



1st Ukrainian BINU Project Report: Agro-biodiversity Indicators for National Use (January 2003-September 2003)

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Abbreviations

BINU	Biological Indicators for National Use
CBD	Convention on Biological Diversity
DBG	Department of Biotechnology and Genetics (IAB, UAAS)
ERRIU	Environment and Resources Research Institute of Ukraine (Kyiv)
GEF	Global Environment Facility
IAB	Institute of Agricolology and Biotechnology (UAAS)
IASA	Institute of Applied System Analysis
KQs	Key questions
MENRU	Ministry of the Environment and Natural Resources of Ukraine
NUKMA	National University “Kyiv-Mohyla Academy” in Ukraine
RIVM	National Institute of Public Health and the Environment (The Netherlands)
SBSTTA	Subsidiary Body on the Scientific Technical and Technological Assistance
UAAS	Ukrainian Academy of Agrarian Sciences
ULRMC	Ukrainian Land and Resource Management Center (Kyiv)
UNEP	United Nations Environment Programme
USDA	U.S. Department of Agriculture
USPS-MAP	Ukrainian Soil Protection Service of Ministry of Agrarian Policy
WCMC	World Conservation Monitoring Centre

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Summary

An integrated assessment of biodiversity in agroecosystems has never been done in Ukraine. (At the same time, this is an important issue, because agro-landscapes cover up to 72% of Ukraine.) This report is one of the steps towards fulfilment of the BINU Project.

During the current reporting period, from January through September 2003, the evaluation and final selection of key questions was achieved through a very methodological approach. The discussion of this complicated issue involved over 100 Ukrainian and international scientists and decision-makers, including those from the UK, Netherlands, Kenya, Philippines and Ecuador. As a result, an extensive key questions list (over 65 questions) was reduced to five main questions to be used in the selection of indicators of national importance.

Over the reporting period, national experts selected about 128 species of wild animals and plants that are serving as indicators for the assessment of biodiversity in agro-landscapes of Ukraine and for the assessment of corresponding pressures. At present, the list of dominant negative impacts includes the following: land use change, fragmentation, exploitation, toxification, disturbance, habitat loss, natural succession and inappropriate environmental management. In general, according to the preliminary expert assessment for the period between 1950 and 2003, the number of such agriculture-dependent wild species in different taxonomic groups in Ukraine was declining first and then started rising or remained stable (e.g. a general trend among bird species is negative). For a number of species, a tentative prediction of changes in the quantity was done covering the period until 2010.

During further project implementation, demonstrations of how national level indicators operate will be continued and improved. The Project provides for further collection of new *in situ* information, integration of statistical, cartographic, and remote sensing data (MODIS, Landsat and ASTER). Among the planned project activities is the development of appropriate layers in a pilot GIS and sample thematic maps, compilation of methodological guidelines and an analytical report on the state of biodiversity in agroecosystems of Ukraine, and other tasks in accordance with project objectives.

Summary (in Ukrainian)

Комплексна оцінка стану біорізноманіття агроєкосистем України іще ніким не проводилась. (В той же час, це питання є дуже важливим, так як агроландшафти займають до 72% території України.) Даний звіт є одним із кроків для досягнення цієї мети проекту BINU до 2004 р.

За звітний період, в січні-вересні 2003 р., нами продемонстровано, що для цілей розробки індикаторів біорізноманіття етап формулювання ключових запитань та їх ретельний вибір був дуже ефективним і методично виправданим. Він дозволив залучити до обговорення цього складного питання більше 100 науковців та управлінців з України та зарубіжжя (Великобританія, Голландія, Кенія, Філіппіни, Еквадор). Це дало також змогу зекономити час і ресурси, визначитись з потенційними користувачами інформації.

В результаті, із об'ємного стартового пакета ключових запитань (більше 65) було відібрано 5 найважливіших узагальнюючих груп запитань, для яких надалі почали підбирати індикатори національного рівня значущості. В зазначений період національними експертами було вибрано й названо до [128](#) видів диких тварин і рослин, які надалі зможуть слугувати орієнтирами для оцінки стану біорізноманіття в агроландшафтах України та для оцінки впливу на біорізноманіття. Сьогодні в перелік домінуючих негативних факторів впливу вже увійшли такі, як *зміна в землекористуванні, фрагментація, експлуатація, токсифікація, порушення спокою, втрата середовищ існування, незадовільний менеджмент*, а також *природні чинники*. В цілому, за попередніми експертними оцінками в період з 1950 р. по 2003 р. зміна багатства диких видів рослин і тварин різних таксономічних груп, залежних від сільського господарства, мала такі тренди, як “зменшення”, “зменшення, а потім збільшення”, “стабільність”. Для ряду видів було розроблено також орієнтовний прогноз зміни чисельності до 2010 року.

На наступних етапах впровадження проекту планується продовжити накопичення прикладів роботи індикаторів національного рівня та їх уточнення. Особливу увагу буде приділено збиранню нової наземної інформації, суміщенню статистичних даних із картографічною основою, даними дистанційного зондування (MODIS, Landsat, Aster). Будуть побудовані відповідні шари в пілотній ГІС та приклади нових тематичних карт. Буде розроблено методичне керівництво та аналітичний звіт про стан біорізноманіття в агроєкосистемах України, інші матеріали, згідно із завданнями проекту.

Introduction

The Ministry of the Environment and Natural Resources of Ukraine (MENRU) and the United Nations Environment Programme - World Conservation Monitoring Centre (UNEP-WCMC), United Kingdom, have cooperated for several years to assess priorities in biodiversity conservation issues in Ukraine; to update statistical data on reserves of Ukraine, especially biosphere reserves; to promote public awareness; and to report on progress and achievements of Ukraine at national and international meetings and conferences. In 1996 in Kyiv, with support of UNEP-WCMC, an international seminar was held regarding biodiversity conservation reporting for the Convention of Biodiversity Conservation. During the Fourth Conference of the Parties of the Convention on Biological Diversity (CBD) in Bratislava, Slovakia in May 1998, MENRU and UNEP-WCMC representatives actively cooperated to develop a project on Biodiversity Indicators for National Use with the direct participation of Ukraine, Philippines, Ecuador and Kenya, to be funded by the UNEP Global Environment Facility (GEF) and other donors. In 2000, MENRU and UNEP-WCMC representatives continued this cooperation at a workshop held in Kenya. This cooperation resulted in the inclusion of Ukraine in the Biodiversity Indicators for National Use project (the Project), with Ukraine focusing on the development of indicators for agro-ecosystems. The Project was approved by the GEF in early 2002.



Figure 1. BINU Project Countries.

On 9 December 2002, MENRU sent a letter of endorsement to the UNEP GEF Coordination Office endorsing the Biodiversity Indicators for National Use project (UNEP GEF: GF/2712-02-4446) in Ukraine, a technical assistance project (the Project) focusing on agro-biodiversity issues, and also endorsing the Ukrainian Land and Resource Management Center (ULRMC) as the principal implementing organization in Ukraine for the Project. Details of the Project Activities and Outcomes are specified in the GEF Medium Sized Project Document for the Project Number UNEP GEF: GF/2712-02-4446.

On 12 December 2002, MENRU and ULRMC signed an “Agreement on Scientific and Technical Cooperation Concerning the Application of Modern Information Technologies in the Field of Natural Resources Sustainability and Protection in Ukraine.” This Agreement on Scientific and Technical Cooperation demonstrates the desire of MENRU and ULRMC to expand and to foster cooperation in the application of information technologies for the protection of the environment and sustainable use of natural resources. It specifically notes the development of a mechanism through which agricultural resources can be monitored.

On 10 January 2003, MENRU and UNEP-WCMC signed a Protocol of Cooperation concerning the implementation of the Project. The executed Protocol of Cooperation recognized the beneficiary of the Project to be MENRU and further recognized the implementer of the Project to be ULRMC, a non-governmental organization existing and operating under the laws of Ukraine. Later, on 26 May 2003, Amendment 1 to the Protocol of Cooperation between MENRU and UNEP-WCMC was signed in which ULRMC was also recognized to be a project recipient, as well as the project implementer.

The specific current and long-term objectives of the Project include, but are not limited to, the following:

- To design ecosystem-specific indicator frameworks and core sets of indicators for use at the national level, using a case study approach and building on work already carried out under the CBD;
- To develop a methodology for biodiversity monitoring at the national level taking into account international reporting, especially in the context of the CBD;
- To assist policy- and decision-makers to apply information supplied by biodiversity indicators to national planning and decision-making;
- To support global and regional development of indicators under the CBD.

In each of the four participating countries (see Figure 1) several indicator frameworks are being tested for a focal ecosystem by national partners:

- Ecuador - The Ministry of Environment and EcoCiencia are focusing on forest ecosystems;
- Kenya - The Kenya Wildlife Service is focusing on wetland ecosystems;
- Philippines - The Protected Areas and Wildlife Bureau and the Bureau of Fisheries and Aquatic Resources is focusing on coastal and marine ecosystems;
- Ukraine – [ULRMC](#) is focusing on agro-biodiversity.

Given that about 71% [1] of Ukraine is agricultural land, and that it is undergoing rapid changes in its economic system, Ukraine is an ideal candidate for understanding the relationships between agriculture and biodiversity.

UNEP-WCMC is managing the implementation of the project and is providing technical support, along with RIVM (National Institute of Public Health and the Environment of the Netherlands). Financial support is provided by UNEP-GEF and governments and national partners, with major contributions by UK-DEFRA, UK-DFID, UNEP, Dutch Ministry of Foreign Affairs, and the Swiss Agency for Environment, Forests and Landscapes. The project runs from July 2002 to December 2004.

Major accomplishments during this reporting period included:

- Identification of key participants and major stakeholders in the project;
- Hosting a BINU workshop on 27-29 January to explain concepts of biodiversity indicators and to begin the process of developing key questions;
- Establishment of the Working Group and selection of External Experts;
- Project registration with MENRU recognizing ULRMC as the project implementer;
- Selection of key questions;
- Creation of bilingual web pages to provide information about the BINU project to participants;
- Participation in the Sixth International Conference "Geoinformation Technologies in Territorial Development Management" that took place in Yalta, Crimea followed by field trip with Dr. Tonnie Tekelenburg.
- Participation in WCMC workshops in Cambridge, UK to present status of project and to begin process of indicator selection;
- Preliminary selection of indicators appropriate to the key questions; and
- Collection of data from External Experts and beginning of pilot GIS.
- Progress in researching genetic aspects of agricultural plants and animals.

These activities are discussed in detail below.

Key Participants and Stakeholders

As a new implementer for the BINU project the first task of ULRMC was to identify the key participants, including one donor, one beneficiary, nine recipients and one implementer (Table 1).

In January 2003, ULRMC began the process of identifying the major stakeholders for the BINU project. As of 30 September 2003, the list of main BINU project stakeholders in Ukraine included the following governmental institutions and NGOs:

- MENRU - State Protected Areas Service, State Environmental Inspectorate, State Committee of the Environment and Natural Resources of the Autonomous Republic of Crimea, and Administrations of Synevir Natural National Park, Opuksky Natural Reserve;
- The State Land Resources Committee of Ukraine (SLRCU) - Department of State Land Cadastre and Monitoring, representing interests of other BINU Project recipients within SCLRU - Vinnytsia Oblast State Land Resource Department and the State Land Resource Department of the Autonomous Republic of Crimea;
- The Ukrainian Academy of Agrarian Sciences (UAAS) with its Hydraulic Engineering and Land Reclamation Research Institute;
- The Ministry of Agrarian Policy of Ukraine (MAPU) - Department of Agriculture, Chemicalization and Soil Fertility);
- State Statistics Committee of Ukraine (Department of Natural Resources and Environmental Statistics);
- The National Security and Defence Council of Ukraine - the Environmental Research and Resources Institute of Ukraine (ERRIU);
- The Ministry of Defence of Ukraine - the National Scientific Research Centre for Defence Technologies and Military Security;

- The Ukrainian Birds Conservation Association (Official Representative of BirdLifeInternational in Ukraine);
- Kerch Subdivision of the Ecology and the World Republican Association, Crimea;
- The Ukrainian Soil Conservation Service of the Ministry of Agrarian Policy of Ukraine, Information and Program Department;

Table 1. Key Participants of the BINU Project in Ukraine

Donor Information	United Nations Environment Programme-World Conservation Monitoring Centre (UNEP-WCMC), Cambridge, United Kingdom
Beneficiary Information	Ministry of the Environment and Natural Resources of Ukraine (MENRU), Kyiv, Ukraine
Recipients Information	State Administration of the Environment and Natural Resources under MENRU (branch of Autonomous Republic of Crimea)
	Ukrainian Academy of Agrarian Sciences
	Environmental and Resources Research Institute of Ukraine
	State Service of Protected Areas under the Ministry of the Environment and Natural Resources of Ukraine
	State Statistics Committee of Ukraine
	Ukrainian Land and Resource Management Center
	State Committee on Land Resources of Ukraine
	State Administration of the State Committee on Land Resources in the Autonomous Republic of Crimea
	State Administration of the State Committee on Land Resources in Vinnytsia Oblast
Project Implementer Information	International Association “Ukrainian Land and Resource Management Center”

ULRMC has considered the following institutions and organizations for the potential list of BINU Project stakeholders: other Departments of the Ministry of Agrarian Policy of Ukraine, Taras Shevchenko National University of Kyiv (Department of Biology), National University “Kyiv-Mohyla Academy” (Department of Biology), National Academy of Sciences of Ukraine (Institute of Zoology, Institute of Botany), Environmental Policy Committee of the Verkhovna Rada (Parliament) of Ukraine, Agrarian Policy Committee of the Verkhovna Rada (Parliament) of Ukraine, Cabinet of Ministers of Ukraine, State Water Management Committee of Ukraine, State Committee of Forestry of Ukraine, protected areas administrations; the donor community, Wetlands International/Ukraine and Ukrainian NGOs and others.

During the reporting period, ULRMC also had meetings and consultations with representatives of the aforementioned institutions and organizations in Kyiv, Kerch, Simferopol, Vinnytsia, Svalyava, Uzhhorod and Synevyr.

BINU Workshop, 27-29 January 2003

On 27-29 January 2003, ULRMC hosted a workshop in Kyiv that brought together stakeholders, the implementer and biodiversity experts from WCMC (Dr. Martin Jenkins) and RIVM (Dr. Tekelenburg and Dr. Ben ten Brink). The purpose of the three-day workshop was to inform Ukrainian stakeholders about the BINU project and to introduce participants to the concepts of key questions and indicators for biodiversity measurements (see Figure 2). The workshop also offered a chance for all participants to meet one another, and was particularly valuable to ULRMC for identifying potential Working Group members and External Experts.

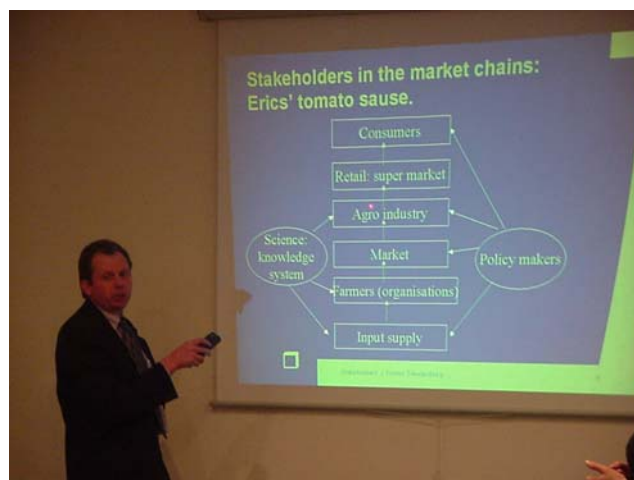


Figure 2. Dr. Tekelenburg Discusses the Relationship between Science and Policy Making.

