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Long-range Transboundary Air Pollution

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Working Group on Effects of the Convention on Long-range Transboundary Air Pollution

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7 THE ICP FORESTS LEVEL I BIODIVERSITY DATA

A HARMONIZED DATA SOURCE AND BASELINE FOR PLANT SPECIES AND STRUCTURAL DIVERSITY ON EUROPEAN FOREST ECOSYSTEMS

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Abstract

Structural and compositional biodiversity surveys on the ICP Forests extensive monitoring plots (Level I) have been incorporated into the collaborative ICP Forests database as LI-BioDiv dataset. Data were collected in the period 2005-2008 and delivered by 27 partners according to harmonized methods. During the integration process data was validated based on a complex system of checkroutines that had been defined before. Conflicts were solved in collaboration with the experts from National Focal Centres (NFCs) and the Expert Panels (EPs) on Biodiversity and Ground Vegetation, and on Forest Growth.

Each Level I plot is georeferenced, commonly related to the soil pit and the crown condition survey. It consists of a circular plot of 2000 m^2 which contains a concentric subplot (400 m^2), and a second smaller circle (30 m^2) designed for different field variables assessments.

The LI-BioDiv dataset is structured in six forms: GPL (general plot location and information, 3340 plots), DBH (tree diameter, status, and composition, 3201 plots), THT (tree top and crown base height, 3083 plots), CAN (canopy closure, layers, number of trees, 3210 plots), DWD (deadwood, 2950 plots), and GVG (ground vegetation composition, 3124 plots).

A transnational internal evaluation process was established and a set of items approved by the related Expert Panels and the ICP Forests Programme Co-ordinating Centre (PCC). Four working groups are producing the first results in terms of scientific papers; the other evaluation projects and the related groups of experts and scientists are described. Recommendations and lessons learned from this experience are shortly provided.

Keywords: ICP Forests, Level I, biodiversity, LI-BioDiv dataset, validation

7.1 Introduction

In 1985 ICP Forests established a large-scale monitoring network (Level I), aimed at gaining insights into the geographic patterns and temporal variations in forest condition. The extensive European monitoring network is based on a probabilistic sampling design, assured by around 6000 plots on a representative 16 x 16 km systematic grid (Ferretti et al. 2010). Annual crown condition assessments were performed as well as foliar nutrient and soil surveys under the EC Regulation 2152/03 Forest Focus, addressed to a harmonised, broad-based, comprehensive and long-term monitoring of European forest ecosystems (following EEC Regulation 3528/86).

Forest Focus also promoted studies and pilot or demonstration projects to broaden the scope of the monitoring scheme from the protection of forests against atmospheric pollution and forest fires, towards environmental issues such as soils and forest biodiversity.

A first draft of a demonstration project including information relevant to forest biodiversity at the European scale, based on the Level I network, was prepared along 2005. The proposal was conceived with two modules addressed to a harmonised collection, handling and assessment of soil data and biodiversity indicators, consistent with the scope of European forest research and policy.

The "BioSoil-Biodiversity" module, treasuring the achievements of the ForestBIOTA project and the COST ACTION E43[9], was developed by the "Working Group on Forest Biodiversity" (WGFB) and discussed at the meetings of the ICP Forests Expert Panel on Biodiversity and Ground Vegetation (EPBDGV) and the Expert Panel on Forest Growth (EPFG). The stand structural approach was adopted, assuming that structurally diverse stands have more associated habitats, thus higher potential for biological diversity (WGFB 2007; Olivier 1981).

Sampling effort was directed to few, simple and most recognised, robust and operational indicators of forest compositional and structural diversity, to be assessed with common harmonized or standardized methods and techniques. The reference to this respect was taken from existing forest monitoring parameters related to ground vegetation, forest growth and crown condition, adding new surveys on forest deadwood, and forest classification. With respect to the traditional Level I network, BioSoil moved from sampling point to circular sampling plots. A common manual was prepared for field activities (WGFB 2007).

This experience was defined as a valuable baseline on forest biodiversity monitoring, in the frame of both the EU biodiversity policy and the EU 2020 biodiversity strategy (Durrant et al. 2011). Unfortunately, the original BioSoil datasets were unavailable for running projects or submitted proposals (e.g. EU Life+ FutMon project; Blust et al. 2013).

