EBONE December 2010 newsletter

# Introduction

**By Rob Jongman**

This is the fifth newsletter of EBONE after a hectic period. We have had busy times, with many teams in the field carrying out field work and several events that we attended. The fieldwork has been carried out successfully and in October we overlooked the results in a data analysis workshop, discussing what to do, by whom and when.

Other important events in the past months were the COP 10 of the Convention on Biological Diversity in October and the General Assembly and Ministerial Summit of GEO on 3-5 November in Beijing. GEO BON and EBONE have been presented on both occasions. A number of speakers in Beijing highlighted the GEO Biodiversity Observation Network as an excellent example of how GEOSS can reach out to the users of Earth observations and address the international political agenda.

Evidence for this view was provided by the Nagoya meeting of the Convention on Biological Diversity (CBD), which concluded just one week before the GEO Ministerial.

The Conference of the Parties to the Convention invited GEO to make a statement during the High-Level Ministerial segment. It gave a specific mandate to GEO BON to prepare an evaluation of existing observation capabilities relevant to the new targets of the CBD for protecting biodiversity by the year 2020.

That gives a good feeling and makes the work that we are carrying out is valued, but it also makes us aware, that much has to be done in a rather short time. In 2011 we will publish and present the results of EBONE and show its usefulness.


## Contents

WP3

## A high resolution bioclimate map of the world: a unifying framework for global biodiversity research

***By Marc J. Metzger***

There is growing urgency for integration and coordination of global environmental and biodiversity data required to respond to the 'grand challenges' our planet is facing, including climate change and biodiversity decline. Ongoing and new programmes are gathering valuable data through a profusion of projects at regional, national and international scales, e.g. the Long Term Ecological Research (LTER) programmes, and activities related to the Global Earth Observation System of Systems (GEOSS). Nevertheless, great challenges remain for, among others, data aggregation across scales, consistent monitoring of global biodiversity change, and linking in situ and earth observations. Progress in these fields is essential to improve future assessments and policy targets relating to the stock and change of global ecosystem resources and biodiversity, including the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), the new EU resolution to halt biodiversity loss, and the recent Aichi targets that were agreed by the Convention on Biodiversity in Nagoya in October.

A consistent classification, or stratification[1], of land into relatively homogenous strata provides a valuable spatial framework for comparison and analysis of ecological and environmental data across large heterogeneous areas. A global stratification could provide a flexible instrument in the coordination and analysis of global biodiversity observation efforts, e.g. for targeting research and monitoring efforts, aggregating observations, and the comparison of trends within similar environments and between strata. Environmental stratifications can also form a framework for systematic global biodiversity conservation management, which will be crucial under Aichi target to increase terrestrial nature reserves form 13% to 17% of the world's land area by 2020. Finally, it would provide a valuable tool for environmental assessments (e.g. IPBES), and global or continental scale agro-ecological and rural development studies. Although there are existing global climate maps in 20-30 classes (e.g. the well-known Köppen map), no numerical high resolution global dataset has been constructed until now that distinguished more detailed strata.

We therefore constructed a new global environmental stratification (GEnS based on statistical methods to make subjective choices explicit, their implications understood and the strata representative for the global context. Statistical screening produced a subset of relevant bioclimate variables, which were compacted in uncorrelated dimensions using principal components analysis. Statistical clustering was subsequently used to classify the principal bioclimate gradients in temperature, aridity and seasonality into relatively similar biophysical environments. To provide structure and support and a consistent nomenclature these strata were aggregated into global environmental zones based on the attribute distances between strata. The GEnS delineates of 125 strata, which have been aggregated into 18 global environmental zones (Figure 1) and has a 30 arcsec resolution (0.93 x 0.93 = 0.86 km$^2$ at the equator).

Added value of the GEnS compared to existing classifications include the rigorous statistical methods used to delineate strata, the high spatial resolution which allows for the identification of regional gradients, and the increased number of strata. Comparison with existing global continental, national stratification confirmed

1 When classes are not meant as descriptive units, but specifically designed to divide gradients into relatively homogeneous subpopulations we prefer to use the statistical term *stratification.*

that it successfully partitions important environmental gradients. The dataset can therefore provide a valuable unifying framework for global biodiversity research by: supporting the aggregating and comparison of local observations; identifying gaps in current monitoring effort; targeting new monitoring and research; and supporting global assessments. The dataset will form a global unifying framework within the Group on Earth Observations Biodiversity Observation Network (GEO BON), and we hope the GEnS will play a role in improving the much needed integration and coordination of global environmental and biodiversity assessment and research.

