis of the data available. Such research has been based on the registration cards held by the appropriate offices of the local authorities. Owing to the variable character of the basic material of the research, as well as to differences in the maintenance of the register of population movements in the various towns, it is considered that no more about two-thirds of all the changes of domicile were registered (whether arrivals or departures). The research thus carried out covered 5896 permanent departures from the four towns, and 8342 arrivals for a permanent stay. The resultant net migration increase of 2446 persons represents, therefore, the outcome of much larger movements of the population. The total number of changes of domicile amounts to about 14 thousand and the net increase due to migration to less than 20% of this figure.

Of the 8342 persons who made their domicile in the four towns 2468 persons (i.e. 30%) arrived from other towns, and 5874 persons (i.e. 70%) from the countryside. Amongst those who arrived from other towns one-third came from Łódź, and one-fifth from the voivodship of Łódź, i.e. from the immediate neighbourhood (Table 5).

Table 5. Analysis of migration movements

	Arrivals			Departures		
	Total	Urban	Rural	Total	Urban	Rural
City of Łódź	787	787	—	1261	1261	—
Voivodship of Łódź	4906	478	4428	2552	376	2176
Remaining pre-war territories	1404	562	842	1030	659	371
Regained territories	1245	641	604	1053	722	331
Total	8342	2468	5874	5896	3018	2878

On the other hand, among those who arrived from the countryside, over 4400 persons (or 75%) came from the voivodship of Łódź. More than one-half of all the persons who registered for permanent domicile in the four towns came from neighbouring districts, in particular those situated in the western part of the voivodship, within a radius of some fifty kilometres. The incomers from cities and towns at a greater distance were mainly from Warsaw, Częstochowa, Cracow, the towns of the Upper Silesian Coal Basin, Wroclaw and the industrial towns of Lower Silesia, Szczecin, Gdańsk, and the smaller towns of the western provinces. It is characteristic that among those arriving from Śląsk (Silesia) some two-thirds came from urban areas. On the contrary, those who arrived from the eastern voivodships were mostly from rural districts. Of the persons who had arrived from outside the area

of the voivodship of Łódź nearly one-half, namely 47%, consisted of people who were moving back from the recovered territories, principally from the voivodships of Wrocław, Szczecin and Koszalin. In all probability they were persons who had previously moved into those territories as settlers [9]. It has

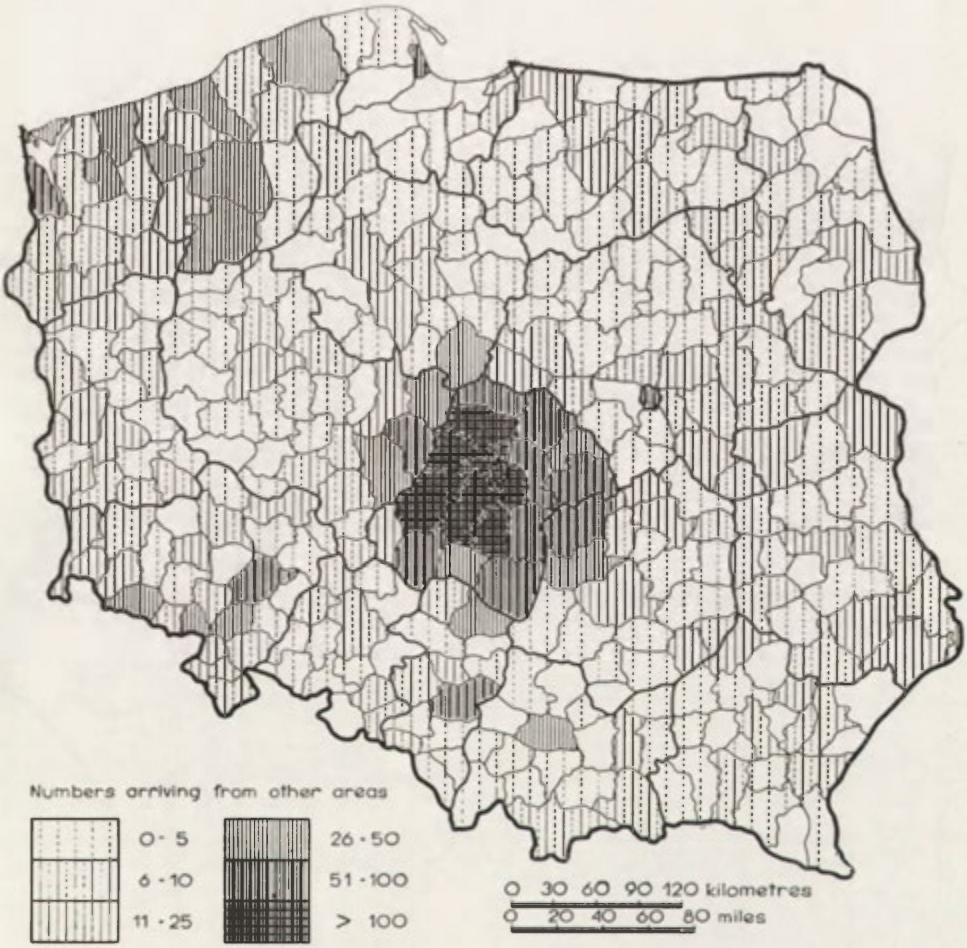


Fig. 2. Immigration into the industrial towns of the Łódź District in 1959–61

been proved that Western Pomerania (Szczecin and Koszalin voivodships) was, to a large extent, settled by population from the voivodship of Łódź, while a considerable number of textile specialists went to the voivodship of Wrocław from Łódź itself and the Łódź industrial district.

Among the new arrivals there was a small excess of women (about 1%). However, they constituted a minority amongst those arriving from the cities and towns (46%), while they were in a majority amongst those coming from

the rural districts. As regards those coming from towns men clearly predominated in the arrivals from Upper Silesia, from the towns of the Gdańsk–Gdynia group, as well as from the voivodships of Zielona Góra, Szczecin, Poznań and Warsaw. There was a small excess of men amongst those arriving from the voivodships of Wroclaw, Cracow, Kielce, from the city of Warsaw,

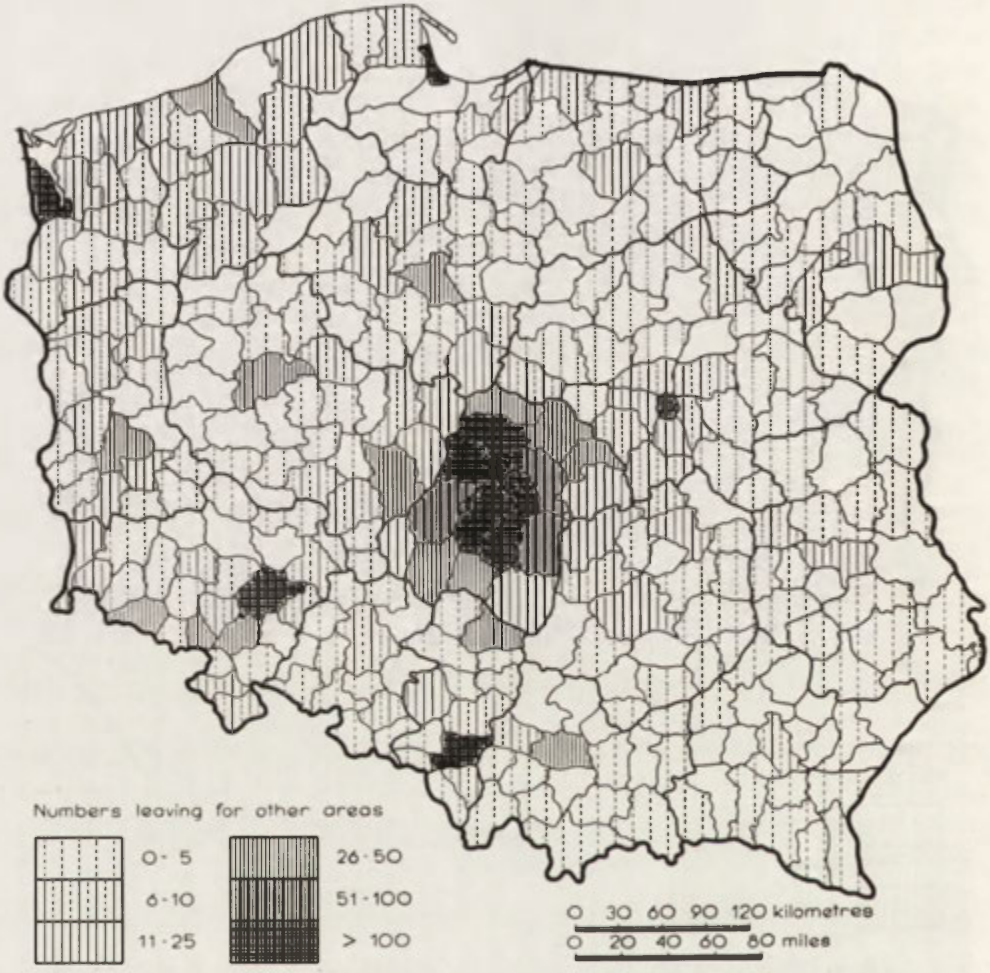


Fig. 3. Emigration from the industrial towns of the Łódź District in 1959–61

and also from the voivodship of Łódź. On the other hand, amongst those arriving from the towns of eastern Poland it was women who predominated. As far as persons arriving from the countryside were concerned, women predominated, especially as regards the arrivals from neighbouring parts of the voivodship of Łódź.

The small, but clear, numerical predominance of migrating women is easy

to explain because of the fact that in the existing textile factories the majority of the workers employed are women. Of the four towns under investigation Pabianice, Aleksandrów and Konstantynów numbered more women than men amongst the immigrants, while Zgierz, where there exist large chemical works, employing mostly men, received a total consisting of 53% men and 47% women.

As has already been mentioned above, within the same three-year period, 1959–1961, 5896 people left the four towns, and the majority of them moved to other Polish towns. While 2468 persons moved in from other towns, 3018 persons left for other towns during the period. Of the above number, as many as 1261, i.e. 40%, moved to Łódź, while 376, i.e. 12%, moved to places within the voivodship of Łódź. The others who left made their way to Warsaw, or to the larger voivodship-capitals or to the larger industrial towns, especially those situated in the recovered territories. Whilst among the incomers there was a considerable majority from places situated in the immediate neighbourhood, those who were going away chiefly made their way to more distant parts of the country. It ought to be emphasized, however, that of those who went outside the area of the voivodship of Łódź a distinct majority went to cities and towns. Most of those going beyond the voivodship of Łódź went to Silesia, particularly the voivodship of Wroclaw. Fairly considerable numbers of persons also moved to the voivodships of Szczecin and Koszalin.

There was an almost complete sex-equilibrium as regards the departing population. A phenomenon similar to the one to which we have drawn attention when discussing arrivals makes its appearance here, namely that among those leaving for towns men predominated while a slightly larger number of women left for the countryside. Similarly, women predominated among those going the shorter distances, while more men left for the distant localities. For every 100 men who went to Łódź and its voivodship there was an average of 103 women. On the other hand, the index of the number of women who left for the recovered territories amounted to 81, and for the remaining areas of Poland, 95.

It is very characteristic that the zone of migration to the four industrial towns is very great, comprising nearly the whole area of Poland. Certainly, outside the area of the voivodship of Łódź and certain regions of the recovered territories mentioned above, the exchange of population is, numerically speaking, not very high, but the phenomenon of migration has a very widespread character, and there are only a few *powiats* in the whole country that do not show population-exchange with the Łódź region.

Summing up the results of the research given above, it can thus be stated that the four industrial towns have a rather low birth-rate and increase their population more by immigration than by natural growth. In the three years

1959–61 they showed a positive migration balance corresponding to an annual average of 1·0–1·2% of the total number of inhabitants.

Gross inward and outward migrations are large. Within the period of the three years under investigation, some twelve thousand new inhabitants made their domicile in the four towns (giving an annual average of about 3·5% of the total number of inhabitants). At the same time some 8·5 thousand persons (that is, about 2·3%) left the towns. Here, therefore, we find a vigorous exchange of population, even though, as a result of such migration, the net increase of the population due to migration amounted to barely one-third of the gross number of immigrants.

Amongst the arrivals it is the inhabitants of the country-side that predominate, particularly inhabitants of the neighbouring villages. On the other hand, the majority of those departing make their way principally to other towns, including a considerable number who go to Łódź, while Warsaw and the towns of Silesia are also important. The great majority of those who migrate are young and single. Occasionally they are people with families, but nevertheless they migrate individually. This is dictated by difficulties in housing conditions, a fairly frequent phenomenon being the removal first of the men and then only after a certain time of their wives and children.

A very great majority of those who migrate into the four towns find employment in industry. As a rule, those who migrate from the countryside have no trade and are employed as unskilled workers. Some of those who leave the countryside, later on return to their former places of residence [10]. Similarly, amongst the incomers there are considerable numbers of persons who had previously departed in search of better living conditions. To this category belong, in particular, those who arrive from Łódź and from the recovered territories.

If we omit this latter feature, the migrations into the four industrial towns show certain general regularities, which may be summarized under three headings:

1. The general balance of migration is active. This results from the considerable predominance of arrivals over departures from the voivodship of Łódź. On the other hand, the balance of migration in relation to the more distant parts of the country, although positive, is, in fact, very small.
2. In-migrants come predominantly from the countryside, particularly from the nearest villages, while out-migrants make their way to the larger centres, especially to Łódź and the larger towns and industrial centres. The migration involving exchange of population with rural areas shows a positive balance, and that with urban areas a small negative balance.
3. In the general picture of migration the number of women and men are nearly equal, with a slight predominance of women. The predominance of women is greatest for short-distance movements, while in exchanges

with Łódź, Upper Silesia and the recovered territories there is a predominance of men. On the other hand slightly more women than men leave for Warsaw.

Bibliography

[1] *Rocznik Statystyczny 1961* (Statistical Yearbook), Warszawa 1961.
[2] Wełpa, B., "Stan i rozmieszczenie zatrudnionych w przemyśle i rzemiośle w Polsce" (Sum. Number and distribution of persons employed in the Polish industries and handicrafts), *Przegl. geogr.*, 31 (1959), 1, 93–118.
[3] Straszewicz, L., "Analyse des bases du développement des régions économiques tiré de l'exemple de la region industrielle de Łódź", in: *Problems of Economic Region*, Warszawa 1961, 294–304.
[4] Straszewicz, L., "The Łódź industrial district as a subject of investigations of economic geography", *Przegl. geogr.*, 31 (1959), suppl., 69–91.
[5] Jelonek, A., "Liczba ludności miast i osiedli w Polsce w latach 1810–1955" (The number of the population of the towns and urban settlements in Poland, 1810–1955), *Dokum. Geogr.*, Warszawa 1956, 5, pp. 250.
[6] Rządkowski, W., "Analiza ruchów migracyjnych na terenie m. Łodzi" (An analysis of the migration movements within the city of Łódź), *Łódzkie Czas. gosp.* (1960), 5, 97–107.
[7] Holzer, J. and Stpiczyński, T., "Wewnętrzny ruch wędrówkowy ludności w Polsce w świetle źródeł" (The internal movement of the population in Poland in the light of the sources), *Wiad. statyst.*, B (1959), 3, 8–13.
[8] Toeplitz, K. L., *Wędrówkowy ruch ludności w miastach województwa warszawskiego w latach 1955–57* (The internal migration movement of the population in the towns of the Warszawa voivodship, 1955–1957), Instytut Urbanistyki i Architektury, Warszawa 1958 (manuscript), pp. 59.
[9] Kosiński, L., *Procesy ludnościowe na ziemiach odzyskanych w latach 1945–1960* (Sum. Demographic processes in the recovered territories from 1945 to 1960), Prace geogr. IG PAN 40, Warszawa 1963, pp. 128.
[10] Pohoski, M., "Selekcyjność migracji ze wsi do miasta z punktu widzenia społeczno-zawodowego" (The selectiveness of migrations from the country to the towns from a social and trade point of view), *Przegl. statyst.*, 7 (1960), 1, 21–40.

THE INFLUENCE OF INDUSTRIALIZATION AND URBANIZATION ON LAND USE AND AGRICULTURE IN POLAND

Jerzy Kostrowicki

It is obvious that the processes of industrialization and urbanization which fundamentally change the economic and social structure of countries, exert a transforming influence upon the countryside. An abundant literature has been devoted to such influences during and since the period of the industrial revolution in Western Europe. In spite of all the differences in historical, geographical and social conditions in which such processes occurred in Great Britain and in Poland respectively, there are many common features: the reason is simply that the same causes, despite all the differences, give the same, or at least similar, results. This is precisely why acquaintance with them in Great Britain, the classical instance of a country where the processes of industrialization and urbanization have gone the furthest, is of great importance to us. This is why we attach great importance to our discussions with British colleagues, who may find, in our difficulties and troubles, a great deal of what is familiar to them, even though often, maybe, not from the contemporary period of their country's development. From British examples, we can acquaint ourselves with the various effects of those indispensable and extremely important processes, including some undesirable effects very often altogether unforseen, and we shall be in a position, in the framework of our planned economy, either to limit, or to prevent, the occurrences of such undesirable effects. Planning by itself, however, will be of no avail here, unless the problem is examined, and efficacious tools and methods of counteraction can be elaborated.

The influence of industrialization and urbanization on the countryside, on land utilization and agriculture, manifests itself in the most varied forms. This is why it is being dealt with by the representatives of a great number of scientific disciplines. It is not my intention here, either to substitute myself for the representatives of all those branches of science, by exhausting all the aspects of that problem, or to provide a summary of the investigation of all those branches. Applied geography does not seem to consist in the geographer

taking the place of all various specialists, nor even in his providing a synthesis of the results of all kinds of research, even though we frequently claim it. While, naturally, making the fullest possible use of the achievements of the neighbouring branches of science, a geographer should, on the basis of his own research, carried out by means of his own methods, bring a separate contribution of his own to the problem by forming a synthesis, not the only possible one, but one of the syntheses, different from the others in that it is spatial, geographical.

That is why my report, without trying to exhaust all the problems and aspects connected with the influence of industrialization and urbanization upon the countryside and agriculture, will be limited to those which result, or may result, from geographical investigations, and emphasize those elements, in which such geographical research may provide results of practical utility.

Since, however, most of those problems have not been investigated geographically as they should be, this contribution is far from being a full geographical synthesis. It merely pinpoints some immediate problems arising from geographical research.

The present report has been based, principally, on the results of the research conducted by Maria Dobrowolska and by her team of the Teachers Training College in Cracow on the transformations of the Małopolska (Lesser Poland) countryside, on the studies by J. Tobjasz from the University of Warsaw, carried out in the area of the Upper Silesian Industrial District (GOP) within the framework of the Commission for GOP attached to the Polish Academy of Sciences, as well as upon the research of the Department of Agricultural Geography in the Institute of Geography (Polish Academy of Sciences), headed by myself. To a lesser degree other contributions have also been drawn upon; I include a list of them at the end of my report.

The present report is composed of two parts: the first deals with various mostly direct transforming influences of industrialization and urbanization on land utilization in Poland, while the second discusses the influence of such processes on agriculture itself.

I

There are three ways in which the processes of industrialization and urbanization influence land use. First, under the influence of the concentration of industry and commerce in certain localities, certain rural settlements are transformed into towns or urban settlements; secondly, the extending industrial ad municipal centres absorb the adjacent and surrounding rural areas; thirdly, the industrialization and urbanization exert a transforming influence on the surrounding rural areas.

As early as the Middle Ages the concentration of handicrafts and commerce in certain localities transformed the latter into urban settlements, the crowning of which process was the granting of municipal rights to such localities. Occasionally, too, towns were founded from scratch without any support in an existing rural settlement. In Poland, it also frequently happened that the granting of municipal rights to the several villages preceded their actual urbanization. Particularly in the sixteenth to eighteenth centuries the specific policy of the Polish *szlachta* (gentry), whose ambition consisted in having a town within one's estate, caused an urbanization, semi-urbanization or else pseudo-urbanization of a whole number of villages; this fairly often consisted in granting the right of holding fairs and settling a certain number of Jewish families, to whom the right of *propinatio*, i.e. of the selling of alcohol distilled in the estates, was granted [6, pp. 13–17]. In the neighbourhood of the larger towns the *szlachta* also founded so-called *jurydyki* (autonomous settlements) which competed with the towns, and which, in the course of time, became transformed into suburbs. In any case, however, many such villages were actually transformed into small towns which fulfilled, to a greater or less extent, the functions of local centres. One result of this was that when, in the nineteenth century, the development of transport made a greater concentration of local functions possible, the urban network proved to be too dense for the new needs. And so, at the beginning of the twentieth century, and even at the end of the nineteenth, we observe, side by side with the strong development of some towns, the downfall and ruralization of many old local centres [6, pp. 18–19]. New towns arose, in this period, mostly under the influence of the developing industry.

Even at the earliest stage, that which Mumford calls the "eotechnic" phase, of the development of industry on Polish territory, the growth of centres of extraction and processing of metal ores, as well as those of various kinds of specialized handicrafts, exerted a transforming influence on the villages in or near to which they were introduced. In the districts where iron or copper ores were exploited i.e. in the Świętokrzyskie Mountains, of textile industry in the Sudety Mountains, of lead and silver mining in the neighbourhood of Olkusz, etc., there developed settlements different in their character both from the hitherto existing agricultural, or agricultural-*cum*-artisanal villages, connected with feudal estates, and from feudal towns, strictly isolated from them. The development of magnates' manufactures in the eighteenth century and later on the industrialization of the Kingdom of Poland (autonomous from 1815 to 1830), planned in an altogether modern way, bring further transformations, the results of which have survived to the present time, not only in the form of the industrial buildings, imposing by their dimensions and the style in which they were built, in the so-called Old Polish Industrial District, but also in the form of developing industrial centres, which still

exist, and which have transformed villages and decaying little towns into strong municipal centres, or have caused the creation of new towns in rural areas [8]. On a smaller scale the industrialization of the countryside proceeded at the same time in the area of the so-called Republic of Cracow, which from 1815 to 1848 constituted an independent state [3].

A thorough transformation of the countryside in many regions was also brought about—to continue to use Mumford's terminology—by the "paleotechnic" phase of industrialization, the greatest intensity of which, in Poland, was concentrated between 1860 and 1914. During this period industry developed spontaneously in some parts of the country. Particularly in the mining districts many hitherto agricultural villages changed their functions, either entirely or in part, continuing for some time to play two roles; and their system of construction gradually became transformed. The place of the rural farmsteads was taken by miners and industrial workers' houses, without any farm buildings. Only the layout of the settlements, despite workers' quarters built by the mines or industrial enterprises, remained relatively unchanged. A particularly strong transformation affected the villages of the Upper Silesian Industrial District. With the exception of three (Gliwice, Bytom and Będzin) all the large and medium-sized towns of the Upper-Silesian agglomeration are former agricultural villages, whose primitive rural layout is still visible. Many industrial towns and settlements were also created in the mining areas which surround that agglomeration. Villages situated in the Sub-Carpathian oil districts were subjected to slower transformation and to this day they have preserved, at least in the majority of cases, their mixed character.

Towards the end of the inter-war period similar transformations took place in some of the villages situated in the so-called COP (Central Industrial District), which was to arise in the triangle formed by the Vistula and its tributary, the San (e.g. Stalowa Wola); less frequently such instances can be met with in other districts (Chełmek). The construction or extension of industrial plant in this area has led, within recent years, to the creation of further new towns and urban settlements (e.g. Dęba).

The planned industrialization of the country, undertaken after World War II, has resulted in a powerful stimulus to the development of existing towns. However, the placing, occasionally without sufficient justification, of a number of industrial enterprises in rural villages has brought about violent, and frequently rather unpleasant changes for their inhabitants, who were compelled, for a number of years, to live in towns *in statu nascendi*, with all the shortcomings and discomforts which accompanied such a state of affairs. For these and for other reasons, and since there already exists in Poland a considerable number of small towns which have inadequate bases for their development, such an industrial location with the exception of

the industries directly connected with mineral resources should be regarded as wrong.

Furthermore, the localization of large industrial plants, even when connected with existing towns, has frequently not taken into account the interests of the countryside. The much-discussed localization of Nowa Huta iron works near Cracow, for example, has its undersirable aspects. For in spite of the existence, in the neighbourhood of Cracow, of other convenient areas, it has occupied a large tract of extremely fertile loess soils, thereby withdrawing them from agricultural exploitation. Even though so far no lack of arable land is being felt in Poland, our country has not enough fertile soils. This is, therefore, a considerable loss. On the other hand, the town, where building operations are continuous, either sinks into a thick loess mud, or else, in the dry season, is covered by clouds of loess dust, which is swept by the winds from the uncovered soils, and which penetrates everywhere.

In this respect, in spite of rather faulty general localization, the "Warszawa" steel works has been better sited, as it has occupied extensive areas of sandy half-waste land, which adjoin the city of Warsaw on the north-west.

Another way in which industrialization and urbanization can impinge upon rural areas is the absorption of rural areas by developing towns. Instances of this may be found in Warsaw and the Upper Silesian agglomeration. Warsaw, which developed rather slowly in the medieval period, was, at the time when it became the capital (1595) a small town, surrounded by extensive agricultural areas on the left bank of the Vistula, and by large forests in the East and North. Even in the first centuries after the moving of the capital to Warsaw, the development of the city caused the urbanization and absorption of a number of surrounding villages. This process continued throughout the nineteenth and twentieth centuries. Now only the names of the several districts of the City of Warsaw (Wola, Czyste, Bródno, Grochów, etc.) bear witness to the former existence of separate agricultural villages.

In the inter-war years there also began an urbanization of a number of villages situated at a somewhat larger distance from Warsaw, but having good communications with it, which were gradually transformed into various types of satellite towns (Włochy, Brwinów, Milanówek, Wawer, Anin, Falenica, Józefów, etc.).

The post-war re-building and the planned reconstruction of Warsaw, in accordance with new town-planning ideas, caused the incorporation into the administrative area of the City of extensive rural areas, and then the gradual building over of the latter. At the same time, owing to the housing difficulties which resulted from the destruction of Warsaw, many of its inhabitants have settled in its neighbourhood, either in former satellite settlements, thereby causing their violent growth, or else beyond them, widening the range of urbanization far beyond the old area. Such processes were exaggerated by the

further development of Warsaw's functions, and, more particularly, by the development of industry. The creation of new industrial districts on the periphery of the capital has caused a rapid urbanization of the adjoining areas, transforming them from entirely rural or else suburban ones into modern big-city residential districts (Żerań, Młociny, Bielany, Służewiec).

The result is that Warsaw, not yet entirely rebuilt in its central parts, has begun to swallow up, at a rapid rate, the areas surrounding it. Here, too, mistakes were made as a result of inadequate knowledge, or of the neglect of other considerations. The environs of Warsaw are mostly covered with poor soils. There exist, however, in its neighbourhood, good, and even very good soils, sometimes intensely utilized by commercial agriculture of a market gardening type. Building activities ought to have spared such areas for the sake of supplies to the City, while freely extending to the areas with poorer natural conditions and less developed for agricultural purposes. Unfortunately this did not always happen.

Another instance is the big industrial and municipal agglomeration of the Upper Silesian Basin, already referred to. The development of mining and industry, the urbanization of the existing villages and the creation of new workers' settlements all ousted agriculture and swallowed up ever larger and larger rural areas, replacing them by mines, slag and spoil heaps, areas of subsidence, industrial plants and developing housing estates. The developing centres have gradually approached each other so as to coalesce, thereby forming one big industrial-cum-municipal complex, in which the utilization of land for agricultural purposes plays an altogether negligible role. In 1950 a reorganization of the administrative division was carried out here, by liquidating the fiction of rural areas in the very central part of the Coal Basin, and by creating, out of the hitherto existing towns and rural parishes, six large towns (of over one hundred thousand inhabitants each) and nine medium-sized towns, occasionally joining in an artificial way neighbouring mining townships which had not possessed any stronger links with one another, or any common centres. At the same time, however, the agglomeration begins to spread outwards, swallowing up the neighbouring, more or less urbanized former agricultural villages. The Regional Plan for the Upper Silesian Industrial District attempts to introduce a certain order into the existing situation. The inflow of industry has been limited. New residential districts are being built, parks are created, trees are planted on top of spoil-heaps, etc. In the rural areas which surround the Basin planned satellite towns are being built (Nowe Tychy, Pyskowice, etc.) [9].

At the same time, within recent years, to the south of the central part of the Upper Silesian Basin, there has been a rapid urbanization of the villages of the Rybnik Coal Basin, connected with the extension and construction of a number of new mines of coking coal. The regional plan, elaborated for

this area, attempts to canalize that development within an orderly scheme. It cannot, however, altogether leave out of consideration the existing network of more or less urbanized mining or else mining-*cum*-agricultural villages.

In the elaboration of all such plans, in the preparation of bases for their compilation and, to a certain extent, in their carrying out, geographers have played a part. Geographers also conducted, and took a lively part in, the operations of the special committee of the Polish Academy of Sciences, called into being in order to prepare scientific foundations for such plans.

The third kind of influence exercised by industrialization and urbanization on rural areas is the transformation of the surrounding rural areas under the influence of such processes.

A town, according to its size, provides a market for agricultural produce. Since some of this produce can be transported or preserved without its quality thereby becoming lowered, around almost every town there develops a specific kind of agriculture, which concentrates its efforts on the production of vegetables, fruit, fresh milk, etc. In the neighbourhood of a large city, such agricultural activities are very profitable, so that it pays to invest in the land, occasionally altogether transforming the soils, water conditions, and even the relief, so that a maximum production of the articles in demand on the town market might be obtained. Therefore, in the suburban zone both the ways of agricultural utilization of land and its orientations and effects, are different.

At the same time, the shifting of the population from agriculture to industry and other town occupations is expressed, not only in the emigration of part of the population of the countryside to the towns, but also in a certain part of the population journeying to work; for various reasons they prefer to remain, or even to settle in the countryside, in spite of the loss of time involved, and the effort expended. Apart from certain internal, indirect effects, in so far as agriculture is concerned, effects which will be dealt with below, this produces certain external effects in land utilization, easy to be observed. The higher incomes of that part of the population, earned from extra-agricultural sources, and their closer contacts with town culture cause the buildings inhabited by them to differ considerably from those previously erected in the same village. They are houses, more or less successful from an architectural point of view (more frequently less than more), but more comfortable, better equipped, built of bricks, slag-concrete, or rubble-concrete, covered with a fireproof roof (tiles or roofing sheets) destined primarily as dwellings. This process is particularly noticeable in localities where timber huts with thatched roof formerly prevailed, as in the neighbourhood of Warsaw, in the Carpathian Mountains, in the Sandomierz Basin, etc. The farm buildings play a secondary role, and in the case of a total divorce from the soil they disappear altogether. In nearly all the suburban zones a parcelling

of land into minute holdings takes place [3] and agricultural holdings are transformed into workers' allotments. There arise, thickly scattered, particularly along lines of communication, numerous houses of a population which has never had any connection with agriculture at all, for whom the smallish plot of ground roundabout the house serves, at most, as a source for supplying themselves with vegetables and potatoes, as a place for working off the excess energy in manual work, after their frequently sedentary work in town, or finally constitutes a capital invested in the land.

Therefore, in a suburban zone, even predominantly agricultural, the town advertises its proximity by a number of external details, such as different kinds of houses, the lack of farm buildings, the appearance of certain establishments, such as cold frames and greenhouses, and by differences in the kinds of crops grown.

II

The second problem is the transforming influence of industrialization and urbanization upon agriculture itself. Whether industrialization and urbanization cause an intensification, or, on the contrary, an extensification of farming, is the subject of much current debate.

