EBONE newsletter

December 2011

INTRODUCTION

EBONE results and follow-up

By Rob Jongman

This is the last EBONE newsletter before the final meeting that will be held in Brussels on March 12-13 in the building of the Flemish parliament.

Now, in December and near the end of the project it is time to look back on what we did, to conclude if we can be satisfied and to look forward to what will be done with our work. Will it be a useful product for those who need it, will it be just a scientific result or will it be both?

This issue of the newsletter presents our results and what we foresee is going to be done with the knowledge developed in EBONE.

The European stratification, which already was developed in BioHab, has been used in EBONE, but also increasingly in many other European projects and for policy development such as a background document for the Nitrate Directive. There are signs, that the global stratification that has been developed in EBONE as a GEO BON contribution will be used even more, JRC is already using it and as you can read in this issue inside and outside Europe there are upcoming applications.

The General Habitat Categories (GHCs) seem to become a successful basic habitat classification for field inventories and for linking remote sensing with in situ. This issue presents two of the applications at national level in Switzerland and Israel, both adapted to the needs within these countries. Also FP7 projects are using the approach to collect basic field data such the BioBio project (see www.biobio-indicator.org) and BIO SOS (www.biosos.wur.nl/UK/). Moreover, an important product for the near future and for global cooperation is the extension of the GHC classification to all biomes of the world, making it a tool for linking in situ and RS globally conform the objectives of GEO and GEO BON.

Results are now also being produced in the application of RS observations. Most of these results are expected in the coming months, but in this issue of the newsletter we show how LiDAR data can be used in biodiversity monitoring. Although we made progress, we surely are aware that RS applications in biodiversity observations still need further development, both in topical precision and in spatial resolution. From the EBONE project and through GEO BON we are developing the vision how to make use of these tools. We are discussing which biodiversity observations are essential and can be observed by RS and which essential variables should always be monitored in situ. These are fields for further development and linking with other European and global activities such as GTOS, GOFC-GOLD and organisations such as DIVERSITAS, ESA and NASA.

On 16-18 November the GEO VIII General Assembly has been held in Istanbul. There we could show our present results to the world and these have been recognised as important contributions to the work of GEO. A short overview of the work produced until now was given in the speaker's corner of the GEO stand and EBONE had its own sub-stand within the EU pavilion to discuss further with interested participants.

Finally, we would like to invite you to our final meeting on 12-13 March 2012 in Brussels. It is an open meeting, but we would like you to register for our preparations. Registration is possible filling in the form at the EBONE website (www.ebone.wur.nl) and more details concerning the programme can be found there as well.

We hope to meet you in Brussels.

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Updates from the Work Packages

Environmental stratifications as the basis for biodiversity monitoring

By Marc Metzger and Robert Zomer

There is growing urgency for integration and coordination of global environmental and biodiversity data required to respond to the 'grand challenges' the planet is facing, including biodiversity decline. A consistent stratification of land into relatively homogenous strata provides a valuable spatial framework for comparison and analysis of ecological and environmental data across large heterogeneous areas. Within EBONE we recently developed a Global Environmental Stratification (GEnS). This dataset distinguishes 125 strata and eighteen zones with a 30 arcsec resolution (approximately 1km2).

The GEnS has recently been used in a study by the International Centre for Integrated Mountain Development (ICIMOD) to prepare the development of a monitoring programme in the transboundary Kailash Sacred Landscape in the Himalayas. This landscape encompasses a highly diverse terrain of some of the highest and most remote mountains in the world, most notably the sacred Mt. Kailash. This vast area (approx. 31,000 km2) is endowed with rich natural resources and high levels of natural and agricultural biodiversity, providing a broad array of ecosystem services to the more than one million people living within the KSL.

Systematic monitoring, analysis and modelling of on-going change of the region's ecosystems require consistent data across the region. Unfortunately, data availability is poor, with considerable inconsistencies between countries. For example, the WWF eco-regions Map for the KSL (Figure 1) shows a marked discontinuity between different countries.