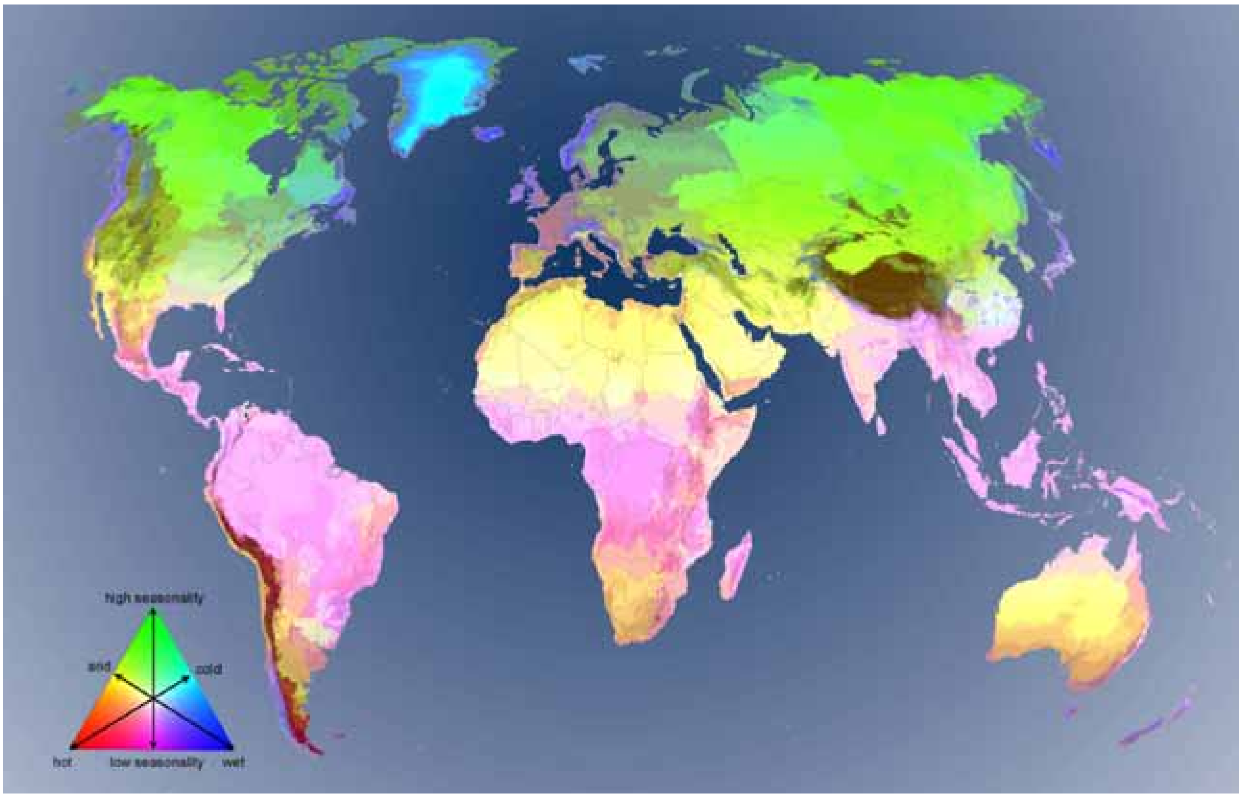



*Figure 1. Map of the global environmental stratification, depicting 125 strata at a 30 arcsec (approximately 1km$^2$) spatial resolution. The legend provides a visual combination of the three main climatic gradients incorporated in the clustering.*

WP5

## *Remote sensing of Israel's natural habitats*

***By Dr. Noam Levin and Prof. Yohay Carmel***

The aim of our work in Israel is to develop a remote sensing methodology for mapping EBONE land cover categories from space-borne sensors and to examine the relationship between the remotely sensed categories and in-situ habitat data. We evaluate various sensors for this purpose, in order to develop a general methodology and specify sensors that offer good performance and yet are not prohibitively costly. In addition, we will examine what are the limitations of remotely sensed based classification with respect to the EBONE categories and the spatial heterogeneity characterizing Israel's Mediterranean and desert landscapes.

Once the project is over the resulting layers will be made available for public use.

Our study area covers the State of Israel and ranges from extreme desert in the south to Mediterranean areas in the north of the country. While our aim will be to map natural land cover categories throughout Israel, EBONE-wise field mapping of habitats has so far been conducted within two areas in Israel, Ramat HaNadiv in the north, and Avdat in the south (Figure 1). An additional site will be mapped for the case of this work in the transition area between the desert and the Mediterranean (e.g., Lehavim, Figure 1). We will develop and test our methods on the field sites, and then apply them to the entire country.