It is obvious that, on a national scale, the result of industrialization and urbanization is the development and intensification of agriculture. The strong increase in demand, despite price regulation, causes a perpetual relative increase in the prices of agricultural produce, the result of which is, first and foremost, the increase in livestock raising, which has been going on in Poland uninterruptedly since the war, particularly in the breeding of pigs, and, within the last five years, also of crop production, expressed in the average annual increase of yields of grain crops by one quintal per hectare.

The above developments also result from agriculture being supplied, by the developing industry, with an ever-increasing quantity of fertilizers, agricultural machines and implements, of insecticides, etc.

On a regional scale, on the other hand, an intensification of farming takes place primarily in the developing agricultural suburban zones, as around Warsaw, and to a much smaller extent, around the Upper Silesian agglomeration and other cities and towns. Such intensification finds its expression in the increase of capital outlay in agriculture, a better tillage of the land, better fertilizing, more intense systems of farming, the increase of yields and the general increase in the productivity of farming. The farmer obtains a considerably larger amount of produce per unit of area, and, though to a smaller extent, per unit of labour, than is the case in areas more distant from urban centres.

Of course, the development and range of suburban agriculture is not

exclusively proportionate to the distance, even though transport costs play considerable role here. The investigation conducted by the Department of Agricultural Geography of the Institute of Geography of the Polish Academy of Sciences has shown, for instance, that the differentiation in farming in the suburban zone of Warsaw is considerably greater than had been imagined, while the participation and character of suburban farming is only to a limited extent a function of the distance from the city. One might, on the other hand, within the framework of Warsaw's suburban zone, distinguish a number of clearly differing sectors. This fact is only partly connected with natural conditions.

The areas situated to the east and north of Warsaw have poor podzolized soils, formed from thick layers of sand, deposited here in the period of the last glaciation on the bottom of a large lake. The areas situated to the west and south of Warsaw lie at higher elevation, and are covered by boulder clay, from which considerably better soils were formed. Some ten miles to the west of Warsaw there begins the region of fertile black earths, of marshy origin, which extend further westward. Finally, the river valleys are covered with various kinds of recent alluvia, and among these the Vistula alluvia are distinguished by their particular fertility.

The above set of natural conditions, however, has caused, not so much a differentiation of that zone, as rather the limitation of its range, especially in an easterly direction. With the exception of a narrow belt which extends along the Vistula, those areas are covered by forests, while, just a couple of miles from Warsaw, in spite of the existence of a number of satellite towns, agriculture does not show any serious influence of the Warsaw centre.

On the other hand, the agricultural differentiation of Warsaw's suburban zone is most frequently connected with transport relations, and with the population's skills and traditions. And thus, e.g., on the basis of an as yet incomplete detailed investigation (1:25,000), as well as of an unfinished general map of land utilization (1:100,000) one may distinguish, within Warsaw's suburban zone, the following sub-zones:

(1) The market gardening sector is most strongly developed in the shape of a gradually narrowing belt, along the Warsaw–Sochaczew–Poznań road, while gradually giving way, towards both north and south, to the rye-and-potatoes orientation of arable land utilization, typical of central Poland[1], and, to the west, in connection with the appearance of black-earth soils, to rye-and-sugar beet, or rye-and-wheat and sugar beet orientations. The livestock-

[1] The definition of the orientation in arable utilization in Polish agricultural geography is based on the proportion between three principal groups of crops (the exhausting crops—mostly grains; the intensifying crops—mostly root and other ridged up crops, and the structure forming crops—mostly leguminous plants) and then the dominance or co-dominance of particular crops in each group. For a detailed description of the method see [5].

farming remains on the average level. A similar market gardening zone is found to the south of the city, in particular on the alluvial soils of the flood terraces of the Vistula river. A narrow belt of the same character may be observed along the river bank, to the north of the city on both sides of the Vistula.

The share of vegetables in all this sector is difficult to estimate with any degree of precision, for here statistics fail. Since a tax has to be paid on more than a quarter of a hectare under vegetables, the peasants almost always return no more than precisely such an area of cultivation; investigation on the spot, however, has shown that the actual area of vegetable cultures considerably exceeds that amount, and occasionally vegetables cover 50%, or even more, of the arable land. In the statistics such areas figure as occupied by potatoes or fodder plants sown in fact as after crops.

(2) On the clayey soils to the south-west of the city the share of vegetables diminishes, while the intense suburban farming here aims to supply Warsaw with potatoes, which here cover occasionally 50% and more of the total arable area. Again, however, there are strong connections with the roads leading to Warsaw. Away from them the traditional rye-and-potatoes farming reaches even right into Warsaw's administrative boundaries.

(3) Finally, the south, and, in particular, the neighbourhood of Góra Kalwaria and Grójec, is characterized by a specialization in orchards. Considerable areas there are covered by apple-trees, pear-trees, and cherry-trees, the fruit of which is supplied to the Warsaw market, usually intercultivated with small fruit bushes, vegetables, potatoes, strawberries or even various cereals and leguminous crops. Most of these orchards are young and not yet fruit-bearing, or else bearing but little fruit, as they were planted but a few years ago, particularly after the abolition of the tax on orchards containing more than twenty trees. Such orchards, created within quite recent years, often do not figure on the available topographic maps. The checking of the latter map with aerial photographs or on the spot will make it possible to remove such shortcomings.

Within quite recent years the development of fruit-culture has also begun to the north of Warsaw, in the region between Modlin and Płońsk. Fairly large areas there are already covered by young orchards, side by side with which there continues to develop the rye-and-potato farming.

(4) The remaining areas go in for a farming which does not greatly differ from the areas situated farther away: the growing of rye and potatoes, along with the breeding of pigs or cows.

Within recent years, Warsaw's agricultural suburban zone has been extending, in spite of certain fiscal difficulties, over wider and wider areas, while at the same time becoming differentiated and specialized to an ever higher degree. Such development, which is spontaneous and not always very rational,

demands a planned spatial organization. Such a plan ought to be founded on a good knowledge of both the conditions of agriculture, and also of the systems in use, of the principal farming orientations and of the results obtained.

The concentration of the field work of the Department of Agricultural Geography in the Institute of Geography of the Polish Academy of Sciences on this area within the last two years has for its purpose precisely the supplying of such materials. In any case, Warsaw's suburban region which at one time used to supply even St. Petersburgh with vegetables, and nowadays, apart from covering the needs of Warsaw, also supplies vegetables to Upper Silesia, and even as far as Szczecin, is an example of the intensification of agriculture, connected with urbanization and industrialization.

Another instance of the same phenomenon is the suburban zone of the Upper Silesian Basin [10]. This area, quite considerably differentiated from the point of view of natural conditions, does not have an agricultural suburban zone adequately developed for the needs of its agglomeration. To the north-west of the central part of the Basin rye-and-potato farming is dominant reaching the very boundaries of the town; in this area grain crops occupy more than 55% of the land sown. Vegetables are principally grown within the administrative boundaries of the towns of the agglomeration (particularly in Katowice, Szopienice, Mysłowice, Gliwice, Zabrze and Ruda) as well as to the north of the agglomeration in the neighbourhood of Pyskowice and Tarnowskie Góry, and in the south, in the region of Orzesze. Dairy farming is developed to the west (Łabędy), the north-west (the region of Będzin), and the south-west (Tychy, Murcki) of the central agglomeration.

J. Tobjasz's research in the neighbourhood of Tychy [12] has also drawn attention to the fact that the spatial differentiation of farming in the area of the Upper Silesian Industrial District is more closely connected with the size of holdings. The areas with a predominance of very small farms (up to two hectares—5 acres) show the potato orientation with rye, or else a potato-and-rye orientation, while the larger holdings are characterized by rye-and-potato, or else rye with potato orientations. Larger too, though everywhere small, is the share, in the bigger holdings, of leguminous and industrial crops, which are hardly grown on the smallest holdings. On the other hand, the share of vegetables does not exhibit any particular connection with the size of holdings, but is rather connected with certain areas.

As far as livestock-breeding is concerned, the smallest holdings (up to two hectares—5 acres) go in rather for the breeding of goats and poultry, followed by cows, while in the small holdings (two to five hectares—5–12·5 acres) cows altogether supplant goats. Pig-breeding appears uniformly in holdings of various sizes.

Of course there might be reservations as to whether or not a holding of

a surface of up to 0·5 hectares, or, depending on conditions, even up to one or two hectares, may be considered to be a farm at all. Such holdings, however, constitute as many as 85·1% of the total number of holdings within the area of the Upper Silesian Industrial District, and, if we include those of up to five hectares—even 95·2% (of the holdings, as well as 58·6% of the surface of agricultural land). The considerable majority of them belong to persons who work both in agriculture and in non-agricultural occupations. And it is here that we are faced with the problem, acute and controversial in present-day Poland, of the so-called peasant-workers i.e. persons who go in for work in agriculture as well as work outside agriculture, in most cases commuting to work in the nearby mines, factories or construction establishments.

The increase of income together with the acquaintance and familiarity with urban culture results in much new building, in the areas from which people travel to work, of new homes, larger and better equipped. It also results in a raising of the cultural level of the population, of the way of living, of dressing, of eating, a raising of the level of education by an increase in the number of young people who get a training in schools, and by the vocational training of adults; and it results too in the more universal usage of such achievements of technique as bicycles, wireless, electric irons, washing machines, motor-cycles, and even television sets and motor-cars. On the other hand, however, the commutation to work of part, or even of majority, of the members of a household, mostly of men, causes a shortage of manpower, and throws the agricultural labour onto the shoulders of women, burdened as they already are with household chores and the bringing up of children and this as a result, causes the avoidance of the more labour-absorbing but more intensive orientations in farming, while limiting the latter to the subsistence production of potatoes, eggs and milk, less commonly of vegetables, grains and meat. Since they obtain the bulk of their income from extra-agricultural sources, such peasant-workers also frequently lose interest in their holding, and tend to treat it as a supplement of their earning, and not as a livelihood.

Examples of this kind of extensification of peasant holdings as a result of travelling to work have been noticed in some of the areas which surround the Upper Silesian Basin [11] as well as in the Carpathians [2], in the Old Polish Industrial District, and even in the Białystok Region [1]. This phenomenon takes a particularly acute form in those localities where, as a result of transport difficulties, the peasant-workers live in workers' hostels throughout the working week, and return to their farms only for Sundays and other holidays.

On the other hand, the opposite phenomenon has also been found to occur, particularly in the Opole region, viz. that of an increase in outlay for farming on the part of the peasants employed outside agriculture. Which therefore prevails, where and in what conditions? How far is this a mass phenomenon?

How should one proceed in order to counteract its undesirable effects, stated above?

Maria Dziewicka's sample research by enquiry [4] has estimated the number of peasant-worker holdings in Poland at about 1200 thousand, i.e. about one-third of the total number of holdings in the country. They occupy, however, on a national scale, a mere 9·4% of the land under cultivation, while giving about 12·3% of the total produce of agricultural output, and about 7·3% of its commercial production. On a national scale, therefore, the phenomenon would not provide any serious reason for anxiety, were it not for the fact that it exhibits a strong tendency to increase, while in the industrialized areas it is becoming universal. In the voivodship of Katowice such holdings constitute two-thirds of all the holdings, they occupy 31·5% of the agricultural land and produce 46% of the gross production, but only 20·1% of the commercial production. Consequently, this phenomenon is not to be neglected. For the voivodship of Katowice may serve as an example of what may soon happen elsewhere.

The worker-peasant holdings are, for the most part, very small, with an area less than three or four hectares.

A comparison between these holdings and holdings of the same size, on which the owner does not draw any income from outside agriculture (Table 1) shows, for each hectare of agricultural land, a considerably lower production, both gross and net, and particularly commercial production, as well as lower outlays, and particularly outlays for farming proper, but a much higher personal income and consumption. Incidentally, considerably smaller differences make their appearance in the holdings of up to three hectares, and considerably larger ones in the larger holdings of from three to four hectares.

Since the investigation covered the holdings which keep accounts, and consequently, the better ones, it is to be supposed that, on a larger scale, the differences are even greater. Moreover, serious differences appear in this respect between one region and another.

The research of Maria Dobrowolska and her group in the area of southern Poland [2], research based on detailed field-work, demonstrates that in the whole region between the Upper-Silesian Basin and Cracow, as well as in certain Carpathian and Sub-Carpathian regions, where the countryside had long been over-populated, and the natural conditions are mostly poor, there appears, in the worker-peasant holdings, particularly in those of up to two hectares, a limitation of labour-absorbing crops, with the exception of potatoes; this is even true concerning the vegetables destined for personal consumption. Farming is reduced to the growing of grains and potatoes, and to the breeding of poultry and pigs, occasionally of one cow. At the same time, however, in their tendency to decrease the amount of unavoidable work, the farmers more and more often introduce agricultural machines and use more fertilizers,

Table 1

Specification	Holdings		
	small, of up to 3 ha. constituting livelihood		medium 3-7 ha
	auxiliary	principal	
Average size of holding (ha)	1·9	2·2	4·8
Number of persons per holding	4·7	3·6	4·3
Gross production—effects of farming (in thousand zl. per holding)	28·3	39·8	65·9
including: crop production	12·6	18·1	32·9
animal production	15·7	21·7	32·9
Financial outlay	16·7	20·0	32·9
Net production	11·6	19·8	33·0
Income from commercial production	10·9	16·6	29·0
Income from outside farming	22·1	6·6	4·2
Personal income	31·2	24·3	31·6
Consumption	28·5	22·6	28·2
including: materials	10·0	12·0	13·7
Investments, total	3·4	2·0	1·9
including: housing	2·6	1·0	2·4
machines	0·1	0·2	1·7
Consumption per member of household (in zl.)	6048	6362	6622

Source: Czerniewska M., "Dochody gospodarstw chłopskich w 1959/60 r." (Income from peasant holdings in 1959/60), *Zagadnienia Ekonomiki Rolnej*, 6 (1961), Suppl. p. 70.

obtaining as a result, crop yields which are little, if any smaller then the full-time farmers[2]. The existence, in the neighbourhood, of possibilities of employment outside agriculture decreases the surpluses of manpower in agriculture, while at the same time imposing a brake upon their flowing away from the countryside, and accelerates the splitting up of holdings, transforming them into mere household allotments. All round every major or medium-sized industrial centre we observe an increase of the ratio of minute holdings, or rather, properly speaking, of household allotments[3], whose independent exist-

[2] On the basis of his investigation, conducted in the Carpathian Oil District, J. Niemiec [7] finds that the first purchasers of motors and threshing machines in the countryside were peasant-workers. On the other hand, the more well-to-do farmers, who possessed horse gears even before the war, still thresh with them to this very day. Thus a reversion of the order of things hitherto prevailing has taken place, and the smaller holdings now use more elaborate machines than the larger ones.

[3] In the neighbourhood of Chrzanów and Trzebinia on the eastern margin of the Upper-Silesian Industrial District the holdings of up to one hectare (2·5 acres) constitute from 65 to 82% of the total. From 50 to 80% of the professionally employed population work outside agriculture. The number of holdings of over two hectares (5 acres) amounts to from 9 to 12%, or else they are altogether absent. Self-supporting peasant holdings slowly disappear. Around even such young and relatively small industrial centres as Mielec, Dębica, Żywiec or Gorlice

ence, without employment outside agriculture, becomes impossible. Commutation and the splitting up of holdings gradually begins to affect even the medium-size holdings. Non-self-supporting allotment holdings begin to cover even larger and larger areas, rendering difficult, in the future, any rational organization of agriculture.

This problem also has its industrial aspect; the workers who travel to work constitute the most unstable element of the whole personnel, they easily abandon work in the period of an accumulation of field labours, thereby disorganizing the work in those enterprises which employ them in large numbers, and there are many such[4]. Travelling to work, more particularly when the distance is long, also lowers the efficiency of work.

On the basis of the above data and considerations one might, therefore, draw the conclusion that, for the national economy as a whole it is more advantageous that those peasants who find employment outside agriculture should abandon the land altogether. Even if we left out of account the question of the impossibility of building new homes in the towns for all employed in non-agricultural occupations, such a conclusion would even then be correct only to some extent. The flowing away of the population liquidates the overpopulation of the countryside and efficaciously stems the process of splitting up of holdings, the more so that according to the custom those who leave the village make over the land they leave behind to their relatives, either as property or by way of lease. Therefore, the amount of land per one farmer increases, and so does production per head and the marketability of agriculture. This is how the situation develops in some areas. The excessive drain of the population from the countryside to the towns, however, more particularly in the less densely populated areas, causes a warping of the age-structure of the population. For, indeed, those who go away are adult people and youngsters going to schools, who do not return to their villages. It is, moreover, the most enterprising individuals who go away. Those who remain on the land are elderly or passive people, who are not in a position to manage their farms, or, at any rate, to manage them intensively. The result, to use Hartke's term, is thus a social, or rather demographic, fallow, which comprises the lots situated farthest away from the village, or on poor soils. As contrasted with

in the Carpathians, holdings of up to one hectare constitute from 34 to 48% of the total number of holdings. As we draw away from the town, as can be seen from the maps drawn by J. Niemiec, K. Kurzawa and Z. Bobek, the percentage of smaller holdings increases. The density of the population around industrial centres exceeds 200, or even 300, persons per km², while in the more distant areas it is a mere 50 to 80 persons per km² [3].

[4] As Maria Dobrowolska states [3], out of 378 thousand people employed in State or cooperative enterprises in the voivodship of Cracow, more than one-half commute to work. In such centres as Chelmek, Trzebinia or Grodziec 75% of workers commute to work every day, 50% of those employed in the Siersza coal mine do likewise, while 25% who hail from more distant regions live in workers' hostels.

the areas of mass travelling to work the "emigration" villages are characterized, frequently even though not always, by stagnation, and indeed even the gradual decay [3]. Thus we have, once more, to do with an extensification of farming under the influence of industrialization and urbanization.

To what extent are such phenomena harmful, and what ought to be done in order to prevent their undesirable effects? My answer to the above question cannot be a full one, since this problem has not yet been adequately investigated geographically, i.e. spatially, in all its natural, economic and social contexts.

We must assume, however, that, in the Polish circumstances of rapidly increasing population, of rising living standards and a rising percentage of non-agricultural population, with the lack of open, unoccupied spaces, the intensification of agriculture is the fundamental, if not indeed the only method of satisfying her inhabitants' demand for food. If, therefore, comparing the present productivity of Polish agriculture with the highly intensive western-European agriculture and taking into consideration the natural conditions, we find that there still exist in Poland serious potential possibilities of a development of agricultural production, we must assert above all that any form of under-employment of land resources, such as fallow or the extensification of agriculture, must be considered, in Polish conditions, as undesirable. In our circumstances of small-scale peasant farming we cannot afford to abandon the land in order to come back after some time with modern large-scale methods and techniques, for we have to produce more and more food and other agricultural products to meet increasing needs of our rising population.

It is obvious that a further drift of population from agriculture to non-agricultural trades, more particularly to industry, must take place for the good of the country as a whole, as well as for that of agriculture; in the southern regions of the country we still have, even with today's structure of farming, certain surpluses of manpower in the countryside, which unproductively burden Polish agriculture.

In the light of what has been said above, the policy of industrializing the country ought to be varied, also in the interests of agriculture. For instance in over-populated areas or such as have poor potential possibilities for the development of agriculture, as well as low living standards, the location of industrial plants in small towns may not be followed by much investment in residential building. In such cases commuting to work will raise the living standards and culture of the inhabitants of those regions, while the expansion of household allotments will not inflict any more serious damage to agriculture, since its economy in any case does not yield much in the way of commercial production.

On the other hand, in the regions with better potential conditions for agriculture, particularly those where more has been invested in agriculture,

and those more sparsely populated, the construction of new industrial plants ought to go hand in hand with the construction, around them, of residential districts. In such a case manpower for the industries ought to be recruited from farther-lying regions, for limited commutation to work and the results which flow from it would not disorganize the well-established, productive and commercial farming.

The inclusion of the several regions of the country in one or other category, or in mixed categories, however, demands geographical investigations into all the agricultural problems of such regions. Such research, as being of immediate utility for the planning of the development of the country, would undoubtedly be research in the field of the applied geography of agriculture.

This, of course, is but an answer for today and, possibly, for tomorrow. In a more distant future the modernization of Polish agriculture is an indispensable thing. It will take place parallel with a further strong industrialization and urbanization of the country. Such modernization ought to be based on a good knowledge of natural conditions and of the areal differentiation of agriculture, of its systems, orientations, types and zones, as well as on the elaboration of the precise quantitative methods of defining, distinguishing and individualizing them. In this work geographers may play an important part.

Bibliography

[1] Biegajło, W., "Gospodarka rolna w strefie podmiejskiej. Gromada Horodniany" (Sum. Agriculture in suburban zone. The commune of Horodniany), *Przegl. geogr.*, 29 (1957), 1, 143–158.

[2] Dobrowolska, M., "Przemiany struktury społeczno-gospodarczej wsi małopolskiej" (Sum. Changes of socio-economical structure of the village in Lesser Poland), *Przegl. geogr.*, 31 (1959), 1, 3–32.

[3] Dobrowolska, M., "Badania nad geografią osiedli południowej Małopolski" (Sum. Research on the geography of settlement in the southern Poland), *Roczn. nauk.-dydakt. WSP*, 8, Kraków 1958, 93–124.

[4] Dziewicka, M., "Liczba gospodarstw chłopsko-robotniczych i małorolnych niezarobkowych w Polsce w 1957 r." (The number of peasant-worker and small-owner holdings in 1957), *Zagadn. ekonom. roln.*, 47 (1961), 5, 125–135.

[5] Kostrowicki, J., "Geographical typology of agriculture in Poland. Methods and problems," *Geographia Polonica* 1, 1963, 111–146.

[6] Kostrowicki, J., "Problematyka małych miast w Polsce w związku z badaniami nad warunkami ich aktywizacji" (Sum. Small towns in Poland and their problems), *Przegl. geogr.*, 25 (1953), 4, 12–52.

[7] Niemiec, J., "Wpływ przemysłowego ośrodka Gorlic i Glinika Mariampolskiego na rolnicze zaplecze (na tle stosunków społeczno-gospodarczych powiatu gorlickiego)", (Sum. Glinik Mariampolski and its influence upon the surrounding country), *Roczn. nauk.-dydakt. WSP*, 8, Kraków 1958.

[8] Ostrowski, W., *Świetna karta z dziejów planowania w Polsce 1815–1830* (A magnificent period in the history of planning in Poland 1815–1830), Warszawa 1949, pp. 98.

[9] Pounds, N. J. G., *The Upper Silesian Industrial Region,* Bloomington 1958, pp. 242.
[10] Raszeja, E. and Tobjasz, J., "Niektóre zagadnienia produkcji rolniczej GOP" (Some problems of agricultural production in the Upper-Silesian Industrial Region), *Roczn. nauk. roln.* 75-G-3 (1959), 562–593.
[11] Szczęsny, R., *Sprawozdanie z użytkowania ziemi w powiecie Myszków* (A report for the land use survey of the powiat of Myszków), Institute of Geography, Polish Academy of Sciences, (Manuscript).
[12] Tobjasz, J., *Rolnictwo obrzeża miasta Nowe Tychy* (The agriculture in the surroundings of the city of Nowe Tychy), Pol. Academy of Sciences, Committee for the Upper-Silesian Industrial District, Warszawa 1962, pp. 142 (mim.).

AGRICULTURE AND URBANIZATION IN ENGLAND AND WALES

Harry C. K. Henderson

In this country the competition for land is more acute than in Poland. England and Wales include a population of 46 million people who live in an area 150,000 km² whereas Poland has nearly 30 million living in 312,000 km². This means we have 50% more people to accommodate in half the area and it was estimated that urbanization of land would amount to 500,000 acres (200,000 ha) between 1951 and 1971.

Competition for land began to be publicized with the development of planning authorities[1] and the resultant element of control and of careful consideration of individual cases upon which has been built the structure of a means of assessing the claims of the various interests. One of the early considerations was the argument concerning what became known as the garden controversy. Do gardens produce as much food as farmland? On the evidence of two separate inquiries it was estimated that the average housing estate with about 10–12 houses to the acre about 14% of the land cultivated for vegetables and flowers.

Such estates have often been built on the type of land that can be classified as "better than average" and the estimated yield in terms of farm crops would be about £ 45 per acre at farm-gate prices. It was also estimated that the yield per acre of the gardens of the housing estates would be about £ 42 per acre at retail prices, on which basis a householder would need to grow sufficient flowers or vegetables to save a retail expenditure of £ 4 sterling per annum, to compensate for loss of farm land.

These arguments are faulty on several scores—first, it is wrong to take the retail value in the one case and the farm gate value in the other when one is arguing on the basis of productivity of land and the loss of national resources.

[1] The Ministry of Town and Country Planning was set up in 1943 and an Act of Parliament was passed in 1947 to provide a framework or pattern of land use throughout the country, by means of development plans drawn up by local planning authorities (Counties and County Boroughs) and approved by the Minister (now the Minister of Housing and Local Government).

Secondly, there is no allowance made for parks, sports grounds, factory sites, shops, all of which reduce the housing density over an estate or a new town as a whole.

Thirdly, it is a gross underestimate of land values and crop-cash yields in many cases where market gardening has been displaced. E. C. Willatts raised this particular point with reference to the building of a new reservoir near Staines but later on Heathrow airport led to the demolition of the village of Heathrow and of many acres of market garden land and glasshouses.

Fourthly, it is insufficient to take just market price yields as a guide to value as the capital investment has often been very high and should also be taken into account, as for example in the case of the Worthing tomato glasshouses, the Lea Valley (1000 acres i.e. 400 ha of glasshouses) and the Taplow Terrace areas of S. W. Middlesex.

In 1960 the value of horticultural crops in England and Wales was £ 140 million produced from 400,000 acres (160,000 ha) of market garden vegetables and 290,000 acres (116,000 ha) of fruit—this gives a cash return at farm gate prices of £ 200 per acre (£ 80 per ha) per annum which would necessitate a garden yield of £ 20 per house garden at farm gate, not at retail, prices. The value of field crops was £ 260 million from a total of about 8 million acres (3·2 million ha) which gives a value of £ 32·10·0 per acre (£ 13 per ha) and leaves the farm gate value of "better than average" land at about £ 45 per acre (£ 18 per ha).

The value of glasshouse crops was c. £ 28 million or £ 7000 per acre (17,500 per ha); the tomato crop alone was valued at £ 100,000 and considerable areas of glasshouses have been lost in the areas named above.

Two major changes are taking place in the farm cropping systems of England. First, farmers within a limit of about 15 miles (25 km) of quick-freeze plants are growing market garden crops such as peas or beans in their normal rotation. Secondly, a more far reaching change is taking place in the normal rotation as barley is becoming the dominant cereal. Wheat is maintaining its importance but oats and root crops are both declining rapidly as farmers are preferring barley for feeding stock especially as this crop is well subsidized. Both these features will inevitably affect land values in certain areas but the former may revolutionize the distribution of market garden crop production.

One of the more satisfactory tools for valuing land in terms of productivity has been the Land Utilization Survey which was undertaken in the early 1930s during the world economic depression and under conditions which triggered the development of the various forms of subsidy which British farmers now enjoy. It is reasonable to assume that land in cultivation as tillage or in more intensive use in the early 1930s is land of high quality and value.

On the basis of this argument we can consider three areas in which urban

growth has spread rapidly over agricultural land. First, Manchester, a conurbation of relative stagnation, with a inner area of 145 km² in the adminis-

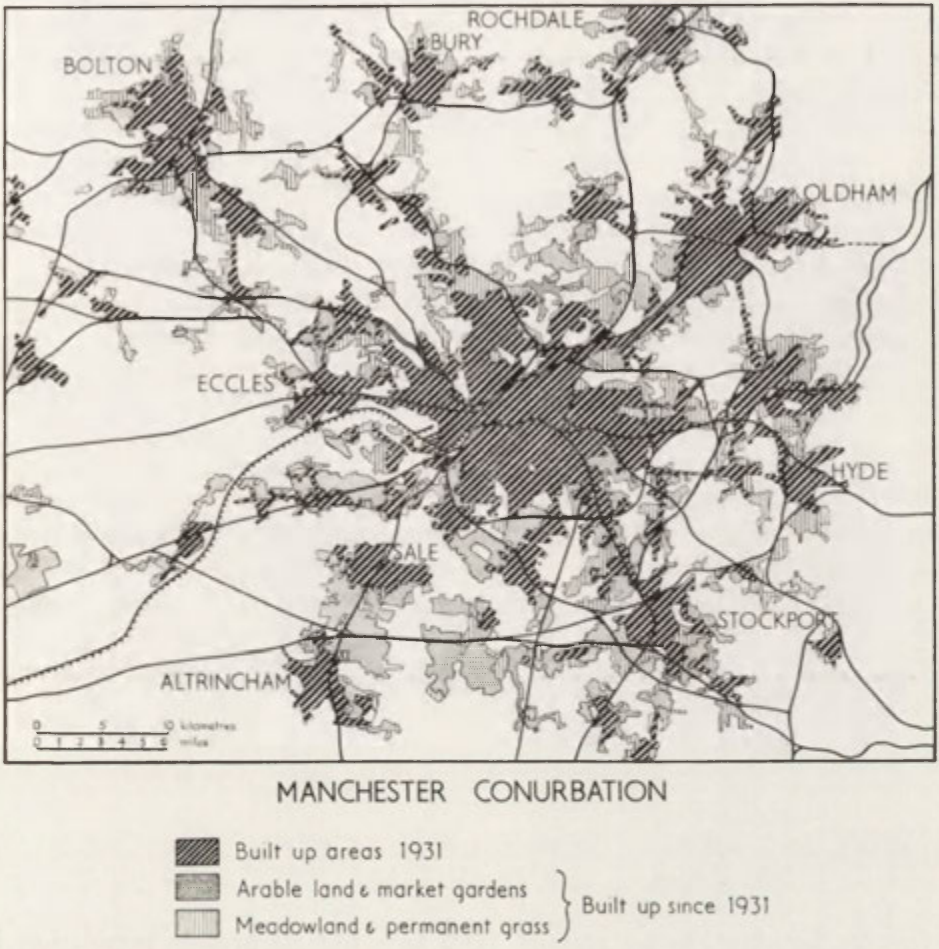


Fig. 1. Manchester conurbation

trative areas of Manchester, Salford and Stockport, is spilling beyond its old boundaries because of the general reduction in housing density. The population changes are given below:

(Thousands)	1921	1931	1951	1961	Area in km²
Greater Manchester	1020	2046	943	876	145
S. E. Lancashire	2361	2427	2623	2427	980

Thus south-east Lancashire shows stagnation as a whole, while Manchester

itself has declined by 144,000 over the last forty years. Nonetheless the areal expansion has continued especially westwards and the accompanying map reveals that since 1931, a very considerable area of better quality agricultural land has been absorbed especially between Sale and Altrincham. In other directions, the expansion has not taken place on to previously intensively cultivated land.

Secondly, in the part of Sussex which it has been suggested should become a separate county for administrative reasons and is certainly a seaside conurbation, the boroughs of Brighton and Hove form a nucleus from which expansion of the urban area has occurred mainly in a westerly direction, along the Sussex coastal plain. The conurbation has a total area of 160 km².

(Thousands)	1921	1931	1951	1961	Area in km²
Brighton	142	147	156	163	
Hove	46	55	69	73	
Central Sussex	260	290	358	398	160

It is seen that the population of Brighton has increased only 14% but the map shows that the built-up area has nearly doubled, while Central Sussex as a whole has experienced an increase of 54% in its population and 295% in its area of which the vast majority was arable land or nursery gardens including a considerable acreage of glasshouses in the Worthing area.

Thirdly, West London has been mapped similarly: this is another area of very rapid expansion.