KSL-Nepal presents the highest level of detail, spatial accuracy and stratification richness. KSL-India and KSL-China have an insufficient level of detail to distinguish between major vegetation types. The GEnS successfully stratifies the KSL into ten zones and 34 strata. Twelve vegetation types were distinguished and named based on their corresponding eco-region (Figure 2), providing a consistent map for the region. Further analysis focused on the sensitivity of these vegetation types to climate change, and recommendations were made for developing a more detailed monitoring programme in the region.

The work in KSL is a first example illustrating the potential of the GEnS to support global biodiversity monitoring. The dataset has been identified as a focal geospatial data resource for tasks of the recently launched Group on Earth Observation Biodiversity Observation Network (GEO BON), and a scientific publication is currently in review.

Figure 1 WWF Ecoregions for the Kailash Sacred Landscape in the Himalayas

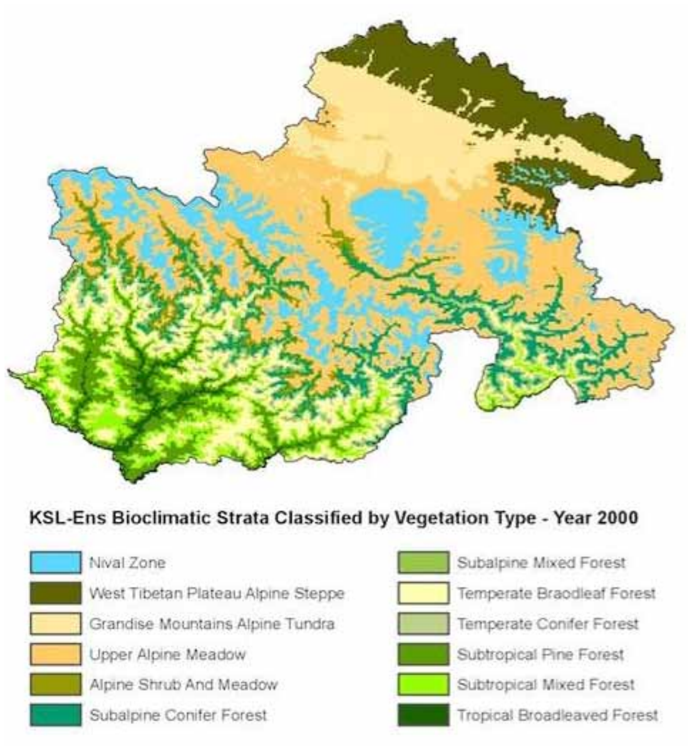

Figure 2 The GEnS was used to consistently define vegetation classes across the region.

Developing a monitoring program for agricultural species and habitats in Switzerland

By Felix Herzog, Robert GH Bunce, Gabriela Hofer

As in most European countries, but also in Switzerland agricultural species and habitats are under pressure. The administration is aware of the threats to biodiversity and the government has proposed a biodiversity strategy with a related action plan. Accordingly the Ministries of Agriculture and of Environment have now joined forces in the implementation of a monitoring program for agricultural species and habitats.

The monitoring program is intended to assess the status quo and changes over time of both priority species and habitats, as well as the overall biodiversity, in agricultural landscapes. Although Switzerland is not a large country, it has a high topographic and climatic variability – with farmland altitudes ranging between 200 and 2500 m a.s.l., with cold plains, steep slopes. In addition, the central and southern Alpine regions have a sub- Mediterranean climate with many types of grasslands, crops and vineyards.

We have two years to propose a monitoring approach and a further one to two years to make the proposed system operational. In the first year we started with an overview of existing monitoring systems (mainly EBONE, UK Countryside Survey, 3Q Norway) and developed an adaptation of the existing Swiss habitat classification and list of priority habitats and species. In doing so, we needed to make sure that the proposal would be compatible with ongoing biodiversity and landscape monitoring activities, such as the Biodiversity Monitoring of Switzerland, the Swiss Forest Inventory and the Monitoring of Protected Habitats. We tested the approach in 11 kilometer squares across Switzerland, from the lowlands to the mid slopes up to the high summer pastures. At present we are evaluating the lessons learned, listing advantages and disadvantages of map based as opposed to raster based approaches, as well as discussing sampling design questions. Later this year we will decide, together with the Ministries, which approach fits their requirements best.