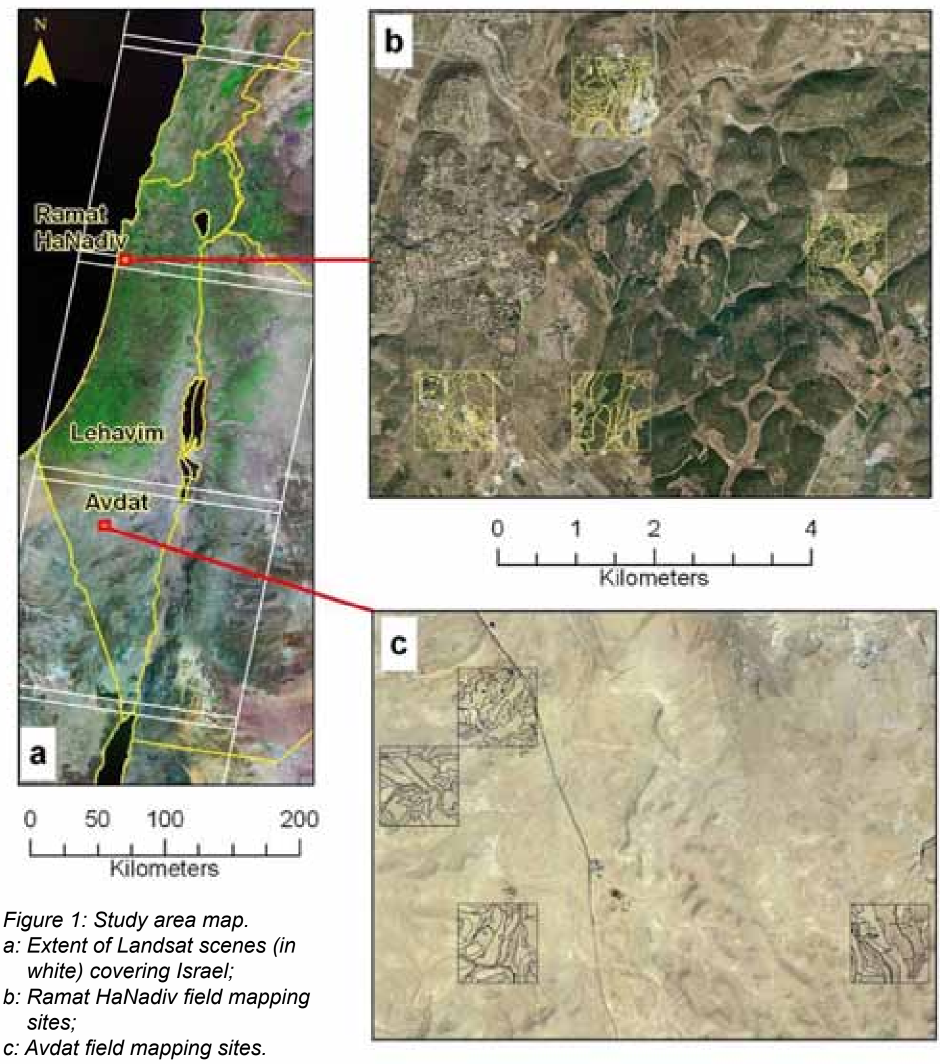
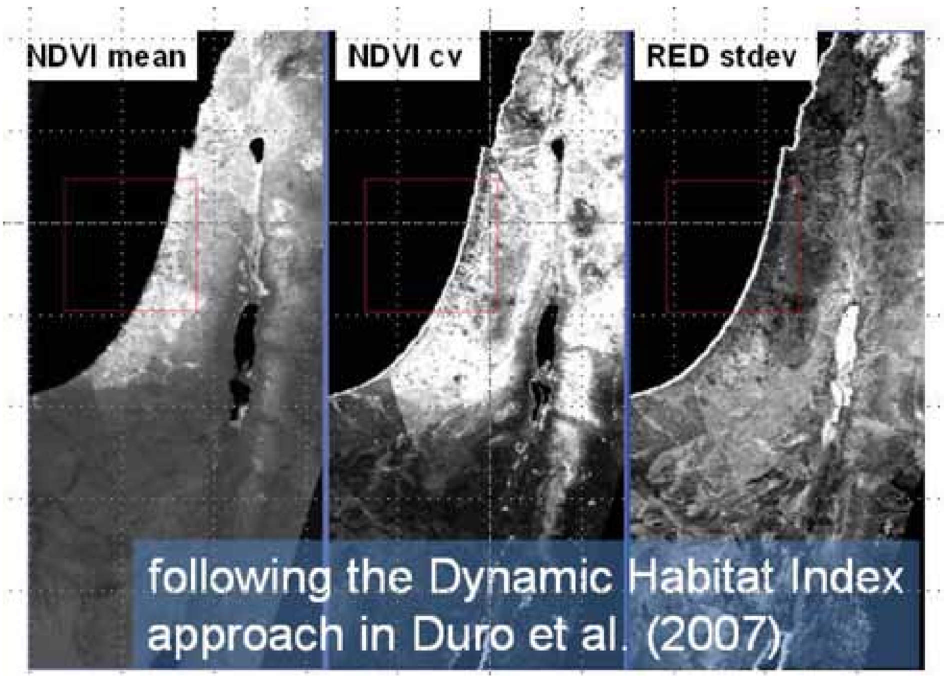