(Thousands)	1921	1931	1951	1961	Area in km²
Greater London conurbation	7488	8216	8348	8172	1840
West London	151	251	406	436	180

Greater London has an area of 1840 km² and its present population is 8,172,000 persons. The area of West London on the accompanying map is about 180 km²; it had a population of 151,000 in 1921, rising to 436,000 in 1961, an increase of 189%. Again the map shows that more than half the area built over since 1931 was at that time under the plough and much of this was intensively cultivated for fruit and vegetables in south-west Middlesex on the Taplow Terrace. London Airport lies on this terrace but appears as open space on the map.

One may well enquire in the first place why so much land should be absorbed for housing and secondly why should so much first quality land be used. In the first case, we know from sample studies conducted by the Ministry of Housing and Local Government that the preferences are for (1) detached

house, (2) semi-detached house, (3) terraced house, (4) maisonette, (5) flat on the ground floor or the top floor, (6) flat on some other floor. This order of preference is based on samples in England and Wales: English folk like gardens with an open building plan, whereas in Scotland, under difficult conditions, both social and climatic, the residents of the new town of East Kilbride have shown an unwillingness to maintain gardens. On this evidence, new plans

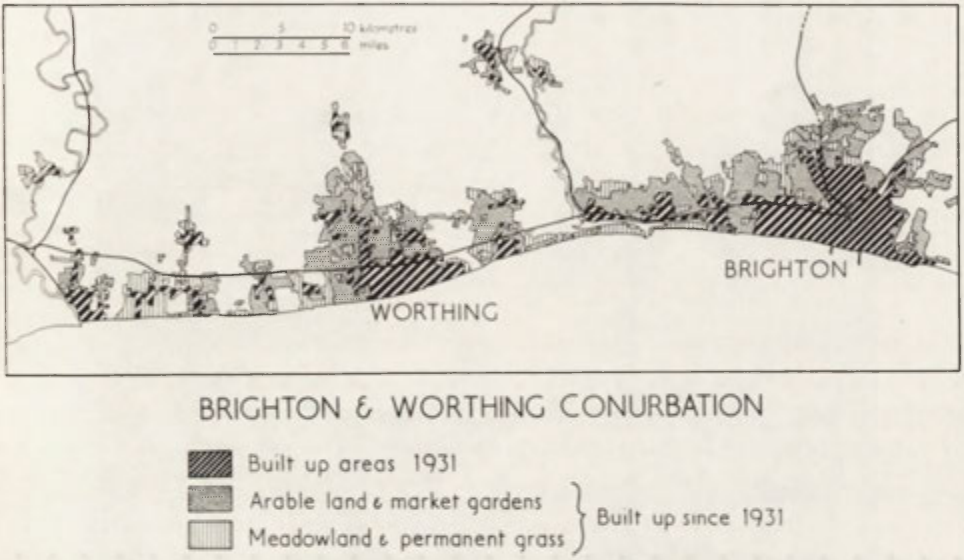


Fig. 2. Brighton–Worthing conurbation

which involve the construction of tenements and an "umbrella" shopping district have been developed. The cost in terms of construction increases with the height of the building and it is claimed that tenements with more than four of five storeys are uneconomic. Nonetheless many tall blocks of flats with ten or twelve storeys are being constructed even in new towns where land values are much less than in the centres of cities. The more open density of 10 or 12 houses per acre (25 to 30 per hectare) necessitates a much heavier expenditure on public services. Crawley New Town has a density of 10 houses per acre (25 per hectare) and occupies 26 km² of land with a cost for sewerage, water and roads of about £ 3 million. Harlow has a higher building density at 12·5 houses per acre (31·5 per hectare) spread over a total area of 27 km² and the sewers and roads expenditure is about £ 2·4 million.

Recently, there has been a marked tendency to increase the proportion of dwellings which are in multi-storeyed blocks. In 1958 36% of the new dwellings erected in England and Wales were flats. In 1959 the percentage was 41 and in 1960 it has increased to 46%. About one third of these flats were in multi-storeyed blocks such as in the central areas of slum clearance in

Fig. 3. West London

Birmingham and in Salford, or in the East End districts of London such as Poplar and Stepney.

Another restraining influence on areal expansion has been the official policy of "in-filling" announced by the Ministry in 1960, which encourages the increase of density on land already withdrawn from agriculture but carrying, for example, only one or two houses to the acre (2·5–5 to ha).

A last comment on the flow of population to south-east England and to London in particular is perhaps of interest to Polish colleagues. For many years, London grew by migration from rural areas in the British Isles but most of the modern immigrants to the area come from industrial districts in northern England, Wales and Scotland.

Bibliography

[1] Best, R. H. and Ward, J. T., *The garden controversy*, Department of Agricultural Economics, Wye College, University of London 1956, pp. 31.
[2] Wibberley, G. P., *Agriculture and urban growth*, London 1959, pp. 240.

CHANGES IN THE GEOGRAPHICAL ENVIRONMENT BROUGHT ABOUT BY INDUSTRIALIZATION AND URBANIZATION

Sylwia Gilewska

Up to the Second World War, the anthropogenetic transformations of the geographical environment in Poland, still an agricultural country, were comparatively small. Most intensively altered were the two coal basins, of Upper Silesia and of Wałbrzych. In the post-war years, as a result of the rapid industrialization of the whole country, these changes assumed much larger proportions. Lately, open-cast mining of soft coal i.e. lignite (Turoszów, Konin, Adamów) as well as of sulphur (Tarnobrzeg) is developing. New collieries (in the Coal Basin of Rybnik and around Spytkowice) and copper mines (Legnica) and numerous large chemical plants (along the Vistula) are at present under construction. Thus new problems arise, connected with the rehabilitation of areas laid waste by mining and industry.

The extent of the transformations and changes in the natural geographic environment caused by this intensive industrialization may be discussed by taking as an example the relatively small area of the Upper-Silesian Industrial District (in Polish: Górnośląski Okręg Przemysłowy, generally abbreviated to GOP). Within the scope of research work allotted to the special committee of the Polish Academy of Sciences under the direction of Prof. S. Leszczycki, and concerned with studies of the development of GOP, an exhaustive and detailed analysis was undertaken of the nature and relief of this district, its hydrology, climate, vegetation and soils, and of the extent of the destruction which threatens it.

Upper Silesia in an upland area across the watershed of the Odra and Vistula rivers. Geologically it is built of coal-bearing Carboniferous sediments and of Triassic rocks among which the ore-bearing dolomites (containing lead, zinc and silver) are of great economic importance. Upper Silesia has been an important mining and metallurgical centre since the 12th century. Traces left by the mining industry of the earlier period (mainly of non-ferrous ores) are the numerous waste lands (*warpie*) which date from the 17th, 18th and early 19th centuries.

A further development of iron smelting and later on of coal mining took place at the end of the 18th and the beginning of the 19th century. At this time, bituminous or hard coal was extracted in a most primitive way, mostly from surface excavations, and the barren rock and furnace slag were used to fill in workings or to level uneven ground. Since the second half of the 19th century, the more rapid development of mining and metallurgy has been accompanied by the formation of huge dumps of waste rock and slag, frequently in the immediate vicinity of settlements and of the scant forests, thus seriously impairing sanitary conditions through fumes and dust from the burning heaps. Since 1901, the area of waste land of industrial origin has also increased by numerous small sand pits where sand was taken for hydraulic back-filling of the worked-out mines. The total area of industrial waste land in Upper Silesia now exceeds 30,000 hectares.

Of the total area of GOP (2374 km²) the central part embracing 704 km² contains 85% of the bituminous coal mines active today in Upper Silesia, all its zinc and lead mines and more than 85% of other industrial plants. This district possesses at present the greatest density of population in Poland. The total number of inhabitants is 1·69 million, the mean density of population about 1970 per km² and in some of the towns well over 2000.

The result of this tremendous concentration of mining, heavy industry, transport facilities and housing in GOP is a complete transformation of the natural geographical environment. This has been brought about by changes in the relief of the land, in its hydrological conditions, its micro- and meso-climate, its soils and its vegetative cover.

A. Changes in the relief of the land

I. Forms created by man's accumulating activities.

Waste dumps most frequently occur in the central part of GOP, directly adjoining the various scattered coal mines and iron works. New waste dumps are beginning to appear also in the Mining District of Rybnik where mining of bituminous coal has recently been started. In GOP, the dumps occupy some 2000 hectares; two thirds of this total area comprise dumps from bituminous coal mines, the remainder being slag from smelters and refineries. The area of waste dumps grows annually by 67 ha of which 50 ha are due to coal mining. More than 20% of the piles are on fire through spontaneous combustion.

From their origin we may distinguish:

(a) dumps of collieries where barren rock from coal mining is discarded,
(b) dumps of barren and gangue rock from zinc mines,
(c) dumps of barren and gangue rock from iron ore mines,

(d) dumps of limestone quarries where waste materials from the production of lime and cement are discarded,

(e) waste materials from flotation of zinc,

(f) slag dumps, including furnace cinders, blast furnace and open-hearth slag,

(g) dumps of zinc slag containing residues from zinc smelters,

(h) various other dumps (waste from chemical plants, sewage farms, etc.).

Dumps may also be differentiated as to their shapes (conical, dome- or table-shaped, crested, level-topped), their state of thermic and chemical activity (active, a flame, or passive, burnt out or partly burnt out), stage of use (active, abandoned, in exploitation) or their vegetation cover (barren, afforested, etc.).

Dumps often exert a very harmful effect on their neighbouring land:

(a) Frequently they act toxically on the vegetation; periodically they increase the salinity of the soils and influence the chemical character of the groundwater.

(b) Their chaotic distribution impedes the natural run-off of surface waters.

(c) Deformation of the ground caused by the pressure of the dumps on the plastic substratum leads to the destruction of roads, drainage systems, etc.

(d) They modify the conditions of microclimate; slag dumps on fire pollute the air, barren rock dumps are sources of dust clouds, and so on.

Dumps are destroyed by: (1) natural processes such as chemical and mechanical weathering, erosion by rainfall and floods active on the bare surfaces of steep slopes, mass movements similar in character to land slides, movement of rock debris along slopes, wind erosion; (2) the action of man.

The schemes for recultivation of industrial dumps in GOP have principally in view: (1) *The reclamation of existing dumps* by planting (provided that in the case of colliery spoil-heaps the burning process has ceased). The regional plan provides for reclamation by planting of some 649 ha of dumps, mainly colliery spoil-heaps. However, such development is fraught with serious difficulties. Detailed research has shown that, in view of the considerable variability as to their physical, chemical and microclimatic properties, the different dumps or even parts of dumps, require different methods of reclamation. Thus, for instance, all efforts towards planting on dumps of flotation wastes have proved futile. (2) *The removal of dumps* for the filling in of depressions and old pits of various origins, for the levelling of the ground or building up of embankments and terraces as well as at least partly, for the back-filling of the worked out underground pits and mines. (3) *Utilization of dump material* by use of specific technological processes depends on its physical, chemical and mineralogical composition; thus slag is used for manufacturing precast concrete elements, and fertilizers; shales can be used for manufacturing various ceramics for building purposes. Some of the old dumps of coal mines and of iron and non-ferrous metal foundries, frequently containing

valuable raw materials, are going once more to be worked over for coal or metal ores within the next 50 years. Even so, the utilization of dump materials is so far extremely small; in 1950–1956, it amounted to barely 12·6% of the annual increase in the volume of dumps.

II. *Forms created by man's destructive activities.*

1. *Forms caused by surface exploitation of mineral resources.* (a) Sand, clay and gravel pits: The distribution of sand pits for extraction of sand for hydraulic back-filling of worked out underground mines depends on the occurrence of deep pre-quaternary valleys filled with a thick series of fluvioglacial and fluvial sands. Between 1901 and 1950, each coal mine had its own sand pit usually situated on the outskirts of towns in the central zone of the GOP. Since 1950 sands have been exploited from pre-quaternary river valleys further towards the periphery of GOP (the valleys of the Jaworznik, Biała and Czarna Przemsza rivers and Kłodnica valley) as well as the Błędów desert. Often the depth of the sand pits exceeds 20 m while their length reaches several kilometres. In the period from 1901 to 1960 the sand pits covered an area of some 4000 ha; in the period from 1961 to 2000, the exploitation of sand is expected to extend over an area of 20,000 ha 90% of which is at present covered by forests.

There are several possibilities for the reclamation of abandoned sand pits. Up to now some 120 ha have been occupied by water storage basins, about 90 ha for the dumping of colliery spoil, about 140 ha have been re-afforested and about 160 ha re-afforested and adapted to recreation purposes. In future construction of settling basins and filtering plants for industrial sewage as well as of swimming pools on 3000 ha is foreseen. About 2000 ha will be filled up with materials from dumps and then re-afforested and some 10,000 ha will be simply re-afforested.

(b) Areas abandoned after open-cast mining of bituminous coal. Their total surface does not exceed 300 ha. Many smaller workings have been already completely filled in after coal extraction ceased. Unfortunately, as a result of the high acidity of the heavy clays and the admixture of iron and sulphur compounds these filled areas remain as waste land. The largest open-cast mine at present in operation has a length of more than 1000 m, a width of 500 m and a depth of more than 90 m. The question how to re-cultivate the waste land left by this mine has perhaps not yet been answered.

As with sand pits, the harmful effect of open-cast mining of bituminous coal consists in the drying-out of springs and the general lowering of the groundwater table, resulting in increased aridity in the surrounding area.

(c) Waste land connected with small coal pits on outcrops of bituminous coal, such as the areas left after the so-called *bieda-szyby* (poor squatters pits) from the inter-war period.

(d) Dumps left after former open-cast exploitation of zinc, lead and silver

ores, on the outcrops of ore-bearing dolomites in the region of Bytom and Tarnowskie Góry. These will probably be afforested.

(e) Quarries of sandstone, limestone and dolomite. These are partly to be filled in; the majority however will remain as waste land.

2. *Forms connected with underground exploitation of mineral resources.* These forms are produced by subsidence of the ground over the old mine workings. We may distinguish: (a) wide basins with gently sloping margins; they develop, in cases of deep exploitation, in rock formations tending to subside; (b) soft terraces forming on the surface along fault lines; (c) subsidence areas in the shape of funnels or trenches, appearing singly or in groups; they exploitation of the coal seams subsidence lasts from 6 to 8 years, at times as well as from the flushing of quicksand deposits into mine workings.

Recently the systematic removal of supporting pillars in coal seams under urban residential and industrial areas has been started and, as a result of this form of exploitation, a uniform subsidence of large areas is expected. Such settling of the ground is in Upper Silesia a long-term process. After full exploitation of the coal seams subsidence lasts from 6 to 8 years, at times as long as 30 years.

Depressions connected with subsidence of the ground over the mines are very common in GOP. They present some danger both to residential development and industrial plants. Often they introduce inversion of the relief, and in the floors of the river valleys they sometimes cause erosion and sometimes fluvial accumulation. Deep depressions are often submerged or swampy; consequently in forests trees in some areas die because of the excess of water in the ground, while on the surrounding higher land they are desiccated by the lowering of the groundwater table. The problem of how to re-cultivate such areas is still unsolved.

The data presented above show that in GOP the anthropogenetic forms are of different age and origin. Their morphogenetic role is various. Thus, on the one hand, the dumps tend to preserve the natural forms of the surface of the earth, on the other hand, they introduce new convex forms strongly modifying the surrounding landscape. In yet another cases, in deep and extensive excavations such as sand pits and open-cast bituminous coal mines, the old pre-quaternary relief of Upper Silesia covered by a thick mantle of quaternary deposits is exhumed. Generally speaking, in this manner man increases the differences in the relief of the region.

B. Changes in water conditions

The Upper-Silesian Industrial District is by no means rich in water resources, as it is situated on the main watershed; thus its water economy is

fraught with enormous difficulties. As a result of the very high degree of industrialization, the natural circulation of water is much disturbed.

I. *Changes in the level of the groundwater table.*

1. Open-cast exploitation of mineral resources lowers the water level in wells, causes the disappearance of springs and dries swampy valley floors in the vicinity of the mines; in mine workings, water accumulates on an impermeable substratum, forming underground reservoirs.

2. As a result of underground mining of bituminous coal and non-ferrous ores: (a) river water escapes into the fissured substratum and floods mine workings (e.g. the river Brynica); (b) by pumping of water from deep workings the groundwater table is lowered in large areas leading to desiccation of the surface ground; (c) subsidence of the ground over the old mine workings involves local rise of the ground-water table and flooding of depressions.

The total area of water in depressions and old sand pits exceeds 160 ha. Part of this area (some 50 ha) is used as fish ponds or as swimming pools; even so, the major part is lying waste. Into these waste areas city and industrial rubbish are now dumped, so that the levelled surface can be utilized (e.g. the ground of the Lunapark in Chorzów).

II. *Transfer of water from one basin into another, and pumping of considerable quantities of groundwater to the surface.*

In consequence of the industrialization and urbanization, the demand for water in the GOP is steadily increasing. Because of the lack of drinking water in the central zone of the district, water must be brought in from the periphery where reservoirs have been constructed, as for instance on the Brynica river (at Kozłowa Góra) and on the Upper Vistula (at Goczałkowice). In 1958, the total production of drinking water including the supply from the Goczałkowice storage amounted to 592,000 m^3 daily. Even so, this quantity was inadequate since in 1960 the water demand already reached 832,000 m^3 daily and, in 1970, it is expected to be 979,000 m^3 per day. Consequently, to take care of this steadily growing demand, the construction of a new reservoir in the Czarna Przemsza valley was started (near Siewierz).

Together with surface waters, mine waters are another source supplying industrial water. In GOP, 925,000 m^3 of water is being raised daily from mine bottoms to the surface; of this quantity some 500,000 m^3 are used daily by the coal mines for hydraulic sand-stowage of the workings, and in coal washers, whilst the remaining water is drained off into rivers.

In all these processes large quantities of water are transferred from the basin of the Vistula into that of the Odra.

III. *Water pollution.*

Since large quantities of mine waters from coal pits and of urban and industrial sewage are discharged into the natural run-off of the GOP area, the rivers often carry a flow many times larger than the mean flow from their

natural drainage areas. Altogether the GOP rivers deliver to the Vistula some 1,120,000 m³ and to the Odra some 270,000 m³ of water per day. The composition of the delivered waters is as follows:

city sewage	15%
mine waters (pit waters, washery outflow)	40%
waste water from steel plants	25%
waste water from other industrial plants	20%

In the area of GOP, the waters delivered to river courses are polluted to a very high degree (Fig. 1). The pit waters from coal mines contain

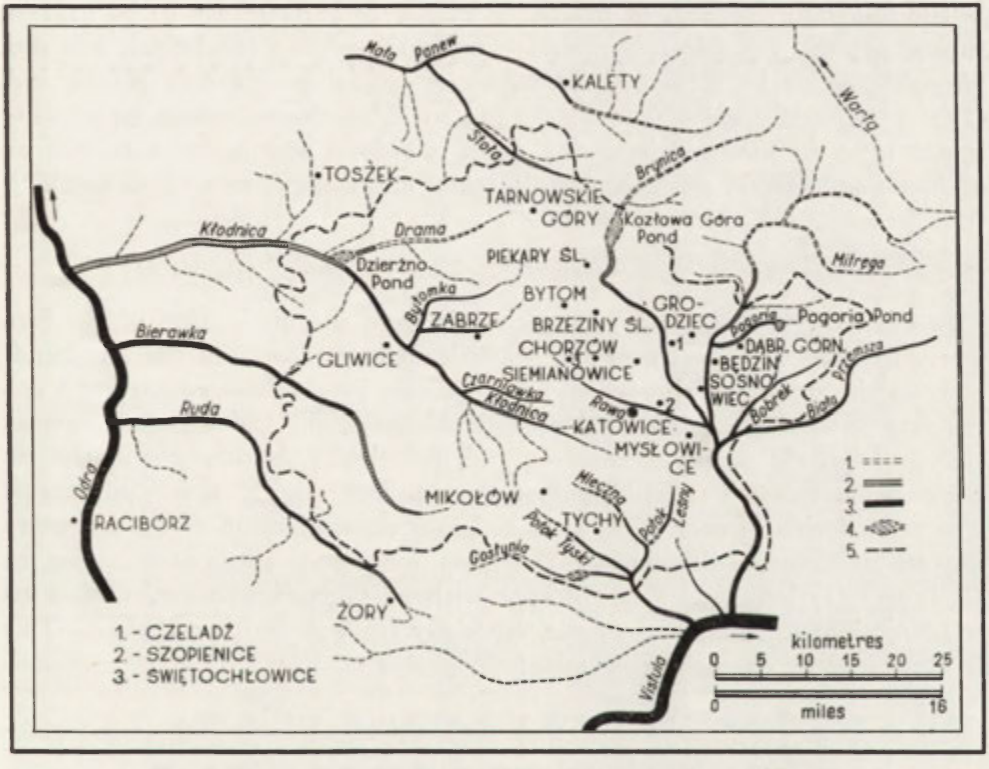


Fig. 1. Stream pollution in the Upper Silesian Industrial District
(after E. Zaczyński)
1. Clean; 2. Moderately polluted; 3. Highly polluted; 4. Reservoirs; 5. Boundary of G.O.P.

considerable admixtures of various mineral salts (NaCl, Na_2O). The pollution of the urban and industrial sewage consists of: (1) non-decomposed organic refuse, mainly from city sewage; (2) insoluble inorganic waste matter in suspension, mainly slack coal and coal fines which settle at the bottom of the rivers, causing there some aggradation; (3) soluble compounds. The Przemsza river alone carries to the Vistula 40–50,000 kg of soluble compounds per hour. In the Vistula the polluting effect of GOP sewage is felt as far

as Cracow. This sewage contains ammonia, nitrates, sulphates (SO_4), chlorides, iron compounds, phenols, heavy and light oils and tar. For instance, an analysis of Rawa water discloses 3115·2 mg of various soluble compounds per litre.

The water in the rivers is polluted chemically and mechanically to such extent that some of them like the Bytomka, Czarnawka, Kochłówka, Brynica and Rawa have lost their character of natural streams and became sewers. Because of the toxic action of these pollutants, animal life in these streams has been partly or completely destroyed.

The following methods of utilization of sewage in GOP are to be used in future: (1) the valuable raw materials from the sewage (coal fines, oils and phenols) are to be recovered by means of special purification plants, and (2) after a purification of the sewage (up to 75%) the remaining liquid substance is to be used for irrigating fields, meadows and pastures as well as orchards and certain waste lands (old mines and dumps) in an area totalling 9000 ha.

C. Changes in micro- and mesoclimate

In the GOP area, climatic changes result from the diminution of the formerly forested areas, pastures and water-logged meadows, on the one hand, and, on the other, by the density of buildings, by the heat emanating from burning spoil-heaps, smoke stacks, and chimneys, oil and diesel motors as well as from the people themselves, and, principally, by changes in the air composition through the addition of gases and chemically active substances. The most decisive factor is the dust and soot contamination of the air, bearing on all elements of climate. The main sources of air contamination in GOP are: (1) industrial waste dumps without vegetation cover, subject to wind erosion; (2) industrial smoke, especially from steam power plants. This is illustrated by the following table:

Table 1. Mean daily dust deposits in the centre of GOP in the vicinity of large power stations

Distance from the power station	Amount of dust deposited in g/m²
50 m	13·79
300 m	19·72
600 m	16·24
800 m	25·52
1000 m	26·95
2800 m	1·81

In the GOP area, dust is deposited at a monthly average of 10 to 15 kg per 100 m². A considerable amount of gas pollution originates in the metal-

lurgical plants which, besides large quantities of CO and SO_2, release volatile compounds of lead, arsenic, zinc and other metals, as well as tar. These quantities of gas and dust in the air are toxic, consequently the immediate neighbourhood of these metallurgical plants is turned into a waste in which vegetation disappears altogether, whilst the inhabitants of housing estates situated in the vicinity of the plants, often fall victims to specific diseases.

The concentration of industrial plants in river valleys leads to accumulation of noxious smoke and dust in the depressions of land, mainly in the lowest layers of the atmosphere. As a result of the stagnation of the air, inversions of temperature and obstructions to insolation develop, the amount of fog increases and visibility is lessened. Moreover, the harmful effect of air pollution extends far beyond the centre of GOP affecting areas where agriculture dominates. This fact may be observed, for instance, by the impairment of the growth of pine and spruce; altogether an area of some 800 km^2 is exposed to those toxic influences.

In view of the data presented, a battle against smoke and dust is imperative to improve the bioclimate of GOP both for population and vegetation.

D. Changes in soils

Over an area of 100,000 ha the major part of the soil has undergone changes due to direct and indirect influences of mining and industry. Frequently the soils have been affected by human action, exposed to the continuous action of neighbouring dumps, to changes in surface relief caused by subsidence of the region and by surface exploitation of mineral resources as well as to changes of hydrological and vegetative conditions. All these changes diminish soil fertility. Moreover, the soils of the GOP district are constantly threatened by the intense action of dust and smoke; locally the pollution of air also leads to the high salinity of the soil. In 1958, the top layer of the soil contained from 250 to 748 mg Zn per kg of dry soil substance or, in other words, the soils on a surface of 1 ha contained 750 to 2250 kg of lead and 900 to 4500 kg of zinc (soil samples were taken in the vicinity of Dąbrówka Mala) whereas soils situated beyond the range of deposition of dust contained but 30 mg of lead and some 90 mg of zinc per kg of dry soil substance. Thus, atmospheric pollution is one of the most important causes of the formation of waste lands in GOP; it also greatly obstructs their reclamation.

The above data clearly indicate that the pernicious effects of air and water pollution are by no means limited to small areas, but are very extended. Consequently the improvement of existing environmental conditions is an extremely difficult and complicated problem.

We have passed in review the wide range of problems encountered in GOP, an area characterized by a powerful concentration not only of mining, but

also of heavy industry and urban development. To obtain a full knowledge of the conditions existing in this area a comprehensive analysis of the whole geographical environment, not of selected elements only, is necessary. The thorough recognition of the difficulties existing in GOP will allow their rational solution and will amass experience for use in other strongly industrialized regions of Poland the number of which is steadily increasing. The investigations hitherto carried out in the GOP area clearly show the necessity of similar complex research in other regions of Poland. Consequently, in 1961, such an investigation of the geographical environment of regions of particular importance in the national economy, indispensable for purposes of regional planning, was included in the research plan of the Committee of Geographical Sciences of the Polish Academy of Sciences. These plans provide for the survey of the following 8 industrial regions: Coal Basin of Spytkowice, Cracow Industrial District, Sulphur Basin of Tarnobrzeg, Copper Basin between Legnica and Głogów, Brown Coal Basins of Turoszów as well as of Konin and Łęczyca, the Valley of the Lower Vistula and the District of Great Mazurian Lakes. On the basis of the detailed study of all the elements of the geographical environment of these regions, estimates are to be made which—we hope—will indicate suitable means for further development of those regions, as well as supply data for proper economic planning.

Bibliography

[1] *Polska Akademia Nauk. Komitet dla spraw Górnośląskiego Okręgu Przemysłowego, Biuletyny* nr 1, 4, 5, 9, 11, 12, 13, 17, 20, 21, 26, 28, 30, 64 (Polish Academy of Sciences, Committee on Upper-Silesian District Affairs, Bulletins)—mimeographed.

[2] *Proceedings of the International Symposium on recultivation of industrial dumps, Leipzig, June 4–9, 1962.* Institut für Landeskultur und Standortkartierung beim Ministerium für Landwirtschaft, Erfassung und Forstwirtschaft (manuscript).

[3] Stokłosa, T., *Ewolucja geomorfologiczna hald w Górnośląskim Okręgu Przemysłowym* (Geomorphological evolution of dumps in the Upper-Silesian industrial district), Department of Physical Geography, Jagellonian University, Kraków 1960 (manuscript).

[4] Thomas, W. L. (ed.), *Man's role in changing the face of the earth,* An international symposium under the co-chairmanship of Carl O. Sauer, Marston Bates, and Lewis Mumford, Chicago 1956.

RECENT INDUSTRIAL CHANGES IN NORTH-WEST ENGLAND AND THEIR SOCIAL CONSEQUENCES

H. Brian Rodgers

A distinction has frequently been drawn between two groups of British industrial regions, the "fortunate" and the "unfortunate" areas. The former, which lie in Midland and Metropolitan England, are regions of quick and continuing economic growth: they are attracting the bulk of both our industrial and our social investment. The latter, the "unfortunate" areas of Wales, Scotland and Northern England, have quite failed to repeat in the twentieth century their quick economic progress in the nineteenth. To them the great changes which are now reshaping the distribution of industry and population in Great Britain have brought little but economic decline, population loss by prolonged migration and intermittent social distress.

Placed in its national context, the North-west is an unfortunate region. In the industrial revolution of the late eighteenth and early nineteenth centuries it made almost explosive economic progress, the result of the enormous but ephemeral success of its cotton manufacture; and until the third quarter of the last century it was increasing its share of the nation's population and wealth. But since the 1890s the population of the North-west has grown more slowly than that of England and Wales and at progressively lower rates (Table 1). The regional rate of increase has fallen from 12% in the decade 1891–1901 to less than 2% in the last ten years, clear evidence of a loss of economic momentum. Though it attracted migrants in great numbers from the rest of the country throughout the nineteenth century, the region is no longer able to support even its own dwindling natural increase of population,

Table 1. Decennial percentage increase in population

	1891-1901	1901-1911	1911-1921	1921-1931	1931-1939	1939-1951	1951-1961
England & Wales	12·2	10·9	4·9	5·5	4·5	4·6	5·3
North-west	12·0	9·8	3·9	2·9	0·5	3·0	1·9

one-half of which has been lost by migration to more prosperous areas during the last decade. This must persist as long as Lancastria's share of the nation's employment continues to fall: during the period 1951–1960 the volume of work available in the two counties grew by only 0·9% in contrast with a national average increase of over 7%. Clearly the increase in employment in the region has been slower even than its sluggish population growth, and it is not surprising that in 1957 it contained only 15% of the country's workers but 20% of the unemployed.

There is little mystery about the cause of Lancastria's economic debility. It is hardly surprising that a region which houses the bulk of Britain's most quickly declining industry, the cotton manufacture, should be suffering serious economic difficulties which are exacerbated, moreover, by the problems of its half-exhausted coal-field. In the past unemployment was widespread and persistent, though it has been mercifully temporary and localized since 1945: it provoked massive emigration southwards during the inter-war period, and this has persisted since the war despite the improvement in the region's unemployment record. Such migration is always age-selective: it has robbed the region of many of its young adults but few of its old people and has thus distorted its age-structure. The textile towns, in particular, now have a relatively elderly labour-force in which large numbers of workers are approaching retirement age, but the reproductive age-groups form a small proportion of their total population with the result that birth-rate has been depressed while death-rate is high. Thus a natural decrease of population is taking place over much of the textile province, and this is becoming an increasingly important cause of the region's adverse population trend.

It would be improper to place the blame for the problems of the North-west wholly upon the declining traditional industries, cotton textiles and coal-mining. The failure of the region to attract new "replacement" manufactures in adequate volume is at least as important a cause. "Footloose" industry avoids Lancastria: all the evidence of the post-war period is that the region can attract its fair share of new industrial investment only when the government's guidance policies are being rigorously applied. Until the early 1950s the North-west acquired rather more than its fair share of new growth, but since then its share has been sub-standard and it has fallen progressively. For the region's failure to secure "replacement" employment on an adequate scale, its peripheral position, its relative remoteness from the main nodes of growth in the Midlands and South and the poor communications of the textile belt are perhaps the chief reasons. But there are social factors. The labour-force of a typical mill-town is not only ageing but also shrinking quickly in size: projections to 1971 show losses of at least 5% by natural wastage alone, and migration may easily double this rate of decline. An industrialist who takes the trouble to do a little social arithmetic is likely to

avoid the textile towns on the grounds of potential labour shortage alone. This is the paradox which bedevils creative planning in the textile zone: towns which are losing their staple industry are beset by problems of present or potential labour shortage which repel the new trades which they need if their economic security is to be restored.