Considering recent work it is not difficult to put into place a sound biodiversity monitoring program– if the resources were not limited. However in the real world, as in the development of the current project, there are always financial limits. There is therefore an optimization problem in how collect the maximum of reliable and repeatable information within the given financial restrictions. This is the real challenge!

Figure 3. A mapped kilometer square in the Swiss summer pasture area with aerial photograph and areas of assigned habitats.

Figure 4. A member of our field team facing the challenge of delineating agricultural habitats in a summer pasture area.

Figure 5. Raster of kilometer squares of the Swiss Biodiversity Monitoring (www.biodiversitymonitoring.ch). The agricultural monitoring will focus on a sub-set of those squares.

Application of the EBONE in Israel and plans for the future

By Linda Olsvig-Whittaker

The Israel Nature and Parks Authority (INPA) is a conservation organization; therefore our interest in EBONE is pragmatically oriented towards new tools for conservation management which we can apply in our own work. INPA will never have enough staff, money or taxonomic knowledge to obtain complete national inventories of biodiversity on either species or habitat level in Israel, so the use of remote sensing and structural mapping seem good to us as proxy methods to estimate such biodiversity.
Prior to the EBONE project, we were trained by Bob Bunce on mapping with methods developed in the BioHab project in the Mediterranean part of Israel. We continued in EBONE with the same eye to shaping EBONE methods to our own particular needs.

Habitat mapping. With some adaptation to arid lands, the BioHab/EBONE mapping methods work for us. To make them practical we need to simplify the system and match the General Habitat Categories (GHC's) to local habitat terms, but we can have done this, and have developed new desert categories also now in the EBONE field manual. By now, we have conducted field trials in Mediterranean, desert and steppe landscapes in Israel. We found this system much faster than classical vegetation mapping.

Remote sensing. The use of RS as a proxy for habitat mapping is extremely interesting for us because it can give us complete coverage for Israel at minimal cost. Israel is small and extremely heterogeneous; hence methods such as orthophoto, LiDar or high-resolution satellite imagery are needed for accurate mapping.
We have experimented with all of these methods as well as medium resolution (LandSat) and coarse resolution (MODIS) satellite imagery. So far, orthophotos remain our main tools.

Biodiversity. We have thought mainly about species diversity, although landscape level diversity is important to us as well. Preliminary studies have been conducted in both desert and Mediterranean parts of Israel to see how well species diversity correlates with GHC's. We learned several things. First, it was important to sample the species diversity in a statistically valid way stratified for GHC's. Analyzing pre-existing data collected for other purposes raised too many statistical problems. Secondly, we found good correlation between whole assemblage composition for both plants and animals versus habitat type (e.g. beta diversity) but simple species richness values proved fairly meaningless. We decided that patterns in whole assemblages (very useful for conservation) should be studied separately from patterns in rare species (which might not relate well to habitat).

Future. We started in EBONE in order to use it, and now we come to using it. Pilot studies have been started in five INPA nature reserves ranging from extreme desert to Mediterranean forest, one in each of INPA's five administrative districts. The distribution of pilot studies enables each district to have its own site, where the local staff can become involved and learn how the EBONE methods work, or don't work, for their needs. Each site has unique management concerns, to which the sampling will be directed. In addition we will hold one final WP9 workshop during January 2012, where a general assessment can be made and plans for future application will be developed.

The use of LIDAR for biodiversity monitoring

By Sander Mücher , Mats Nilsson, Ants Vain, Lior Blank, Karin Nordkvist, Laure Roupioz, Ann-Helen Granholm, Linda Olsvig-Whittaker, Yohay Carmel, Kalev Sepp and Hakan Olsson

Key is the challenge to develop a biodiversity observation system that is transmissible and cost effective. Measuring and reliable reporting of trends and changes in biodiversity requires that data and indicators are collected and analysed in a standard and comparable way. LiDAR as a laser technology is an alternative remote sensing approach that allows to increase the accuracy of (biophysical) measurements and extends spatial analysis of so-called 'point cloud data' into the third dimension (x, y, z). Current LiDAR applications offered by several engineering companies includes amongst others floodplain mapping, forest inventory, transportation and utility corridor mapping, land-use/land-cover classification, 3D urban modelling and line-of-sight analysis. An increasing number of countries, e.g. Netherlands, Sweden and Estonia, are now already collecting laser scanner data for their whole country for different purposes. Although the major purpose is often to construct a highly accurate Digital Elevation Model (DEM), it is not primarily for vegetation studies.
The EBONE project shows that the way forward is to measure habitat diversity as a proxy for biodiversity on the basis of plant life forms including environmental information using a stratified random sampling approach. The objective of our study was to assess to what extent LiDAR can be used to map and monitor plant life forms and associated General Habitat Categories (GHCs) according to EBONE methodology.