As an outcome of the workshop, the participants developed and prioritised a bilingual list of 24 key questions, selected out of an original list of 64 questions (<http://www.ulrhc.org.ua/services/binu/questions.html>). This exercise helped formulate the final set of major key questions established later by the Working Group.

Working Group and External Experts

Later, ULRMC representatives held meetings with BINU Working Group members, appointed in accordance with the official BINU Project recipient and non-recipient proposals. As of 14 May 2003, the Working Group¹ consisted of the representatives listed in Table 2.

¹ The Working Group is to be approved by MENRU, in accordance with Protocol of Cooperation regarding the implementation of the Project, signed on 10 January 2003, between MENRU and UNEP. In September 2003 MENRU will be transformed to new two Committees.

Table 2. BINU Working Group for Ukraine

Dr. Innesa Medvedenko (chair)	Ministry of the Environment and Natural Resources of Ukraine
Academician Oleksiy Sozinov	National Academy of Sciences of Ukraine
Dr. Oleksandr Trofymchuk	Environmental and Resources Research Institute of Ukraine
Ms. Lyudmyla Parkhisenko	State Service of Protected Areas of the Ministry of the Environment and Natural Resources of Ukraine
Dr. Lyudmyla Kvashuk	State Statistical Committee of Ukraine
Dr. Olga Zhovtonogh	Ukrainian Academy of Agricultural Sciences - Research Institute of Hydraulic Engineering and Land Reclamation
Dr. Volodymyr Zhylnin	Ministry of Agrarian Policy of Ukraine
Dr. Oleg Dudkin	Ukrainian Union for Birds Conservation (BirdLifeInternational/Ukraine)
Dr. Mykola Lykhohrud	State Land Management Committee of Ukraine
Dr. Vasyl Prydatko and Mr. Eric Luhmann	Ukrainian Land and Resource Management Center

ULRMC is engaging many external experts to provide agricultural and biodiversity data to support the project. These external experts include: Dr. Ihor Dovgal (Institute of Zoology, NASU), Dr. Valentin Kryzhanovsky (Institute of Zoology, NASU), Dr. Antonina Ilynska (Institute of Botany, NASU), Dr. Oleg Dudkin (Ukrainian Union for Bird Conservation /BirdLifeInternational-Ukraine), Dr. Oksana Veklich (Institute of Economics NASU), and Ms. Lyudmyla Kvashuk (State Statistics Committee of Ukraine).

BINU's recipient representatives, as well as participants of BINU round-tables, seminars, and meetings, have produced numerous ideas and proposals. These representatives come from many organizations including: National Academy of Sciences of Ukraine (Academician Sozinov), UNEP-WCMC (Dr. Jenkins), RIVM (Dr. ten Brink, Dr. Tekelenburg), Environmental and Resources Research Institute of Ukraine (Oksana Pniowska), State Service of Protected Areas (Lyudmyla Parkhisenko), State Ecological Inspection of the Ministry of the Environment and Natural Resources of Ukraine (Viktor Rakov), State Statistical Committee of Ukraine (Lyudmyla Kvashuk and Tetyana Vasylenko), Ukrainian Academy of Agricultural Sciences - Department of Agriculture (Academician Peter Kovalenko), Ukrainian Academy of Agricultural Sciences - Research Institute of Hydraulic Engineering and Land Reclamation (Olga Zhovtonogh), UNDP/ULRMC (Oksana Volosko-Demkiv), National University Kyiv-Mohyla Academy (NUKMA) – Eugene Dyky and Olexiy Zakletsky; Government Agrarian Policy Coordination Council Secretariat - UNPD Agricultural Policy for Human Development Project (Dr. Nick Kobets); Institute of Botany (NASU) – Dr. Volodymyr Dubyna and Olexiy Kalynychenko; InterEcoCentre (Dr. Leodid Protsenko); State Forestry Committee (Sergey Kyrylenko); National Scientific Centre of Defence Technologies and Military Safety (Dr. Sergey Chumachenko and Dr. Irina

Chekanova); Biosphere Reserve Askania-Nova (Dr. Viktor Gavrylenko); Ukrainian Union for Birds Conservation (BirdLife International-Ukraine) – Dr. Oleg Dudkin; and others.

Recent consultations with Dr. Tatiana. Lev (Ukrainian Soil Protection Service of the Ministry of Agrarian Policy of Ukraine) have also been informative. Students in ULRMC’s University Fellowship Program (Yana Sapiton, Oleksiy Kalynychenko and Yaroslav Parkhisenko) helped prepare several thematic maps related to the agriculture landscape associated with protected areas.

Project Registration

Once the key recipients were identified, and an Agreement for the Supply of Services between UNEP-WCMC and ULRMC was signed on 1 March 2003, the BINU project could be registered in Ukraine as an international technical assistance project. On 23 June 2003, the BINU project was registered with the Department of International Technical Assistance Coordination at the Ministry of Economy and European Integration Issues of Ukraine (Registration Card # 1271). The registration card of the project officially recognized the donor, beneficiary, implementer and recipients of the project and made it free of income tax in Ukraine. Unfortunately, this registration card does not provide the BINU project a Value Added Tax exemption when purchasing equipment due to lack of international agreements between UNEP and Ukraine and GEF and Ukraine. A copy of the registration documents (in Ukrainian) is included in [Annex 4](#).

Key Questions Selection

A total of 64 key questions were offered by Ukrainian participants at the BINU Project Workshop in Kyiv (January, 2003). With the assistance of experts from RIVM and participants at the workshop this initial set of questions was further reduced to 24 major questions.

In follow-up discussions with stakeholders and the Working Group from February through May 2003, participants identified the most important questions, (see http://www.ulrhc.org.ua/services/binu/kq_matrix.html). A final set of five primary questions was proposed for the study of wild biodiversity on agricultural lands in Ukraine (Table 3).

Table 3. Major Key Questions Concerning Wild Biodiversity

Key Question 1: What is the current state of agro-biodiversity in Ukraine?
Key Question 2: What are the main factors causing loss or increase of agro-biodiversity, and how do changes in the land use practices impact loss or increase of agro-biodiversity?
Key Question 3: What lands could be returned to a natural state in the near future?
Key Question 4: To what extent are national biodiversity indicators linked with the international ones, and how could the existing national statistics help build nationally and internationally applicable indices for decision-making?

Key Question 5: How can scenarios of agro-biodiversity changes be built, and how can biodiversity loss be stopped in the near future?

These key questions were presented by the Ukrainian delegation at the WCMC workshop in Cambridge, UK (see below).

Web Pages for BINU Project in Ukraine

In May 2003, ULRMC started its [BINU Client Services](http://www.ulrmc.org.ua/services/binu/index.html) web page (Biodiversity Indicators for National Use: Agro-bioindicators for Ukraine), operating in both English and Ukrainian languages (<http://www.ulrmc.org.ua/services/binu/index.html>). The web page includes background information for the BINU project, publications, reports on workshops and round-tables, and new developments in the project.

By regularly accessing the website, stakeholders, Working Group members and external experts can keep current with the progress of the project. The website also promotes public exposure to the BINU project and provides a point of contact for more information.

GIS Conference in Yalta and Field Trip in Crimea

On May 25-30, 2003, ULRMC BINU team (Dr. Prydatko, Mr. Oliynyk, Mr. Schaub) and RIVM representative Dr. Tekelenburg) participated in the [6th International Conference "Geoinformation Technologies in Territorial Development Management"](http://www.ulrmc.org.ua/events/2003/052501.html), held in Yalta, Crimea (<http://www.ulrmc.org.ua/events/2003/052501.html>).

During the conference the team had productive discussions with BINU stakeholders and participants of the conference, including [Space Imaging Eurasia](#), the Environmental Protection Agency (EPA), [ECOMM](#), Tavria National University of V. I. Vernadskiy, the Institute of Advanced Technologies, and other organizations concerning remote sensing and GIS application related to agriculture landscape monitoring.

Dr. Tekelenburg and Dr. Prydatko gave a presentation on "[Assessment of Wild Biodiversity in Agricultural Land Use](#)". First design and perspectives of a pressure-based Global Biodiversity Model ” during a plenary session, and a publication [2].

ULRMC organized meetings and briefings at the conference with representatives from the Government of Ukraine, including the State Committee on Land Resources of Ukraine, Government of the Autonomous Republic of Crimea, and others, as appropriate to broaden awareness of the BINU project in Ukraine.

On 25-28 May the BINU team organised site visits to selected agricultural areas of Crimea together with RIVM representative, Dr. Tekelenburg, and Crimea's BINU Project recipient representatives, Eugene Zhagornikov and Yuriy Ermakov). The travel was organised for collection of data, ground-verification observations, surveys, and meetings with locals.

BINU Workshop at WCMC Headquarters

A Ukrainian delegation consisting of Dr. Prydatko (ULRMC Project Manager), Academician Sozinov (National Academy of Sciences of Ukraine and Working Group member) and Mr. Schaub (ULRMC Technical Advisor) attended the BINU workshop at WCMC headquarters in Cambridge, UK from 30 June through 4 July 2003.



Figure 3. Dr. Prydatko Explains the Ukraine BINU Project at the WCMC Workshop.

At the workshop Dr. Prydatko reported on the status of the project in Ukraine (see Figure 3) and Academician Sozinov discussed genetic issues related to agro-biodiversity. Discussions on key question selection, indicators, and data collection were very helpful to participants. The

Ukrainian delegation worked closely with Dr. Tekelenburg of RIVM to plan future steps in the BINU project as it applies to agriculture.

During the workshop the participants from Ukraine proposed ten criteria for evaluating indicators:

- Are data available for the indicator?
- Does the indicator answer the key question?
- Could the indicator answer more than one key question?
- Is the indicator precise in wording and interpretation?
- Is the indicator biologically sound?
- Can we implement the indicator with limited resources?
- Is the indicator appropriate for large areas?
- Is the indicator useful for forecasting?
- Does the indicator have spatial characteristics that can be included in a GIS?
- Does the indicator measure diversity from a unique perspective (i.e. different from other indicators)?

Genetic diversity became a topic of concern, especially as it relates to agro-biodiversity. Ukraine investigators agreed to pursue this topic, as resources permit, with the assistance of Academician Sozinov. This led to the formulation of a sixth key question for the project in Ukraine:

Key Question 6: What is the status of crop race diversity in Ukraine, and to what extent is Ukraine susceptible to monoculture effects?

Several genetic issues were discussed among participants including:

1. Diversity of major crops, which occupy about 90% of agricultural crops in Ukraine: *wheat, barley, corn, sunflower, sugar beet, rye, triticale, buckwheat,*

- lucerne, clover, and potato*. Evaluation of the change of variety composition from wild biodiversity. Demonstration of changes in variety composition with time.
2. Wild relatives of major crops, their diversity and areas of concentrations.
 3. Diversity of major (wild) plant species, which are closely associated with crops. Evaluation of the dynamics of these species, as well as their densities. Evaluation of impacts of agriculture on the biodiversity of these plants.
 4. Sowing area characteristics. Evaluation of the impacts of this factor on wild biodiversity in agriculture.
 5. Domestic livestock species diversity and the existence of local races.
 6. Genetic banks of plant diversity. Presence of unique gene complexes.
 7. Potentially investigate consequences of plant selection and genetic erosion.

Indicator Selection

In May and June ULRMC composed a list of biodiversity indicators from several sources ([Annex 2](#)). General indicators and indicators specific to agriculture were based on a draft version of “Developing Indicators for National-level Monitoring of Biodiversity” written by a biodiversity Expert Group who met in Montreal, Canada in February 2003. Additional indicators were taken from a list proposed by the European Centre for Nature Conservation (ECNC). Finally, biologists at ULRMC developed several new indicators for consideration.

Indicators were matched to the five key questions for wild agro-biodiversity in Ukraine as indicated by the cyan boxes in [Annex 2](#). Upon reviewing the data availability for the proposed indicators ULRMC concluded that some of the indicators would not be useful for Ukraine (Table 4). Consideration of the key questions and application of the “ten criteria” from the previous section helped to exclude about 36% of proposed indicators from our previous list.

Table 4. Evaluation of Indicators

Results	n	%
Indicators with no data	31	36
Indicators with data	55	64
Indicators for which RS and GIS applications could be useful (out of 55)	11	13

Many proposed indicators with available data related to more than one key question. In fact, four of these indicators help answer as many as four key questions. These indicators are: a) patchiness and diversity of agricultural usage; b) locations of threatened species and hot spots; c) non-indigenous species present by group; and d) change in presence, location, area, numbers of invasive plant or animal species.

During the WCMC Workshop in Cambridge the Ukraine delegation worked closely with Dr. Tekelenburg and Dr. Jenkins to select a working set of indicators to answer the key questions for agro-biodiversity. These indicators are given in [Annex 3](#) and form the basis for data collection. After the workshop, ULRMC received additional information about existing annual statistics from the State Statistics Committee of Ukraine and updated some directions of the annex. The following annual statistic parameters related to Key Questions 1, 2, 3 and 6 (Genetics) would contribute to the development of biodiversity indicators.

Statistics related to Key Question 1:

- Ag and non-ag areas (within protected areas);
- Rare plant communities within the selected protected areas of agricultural importance (e.g. steppe zone) included in the Green Book of Ukraine; Game animals census results and results of breeding/setting free (agriculture-related species);
- Red Data Book species within protected areas of agricultural importance (e.g. steppe zone);
- Water and air pollution by main rivers;
- Water availability and quality;
- The nature-resources potential (NRP).

Statistics related to Key Question 2:

- Financing of protected areas of agricultural importance (e.g. steppe zone) and their staff;
- Land use change by oblast, based on interactive map data;
- Tillage frequency index;
- Agricultural land management (soil & water) index by oblast;
- Agricultural inputs (fertilizers, pesticides and herbicides) index by oblast;
- Average weighted content of humus and balance on nutrients (NRK) in soil by oblast or districts.

Statistics related to Key Question 3:

- Human population distribution and agriculture-related trends by oblasts;
- Demographic urban/rural index by oblasts;
- Location and area trend of lands to be privatised;
- The nature-resources potential (NRP).

Statistics related to Key Question 6 (Genetics):

- Number of major crop varieties, covering about 90% of agro-landscapes;
- Productivity of agriculture by oblast.

Data Collection and Preliminary Results

A very important factor in changing the society-environment relationships in the former Russian Empire was created by changes in the land use structure as a result of implementation of Stolypin's land reform in 1909⁴. During that period, every peasant had an opportunity to become a landowner; only forests, meadows, wetlands and water bodies were usually retained as community lands. The land reform was especially successful and popular in Ukraine. It promoted independent farming and traditional Ukrainian modes of rural economy, including traditional land use, rotation and alternation of crops, better agricultural production, use of natural fertilizers, etc. At the same time, the reform stimulated a strong agricultural expansion, e.g., destruction of forests, ploughing of virgin lands and devastation

⁴ P. A. Stolypin, 1862--1911, Russian statesman and political reformer; Russian Prime Minister and Minister of Internal Affairs from 1906 to 1911.

of some natural ecosystems. It is well known also that in 1930s the Ukrainian agriculture system suffered seriously because of a famine initiated by Stalin's system. With the collapse of the USSR in 1991 and the ensuing economic crisis new pressures on the agricultural system are in effect.

Due to the natural fertility of its soils, Ukraine was one of the Soviet Union's main suppliers of grain (25% of the total production), meat and milk (20%) and sugar (50%). Due to production pressures, farming was developed in areas not optimal for that purpose, such as on slopes, natural steppe, peat land, in drained wetlands or on dry land.