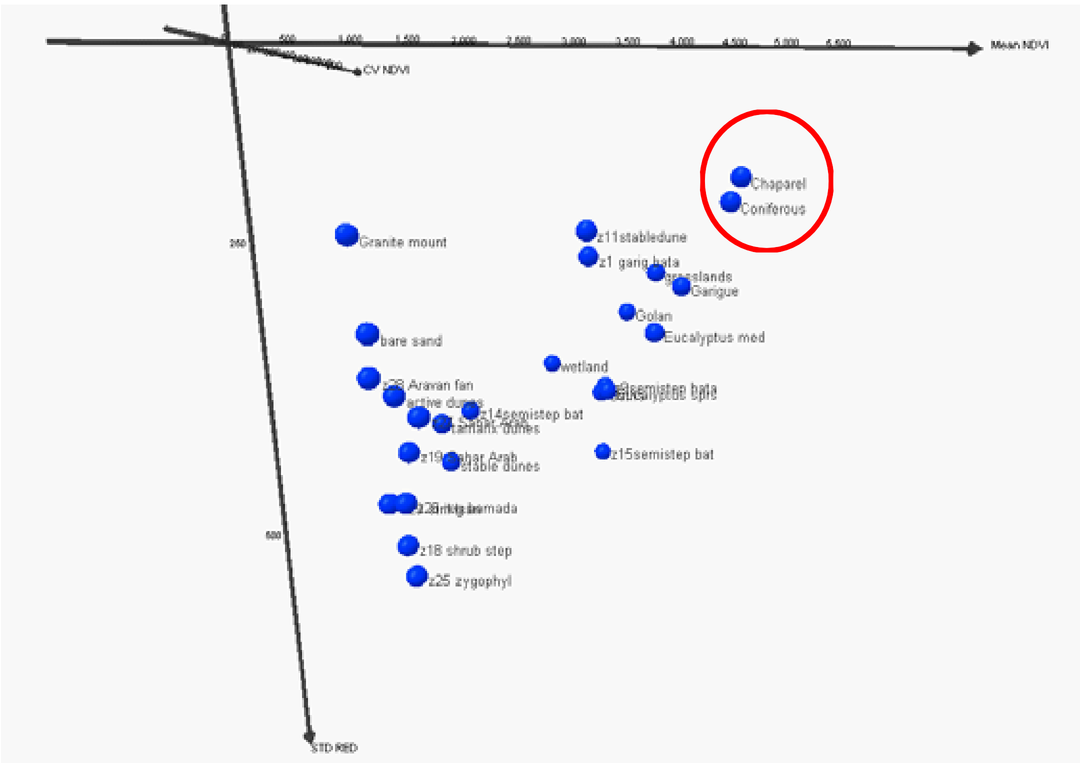

*Figure 1: Study area map.*
*a: Extent of Landsat scenes (in white) covering Israel;*
*b: Ramat HaNadiv field mapping sites;*
*c: Avdat field mapping sites.*

Our classification scheme aims at reflecting the primary EBONE classes. These include four height classes of woody vegetation: (1) FPH - Forest Phanerophytes, FPH>5m. (2) TPH - Tall Phanerophytes, 5m>TPH>2m. (3) MPH - Mid Phanerophytes, 2m>MPH>0.6m. (4) LPH - Low Phanerophytes, LPH<0.6m. Our scheme will reflect the major BIOHAB woody vegetation types: (1) conifers, (2) deciduous, and (3) evergreen broad leaves. In the arid areas the classification may be based in addition to remotely sensed parameters related to vegetation, on topographic and geomorphologic variables. The minimum mapping unit defined within EBONE is 20×20m, roughly corresponding to the spatial resolution of Landsat TM (30×30m).

| Sensor | Spatial resolution (m) | Spectral resolution | Temporal resolution |
|---|---|---|---|
| MODIS | 250 | 36 bands | 1-2 days, |
| (MOD13Q1) | | | 16 days in this product |
| Landsat TM | 30 | 6 bands | Varies, |
| | | | theoretically 16 days |
| QuickBird | 2.5 | 4 bands | Only when tasked |

Preliminary results – spectral separability. We calculated the following variables from the MODIS time series: NDVI mean, NDVI CV, and STDEV of the RED band, and arranged data from known habitats in Israel along three corresponding axes.