It would be completely misleading to suggest that these problems afflict all parts of the North-west. Like Great Britain, Lancastria can be divided between fortunate and unfortunate districts: over most of the west and south, in the lowlands of West Lancashire and over much of Cheshire, employment and population are growing at rates which equal or even exceed the national average. The textile and mining areas of the eastern uplands and part of the coalfield are the unfortunate regions of industrial decline and population loss. A radical redistribution of the region's employment and population is taking place: the classic pattern of Victorian Lancastria, dominated by the coal-field and the industrialized valleys of the uplands, is breaking down as a second industrial revolution remodels the work of the first.

The decline of the staple industries

Coal-mining and the cotton manufacture no longer completely dominate the regional economy, but they remain the staple trades of much of eastern Lancastria and their instability is still the region's most serious economic problem. No other British industry has suffered such a catastrophe as Lancashire's cotton manufacture. After its prolonged inter-war decline only a remnant, its labour dispersed by war-time concentration, survived to face the problems of the competitive post-war world. In 1951 the industry reached the peak of an ephemeral recovery, but a sharp recession in the following year heralded a worsening crisis which has halved its labour force in ten years. By the late 1950s the industry seemed threatened by extinction: while exports and output continued to decline, cheap imports from Asiatic sources grew with such pace that by 1958/9 they exceeded the yardage of exports. In its extremity the industry appealed for government intervention: it was offered, by the terms of the Cotton Industry Act, a plan for voluntary rationalization by the scrapping of surplus machinery and the closure of redundant mills in return for compensatory payments. The aims of the Act were twofold; to reduce the industry to a size more in keeping with its present prospects and, by the offer of re-equipment subsidies, to stimulate a sadly belated technical modernization. The first of these aims was achieved with spectacular success, for the industry made such indecorous haste to liquidate itself that 49% of the spindles and 40% of the looms were abandoned. It is more difficult to assess the progress of re-equipment in the smaller industry which now survives, but by 1961 three-quarters of the spinning capacity was in ring-mills

and almost one-third of the looms were automatic. But the progress of re-equipment has been impeded by a labour shortage, for this shrinking industry has lost so many workers to other trades or by migration and retirement that there have been great difficulties in recruiting labour for the multi-shift operation without which re-equipment cannot be profitable.

The course and the causes of the decline of the cotton manufacture are less relevant to the present purpose than the social consequences, for the decay of a once-dominant industry must bring critical problems to the communities which it supports. There have been marked regional variations in the rate of the industry's decline over the past decade, and there are strong contrasts, too, in the degree to which the several sub-regions of the textile zone still depend on their old industry. These differences are summarized, together with an outline of population trends, in Table 2, which reveals a simple but significant contrast between the north-east of the textile province and the south-west. In the former (which includes the Burnley, Rossendale, Rochdale and Stalybridge sub-regions) between 24% and 42% of the

Table 2. The decline of the textile industry

Sub-regions	% fall in textile employment		Textile employment 1960 as % of total employment			% losses of spindles & looms. 1959/60(A)		% population change 1951/61
	1952/8	1958/60	Male	Fem.	Tot.	Sp.	Lm.	
Preston	10	1	9	23	14	37	29	5
Chorley	14	+2	17	40	27	59	58	0
Wigan	6	10	5	14	8	20	16	0
Leigh	9	10	10	37	20	41	10	−5
Blackburn	21	21	14	30	20	54	52	−2
Burnley	24	16	24	43	32	77	47	−5
Rossendale	5	1	42	43	43	14	24	−5
Rochdale	11	8	35	55	43	36	6	−4
Bury	15	4	23	37	28	23	33	0
Stalybridge (B)	20	(6)	(27)	(40)	(33)	69	0	−3
Bolton	8	11	18	43	28	53	28	−2
Oldham	15	17	18	36	26	51	30	−4
Manchester	15	20	3	7	5	65	26	−2
Stockport (B)	8	(10)	(11)	(20)	(14)	63	22	12

(A) These data are for areas not precisely comparable with the economic sub-regions.
(B) Figures in brackets are for 1958/9 in column 2, & 1959 in col. 3-5.

employed men are mill-workers, and here the primary income of many families depends on the prosperity of the cotton industry. In contrast, in the sub-regions of the west and south the proportion of men in textile work rarely exceeds 15%, though the mills employ—with a few exceptions—at least

one-third of the working women. In this second division of the cotton manufacturing region any further contraction of the industry would have far slighter social impact than in the first, for it would imperil only the supplementary incomes of wives and daughters.

The contrasts in the rate of decay of the industry cut across this simple bisection of the region. Along the western margin, from Preston to Leigh, where the importance of the mills to male employment is slightest, the industry has survived with least contraction. Over parts of the east, for example at Burnley and Stalybridge, there has been quick decline of the industry in areas which depended upon it for a substantial part of their male employment: here there have been outbreaks of serious unemployment during the industry's crises, and both are areas of rapid population loss. Mercifully, in the two sub-regions in which the mills employ the highest proportions of the working men, Rochdale and Rossendale, the industry has shown a remarkable stability, the result of specialization in heavy and industrial textiles. Should the decay of the industry spread seriously and quickly to these towns with economies of almost Victorian simplicity it could cause a social catastrophe.

Lancashire's second staple industry, coal-mining, bears a much slighter responsibility for the present problems of the region—a reflection both of its much smaller size and its more orderly contraction since 1945. During the 1930s mining was at least as depressed as textile manufacture: cheaper Yorkshire coal invaded the North-western market, and the part-exhausted Lancashire field suffered quick decline through its higher costs of production. In national ownership the industry has achieved greater stability; but employment has fallen from a post-war peak of 51,500 in 1953 to 34,000, and 32 pits have been closed in order to concentrate production on the most efficient units with the largest resources.

Since 1945 the re-distribution of the mining industry of the region has been more significant than contraction. Except for the outlying Burnley basin of the north and the Chorley district virtually the whole of the workable reserve of the field lies in a narrow band in the extreme south, where the exposed coal-measures dip steeply under the Trias to form a narrow concealed extension. As the old, exhausted mines further north have closed, the industry has become concentrated into this linear belt between the eastern suburbs of Liverpool and central Manchester, in which the bulk of investment in modernization has been located and which contains the two new collieries at Agecroft and Parkside. This rationalization and re-distribution of production has already created serious problems, particularly in lengthening the miner's journey to work. Many of the towns and villages of the abandoned coalfield still contain strong communities of miners, though their pits have closed: they are still miners' but no longer mining towns. Their colliers leave them each day for work at the great pits of the south, perhaps ten or fifteen miles distant.

Wigan, in particular, "exports" several thousand miners daily to the pits south of St. Helens and—over longer distances—to the line of collieries between Leigh and Manchester. This increasing separation between home and workplace brings problems not only to men but also to management: wastage and absenteeism are often higher among labour recruited from a distance, and some of the pits which draw much of their labour from far away have failed to reach their optimum efficiency despite expensive reconstruction.

Paradoxically, the mining industry has declined most slowly where it is least important to male employment. In the Manchester area, where the diversity of employment is greatest, there has been virtually no contraction, for closures have been balanced by expansion and by the opening of the Agecroft colliery. This area has excellent resources of profitable coal but slight and unstable resources of mining labour, which it imports on a massive scale. At Leigh, in contrast, the pits are much more important to male employment, but there has been slighter investment in modernization and a quicker decline of the industry. At Wigan, where there is still too little alternative work for men, the industry is extinct; but at St. Helens it still flourishes though here glass-making provides male employment on a very large scale.

The location of the "replacement" industries

Coal and cotton no longer dominate the industrial life of the North-west, though they remain the staple trades of some of its constituent regions. In general they are simply parts of a broadly based economy in which five other industries all provide employment for more than 100,000 workers. One of these, the engineering group, is now roughly equal in size to the textile industry: it provides 11% of the total employment, but it is now much the most important source of work for men.

The essence of the regional planning problem of the North-west is that the new industries have not literally taken the place of the old, but have shown a strong preference for sites off the coal-field and away from the textile zone. Engineering has always been most strongly concentrated in Manchester, and its recent growth has been quickest here and on the fringes of the Merseyside conurbation. Over most of the textile province there has been not growth but decline for the dominant branch here is the textile machinery trade, which has contracted with the industry which it serves. Only where Development Area policy has stimulated its growth, at Burnley, has engineering shown any notable expansion during the last decade in the cotton towns. The development of the vehicle industry has been equally strictly localized: most of the growth has been to the established vehicle manufacture of the Preston–Leyland area, though both Bolton and Burnley have attracted some expansion of employment in this industry, partly through the conversion of

old mills. The great development of motor-car manufacture on Merseyside cannot fail to add enormously to the volume and range of work in an area with an evergreen unemployment problem nourished by a high birth-rate: through the growth of sub-contracting firms its influence may spread deeply into central and south Lancashire but scarcely to the textile towns.

The manufacture of heavy chemicals is an old industry in the North-west and it continues to grow but—like engineering and the vehicle industry—at rather less than the national average rate. Almost the whole of its recent expansion has been along the shore of the Mersey estuary and the banks of the Ship Canal, so that this industry, too, has failed to make any notable contribution to the economic rehabilitation of the mill-and-pit towns. In contrast, the clothing industry has spread widely from its focus in North Manchester to many of the cotton-towns, where old mills are easily adapted by it. But this trade has a dominantly female labour-force, and it is a declining industry both nationally and in the region.

From this mere outline of the locational tendencies of some of the newer industries of the North-west it is evident that they have largely avoided the areas with the greatest need for alternative employment, the mining and the textile communities. This conclusion is corroborated by the patterns which emerge in Fig. 1., in which is plotted the construction of new industrial floorspace licensed by Industrial Development Certificates. The bars on this map are in some senses more significant than the squares for they show the floorspace built *per capita* of the insured population of each of the sub-regions. It is clear that industrial investment has been very unequally spread over Lancastria: the influence of Development Area policy is obvious in the high totals for Merseyside and South-central Lancashire. But the Development Area centred on Burnley in North-east Lancashire has been much less successful in attracting industry, though its record is incomparably better than any other part of the textile zone.

It is emphatically demonstrated in Fig. 1 that the main mass of new industrial development in the North-west has sought sites along the two major axes of communications which traverse the region, the east-west axis of the Ship Canal and the East Lancashire Road and the north-south line of direct road and rail communications to the threshold of the industrial Midlands, now improved by the completion of the M6 motorway. Along the first of these axes the growth of industry has been much faster at the western than at the eastern end: in Manchester industrial expansion has been sluggish, particularly when put in *per capita* terms, and it has largely been confined to the southern and western margins of the conurbation. In contrast, all the sub-regions which cluster about the Mersey estuary have made spectacular economic progress which cannot be explained entirely as an achievement of the government's policies of industrial guidance, for growth has been fastest outside the bound-

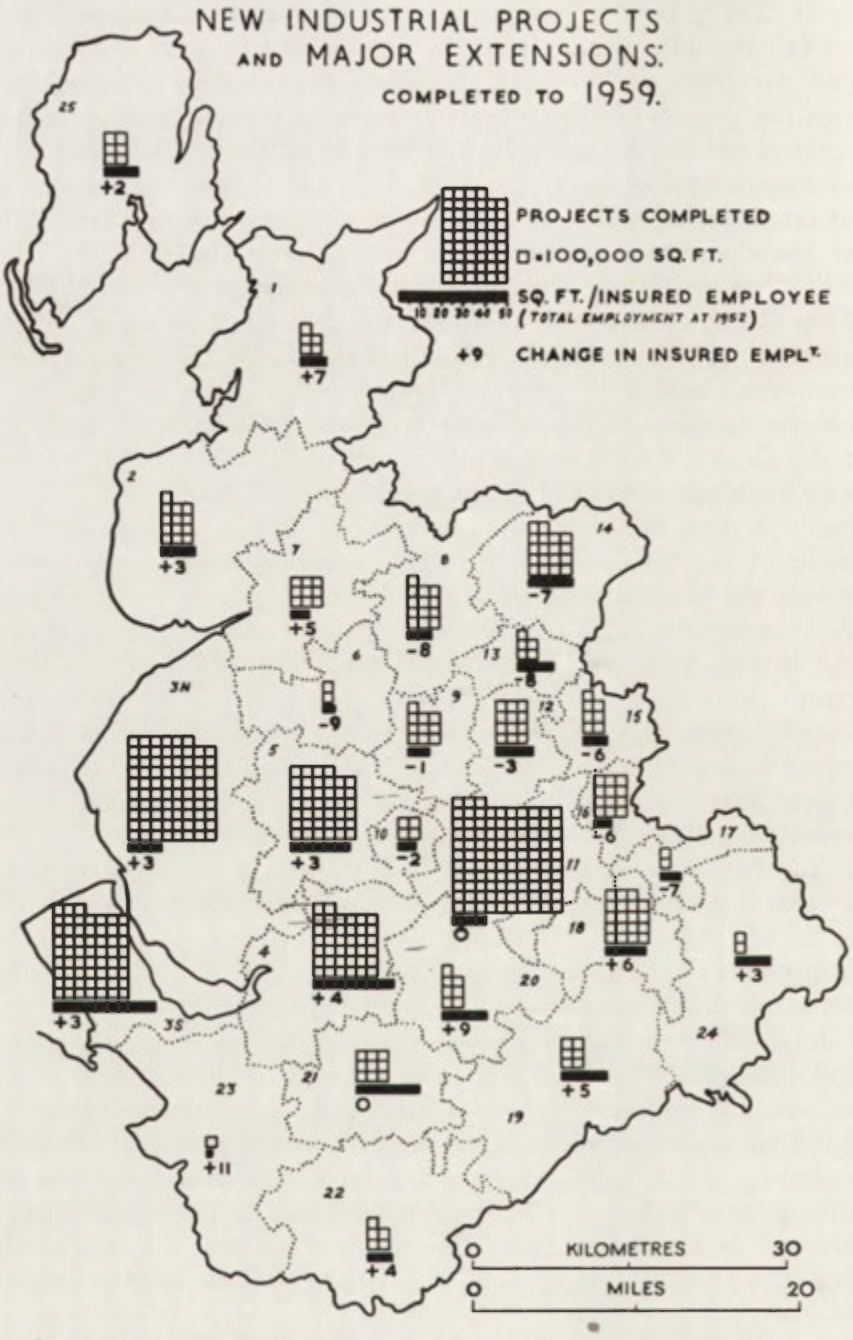


Fig. 1. New industrial projects and major extensions completed to 1959

aries of the old Development Areas. The long north-south belt from Preston to Crewe followed by both the main railway line and the new motorway is clearly destined to attract industrial development at an increasing pace. Already a large proportion of the region's "growth" industry is scattered along it—the vehicle and aircraft factories of Preston, Leyland, Crewe and Sandbach, the glass manufacture of St. Helens, the chemical trades of Warrington and Mid-Cheshire and the new food-preparation plants at Wigan. It is clear that the crossing of the Ship Canal by the motorway near Warrington has immense industrial potential for this is one of the very few sites at which the national motorway system touches salt-water.

There is one aspect of industrial change in Lancashire which is not reflected in Fig. 1, the conversion of empty cotton mill for other uses. Since this has been the spearhead of diversification in the textile towns it deserves brief mention. Of the total of some 1320 cotton mills at work in the region in 1951 620 had closed by September 1962, and of these all but 145 had been taken over by a very great variety of new trades among which light engineering is the most important. Old mills attract new occupants for two reasons: they are available at almost unbelievably low cost, and there is no necessity to seek an Industrial Development Certificate which would be essential for any substantial new building and which would be likely to be refused for any site in the textile area since no part of it is scheduled under the Local Employment Act of 1960. Curiously, it is the Board of Trade's statutory duty to steer new industry away from the decaying cotton towns, but mill-conversion is a fortunate loophole in the machinery of control.

In total the converted mills provide a large volume of diverse employment in trades with better prospects that the traditional industries: recent estimates suggest that they have replaced about two-thirds of the employment lost in cotton since 1951, and certainly this is the chief reason for the surprisingly slight and short-lived distress caused by the decline of the old manufacture. But it is easy to over-value the effects of mill-conversion. Many of the new firms are very small and insecure, and they are not tied to their present sites by a substantial investment in new building. Moreover, not all mills are equally attractive to new tenants: single-storey weaving sheds are more easily adaptable than multi-storey spinning mills, though these have been converted into "flatted factories" in some cases. And old mills with poor road access in deep valleys or along stagnant canals merely crumble slowly away. In short, the impact of conversion on the structure of local employment has varied very greatly from town to town: it has been least, of course, in the areas which still depend most heavily on the textile trades, for here few mills are available for conversion. Thus the economy of the hard core of the cotton province remains undiversified.

A brief commentary on Fig. 2 may prove a useful conclusion to this sketch

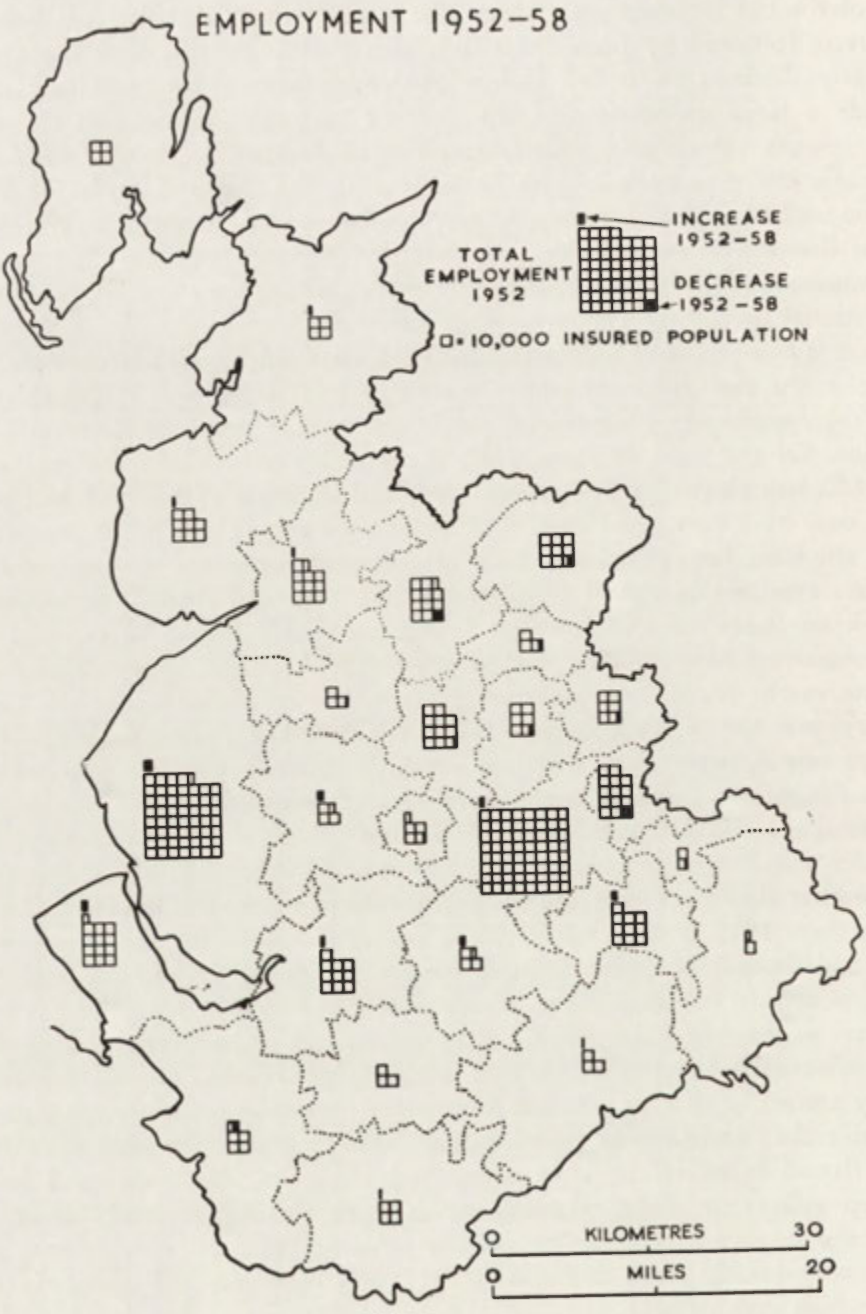


Fig. 2. Employment 1952–58

of industrial trends in Lancastria, for this map shows the over-all change in total employment between 1952 and 1958 and thus it provides a measure of the balance between the decay of the old trades and the growth of the new in each of the sub-regions of the area. The pattern revealed by the map is so simple that it scarcely needs analysis. Employment has shrunk alarmingly throughout the textile areas of the east and north while over the whole of the west and south—except for those rural recesses of Cheshire which have yet to be penetrated by industry—there has been rapid increase. The drift of industry from the upland east and the coal-field to the great axes of communication across the lowlands is clearly demonstrated: indeed, the regional shift is a perfect reflection, in miniature, of the national trend.

The re-distribution of population

In no region of the country is the distribution of population changing more quickly that in the North-west. In outline, these changes are very simple, for they faithfully reflect the industrial trends reviewed above. The three maps, Fig. 3–5, show that the numbers of both population and households have risen at rates which far exceed the national average over most of the south and west and the exceptional losses here (as at Liverpool) are easily explained by short-range suburban migration (for example to Kirkby). In contrast the textile area has lost population at an alarming rate, and the few instances of substantial growth (chiefly at Middleton and Worsley) are the direct result of suburban overspill. These contrasts between east and west are seen most clearly in a comparison of the Manchester and Merseyside conurbations, for the former grew by only 0·2% compared with a 3·5% increase in the latter. Nor is this merely a trick of definition, for if the two conurbations are given their officially "extended" form Merseyside grew at ten times the pace of Manchester.

It is not proposed to discuss the geography of population change in the region in detail, for the maps are self-explanatory, but rather to enquire briefly into the causes. Though some of the data in Table 3 must be treated with caution as approximate estimates, some broad conclusions emerge from it. The areas of strong growth may be divided between those with a high rate of natural increase and those to which immigration is directed. An extensive area of unusually quick natural increase exists: centred on Merseyside, it extends to Preston and Warrington and deeply into mid-Cheshire. Thus the natural trend explains a significant part of the great growth of population in the Lancastrian lowland, though it is strongly reinforced by immigration in the cases of Preston, Crewe and the suburban fringes of both the major conurbations. Conversely the decline of population in the cotton towns is partly—and increasingly—the consequence of natural decrease. The indirect

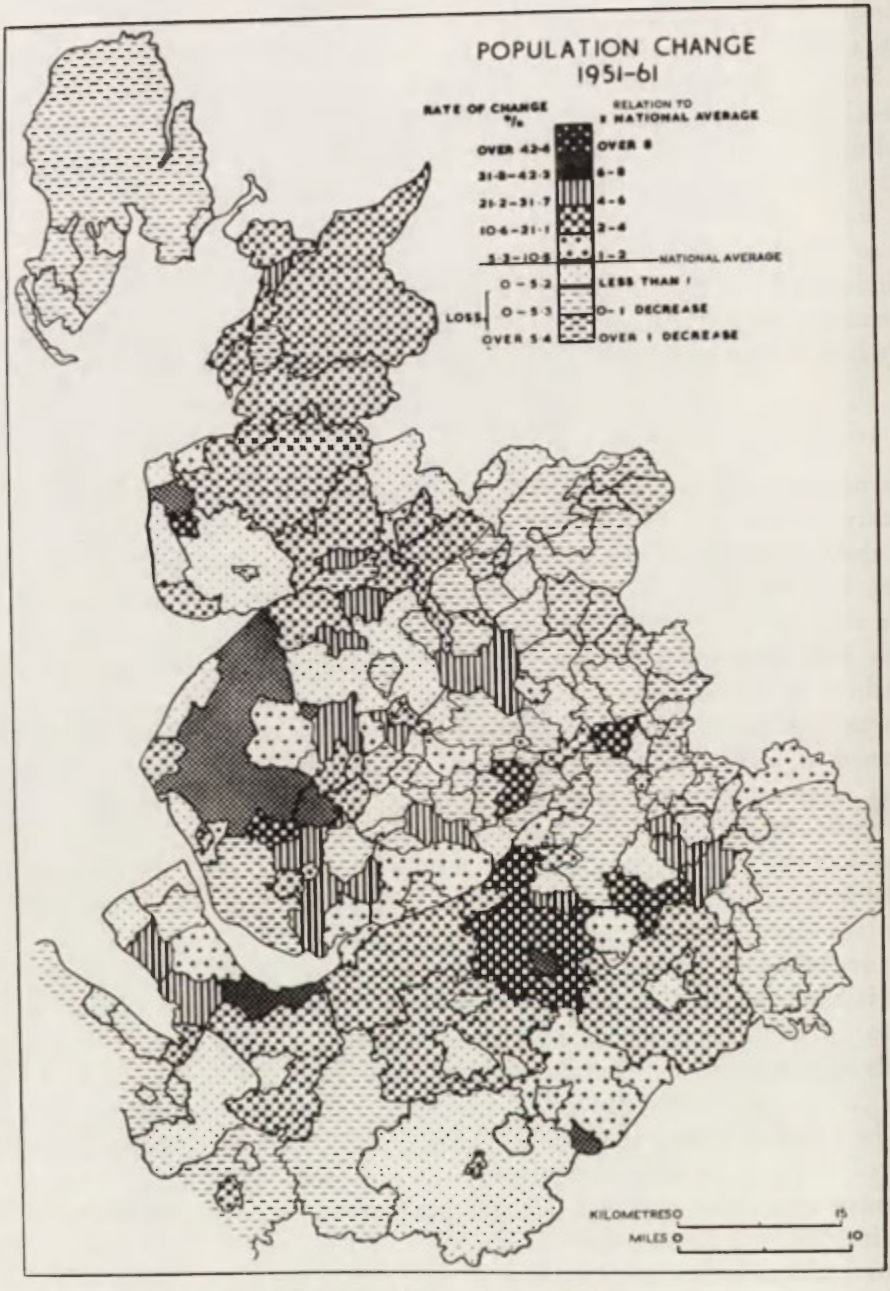


Fig. 3. Population change 1951–61

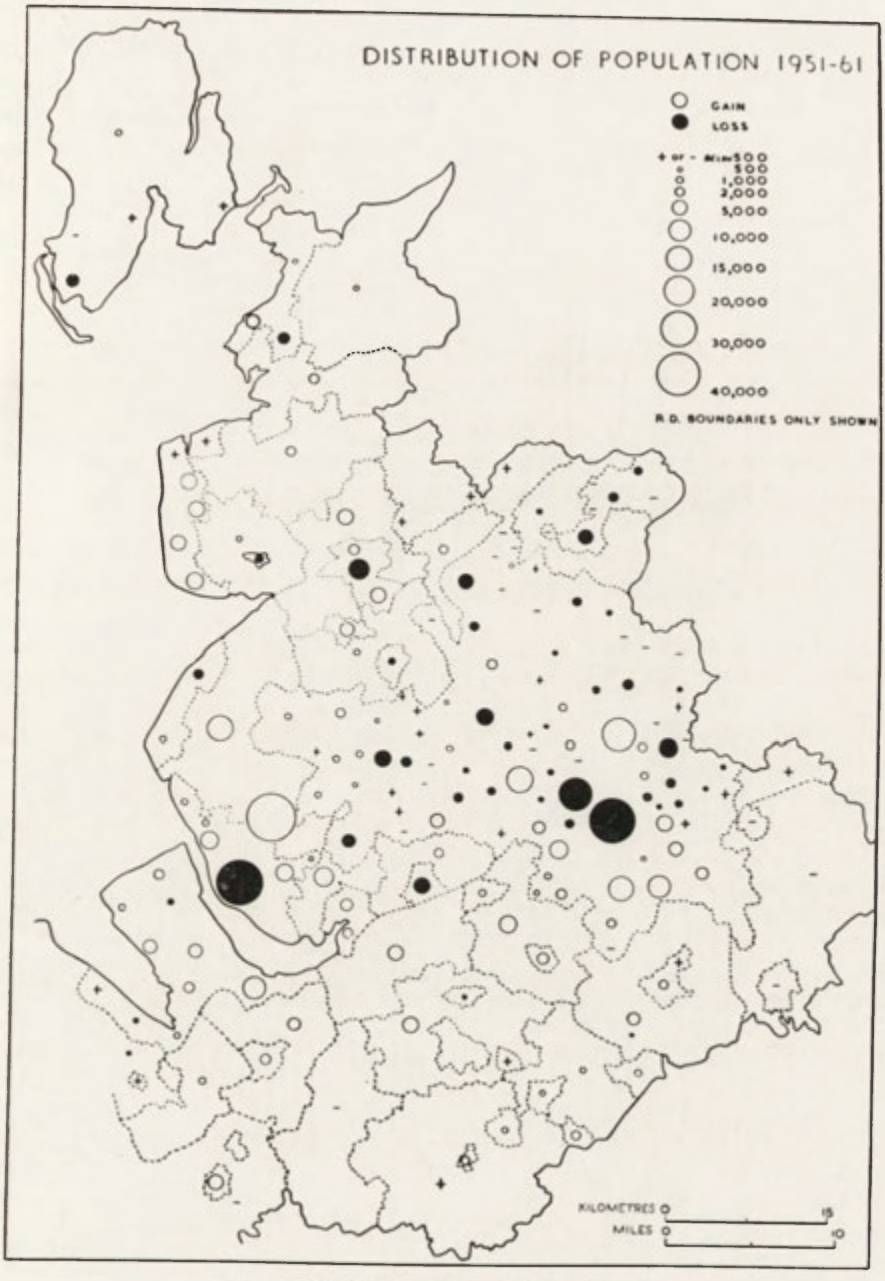


Fig. 4. Distribution of population 1951–61

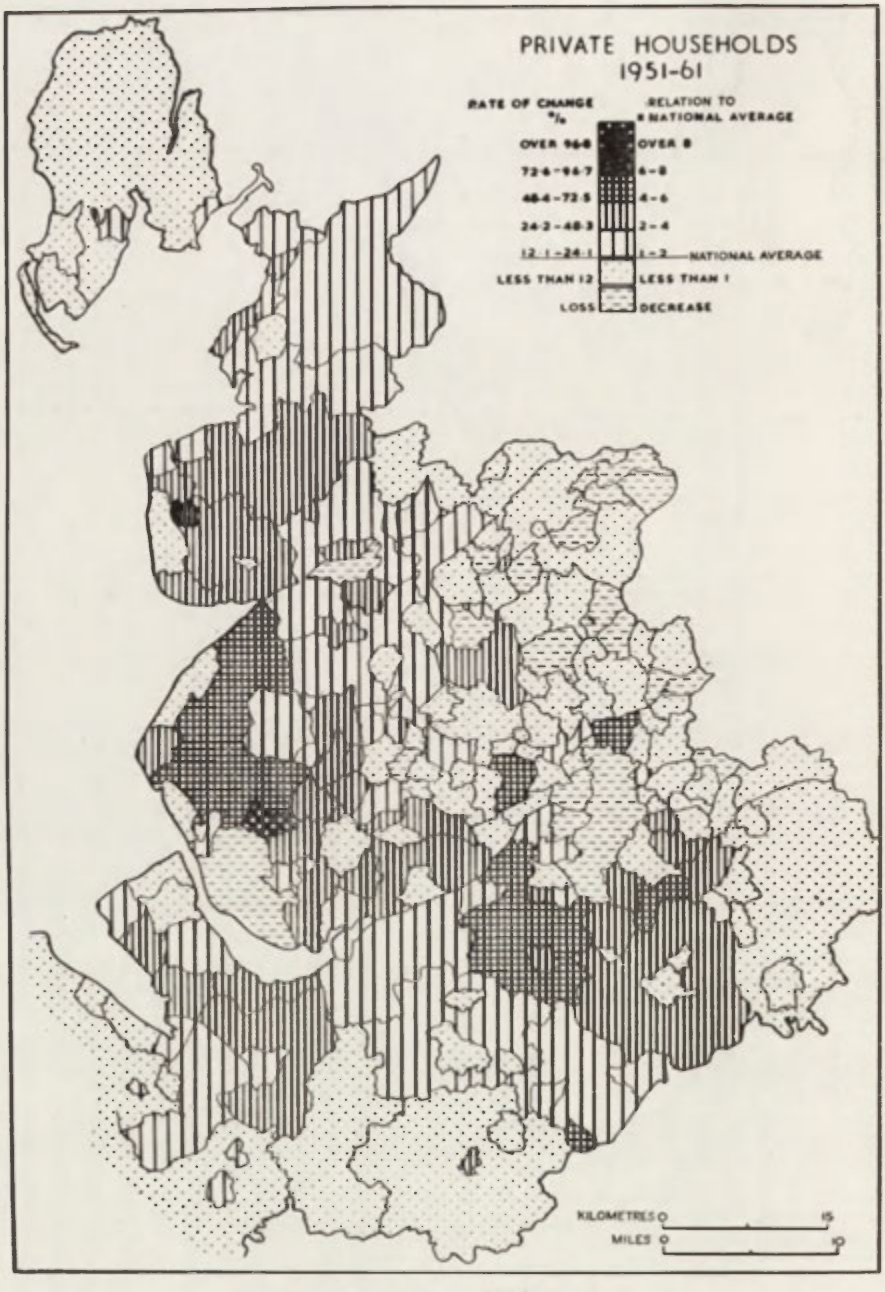


Fig. 5. Private households 1951–61

result of prolonged, age-selective migration, this has now spread widely through the textile zone; indeed scarcely a single cotton town is now recording a significant surplus of births over deaths. But migration to the more fortunate districts both of the region and of the country is still the chief cause of the population losses which the textile towns have been suffering for more than thirty years.