Pilot studies were implemented in the Netherlands, Sweden, Estonia and Israel. Conclusions are that LiDAR provides accurate height measurements on woody vegetation such as shrubs and trees, even in early spring when no leaves are present (in the Netherlands). Unfortunately, not the whole range of plant life forms has yet been investigated using LiDAR. Combination of LiDAR with false-colour aerial photographs and high resolution data such as SPOT provides a powerful tool in combination with specific LiDAR software and classification algorithms (maximum likelihood, decision trees or ensemble classifiers) for the identification of plant life forms and associated GHCs. The Swedish study showed that classification accuracies improved significantly when SPOT satellite data were combined with LiDAR data (e.g. from 51.3% to 74.2%). The Estonian and Dutch study showed that most of the laser points are within +/- 10 cm, which can be considered as a good result. Although the case study from Israel showed large differences for woody cover estimates from LiDAR measurements and field surveys. It seems that the complexity of the Mediterranean vegetation leads to uncertainties in the field estimates as well as by the used techniques, explaining differences in cover estimates up to a maximum of 15% for Mid Phanerofytes (MPH), which are shrubs and trees with a vegetation height between 0.6 – 2 m. These differences are acceptable if one accepts that the inaccuracies in the field surveying methods occur in the delineation of boundaries and vegetation height estimates for complex mapping units. Although the latest generation of airborne LiDAR will have an accuracy of approximately 2 to 3 centimetres, it is still assumed that specific life forms such as