ICP Forests, after some preliminary discussion in 2012 (Joint Expert Panel Meeting on European Level Data Evaluation, Helsinki, FI; 28th Task Force Meeting, Białowieża, PL) recognised the relevance of this data on forest biodiversity, as supported by the research community (e.g.: Clarke et al. 2011, Mikkelsen et al. 2013; Danielewska 2013). The need of a Level I dataset for species and structural diversity on European forest ecosystems was pinpointed, aimed to:

- corroborate the Level I network as European infrastructure for biodiversity assessment,
- provide harmonised, representative data to be combined with other information,
- built a benchmark against which temporal and spatial patterns should be further monitored,
- facilitate the ICP Forests internal evaluation effort, and
- improve data access according to internationally accepted rules.

The task to get together the defined dataset was undertaken by the PCC and the Chair of the EPBDGV (through Camerino University).

The objective was to collect all the datasets from biodiversity surveys realised on the plots of the Level I European network, asking the NFCs to submit the data to the ICP Forests network. This was intended to be the founding action of a new common harmonised dataset on European forest biodiversity (LI BioDiv) based on a representative network of plots.

7.2 Data source

All the NFCs participating in ICP Forests received a formal request to voluntarily submit the national datasets, potentially originating in different projects, according to the expected categories: general information about the plot (GPL), tree dbh, status, and composition (DBH), tree height and height of the

[9] Details can be found on the web at http://www.forestbiota.org/ and http://www.metla.fi/eu/cost/e43/

canopy base (THT), canopy closure and number of tree layers (CAN), lying deadwood (DWD), and ground vegetation (GVG).

Validation and integration of national datasets was a complex task which has been discussed at the joint Expert Panels meetings in Wien 2012, Freising 2013, and Eberswalde 2014, before the data could finally be integrated into the collaborative ICP Forests database.

The first version of the dataset is at the moment further evaluated within internal projects by the ICP Forests network. The documentation of the above steps and the revised system of checkroutines, will allow further data submissions for comparable repeated surveys.

The countries that have acknowledged the new LI-BioDiv dataset, by delivering data, are reported in Table 7-1, with the respective surveys performed in different years (2005-2008).

Table 7-1 Submitted datasets by country and survey years. GPL - general plot location and information; CAN - canopy closure and tree density; DBH - tree species, diameter, and status; DWD - deadwood dimensions and status; GVG - ground vegetation vascular species and cover; THT – heights of the largest trees. Codes and Country description and alphanumeric coding refer to LI-Biodiv dataset and ICP Forests identification.

Country[10]		2005						2006						2007						2008					
		GPL	CAN	DBH	DWD	GVG	THT	GPL	CAN	DBH	DWD	GVG	THT	GPL	CAN	DBH	DWD	GVG	THT	GPL	CAN	DBH	DWD	GVG	THT
Austria	14							•	•	•	•	•	•												
Belgium FL	102							•	•	•	•	•	•												
Cyprus	66							•	•	•	•	•	•	•	•	•	•	•	•						
Czech Republic	58							•	•	•	•	•	•	•	•	•	•	•	•	•				•	
Germany BW	280													•	•	•	•	•	•						
Germany BY	290													•				•							
Germany BB	270							•	•	•		•	•	•			•								
Germany NWD	300							•		•			•	•		•		•	•	•	•	•	•		•
Germany MV	310							•	•	•	•	•	•	•	•	•	•	•	•						
Germany NW	320							•		•			•	•		•		•	•	•	•		•		
Germany RP	330	•				•								•	•	•	•		•						
Germany SL	350													•	•	•	•		•						
Denmark	08							•	•	•	•		•	•				•							
Canaries	95																			•	•	•	•	•	•
Spain	11													•	•	•	•	•	•	•	•	•	•	•	•
Finland	15							•	•	•	•	•	•	•	•	•	•	•	•						
France	01							•	•	•	•	•	•	•	•	•	•	•	•						
Hungary	51							•	•	•	•	•	•												
Ireland	07							•	•	•	•	•	•	•	•	•	•	•	•						
Italy	05							•	•	•	•		•	•	•	•	•	•	•	•	•	•	•		•
Lithuania	56							•	•	•	•	•	•												
Latvia	64							•	•	•	•	•	•	•	•	•	•	•	•						
Poland	53													•	•	•	•	•	•	•					•
Sweden	13							•	•	•	•														
Slovenia	60							•	•	•	•	•	•	•				•							
Slovak Republic	54	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
United	06							•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•
Belgium WL	202	*early negotiation*																							
Switzerland	50	*advanced negotiation*																							
Netherlands	03	*early negotiation*																							

The Level I network is here represented by 19 countries (Germany with eight federal states, Belgium with only Flanders, Spain and the Canaries), accounting to overall 27 partners. Contacts are established to include additional data at a later stage.