TABLE 3. SUB-REGIONAL POPULATION TRENDS, 1951–61

Sub-regions	% change 1951–61	% natural increase 1951–61	% migration 1951–60	% insured pop. in textiles & mining '60	% unemployment		% change total employment 1952/8
					April '61	January '59	
Furness	−2	1	−3	2	2·3	5·3	2
Lancaster	4	0	4	14	0·8	3·1	7
Fylde	8	−3	11	1	1·4	6·5	3
S.W. Lancs.	4	7	−3	2	2·7	5·1	3
Sth. Merseyside	7	5	2	1	2·9	4·9	3
Chester	5	5	0	0	0·6	1·4	11
Preston	5	3	2	14	0·8	2·6	5
Chorley	0	2	−2	32	0·5	3·6	−9
Wigan	0	4	−4	21	2·0	4·4	3
Warrington	3	6	−3	1	1·5	2·8	4
Northwich	5	5	0	7	1·8	3·6	0
Crewe	5	3	2	3	1·5	2·6	4
Manchester	−2	4	−6	7	0·8	2·3	0
Altrincham	21	3	18	1	0·7	1·5	9
Stockport	12	2	10	14	0·9	2·5	6
High Peak	−2	2	0	47	0·6	1·6	3
Macclesfield	8	1	7	26	0·7	2·8	5
Blackburn	−2	−1	−1	24	0·7	4·1	−8
Burnley	−5	−1	−4	38	1·0	4·1	−7
Rossendale	−5	−1	−4	43	0·8	2·3	−8
Oldham	−4	1	−5	28	0·8	7·7	−6
Bury	0	0	0	28	0·6	3·0	−3
Rochdale	−4	0	−4	43	0·5	5·6	−6
Bolton	−2	1	−3	30	1·1	3·5	−1
Stalybridge	−3	0	−3	33	0·6	2·8	−7
Leigh	−5	2	−7	52	1·1	3·0	−2
N.W. Region	1·9	3·7	−1·9	12	1·8	3·8	1·4

Migration is clearly the key to population change in the region—for apart from its direct effects it underlies the contrasts in natural trend—but is causes are by no means fully understood. Both economic and noneconomic factors are involved, but their relative importance has newer been evaluated. Is

unemployment still today, at it was in the past, the chief cause; or is the lack of diversity of employment in a mill or pit town more important? Are regional wage-rates substandard? Is the decline of the cotton industry the basic reason for migration? There is no real evidence that this is so, for the typical mill-worker is elderly and immobile, and he can sell his skill only in Lancashire. Perhaps the non-economic factors are more potent than any of these. The drabness of the urban environment in a Victorian mill-town and the high proportion of unfit housing which it contains, the weeping climate of the textile valleys and the high incidence of fog, frost and air-pollution in them may be the real reasons for the loss of so many of the region's young people. Few of these non-economic weaknesses could be corrected quickly, and some are ineradicable. Even if industrial guidance policies were applied to the benefit of east Lancashire there is no certainty that they would halt migration though they would doubtless slow it.

It is an easy statistical exercise, though too simple to be completely sound, to establish a correlation between migrational loss and each of the factors likely to cause it, where these can be quantified. Surprisingly, there is only a feeble correlation between unemployment rates and migrational loss in the sub-regions. But this may be misleading unless qualified: a surge of migration has taken place from the cotton towns immediately after each of the recessions in the industry, and this has helped to correct unemployment. Yet poulation has continued to seep away from them even in the more prosperous years of almost "overfull" employment. Certainly unemployment is not the only—perhaps not even the most important—cause of migration: a progressive loss of confidence in the future of the basic industries is at least as powerful a factor. Indeed, statistically, this is a more significant cause than actual unemployment, for where the proportion of mill and pit workers is highest the migratory loss is greatest, and the two vary in an almost perfectly linear relationship. Yet local variations in the rate of decline of the traditional industries have little effect on migration. Whatever their fate the flight from them continues: it has been halted only where real progress has been made towards a more diversified economy.

Other economic factors contribute to the flow of population from eastern Lancashire: for example there is a strong inverse correlation between rate of migration and the proportion of employment provided by the service industries. Wage rates, too, are involved, for cotton pays men poorly but women well, and this must explain part of the drift from towns in which the mills still employ much of the male labour. Any assessment of the non-economic forces in migration must remain largely speculative. Housing conditions have an obvious effect, for some of the towns with the largest losses are those with the greatest burden of substandard housing. The influence of the other

unsatisfactory elements in both the physical and social envidonment of a typical cotton town must remain imponderable, though a recent survey at Bolton revealed surprisingly little dissatisfaction with the sunless climate or with the fabric and amenities of the town.

It would be wrong to conclude this somewhat dismal survey of a problem region without a brief stock-taking of the industrial potential of the North-west. That a region could lose so large a part of its basic industry and yet suffer so little persistent distress is itself a measure of the progress of the new industrial revolution which is transforming the regional economy. How can these changes, which alone can restore Lancastria's vitality, be speeded? Little assistance can be expected, for the present industrial guidance policy permits the Board of Trade to "steer" new enterprises only to areas of high unemployment, which has been held in check in Lancashire by migration among a comparatively mobile population. Indeed, the North-west has always been rather ill-favoured by Development Area policy: the scheduling of Merseyside (1950) and the Wigan–St. Helens area (1946) helped to correct local unemployment problems, but at the cost of accentuating the shift of industry and population to the west and south. Except at Burnley, no part of the textile belt has been given effective help in economic rehabilitation, for though a number a cotton towns qualified briefly and fruitlessly as Development Districts under the Acts of 1958 and 1960 they lost their special status as unemployment fell after the 1959 recession. Thus the North-west must compete on unfavourable terms with Development Districts elsewhere for new employment: indeed, it is not even entitled to retain the increment of its own industrial growth.

Despite its difficulties, Lancastria still has much to offer to industry, particularly its excellent port facilities and its rapidly improving communications. Many of its established industries have the capacity to attract new enterprises, either because—like steel and chemicals—they produce the raw material of other manufactures, or because—like the vehicle industry — they "buy in" components from specialist producers. The success of such a wide variety of new trades, among them oil refining, electronic engineering and food preparation, demonstrates that the North-west is by no means obsolete as a location for industry. But it seems almost inevitable that the continued growth of the region as a whole must be bought at the cost of the further decline of the largest of its several parts, the textile province. "Growth points" may be established here: one exists already at Burnley, and others may follow the construction of the Lancashire–Yorkshire motorway; but there seems little doubt that the great routeways and nodes of communications of the lowland of the south and west must attract most of the growth of the future, as they have in the recent past. To exploit the advantages of these most favoured

areas to the full must be the crux of any regional plan, which would have to face, also, the immensely difficult task of reshaping the almost "fossil" settlement pattern of the declining east, which in the future cannot hope to dominate the life of the region as it did in the Victorian past.

PROBLEMS OF INDUSTRIALIZATION AND URBANIZATION IN THE LOWER VISTULA VALLEY

Jan Szczepkowski

The geographical position of the Lower Vistula Valley (Dolina Dolnej Wisly) can be considered as being especially favourable for economic development. The valley links the main towns and principal industrial regions of central Poland—Warsaw and Lódź—with the largest sea-port complex of Southern Baltic, Gdańsk and Gdynia. This was already so in the 19th century when a significant railway and highway system developed alongside the old Vistula tract, converting this area into the most important meridional line of communications in Northern Poland.

The area of the Lower Vistula Valley (called in short LVV) is one of those parts of Poland, which in the coming twenty-year period will be undergoing the most intensive processes of industrialization and urbanization; already the close attention of economists, physical planners and geographers has been turned to this region. For purposes of scientific research it has been considered necessary to include in the LVV area both banks of the Vistula, from the mouth of Bzura in the neighbourhood of Wyszogród down to the head of the river-delta near Tczew and Malbork.

In order to understand more thoroughly the role of the Vistula itself within the area across which it flows, not only the old-river valley (about 6–15 km wide) has been studied, but also the extensive morainic plateau situated on both its sides, about 30–70 m above the river-bed. A very distinct area of gravitation towards the Vistula river and its valley stretches over the already mentioned plateau. The area of the Lower Vistula Valley, so defined, constitutes a belt about 50 km wide (with a territory of 13,700 km^2), inhabited by over 1,400,000 people. In relation to the whole country, this area represents 4·5% of the total surface and almost 5% of the total population.

All plans for the further development of this area are more or less related directly to the great abundance of water in the Vistula river. The width of the river varies from 400–800 m and the depth of the main stream does not exceed 2·5 m. Only during severe floods does the depth of the river exceed

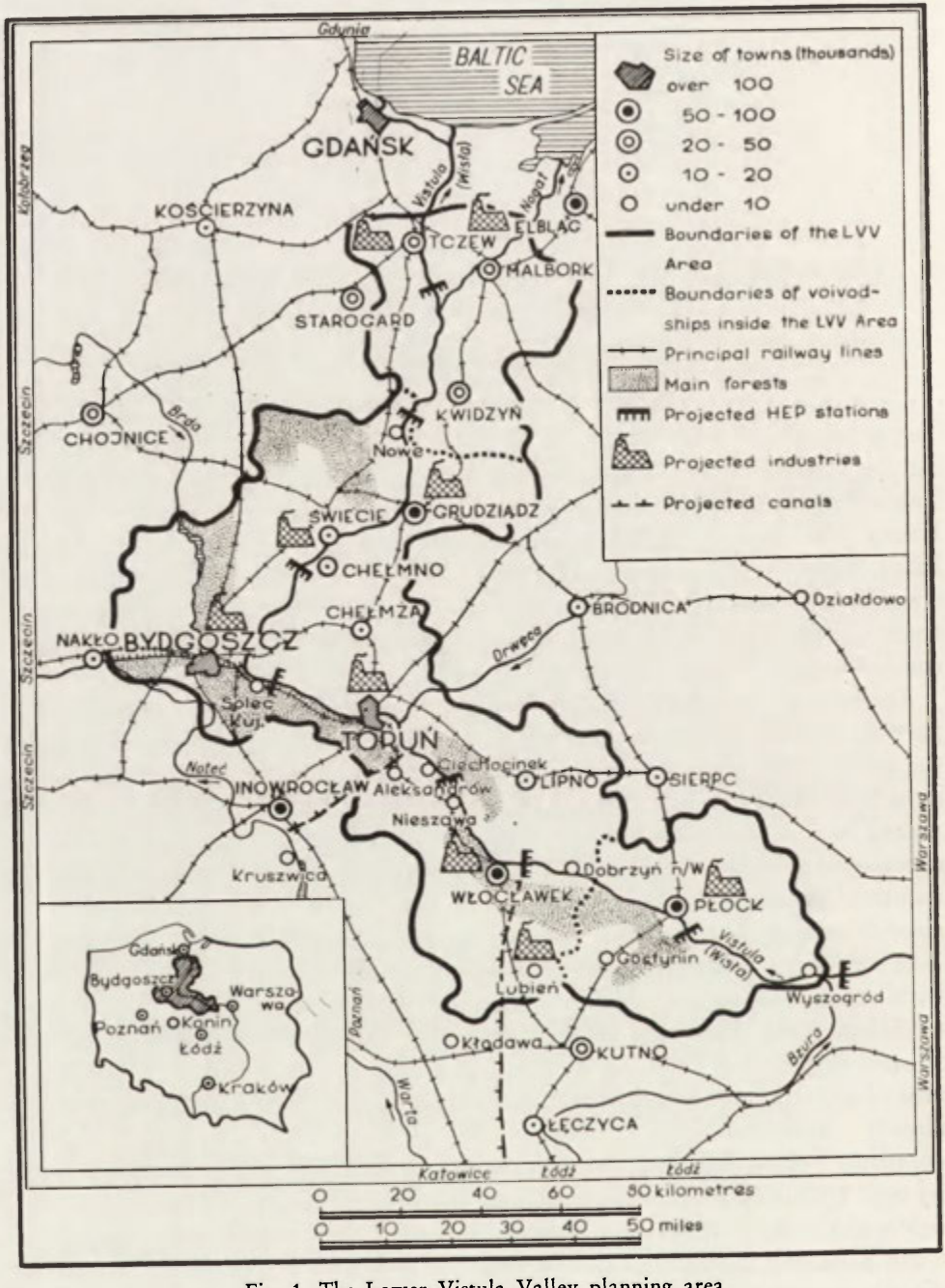


Fig. 1. The Lower Vistula Valley planning area

6 m, but lower lying areas are protected against such flood-waters by high embankments. The average annual flow of water in the lower Vistula amounts to about 1000 m^3 (over 1 million l) per second; in winter the river is usually frozen for 6 to 9 weeks. The water of the Vistula is not as yet polluted to any significant extent except in the vicinity of Włocławek and Bydgoszcz. The most important tributaries of the Vistula in the area under discussion are the Brda and Drwęca rivers, both about 200 km long. They pour about 30,000 l of pure water per second into the Vistula in the vicinity of the largest towns and industrial centres of the whole area, i.e. Bydgoszcz and Toruń.

The hydrological features of the lower Vistula described above, have great significance for the whole economy of the area, particularly for its industrialization and the development of an urban network, for inland navigation and growth of agriculture. If we also realize that the most important feature of this area's climate is a very low rainfall (rarely exceeding 500 mm annually), the difficulties which for many years have confronted agriculture, various branches of industry, inland navigation and water supply for communal purposes will become apparent. It will be clearly evident too, that only a complete solution of the problem of how to utilize the Vistula's waters can give a lasting improvement in the general economic situation of this area.

The Lower Vistula Valley today possesses well developed industry employing nearly 150,000 people and producing over 22 milliard zł worth (about 300 million £) of articles representing 4·5–5% of the value of all Poland's industrial production. The industries of the LVV area are characterized by a wide variety of products; with the exception of mining and metallurgy all other branches are well represented. The productive potential of several branches is of the highest order in relation to the whole country; e.g. the rubber industry in this area accounts for 26% of the Poland's total production, the paper industry 12%, electrotechnical and food industries each 9% and the engineering industry 7%. Important places are occupied also by the chemical, timber, clothing and building-material industries.

The principal industrial centres are: for metal industries—Bydgoszcz, Grudziądz, Toruń, Tczew and Płock; for food industries—Toruń, Bydgoszcz, Włocławek, Grudziądz and Chełmża; for chemical and rubber industries—Bydgoszcz, Grudziądz and Toruń, and for timber and paper industries—Bydgoszcz, Włocławek and Nowe. With the exception of Płock and Tczew all these towns lie in the central part of the LVV area. Industrial works and employment are concentrated predominantly in big towns along the Vistula river, among others in Bydgoszcz—37%, in Toruń—13% and in Grudziądz—10%.

Industrial growth in the Lower Vistula Valley during the post-war period has been very irregular. In the last 15 years industrial employment rose here from 50,000 to 148,000, the largest increases occurring in the urban areas of

Bydgoszcz voivodship, namely: in Bydgoszcz—33,000, in Toruń—15,000, in Grudziądz—12,000 and in Włocławek—7000. Until 1960 this intensive industrial development consisted above all in the reconstruction of war damage and the extension of old factories. On the other hand all new plants were linked either with local agricultural and mineral raw materials, or belonged to the group of establishments characterized by so-called footloose location, i.e. the clothing and electrotechnical industries.

An analysis of the actual level of industrialization in the LVV area proves that this area has not yet achieved the role of a leading Polish industrial region. Although the indices of its industrialization exceed the country's average, they are still far below such regions as Upper Silesia, Warsaw, Lower Silesia, Łódź or Cracow. So the programme of this area's future industrial development should be based upon the solution of the following problems: full utilization of water from the Vistula by the construction of a "staircase" or "cascade" of hydroelectric stations, providing sufficient manpower through the further development of the settlement network, and the finding of suitable industrial building sites in relation to problems of transport and cooperation.

The problem of the proper use of the hydrological conditions existing in the Lower Vistula Valley is however of the utmost importance. These conditions represent an exceptionally valuable factor for the location of water-using industries as well as for the disposal of large amounts of sewage. Nowhere in Poland is there such another large flow of water with more favourable conditions for the location of the petrochemical industry, as well as soda, artificial fibre, cellulose, and specific branches of food industries. An additional advantage of the area consists in the rivers Drwęca, Brda and Wda, which empty into the Vistula in the vicinity of important industrial centres: Toruń, Bydgoszcz and Świecie. This makes possible the use of high quality water from these tributaries, and the discharge of imperfectly purified industrial sewage into the Vistula below the sites of those cities.

The question of sewage is a problem in itself. The excessive pollution of the Vistula river cannot be permitted, because beyond a certain limit of concentration the water loses its ability to purify itself. We must also take into consideration three other aspects of this matter, namely: the additional industrial sewage already discharged into the Vistula from areas outside the Valley (from the regions of Inowrocław and Łódź); secondly, the danger of the infiltration of polluted waters from the Vistula into the Żuławy (Fens) depression—the most productive part of the voivodship of Gdańsk as regards agriculture; and thirdly, the possibility of a high concentration of polluted water and precipitation of sediments due to a slowing down of the outflow from the reservoirs of the future hydroelectric power cascade. On the other hand, the problem of sewage is somewhat easier to solve thanks to the fact that none

of the towns situated on the lower Vistula takes its drinking water straight from the river, but each has its own catchment in the form of wells based on ground waters.

The proposed construction of the Vistula cascade is closely related to large-scale regulation works and will be of considerable importance for general industrial development of the LVV area. The construction of seven hydroelectric stations and reservoirs will ensure a continuous supply of large quantities of water and will also supply sufficient electricity for power-orientated industries. Each hydroelectric station will have a capacity of 80–160 MW and in addition there is a real possibility of construction of huge steam power stations (exceeding 2000 MW) which might be located in the vicinity, using water from the Vistula cascade for cooling purposes.

The construction of the cascade will considerably alter transport conditions in the area under discussion, especially in its south-eastern part. The whole economy of the Lower Vistula Valley will take advantage of the improved possibilities of navigation between Southern Poland and the Baltic Sea, as well as of its situation upon a new transit route from U.S.S.R. to Germany. The elimination of flood danger, the assurance of sufficient quantities of water for agricultural purposes, the provision of facilities for tourism, holidays and sightseeing—all these are additional effects to be considered when making a complex analysis of the effectiveness of this enormous investment.

On the other hand, it is quite doubtful whether the improvement of navigation conditions will immediately affect new industrial locations or not; this creates a problem which must be solved. In fact almost all convenient approaches to the banks of the Vistula are already occupied by towns, settlements or productive areas while remaining areas alongside the river are quite inaccessible. They comprise either waterlogged flood terraces, or slip-off slopes of the old-river valley. Such relief features are of no value for the siting of industry on the very banks of the Vistula.

Mineral resources are rather poor in the LVV and adjoining territories, though on the other hand the region possesses a large surplus of agricultural and forest products. These already form an adequate basis for the further development of food, as well as timber and paper industries. Therefore in this area there are only great water reserves and the anticipated surplus of electricity, which can be recognized as the most valuable raw material for heavy industry.

It is in the light of these problems that the new trends and general rate of industrial development in the forthcoming 20 years are shaped. So, the chemical, engineering and food industries should be developed first of all in the area; but textile and clothing industries will also grow in order to provide additional employment for women.

Realization of these postulations has begun since 1960, when the construc-

tion of a whole series of large industrial establishments on a nation-wide scale commenced. Among these are: the petrochemical combine in Płock, a dam across the Vistula with a hydroelectric station in Włocławek, the polyester–fibre plant (based on technology developed by ICI) and the woollen mill in Toruń, a chemical works in Bydgoszcz, a cellulose factory in Świecie, and so on.

The construction of following additional plants and factories is anticipated before 1980: dams and hydroelectric power stations on the Vistula in Wyszogród, Nieszawa, Chełmno and Gniew, a viscose–fibre plant in Włocławek, a heavy machine plant in Fordon, a thermal power station in Grudziądz, electrotechnical factory in Kwidzyń, a second (smaller) petrochemical combine in Tczew, and others. The most intense industrial development will occur in large towns and in the south-eastern part of the LVV area. Further increases in employment in the big industrial centres may be appreciated as follows: 35,000 persons in Bydgoszcz, 20,000 in Toruń, 15,000 in Włocławek, 12,000 in Płock and 10,000 in Grudziądz.

The questions of future cooperation between the industries of this area, both intra-regionally and inter-regionally, constitute the more difficult problems in the industrialization of the Valley. The necessity for closer relations between cellulose, chemical and textile industries within the area is already obvious at present. On the other hand the LVV area as a whole should cooperate with the ship-building industry located in the Bay of Gdańsk—not neglecting, however, the role of the Valley as a producer of industrial products for all the north-eastern voivodships of Poland.

Industrialization of the Lower Vistula Valley is closely connected with the problems of activating manpower and mobilizing reserves which can be found in the hinterland—in poorly developed agricultural areas, especially in the south-eastern part of the Valley. Thus one of the most important problems to solve is to find the right proportions between the rate of growth of towns in the Valley proper and size of migrations from the agricultural hinterland. In this way the further course of the urbanization process will depend intermediately on the rate of exploitation of the Vistula river as well as progress in production and social changes in agriculture.

Rapid urbanization is one of the characteristic features of post-war Poland's economic development. In the course of the last 15 years the percentage of people living in towns, in relation to the whole population of the country, has risen from 31% to 48%. The same index for the Valley is even higher—at present 54%—and it will probably stay above the national average in the coming period.

The indices of progress in urbanization for specific parts of the Valley are similar to those of their industrial growth. The advance in the urbanization process began in this area immediately after World War II since when the

greatest increases in urban population have occurred in the following *powiats* (municipal boroughs included): Bydgoszcz—120,000, Toruń—50,000, Grudziądz—33,000 and Tczew—20,000. No new towns, however, were founded in this period.

Table 1 shows the rates of growth of the largest towns in the Lower Vistula Valley in pre-war period, during German occupation, and after the war.

Table 1. Growth of towns in LVV, 1910-1963

Town	Population in thousands of inhabitants			
	1910	1939	1946	1963
Bydgoszcz	58	135	135	252
Toruń	46	78	68	114
Grudziądz	40	62	37	70
Włocławek	36	67	48	68
Płock	36	35	29	49
Tczew	17	25	21	36
Malbork	16	27	10	27
Kwidzyn	13	21	8	22
Chełmno	12	13	12	18
Świecie	8	10	8	13

It is evident from the table that in the last 50 years the larger the town, the quicker its growth. Smaller towns, not included in this table, were characterized by minimal growth (with the exception of Ciechocinek and Solec) and in some cases even by the diminution of their population. A considerable fall of population during the war period (1939–1945) was caused either by war destruction (Grudziądz, Malbork and Kwidzyn), or by the extermination of the Jewish population (Płock, Włocławek).

In the LVV area there are now 35 towns, of which 19 are situated immediately on the banks of the Vistula or on its valley slopes, including the 10 largest. Nearly all belong to a group of old towns of medieval origin, and 14 of them possessed the urban status already in the 13th century. Some were known as fortified burghs of local rulers even much earlier.

All towns in the area described can be divided into several groups: large towns (Bydgoszcz), towns bordering on medium and large (Toruń), medium-sized towns (Włocławek, Grudziądz and Płock), towns bordering on small and medium (Chełmno, Kwidzyn, Malbork and Tczew) and the remaining 26 small towns, of which the most important are: five *powiat* administrative centres—Świecie, Lipno, Aleksandrów, Gostynin and Sztum; three considerable industrial centres—Nowe, Chełmża and Solec Kujawski, and a well-known health-resort—Ciechocinek.

The regularity of distances between all large and medium-sized towns in

relation to each other is quite striking. Płock, Włocławek, Toruń, Bydgoszcz, Grudziądz and Tczew lie on the Vistula at distances of 50–65 km from each other, forming multi-functional subregional centres, with the industrial one dominating. Complex functions characterize some smaller towns too, e.g. Malbork, Kwidzyń, Chełmno and Świecie. In the remaining towns just one function usually dominates, for instance: the industrial function in Chełmża, Fordon, Solec Kuj. and Nowe; administrative and service functions in Lipno, Gostynin, Sztum and Aleksandrów; Pelplin is a bishopric and religious centre; Ciechocinek a health-resort, etc. The smallest towns of less than 3000 inhabitants, compose a group of local centres (on the *powiat* level) servicing their agricultural hinterlands.

Commuting to work—which can be considered as an index of the present importance of the largest cities and of possibilities for their further development—presents an interesting picture in the LVV area. The net daily inflow of commuters amounts at present as follows: to Bydgoszcz—10,000, to Toruń —2500, to Płock—2000, to Włocławek—1500 and to Grudziądz—1000.

The analysis of growth conditions for individual towns is the next fundamental problem connected with urbanization and industrialization of the Valley. Among the towns having the best geographical and communications situation are: Bydgoszcz, Toruń, Grudziądz, Tczew and to a certain degree also Malbork, Włocławek, Płock and Chełmża. The best physical sites in terms of hydrogeological and building conditions are found at Toruń, Solec, Fordon and Tczew, and also to a lesser degree at Płock, Świecie and Malbork. The towns best equipped with communal facilities (such as sewers, gas, etc.) and the best housing conditions are: Bydgoszcz, Toruń, Grudziądz and Tczew. Besides the 35 towns already mentioned, there are still some other localities, which on account of their development conditions have a chance to become urban districts up to the year 1980, for example Unisław, Skępe, Drobin, Osie and Gardeja.

The dynamics and directions in the development of particular towns during the forthcoming 20 years are not yet easy to define; and this becomes the most important problem of urbanization to be solved in the regional plan of the Lower Vistula Valley. On the basis of analyses of the existing state of urban growth, of the planned directions of industrial development and of the probability of migrations to towns from the countryside, we can anticipate the following growth of the largest centres in the area examined: Bydgoszcz to 360,000 inhabitants, Toruń to 180,000, Włocławek, Płock and Grudziądz to 100,000, and Tczew to 70,000 inhabitants. Of course the demand for equalizing the present disproportions in the development of the whole settlement network as well as individual towns must be taken into consideration.

The economic development of small country towns must also be examined

and solved as part of the problems of industrialization and urbanization in the LVV area. All of them will be threatened with stagnation in the shadow of great industrial establishments constructed in close connection with the Vistula river itself, as well as with the fact of the previous existence of a strongly developed network of larger urban settlements.

In conclusion we may state that industrialization and urbanization of the LVV area must be treated together, as one of the most essential signs of general economic growth of the region discussed, and that it is the Vistula river itself which forms a fundamental tie linking both the problems mentioned above. In medieval times the Vistula already fulfilled its role as a "mother" of all large cities founded on its banks, because of the considerable defence and transport qualities that it offered. In the second half of the 20th century it will be of a great regional importance, thanks to further economic development based on the control of the river. Thus in the period till 1980 the Lower Vistula Valley can become a leading Polish economic region, along with Silesia, Warsaw, Cracow and Sandomierz.

HYDROLOGICAL RESEARCH FOR THE NEEDS OF THE REGIONAL ECONOMY

Rajmund Galon

The regional economy, its present status and its perspectives and trends of evolution, should be based on a thorough knowledge of the geographical environment. In studies of this environment the method of search for the basic factor, which in a given region decisively dominates over other factors of the environment, is frequently applied. Undoubtedly in many instances the relief is such a basic factor; sometimes it is the type of soil, the vegetation or water conditions in the sum total of their occurrence. Indeed, water is one of the most potent elements in the geographical environment. The manner in which ground water appears on the surface indicates the type of geological structure, the quantity of water is an index of climatic conditions, and surface run-off is controlled by the relief of the region and by the vegetation.

In recent years, with the powerful development of industry in Poland, the increase of urban population and intensification of agriculture, combined with the anticipated economic development of the country within the next 20 years, there has been an almost revolutionary increase in water demand. According to the calculations of A. Tuszko, by 1980 industry will require five times, and home consumption three times, as much water as is used today. It is increasingly becoming evident that water is one of the basic natural resources. On top of this, man's activities are often destructive to water resources, and this leads to harmful consequences which already are difficult to counter. Poland is by no means rich in water resources, so the whole water regime must be controlled and adjusted to the country's needs. To start with, in order to retain flood waters, storage basins and distributing canals must be built so as to carry water from areas of surplus to areas of deficiency.

The water cycle especially when looked upon from the point of view of the water balance for a given region, in particular for a given river basin, may have ceased to be a natural process. Great quantities of both surface and ground water may be diverted to industry and communications, partly returning into circulation in the form of contaminated waters like sewer

discharge. Alongside the natural water regime there exists the concept of an economic or created water regime. The knowledge of the geographical environment of a region is bound to be fragmentary unless we know the pattern of water circulation of this region, a knowledge which reveals the present water balance and possibilities of its improvement. The water balance is a dynamic phenomenon, variable and complex. In order to acquire full knowledge of its nature, long-term studies and observations are being made at numerous stations recording meteorological and hydrological data. As is well known, this evidence is collected in individual countries by the meteorological and hydrological services. Let us investigate the part played in this work by geographical research especially in Poland, and the advantages thus gained for the economic life of a given region.

In contradistinction to the geophysicist, the geographer considers hydrological phenomena within a relatively short period, say, a year. However, in his search for the interrelations between hydrological phenomena and other elements of the geographical environment he arranges them in their geographical context and examines their differentiation within the framework of their geographical environment.

A typically geographic achievement, consistent with the above tendencies, is the Detailed Hydrographical Map of Poland, prepared on the scale of 1 : 25,000 and printed on the scale of 1 : 50,000 [4, 5]. This detailed hydrographical mapping was one of the main tasks set before Polish geographers by the First National Congress of Polish Sciences in 1951. The purpose of this map is to establish the structure of the water circulation within the individual river basins on the basis of, and in combination with, other elements of the geographical environment. This map is not intended so much to show quantitative values required by hydrologists for computing the water balance, as to be a study of the distribution and the cause of hydrographical phenomena, of the links between hydrographical features and geological structure, relief, climate and vegetation, and of the general problems of water economy.

