Raport Badawczy

Research Report

RB/28/2013

IRSES Mid-Term Report 2

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Warszawa 2013

EUROPEAN COMMISSION
Research Executive Agency
Marie Curie Actions – International Research Staff Exchange Scheme

Project No: 247645

Project Acronym: GESAPU

Project Full Name: Geoinformation technologies, spatio-temporal approaches, and full carbon account for improving accuracy of GHG inventories

Marie Curie Actions

Mid-term Report

Period covered: from 24/06/2012 **to** 23/06/2013

Period number: 2nd

Start date of project: 24/06/2010

Project coordinator name:
Prof. Zbigniew Nahorski

Version: 1

Date of preparation: 06/11/2013

Date of submission (SESAM):

Duration: 48

Project coordinator organisation name:
SYSTEMS RESEARCH INSTITUTE OF THE POLISH ACADEMY OF SCIENCES IBS PAN

PROJECT MID-TERM REPORT

Grant Agreement number:	247645
Project acronym:	GESAPU
Project title:	Geoinformation technologies, spatio-temporal approaches, and full carbon account for improving accuracy of GHG inventories
Funding Scheme:	FP7-MC-IRSES
Mid-term period report:	2nd
Mid-term period covered - start date:	24/06/2012
Mid-term period covered - end date:	23/06/2013
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1. GENERAL PROGRESS OF THE PROJECT

The project has fully achieved its objectives and technical goals for the mid- term period;

Qualitative indicators of progress and success in line with workplan and milestones (description of progress towards milestones and deliverables)

Work Package 1: Spatially resolved greenhouse gas inventory for Poland

Task 1.4. Building appropriate datasets' templates for activity data information input. Filling up the datasets with information for a year under investigation.
The corresponding dataset templates were created in order to store activity data and to form georeferenced databases. The datasets were filled out with statistical data for a year under investigation, and with the emission parameters relevant for main sectors and subsectors of the IPCC guidelines.

Task 1.5. Application of the obtained methods to greenhouse gas inventory in Poland for each subcategory of the general sectors: "Energy", "Industry" and "Agriculture". The spatial resolution of 2 x 2 km, 5 x 5 km, and 10 x 10 km is planned. The results are to be presented in the form of digital maps and corresponding georeferenced databases.
Greenhouse gas spatial inventory approaches and methods were applied for distributed inventory in Poland for each subcategory of the main sectors: "Energy", "Industry" and "Agriculture". The results of spatial resolution 2 x 2 km were obtained. They are presented in the form of layers of digital maps, and corresponding georeferenced databases.

Task 1.6. Creating information technology to distribute greenhouse gases inventory based on geoinformation systems and IPCC methods.
Geoinformation technology to distribute greenhouse gases inventory based on geoinformation systems, georeferenced databases of activity data and main emission parameters, and the IPCC methods has been created. Results of the spatial analysis are presented in the form of georeferenced database of emissions, and visualized as layers of digital maps.

Deliverable 1.2. Analysis of emissions' territorial distribution for individual subcategories and greenhouse gases. Deliverable date: 28 month
The activity data were disaggregated to the level of elementary grid 2 x 2 km, and corresponding georeferenced databases of input information were created. The databases and geoinformation technology were used to calculate emissions of the main greenhouse gases on the level of elementary plots, and to produce emission summaries of various profiles, like economic sectors and administrative units. Results are presented in numerous figures and tables. A number of papers have been published in conference materials, as well as national and international journals.

Milestone no. 2: A spatial inventory of GHG emission for Poland. Deliverable date: 36 month
The spatially resolved - at the level of elementary 2 x 2 km plots - greenhouse gas emission inventory has been performed for the whole territory of Poland. Spatially resolved activity data for Poland (e.g., fuel consumption, cement production, and vehicle-miles travelled etc.), the specific net calorific values, emission factors and other parameters relevant for each region, instead of using aggregated values, were used to build spatial inventory. This way the distribution and structure of GHG emissions on the territory of Poland is reflected. The developed approach provides numerous opportunities: to conduct various types of analyses aimed at implementation of effective ecological initiatives on different scales (from local to regional programs); to draw a comparison with satellite or other remotely sensed data, and therefore, to learn more about greenhouse gas emission processes; to find new ways of uncertainty reduction; to apply obtained digital maps with spatially resolved inventory in air dispersion models.