[10] ICP Forests partners (code)

7.3 Materials and methods

A common field methodology was adopted as described in the BioSoil-Biodiversity field manual (WGFB 2007), which allows different interpretations when translated in the operational manual at national level. Moreover, the fact that different national projects have been included, introduced some deviation from the standard, which was considered as far as possible by following a conservative principle. All the cases have been discussed with national experts and in dedicated sessions of the EPBDGV and EPFG meetings, in order to harmonise the data of the LI-BioDiv dataset.

The location of each Level I plot is commonly related to the soil pit and the crown condition survey plots of the Level I network, from which they are established; geo-referencing is provided by countries.

Each plot is consistent with the following scheme: a circular plot with a radius of 25.24 m (2000 m^2) contains a first concentric subplot (r = 11.28 m, thus 400 m^2), and a second smaller circle with a radius of 3.09 m (30 m^2), identified as subplot no. 3, 2, and 1 respectively (Figure 7-1). Each subplot is devoted to particular measurements or assessments (Table 7-2) while the entire plot is used for data assessment of the GPL form.

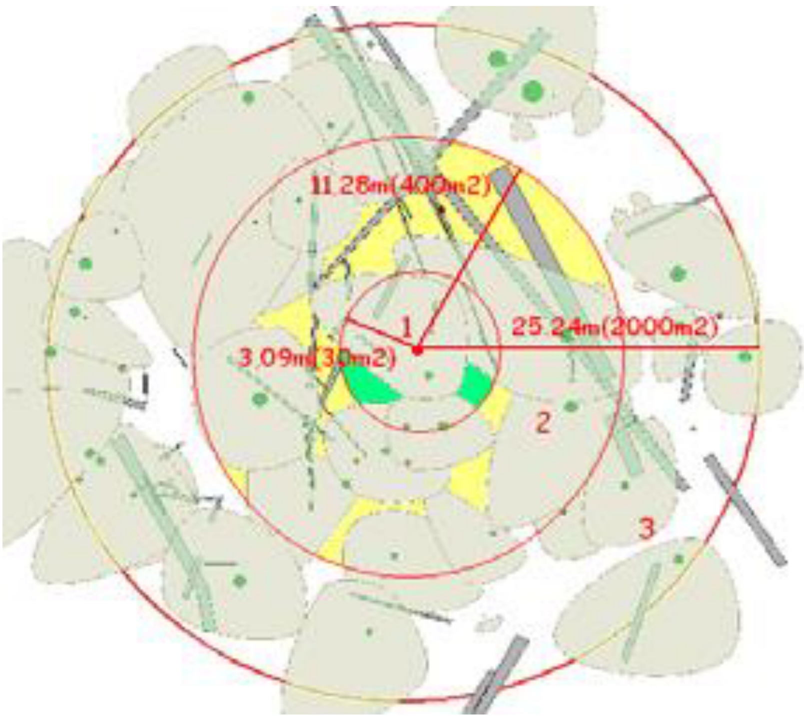

Figure 7-1. Representation of the LI plot and the concentric subplots (Pavlenda and Pajtík 2008).

Table 7-2. Mandatory minimum measurements \ assessments, with optional actions and designs in the Level I plots for forest biodiversity. Variables, subplots and related thresholds are indicated.

Category	Variables	Mandatory\ optional	Subplots and thresholds		
			1 - 30 m^2	2 - 400 m^2	3 - 2000 m^2
GPL	Previous land use, origin, age, management, forest type and classification, deadwood removal, tree mixture, slope, orientation, fencing	m	at plot level		
DBH	Diameter at breast height of all woody plants	m	h > 130 cm; D > 0 cm	h > 130 cm; D ≥ 10 cm	h > 130 cm; D ≥ 50 cm
	Species determination	m			
	Status (standing living or dead, lying)	m			
	Decay stage	m			
	Distance and azimuth from plot centre	o			
THT	Top height	m	At least 3 largest measured trees for DBH		
	Height of canopy base	m			
DWD	Coarse woody debris (diameter, length, species type, decay class)	m	D > 10 cm		Optional design: 4 replicates 10x10 m
	Snags (diameter, height, species type, decay class)	m	h > 130 cm; D > 10 cm		
	Stumps (diameter, length, species type, decay class)	m	h < 130 cm; D > 10 cm		
	Fine woody debris (diameter, height, species type)	o	5 < D ≤ 10 cm		
CAN	Canopy closure	m	subplots 1 and 2		
	No. of tree layers	m			
	Number and fraction of trees assessed for DBH	m			
GVG	Overall vascular species list	m	subplots 1 and 2		
	Specific cover	o			
	Tree layers distinction	o			
	Mosses and lichens	o			

To complement the tree stand structural parameters, deadwood assessments have been added with a common developed methodology, while the vascular plant communities of the ground vegetation were also assessed according to the *Flora Europaea* with reference to the ICP Forests manual and eventual amendments in the current updated version (Aamlid et al. 2007, Canullo et al. 2010). Forest classification is considered a strategic issue to account for large variability of forest biodiversity information and to adopt ecologically sound stratification for the interpretation of forest monitoring results and harmonized reporting (Barbati et al. 2007, 2014). Pre-assessed European Forest Type Classification was adopted, consisting of 14 categories (Barbati and Marchetti 2005, EEA 2006), to be validated in the field at the plot level.