Hydrographical mapping was started in 1951 under the auspices of the Polish Geographical Society and, since 1954, it has been carried out within the research programme of the Institute of Geography in the Polish Academy of Sciences. In 1958, the first sheets of hydrographical maps on 1 : 50,000 scale were published. All geographic research centres, both at universities and elsewhere, are taking part in the preparation of the maps. The Department of Geomorphology and Hydrography of Mountains and Uplands in Cracow and the Department of Geomorphology and Hydrography of Lowlands in Toruń, both of the Institute of Geography of the Polish Academy of Sciences, consider hydrographical mapping and the coordination of hydrographical research undertaken by the geographical research centres at universities to be one of their principal tasks. In view of the practical importance and use of

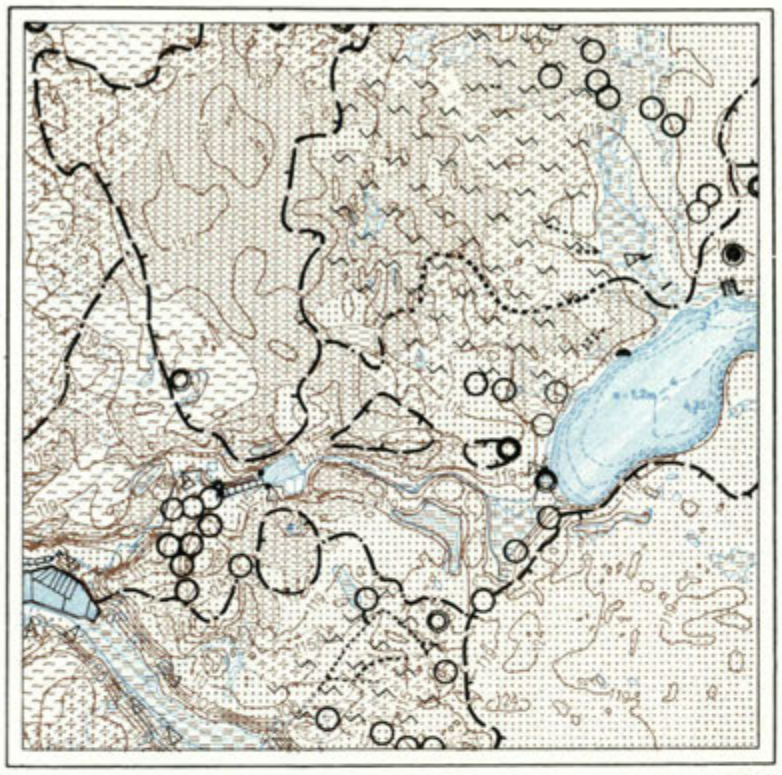


Fig. 1a

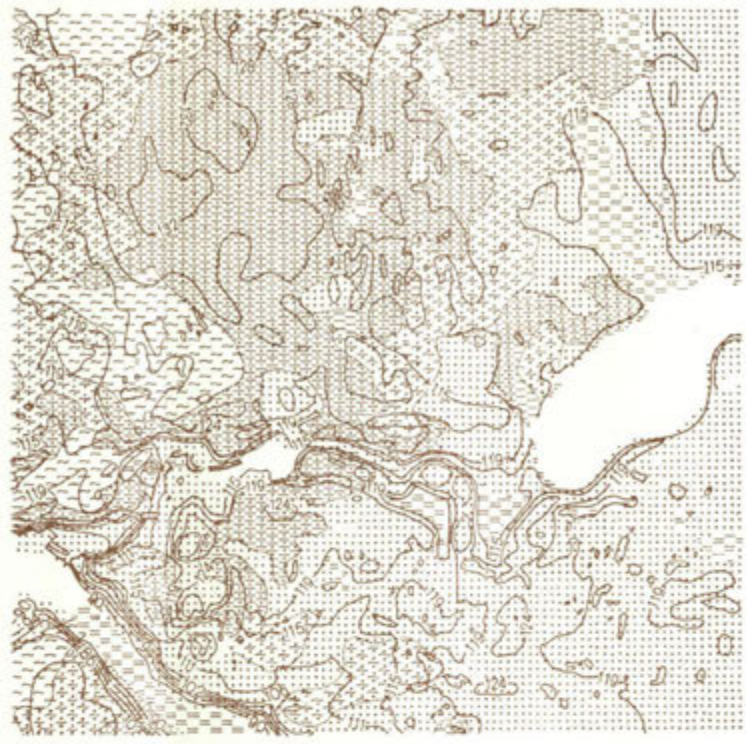


Fig. 1b

Fig. 1a. All the elements of the hydrographic map of Poland. Fig. 1b. Relief and litological conditions of the infiltration. Fig. 1c. Surface waters and data on outflow of subsurface water. Fig. 1d. Watersheds and hydrological objects.

Surface runoff and infiltration. Relief: 1. Contour lines and escarpments; 2. Altitude points (above sea level). *Surface watersheds*: 3. Watersheds of second order; 4. Watersheds of third order; 5. Watersheds of undrained areas. *Litology of surface deposits. Deposits easily permeable:* 6. Gravels and sandy gravels; 7. Sands (dunes, river and glacial deposits). *Deposits medium permeable*: 8. Silty sands, sandy aluvial soils, humus sands. *Deposits less permeable*: 9. Boulder clay. *Deposits unpermeable*: 10. Loam and alluvial clay; 11. Peat. *Marshes and stagnant waters. Areas waterlogged*: 12. Quagmire; 13. Peat-bog perenially waterlogged; 14. Peat-bog periodically waterlogged; 15. Area periodically waterlogged. *Natural water reservoirs:* 16. Lake-isobathic lines; 17. Pond. *Artificial water reservoirs:* 18. Fish-pond. *Ground water. Depth to the ground water-table in wells:* 19. Up to 1 m; 20. 1-2 m; 21. 2-5 m; 22. 5-10 m; 23. 10-20 m. *Natural outflow of ground water*: 24. Permanent spring with runoff; 25. Boggy spring; 26. Leakage; 27. Effusion. *River pattern. Natural and artificial streams:* 28. Permanently flowing stream. Breadth of river bed up to 1 m; 29. Permanently flowing stream. Breadth of river bed 1-3 m; 30. Periodical stream; 31. Episodical stream; 32. Area flooded (each 1-3 year). *Water constructions*: 33. Weir; 34. Mill; 35. Draining ditch; 36. Area drained by drain pipes (1) and main collectors (2). *Observation points*: 37. Pluviometr-Station; 38. Point of hydrological measurement.

Fig. 1c

Fig. 1d

Fig. 1. Hydrographic map of Poland 1 : 50,000 (elaborated and compiled by T. Celmer)

the hydrographical maps, it is planned to complete them for all of Poland within the next 8–10 years; this work is to be assigned to some specially-created central institution.

Let us now investigate the content of the Detailed Hydrographical Map of Poland, using as an example a segment of the hydrographical map prepared for the Polish Lowland by the Department of Geomorphology and Hydrography at Toruń. The content of the map is explained in an attached list of symbols; there are some 150 of them. The map contains: the contour lines of the relief, the watersheds of surface waters, information on the lithological character of the surface strata divided into four grades of permeability, swampy areas and stagnant waters with due consideration to the oscillations of their levels, data on groundwater as measured in wells with indications of depths and type of aquifer strata, as well as the manner and magnitude of run-off of groundwater and finally the pattern of all rivers. As regards the latter data the map is particularly explicit and concise, presenting the network of both natural and artificial streams. It also records the widths of channels, all irrigation water and drainage works, etc., and classifies streams into permanent, seasonal and intermittent. Each sheet covers some 315 km².

The Hydrographical Map is printed in three colours (Fig. 1a). Contour lines and lithological conditions are shown in sepia (Fig. 1b), surface waters and data on outflow of subsurface water in light-blue (Fig. 1c) and boundaries of water-sheds as well as hydrological objects (wells, water control stations, etc.) in black (Fig. 1d).

Each sheet of the hydrographical map is supplemented by a text presenting a geographical analysis of the given area. It includes hydrogeological and hydrological profiles, with a description of the various streams and stream basins, groundwater conditions and, wherever possible, a map with contour lines of the configuration of the groundwater table (Fig. 2). There is also a map showing the depths of the groundwater table below the surface (Fig. 3).

Even when supplemented by text sheets, the hydrographical map by no means presents a full image of the water balance of an area. Of the successive phases of water circulation—precipitation, surface flow, infiltration, subsurface run-off, retention and evaporation—the map, generally speaking, presents only the flow in streams, the conditions of infiltration, the manner of outflow of subsurface water and the ground and surface retention. Thus the map is, in the first place, a cartographical image of hydrological conditions in a given region, in their connections with other elements of the geographical environment; it illustrates the natural pattern of the occurrence of water resources and can be used as the basis for any hydrographical regionalization, both for scientific and economic purposes.

We may now discuss some examples of regional studies. First let us look at the cartographical presentation of the Kujawy region, known for its fertile

soils and also for its extreme contrasts in hydrological conditions. The map shown here, prepared by T. Celmer [1] of the Department of Geomorphology and Hydrography of Lowlands of the Institute of Geography of the Polish

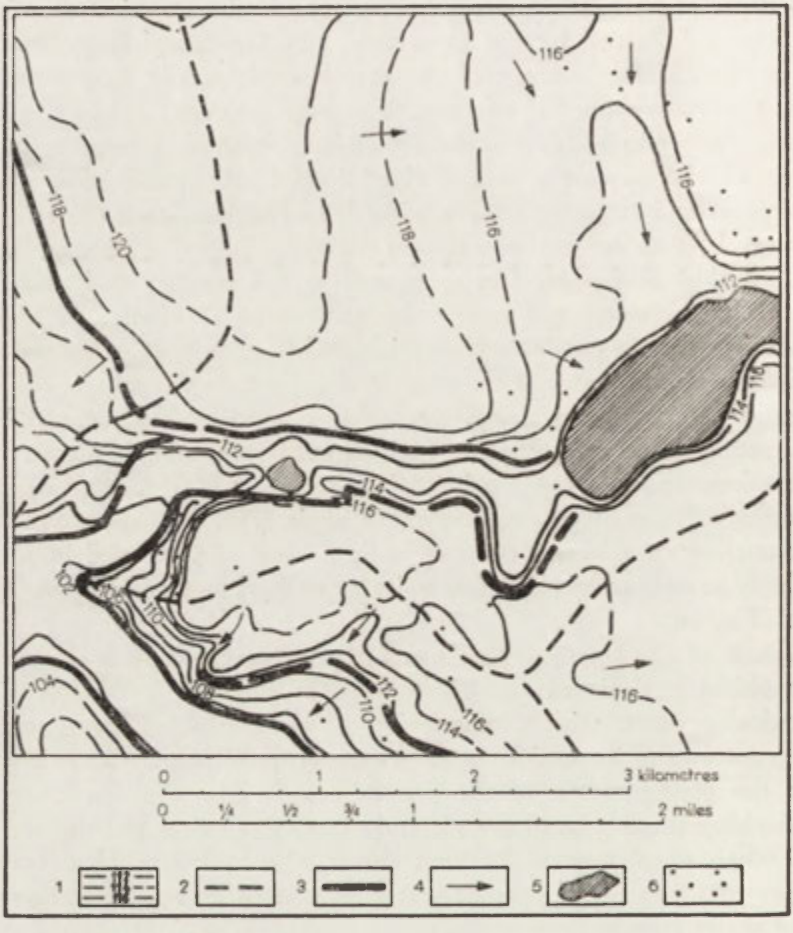


Fig. 2. Configuration of the groundwater table
(after T. Celmer)
1. Contour lines of the groundwater table; 2. Subsurface watersheds; 3. Limits between groundwater horizons; 4. Run-off of groundwater; 5. Lake; 6. Points of measurement of wells

Academy of Sciences at Toruń, divides the mapped area into areal units of varying hydrographical conditions (Fig. 4).

Within the area of a ground moraine diversified by subglacial valleys, three hydrographical regions with subregions are distinguished. Region A comprises ancient streamways and larger river valleys, as well as outwash plains and some more arenaceous areas of the ground moraine. In this region infiltration

predominates; good opportunities for the retention of subsurface waters exist. The author distinguishes within Region A three subregions. The first (I) embraces the flood channel of the Vistula valley and other river beds and is

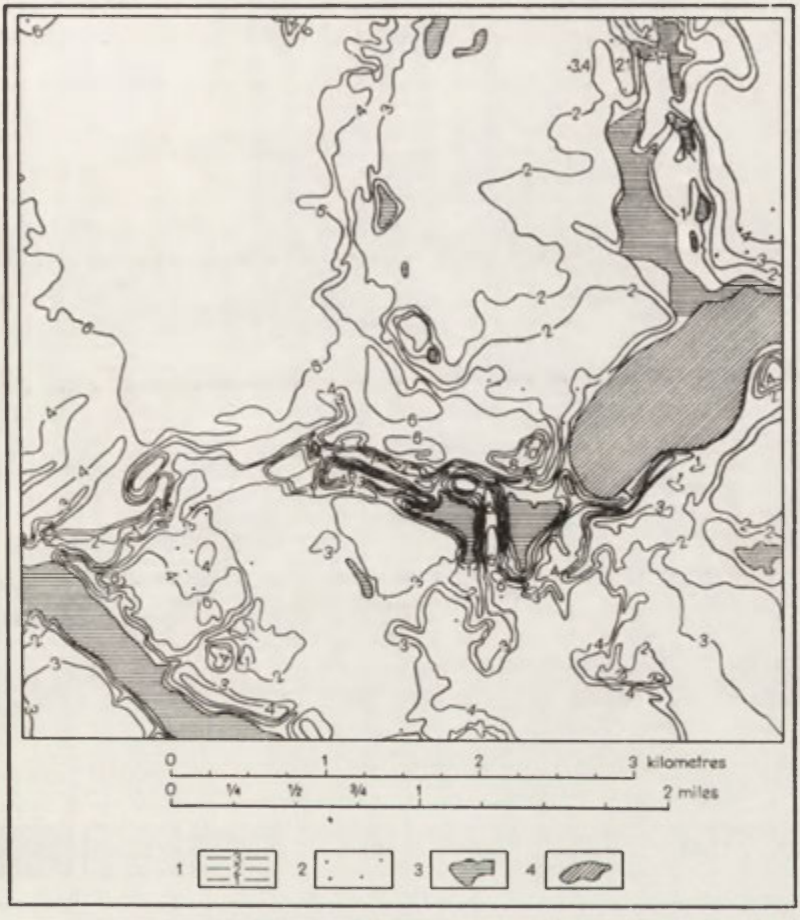


Fig. 3. Depth of the groundwater table below the surface
(after T. Celmer)
1. Isobathic lines; 2. Points of measurement of wells; 3. Extent of marshes; 4. Lake

marked by great variability of water conditions. The second (II) subregion shows variability as between a predominance of infiltration and of surface run-off depending on whether the given year is humid or dry. The high level of the groundwater table and the flatness of the area tend to render the entire region palustrine. The third subregion (III) is characterized by the most intensive infiltration of atmospheric waters combined with an almost complete lack of surface waters. This area is the driest of all; it is almost incapable of retaining groundwaters.

Region B takes in the moraınic plateau built of boulder clays. Here again we note variability between a predominance of infiltration and of surface run-off. Both surface waters and the shallow subsurface water are subject to retention. Region B contains three subregions. The first (I) consists of flat areas, very soggy in humid years, and where drainage is necessary. The second (II)

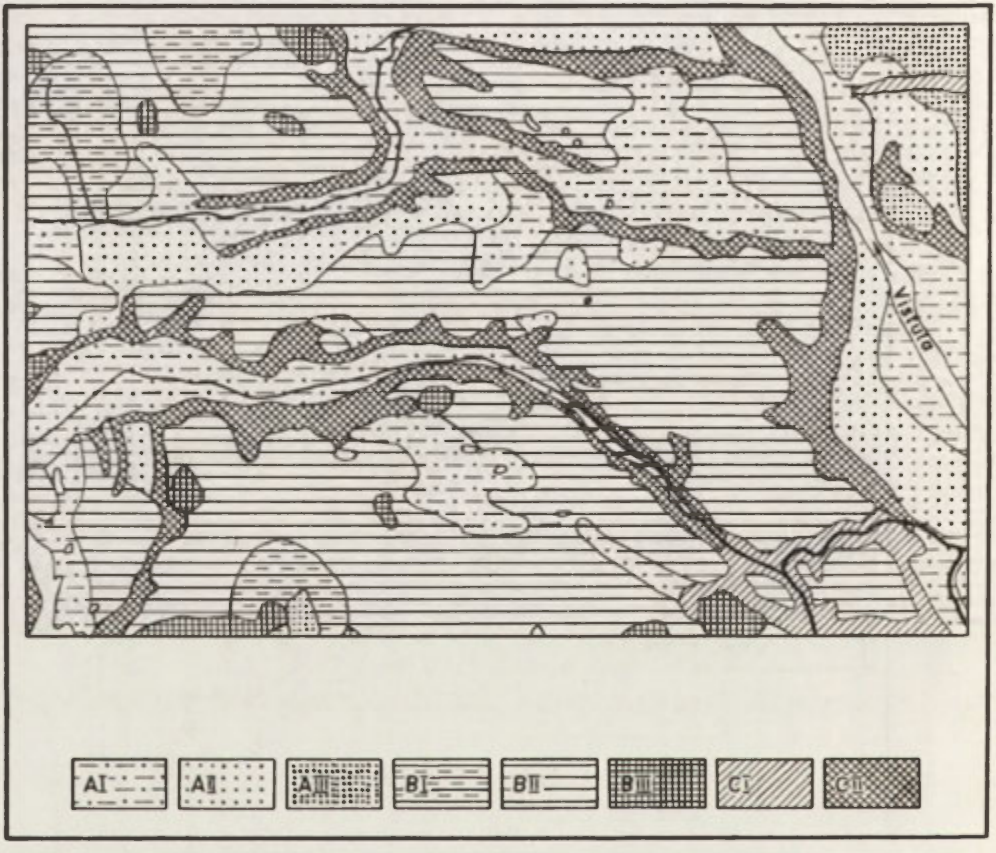


Fig. 4. Hydrographical units of Kujawy moraine plateau
(fragment)
Elaborated by T. Celmer
Explanation see text p. 242-245

covers flat depressions which in wet years are flooded by surface waters from adjoining areas. In the third subregion (III), surface run-off prevails over retention because of steeper slopes and poor permeability of the soil. In dry periods, lack of water here endangers cultivation.

In Region C small valley floors filled with sands and peats (subregion I) as well as their valley slopes (subregion II) are included. The valley floors are

swampy or submerged in flood years. Water from the plateau reaches the valley floors along the slopes.

The detailed hydrographical classification shown in the above example may easily be used for far-reaching conclusions as regards measures to be taken into consideration in water economy and in regional planning.

Another example of hydrographical regionalization is that prepared by K. Wit and Z. Ziemońska [8] of the Cracow geographical centre, showing a fragment of the Western Tatra Mountains, and based on the Detailed Hydrographical Map (Fig. 5). Here the authors distinguished three hydrographical regions: (1) the region of the Tatra Mountains with the following three subregions of differing prevalence of specific hydrographical features: (A) the southern, (B) the middle and (C) the northern subregion, (2) the Submountainous region and (3) the Upland region.

The region of the Tatra Mountains is characterized by a high precipitation, a predominance of regions of infiltration and a relatively strong surface run-off. Because of the permeability of the morainic deposits and the karst-type substratum, this region has a copious subterranean retention, indicated by numerous springs of steady flow. The southern, or crystalline, subregion shows high surface run-off over impermeable crystalline rocks and powerful retention in its morainic covers. The permanent stream system is here relatively dense. The middle subregion, a typical karst landscape, shows lesser surface run-off due to the greater retentive capacity of the limestones. Basins of underground water disclose their presence by numerous springs of ample flow which emerge mainly at the valley floors. Seasonal water-courses predominate. The northern subregion, a dolomite–schist region, also shows some water circulation in the joints of the dolomite rocks, but here the surface run-off due to the smaller retentive capacity of the substratum is greater. Slope springs are numerous, and the density of the river system is high.

The submountainous region, matching the Sub-Tatra "graben", shows a limited surface run-off and a high retentive capacity within its fluvial and glaciofluvial covers. The table of groundwater is shallow, its outflow, is accompanied by swampy areas. The river system is dense, but its water supply is derived mainly from the adjacent regions.

In the Upland region comprising the Gubałówka Plateau, the surface run-off exceeds retention; this is due to the relatively steep slopes and the feeble permeability of the ground. The subsurface water is accumulated mainly in the sandstone strata. Springs are numerous but of small volume; they show marked oscillations, as do the rivers which usually contain but a scant flow.

Regionalization as discussed above represents an example of linkage between hydrographical phenomena and other elements of the geographical environment; its study proved of considerable practical value. Still greater is the practical significance of the hydrographical regionalization of the Upper

Silesian Industrial District, the so-called GOP prepared by K. Wit of the Department of Geomorphology and Hydrography of Mountains and Uplands of the Polish Academy of Sciences in Cracow, on the basis of a detailed hydrographical survey and of additional maps [see also 5].

This region is built of Carboniferous sediments covered by Triassic, Tertiary and Quaternary deposits. The author emphasizes that "considered

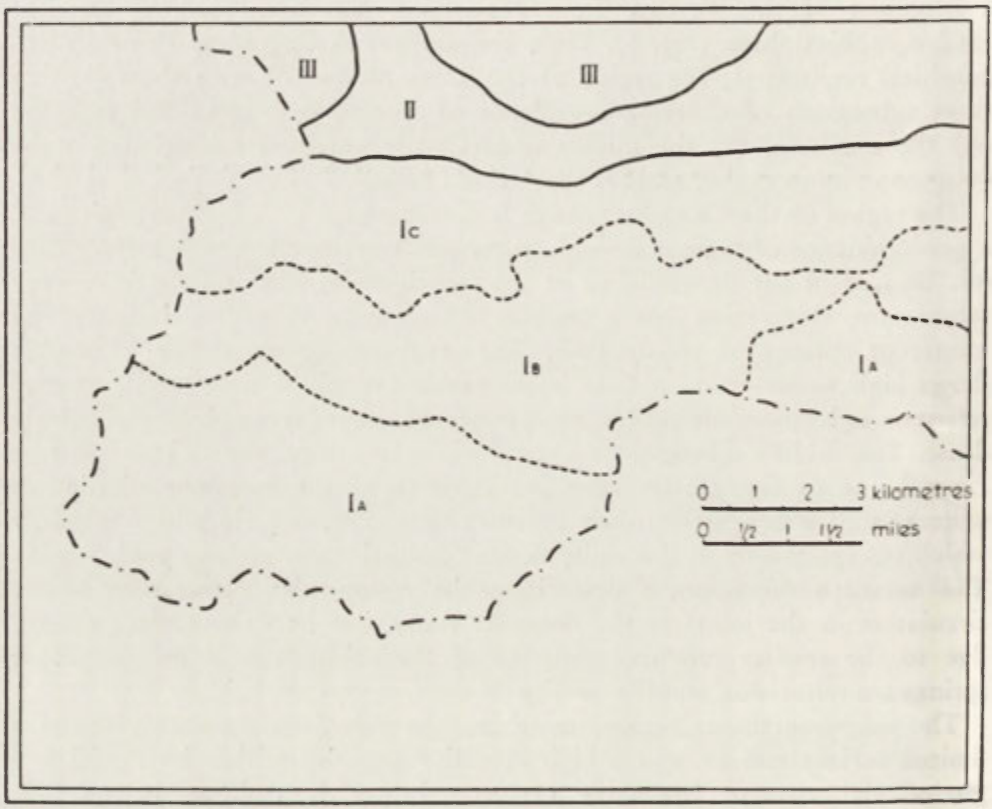


Fig. 5. Hydrographical regionalization of the Western Tatra Mts.
(elaborated by K. Wit and Z. Ziemońska)
Explanation see text p. 245-247

from a geographer's point of view, the purpose of hydrographical regionalization is an areal differentiation in the circulation of water, based on the sum of phenomena of subsurface and surface water linked with natural conditions of the geographical environment". This district is an area of intensive interference of man with natural water conditions. The author distinguishes here three basic hydrographical regions (A, B and C). Region A, built of Quaternary deposits, shows a relatively simple circulation of water, little altered by

man's economic activities. In region B, built of Triassic limestones, many copious springs issue while the density of permanent streams is limited. In the major part of this region the water circulation is markedly altered by the local economy. Region C, built of sandstone and schists, also shows complex water conditions. Surface run-off exceeds retention; therefore the subsurface water resources are limited. The circulation of water is altered to a high degree by man's economic activities as shown, *inter alia*, by the large number of artificial reservoirs for water storage.

Within the above regions the author distinguishes numerous subregions and many micro-regions. Among the subregions are those that accumulate water, retaining large or fairly large water resuorces; others which partly store and partly supply water, with large, fairly large, medium and small capacities of storage; and, finally, subregions supplying water.

The study of the hydrographical conditions of GOP implies that, in principle, the water resources of this district suffice to cover the needs of both agriculture and rural population, but are far from supplying water for the need of industry and urban population. In order to satisfy the constantly growing demand it is necessary to divert water from adjoining regions and to apply a more rational economy to the groundwater regime in the Upper Silesian Industrial District.

Some of the hydrographical surveys used for purposes of the regional economy are based on a single hydrological element which in given conditions happens to be most important, such as, for instance, the distribution and discharge of springs, the occurrence of lakes or swamps, or the quantity of groundwater and the localities of its emergence.

On the basis of the results of numerous borings, B. Krygowski [6] of the Poznań University prepared for the voivodship of Poznań numerous profiles and a map showing groundwater conditions, where he differentiates between areas more and less advantageous. This research was highly appreciated by institutions working on the location of newly proposed industries and of urban settlements in this regions.

At the request of local authorities T. Wilgat [7] of the Lublin University investigated, on the basis of the geological structure and the relief of the region, subsurface water conditions in the zone of the Wieprz–Krzna irrigation canal. This is an area situated on the watershed of two river basins. Using the shallow level of the groundwater, man's activities had caused here marked changes in the hydrography of the surface waters. As a result of the excessive desiccation of the soil, this proved very harmful to farming. Hence it became imperative to transfer to this area water from outside by means of a canal; it has a length of 140 km. More than 3500 wells were examined and used for tracing the contour lines of the levels of the groundwater. This survey indicates that a uniform groundwater table slants here

polskiej" (Ground-water basins on the Wielkopolska Lowland), *Spraw. poznań. Tow. przyj. Nauk*, I–II (1959), 72–79.

[7] Wilgat, T., "Stosunki geomorfologiczne i hydrograficzne w strefie kanału Wieprz-Krzna" (Sum. Geomorphologic and hydrographic conditions in the Wieprz–Krzna canal zone), *Przegl. geogr.*, 29 (1957), 2, 259–285.

[8] Wit, K., Ziemońska, Z., *Hydrografia Zachodnich Tatr. Objaśnienie do mapy hydrograficznej "Tatry Zachodnie"* (Sum. Hydrography of the Western Tatra Mts. Explanation to the hydrographical map "Tatry Zachodnie"), Polish Academy of Sciences, Institute of Geography, Department of Geomorphology and Hydrography of Mountains and Uplands, Kraków 1960.

PHYSIOGRAPHIC RESEARCH IN TOWN AND COUNTRY PLANNING

Wiesława Różycka

In Poland, investigations in the field of urban physiography have developed widely in the course of the last seventeen years. This paper describes the methods used in presenting the results of the study of the geographical environment for the use of planners who are to prepare development plans for towns and rural communities.

Lack of space prevents a fuller description of early Polish studies of urban physiography. Those interested may find full information on this subject elsewhere [2, 5, 7, 8, 14, 15].

The last war brought destruction to many towns and villages in Poland, the greatest sufferer being Warsaw. In the first four post-war years the attention of the town-planners was therefore centred mainly on Warsaw and physiographical research was conducted then at the Physiographical Laboratory of the Warsaw Reconstruction Office (*Biuro Odbudowy Stolicy*). This Laboratory still exists and is carrying on the investigation necessary for housing construction in Warsaw [13]. Later on, I will present some examples of its work.

Physiographical studies for other towns and settlements were started in 1949, and for rural areas they began on a wider scale c. 1960. An independent enterprise for geological, physiographical and geodetic research, called the *Geoprojekt*, was founded in 1952. The enterprise employs at present 1200 staff, including 650 fully qualified workers of which 254 belong to physiographical and geological sections. At present *Geoprojekt* has ten departments in different towns. The above mentioned Physiographical Laboratory of the Warsaw Reconstruction Office and *Geoprojekt* supply studies for planning needs in Warsaw and other urban centres scattered all over Poland [15]. These are prepared in a small number of copies and delivered directly to the institutions which had ordered them. They are always incorporated into the whole set of survey and planning [8, 10]. Only in very rare cases they are published in print [16].

environment, and forsee the direction of these changes in result of the implementation of the project [6].

During the preparation of the plan, it is frequently necessary to use simultaneously physiographical survey and additional studies dealing with various other problems, explaining in more detail the conditions of a single set of characteristics, for instance, the hydrogeological or climatic conditions, and others.

In summing up, it might be said that the process of arriving at the concept of the plan does include an analysis of physiographical conditions. It is frequently necessary to make use also of the results of problem studies, just as is done when one prepares programme for various investments, such as bridges, railway lines, etc.

The principles of problem studies are governed by different rules, for as a rule they are prepared in detailed scales for purposes chosen in advance. Rules and methods of study of geological engineering problems, hydrological questions and geological research for mineral resources are defined, for instance, by the Central Geological Office and its Geological Institute [9].

One might ask what is the purpose of the physiographical surveys of various kinds.

Preliminary physiographical surveys are of a very general nature. They help in the preparation of plans for groups of rural settlements, especially in working out of:

— transformation of the network of rural settlements, as those studies show which settlements and villages have physiographical conditions favourable or unfavourable for further physical development;

— selection of sites for new settlements, the programming of tourist and recreation facilities;

— long-term investment schemes for land improvement (as suggested by the long-term economic plans), as well as schemes to combat soil-erosion;

— programming for the transformation of natural conditions by technical and biological means in form of wind-protection belts, afforestation, vegetation control along the banks of streams, water reservoirs, etc.;

— conclusions pertaining to the adjustment of administrative boundaries of a *powiat* or *gromada*,

— programming of nature reserves;

— programming of further physiographical investigations of smaller urban settlements and villages.