Most agricultural land in Ukraine is tilled, and because it is exposed to wind and water erosion, it is subject to a great deal of pressure. Each year up to 330 million tons of fertile soil are lost due to erosion [3].



Figure 4. Major agricultural regions of Ukraine: 1 - Polissya (Forest); 2 - Forest-Steppe; 3-5 - Steppe (Steppe, Steppe-Arid, Steppe-Semi-Arid); 6 - Crimea Mountains; 7 - Carpathian Mountains. Source: see the text.

Agricultural lands in Ukraine are subdivided by some experts into as many as 32 agricultural provinces based on agricultural districts, relief types and soil types [4]. Other authors [5] subdivide the country into nine agrarian regions: Western Polissya, Polissya; Western Forest Steppe, Dnipro Left Bank Forest Steppe, Dnipro Right Bank Forest Steppe; Northern Steppe, Southern Steppe; Carpathian Mountains, Crimean Mountain

ULRMC has worked with the Working Group and External Experts to consolidate the agricultural regions of Ukraine into five major ecological units based on natural zoning (see Figure 4). These regions are forest, forest-steppe, steppe, Carpathian Mountains and Crimea Mountains. These units will be important for determining trends in biodiversity that are dependent upon particular agricultural landscapes.

Indicative wild species. Based on information provided by Dr. Tekelenburg, ULRMC developed an ecological profile matrix to be completed by external experts for selected indicator species. The profile parameters, shown in Table 5, describe the ecological niches of respective species, their threats, and their environmental significance.

Table 5. Ecological Profiles of Indicator Species

Animals and Plants	Animals Only	Plants Only
Position in Food Chain	Food Type	Moisture
Causes of Change	Dispersion	Acidity
Policy Relevance	Movement	Nutrient Requirements
Environmental Significance	MVP Area	Salt Tolerance
		Structure

As of September 2003 significant progress had been made on gathering data related to the indicators, including the species profiles. Selected indicative wild species by natural agriculture zones has involved in the analysis of 128 species to date.

Invertebrates

Forest: *Papilio machaon*, *Lucanus cervus*, *Argyroneta aquatica*, *Cybister lateralimarginalis*, *Hyrudo medicinalis*, *Helix pomatia*, *Bradybaena fruticum*, *Zerynthia polyxena*, *Limnophilus flavicornis*, *Asellus aquaticus*.

Forest-Steppe: *Helix pomatia*, *Lucanus cervus*, *Papilio machaon*, *Argyroneta aquatica*, *Cybister lateralimarginalis*, *Hyrudo medicinalis*, *Bradybaena fruticum*, *Helix albescens*, *Zerynthia polyxena*, *Limnophilus flavicornis*, *Asellus aquaticus*, *Iphiclides podalirius*.

Steppe: *Papilio machaon*, *Carabus hungaricus*, *Empusa pennicornis*, *Helix albescens*, *Mantis religiosa*, *Pimella subglobosa*, *Saga peda*.

Crimea Mountains: *Helix lucorum tauricus*, *Procerus scabrosus tauricus*, *Empusa fasciata*, *Calasoma sycophanta*, *Libeloides macaronius*, *Calopteryx splendor taurica*.

Carpathian Mountains: *Bielzia coerulans*, *Helix pomatia*, *Lucanus cervus*, *Perla maxima*, *Cerambyx cerdo cerdo*. Steppe: *Papilio machaon*, *Mantis religiosa*, *Empusa pennicornis*, *Pimella subglobosa*, *Carabus hungaricus*, *Helix albescens*, *Saga peda*.

Bees (*Apis* sp.) are also included in this group of indicative invertebrates and the discussion on genetics (below).

Mammals⁶

Forest: *Talpa europaea*, *Crocidura leucodon*, *Lepus europaeus*, *Micromys minutus*, *Glis glis*, *Cricetus cricetus*, *Microtus oeconomus*, *Vulpes vulpes*, *Mustela nivalis*, *Capreolus capreolus*.

Forest-Steppe: *Talpa europaea*, *Lepus europaeus*, *Citellus suslicus* (*C. citellus*), *Marmota bobak*, *Spalax micropthalmus* (*S. polonicus*), *Cricetus cricetus*, *Allactaga jaculus*, *Vulpes vulpes*, *Mustela eversmanni*, *Capreolus capreolus*.

Steppe: *Lepus europaeus*, *Mustela eversmanni*, *Rhinolophus hipposideros*, *Sicista subtilis*, *Erinaceus europaeus*.

Crimea Mountains: *Crocidura suaveolens*, *Allactaga jaculus* (*major*), *Apodemus flavicollis* (*Sylvimus tauricus*), *Capreolus capreolus*, *Citellus pygmaeus*, *Cricetulus migratorius*, *Ellobius talpinus*.

Carpathian Mountains: *Vulpes vulpes*, *Felis lynx*, *Ursus arctos*, *Glis* (*Myoxus*) *glis*.

Cattle and sheep are also included in this group of indicative mammals and the discussion on genetics (below).

⁶ Last updated: July 2, 2004.

Birds

Forest: *Columba palumbus*, *Tyto alba*, *Acrocephalus paludicola*.

Forest-Steppe: *Botaurus stellaris*, *Ciconia ciconia*, *Anser anser*, *Circus cyaneus*, *Falco subbuteo*, *Falco tinnunculus*, *Perdix perdix*, *Crex crex*, *Tringa stagnatilis*, *Vanellus vanellus*, *Athene noctua*, *Merops apiaster*, *Lullula arborea*, *Anthus trivialis*, *Anthus pratensis*, *Lanius minor*, *Acrocephalus palustris*, *Turdus philomelos*, *Carpodacus erythrinus*, *Miliaria calandra*, *Emberiza hortulana*, *Saxicola rubetra*.

Steppe: *Falco subbuteo*, *Falco tinnunculus*, *Falco vespertinus*, *Coturnix coturnix*, *Vanellus vanellus*, *Columba palumbus*, *Athene noctua*, *Hirundo rustica*, *Melanocorypha calandra*, *Lullula arborea*, *Galerida cristata*, *Motacilla flava*, *Lanius collurio*, *Pica pica*, *Sylvia communis*, *Passer montanus*, *Carduelis chloris*, *Carduelis carduelis*, *Carduelis cannabina*, *Emberiza schoeniclus*.

Crimea Mountains and Carpathian Mountains: *Falco tinnunculus*, *Coturnix coturnix*, *Columba palumbus*, *Streptopelia turtur*, *Cuculus canorus*, *Hirundo rustica*, *Motacilla cinerea*, *Lanius collurio*, *Pica pica*, *Passer montanus*, *Carduelis chloris*, *Carduelis cannabina*, *Emberiza citrinella*.

Plants

Forest: *Diplotaxis tenuifolia*, *Alyssum gmelinii*, *Lunaria rediviva*, *Dentaria glandulosa*, *Hesperis pycnotricha*, *Sisymbrium strictissimum*, *Erysimum sylvaticum*, *Arabis pendula*, *Dentaria quinquefolia*, *Alliaria petiolata*, *Cardamine tenera*, *Turritis glabra*.

Forest-Steppe: *Lepidium latifolium*, *Erysimum hieracifolium*, *Diplotaxis tenuifolia*, *Schivereckia podolica*, *Alyssum gmelinii*, *Thlaspi praecox*, *Erucastrum gallicum*, *Schivereckia mutabilis*, *Matthiola fragrans*, *Sisymbrium volgense*, *Turritis glabra*.

Steppe: *Crambe tataria*, *Erysimum leucanthemum*, *Rorippa hybrida*, *Brassica campestris*, *Bunias orientalis*.

Crimea Mountains: *Hesperis steveniana*, *Alyssum calycocarpum*, *Sobolewsia sibirica*, *Thlaspi perfoliatum*, *Lepidium virginicum*.

Carpathian Mountains: none.

Pests and exotic species are also included in this group of indicative plants (below).

Data for indicator species not only provide valuable information on taxonomic diversity, but may also serve as indicators of population trends and genetics. A reduction in the indicator species population numbers means a risk of depletion of their gene pools and/or even extinctions of some local populations.

Pests and exotic species. For biodiversity conservation, monitoring of the state of populations of pest and weed species is of great importance for the management of agroecosystems. Statistical information is available on chemicals that are used to control these organisms. According to the section “Chemical Plant Protection” of the data of the

Ministry of the Agrarian Policy [6] there are **118** species of agricultural pests (in Ukrainian): 54 plants (weed species) and 64 animals (insects and mammal species). Most weed species are associated with vegetables, feed crops and grains. Most of the animal pests are associated with grains, leguminous plants, vegetables and industrial crops. (Additional useful information could be found at the web-page [AGROMAGE](#) (in Russian).

As pointed out by BINU experts, the pest list includes species (e.g. plant louse), which are often hard to identify by systematic features and require special equipment and knowledge. Inclusion of some plant species into the weed list is also questionable.

Species richness. Determining the relationship between European biodiversity and agrobiodiversity indicators is a desirable and important activity for decision-making.

Dr. Prydatko (ULRMC) and Dr. Minarchenko (IASA) have analysed statistical data of the widely known ECNC network related to species richness in Europe [7] and attempted to create spatial trends [8]. In the ECNC data array there are clusters of statistical stability that were identified using Spearman & Kendall correlation analysis and modelling. According to the statistical indicators European countries can be grouped based on biodiversity patterns. Selecting those countries geographically close to Ukraine, and for which good biodiversity data exist, we found out there is a great coefficient of ranks correlation and adequacy level (0,950 to 0,999) between the species richness measurements of major taxonomic groups, such as between vascular plants and breeding birds. (From this relationship it is estimated that Ukraine should have about 272 to 284 species of breeding birds.)

Preliminary results indicate that: 1) basic biodiversity indicators from the ECNC network have hidden aggregative features that become apparent with correlation methods of information processing; 2) the manifestation of the aggregative features is that in the correlation field, developed for some pairs of indicators (in this example, “nesting birds-vascular plants”), it is possible to identify groups of countries (or perhaps **groups of agriculture landscapes**) that will have a correlation coefficient of 0,95 or higher; and 3) these groups make it possible to plot spatial trends on the map of Europe. This special feature of data clusters proves that they could be compatible with the natural zoning of Europe.

We consider this conclusion very important for the purposes of the BINU Project, since it is physically very difficult to identify the actual number of all vertebrate species per agricultural area. Provisional results were demonstrated during the GIS Conference in Yalta, 2003 (see <http://www.ecomm.kiev.ua/gis/yalta2003/materials/CB.doc> for report written in Ukrainian).

Species trends and causes of change. The Living Planet Index (LPI) will be used to identify species trends among the major groups of organisms and agricultural regions from 1950 to the present and forward to 2010. From the species profiles it may be possible determine the causal relationships between species trends and environmental pressures. If possible, further studies will extend the baseline back to 1910 or 1917.

Birds. The dominant cause of change for steppe zone birds associated with agriculture is “Land use change”, and the dominant trends are “Decreasing” and “Increaseing.” The same pattern occurs in mountain zone ([Annex 5](#)). The dominant causes of change for forest zone

birds are also “Land use change” and “Nature management.” The dominant trend is “Decreasing.” The same pattern occurs in the forest–steppe zone [Annex 9].

Plants. The dominant cause of change for mountain, forest, forest–steppe and steppe zone plants is “Land use change”, “Nature Management” and “Exploitation”, and the dominant trends are “Decreasing”, “Increasing” or “Decrease-increase” (Annex 6, Annex 12).

Mammals. For steppe zone mammals dominant pressures are “Land use change”, “Fragmentation” and “Exploitation” (Annex 7). The dominant cause of change for forest and forest–steppe zone mammals is “Land use change” (Annex 10). The dominant trends for all areas are “Decreasing” or “Decrease-increase”.

Invertebrates. For forest, forest–steppe, steppe and mountain species dominant pressures are “Toxification” (Annex 8, Annex 11). The dominant trends for the steppe and mountain zones are “Decrease-increase” and “Stable” The dominant trend in forest and forest-steppe is “Decreasing” (Annex 11).

Allotted hunting lands and numbers of game animals. Game species have been recently added to the group of potential indicators because numerous game species from three groups (“hoofed animals”, “fur-bearing animals” and “game birds”) use agriculture landscapes as habitats, permanently or temporarily – see “Indicators Selection” section. In addition, Ukrainian annual reports on the state of environment provide a readily available source of data for this information. In Ukraine indicators of biodiversity and landscape have been related to game species, and in turn, to the total number of plants, animals or rare species [9]. Official statistics track the status of species such as *Lepus europaeus*, *Vulpes vulpes*, *Sus scrofa*, *Capreolus capreolus*, and *Cervus elaphus* and common names of groups of these species, for example, “ducks.” In all, there are about 40 game species. However, official statistics on their population levels and response to hunting pressures are poor. Allotted hunting lands in Ukraine are decreasing, as well as the numbers of game animals (Figure 5) [10].

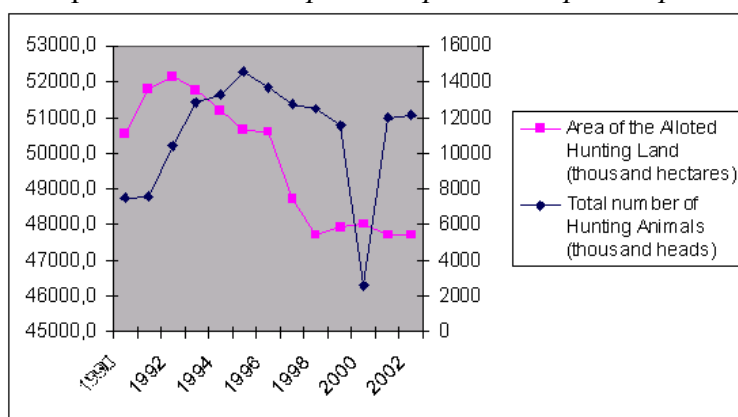


Figure 5. Area of the Allotted Hunting Land and Hunting Animals in Ukraine in 1990-2002. See the legend.

Soil (diversity). Soils of Ukraine are quite diverse. There is about 650 types or varieties of soil recognized, and there are 4000 taxonomical groups among them; the most fertile soils, chernozems (black soil), occupy 60% of all agricultural lands of the country, especially in the forest-steppe and steppe zones [11]. Approximately 80 to 90% of chernozems (black soil) are under agricultural pressure. Mapping of these areas with GIS is in progress.

Soil (humus content). The Ukrainian Soil Protection Service of Ministry of Agrarian Policy (USPS-MAP) has provided ULRMC with new data about humus content of soils in Ukraine (see Figure 6), an important factor in soil quality. In general, the soils with the highest humus content are found in central and eastern Ukraine. During last 10 years the average weighted contents of humus in Ukraine has changed from 3,24% up to 3,14%.

