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PREFACE

SCOPE OF STUDIES, EXPERIMENTAL DESIGN, STUDY AREA*

In the course of recent decades there have been unsettling declines in the species diversity of the vegetation in many ecosystems. Such a phenomenon is very clearly occurring in meadows in Poland (Kostuch 1987, Michalik 1990, Kornaś and Dubiel 1990, Kotańska 1993). Multi-species, colourful swards are replaced by vegetation dominated by a single species of grass, mainly by *Dactylis glomerata*. The factors leading to such occurrences include changes in methods of management – the use of large doses of mineral fertilizer, herbicides, pesticides and heavy machines. Pesticides and herbicides applied on cultivated fields also have unintended impact on the meadows and boundary strips surrounding them.

Much research has been done recently in relation to the issue of diversity, but there is still little data on its functional significance. The collection of papers presented in this volume represent therefore a search for the functional significance of sward species richness through analysis of differences in soil invertebrate communities and in the decomposition pattern in meadows at different stages in secondary succession.

Sward species richness increased with successional age of meadows. Newly-established ley meadows are sown with one species of grass, or a mixture of two or several species. On the oldest many-year-old leys or permanent meadows there may be over 30 species in the sward (Jankowski, this volume b).

As succession proceeds the structure of meadows also becomes steadily more complicated. Layers are formed above and below ground and a separate litter layer emerges (Jankowski, this volume b). Similarly humus content and cation exchange capacity increase (Kusińska and Łakomiec, this volume).

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The differences noted in our studies between the meadows are the consequence of the interactions between many abiotic and biotic properties changing with meadow age.

In field conditions it is very difficult to find sites differing only from the point of view of one factor, namely of vegetational richness.

In order to decrease the influence of these interferring factors, a field experiment in mesocosms was carried out. In every experimental site 90 sand filled holes each with a surface area 200 cm^2 and a depth of about 30 cm distributed at a distances of 0.5 m were placed (Fig. 1A, B). Half were covered with litter bags containing air-dried stems and leaves of *Dactylis glomerata* (10 g dry wt) and the other half left uncovered.

The experiment allowed for comparisons to be made of the decomposition pattern of the same plant material, on the surface of analogous substrate in every meadow. The low organic matter content in sand at the start of the experiment allowed also for estimation of the increase of carbon content in the course of an experiment.

The experiment with sand was repeated three times, in 1984–1985, 1988–1989 and 1989–1990. It was carried out on 5 sites (Table 1).

The study area was located in north-eastern Poland, on the meadows of the Eastern Suwałki Lakeland (Kondracki 1994) within Suwałki Landscape Park and its buffer zone (Fig. 2).

The meadows of this area are well suited to research on diversity because they provide very marked contrasts in the species richness of plant communities over a relatively small space. This results from the varied relief of this young-glacial terrain, which consists of morainic elevations and outwash plains dissected by river valleys, as well as numerous lakes, hollows without outflows and boulder plains (Fig. 2).

In the face of terrain heterogeneity agriculture is of relatively low intensity with only small size of particular cultivated fields or meadows (from just over one ha to several ha). Grasslands account for a significant proportion of the land used (24 %) and there is also a large share of wasteland (8%) which is greater than in other regions of Poland (Kondracki 1972). Forests remain in the form of small islands, single trees among the fields or small clumps being very characteristic.

Meadows on elevations or outwash plains are generally linked into rotation cycles, and are thus leys. Their establishment involves the tilling of a field and its sowing with a single species of grass or a mixture of grass and clover. After several years have passed these are again used as cultivated fields. However, excessively rocky, steep or wet areas are occupied by permanent meadows and pastures.

The papers are based on investiqations in 13 sites on outwash plains or on their edge zones, in the villages of Błaskowizna, Bachanowo and Malesowizna (Fig. 2). All sites are found on typical brown soils or leached brown soil derived from medium sand (dystric and eutric cambisols) (Łakomiec and Kusińska, this volume), and belong to the order of moist meadows Arrhenatheretalia (Jankowski, this volume b).

The sites formed four sequences of 2–4 meadows analysed in different years. They range from the most simplified young ley meadows (one or several years old) where *Dactylis glomerata* or *Phleum pratense* cover more than 80% of the ground, to many-years-old (8–12 years) leys or permanent meadows with multi-species swards (Table 1).