**Results so far indicate that**

- We can separate between most of the vegetation categories observed using MODIS (free of charge; high temporal resolution)
- We still have to work on separating a few classes
- We may distinguish between "un-separable" classes using other methods, like NDVI

The next major task is correlating the same remote sensing data with habitats mapped according to EBONE This work is ongoing.

**Reference:**

Duro, D.C., Coops, N.C., Wulder, M.A., and Han, T. (2007). Development of a large area biodiversity monitoring system driven by remote sensing. Progress in Physical Geography, 31, 235-260.

# WP5

## *Intercalibration of EO-derived phenology indicators with forest GHCs data*

***By Nicola Clerici***

The main goal of the Task is to assess if phenology information as derived from NDVI time series can provide valuable information for the identification and mapping of forest habitat under the GHC scheme proposed by EBONE. A large set of phenology indicators (date and productivity phenometrics) was extracted from SPOT and MODIS NDVI time series using the Phenolo model, developed by EC-JRC[1]. The model considers an annual cycle of vegetation as represented by one permanent component, or 'background' and a variable component function of seasonal dynamics. The phenology indicators were extracted for the whole of Europe. In the year 2010 the work focused on the MODIS data at 250 m, being at a more appropriate spatial scale. In the last Task activities a Random Forests classifier (Breiman, 2001) was trained with field data derived from 74 one-kilometre plots representing harmonized General Habitat Categories (GHC) at fine scale. One main advantages of the RF technique is that it provides an internal unbiased measure of error (OOB error) thus allowing an optimal choice of phenology indicators to be used as input variables. A classification was performed for the whole of Austria (test site) for the coniferous and deciduous forest classes (FPH/CON and FPH/DEC). Overall mapping accuracy was >80%, while class accuracy was satisfactory for FPH/CON but unsatisfactory for FPH/DEC. Future activities will involve classification tests in three different Environmental Zones to investigate how no data (clouds/snow/..) in the NDVI time series influence the intercalibration assessment. Overall, the investigation work should finally assess if phenology indicators as derived by NDVI time series can be used to infer GHCs distribution.

[1] Ivits, E.,Cherlet,M., Mehl,W.,Sommer,S. 2009. Estimating the ecological status and change of riparian zones in Andalusia assessed by multi-temporal AVHHR datasets, *Ecological Indicators*, 9:3, 422-431.

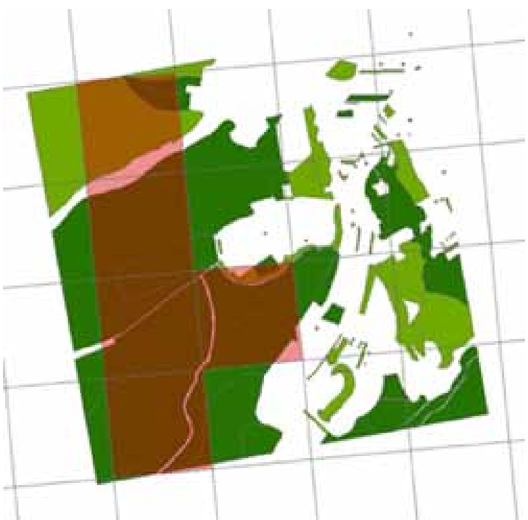


*Fig.1 Pure pixels selection superimposing the MODIS NDVI raster structure on the vector GHCs field plots*

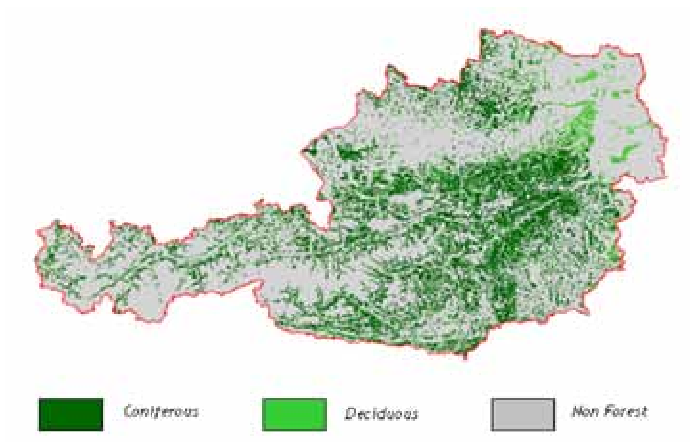



*Fig.2 Random Forests classification of FPH/CON and FPH/DEC using phenology indicators from MODIS NDVI time series*

WP5

# Computer classification of General Habitat Categories by combining LiDAR and SPOT data

**By Karin Nordkvist and Håkan Olsson**

General Habitat Categories (GHC) is a classification scheme developed in BioHab and a central concept in EBONE. One characteristic of GHC is plant height, which can be derived using Light Detection And Ranging (LiDAR) data.