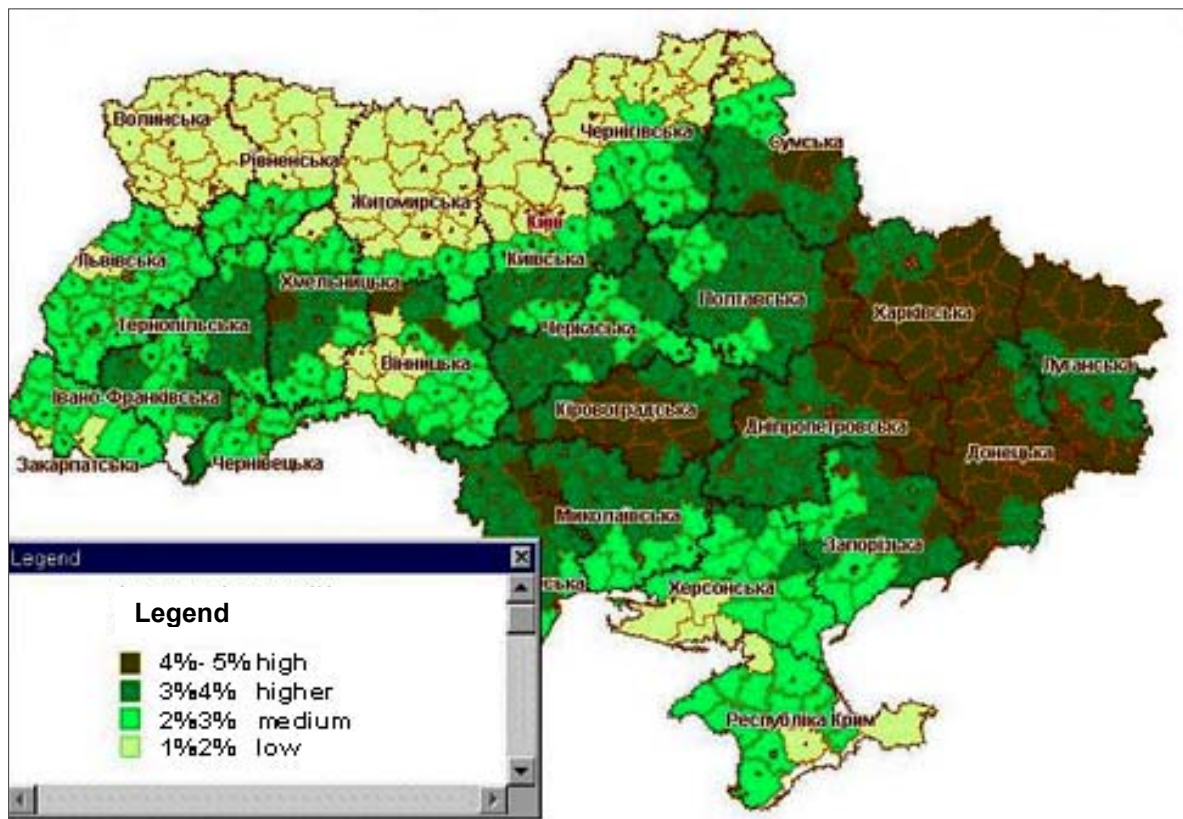


Figure 6. Average humus content by weight (as of 1 January 2002). Source: the Ukrainian Soil Conservation Service of the Ministry of Agrarian Policy of Ukraine.

Soil (microorganisms). In 1999 there was a series of publications on the necessity of conservation of soil algae, phytonematods, and microarthropods [12, 13, 14]. The Microbiology and Virology Institute of NASU, with microbiological laboratories of others organizations, under the head of the Agriculture Microbiology Institute (Chernihiv) monitors soil biota. They confirmed in 1997-1998 a deficiency of soil biota populations due to active chemical impacts and concentration of agriculture industry. Recently, numbers of harmful species of phytopathogenic and phytotoxic organisms have been increasing useful species are decreasing. Azotobacteria, which is an indicator of soil fertility, is rare in many soils types in Ukraine.

Ukrainian scientists have called for the conservation of useful soil microflora, which contribute to plant health. Ukrainian institutions have synthesized the following microbiological preparations: ryzogrin, ryzoenteryn, azotobacterin, diazobacteryn, polymicsobacteryn, chetomyc, biotocsibacellin, and others. Partly or fully they can provide plants by organic nitrogen and phosphorous and protect them against diseases or pests and as a result they promise a harvest increase of 10% more as well as for planting quality. In addition it can lower chemical press onto soil and plants. Another positive effect of the preparations is enrichment of useful soil microphlora. Microflora has long-term positive influence on the next food plants cultures. Other agricultural methods are in use to increase microbiological diversity of soil, for example through growing beans.

Land use management. An agrochemical "passport" program for agricultural land was launched in 1996 for the purpose to assess the agrochemical quality of the soils: 97 300

"passports" were delivered in 1996, and 116 400 passports were delivered in 1997. This program is used in the land privatization: land distribution as well as land use must be based on the soil's agrochemical quality. It is part of the national program for soil protection to be implemented before 2010.

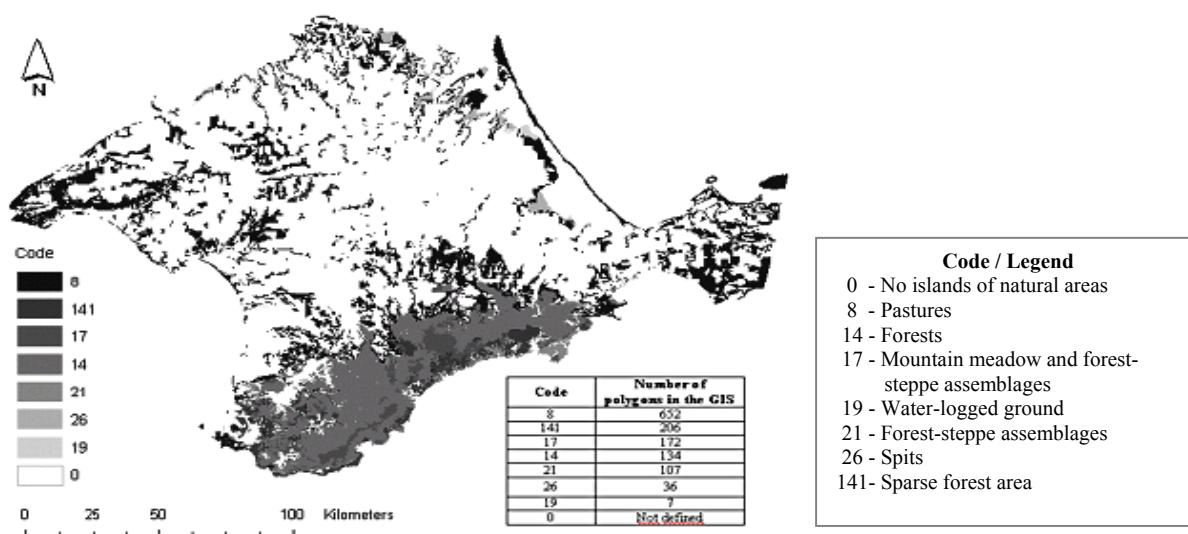


Figure 7. A map demonstrates allocation of 1314 "islands" on natural ecosystems with the total area of 0,8 million ha which were identified in Crimea using Landsat 7 ETM+ (1999, 2000). About 50% of the islands are located on the agriculture territories (pastures).

Remnants of natural ecosystems. As in many agricultural landscapes, there is often a mosaic of cultivated land and natural areas in Ukraine. In some cases agricultural land parcels are found within protected natural areas. Ukraine's government institutions refer to this situation in "Land Parcelling for the Objects of Natural Reserves in Crimea Autonomous Republic and Oblasts" [15]. Unfortunately, such protected territories and sites are not always able to maintain biodiversity in the agro-landscape [14].

ULRMC has studied the occurrence of habitat fragmentation within the agricultural areas of Crimea (see Figure 7). It showed that remotely sensed data (Landsat 7 ETM+ and Terra ASTER) could be very effective for the Initial Assessment of Ecosystems Insulation Scale and Natural Areas Regeneration on the Crimean Peninsula. A pilot-GIS was developed and thematic mapping of "islands" of natural areas in Crimea at 1:200 000 scale was performed, using new 1999-2001 remotely sensed data (Landsat 7 ETM+, Terra ASTER). Approximately 1,314 natural "islands" with the total area of 0.8 million ha were identified, 50% of which were located on pastures. The results were published [15] and presented at the [GIS conference in Yalta](#) (Ukraine).

NCI and NRP. RIVM and WCMC have used the Natural Capital Index (NCI) [16], which represents environmental quality and quantity in a single value, as a very robust indicator of biodiversity. RIVM's description of the NCI was translated into Ukrainian and can be found on ULRMC's website at http://www.ulrmc.org.ua/services/binu/nci_flyer_ua.pdf.

Previous calculation demonstrates that the NCI for natural areas in Ukraine in 1990 was about 4% only and would be about 13% in 2010 [16, p.30]. New data will be used to recalculate the NCI during BINU project implementation.

In the 1990's a nature resources potential (NRP) index was developed in Ukraine, including land, forest and faunistical components. In accordance with these data land resources constitute the main part of this capital - 44%, and faunistical – the lowest part - 0,5% [17]. It was an example of national level how to deal with integrated indexes similar to NCI.

Genetics of Agricultural Plants and Animals

In addition to developing indicators of wild biodiversity, ULRMC intends to investigate several important genetic issues of agricultural plants and animals (Annex 3). Ukraine possesses very rich genetic resources of species, varieties, forms, breeds, lines and strains of plants, animals and microorganisms representing both native and non-native taxa, as reported to CBD/COP4 in 1997 [18]. For instance, the unique collection of cultivars, forms, hybrids, strains and lines of agricultural crops (*rye, wheat, maize, sugar beets, etc.*) at the Institute of Plant Physiology and Genetics contains more than 20,000 specimens. This collection can be used for selection and breeding of the mentioned crops both in Ukraine and other countries.

Plants varieties. In 1992 the State Plant Varieties Register (Ukraine) referred to 2078 varieties of agricultural and other cultural plants [26]. New information of 2003 related to 2898 varieties of cultural plants could be found in electronic form in the Internet via AgroSphere web-page. The site represents a comprehensive catalogue of plants varieties registered in Ukraine in accordance with the information about natural-agricultural zones (Polissya (Forest), Forest-steppe, Steppe, Carpathian Region and Crimea Region).

Cattle. Ukraine possesses local breeds of cattle that have economic and historical value, which were created through selection without cross-breeding. It also has national breeds that originated from both aboriginal and cultural breeds. Local Ukrainian breeds including Pinzgau, Brown Carpathian, White-Headed Ukrainian, Red Polish and Lebedyn. Local breeds have a limited distribution and breed in a certain zone, district or farm. For instance, the zones of the Brown Carpathian and Pinzgau cattle include the mountains and foothills of the Carpathians; and White-Headed Ukrainian cattle occurs in the wetland zones of Polissya. Among the threatened (local) breeds in Ukraine are the Grey Ukrainian (also known by Seraya ukrainskaya, Seroukrainskaya, or Ukrainian Grey Steppe) and the White Headed Ukrainian (also known as Ukrainskaya belogolovaya, Whiteheaded Colonist) [19].

Sheep. Over recent years, in Ukraine, the following sheep breeds were certified: Askania and Kharkiv types of Ukrainian meat-and-wool sheep breed, Tavria subtype of Askania Fine-wooled sheep, and the Ukrainian Carpathian Mountain sheep [20]. The percentage of each breed in Ukraine is shown in Table 6, below:

Table 6. Sheep Breeds in Ukraine.

Sheep Breed	% of the Total Sheep in Ukraine
<i>Askania Fine-wooled Sheep</i>	35
<i>Prekos</i>	25
<i>Tsygayaska</i>	25
<i>Sokilska</i>	3
<i>Karakulska and Askania multi-birth type of Karakulska sheep</i>	3
<i>Latvian Dark-Headed</i>	3

<i>Ronmi-Marsh</i>	2
<i>Carpathian Mountain</i>	No data
<i>Askania Crossbred (Ukrainian type of meat and wool sheep of Askania selection)</i>	1
<i>Merino-Fleisch, Northern Caucasian meat and wool, Romanivska, Polvars, Australian Merino</i>	< 1

In 1993, a new Ukrainian Carpathian Mountain Coarse-wooled sheep breed was certified. However, due to the crossbreeding of the new breed with Tsygayska breed in the Carpathians, a semi-coarse-wooled sheep appeared and began spreading.

At present, Ukrainian sheep breeding is in a difficult situation. Livestock numbers are depressed due to the effects of economic difficulties on production. At sheep breeding facilities, sheep productivity is not high, which under standard feeding conditions indicates a lack of a genetic potential of the animals.

[The Department of Biotechnology and Genetics](#) (IAB, UAAN) proposed to initiate the investigations of the peculiarities of the genetic structure along commercial and native *sheep breeds* (in Ukraine and neighbouring countries) using the molecular-genetic markers of the different genome regions.

Bees. The most common bee cultivars in Ukraine are the Carpathian, Ukrainian Steppe, Central Russian, and Grey Caucasian Mountain bees [21]. For scientific and production purposes, Yellow Caucasian, Crain, Italian and other cultivars are used. Because of their adaptability to local climatic conditions and their honey yield, a geographic distribution of native bee cultivars of Ukraine has developed: Crimea – Ukrainian Steppe and Carpathian Bee; Vinnytsya Oblast – Ukrainian Steppe Bee; Volyn Oblast – Carpathian and Polissya Bee; Dnipropetrovsk and Donetsk Oblast – Ukrainian Steppe Bee; Zhytomyr Oblast - Ukrainian Steppe and Polissya Bee; Zakarpattia Oblast – Carpathian Bee; Zaporizhzhya Oblast – Ukrainian Steppe Bee; Ivano-Frankivsk Oblast – Carpathian Bee; Kyiv Oblast – Ukrainian Steppe and Polissya Bee; Kirovograd and Lugansk Oblasts – Ukrainian Steppe Bee; Lviv Oblast – Carpathian Bee; Mykolayiv, Odesa, Poltava Oblasts – Ukrainian Steppe Bee; Rivne Oblast – Carpathian and Polissya Bee; Sumy Oblast – Ukrainian Steppe and Polissya Bee; Ternopil Oblast – Carpathian Bee; Kharkiv, Kherson, Khmelnytsky and Cherkasy Oblasts – Ukrainian Steppe Bee; Chernivtsy Oblast – Carpathian Bee; Chernihiv Oblast – Ukrainian Steppe and Polissya Bee.



Figure 8.
Wild einkorn -
Triticum
boeoticum Boiss.

Wild Relatives of Cultivated Plants. Wild einkorn (*Triticum boeoticum* Boiss. (also *T. thaouidar* Reut. ex Hausskn., *T. monococcum* L. subsp. *boeoticum* (Boiss.) A. et D. Love)) is an example of a wild relative of a cultivated corn in Ukraine (see Figure 8). This species is widespread in the Balkans, Asia Minor, Iran, and Southern and Eastern Transcaucasia. In the literature [22], seven locations are known in Ukraine where this species can be found as individual plants or in small groups. Wild einkorn is found mainly in southern portions of the Crimean Peninsula, including the Sapun Mountains and the villages of Orlyne, Peredove and Novobobrivske (near Sevastopol), the Baydarska Valley near Sudak, Bilogorsk Rayon, and the northern part of the Kerch Peninsula. In Ukraine, the distribution of the species is shrinking due to cattle grazing and grass mowing. However, in some locations, such as the Baydarska

Valley, the species is in optimal condition (from 40 to 728 generating stems per square meter) and has its greatest polymorphism level.