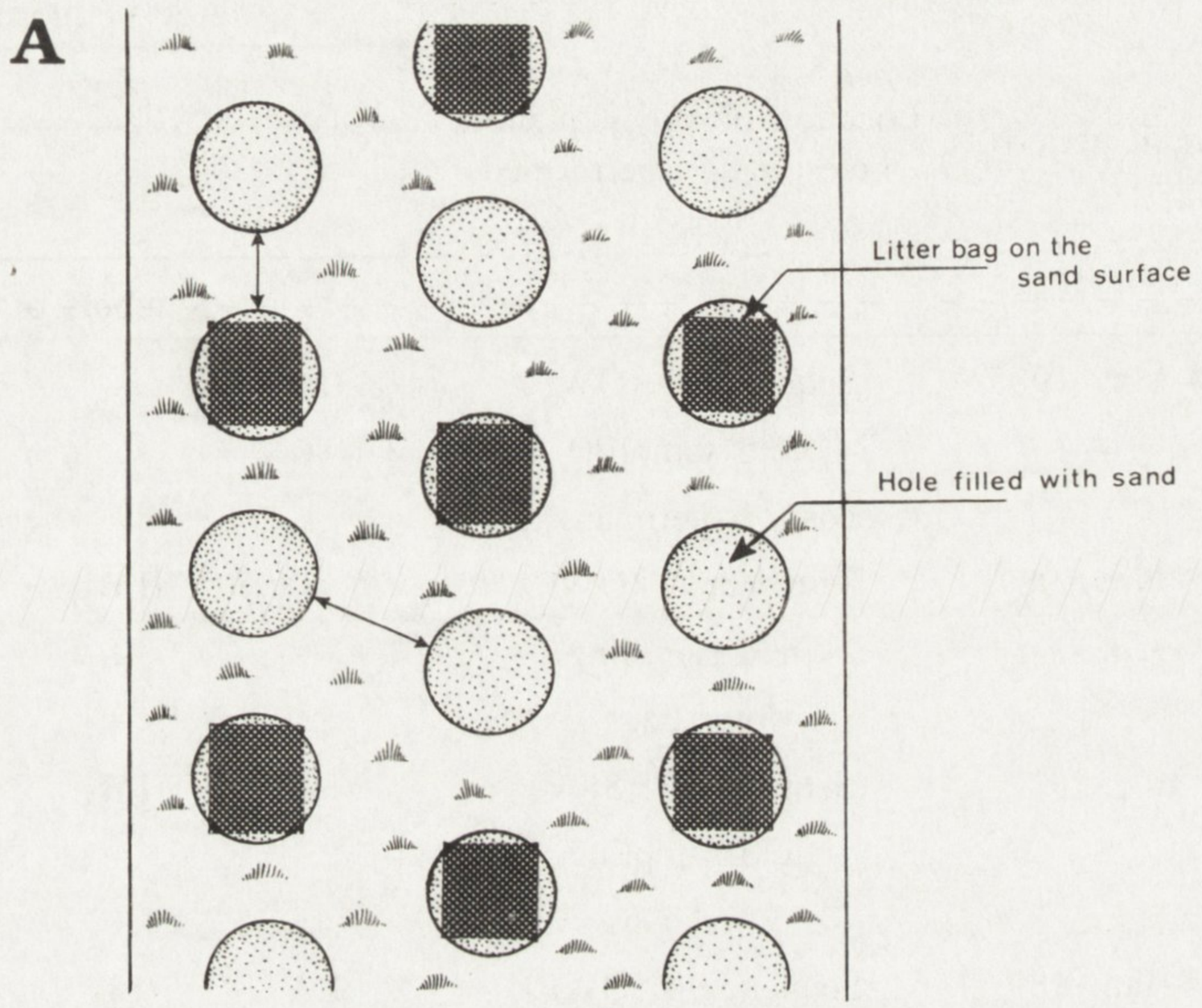

Fig. 1. Design of field experiment
A – Experimental plot, view from above. Half of the holes filled with sand were covered by litter bags, B – Cross section of a mineral bag

Ley meadows studied were denoted by the letter L and A for the youngest, B for intermediate C for oldest. Permanent meadows were signified by the letter P (Table 1).