For all these purposes within the framework of preliminary physiographical surveys the estimates of whole set of characteristics are included. They serve as a basis for the zoning of the physiographical environment from the planning point of view. The selection of areas, which are physiographically best for rural development, may indicate, for instance, whether physiographical condi-

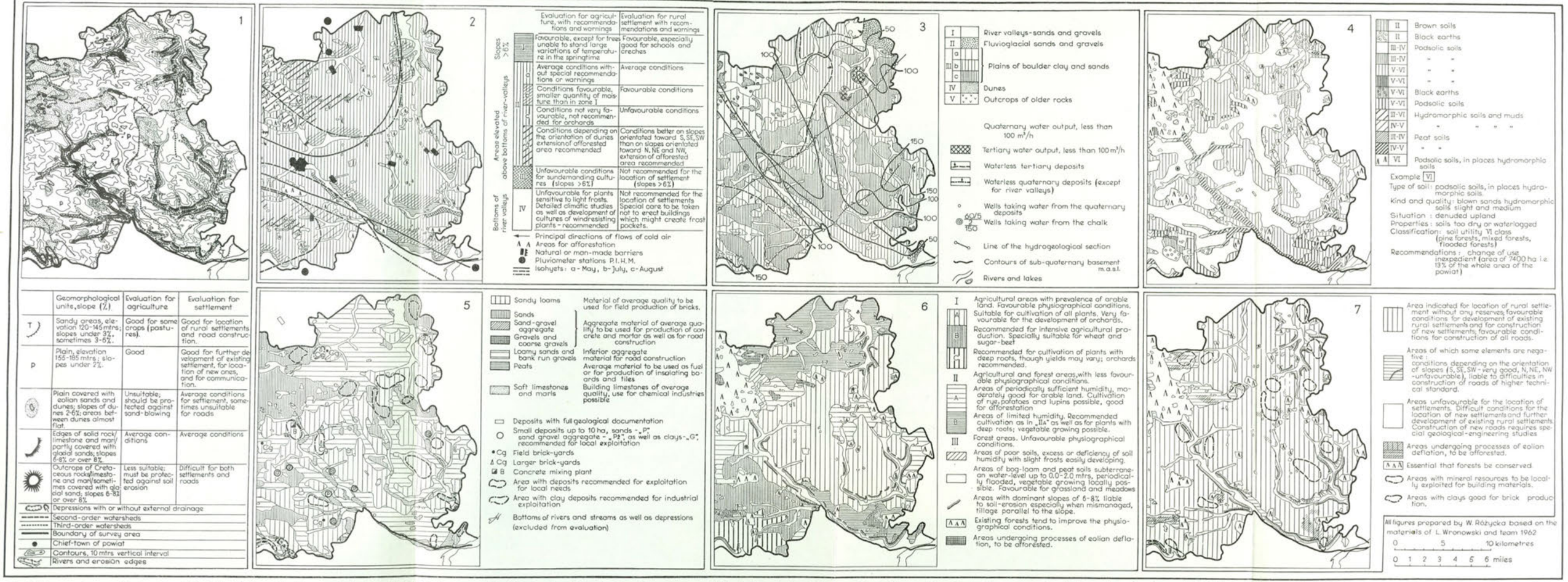


Fig. 1. Hypsometric map, with selected morphological and hydrographical features. Evaluations of forms for the purposes of settlement and agriculture (land use, forests, open space). Fig. 2. Map of selected features of local climate, with evaluation for purposes of agriculture and rural settlement. Fig. 3. Hydrogeological map with classification of resources. Fig. 4. Genetic map with soil evaluation. Fig. 5. Geological map showing: 1. mineral resources, with value production of building materials, 2. deposits recommended for exploitation. Fig. 6. Map of physiographical and typical rural zones evaluation for land utilization, in particular of agriculture and forestry. Fig. 7. Map of physiographical and planning zones evaluation for purposes of organization of rural settlement and transport

tions are favourable for establishment of big agricultural farms, agricultural and stock-breeding farms, or of stock-breeding farms, or whether these conditions are most convenient for individual small-holdings and in what proportion. Thus a town-planner receives indirectly a confirmation of the economic programme, or a warning that it is inconsistent with local conditions. Such information influences the size of proposed building programme and the character of planned settlement network.

Figures 1 to 7 represent preliminary physiographical survey for the master development plan (directive as well as perspective plan) for one group of rural settlements in central Poland. The whole survey covers an area of seven hundred square kilometres. The above mentioned figures present the same part of each map only. It was carried out within the *Geoprojekt* in 1962, under the direction of L. Wronowski, a physical geographer, and a team of specialists including: a climatologist A. Machowska, a soil expert A. Smialkowska, a hydrogeologist B. Więckowski, a geologist M. Sianowska. They all based on the author's methods.

The first five maps do not require much explanation. By and large, they present the set of characteristics which are to be taken into account in establishment of the smallest areal units which may still be distinguished on a scale of 1:100,000.

An additional help was obtained by an analysis of conditions of natural water balance.

The following physiographical agricultural zones are shown on the Fig. 6 favourable for agriculture, for agriculture and forestry, finally for forestry, grasslands and meadows. The division was based on geomorphological and hypsometric characteristics as guiding criteria. Further subdivision was carried out by taking into account the value of soils, together with water and hypsometric conditions.

The following physiographical-settlement zones established for the needs of development of rural settlements and the road network were shown on Fig. 7: areas in which there are no obstacles to the further development of the existing settlements and the construction of new ones; favourable conditions for road construction; areas in which there are some physiographical elements negative for settlement development; areas where difficulties may arise in the construction of roads of higher technical standard, and areas in which most of the physiographical characteristics are negative. It should be noted that in the case of those latter areas, when reconstruction of the existing settlements or the construction of new ones are intended, it is necessary to examine the physiographical conditions in more detail.

The selection of areas was based on hypsometric conditions, on climatic conditions, and on groundwater conditions. Information about resources to

be used as building materials and the nature of the water supplies was also taken into account. Morphological characteristics were again the guiding element in the selection.

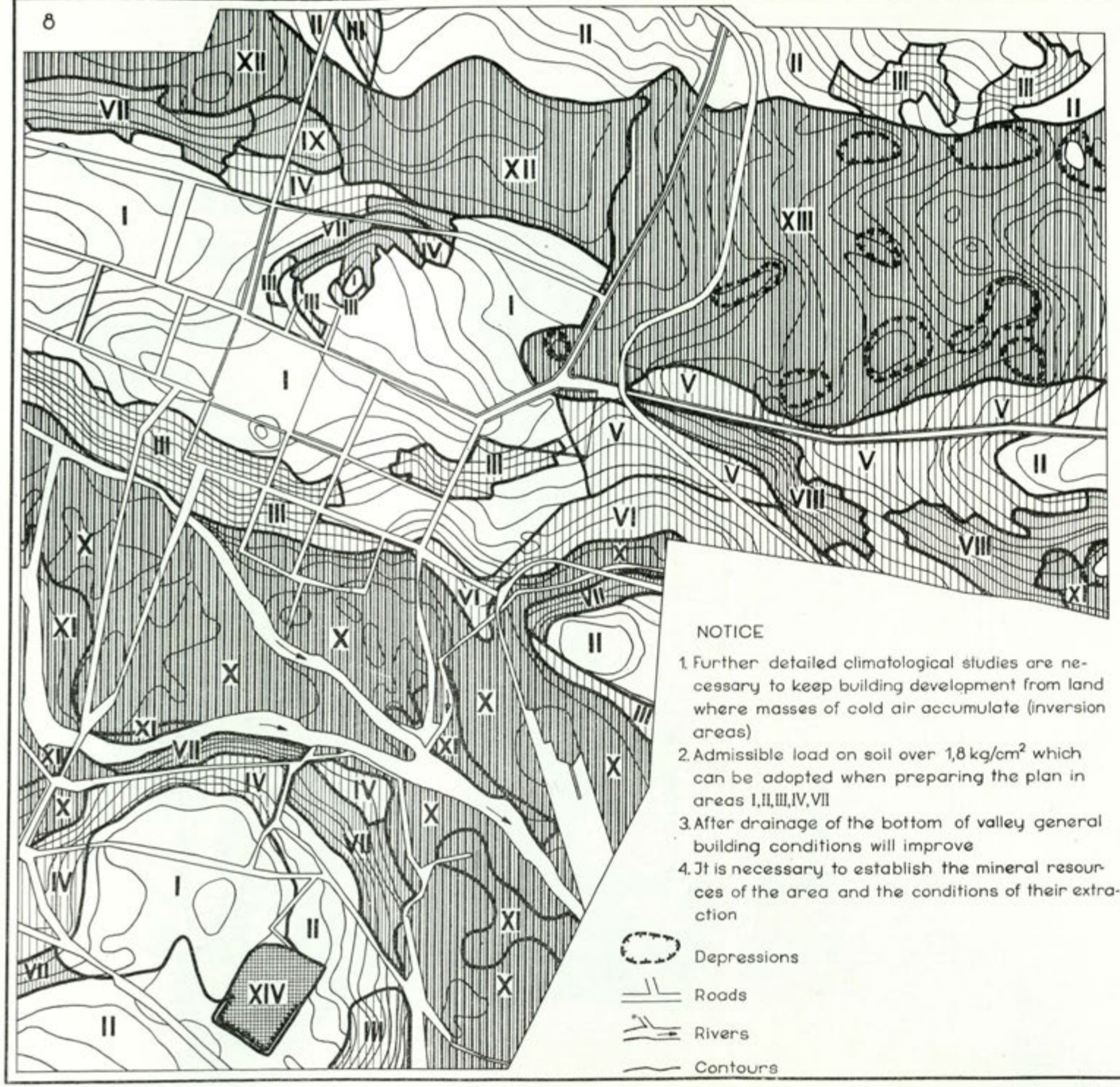
Summing up, it should be stated that all those zones and subzones of physiographical conditions, classified from the point of view of agriculture and rural settlement constitute together the background on which the planner verifies whether the existing settlements are properly located and prepares his conclusions for the preliminary concept of the network of rural settlements of the *powiat* or in some cases of a suburban area.

As previously noted, general physiographical surveys are prepared for use in making of general development plans of towns, of the districts of large towns and of urban settlements. They help in decisions related to:

— the future size of the given settlement;
— the directions of the possible territorial developments of the given settlement and the size of its immediate neighbourhood;
— proper location of the residential areas;
— proper location of industrial plants injurious to human health;
— the size and shape of the zone protecting residential areas from the effects of water and air pollution;
— proper location of open spaces necessary for human health protection and recreation in the settlement;
— the manner of development of areas outside the zone of concentrated urban development;
— location of cemeteries, sports fields, hospitals, sanatoria, etc.

Also indicated in the survey are: sites to be excluded from further physiographical investigations (if their negative values are clearly established on basis of simple criteria), sites on which further detailed physiographical investigations should be undertaken or on which some special problems should be additionally investigated.

General physiographical survey for the master development plan (perspective as well as stage plan) contains 6–8 maps on the scale of 1:5000 or 1:10,000 and covers usually an area of a few km²: (i) map of relief (gradients of land declivity); (ii) geological map of substratum-ground under two metres of upper strata, that is at the average depth of foundations for three to five storey residential and public buildings; (iii) hydrological map—"water zones"—these areas differing with the depth of water-table, dimensions of fluctuation of water-table. Moreover, there were shown areas with water-table less than 2 m from the surface; (iv) soil map showing different soil complexes in the stratigraphic setting and the types of soil within soil complex; (v) map of classification of climatic conditions, and finally (vi) map of evaluation of physiographical conditions, especially for residential uses and public open spaces but also other kinds of urban land use.



NOTICE

1. Further detailed climatological studies are necessary to keep building development from land where masses of cold air accumulate (inversion areas)
2. Admissible load on soil over 1,8 kg/cm² which can be adopted when preparing the plan in areas I, II, III, IV, VII
3. After drainage of the bottom of valley general building conditions will improve
4. It is necessary to establish the mineral resources of the area and the conditions of their extraction

Depressions

Roads

Rivers

Contours

AREAS SUITABLE FOR RESIDENTIAL DEVELOPMENT

I Areas eminently suitable for residential development

II Areas less suitable for residential development (the detailed plan includes proposals for residential development; if over 4 stories, special geological and engineering studies necessary); suitable for open spaces and allotments

AREAS SUITABLE FOR RESIDENTIAL DEVELOPMENT WITH RESERVATIONS

ONE NEGATIVE CHARACTERISTIC

III Slopes over 8%; suitable for afforestation

IV Poor conditions of daily insolation (orientation of slopes NE, N, NW) suitable for afforestation

V Possibility of occurrence of karst phenomena. Suitable for gypsum exploitation as well as for afforestation

VI Shallow water table; suitable for open spaces and allotments

TWO NEGATIVE CHARACTERISTICS

VII Slopes over 8% as well as N, NE and NW orientation

VIII " " " 8% " " " weak soil

IX " " " 8% " " " threatened with karst phenomena.

Areas VII - IX suitable for tree-planting

AREAS UNSUITABLE FOR RESIDENTIAL DEVELOPMENT ON ACCOUNT OF:

X High water table in river valley during whole year, and subject to cold air drainage; suitable for meadows and grassland or for open spaces (after drainage).

XI High water table in river valley during whole year, as well as soft soil and liability to cold air drainage; suitable for meadows.

XII Waterlogged with soft soils, parts suitable for meadows

XIII Active karst phenomena, in part of area high water table on impervious sub-strata; suitable for afforestation

XIV Quarry

0 100 200 300 400 500 metres

0 100 200 300 400 500 yards

Prepared by W. Różycka 1962
based on the materials of A. Kłębek and team

Fig. 8. Map of physiographical zonning for urban development especially for residential use and public open spaces

	LAND RELIEF	WATER CONDITIONS	SOIL CONDITIONS	CLIMATIC CONDITIONS	SUITABILITY OF LAND FOR BUILDING	ADDITIONAL REMARKS
	Undestroyed level land surrounding clay pit	Ground water at the depth of 5m	Series of pleistocene clays and arenaceous silts	Neutral	Building conditions good	
	Rubbish	As above	Mixed soils of different age and composition	As above	Suitable for building with exception of the edge of the pit	
	Edge of the pit	As above	Arenaceous silt soils	As above	Area unsuitable for building	Danger of land slides
	Land sloping from 2m to 7m towards the pit	Ground water on variable levels	As above	Favourable or unfavourable daily insolation	As above	
S	Upper part of the pit forming a sharp slope	Ground water on the same level as the water in the pit, but at variable depth from the surface	As above	As above	Areas less suitable for building	
T	Upper part of the pit forming sloping terracee	As above	Series of pleistocene clays and arenaceous silts	As above	Areas suitable for bungalows and for recreational constructions	
Gr	Interior dyke	Water at the depth of 1-2 m.	As above	Neutral	Areas unsuitable for building; good for paths	
	Lower part of the pit	Waterlogged	As above		Areas unsuitable for building; suitable for open spaces	Impermeable soils
W	Shallow depressions without drainage	Periodically flooded	As above		Possible for building but only except the pit after drainage; suitable for open spaces	Impermeable soils
	The lowes part of the pit	Surface water to the depth of several metres				Impermeable soils

Fig. 9. Classification of land for residential development (one-family houses) on land reclaimed after mineral working.

In the physiographical survey, a part of which is presented in Fig. 8 zoning was first established from the point of view of housing and only later adjusted from the point of view of open spaces. It was based on the classification of geomorphological conditions, which in this case are also reflecting the conditions of the local climate. Groundwater and soil conditions as well as problems of mineral resources served as additional criteria for zoning. The key to Fig. 8 was prepared in such a way that it shows what characteristics and processes are taken into consideration when distinguishing zones and subzones. Four zones were distinguished. The first zone (subzones I, II) suitable for residential areas, open spaces as well as orchards. The second zone (subzones III–VI) comprises areas in which the characteristics of one element are not favourable or give occasion to unfavourable processes. In the third zone (subzones VII–IX) at least two elements are negative (for example gradients of land declivity and gypsum in ground). The fourth zone (subzones X–XIII) is an area in which it is inadvisable to place residential development because the present physiographical conditions cause unhygienic living conditions (water-logged ground, inversion of temperature). Also shown are the zones in which soil will bear typical residential buildings of five storeys (foundations deeper than 2 m), and the areas in which drainage will improve physiographical conditions; those areas will then pass to the higher class zone.

By comparing zones between themselves it becomes possible to choose the optimum economic and sanitary solution to the problems of town development based on proper use of the physiographical environment as well as to define the consequences of following other alternatives of such a solution. At the same time it is often possible to consider whether the choice of a solution respecting measurable economic arguments only and by-passing immeasurable but socially important ones is really proper and reasonable.

The third type of physiographical survey now prepared is the detailed physiographical survey. As an example of such a survey let us look at a fragment of survey prepared for Warsaw in the Planning Office of Warsaw by B. Czechowicz and his assistants (Fig. 9). This survey was presented in a form of a map on the scale of 1:1000, called "Classification of land for residential development (one-family houses) on land reclaimed after mineral working". The colony was to be built on an exploited and abandoned clay-pit. First, suitability of land for building purposes was defined in relation to the character of relief. Then the celected sites were characterized from the point of view of climatic, water and soil conditions. Finally suitable, less suitable and unsuitable sites for building were mapped alongside sites for recreational facilities and for open spaces.

It is necessary to add a few words on the applying of physiographical surveys in planning. Two maps, Fig. 10 and 11, are the example of applying the results of physiographical survey to a plan of the settlement network of

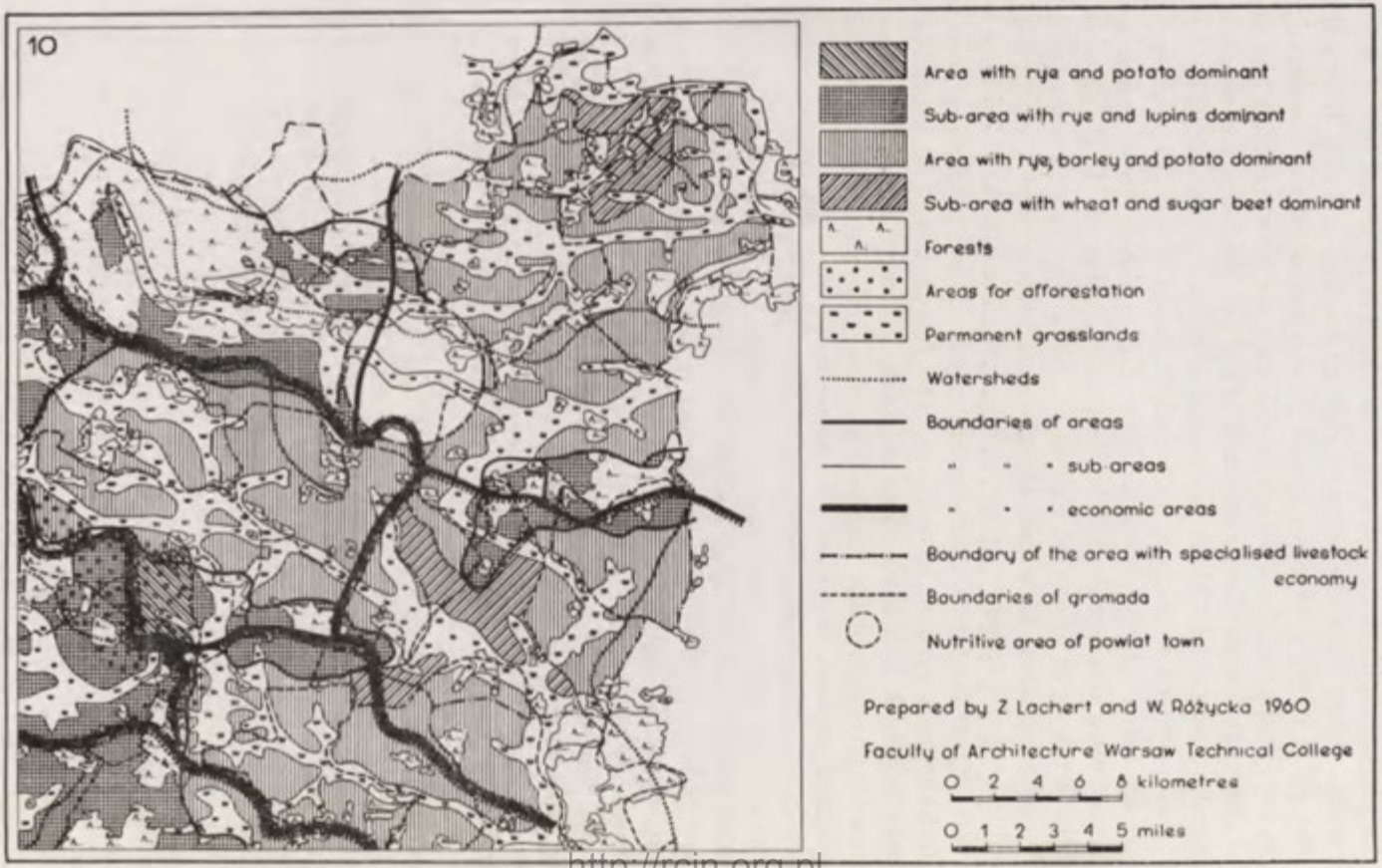


Fig. 10. Map of economic areas

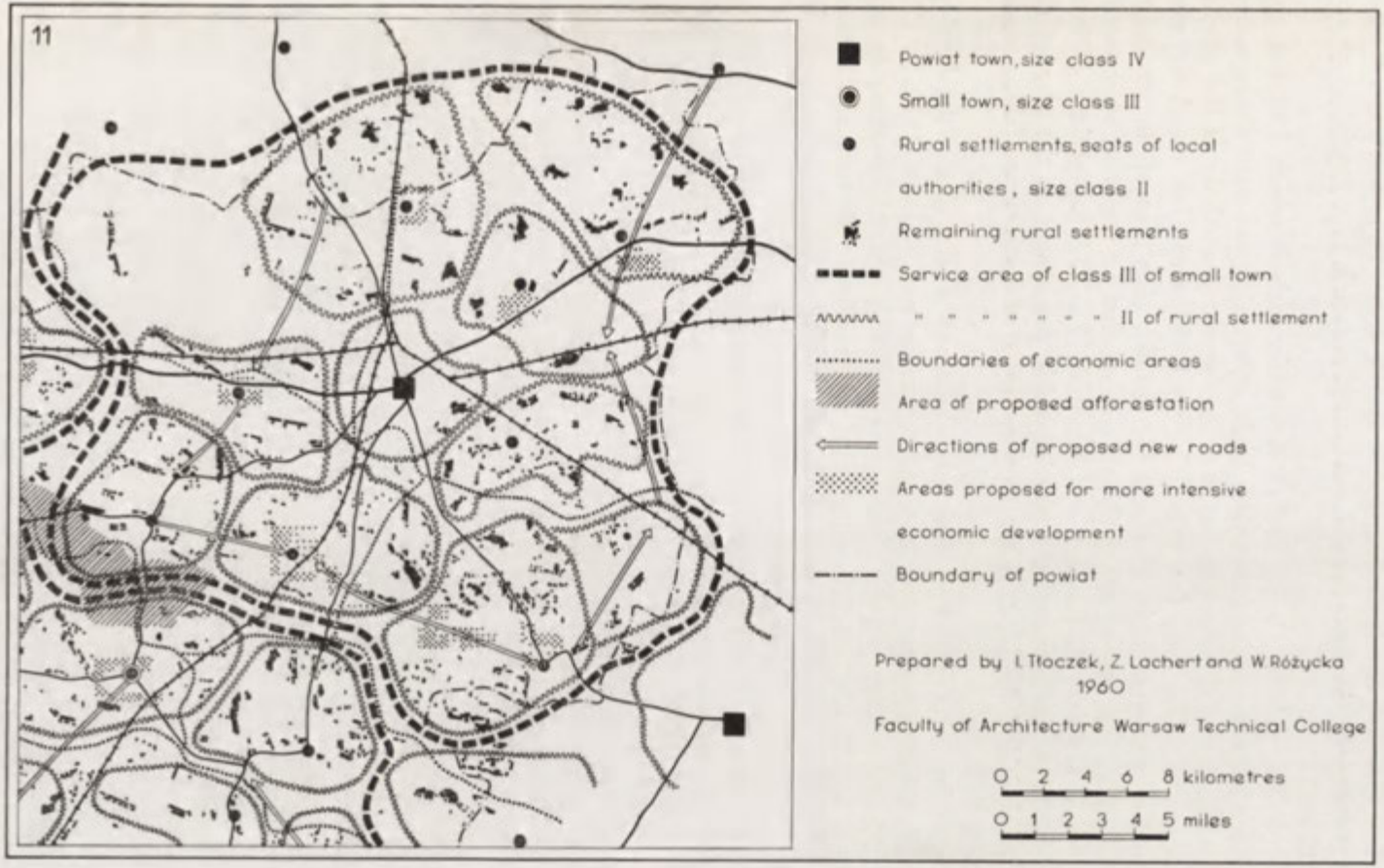


Fig. 11. Directions for settlement network of *powiat*

a *powiat*. The first one is the map of economic areas. Z. Lachert and W. Różycka produced it in 1960 for the settlement network of a *powiat* in an area of 1500 km² [19].

The physiographical survey and an economic analysis which I cannot give here, have been the basis of this map. Eight economic areas were distinguished. The boundaries of these economic areas corresponded to those of the physiographic zones. The area for afforesting and the areas for meadows were indicated on the same basis. The basis for the direction plan of the settlement network (Fig. 11), among other things, was studied on the map of economic areas by I. Tłoczek, Z. Lachert and W. Różycka. The comparison of both maps shows the influence of the physiographic conditions on the plan of the *powiat*, especially on its division (service areas of settlements falling under size class III).

The number of prepared physiographical surveys testifies clearly the development of urban physiography in Poland. In the period from 1949 to 1962 about 30 preliminary physiographic surveys were prepared, covering an area of about 20,000 km². Moreover, general physiographic surveys and detailed physiographic surveys have been completed for about 800 towns, large and small in the area of about 5000 km².

The question may be raised whether the whole abundant material collected in physiographical surveys, various attempts at assessing the physiographical environment for the purposes of the urban and rural planning in the form of classification maps were properly used in the present practice of planning, and what is even more important, whether they have influenced seriously the contents of the development plans [11]. To answer this question is not easy. The ability to use physiographical studies among planners varies in a quite remarkable way. In any case, it may be stated that at first the greatest interest was aroused by studies which today are called "the case or problem studies" as, for instance, the geological–engineering maps. Planners were interested only in ground resistance and admissible load on soil.

Today a town-planner uses generally complex physiographical studies and demands additional information for many problems. Study prepared now for the purposes of physical planning along the Baltic Coast includes, for example, research on the local climatic conditions, as influencing the location of health and holiday resorts, as well as a detailed description of the coastal belt from the point of view of its various recreational functions, that is of beaches, possibilities of bathing, water sports and others. The tremendous interest taken in perspective planning of towns, numerous planning studies undertaken for purpose of establishing the possibilities of further development of bigger Polish cities (directive plans) have increased demand for physiographical investigations.

In most cases physiographical studies are prepared on so wide a scale that

they begin to make a considerable contribution to the general knowledge of the geography of our country. One must bear in mind, however, that the physiographic conditions are subject today to accelerated transformation, and all collected material should be kept up-to-date if it is to be of any use [4, 17]. Surveys must be, therefore, periodically checked and verified in the field. Comparison of data every few years certainly allows us to make better forecasts. Thus at least certain systems of measurable characteristics will arise; they may be used for criteria in estimating the local costs of the urban construction.

Physiographical studies constitute, at the same time, a valuable instrument with which one can follow the changes taking place in the geographic environment under the influence of urbanization.

It is a new trend in the geographical research which—I think—has an interesting future [3].

Bibliography

[1] Dembowska, Z., Różycka, W., *Wytyczne w sprawie zakresu i sposobu wykonywania i wykorzystywania dokumentacji fizjograficznej, opracowanej dla potrzeb planów zagospodarowania miast i osiedli* (Directions for the sphere and the way of performing and exploiting the physiographical survey), Komitet Urbanistyki i Architektury, Warszawa 1957, p. 43.

[2] Domosławska, M. D., "Zadania fizjografii urbanistycznej" (Sum. The scope of urban physiography, *Przegl. geogr.*, 24 (1952), 1–2, 84–87.

[3] Dziewoński, K., "Nowy dział badań geograficznych—fizjografia urbanistyczna" (Sum. A new branch of geographic research—urban physiography), *Przegl. geogr.*, 27 (1955), 3–4, 489–500.

[4] Fabijanowski, J. and Zarzycki, K., "Wpływ obniżenia poziomu wód gruntowych na roślinność w związku z budową odkrywkowej kopalni siarki w Piasecznie" (Sum. The effect of the lowering of ground water level on vegetation, in the connection with the development of open-cast sulphur mining at Piaseczno), *Ekologia Polska*, ser. B, 7 (1961), 3, 203–213.

[5] Gajkowska, S., "Rola i znaczenie dokumentacji fizjograficznej" (The role and meaning of the physiographical survey), *Biul. techn. Biur Proj. Budown. miejsk.*, 8–9 (1954).

[6] Gut, S., "Zmiany w krajobrazie doliny Dunajca spowodowane wybudowaniem zapory w Rożnowie" (Sum. Changes of the landscape of the Dunajec valley caused by the construction of the Rożnów dam), *Chrońmy Przyrodę Ojczystą*, 15 (1959), 6, 3–8.

[7] "Instrukcja w sprawie dokumentacji fizjograficznej" (Instruction for physiographical survey), *Biul. Inform. KUA*, 4 (1956), Suppl. V–X.

[8] Jaromin, Z., "Studia fizjograficzne w dokumentacji urbanistycznej" (Physiographical studies in the town planning survey), *Biul. techn. Biur Proj. Budown. miejsk.*, 10, (1953).

[9] Kowalski, W. C., "Główne problemy geologii inżynierskiej w Polsce" (Sum. Main problems of engineering geology in Poland), *Przegl. geol.*, 8 (1960), 1, 18–23.

[10] Krzyszkowski, A., "Przydatność opracowań fizjograficznych dla planów urbanistycznych" (Sum. The importance of Physiographic studies for urban planning purposes), *Przegl. geogr.*, 27 (1955), 3–4, 567–577.

[11] Malisz, B., *Elastyczność planu urbanistycznego jako kryterium jego realności* (Sum. Flexibility of a town plan as a criterion of its realisability), Warszawa 1960, pp. 111.

[12] Malisz, B., "Metoda planu kierunkowego" (The method of directive plan), *Miasto*, 13 (1962), 1, 1–5.
[13] Prószyński, M., "Prace fizjograficzne wykonane w Biurze Urbanistycznym Warszawy" (Physiographical surveys made in the Planning Office of Warsaw), *Przegl. geogr.*, 27 (1955), 3–4, 611–619.
[14] Różycka, W., "Fizjografia urbanistyczna" (Urban physiography), in: *Urbanistyczne założenia programowe*, Warszawa 1954, 137–143.
[15] Różycka, W., "Problematyka i zadania fizjografii urbanistycznej" (Sum. Scope and aims of urban physiography), *Przegl. geogr.*, 27 (1955), 3–4, 501–521.
[16] Szarzyńska-Rewska, H., "Metody opracowania wstępnej oceny terenu dla planu zagospodarowania miast" (Sum. Methods of elaborating preliminary land classification for the development of towns), *Przegl. geogr.*, 27 (1955), 3–4, 553–565.
[17] "Ustawa o planowaniu przestrzennym" (Physical Planning Act), *Dziennik Ustaw*, 7, Warszawa 1961.
[18] "Zarządzenie nr 47 Przewodniczącego KBUA z dnia 29.VII.1961 r. w sprawie szczegółowych prepisów o sporządzaniu miejscowych planów zagospodarowania przestrzennego" (The order 47 of the chairman of the KBUA for the detailed rules of the local physical planning), *Dziennik Budownictwa*, 1, Warszawa 1962.
[19] Tłoczek, I. F., *et al.* "Plan zagospodarowania przestrzennego powiatu łukowskiego, część I" (Area-development plan of the *powiat* of Łuków, 1st part), Katedra i Studium Architektury i Planowania Wsi Politechniki Warszawskiej, Warszawa 1961.

SOME ASPECTS OF WATER RESOURCE DEVELOPMENT IN RELATION TO LANCASHIRE

STANLEY GREGORY

THROUGHOUT the past hundred years of more, both official and public interest in the development and exploitation of the water resources of Britain have tended to be sporadic and intermittent. They have been stimulated periodically by rather more dramatic events, such as the Royal Commission of 1844, which stressed the water and sewage requirements of the growing industrial towns; the droughts of 1933 and 1934 which led to the Rural Water Supplies Act and the Supply of Water in Bulk Act, both passed in 1934; or the occasional disastrous river flood, such as at Lynmouth in 1952. Resultant action, however, has more often than not been only permissive in character, and positive action has depended on the interest and vitality of local organizations. Furthermore, authority has been vested in the hands of a wide range of bodies, each interested in but one aspect of water exploitation—water supply, drainage, flood control, sewage, navigation, fisheries.