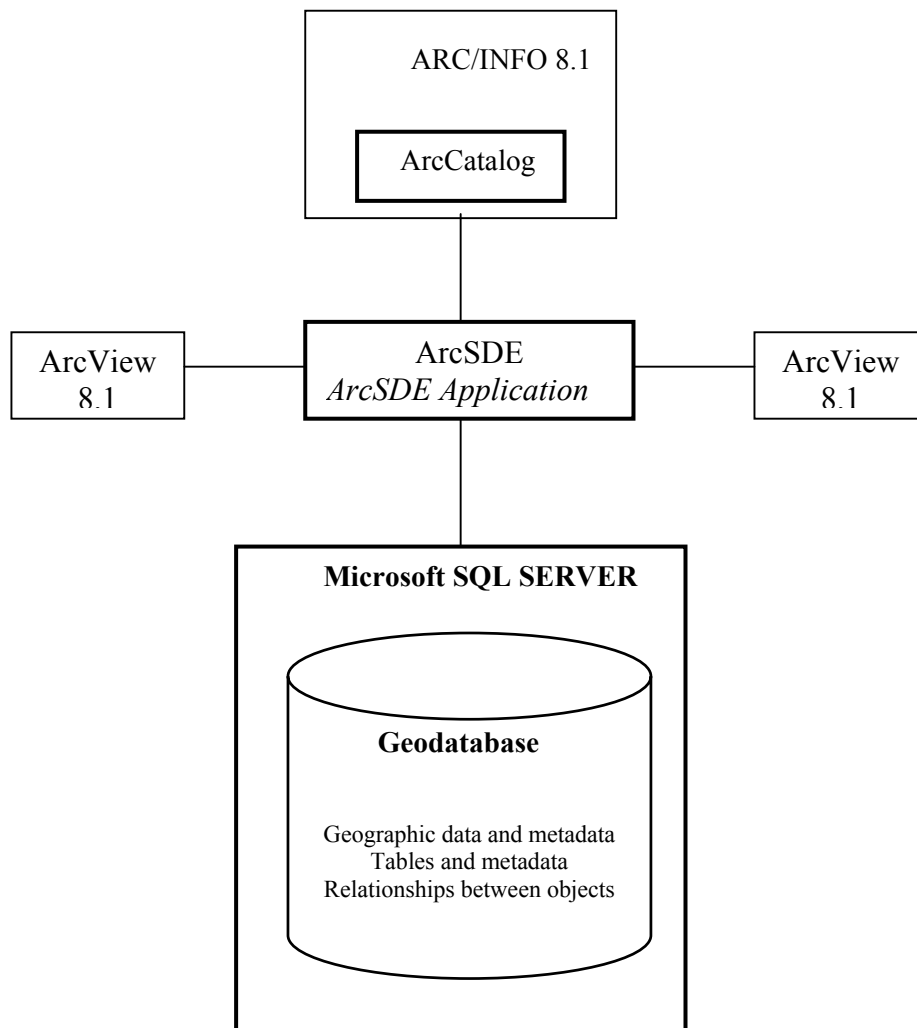


Figure 9. Agrobiodiversity Geo-Information System Architecture (BINU Prolect).

Agro-biodiversity Geo-Information System Architecture

As a database management system, Microsoft SQL Server is being used. Generation and administration of the database, containing vector maps, satellite imagery of different levels of processing, tables and metadata is done using an ARC/INFO 8.1 system in combination with the ArcSDE module, serving as a bridge between ARC/INFO and the Microsoft SQL Server relational database (see Figure 9). ArcSDE also functions as an application server (ArcSDE Application Server), allowing users of the local network to working effectively with a spatial database. ArcView 8.1 can be used as a client tier.

ArcCatalog, one of the key ARC/INFO modules, is used for entering data into the system and associating different database objects. ArcCatalog also provides tools for generating

metadata (i. The information about data) (metadata) and is created using a metadata editor based on using either a common standard, such as FGDC, or based on a newly generated one.

Metadata contain properties and documentation. Properties, such as the coordinate system, spatial location of the object and links to the database tables are extracted directly from the data. Documentation is created developed by the database administrator. Metadata is stored together with the data. Once metadata is created, it can be copied, moved or removed together with the data source.

Evaluation of Agricultural Practices

Agriculture output among the oblasts in Ukraine is comparable. This is due to favourable natural conditions for agriculture throughout Ukraine. For example, in 1997 the ratio between the highest and lowest values of gross agricultural output per capita was 4:1 (UAH 999 in Vinnytsia versus UAH 263 in Donetsk). The most productive oblasts are Vinnytsia, Kyiv, Chernihiv, Khmelnytsky, Cherkasy, and Ternopil Oblasts. These oblasts are situated primarily in the forest-steppe transition, which is the most favorable region for farming. Despite this, these oblasts experienced the greatest decline in gross agricultural output [23].

For the period of 1998 to 2003 Ukrainian experts have begun studying the potential of biodiversity conservation in agricultural landscapes. Thoroughly analyzing state of agricultural technologies that currently have been used in the south of Ukraine, they emphasized a great possibility of nature reconstruction within agricultural territories and adjacent regions.

The private-rent farm "Rossiya," in Crimea, is participating in long-term workplans that integrate ecological land management, pest and fertilizer application, irrigation water use control, etc. The farm uses low quantities of pesticides and inorganic fertilizers. For winter wheat in 1998, 101 kg of chemicals per hectare were used in comparison to 331 kg in 1991. Nearly 34% of their lands were farmed without deep ploughing. The head of the farm (Ms. T. Bilouis) gave a report entitled "Merging Biodiversity and Agricultural Production Goals in the Ukraine" at the agricultural conference "Sustainability in Agricultural System in Transition" (10-22 October 1998, Baltimore, Maryland, USA).

Other examples of agricultural management to improve biodiversity include restoration of meadows' lands in Kyiv and Volyn Oblasts and steppe lands in Kharkiv Oblast. The "Pecheneg Pole" protected area was developed and established with the assistance of the private agrarian firm "Fauna" near the city of Kharkiv.

The newspaper "Donbass" (20 June 2001) reported that a private agrofirma "Shakhter" introduced contour land-improvement technology to prevent continuing land degradation. Some arable land that was eroded and located on hillsides was turned into pastures. As a result, grain yield reached 27 quintal/ha, instead of yield of 17 quintal/ha at other farms. The agricultural firm attained milk yields about 3,5 - 3,6 thousand Kg per cow, 35-50% higher than in neighbouring farms.

Lessons Learned

Improvements for the criteria set for indicator species (invertebrates). Using invertebrates as an example, Dr. Dovgal (Institute of zoology, NASU) recommend the following additional improvements in the criteria set for invertebrate indicator species:

- The species should be quite conspicuous (numerous) and easy to discern even for non-specialists;
- The species should occur in diverse habitats;
- The species should be observable for more than one season. For instance, ephemeral species that occur only in spring are not ideal indicators. Some ephemeral insects, such as butterflies, whose are easily distinguishable in their adult stage, can be used successfully if their larvae are equally identifiable.

Improvement of the trends assessment scale (invertebrates). Dr. Dovgal (Institute of zoology, NASU) suggested that the relative abundance scale used in developing species trends (now ranging from 0 to100) implies too precision for subjective estimates - for level of invertebrates indicators. As such, some authors are considering other alternatives, such as a 10- or 12-point scale.

Table 7. Experimental status of 10 Polissya Zone invertebrate indicative species in Pynovo Village, a forested area. Population status (pressure index): 0 – no species, 1 - depressed population; 2 - stable population; 3 - flourishing population. Reason for population status change: 1 - Habitat loss, 5 - Eutrofication, 7 - Toxification, 12 - Nature Management.

Species	Reason for population status change	Population status (pressure index)
<i>Helix pomatia</i>	7	0
<i>Lucanus cervus</i>	12	0
<i>Papilio machaon</i>	7	2
<i>Argyroneta aquatica</i>	7	2
<i>Cybister lateralimarginalis</i>	1	3
<i>Hyrudo medicinalis</i>	1	0
<i>Bradybaena fruticum</i>	12	2
<i>Zerynthia polyxena</i>	7	0
<i>Limnophilus flavicornis</i>	5	2
<i>Asellus aquaticus</i>	7	3

In Ukraine usually, in such cases, a 3-5 points scale is proposed [24]. This way, it is easier (for some zoologists) to assign a certain interval of abundance or density of spatial distribution to each point on the scale, or give it just a textual description: e.g. depressed, flourishing, etc. At the same time, some difference in the abundance and density of distribution of the monitor- species in the Forest-Steppe and Polissya (Forest) nature zone is evened out. In this regard, for further use, a 4-point scale was offered: 0 – *no specie*, 1- *depressed specie population*; 2- *stable specie population*; 3- *flourishing specie population*.

While assessing a trend, unification of the scale points allows getting an average figure per invertebrate indicator species, reflecting different peculiarities of deviations from the norm in the ecosystem state (e.g. overgrazing) and presenting the result in the form of an amoeba-

chart. In the chart, each line would indicate a trend (average figure) of pressure (deviation from the norm). The same can be done using a colour chart that is often used while processing remote sensing data. A scale divided into fewer classes would be easier to comprehend and more convenient for use, including the case when a colour chart is used (Figure 10). Here is an example of a pilot assessment of invertebrate indicator species populations on one of the sites of Left-Bank Polissya (around Pynovo Village, Vyshgorod Rayon, Kyiv Oblast, August 2003). Pynovo Village is located on the right bank of the Desna River. Agricultural landscapes include floodplain meadows, fields and private vegetable gardens. North of the village, there is a large coniferous forest with scattered deciduous trees. There are several recreation centres in the vicinity of the village, resulting in significant recreation pressures.

Changes in the population of the selected 10 invertebrate indicator species on the study area are due to “Nature management”, most likely, recreation - 0,5; “Toxification” (1,6); “Habitat loss” (1,5); and “Eutrophication” (2) (see Figure 10).

It should be mentioned that such a scheme works even with a small number (10) of indicator-species. The assessment can be made more precise by using a larger set of indicating organisms.

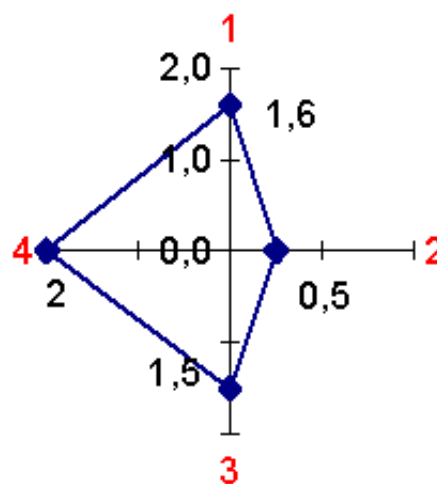


Figure 10. Status of indicator species populations (average pressure index by type of change). 1 – change arising from “Toxification”. 2 – change arising from “Nature management” (recreation). 3 – change arising from “Habitat loss” (the loss of area). 4 – change arising from “Eutrophication”.

Improvement of collection of in-situ information to be used in the remote sensing and GIS analysis. Dr. Dovgal (Institute of Zoology NASU) has also proposed that more field data be collected to associate the status of the indicator species with landscape changes that are observable in satellite imagery, such as burned areas⁸. Using a collection of species, it might be possible to see patterns in ecosystem deviations. Development of a bank of such data will enable prompt preliminary assessments of biodiversity changes by using imagery and without *in situ* studies. However, work on the data bank will require numerous field expeditions, involving appropriate specialists, which may exceed the scope of this project.

Improvement of selection of mammal indicative species. As result of the selection process for indicator mammal species for Forest and Forest-Steppe agricultural zones, Dr. Valantin Kryzhanovsky (Institute of zoology NASU) developed the following additional criteria:

⁸ ULRMC performs fire monitoring of Ukraine with its remote sensing assets (see <http://www.ulrhc.org.ua/services/export/fire/fire.asp>).

- Species should represent different life forms and trophic levels;
- Species should have different types of spatial distribution;
- Species should have a relatively stable numbers;
- Species be sensitive to the impact of negative factors, e.g. rare vulnerable species;
- Species should represent different levels of direct and indirect human pressure;
- Species should be accessible and convenient for monitoring.

One of the peculiarities of the mammal fauna of the Forest-Steppe Zone is that many of the species are wide spread throughout Ukraine and in neighbouring countries. This is probably due to the diversity of habitats found with in the zone, which can accommodate species having many different ecological requirements.

Zoning and indicators. Dr. Kryzhanovsky (Institute of Zoology, NASU) has stated that the assessment of biodiversity in a natural agroecosystem zone is abstract, because different parts within the zone (and different specific agroecosystem types) can have apparent differences, caused by natural, human and historical factors. Thus, not all species included in the proposed species list may be present in certain types of agroecosystems. In a larger study it would be more ideal if agroecosystems of a certain zone could be sub-divided into homogenous blocks that differ from one another other by certain distinctive features. It the future, this could be done, based on botanical zoning.

Another important remark is that most biodiversity indicators that are already in the list compiled by ECNC specialists [25] and which we tried to apply, appeared to be the indicators of indirect meaning, which were sometimes difficult to apply and hard to understand. Some of them will require special or additional scientific research.

To our mind, the simplest biodiversity indicator and its formalized representation can be a ratio of the number of indicative biological species that live in a certain block or ecosystem and a total number of indicative species, identified for all agroecosystems of a certain zone. In this case, it's worth considering whether we should give importance to lacking of certain indicative species in the ecosystem. However, beforehand, we should thoroughly consider the preferences in species that we want to include in the list, taking into account their nature conservation status and other importance. Species can be divided into groups (the most common, ordinary, rare, threatened, etc.). In this case, additional amendments can be introduced into the biodiversity index of a certain ecosystem.

The lessons learned will been taken into account for preparation of Manual Guide for the BINU Project.

Inclusion of the tasks on the assessment of biodiversity in agroecosystems into the plans of the Students' Practical Work. To follow up the results of the seminars and conferences on the BINU Project issues, held at ULRMC in 2003, Oleksandr Zakletsky and Eugene Dyky, the representatives of the National University "Kyiv-Mohyla Academy" (NUKMA), recommended including the tasks on the assessment of biodiversity in agroecosystems into the plans of the Academy students' practical work.

Both professors and students of the National University "Kyiv-Mohyla Academy" agreed that such initiative has good perspectives. Taking into account the requirements of the Academy's curriculum, and given that most of the practical assignments are done by the students on the protected areas, the list of priority tasks included the following: a) collection of materials in

agroecosystems, on the borders between protected and unprotected areas, and further comparison of the collected data; b) comparison of the species composition in the unchanged steppe and meadow ecosystems, and steppe and meadow agroecosystems. It is also worth including these two topics into the list of diploma theses topics for the students of the Academy.

The representatives of the National University Kyiv-Mohyla Academy noted that in the future, an inexpensive illustrated guide of plants and animals of different habitats and natural zones of Ukraine should be developed in order to assist students in their work and improve the awareness of the local population and farmers. Such directory should also be created in the electronic format on magnetic media or available through the Internet. In case of implementation of this initiative, this directory and other educational materials on biodiversity of agroecosystems could also provide the development of the BINU Project initiatives after the completion of the Project.

Conclusion

During the current reporting period, from January through September 2003, development of key questions and their thorough selection proved to be a very efficient methodological approach. The discussion of this complicated issue involved over 100 Ukrainian and international scientists and decision-makers, including those from the UK, Netherlands, Kenya, Philippines and Ecuador). Such approach allowed saving time and resources and identifying potential information users.

During further project implementation, it is planned to continue collection of examples of how national level indicators operate, and continue their improvement. The Project provides for further collection of new *in situ* information, integration of statistical, cartographic, and remote sensing data (MODIS, Landsat, Aster). Among the planned project activities is the development of appropriate layers in a pilot GIS and sample thematic maps, and the compiling of methodological guidelines and analytical report on the state of biodiversity in the agroecosystems in Ukraine, and other materials, in accordance with the project tasks.

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Annex 1. Visit of Dr. James S. Schepers (USDA-ARS) to the Ukrainian Soil Protection Service of the Ministry of Agrarian Policy of Ukraine

(This visit was arranged by the ULRMC BINU team on September 17, 2003 and included a field trip to a conservation project near Kyiv (Chodosivske Urochische). The visit was held at the request of Dr. James S. Schepers (USDA-ARS), the Ukrainian BINU Team (Dr. Vasyl Prydatko and David Schaub) and by Dr. Tatyana Lev (Head of Information and Program Department for the Ukrainian Soil and Protection Service)).