All the meadows studied were located among cultivated fields, while some were also bounded by small patches of woodland. The area taken up by the experiment was excluded from use during its duration.

Table 1. Study sites, symbols used, periods of field and experimental investigations

Investigation period	Location of site sequences investigation performed	Age of meadows (years)			
		1–2	3–6	7–9	> 10
		Grass leys			Permanent meadows
		Symbols of study sites			
June 1984–May 1985	Sequence 1 (OWP)	LA_1	–	LC_1	–
	field sampling	+		+	
	mesocosm experiment (Ex I)	+		+	
June 1987–Nov.1987	Sequence 2 (OWP)	–	2(LB_2)*	LC_2	P_2
	field sampling		+	+	+
	litter bags		+	+	+
	Sequence 3 (SRV)	–	LB_3	LC_3	P_3
	field sampling		+	+	+
	litter bags		+	+	+
May 1988–Jan.1989	Sequence 4 (OWP)	LA	LB	LC	P
	field sampling	+	+	+	+
	mesocosm experiment (Ex II)	+	+	+	+
May 1989–Feb.1990	Sequence 4 (OWP)	LA	–	LC	P
	field sampling	+	–	+	+
	mesocosm experiment (Ex III)	+	–	+	+

Abbreviations: OWP – Outwash plain, SRV – Slopes of the river valley;
*2(LB_2) – two sites analysed – (LB_2) – 4 years old and (LB_2) – 6 years old.