Tree variables for DBH and THT categories are assessed across the entire BioSoil plot, according to the thresholds shown above. DWD, CAN, and GVG categories are based on surveys referred to a common sampling area of 400 m^2 usually achieved by the circular subplot 2; optional design with four replicates 10 x 10 m each, randomly distributed on the overall area (subplot 3) is allowed to account for local heterogeneity.

Countries representatives have participated in a Forest Biosoil Field Training at Radovljica (Slovenian Forestry Institute) from 19 to 21 April 2006.

Structure of the dataset

The LI-BioDiv dataset consists of six forms:

- **GPL** general plot location and information
- **DBH** tree diameter, status, and composition
- **THT** tree top and crown base height
- **CAN** canopy closure, layers, number of trees
- **DWD** deadwood
- **GVG** ground vegetation composition

Each form contains variables related to specific items, and the common reference to country, Level I plot, subplot, and survey. The definition of the objects of survey, the employed methods and techniques for selection, assessments, and measurements of parameters and variables follows the general statements reported in the BioSoil-Biodiversity manual (WFFB 2007) with additional specifications and integrations linked both to operational and harmonising needs and the optional vs. mandatory specifications (see Materials and Methods).

GPL

The General Plot Location and information (GPL) describes the geographical location and a number of environmental and management characteristics of each plot. A detailed documentation of the form is available under http://icp-forests.org/documentation/BD/GPL.html

DBH and *THT*

Structural biodiversity information on the individual trees are contained in two forms: DBH reports the measured diameters, the species and the biological condition (standing dead or living, lying), and THT contains tree top and crown base heights, as assessed on selected largest trees within the plots (as previously included in the DBH dataset). A detailed documentation of the forms is available under:
http://icp-forests.org/documentation/BD/DBH.html
http://icp-forests.org/documentation/BD/THT.html

DWD

Deadwood typology, dimensions and status are contained in the DWD form where each record reports the variables of a single deadwood piece. A detailed documentation of the form is available under http://icp-forests.org/documentation/BD/DWD.html

CAN

In this form details of the state of canopy closure and the number of layers are reported. The number of trees assessed for DBH within the sampling area and the percentage of the total in case of sampling are also included. A detailed documentation of the form is available under
http://icp-forests.org/documentation/BD/CAN/html

GVG

The form GVG (ground vegetation composition) contains the list of all species and the layers and cover assessments if performed. A detailed documentation of the form is available under
http://icp-forests.org/documentation/BD/GVG.html

Plant species codes are given according to a taxonomic reference table based on *Flora Europaea*, available through EPBDGV (Canullo et al. 2010). Vegetation layers are reported by codes defining the vertical stratification in the system; cover assessment is submitted as percentage.

Results

Validation of available data could be finalized and data could be integrated into the collaborative ICP Forests database. The approved ongoing projects for internal evaluation with the general items and research questions are also summarized, with the indication of involved researchers.

Data processing and validation issues

The creation of the LI-BioDiv dataset, was not yet served by web-based submission tools: the files have been delivered to the working group (PCC and EPBDGV) in different formats. Forms are then affected by different national projects, have been submitted by subject aggregation irrespective of the survey, suffered misinterpretation of the common definition, etc.

Thus, the first action to assure a high quality of the dataset was the translation of the received files in correct formats, sequence, and survey year. In order to harmonise the whole dataset, the introduction of ancillary parameters was necessary (as common WGS84 coordinates, creation of UTM zones, etc.), as well as the fine-tuning of definitions, data dictionaries, the improvement of identifier fields (as for deadwood pieces, or tree number), the description of objects, thresholds, and intervals, etc. These operations have been conducted by harmonizing the content of the Bio Soil Biodiversity manual (WGFB 2007, and previous versions), the national field manuals and the descriptions of the experimental designs (when available).

The validation process started in strict co-operation with the PCC, the company DigSyLand, and the chair of the EPBDGV, by the early identification of attributes defined as primary keys, mandatory and obligatory fields for the six forms.

The overall strategy used in the FutMon project was adopted for validation (Granke et al. 2010; Figure 7-2).