The Ukraine Ministry of Agrarian Policy is very concerned about soil degradation, especially as the titles to more and more land are turned over to individuals. Of the 30 million ha of arable land in Ukraine, they are proposing that about one-third would be reserved for return to native settings or otherwise be protected.

The perception seems to be that under the cooperative farming system of the past, the land was allowed to degrade and production potential was lost. Part of the present concern is that as ownership of the land is returned to individuals, the process of soil degradation could continue or even become accelerated. This being the case, the Ministry wants to develop an inventory of lands and categorize them according to the fertility status. Indirectly, I think they would also like to classify these lands according to their productivity potential, even though this was not specified. Ukrainian scientists were keen on the idea that soil erosion was closely tied to fertility status. My impression is that they hadn't directly made the link between the state of soil erosion and the productivity, even though they had obviously thought about it. Their goal was to use remote sensing to classify the state of erosion so that they could make management decisions about how the land would be handled during the re-titling process (i/e/. which lands would be allowed to go back to native situations). They also hope to use the maps and imagery to help farmers and local agencies better manage the land. I suggested that images or maps of the crops near harvest could be used as a proxy for relative yield (biomass and green color or chlorophyll) within a field and as such might be a powerful tool to entice producers to become better managers. In particular, such images of the growing crop would help farmers and managers know where to target their stewardship efforts first. Chances are very good that images that illustrate soil color taken in early May for summer crops will show the same patterns as the vegetation maps in mid August. The similarities will demonstrate a nice cause and effect relationship.

There seems to be a basic difference in philosophy between the US and Ukraine when it comes to land management. Maybe both are right for the situation. In the US, it is assumed that producers have an innate sense of land stewardship and the government will not intervene unless the environment is threatened. Basically, it is assumed that it is in the best interest of farmers to control erosion because they know the consequences in terms of productivity and property values. In Ukraine, farmers have not owned the land in the recent past and perhaps they did not feel a vested interest in maintaining the productivity of the land for future generations. It is also possible that individuals were not empowered to make stewardship decisions or undertake such activities (lack of resources and time)? For these reasons and others, soil erosion in Ukraine is considered to be a serious matter.

Soil survey maps for the country developed before 1972 are considered to be inaccurate because of erosion that has occurred since then. I would argue that the map boundaries are probably still reliable, but the designation of erosion class could be wrong and that some marginal lands from the past could now be totally non-productive.

Dr. Lev said that the Ministry had GIS expertise to apply toward developed a soil erosion inventory for Ukraine, but did not have the imagery or the protocol from which to complete such an inventory. During the short time of the visit, it was not possible to ascertain the GIS capabilities (specialized expertise and capacity) within the Ministry. I suggested that in the interest of time and probably money too, that the Ministry explores working with ULRMC on some demonstration projects to test the feasibility of the concept using the imagery that already exists. The Ministry has a mandate to establish sound stewardship practices on the land and either already has or plans to have personnel located at the local level who could help with the calibration efforts. ULRMC has the personnel and most of the expertise needed to develop the interpretation algorithms to link indicators of soil erosion with patterns in recent imagery. The only things that are lacking would seem to be the funds to help start the project and perhaps a little expertise on how to make the algorithms a little more dynamic and robust. Much of this expertise exists within the USDA-ARS and NASA, but would have to be validated with Ukraine soils and crops.

One of the key philosophical challenges will be the desire on the part of the Ministry to implement erosion control measures that have not been used in the past. The situation is further complicated by the fact that the standard of living for many Ukrainian farmers is quite low compared to US or European standards. Thus, when given a choice to spend their own funds on inputs that are likely to increase production in the near term or on erosion control that will contribute to sustainability in the future, they will likely opt for putting more food on the table now. This tendency will likely continue until farmers have a comfortable standard of living unless there are incentives that entice producers to the contrary. Care should be taken not to draw too much from analogies between the US or Europe and the Ukraine because farm subsidies average about 22% in the US and 35% in the EU. Subsidies in the US and Europe (paid after the fact) are frequently tied to environmental compliance in the past. Dr. Lev talked about exploring environmental incentives (lower taxes etc.) for those who demonstrate a good stewardship ethic. My only knowledge of where this approach was tried in the US was when cities and states provide a tax incentive to attract new industry, but when the incentives dwindle the industry sometimes leaves.

During the field trip (guided by Dr. Tarariko), we visited a site that was seriously eroded in the early 1980s as noted in aerial photographs, but has since been taken out of production, terraced and planted to grasses. Soil erosion is now totally under control. The major gullies are now vegetated with a variety of trees and scrubs, which provide wildlife diversity and protection against further erosion. This project was initiated in 1983 with the support of the Soviet Union, but similar projects would not be possible today because of a lack of resources.

It is my impression that while support from outside sources would probably accelerate the land classification process; this approach would probably take considerable time to develop and implement. A more expedient and probably equally effective approach might be to solicit technical assistance to help Ukrainian scientists develop a protocol for data collection, work with ULRMC personnel to acquire and process the imagery, and jointly verify the algorithms on some test cases so that all processes could eventually be carried out internal to Ukraine.

Annex 2. Complete set of prospective BINU indicators that were considered for agro-biodiversity

Potential Indicators	What is the current state of agro-biodiversity in Ukraine?	What are the main factors causing decrease or increase of agro-biodiversity, and how do changes in the land use practice impact decrease or increase of agro-biodiversity?	What lands could be returned to nature in the near future?	To what extent are national biological indicators linked with international ones?	How can scenarios of agro-biodiversity changes be built, and how can biodiversity loss be stopped in the near future?	Are data easily available for Ukraine and numbers of KQs?
I. General Indicators						
LPI						
Number of endemic/threatened/ endangered/vulnerable species by group						3
Percentage of protected area to total area						2
Soil quality						1
Existence of institutional capacity, policy and regulatory framework for the planning, management and conservation of biological diversity						3
Diversity of native fauna						1
Species with decreasing populations						2
Recorded species present by group						1
Species used by local residents						2
Species group: total number versus threatened species						2
Temporal change in number of species (increase/decrease)						1
Species with stable or increasing populations						2

Sex ratio, age distribution and other aspects of population structure for sensitive species, keystone species, and other special interest species						3
Indigenous species present by group						1
Change in number and/or distribution of keystone or indicator species						0
Change in habitat boundaries						2
Change in composition of species overtime						2
Non-indigenous species present by group						4
Changes in average size of a particular habitat type						2
Change in presence, location, area, numbers of invasive plant or animal species						4
Quantity of specimens or species of economic/scientific interest removed from the environment						3
Diversity in total area of a particular habitat type						3
Spatial differences in the number of rare vs. common species						3
Changes in largest block of a particular habitat type						2
Species risk index						
Species with small populations vs. larger population size						2
Spatial differences in the restricted vs. wide range species						1
Percentage of area dominated by non-domesticated species						3
Change in mean nearest distance between blocks of a particular habitat type						2
Degree of connectivity of food web						
Change in average width of break in an identified habitat corridor						3

II. Agriculture						
Use of agricultural pesticides						3
Agricultural area by crops (cereal, oil crops, forage, woodlands)						2
Change in area of agricultural land (conversion to or from agriculture)						2
Agricultural area (intensively farmed, semi-intensively farmed and uncultivated)						2
Species diversity used for food						3
Intensification and extensification of agricultural land use						2
Erosion/Loss of genetic diversity patrimony						3
Crops/livestock grown as a percentage of number of 30 years before						
Replacement of indigenous crops						3
Number of species threatened by agriculture by group e.g. birds, mammals, vascular plants, vertebrates, invertebrates)						3
Number of vertebrate species using habitat on agricultural land by species						3
Accessions of crops generated in the past decade (per cent)						
Differences in species diversity and abundance of arthropods and earthworms in organically and conventionally cultivated arable land						3
Rate of change from dominance of nondomesticated species to domesticated species						2
Rate of genetic interchange between populations (measured by rate of dispersal and subsequent reproduction of migrants)						2
III. Indicators from ECNC Sources						

Use of agricultural pesticides						3
Ag area by crops (cereals, oil crops, forage, woodlands)						1
Change in area of agricultural land area "to" or "from" agriculture						1
Arable land per capita						1
Number of species of crops and trees used by local residents						2
Percentage of agricultural land under exploitation						2
Use of fertilizers						
Agricultural intensity						2
Agri-environmental management contracts						1
Availability of wildlife habitat on farmland						3
Area of farmland covered by the agri-environmental programs						2
Area and percentage of farmland subject to restrictions						3
Area under organic farming						2
Trends: marginalisation						2
Matrix of changes in land cover classified by type and size						2
Area of high nature value						2
Species richness						2
Density of linear elements and diversity of land cover at the level of the holding						2
Indices of overall and of agricultural diversity and of their evolution through time						3

IV. ULRMC Proposed Indicators						
Inventory of natural remnants (e.g. wetlands, forests, grasslands, etc.)						2
Ratio of perimeter to area of natural fragments (shows fragmentation)						
Average size of natural fragments						3
Distribution of natural fragments						3
Abundances of a few widespread vertebrate species that are easily monitored						
Distribution of human population						3
Water quality and alteration of wetlands, ponds, etc.						3
Air quality in rural areas						3
Water management (esp. irrigation)						2
Exploitation of natural fragments (wood harvesting, hunting, fishing)						3
Water table levels						3
Level of agriculture intensity (incl. crops/year)						2
Types and abundances of domesticated animals						
Patchiness and diversity of agricultural usage						4
Trends in types of agricultural practices						2
Legislation on land management and privatization						3
Projections on economy and demographics for 2010						3
Locations of threatened species and hot spots						4

Numbers of conservation organizations	[Cyan bar]		[White bar]		[Cyan bar]		[Pink bar]		1
Ag lands in proximity of reserves	[White bar]		[Cyan bar]		[White bar]		[Cyan bar]		2
Census data for migratory species	[Cyan bar]		[White bar]		[Cyan bar]		[Cyan bar]		3
TOTAL (with possible data)	23	19	16	4	28				

- KQ, which the data could help to answer
- 4KQs of 5KQs (could help to answer)
- Rejected indicators (because of lack of data or any difficulties of collection)
- No data for the indicator

Annex 3. Results of indicators selection

KQ1 What is the current state of agro-biodiversity in Ukraine?

LPI

Species richness

NCI

Status of rare species

Alien species

Types/areas of ag land

Analysis and inventory of natural fragments

Water availability and quality

KQ 2 What are the main factors causing decrease or increase of agro biodiversity, and how do changes in the land use practice impact decrease or increase of agro biodiversity?

Human population distribution and trends

Land use changes

Alien species

Fragmentation

Tillage frequency

Ag land management (soil & water)

Ag inputs (fertilizers, pesticides, herbicides)

Abiotic environment quality (soil, water, air)

Global climate change and pollution (provided by GLOBIO)

KQ 3 What lands could be returned to nature in the near future?

Spatial integrity index

Marginal ag lands (lands with low ag value)

Areas of high diversity with threatened species

Ag lands with long fallow periods

Low agricultural inputs

Human population

Lands to be privatized

Economic pressures

Lands planned for conversion to a natural state

KQ 4 To what extent are national bio-indicators linked with international ones?

LPI on migratory spp.

Ag lands best for migratory spp.

Participation in international agreements processes (FAO, CBD, CMS)

Evaluation of government policy on international agreements

KQ 5 How can scenarios of agro-biodiversity changes be built, and how can biodiversity loss be stopped in the near future?

Calculate the magnitude of the problem (LPI, NCI)

Forecast pressures from KQ 2

Future government policy

Evaluate species risks and develop action plan

GENETICS

What is the status of crop race diversity in Ukraine, and to what extent is Ukraine susceptible to monoculture effects?

Consumption patterns

Total number of crop genotypes

Number of genotypes that are commonly grown

Distribution and abundance of wild relatives of crops

Effects of high production crops on wild biodiversity

Note: Key Questions 1 - 5 relate to wild biodiversity. Genetics issues are primarily concerned with domesticated biodiversity.

Annex 4. BINU Ukraine Project Registration Card #1271 (copy)

Форма затверджена Постановою
Кабінету Міністрів України
від 15.02.02 №153

РЕЄСТРАЦІЙНА КАРТКА ПРОЕКТУ № 1271

Донор	Екологічна програма ООН - Світовий центр моніторингу збереження природи (UNEP - WCMC)
Виконавець	Міжнародна асоціація "Український центр менеджменту землі та ресурсів" ЄДРПОУ № 30263304
Реципієнт	1. Міжнародна асоціація "Український центр менеджменту землі та ресурсів" ЄДРПОУ № 30263304 2. Республіканський комітет АР Крим з екології та природних ресурсів ЄДРПОУ № 00048076 3. Українська академія аграрних наук ЄДРПОУ № 00024360 4. Український інститут дослідження навколишнього середовища та ресурсів ЄДРПОУ № 20077163 5. Державна служба заповідної справи, Мінкоресурсів ЄДРПОУ № 20064479 6. Державний комітет статистики ЄДРПОУ № 00013633 7. Державний комітет України по земельних ресурсах ЄДРПОУ № 00032632 8. Республіканський комітет України по земельним ресурсам АР Крим ЄДРПОУ № 00048113 9. Вінницьке обласне головне управління земельних ресурсів ЄДРПОУ № 20088250
Бенефіціар	Міністерство екології та природних ресурсів
Назва проекту	Індикатори біорозмаїття для національних потреб
Цілі та зміст	Проект спрямований на активізацію використання комплексу важливих для екосистем індикаторів, підбір супутніх індикаторів, розробку методології для моніторингу біорозмаїття на національному рівні, підтримку тих, хто приймає політичні рішення з питання використання інформації, яка надходить завдяки використанню біоіндикаторів, підтримку розробки підходів щодо біоіндикації, надання обладнання українським реципієнтам для забезпечення ефективного обміну інформацією за проектом
Кошторисна вартість	251 240 доларів США
Термін виконання	01 липня 2002 - 31 грудня 2004
Реєстраційний номер проекту (програми), визначений донором (або номер контракту)	UNEP GEF: GF/ 2712-02-4446
Міжнародний договір	Угода між Урядом України і Програмою розвитку Організації Об'єднаних Націй Угода між Урядом України та ООН про відкриття Представництва ООН в Україні Конвенція про привілеї та імунітети спеціалізованих установ ООН Протокол про співпрацю між Міністерством екології та природних ресурсів України та екологічною програмою ООН - Світовим центром збереження природи
Інші відомості щодо проекту	Відповідальна особа - старший спеціаліст з проектів Українського центру менеджменту землі та ресурсів В. І. Придатко, т. 230-22-67
Дата державної реєстрації	23 червня 2003 року

Заступник директора Департаменту координації
міжнародної технічної допомоги
Міністерства економіки та з питань
європейської інтеграції України



Н. Рябцева

Annex 4. (Continued)

Approved by the Cabinet of Ministers of Ukraine
Decree #153 of February 15, 2002

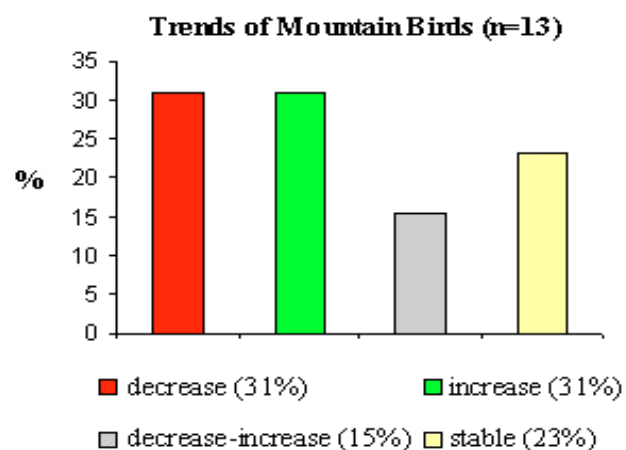
Project Registration Card #1271

Donor	United Nations Environment Programme-World Conservation Monitoring Centre (UNEP-WCMC)
Implementer	International Association “Ukrainian Land and Resource Management Centre” <i>State Registration # 30263304</i>
Recipient	International Association “Ukrainian Land and Resource Management Centre” <i>State Registration # 30263304</i> State Administration of the Environment and Natural Resources under MENRU (branch of Autonomous Republic of Crimea) <i>State Registration # 00048076</i> Ukrainian Academy of Agrarian Sciences <i>State Registration # 00024360</i> Environmental and Resources Research Institute of Ukraine <i>State Registration # 20077163</i> State Service of Protected Areas under the Ministry of the Environment and Natural Resources of Ukraine <i>State Registration # 20064479</i> State Statistics Committee of Ukraine <i>State Registration # 00013633</i> State Committee on Land Resources of Ukraine <i>State Registration # 00032632</i> State Administration of the State Committee on Land Resources in Autonomous Republic of Crimea <i>State Registration # 00048113</i> State Administration of the State Committee on Land Resources in Vinnytsia Oblast <i>State Registration # 20088250</i>
Beneficiary	Ministry of the Environment and Natural Resources of Ukraine
Project Title	Biodiversity Indicators for National Use
Project Aims and Content	The project aims in activating the use of a set of ecosystem specific indicators, selection of auxiliary indicators, development of a methodology for biodiversity monitoring on the national level, support of the decision-making regarding the use of information acquired through the use of bioindicators, support of the development of approaches to biodiversity, provision of the equipment to the Ukrainian recipients in order to facilitate an efficient information exchange in the framework of the Project.