Optical satellite data is widely used for computer classification of vegetation. These two dimensional data contain spectral (color) information about the target, but lack information about height. The EBONE Team at SLU in Sweden has investigated if a combination of optical satellite data and LiDAR data can improve classification accuracy, compared to using satellite data alone. The study site is a 1×1.5 km area in southerm Sweden, which is mainly covered by managed, hemiboreal forests dominated by Scots pine (Pinus Sylvestris), Norway spruce (Picea Abies) and birch (Betula spp).
After excluding arable land, urban areas and water, as they appear in the 1:50 000 terrain map, we classified the remaining vegetation into the following classes: young forest >2m; young forest 2-5m, young forest >5m; coniferous forest >5m; broadleaved forest >5m and mixed forest >5m. Maximum likelihood classification using the four spectral bands of the SPOT5 satellite gave an over-all accuracy of 70.8%. Using different combinations of SPOT5 data and LiDAR features such as height percentiles and vegetation ratio (ratio between laser returns from vegetation and total number of returns), improved the over-all accuracies to between 71.6 and 76.8%. For the large coniferous class, there was only a small increase, or even a decrease in accuracy, while other classes showed a higher improvement.

To conclude: laser data has a certainly potential to improve traditional multispectral classifications, especially for certain vegetation classes defined by their height or canopy structure, but more work is needed in order to investigate how such classifications best could be done.

*Table 1. Overall accuracy for maximum likelihood classification of multispectral SPOT satellite data (B1-B4) in combination with features from airborne LiDAR data, where p50 means the 50% percentile of laser hits above the ground etc, and vr means the ratio of the laser returns from vegetation divided with the total number of laser returns*

| Laser data features used in addition to the SPOT data | Young forest <2m | Young forest 2-5m | Young forest >5m | Mixed forest >5m | Deciduous forest >5m | Coniferous forest >5m | Over-all |
|---|---|---|---|---|---|---|---|
| none | 61.1 | 40.0 | 64.9 | 37.5 | 53.3 | 85.6 | 70.8 |
| p50, p100 | 62.5 | 40.0 | 82.5 | 40.0 | 67.8 | 81.4 | 72.8 |
| p50, p100, vr | 73.6 | 45.0 | 78.9 | 37.5 | 64.4 | 78.1 | 71.6 |
| p60, p70, p100, applied with a 2-step method | 86.1 | 60.0 | 45.0 | 50.0 | 71.1 | 86.9 | 76.8 |

# WP6

## TWP6 Testing the EBONE habitat and biodiversity field mapping method

***By Philip Roche***

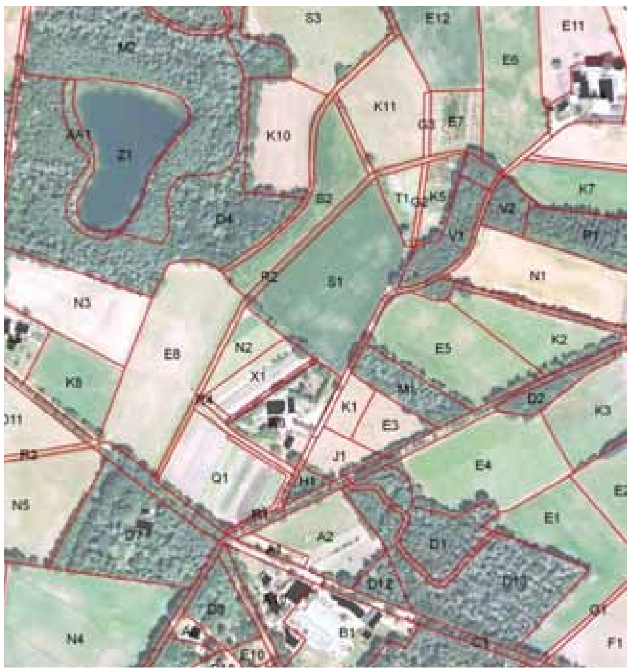
During the vegetation season of 2010, the main part of the work dedicated to WP 6 was conducted: testing the EBONE habitat and biodiversity field mapping method. Early spring 2010 training sessions were organized together with Bob Bunce, Marion Bogers and the local teams. The first one took place in Spain in March in the area of Sierra de los Gredos. A dozen participants from five countries were involved in learning the field protocol and working with the field computers in the Mediterranean mountain environmental zone. Thanks to Marta Ortega and her colleagues, this training session was really a success. The second training session was organized in May in Romania and was dedicated to Alpine environments. Excellent organisation from Elena Preda and her colleagues ensured that this second training session, located in the town of Sinaia and involving again participants from five countries, was also very constructive.