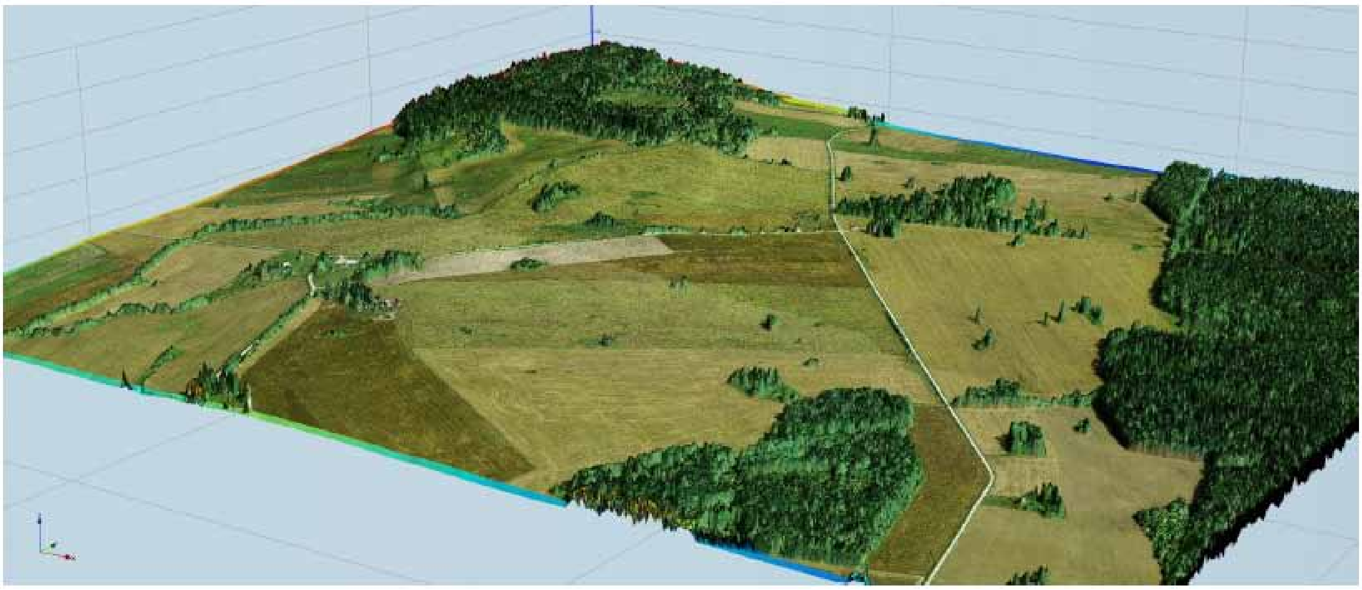

Figure 6. 3D image of the combination of aerial image and LiDAR data. (Source: Vain et al. 2011)

cryptogams and dwarf chamaephytes (below 5 cm) will be difficult to be measured.

In general, it has been demonstrated in EBONE project that good characterization of 3D-vegetation objects is possible with LiDAR. The combined use of LiDAR data and optical data will lead to better vegetation and habitat maps than presently available in many countries. Such maps can for example be used to investigate the occurrence of different habitats and their distribution. Another important use of such maps is stratification in field surveys, meaning that field data collection can be made more cost-efficient. Although wall-to-wall maps can be produced, sample based designs that aim at providing reliable statistics for large areas are still of interest in future monitoring efforts. Note also that the production of an accurate Digital Elevation models (DEM) is a pre-requisite for the production of Canopy Height Model (CHM) from LiDAR. Comparison with field surveys of the General Habitat Categories in the different countries showed uncertainties in the proposed methodology as well as in the used field methods. Central is that cover estimates of woody life forms with LiDAR are more accurate than from field measurements, although this advanced technique misses the ability to identify the dominant species, and the required environmental and management qualifiers as prescribed by the EBONE field protocols. Part of this limitation can be counteracted by the use of very high resolution satellite imagery. However, we propose that future habitat mapping and biodiversity monitoring will further integrate field survey and earth observation techniques at different scales so that the strength and weakness of each approach will be fully exploited. So, 3D remote sensing is expected to become increasingly important for characterization of vegetation canopies. The costs for acquiring data are decreasing, which probably will lead to an increased use of airborne LiDAR data for biodiversity monitoring, often in combination with optical data. Although price policies for LiDAR still differ largely between countries. Shared price policies such as in the Netherlands leads to shared costs at lower prices (commercial prices are about 28 cent/ha, www.ahn.nl/bestellen/prijzen_ahn_2, and for non-commercial purposes it can be obtained for the entire country, approximately 35000 km^2, for € 1500,-). Such price policies would be a major incentive for its use.

The GEO VIII Plenary in Istanbul

By Rob Jongman

The GEO VIII Plenary in Istanbul hosted by the Scientific and Research Council of Turkey (TUBITAK) was important as it had to decide on the GEO work plan for 2012-2015. The year 2015 is the final year of the first phase of GEO Implementation and the year that the formal decision on the future of GEO will be taken.

The Plenary accepted the new GEO 2012-2015 Work Plan. The improvements in the GEOSS Common Infrastructure were shown, providing access to millions of data sets and information products through the GEO Portal. It includes the GEOSS Data-CORE, a distributed pool of documented datasets with full, open and unrestricted access at no more than the cost of reproduction and distribution, but still few biodiversity data are included. Other important outcomes of the meeting were the acceptance of the GEO Global Forest Observations Initiative (GFOI) Implementation Plan, and the launch of a process for defining the post-2015 phase of GEOSS. The GFOI will foster the sustained availability of observations for national forest monitoring systems and assist countries to make the best use these observations by and support for governments that are establishing national systems by:

- Providing a platform for coordinating observations working with the space agencies of the Committee on Earth Observation Satellites (CEOS), commercial data providers and researchers collecting relevant ground data;
- Providing assistance and guidance on utilizing observations working with international bodies such as FAO and IPCC;
- Developing methods and protocols.

A meeting was planned between GFOI and GEO BON, but had to be cancelled due to full agendas and travel schedules. It will now be done through a telecom later this year.

A GEO Post-2015 Working Group will assess options and scenarios for the next phase of GEOSS, concerning implementation as well as the institutional arrangements, internal governance and resourcing of GEO.