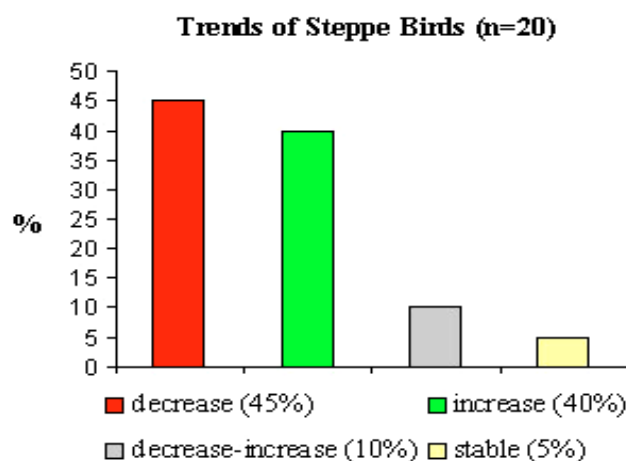
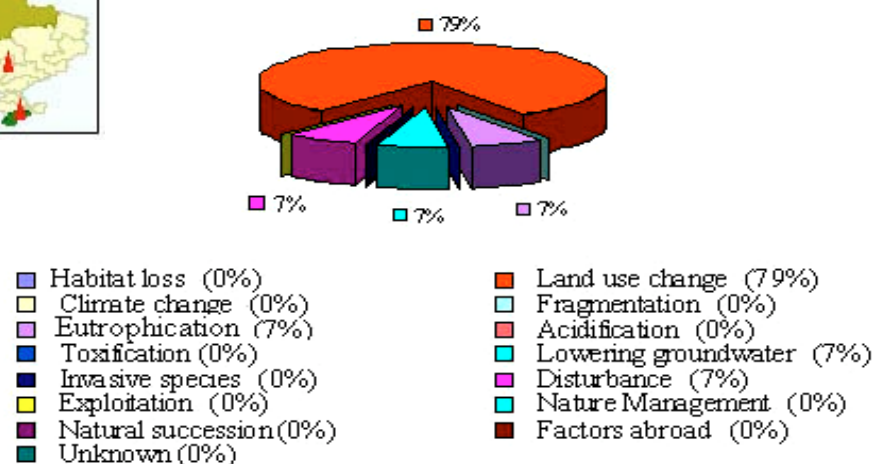
Project Cost	251,240 USD
Project Implementation Period	July 1, 2002 – December 31, 2004
Project (Program) Registration Number Given by the Donor (or Contract Number)	UNEP GEF: GF/2712-02-4446
International Agreement	Agreement between the Government of Ukraine and the UN Development Program Agreement between the Government of Ukraine and the UN on Opening of the UN Representative Office in Ukraine Convention on the Privileges and Immunities of the United Nations Protocol of Cooperation between the Ministry of the Environment and Natural Resources of Ukraine and the United Nations Environment Programme-World Conservation Monitoring Centre (UNEP-WCMC)
Other Project Information	Project Manager – Vasyl I. Prydatko, Chief Project Specialist, Ukrainian Land and Resource Management Center, tel.: 230-2267
State Registration Date	June 23, 2003

N. Ryabtseva
Deputy Director
Department of Coordination of International Technical Assistance
Ministry of Economy and European Integration Issues of Ukraine

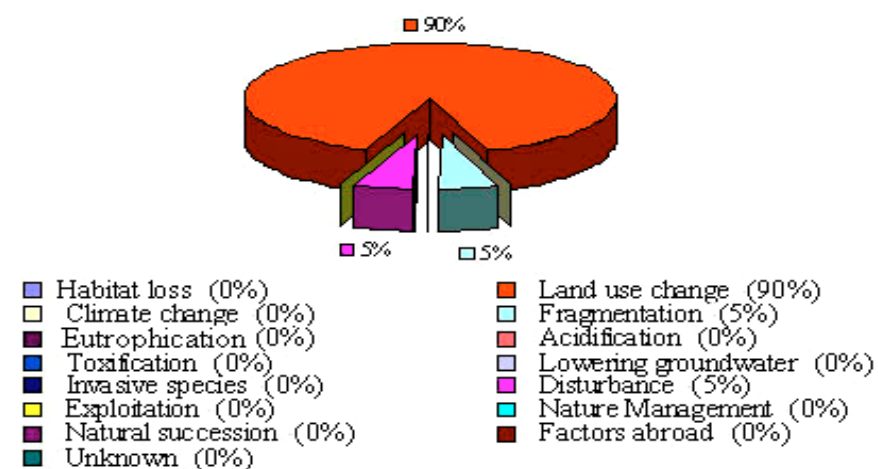
Annex 5. Trends and causes of change of birds related to agriculture landscapes for steppe zone and mountain zone in Ukraine



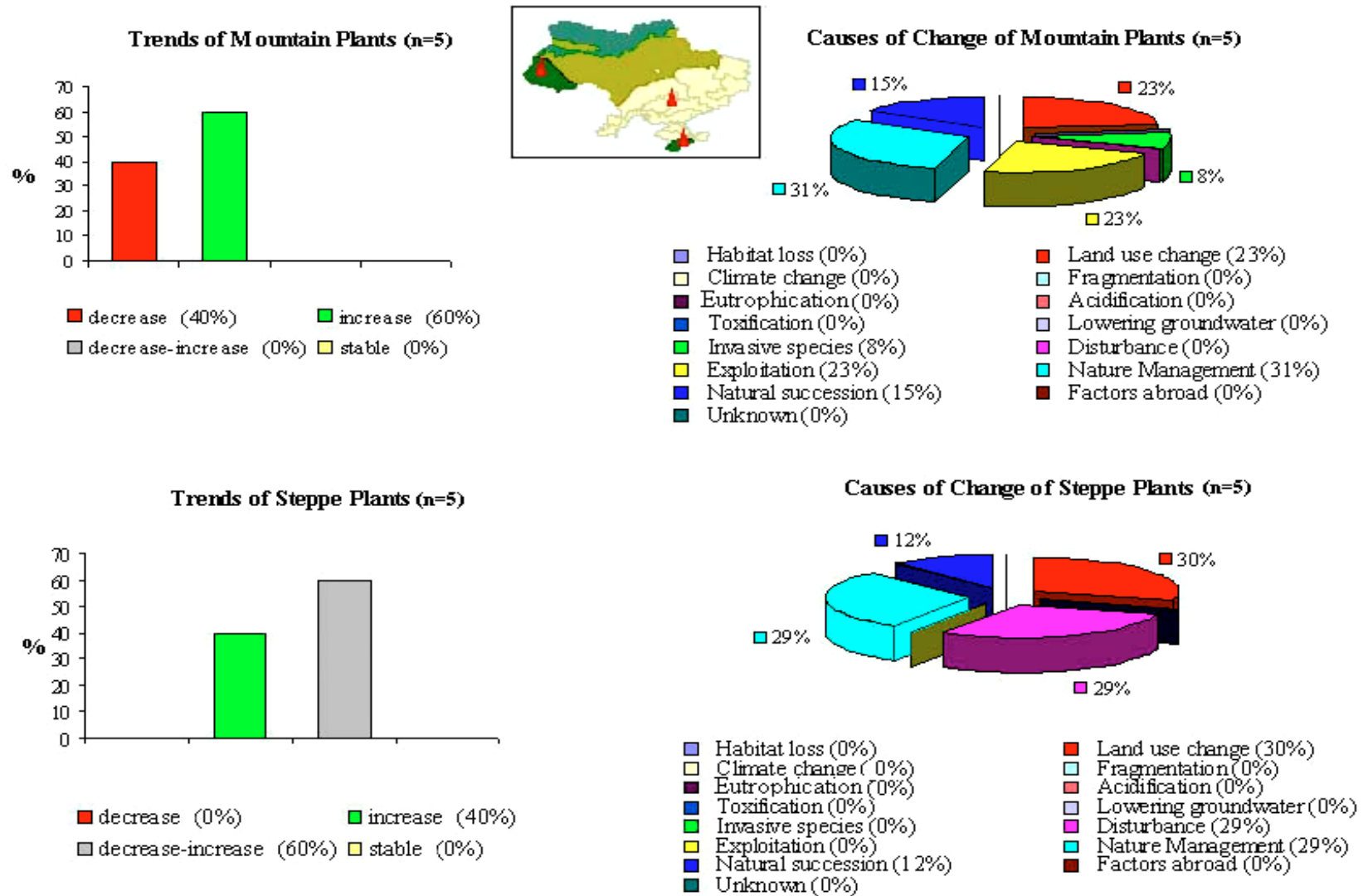
Causes of Change of Mountain Birds (n=13)



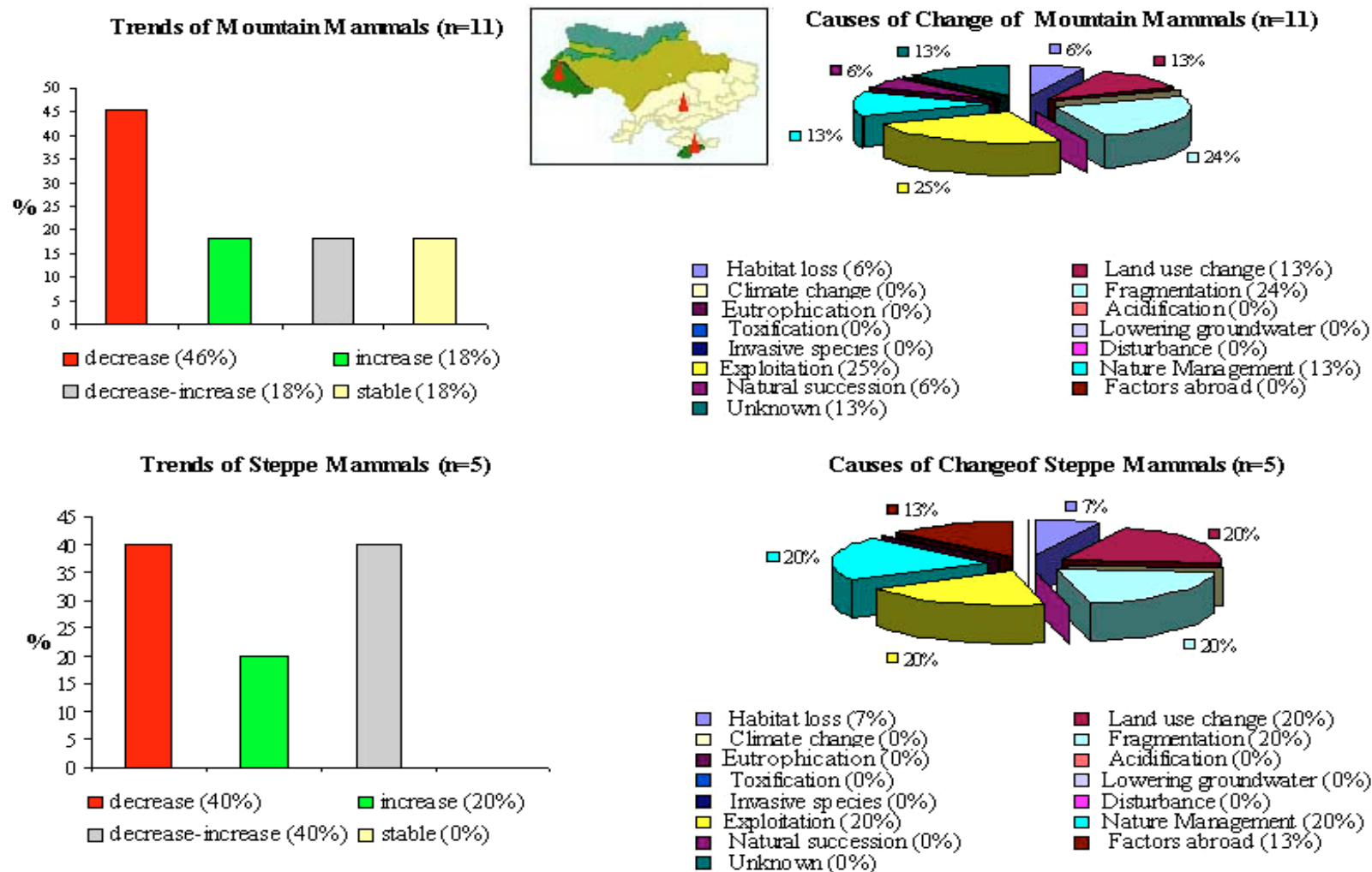
Causes of Change of Steppe Birds (n=20)



Annex 6. Trends and causes of change of plants related to agricultural landscapes for steppe zone and mountain zone in Ukraine

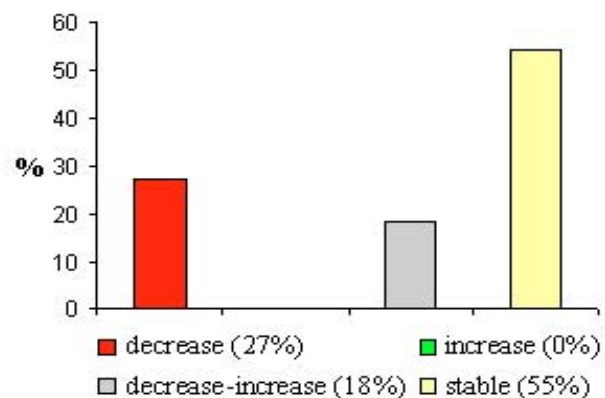


Annex 7. Trends and causes of change of mammals related to agricultural landscapes for steppe zone and mountain zone in Ukraine