After these training sessions, the real WP6 work could start in the different partners' countries and regions. Guided by the phenology of vegetation, since the field work should be done as closest as possible to the peak of the vegetation season, the field work took place in the different environmental zones from March (South Mediterranean) to September (Boreal).

Eleven partners were involved which allowed us to collect habitat and plant species diversity data from 12 countries (Austria, Belgium, Estonia, France, Greece, Norway, Portugal, Romania, Slovakia, Spain, The Netherlands and the United-Kingdom). By the end of 2010, we will have 92 $km^2$ sampled in 11 environmental zones from Mediterranean South to Boreal.

The objective of this work is to achieve a full scale test of the protocol in collaboration with the statistics (WP3) and data management (WP7) teams. With the data gathered we can now work on the data flow and data analysis. Although we do not aim to produce relevant statistics at EU level, we can produce some figures that illustrate what will be the outputs of a real EU level monitoring. The data analysis will be conducted early in 2011.

As part of the field work, field quality control was also organized in eight countries involving Bob Bunce, Geert de Blust, Ilse Geijzendorffer, Rob Jongman and Philip Roche. The aim was to assess the problems encountered in the field by the partners' teams, identify the critical points in the field handbook and propose solutions. The field quality control greatly improved the coordination of the data by limiting variability between teams and improving the readiness and practicability of the field handbook.



*Example of a mapped $km^2$ (areal elements)*

# The Research Institute for Nature and Forest (INBO)

The Research Institute for Nature and Forest (in Dutch Instituut voor Natuur- en Bosonderzoek, abbreviated INBO) was created in 2006 by the amalgamation of the Institute for Nature Preservation and the Institute for Forestry and Wildlife Management. In other words, it is a research institute with a background and a history. But it also has a very clear view of the future. It was precisely with this view of the future in mind that the INBO was thoroughly reorganised two years ago.

**Four types of research**

In order to provide optimal support to Government policy, it is necessary to have a mixture of four different kinds of research. The greatest efforts are made in the field of applied research. Starting from the twelve strategic objectives of the INBO, a list is drawn up of the research which is most urgently needed for the development of the best possible policy. This applied research is supplemented by demand-driven research, which looks at evolutions in Flanders, Europe and the rest of the world, and offers answers to the resulting knowledge questions which may arise. In addition, there is also room for innovative research, which looks forward to developments further removed from the here and now. There is also budgetary provision to react quickly to questions which may arise from current developments and problems: the so-called actual research. Finally, the INBO undertakes a limited amount of basic research. This type of research does not necessarily have an immediate application but can be a useful aid for future demand-driven, applied research.

**Departments and research groups**

The last two years saw many changes at the INBO and the new structure finally became operational at the beginning of 2010. Two scientific departments, which both contain five separate research groups, concentrate on Management and Sustainable Use of Nature and Biodiversity and the Natural Environment. The Department of Management and Sustainable Use conducts research into populations, species and eco-systems under the influence of different management regimes, in function of the preservation, recovery or development of biodiversity and in function of the sustainable use and administration of nature and woodland. In addition, the department also conducts new research, focused on the relationship between biodiversity and society.
The Department of Biodiversity and the Natural Environment targets its research on the evaluation and optimisation of area-specific policy instruments. This research is carried out at different levels: gene, population, species, biotic community and eco-system.

The scientific departments are underpinned by a Department of Advice and Information, in which the laboratories and the quality control group can provide the necessary support. The drawing up of reports and the issuing of advice on nature matters – another core task of the INBO – is also the responsibility of this department, as is the Information and Data Centre.

Both with regard to the formulation of ideas, the implementation of the research and its translation into policy, the emphasis is placed fairly and squarely on innovation. The INBO follows new developments closely, in part through its participation in various European research projects. Besides, the INBO often works with researchers and scientists from other disciplines, in particular the social and economic sciences.

But the INBO wants to be much more than a scientific institution which carries out research of great quality and excellence. It is crucial that the research should also be framed with consideration for all the users of nature. This is the only way to ensure that everyone will continue to approach biodiversity in a responsible and sustainable manner after the International Year of Biodiversity 2010.