Since 1945, however, greater powers of centralized control have been gradually established. The Water Act of 1945 imposed on the Minister of Health, now the Minister of Housing and Local Government, a duty "to promote the conservation and proper use of water resources and the provision of water supplies in England and Wales and to secure the effective execution... of a national policy relating to water". Numerous county surveys were carried out by the water engineers of the Ministry of Housing and Local Government which have since been periodically brought up to date by the local planning authorities, while more recently several catchment area surveys have been made. Also, since 1956 the regrouping and reorganization of water supply undertakings under Ministerial pressure reduced their number in England and Wales from 1030 in September 1956 to 628 in March 1962 and to 488 in March 1963. Furthermore, by the River Boards Act of 1948 statutory powers related to drainage, fisheries and the prevention of pollution were concentrated in the hands of a single authority for each river board area, and although the actual powers of these river boards have left something to be desired, they

have been steadily strengthened by the Rivers (Prevention of Pollution) Acts, 1951–1961.

The need for longer term planning, however, became obvious in the early 1950's, and in 1955 the Government asked the Central Advisory Water Committee to make a series of enquiries into water demand and the need for conservation. After several interim reports, the Final Report of the Central Advisory Water Committee's Sub-Committee on this theme was published in February 1962, and a government White Paper (Water Conservation—England and Wales) appeared in April 1962. This envisaged the establishment of River Authorities throughout England and Wales, responsible for water conservation and also for the present functions of the river boards but not for water supply as such. A central authority on water conservation, the Water Resources Board, is also to be established, although this will be primarily advisory in character, coordinating the fact-finding activities of the River Authorities. A Water Resources Bill, designed to effect these changes had, by the end of April 1963, been read a second time in both the House of Commons and the House of Lords. These official policies, past and present, are variously reflected in different parts of the country, depending both upon local water resources and upon the type and intensity of the demand placed upon them. This paper will concentrate upon illustrating some of the problems and characteristics that have resulted in north-western England, especially in the county of Lancashire.

The basis of the water resources of any area is clearly its rainfall (Fig. 1). Over Lancashire this ranges on average from just under 30″ (750 mm) *per annum* in the mid-Mersey area to more than 80″ (2000 mm) in the southern Lake District. Within the county boundary, however, only limited areas experience more than 50″ (1250 mm) *per annum*, for many of the wetter areas are just outside the county. Nevertheless, with evaporation averaging about 18″ (450 mm) *per annum*, even the drier areas do not normally require summer irrigation for crop cultivation, despite the marked tendency for a winter maximum in the rainfall regime. Moreover, within the uplands in, and especially around, the county many areas can rely on rainfall of 50″ (1250 mm) or more *per annum* in at least 7 years out of 10. It is from these uplands that the main rivers of Lancashire rise (Fig. 1)—the Mersey system from the southern-central Pennines and from southern Rossendale; the Ribble system from the north-central Pennines, northern Rossendale and Bowland; the Lune from the northern Pennines, Bowland and the eastern Lake District; and the Furness rivers from the southern Lake District.

The water resources provided by run-off along these rivers bears a close relationship to rainfall conditions. Thus in the Etherow valley, a highly exploited tributary of the Mersey, the correlation coefficient between annual rain-fall and annual run-off for the period October 1937 to September 1953

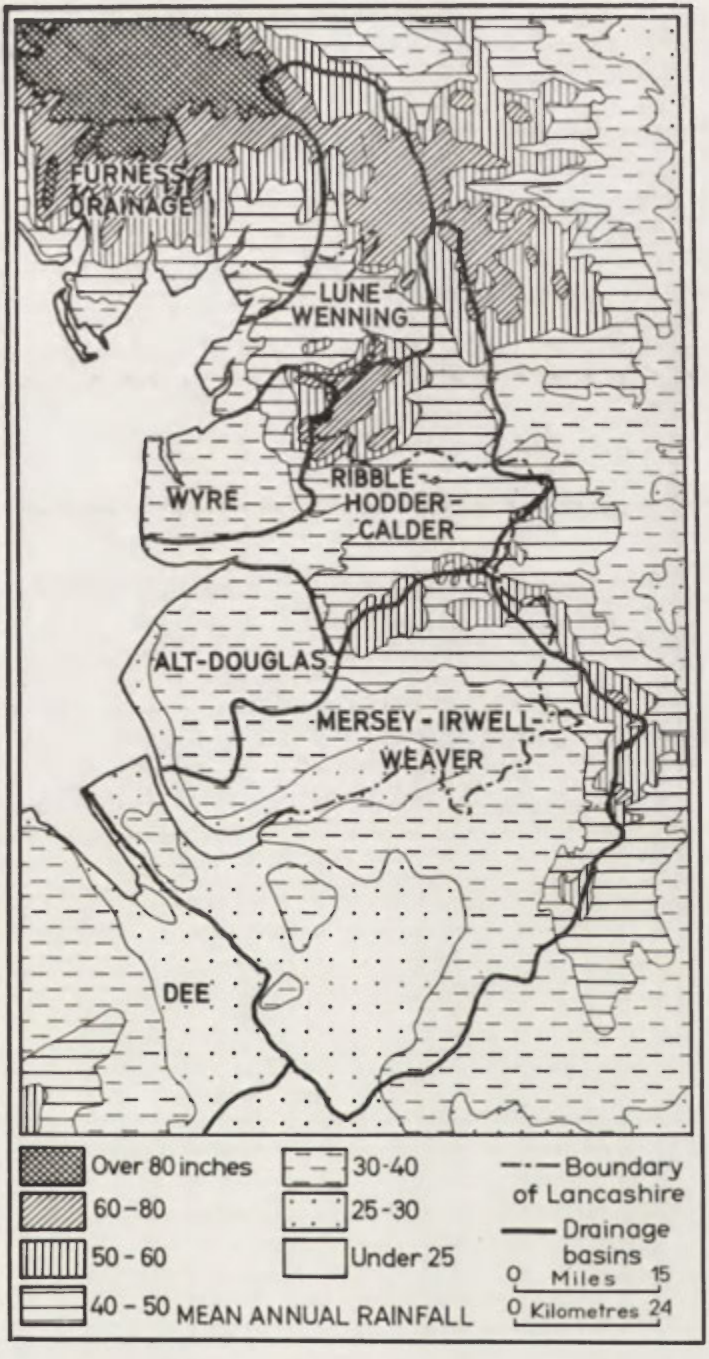


Fig. 1. Major drainage basins and mean annual rainfall (1881–1915) in and around Lancashire

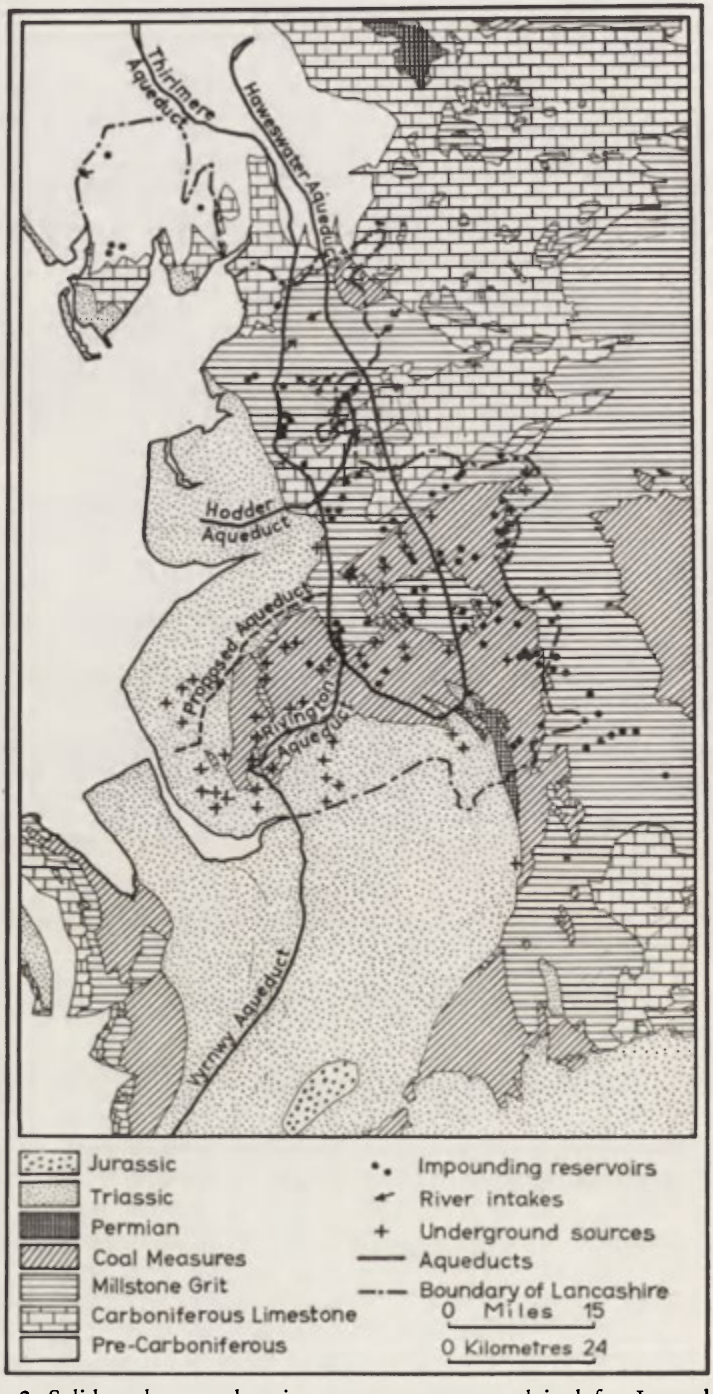


Fig. 2. Solid geology, and major water resources exploited for Lancashire
(based on data provided by the Lancashire County Council Planning Department)

was +0·92. The water resources of the county are therefore mainly those provided by such river systems flowing from these several uplands. Additional resources, however, are provided by underground water within the Triassic sandstones of south-west Lancashire and the Coal Measure sandstones of south-central Lancashire (Fig. 2).

The types of demand made upon these resources, and the various interests that must be considered in water conservation policies, grow from the economic development of the county. Lancashire is the most populous county in Britain, the only one with a population of more than 5 millions (5,131,646 in 1961). Most of these are concentrated in the industrial south of the county, especially within the south-east Lancashire and Merseyside conurbations and the towns of the coal-field. This population concentration and intensive industrialization has meant an excessive demand for water, a demand that has for long necessitated drawing on water resources from far outside Lancashire as well as on those within the county itself.

Underground water formerly provided a high proportion of supplies, but today its significance is limited to the western half of southern Lancashire where Triassic and Coal Measure sandstones provide useful aquifers (Fig. 3). Even in these areas water tables have often fallen considerably, and salt water seepage occurs near the sea. Few areas now rely wholly or mainly on such sources, although many individual industrial premises do possess their own wells or boreholes. Moreover, within the coal-mining areas water pumped from mine shafts is also used industrially. Another source is the abstraction of water from the lower reaches of the major rivers. In the southern densely populated half of the county, where such water would be of great value, the degree of pollution by domestic and industrial effluent, especially of the Mersey–Irwell system, is such that the water has so far only been used for industrial purposes.

Upland gathering grounds thus form the major source for water exploitation. Rossendale and the Pennines east of Manchester have traditionally provided the chief nearby sources, including the Rivington reservoirs for Liverpool and the Longdendale reservoirs for Manchester. Since the latter part of the nineteenth century the major consumers have needed to look farther afield, as local Lancashire supplies became inadequate. Thus Liverpool obtains most of its supplies from Lake Vyrnwy, part of the headwaters of the River Severn in Central Wales, while Manchester has turned to the Lake District, Thirlmere and Haweswater providing more than three-quarters of its water. The location of these source regions in relation to the consuming areas of Liverpool and Manchester has been of great significance for the intervening rural areas. Such rural areas have in Britain, as in all other countries, lagged behind urban areas in the development of an adequate piped water supply system. Dispersal and low density of population, absence of

Fig. 3. Upland sources of water, and the areas to which it is supplied, in and around Lancashire

(based on S. Gregory, Trans. Inst. Brit. Geog. 25 (1958), p. 153)

industrial demand and lack of public money have all contributed to this. The Liverpool and Manchester aqueducts, together with that of the Fylde water board from Stocks Reservoir in Bowland to a much lesser extent, have provided a sort of "water grid" which has been utilized by many rural and small urban areas. Furthermore, this has also provided supplies for many areas far outside Lancashire which, but for the demand from industry and population in Lancashire, may not have obtained adequate piped supplies so speedily or so cheaply.

The pattern of water supply undertakings that has grown up in Lancashire reflects these general tendencies, especially remembering that from the days of the 1848 Health Acts it has been the Local Authority (the administrative unit of city, town or rural district) that has had primary responsibility for water supplies. The pattern grew piecemeal until by 1935 (Fig. 4) the undertakings consisted of a number of county Boroughs, often incorporating all or part of neighbouring smaller Local Authorities; many Municipal Boroughs and Urban Districts; many Rural Districts; and a few Water Boards displaying embryo moves to local or regional integration.

The next 20 years saw few changes. By 1955 (Fig. 5) a few smaller Local Authorities had been absorbed by larger Local Authorities, but the main change, apart from the incorporation of Salford into the Manchester undertaking, was the expansion of Fylde Water Board inland from its supply areas at the coast towards its sources in Bowland. Governmental pressures to reorganization have had considerable impact during the recent past, however. By 1961 the number of undertakings had decreased from 68 to 31 (Fig. 6). Manchester, Bolton and St. Helens all absorbed Local Authorities which they had been supplying "in bulk" (i.e. wholesale) for some years. The main changes were the creation of a number of large Water Boards, thus eliminating the independent existence as water suppliers of such County Boroughs as Barrow, Preston and Wigan; rationalizing the complex of minor units around Wigan; and removing from all but a few Rural Districts their role as water supplier. Also Fylde Water Board expanded yet again, its areas of incorporation including the County Borough of Blackburn. One valuable result of these changes has been the greater integration of town and countryside into the one administrative unit.

This rationalization of water undertakings, which may well go yet further, has not, unfortunately, included any reorganization or reallocation of water resources. It may be unfair to comment on this as yet, for many of these changes are little more than a year old. Nevertheless the urgent need for consideration of this is all too clear. Water from many upland areas is exploited for widely dispersed areas in Lancashire, the pattern being largely the result of historical accident (Fig. 3). The only truly indigenous source of upland water, Rossendale (Area F), supplies much of south-central and south-west

Lancashire. Bowland water (Area E), mainly drawn from Yorkshire rather than Lancashire, goes to Blackburn, Preston and the holiday resorts of Fylde. From outside the county, Central Pennine water (Area B) goes to south-eastern areas; Lake District water (Area D) is used from north to south throughout the county, *via* Manchester's aqueducts; while from Central Wales (Area H) Liverpool and neighbouring areas draw their chief supplies.

This complex pattern of water source utilization will be further intensified by the more recent schemes of both Liverpool and Manchester. Thus Liverpool has extended its interests in Central Wales from the upper Severn to the upper Dee. Reservoir construction in the Tryweryn valley is well under way, as a means of regulating the flow of water along the River Dee. Abstraction will then be effected at Huntington, just upstream from Chester. This development also impinges on those of other water undertakings. For example, Birkenhead, and through them Wallasey, draw water from the Dee, having effected partial control from Lake Bala; the city of Chester depends on it as a source; while the Mid and South-east Cheshire Water Board abstract downstream from Llangollen. In this way, inter-authority co-operation has been evolved, extending across both county and river basin boundaries. It should be noted, however, that these water resource developments aroused marked opposition both from inhabitants of upland Wales and from others sympathetic to their cause. Although such opposition was not effective in the case of Bala or Tryweryn, similar opposition has so far prevented Manchester from proceeding with schemes to increase its supplies of Lake District water by exploiting Ullswater.

Such opposition is often emotional rather than rational. Nevertheless, it must be admitted that upland reservoir development does have significant effects upon the character, life and economy of the uplands. Valley farmland, and sometimes farm buildings, are drowned, and the elimination of such valley bottom land renders efficient agricultural use of neighbouring hills difficult if not impossible. Moreover, the policy of close control of catchment areas exercised by many undertakings raises problems as to the type of farming that may be carried on, even where access is allowed. Thus on the Pennines east of Manchester some exploited catchments are owned by the water undertaking and some are not. The latter especially applies when reservoirs are for railway or canal use or only for compensation water. In the owned or controlled areas, catchments for domestic supplies are usually restricted to sheep grazing as the sole agricultural pursuit, while access for people is normally forbidden or restricted. Below domestic reservoirs and around compensation reservoirs, however, cattle are often allowed and farming thus changes. Such effects as these must be balanced against the contribution to the national economy made by adequate water supply for the industrial towns. Moreover, in many cases such water exploitation can be effectively associated

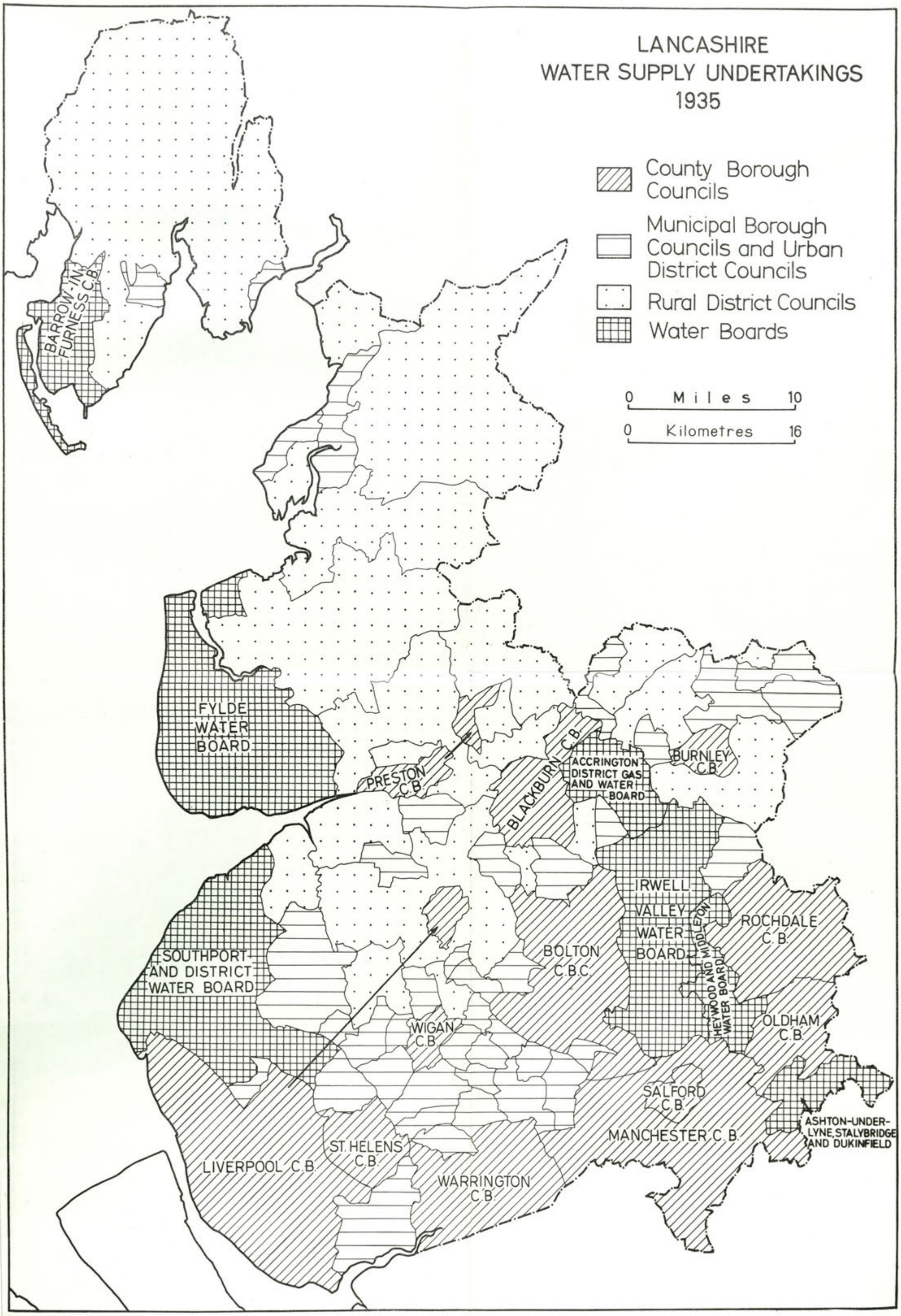


Fig. 4. Water supply undertakings in Lancashire, 1935
(based on data extracted from the British Waterworks Directory with statistical tables, 1936)

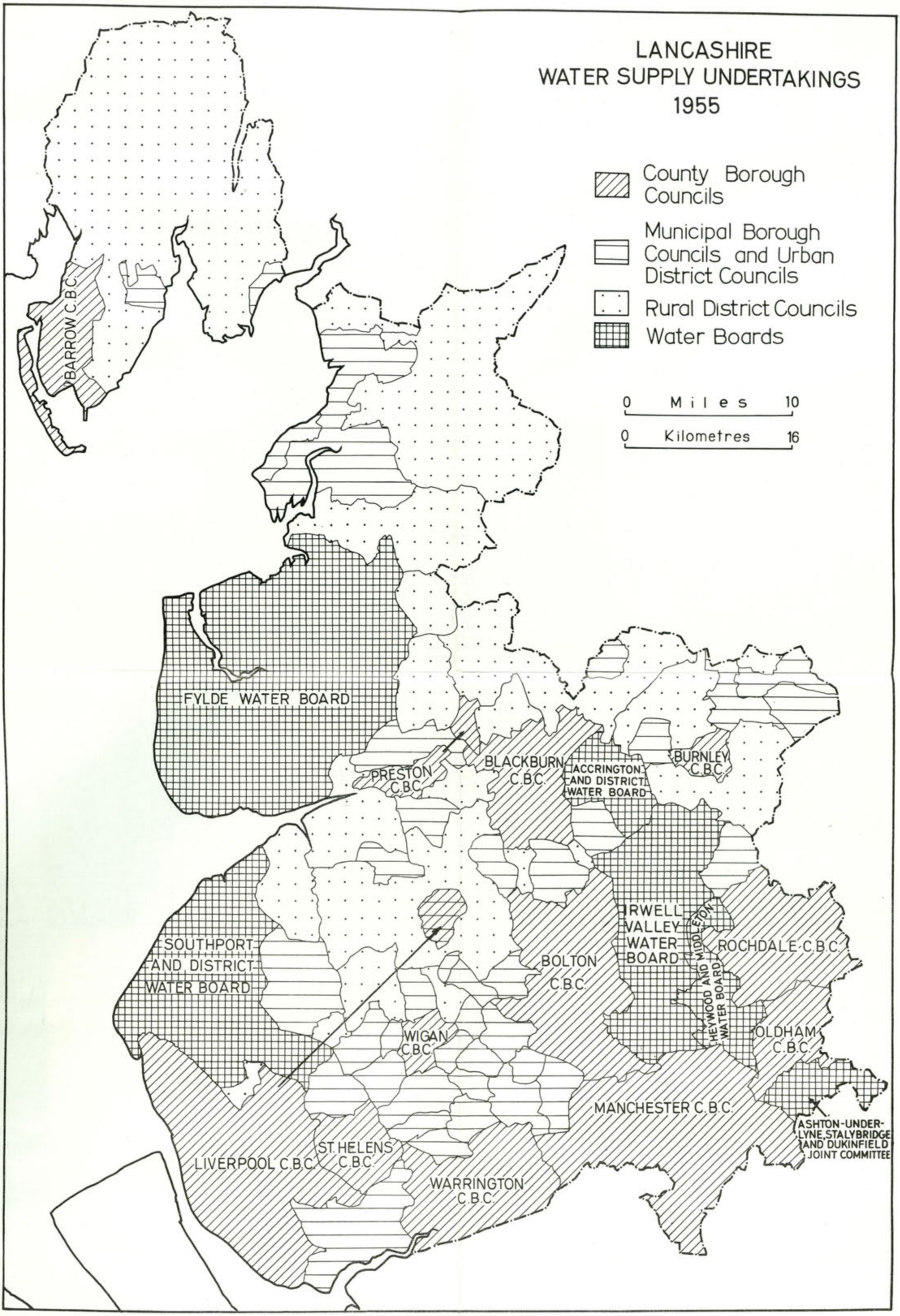


Fig. 5. Water supply undertakings in Lancashire, 1955
(based on data provided by the Lancashire County Council Planning Department)

LANCASHIRE
WATER SUPPLY UNDERTAKINGS
1961

County Borough Councils

Municipal Borough Councils and Urban District Councils

Rural District Councils

Water Boards

0 Miles 10

0 Kilometres 16

FURNESS WATER BOARD

LUNE VALLEY WATER BOARD

FYLDE WATER BOARD

PRESTON AND DISTRICT WATER BOARD

NORTH CALDER WATER BOARD

BURNLEY C.B.C.

ACCRINGTON AND DISTRICT WATER BOARD

IRWELL VALLEY WATER BOARD

MIDDLETON

HEYWOOD AND MIDDLETON WATER BOARD

ROCHDALE C.B.C.

BOLTON C.B.C.

WEST LANCASHIRE WATER BOARD

MAKERFIELD WATER BOARD

OLDHAM C.B.C.

MANCHESTER C.B.C.

ASHTON-UNDER-LYNE, STALYBRIDGE AND DUKINFIELD JOINT COMMITTEE

ST. HELENS C.B.C.

LIVERPOOL C.B.C.

WARRINGTON C.B.C.

Fig. 6. Water supply undertakings in Lancashire, 1961
(based on data extracted from the Water Engineer's Handbook, 1962)

with upland reafforestation, although little has been carried out east of Manchester. Many would maintain, in fact, that afforestation is a form of upland land use that is economically more valuable than sheep farming, even without the added value of the water in catchment areas. Furthermore, many schemes are now concerned with upland reservoirs simply as a means of ensuring a regular river flow, abstraction occurring nearer the consuming area—the Tryweryn scheme is of this type, as is the projected Fylde scheme for the upper Ribble. Control of access and of type of farming is thus no longer necessary to keep the water pure, as purification is effected on abstraction.

The water obtained from these several sources, and distributed through these many undertakings, is used both domestically and industrially. Industries often obtain their own water instead of, or as well as, using public water. This may be by borehole, river abstraction or *via* their own reservoirs, as with railways over the Pennines. Quantities used vary considerably, depending on the type of industry, the size of plant, the efficiency of equipment, and the cost of water; overall, it greatly exceeds domestic use. Thus, in north Liverpool one synthetic fibre plant uses as much water as a town of 50,000–100,000 people; while the Clarence Dock electric power station, even at its normal one-third capacity, has a through-put of water (mainly estuarine water for cooling purposes) greater in amount than the whole of the public supply of Liverpool County Borough.

Most of the water used ultimately finds its way into the rivers of Lancashire in the form of effluent—domestic or industrial. This use of rivers virtually as open sewers, although regulated by law and supervised by the river boards, presents an alternative use of the drainage system which competes with, and militates against, the abstraction of water from these same rivers. Other competitive uses include the development of rivers for navigation, and their use for fishing and recreation, although none of these is very important in the south Lancashire rivers. Flood prevention can be important, however, and its requirements may well involve policies different from those for water supply exploitation.

The resolution of such problems should in future be in the hands of the projected River Authorities, although their probable domination by Local Authority interests may decrease their ultimate effectiveness in certain fields. Within Lancashire the boundaries of these River Authorities were unresolved in the government's White Paper. It was scheduled that there should be the following two bodies:

1. Cheshire (excluding the Dee valley which comes under Dee and Clwyd), Mersey (including the areas outside Lancashire) and an area called Lancashire (part);
2. Cumberland, and again Lancashire (part).

Clearly, the Furness rivers of Lancashire would be incorporated with those of Cumberland, leaving the Lune and Ribble systems as the major unallocated river basins. In view of the nature of economic activity north and south of the Ribble, and of the water source (supply area links outlined earlier), it would seem most reasonable for the Ribble to be associated with the Mersey group and the Lune with the Cumberland group. (In the Bill presented to Parliament this was not adopted, both the Lune and the Ribble catchments being incorporated with the Lake District as a whole. In the Act as finally passed in July 1963, however, the pre-existing Cumberland River Board and Lancashire River Board were re-established, in deference to local pressures).

A further pattern of administration is thus being superimposed upon the present complexity of local authorities and water undertakings, and the creation of efficient working arrangements may well prove difficult. Furthermore, as the future water exploiters these River Authorities will be faced with many immediate and difficult problems, quite apart from the administrative one. The people and industries of southern Lancashire and northern Cheshire need more water, and these needs can only be met from the wetter uplands. This means reservoir construction and the drowning of some upland valleys, in the Lake District, the northern Pennines or in Wales, despite pleas of amenity, agriculture or Welsh nationalism. It is also possible that, at least in the market gardening areas north of Liverpool, irrigation water may be required in the future, though not on the scale of eastern England. Moreover, pollution of rivers needs more effective control than now, so that more river water can be abstracted (at least for industry). This could mean a considerable increase in production costs for some industries. In the rural areas, especially along major tributaries, flood prevention measures have been widely neglected and need improving. This, as well as the collection of water for supply, will probably require more direct control of land use, especially in the uplands. Finally, water abstraction by private firms, both from underground and from streams, will need supervision and organization. Clearly, when these projected River Authorities are established, and if they are allowed to carry out the water conservation and resource development suggested here, they will not only be very busy; they will also be powerful factors in the future planning of much of the landscape and economy of Britain.

LIST OF FIGURES

ERRATA

For	Read	Page/Line		Col.
1941	1841	138_{18}		
+929	+924	142_{10}	table	IV
Country	County	143_{1}		
passibly	possibly	$147_{?}$		
geatly	greatly	150^{19}		
1515	1·515	150_{10}		
3369	3·369 (decimal)	150_{9}		
2158	2·158 (dot)	150_{8}		
2592	2·592	150_{8}		
−55,375	−54,375	152^{2}	table	III
−100,296	+100,296	152^{5}	„	V
−45,300	+45,300	152^{5}	„	VI
+7437	−7437	152^{8}	„	IV
+47,851	+47,821	152_{7}	„	VI
−35,885	−35,883	153^{3}	„	II
−59,736	−59,730	153_{9}	„	II
−40,941	−40,942	153_{1}	„	III
−15,784	−15,748	153^{7}	„	V
+420,386	+420,396	159^{5}	„	II
−1·81	−18·1	159^{1}	„	III
30+,677	+30,677	159_{1}	„	II
−117,221	−117,121	159^{15}	„	IV
+197,163	+197,167	159^{17}	„	IV
Notes:	Note:	159_{4}		
represents	re-presents	160^{1}		
43·89	37·89	161_{1}	table	VIII
1945.	1945. Chapter 1.	162^{4}	No. 2	
Newson, M.G.B.	Newson, M.G.C.	162^{5}	No. 3	
Marschal, J.	Marschak, J.	162^{14}	No. 8	
1815–1951	1851–1951	162_{19}	No. 15	

Fig. 4 p. 50/51—add

A. Indices of growth of urban population, *B*. Indices of growth of rural population, *C*. Size of towns—circles for towns of over 10,000 inhabitants proportional to the number of inhabitants, *D*. Towns and urban settlements created after 1950.

Note: To the List of Participants in Second Anglo-Polish Seminar the name of Prof. K. C. Edwards, University of Nottingham should be added (p. ix).

The First Anglo-Polish Geographical Seminar was held in Nieborów, Poland, from September 15–18, 1959. Proceedings of the Seminar were published in a separate volume "Problems of Applied Geography", Warszawa 1961.

The Second Anglo-Polish Geographical Seminar was organized at Keele, Great Britain, from September 9–20, 1962. The discussion was again focussed on the problems of applied geography.

This volume contains a general report of the Seminar, the resolution approved by the participants, a list of participants—followed by the papers read during the Seminar. The papers deal with the theoretical problems of applied geography, problems arising from industrialization and urbanization including population movements, changes of land use and climate. General studies are followed by several regional examples.