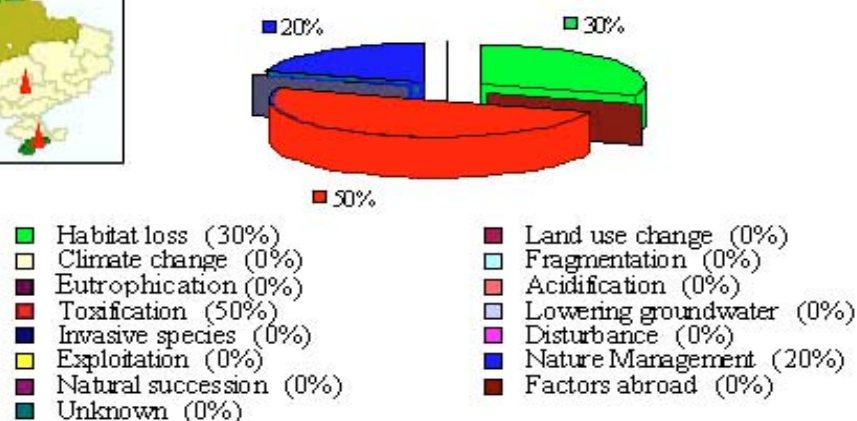


Annex 8. Trends and causes of change of invertebrates related to agricultural landscapes for steppe zone and mountain zone in Ukraine

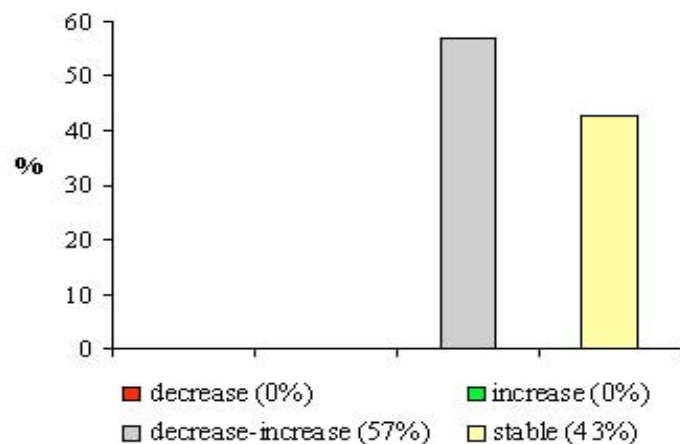
Trends of Mountain Invertebrates (n=11)



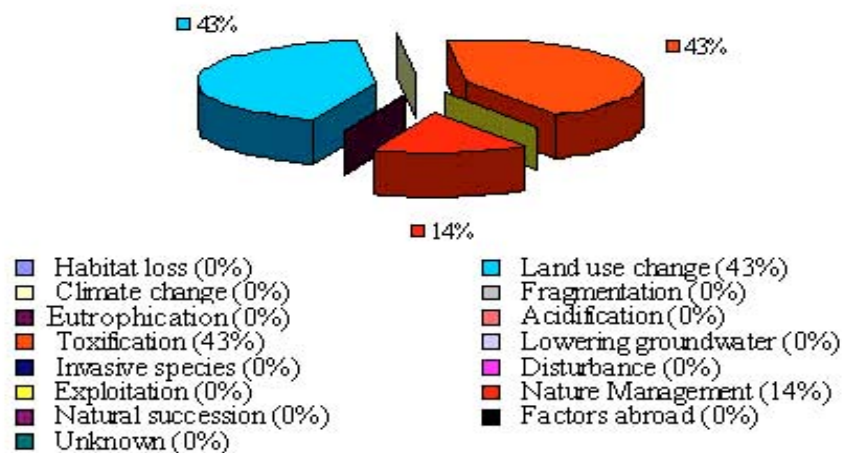
Causes of Change of Mountain Invertebrates (n=11)



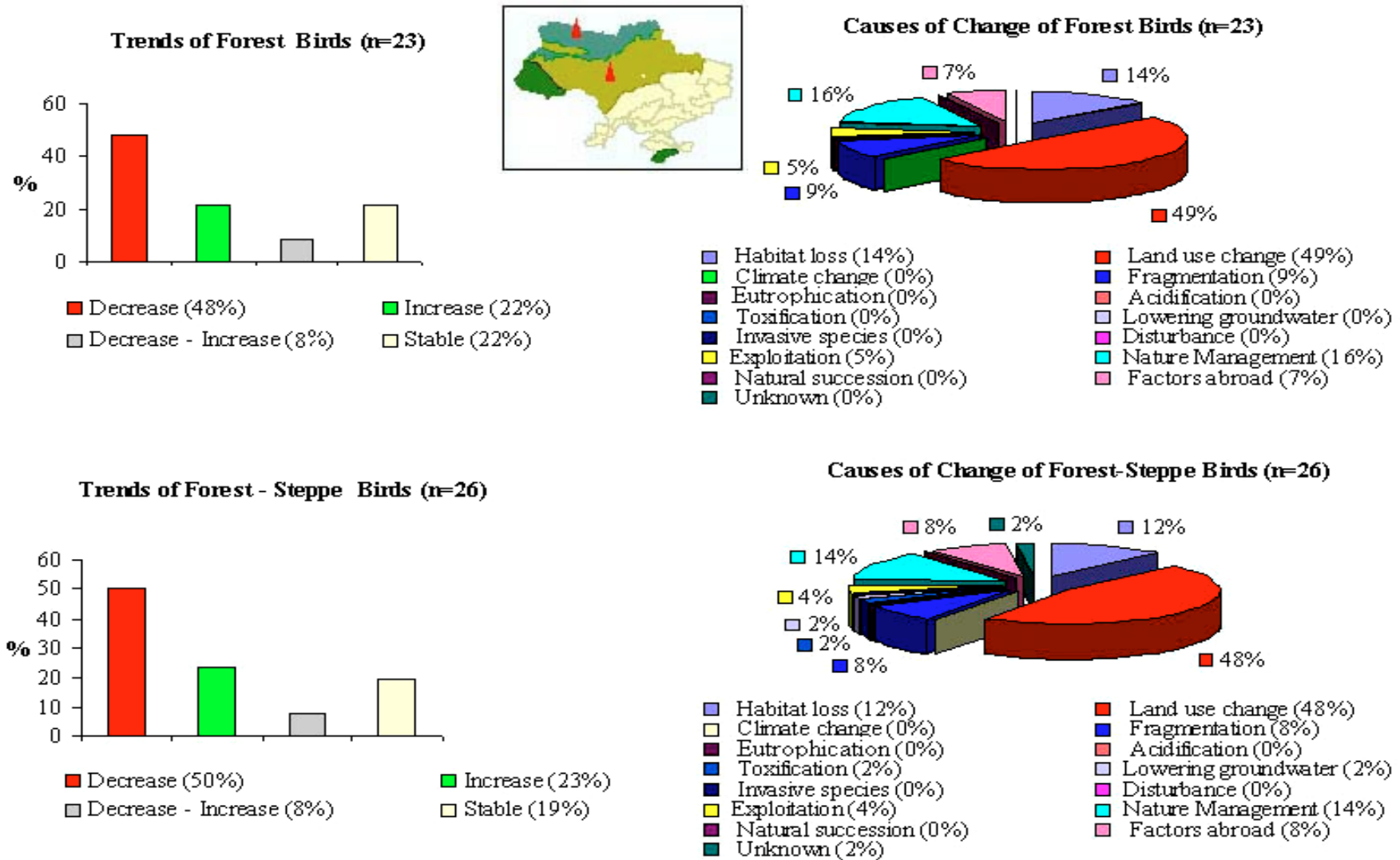
Trends of Steppe Invertebrates (n=7)



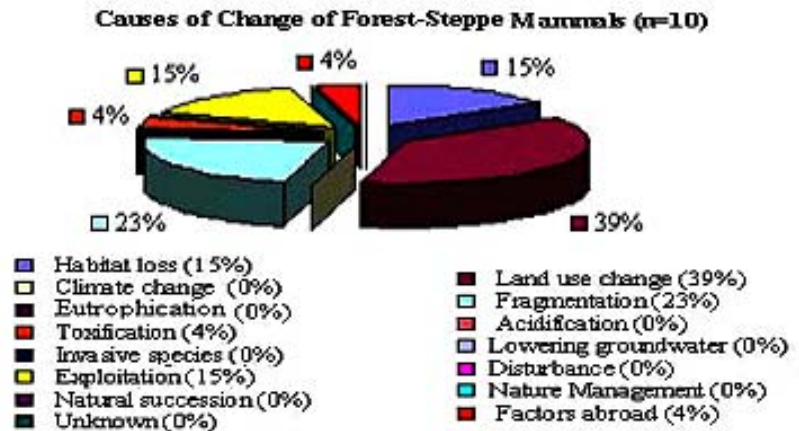
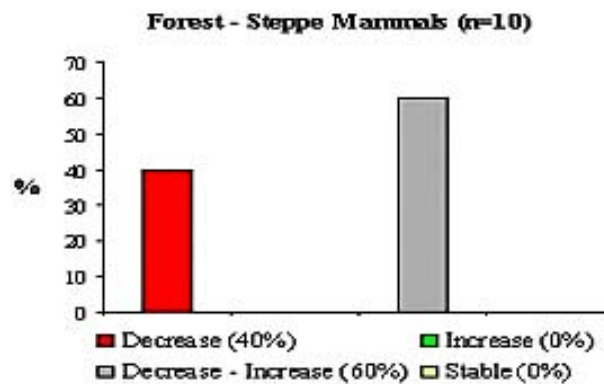
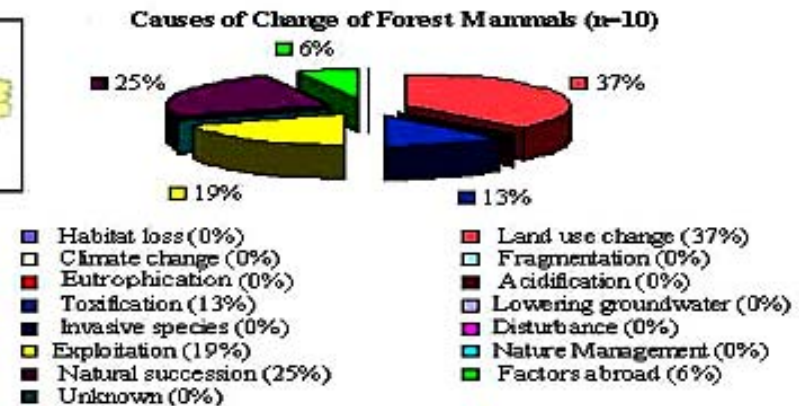
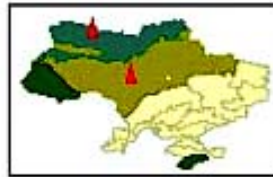
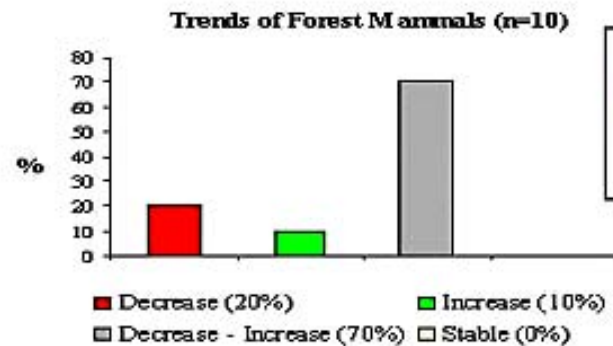
Causes of Change of Steppe Invertebrates (n=7)



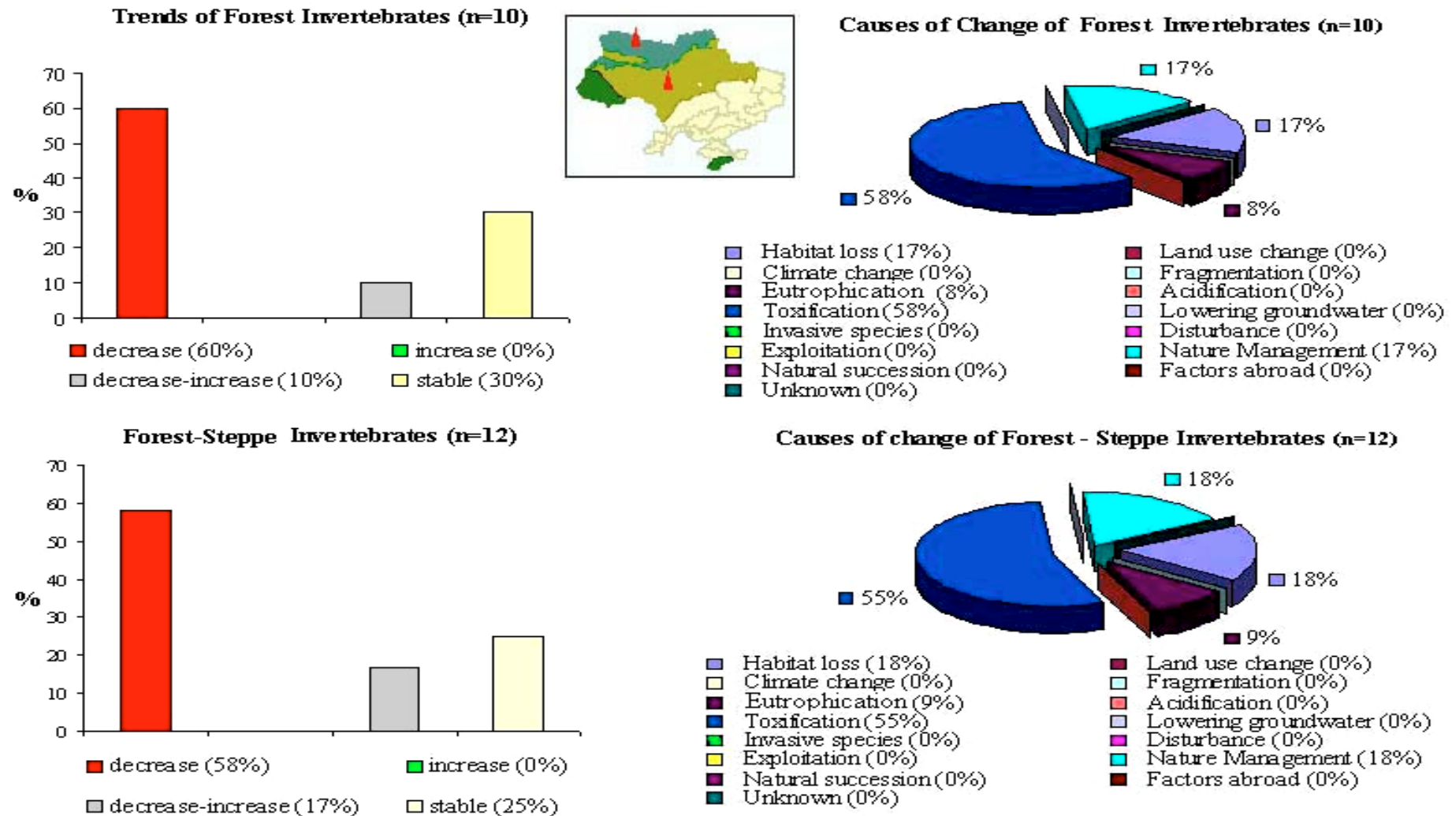
Annex 9. Trends and causes of change of birds related to agricultural landscapes for forest zone and forest – steppe zone in Ukraine



Annex 10. Trends and causes of change of mammals related to agricultural landscapes for forest zone and forest – steppe zone in Ukraine



Annex 11. Trends and causes of change of invertebrates related to agricultural landscapes for forest zone and forest – steppe zone in Ukraine



Annex 12. Trends and causes of change of plants related to agricultural landscapes for forest zone and forest – steppe zone in Ukraine