# The Helmholtz Centre for Environmental Research (UFZ


The Helmholtz Centre for Environmental Research (UFZ) was founded in 1991 and is part of the German Helmholtz Association, a community of 16 scientific-technical and biological-medical research centres, which have been commissioned with pursuing long-term research goals on behalf of the state and society in six core fields: Energy, Earth and Environment, Health, Key Technologies, Structure of Matter, Aeronautics, Space and Transport.

The UFZ comprises 34 research departments and has now about 900 employees in the cities of Leipzig, Magdeburg and Halle. It has a strong focus on interdisciplinary research involving ecologists, social and legal scientists, and economists. They study the complex interactions between humans and the environment in cultivated and damaged landscapes.

The UFZ is involved in EBONE through the Department of Conservation Biology which is based in Leipzig and supported through the Department of Community Ecology based in Halle.

The Department of Conservation Biology aims to improve the science basis and policy interface for biodiversity conservation and sustainable land use. The department focuses first on understanding environmental changes and their influence on biodiversity in the context of an ecosystem approach, and then reflecting this knowledge into the policy arena. In accordance with these aims, the research topics are divided into three working groups: a) Population ecology and Landscape structures; b) Floodplain Ecology, and c) Theory and Science-Policy. Our goal is to understand environmental changes and their influence on biodiversity in the context of an ecosystem approach.

A broad spectrum of modern methods ranging from field experiments and pattern analyses to rule based, ecological modelling are applied. Both basic and applied research are integrated, to address demands of nature conservation and societal and economical challenges. Consequently, most projects of the department are directly addressed to policy or designed for direct application, and research activities are typically interdisciplinary. The work of the NSF thus covers the necessary links between the development of scientific tools, the study of processes and impacts, the dissemination of knowledge into policy, and monitoring.

In EBONE the Department of Conservation Biology is involved in WPs 2 (WP leader), 7 and 8. We analysed the coverage of existing biodiversity monitoring schemes in Europe and summarized and evaluated topical and spatial priorities for monitoring of habitats and species. Furthermore our Department together with the Department of Community Ecology support the work on the development of the EBONE data system.

*UFZ Leipzig (Photo: Norma Neuheiser)*

## Project meetings

### Meeting in Västerås

The Swedish NILS-program (National Inventory of Landscapes in Sweden) was in focus during the EBONE General Assembly meeting in Västerås. Sweden, September 27 to 30, with the conference venue located in one of the 631 permanent NILS 5x5 km sample plots. The general assembly reviewed and discussed reports from all work packages and concluded that there has been progress in line with the plans, and in addition agreed upon upcoming central issues such as a plan to involve stakeholders, a contingency plan and plan for scientific outputs. Preceding the general assembly, work packages 3, 5 and 7 took the opportunity to organize working sessions. The host partner, the Swedish University of Agricultural Sciences, provided a combined information sharing and excursion session with presentations on the NILS-program, on the EU Life MOTH-program (Demonstration of an integrated North-European system for monitoring terrestrial habitats) and on approaches for aerial CIR photo interpretation within NILS and MOTH. The field excursion to the NILS sample plot elucidated some of the field inventory components and included a field lunch overlooking a central Swedish agricultural setting in the best possible weather conditions.

# Forthcoming conferences and events

## European Lidar Mapping Forum 2010
**Date:** 30 November 2010
**Place:** The Hague, Netherlands
**Further information:** http://www.lidarmap.org/ELMF/

## 12th European Ecological Federation Congress
**Date:** 25 - 29 Sep 2011
**Place:** Avila, Spain
**Further information:** http://www.eefcongress2011.eu/

## The 8th IALE World Congress
**Date:** 18 - 23 August, 2011
**Place:** Beijing, China
Further information: http://www.iale2011.org/page.asp?id=109 /

## Research and management of the historical agricultural landscape
**Date:** 14 - 16 March 2011
**Place:** Viničné, Slovakia
**Further information:** http://www.uke.sav.sk/index.php?lang=en

## International Conference on Biodiversity: Biodiversity and the UN Millennium development Goals: Challenges for Research and Action
**Date:** 1 - 3 December 2010
**Place:** Frankfurt/Main, Germany
**Further information:** http://www.biodiversity-conference2010.de/

## 5th Biennial Conference of the International Biogeography Society
**Date:** 6 - 10 January 2011
**Place:** Creta, Greece
**Further information:** http://www.biogeography.org/html/Meetings/index.html

## XVIII International Botanical Congress
**Date:** 23 - 30 July 2011
**Place:** Melbourne, Australia
**Further information:** http://www.ibc2011.com/