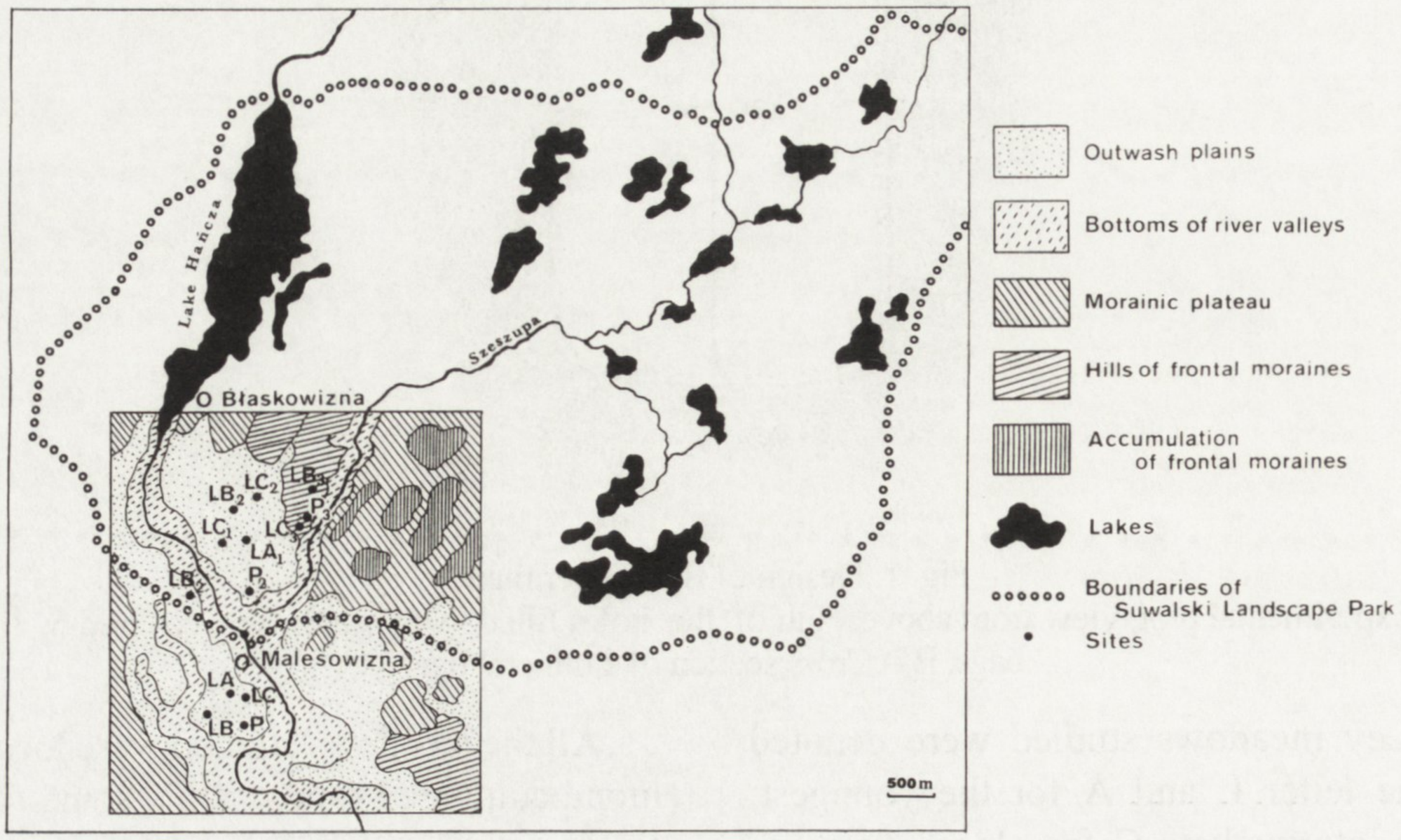

Fig. 2. Map of investigation area and location of study sites

The four first papers describe the vegetation and soils of the study area in detail (Jankowski, this volume a, b, Kusińska and Łakomiec, this volume and Szanser, this volume). Particular emphasis is put upon the changes occuring with succession in the sward composition, soil organic matter content and humus fractions.

Several papers analyse the results of the aforementioned experiment – comparing the rate of litter weight loss (Bogdanowicz and Szanser, this volume) and changes in humus content occurring in the course of decomposition in the litter itself and in the underlying sand (Kusińska, this volume). In several further papers, the authors analyse the colonization of litter and sand by organisms. An attempt is made to analyse their influence on the decomposition pattern. The analysis in question concerns the microflora (Stefaniak et al., this volume b, c), the microfauna (Stanuszek, this volume c) and the microarthropods (Kaczmarek and Kajak, this volume).

The role of animals in the transformation of organic substances and in the nutrient storage are the subjects of the papers on earthworms (Makulec, this volume, Makulec and Kusińska, this volume).

A series of papers evaluate a relationship between the species richness of the vegetation and the diversity of communities of soil animals, and tries to show the differences in the structure of animal communities between young and old and permanent meadows (Stanuszek, this volume, Wasilewska, this volume, Kaczmarek and Kajak, this volume and Petrov, this volume).

The volume ends with a paper summarizing the results of our studies on the influence of sward diversity on grass litter decomposition and humus accumulation in meadow soils (Kajak and Wasilewska, this volume).

REFERENCES

1. Kaftan J., Pioruńska K. 1988 – Rzeźba terenu Suwalszczyzny i jej współczesne zmiany [The relief of the Suwałki region and the contemporary changes in it] – Człowiek i Środowisko, 12: 57–77.
2. Kondracki J. 1972 – Polska północno-wschodnia [North-east Poland] – Państwowe Wydawnictwo Naukowe, Warszawa, 271 pp.
3. Kondracki J. 1994 – Geografia Polski: Mezoregiony fizyczno-geograficzne [Geography of Poland: Physico-geographic mesoregions] – Państwowe Wydawnictwo Naukowe, Warszawa, 339 pp.
4. Kornaś J., Dubiel L. 1990 – Przemiany zbiorowisk łąkowych w Ojcowskim Parku Narodowym w ostatnim trzydziestoleciu [Changes in meadow associations in last 30 years in Ojcov National Park] – Prace Muz. im. Władysława Szafera, Prądnik, 2: 97–106.
5. Kostuch R. 1987 – Zmiany florystyczne w runi górskich użytków zielonych zachodzące pod wpływem zróżnicowanego nawożenia azotowego [Floristical changes in the sward of montane grasslands as an effect of N-fertilizing] – Zesz. probl. Post. Nauk roln. 308: 209–218.
6. Kotańska M. 1993 – Response of meadows of the Calthion alliance to variations of weather and management practices – a thirteen year study of permanent plots – Studia Naturae, 40: 3–47.
7. Michalik S. 1990 – Sukcesja wtórna i problemy aktywnej ochrony biocenoz półnaturalnych w parkach narodowych i rezerwatach przyrody [Secondary succession and problems of active conservation of seminatural communities in national parks and nature reservations] – Prace Muz. im. Władysława Szafera, Prądnik, 2: 175–198.