Work Package 2: Methodology, modeling network and information background of verified full carbon account of forest ecosystems: Adaptation for Ukraine.
Milestone no. 3: An estimation of the productivity of Ukraine forest.
Task 2.2. Developing a hybrid forest map for Ukraine based on on-ground inventories and multi-sensor remote sensing concept.

Task 2.4. Assessing major indicators of forest productivity such as Net and Gross Growth, Live Biomass, and Net Primary Production, and presenting their spatial distribution according to the hybrid forest map.
Task 2.5. Assessing spatially distributed major indicators of full carbon account (heterotrophic respiration; fluxes caused by disturbances, particularly fire; fluxes to hydrosphere and lithosphere; Net Biome Production).
Tasks 2.2, 2.4 and 2.5 have been accomplished and the results summarized in the Deliverable 2.3.

Deliverable 2.3. Hybrid forest cover for Ukraine with spatially distributed major indicators of the FCA. Deliverable date: 30 month
Hybrid forest cover for Ukraine was created in form of a digital map with a resolution of 300 m. First, a forest mask was created by using the developed algorithm that is based on geographical weighted logistic regression. The basic idea of algorithm is to create spatial map of probability that global land cover products define the same land cover type as crowdsourced points (points generated in the environment of geo-wiki.org). Second, the created forest mask has been parameterized with main forest parameters (tree species, age, site index etc.) by using a method that integrates statistics, remote sensing and in-situ information. And final, based on the forest map, hybrid forest cover for Ukraine with spatially distributed major indicators of the FCA was created.
We continue working on the next version of the hybrid map to involve new information which has become recently available:
- new forest statistics for Ukraine was released in 2013 (base year 2011). The previous statistics is dated 2002;
- new high resolution remote sensing products (e.g. Sexton et al., 2013).
Major indicators of forest productivity have been calculated, namely: net and gross growth, live biomass, and net primary production.
Major indicators of full carbon account and their spatial distribution have been assessed: heterotrophic soil respiration, fluxes caused by fire and other natural and human-induced disturbances, fluxes to hydrosphere and lithosphere; Net Biome Production.

Task 2.6. Estimating the uncertainties of the FCA of Ukrainian forests.
Deliverable 2.4. Analysis of uncertainties of the FCA of the Ukrainian forests.
Towards the deliverable 2.4. we estimated the accuracy of forest map of Ukraine: the map was validated using (1) in-situ data of forest parameters and (2) crowdsourced data collected in geo-wiki environment (http://www.geo-wiki.org). Statistical agreement was measured for the achieved forest map and available on-ground samples of forest; we calculated Kappa and AC1 coefficients that are the more robust measures, than simple percent agreement calculation, since they take into account an agreement occurring by chance.

Work Package 3: Improving accuracy of inventories by means of spatio-temporal statistical methods

Task 3.3. Designing a disaggregation model for the regional activity data, taking advantage of the gridded information on land use and line emission sources. Basically, the relevant statistical tool is based on a conditionally autoregressive structure, however, some further details are to be determined.
Task 3.4. Carrying out numerical experiments and choosing appropriate algorithms for parameter estimation in the model.
Task 3.5. Verification of the model, based on the Ukrainian data set, and its application to disaggregation of activity data in Poland. Providing the obtained map for further usage in Work Package 1.
In the reported period Tasks 3.3, 3.4 and 3.5 have been accomplished, and the results are summarized below in Deliverable 3.2.