It was also an interesting meeting for EBONE. We were part of the EC Stand, which was the biggest of all and brought together national initiatives and European FP7 projects. This made it a busy meeting point where researchers, EC officers, EEA officers and interested guests met. There was also a speaker's corner where everyone who had volunteered could speak with a maximum of 20 minutes. This was an interesting place to learn about on-going and starting initiatives. At the opening the official Turkish Ministerial delegation visited the stand and talked with many of us shortly.

Contrary to former meetings such as in Beijing, EBONE had too little place to show all its products. However, with some improvisation all posters got a place in the exposition area. There was much interest in the EBONE flyers and the special issue of Research Innovation on environmental data that contained the short overview of EBONE. We presented EBONE in a short presentation of 20 minutes at the speaker's corner and we also could see the presentations of other projects that made use of approaches developed in EBONE such as the use of the European Stratification and the GHCs linking RS information to in situ.

In the three years that EBONE visited these GEO Plenary and exhibition meetings the exchange between research projects and the sharing of knowledge is developing further beyond the own community. The joint GEO meetings – both the general, but even more the targeted European meetings – are fruitful concentrated meeting points that help to build an interdisciplinary science community.

The Swedish University of Agricultural Sciences (SLU)

The Swedish University of Agricultural Sciences (SLU, www.slu.se) was founded in 1977 when the separate sector colleges of forest, agriculture and veterinary were combined into a new cluster, alongside with a reform and re-allocation of sector institutes and state agencies. The SLU mission statement stresses the development and understanding of sustainable use and management of biological natural resources. Thus, the evident sector orientation implies that SLU, unlike any other university in Sweden, is associated with the Ministry of Rural Affairs to ensure close and effective applied research. Current SLU consists of five faculties: Landscape Planning, Horticulture and Agricultural Sciences; Natural Resources and Agricultural Sciences; Forest Sciences; and Veterinary Medicine and Animal Sciences. A fifth faculty oriented towards aquatic biology is under establishment as a consequence of the re-orientation of the Swedish Board of Fisheries. As well, SLU hosts a number of collaborative Centers, such as the Swedish Species Information Centre, and Interdisciplinary platform programs that ensure leading approaches in life science research. SLU have campuses and other facilities across the whole Swedish land base, with the main campuses in Alnarp in south Sweden, Uppsala, Skara and Skinnskatteberg in central Sweden, and Umeå in north Sweden. The Environmental Monitoring and Analyses branch is specific for SLU. This branch emphasizes that SLU should provide a strong connection between environmental monitoring and assessment and other academic activities, actively contribute to the international development of science-based environmental analysis, and deliver a basis for decision-making which recognises that the use of resources and the environmental consequences can be measured together.

The department of Forest Resource Management (www.slu.se/srh), Faculty of Forest Sciences, is active in the EBONE project. The department currently employs about 140 persons and consists of five sections: Forest Remote Sensing; Forest Inventory and Empirical Ecosystem Modelling; Forest Planning and Technology; Forest Resource Data, and Landscape Analyses. The Landscape Analyses section includes the NILS program – National Inventory of Landscapes in Sweden (Swedish Environmental Protection Agency) – alongside with additional landscape monitoring approaches, such as monitoring and assessment of pastures and semi-natural grasslands (Swedish Board of Agriculture), regional environmental monitoring and assessment (County Administrative Boards). As well, the development of monitoring methods for habitats in the EC Species and Habitats Directive (MOTH, EU Life 08) is included and integrated with the NILS program. The Forest Resource Data section includes the Swedish National Forest Inventory (NFI). The Remote Sensing section includes research on remote sensing of forests and other terrestrial vegetation, including Geographic Information Systems (GIS) for, e.g., landscape visualization under different scenarios. Remote sensing data are often processed together with field data in order to evaluate sensors, develop techniques, methods, or data products of relevance for forestry and other land uses and management.

The combination of the NILS program with additional monitoring and assessment approaches, the NFI, the Remote Sensing and the Inventory and Empirical Ecosystem Modeling experiences ensures capacity to establish and conduct required and effective environmental monitoring systems.