Deliverable 3.2. Methodology for spatial scaling of GHG activity data. Deliverable date: 36 month
We continued the research on development of spatial scaling methods, aimed to support the procedure of compiling high resolution activity data.
First, we considered the data disaggregation task, accounting for a spatial correlation within a dataset and also for covariate information available in a fine grid. Statistical model of spatial dependence is set, and it is assumed not to vary with a change of grid. As planned, it is modeled with the conditional autoregressive structure, introduced into a linear model as a random effect. The maximum likelihood approach to inference was employed, and the optimal predictors were

developed to assess missing values in a fine grid. Relevant formulas have been derived to quantify also the error of achieved predictions.
The usefulness of the method has been demonstrated for agricultural sector, involving spatially correlated area data. The technique has been verified for livestock inventory data, which are disagreggated from district to municipality level. Only rural areas have been considered. Population density and land use information were used as proxy data. In addition, the basic model of spatial scaling has been extended to reflect possibly diversified regression coefficients across regions (here voivodeships). On the other hand, the procedure proved to have limited applicability for the residential sector, in particular for data on natural gas consumption in households.
Secondly, the supplied gridded data are often on incompatible, ill-aligned grids. To improve data processing, an approach to perform grid transformations and grid remapping using additionally available knowledge is being developed. Additional information are often available and can help approximate the underlying data distribution, which is needed for better grid transformations. The developed approach uses techniques from artificial intelligence and soft computing.

2. PROJECT ACHIEVEMENTS

Scientific highlights and research achievements:

Work Package 1: Spatially resolved greenhouse gas inventory for Poland
• Methods and algorithms of distributed GHG inventory, developed for Ukraine, were modified taking into account Polish parameters: sectors specificity; available statistical data, and other information obtained from reference books, scientific investigations etc.; available digital maps with spatially resolved information etc.
• Geoinformation technology to distribute greenhouse gases inventory based on geoinformation systems, georeferenced databases of activity data and main emission parameters, and IPCC methods has been created. Results of the spatial analysis are presented in the form of georeferenced database of emissions, and visualized as layers of digital maps.

Work Package 2: Methodology, modeling network and information background of verified full carbon account of forest ecosystems: Adaptation for Ukraine
(1) Algorithm to create hybrid land cover map based on geographical logistic regression model; the algorithm uses global land cover maps and crowsourced data points generated through the Geo-Wiki tool;
(2) Methodology to parametrisize Ukrainian forest map with the information about tree species, age, site index etc.; the methodology integrates statistics, remote sensing and in-situ information;
(3) Methodology of Full Carbon Account modified for Ukraine with respect to specifics of the forests and forest cover and information available
(4) The first draft of the Full Carbon Account for forest ecosystems of Ukraine with spatially distributed major indicators of the FCA based on the first created forest cover map for Ukraine.

Work Package 3: Improving accuracy of inventories by means of spatio-temporal statistical methods
• A novel approach for allocation of spatially correlated data on emission inventories (activity data) to finer spatial scales, conditional on covariate information observable in a fine grid.
• The proposed method is suitable for area emission sources, in particular for agricultural sector.
• The test procedure involved allocation of livestock data (a number of horses) from district to municipality level, and proved that the method outperforms a naive and commonly used approach of proportional distribution.
• Prototype of the grid transformation algorithm using artificial intelligent methods has been developed. The prototype is currently in testing phase: the artificial intelligent approach needs thorough verification and refinement, for which generated data are used.

Transfer of knowledge and Training activities (workshops):

Seminars
26 March 2013: The working seminar on calculation of forest productivity across Poland has been organised in the State Natural Reserve "Roztochya" (Ukraine). It was attended by participants from the Systems Research Institute of the Polish Academy of Sciences (SRI) and the Lviv Polytechnic National University (LPNU).
27-29 May 2013: Results of research have been presented at the 3rd Global Forest Carbon Working Group Meeting – Workshop "Future of Global Forests" that took place at the International Institute for Applied Systems Analysis (Laxenburg, Austria)

Teaching
The project results were used in the performance of:
a) PhD degree theses:
Ivan Lakyda (NULESU) "Biological productivity and its dynamics of planted pine forest of Kiev city", defense November 3rd, 2012.
Yury Myklush (NULESU) "Forestry and recreational features of forest of green belt of Lviv and the organization of sustainable management", defense March 5th, 2013.
b) Doctor of Science degree theses:
Sergiy Zibtsev (NULESU) "The theoretical and methodological basis for forest monitoring in the areas of radioactive contamination from the Chernobyl accident", defense April 3rd, 2013.
c) Master degree theses:

Danylo O. Spatial modelling of greenhouse gas emissions in the residential sector in Poland (supervisor - prof. R. Bun); this thesis was awarded as the Best Dissertation Award from the Department of Applied Mathematics, Lviv Polytechnic National University, November, 2012;
Boyanivska N. Modeling greenhouse gas emissions caused by industry and construction in Southern Poland (supervisor – Dr. M. Lesiv);
Karas R. Modeling greenhouse gas emissions caused by electricity and heat production in Southern Poland (supervisor – Dr. M. Lesiv);
d) Bachelor degree theses:
Tityk S. Information technology for greenhouse gas inventory in Subcarpathian Region of Poland: refining and gas industry (supervisor – Dr. M. Lesiv);
Kadyuk O. Information technology for greenhouse gas inventory in Silesian Voivodeship of Poland: mining and production of solid fuels (supervisor – Dr. M. Lesiv).
September 2012 – June 2013, on a base of the project results a new lecture courses were applied for master-students at the Lviv Polytechnic National University:
• „Mathematical modeling and spatial analysis of GHG emissions and sinks" (lecturer: Prof. R. Bun);
• „Spatial modeling of ecological problems" (lecturer: Dr. M. Lesiv).

Dissemination of results (conferences, publications...):

Awards
Professor Rostyslav Bun was awarded the prestigious Knight's Cross of the Order of Merit of the Republic of Poland in recognition of his outstanding achievements in teaching, research and the development of Polish-Ukrainian cooperation in science (Decree of the President of Polish Republic Bronislaw Komorowski on the 24th of April 2013 on the assignments of orders: http://monitorpolski.gov.pl/mp/2013/520/1).

Dr. Myroslava Lesiv was awarded as "The best young scientist of the year 2012" at Lviv Polytechnic National University, Lviv, Ukraine, February 2013;

Dr. Myroslava Lesiv was awarded by Lviv Regional Council for the considerable contribution into the development of science in Lviv region of Ukraine, November 2012;

Young scientists from the Lviv Polytechnic National University (GESAPU Project participants) were selected for participation in prestigious Young Scientists Summer Program of the International Institute for Applied Systems Analysis (IIASA), Austria:
• Olha Danylo with project 'Spatial modeling of greenhouse gas emissions in the residential sector' (June-August 2012);
• Mariia Halushchak with project 'Spatial modeling of greenhouse gas emissions in the industry and construction sector' (June-August 2013).

Dissemination of results
• Within the 9th edition of the Science Festive, R. Bun gave invited talk entitled "The greenhouse gas effect and climate change – social and economic implications". The event, aimed at popularization of science and its achievements, took place in D#browa Górnicza (Poland) on 18-24 March 2013. More information is available at:
http://www.dabrowa-gornicza.pl/aktualnosc-23781-rozpoczal_sie_ix_festiwal_nauki.html and
http://www.wsb.edu.pl/index.php?p=ga&idg=mg,300,306&id=659&action=show
• Preparation of the Success story text, publicizing scientific achievements of the GESAPU project. The text is to be launched on the European Commission website.
• Preparation of the Scientific Plan and Implementation Plan of the EU funded project "Clima East: Support to Climate Change Mitigation and Adaptation in Russia and ENP East Countries" (EuropeAid/132127/C/SER/Multi). More information is available at www.climaeast.eu

Publications
Boychuk P., Boychuk K., Nahorski Z., Horabik J. (2012) Spatial inventory of greenhouse gas emissions from the road transport in Poland, Ecotechmod. An International Quarterly Journal on Economics of Technology and Modelling Processes 1(4), pp. 9-16.
Charkovska N., Bun R., Nahorski Z., Horabik J. (2012) Mathematical modeling and spatial analysis of emission processes in Polish industry sector: cement, lime and glass production, Ecotechmod. An International Quarterly Journal on Economics of Technology and Modelling Processes 1(4), pp.