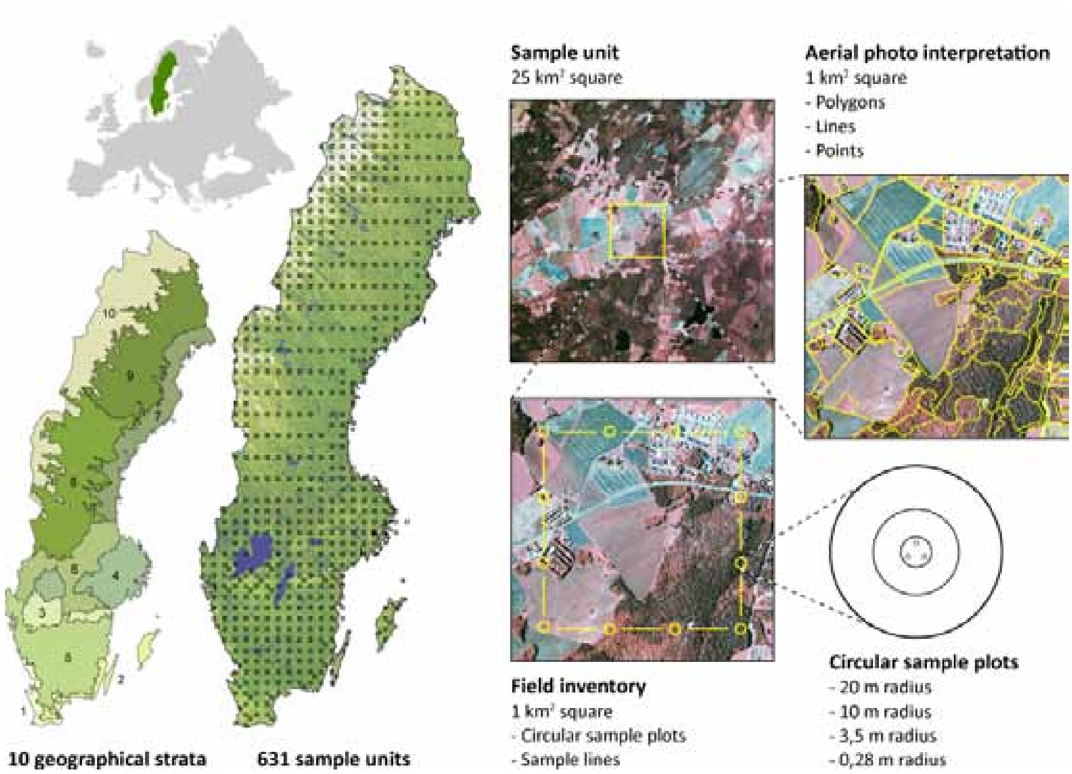

Figure 7.
NILS sample design (Ståhl et al. 2011. National Inventory of Landscapes in Sweden (NILS) – Scope, design and experiences from establishing a multiscale biodiversity monitoring system. Environmental Monitoring and Assessment 173: 579-595).

Forthcoming conferences and events

WP9 International workshop
Date: 10 to 12 January 2012
Place: Ein Gedi Oasis, Israel
Further information: www.ebone.wur.nl

EBONE final conference
Date: 12-13 of March 2012
Place: Brussels, Belgium
Further information: www.ebone.wur.nl

Planet Under Pressure: New knowledge towards solutions
Date: 26-29 of March 2012
Place: London, United Kingdom
Further information: www.planetunderpressure2012.net

2012 Biodiversity Planning Forum
Date: 22–25 May 2012
Place: Kruger National Park, Republic of South Africa
Further information: Email T.Mashua@sanbi.org.za

TEEB Conference 2012: Mainstreaming the Economics of Nature: Challenges for Science and Implementation
Date: 19th – 22nd March 2012
Place: Leipzig, Germany
Further information: www.teeb-conference-2012.ufz.de

2nd Forum Carpaticum: From data to knowledge, from knowledge to action
Date: 30th May – 2nd June 2012
Place: Stará Lesná, Slovakia
Further information: www.uke.sav.sk

3rd European Congress of Conservation Biology
Date: 28th August – 1st September 2012
Place: Glasgow, Scotland
Further information: www.eccb2012.org

Editorial
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