17-22.
Horabik J. (2012) Spatial disaggregation of activity data for GHG inventory in agricultural sector of Poland, Raport Badawczy RB 41/2012. IBS PAN Warszawa.
Lesiv M., Schepaschenko D., Shvidenko A., Bun R. (2012) Forest digital map of Ukraine based on global land cover data, Journal of National University of Forestry and Wood Technology, 22.9, pp. 24-30.
Lesiv M., Karas R., Topylko P., Sorochych M. (2012) Spatial modeling of greenhouse gas emissions: electricity and heat production of Southern Poland, Journal of the Lviv State University of Life Safety, 6/1, pp. 23-28.
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Lakyda P.I., Bilous A.M., Vasylyshyn R.D., Matushevich L.N., MakarchukYa.I. (2012) Biological productivity and energy potential of softwood stands of Ukrainian Polesye: a Monograph. Korsun-Shevchenskivsky 454 p [in Ukrainian].
Lakyda P., Shvidenko A. (2012) Field data and new models of growth and productivity of Northern Eurasia forests, Forest Observational Studies, Proceedings of an International Workshop at Beijing Forestry University, Beijing Forestry University, Beijing, pp. 59-73.
Lakyda P.I., Shvidenko A.Z., Schepaschenko D.G.,Vasylyshyn R.D., Bilous A.M., Lakyda I.P., Matushevich L.N.(2013) Biological productivity of Ukrainian forest in European ecoresouse dimension, Bioresursy i pripodopolzovanie (Life and Environmental Sciences). V. 5(5-6). Pp. 56-63 [in Ukrainian].
Shvidenko A., Lakyda P., Schepaschenko D., Vasylyshyn R., Marchuk Yu. (2013) Global change and landscape structure in Ukraine: Ecological and socio-economic implications [Electronic resource] Geophysical Research Abstracts – EGU General Assembly 2013, Vol. 15, EGU2013-10627, April 7-12, 2013, Vienna, Austria. European Geosciences Union – Web access: http://meetingorganizer.copernicus.org/EGU2013/EGU2013-10627.pdf.

Forthcoming publications

Boychuk Kh., Bun R. Regional spatial cadastres of GHG emissions in Energy sector: Accounting for uncertainty, accepted for publication in Climatic Change.
Charkovska N., Bun R., Nahorski Z., Sorochych M., Horabik J. Modeling and spatial analysis of greenhouse gas emission processes: animal sector of Poland, accepted for publication in Journal of the Lviv State University of Life Safety.
Charkovska N., Bun R. Modeling and spatial analysis of GHG emission in chemical industry of Poland, accepted for publication in Modeling and Information Technology.
Charkovska N. Modeling of non-methane volatile organic compound emissions in Polish industry sector: sugar production, accepted for publication in The 6th International Academic Conference of Young Scientists «Computer Science and Engineering 2013» (CSE-2013), Lviv, 2013.
Charkovska N.V., Bun R.A. Geoinformation technology of modeling and spatial analysis of direct emissions of nitrous oxide from agricultural soils, accepted for publication in Artificial Intelligence, Donetsk, Ukraine.
Danylo O., Bun R., Striamets O., Topylko P., Lesiv M., Boyanivska N. Spatial modeling of greenhouse gas emission in industry and construction sectors of the Southern Poland, accepted for publication in Modeling and Information Technology
Danylo O., Bun R., Striamets O., Topylko P. Modeling and spatial analysis of GHG emissions in the residential sector: case-study for the Silesian Voivodeship in Poland, accepted for publication in The 8th International Scientific and Technical Conference "Computer Sciences and Information Technologies" (CSIT'2013), Lviv, 2013.
Horabik J., Nahorski Z. Improving resolution of spatial inventory with a statistical inference approach, accepted for publication in Climatic Change.
Lesiv M., Bun A., Jonas M. Analysis of change in total uncertainty in GHG emissions for the EU-15 countries, accepted for publication in Climatic Change.
Lesiv M., Schepaschenko D.,Stryamets O., Nahorski Z. Method and tool to develop a forest map by using GWR model in R: case study for Ukraine, accepted for publication in The 8th International Scientific and Technical Conference "Computer Sciences and Information Technologies" (CSIT'2013), Lviv, 2013.
Shvidenko A., Lakyda P., Schepaschenko D., Vasylyshyn R., Marchuk Yu. (2013) Carbon, climate and land-use in Ukraine: Forest Sector, a monograph, 290 pp.
Topylko P., Bun R., Striamets O., Danylo O. Uncertainty of greenhouse gases spatial inventory:

power and heat production, accepted for publication in The 8th International Scientific and Technical Conference "Computer Sciences and Information Technologies" (CSIT'2013), Lviv, 2013.
Topylko P., Lesiv M., Bun R., Nahorski Z., Horabik J. Geoinformation technology for spatial inventory of greenhouse gas emissions: electricity and heat generation in Poland, accepted for publication in Econtechmod. An International Quarterly Journal on Economics of Technology and Modelling Processes.

Participation in conferences
Nahorski Z., Bun R., Lesiv M., Horabik J., Jarnicka J., Danylo O., Gusti M., Topylko P., Boychuk P., Charkovska N., Yaremchyshyn O., Spatial inventory of greenhouse gases emissions in Poland. XII Konferencja Polskiego Towarzystwa Bada# Operacyjnych i Systemowych BOS. Warsaw, Poland. 17-19 September 2012. A plenary lecture.
Lesiv M., Schepaschenko D., Shvidenko A., See L., Bun R. Land cover for Ukraine: the harmonization of remote sensing and ground-based data, AGU Fall Meeting, San Francisco, 3-7 December 2012, San Francisco, USA, 2012. – Available online at: http://fallmeeting.agu.org/2012/eposters/eposter/gc31a-0976/
Danylo O. Spatial inventory of greenhouse gas emissions in the residential sector: a case-study for Poland and Ukraine, World with Reach: from Science to Policy; IIASA 40th Anniversary Conference, Vienna, Austria, 24-26 October 2012. http://conference2012.iiasa.ac.at/poster_session.html
Charkovska N.V., Bun R.A. Mathematical modeling and spatial analysis of nitrous oxide emission processes from the putting into arable lands of crop residues in Poland, Proc. of the 2nd Ukrainian Scientific and Practical Conference of Young Scientists and Students "Intelligent Technologies in System Programming", Khmelnytsky, 18-19 April 2013, Khmelnytsky National University, pp. 259-262.
Charkovska N.V. Mathematical modeling of greenhouse gas emissions from the growing of nitrogen-fixing crops, Proc. of the 2nd International Scientific and Technical Conference "Computational Intelligence"; Cherkasy, 14-18 May 2013, Cherkasy State Technological University, pp. 443-444.
Charkovska N.V. Spatial analysis of carbon dioxide emission processes from the production of chemicals in Poland, Abstracts of Ukrainian Scientific and Practical Conference of Young Scientists and Students "State Environmental Safety"; Kyiv, 16-18 April 2013, National Aviation University, pp. 85-86.
Striamets O., Bun R., Stryamets N. Informational approach for cadastre of forests of Poland for determining carbon balance in forestry, Experience of Designing and Application of CAD Systems in Microelectronics (CADSM), 12th International Conference, 19-23 Feb. 2013, Lviv, LPNU, pp. 359-360.
Charkovska N.V., Striamets O.S. Modeling of nitrous oxide emission processes from the pasturing of agricultural animals in Poland, Proc. of the 11th Open Scientific Conference of the Institute of Applied Mathematics and Fundamental Sciences «PSC-IMFS-10», Lviv, 13-14 June 2013, pp. 159-160.
Halushchak M., Bun R., Topylko P. Features of GHG emission inventory from fuel use in industry and construction sector of Silesia Region in Poland, Proc. of the 11th Open Scientific Conference of the Institute of Applied Mathematics and Fundamental Sciences «PSC-IMFS-10», Lviv, 13-14 June 2013, pp. 148.
Striamets O.S., Bun R.A., Charkovska N.V., 2013. Using of digital maps of land use of Poland for spatial analysis of greenhouse gas emission/absorption processes in forestry, Proc. of the 11th Open Scientific Conference of the Institute of Applied Mathematics and Fundamental Sciences «PSC-IMFS-10», Lviv, 13-14 June 2013, pp. 155.
Lesiv M. Specificity of the formation of digital forest map of Ukraine considering main physical and geographical parameters, Proc. of the 11th Open Scientific Conference of the Institute of Applied Mathematics and Fundamental Sciences «PSC-IMFS-10», Lviv, 13-14 June 2013, pp. 165.
Danylo O. Geoinformation modeling of greenhouse gas emissions in the residential sector in Ukraine and Poland, Proceedings of the 70th Student Scientific Conference: Section "Applied Mathematics and Basic Sciences", Lviv, 12-13 October 2012, NU "LP", pp. 15-16.
Lakyda P.I., Shvidenko A.Z. Field data and new models of growth and productivity of Northern Eurasian forests, Proceedings of the International Workshop at Beijing Forestry University "Forest Observational Studies", supported by the Special Research Program for Forestry Welfare in China (200904022) and the 12th five-year National Science and Technology plan of China

(2012BAC01B03), September 20-21 2012, pp. 59-73.

3. PROJECT MANAGEMENT

Overview of the activities carried out by the partnership; Identification of problems encountered and corrective action taken:

The project is coordinated by the Management Committee (MC).

The 4th meeting of the Management Committee was held on the 26thOctober 2012 in Laxenburg, Austria at the International Institute for Applied Systems Analysis during IIASA 40th Anniversary Conference "World with Reach: from Science to Policy". It was attended by participants from LPNU, IIASA and NULESU. Participants presented advancement of research, followed by a discussion, and in conclusion, proper advancement of the works has been found.

The 3rd meeting of the MC, already mentioned in the previous Mid-Term Report, identified some discrepancies of the realized secondments from the schedule, as specified in the Gantt chart of the Annex I. As a consequence, on the 5th MC meeting (organized on the 20th February 2012 using e-mail facilities) it was agreed to reallocate 11 months for travels from Ukraine to IIASA, and 2.5 months from Ukraine to SRI (instead of respective secondments from IIASA/SRI to Ukraine). The reasons were as follows. The secondments of mostly young scientists from Ukraine are very important from a methodological and educational point of view, and such visitors do real research at IIASA and SRI, also taking advantage of available computer facilities and software. Relevant time for visits of experienced scientists from IIASA and SRI to Ukraine is much shorter, since their tasks are limited by methodological problems, different seminars etc. The proposed changes to the secondment schedule were approved by the Project Officer, Mr Frederico Miranda.

The 6th meeting of the Management Committee was held on the 22nd May 2013 in Warsaw, Poland at the Systems Research Institute of the Polish Academy of Sciences, and it was attended by participants from LPNU and SRI. Members of the Management Committee and other participants presented results of research carried out within each Work Package. A good discussion followed. In conclusion, it has been agreed that advancement of the research follows the plans.

4. ADDITIONAL INFORMATION

Additional information, which may be considered useful to assess the work done during the reporting period:

During the reported period, 6 young and 5 experience scientists from Ukraine have spent 18 person-months at IIASA; 3 experienced scientists from IIASA have spent 3 person-months in Ukraine where they provided a number of lectures, consultations and seminars.

Also, 3 experienced researchers from SRI spent 5.75 person-months at LPNU; while 1 experienced and 4 early stage researchers were seconded to SRI for 4.84 person-months altogether.

Attachments

Date:

Person in charge of the project for the beneficiary(ies):