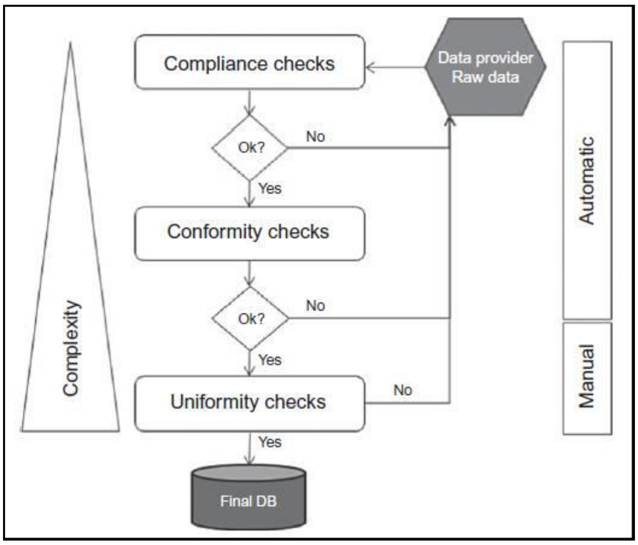

Figure 7-2. The sequence of the data checks applied to the LI-BioDiv dataset (Granke, 2013).

The first validation has been processed according to the given format specifications, reference to codes, and data completeness or duplicates (Compliance checks). The second validation was performed by rules covering plausibility and temporal or spatial consistency of the dataset (conformity checks).

In both cases, the automatic control resulted in error flags (data to be changed or deleted as implausible) or warning flags (out of defined ranges, can be changed or confirmed). Data was modified and confirmed only after a series of feedback with the data providers.

Uniformity testing is to be verified based on expert-based plausibility checks and interpretation of the data with respect to neighbouring and temporal consistency. This issue will be part of the internal evaluation process, as it includes data aggregation analyses, spatial patterns and time series evaluation. A set of simple elaborations have been preliminarily proposed as a tool to support uniformity checks (Table 7-3).

Table 7-3. Description of uniformity checks queries, by proposed tests for selected variables and aggregation levels.

Category	Test
GPL	*age, forest_type, origin, preuse* (descriptive to present plots, distribution)
DBH	*dbh* (mean and SD per species, and subplot) *trees* (count, per subplot, and decay I\0)
THT	*height* (mean and SD per subplot, main species, and all species) *canopy_height* (mean and SD per subplot, main species, and all species)
DWD	*dw_ID* (count per decay, and subplot) *diameter* (count, mean and SD per type, and subplot)
CAN	*n_treelayer* (per sublot) *canopy* (per subplot)
GVG	*species_code* (count per plot per layer - by layer, and all layers) *species_code* (sum)

It is worth to note that, in some cases, not all parameters were assessed (e.g., mandatory variables) or correctly reported; in other cases some scores are missing or still unclear. For these cases additional options in the reference tables (data dictionary) had to be defined. Nevertheless, including some late contacts with national experts, files integrity can be considered quite complete. Doubtful cases, as well as the differences in sampling design or field techniques, will be documented precisely. The documentation of the LI-BioDiv dataset could be improved continuously during the validation process.

The number of plots, and the overall records of the LI-BioDiv dataset by countries are shown in the Table 7-4 and Table 7-5. In some cases, the data from France and Ireland is not fully validated due to lack of information.

Table 7-4. Number of plots delivered by country\region as incorporated into the LI-BioDiv dataset.

Country	Code[11]	GPL	DBH	THT	CAN	DWD	GVG
Austria	14	136	135	129	133	128	136
Belgium Flanders	102	10	10	10	10	10	10
Cyprus	66	19	19	19	19	19	19
Czech Republic	58	146	139	138	141	142	146
Germany Baden-Württemberg	2804	50	49	49	49	50	50
Germany Bavaria\Bayern	2904	97					96
Germany Brandenburg-Berlin	2704	53	53	53	53	40	53
Germany Hessen	3004	29	29	29	29	29	29
Germany Mecklenburg-Vorpommern	3104	17	17	17	17	16	17
Germany Niedersachsen	3204	42	42	42	42	42	42
Germany Rheinland-Pfalz	3304	26	26	25	26	26	25
Germany Saarland	3504	9	9	9	7	9	
Denmark	08	22	22	22	22	5	22
Spain	11	151	145	147	151	92	151
Spain Canaries	95	4	4	4	4	4	4
Finland	15	630	621	617	630	577	629
France	01	548	539	526	538	504	547
Hungary	51	78	77	77	78	74	18
Ireland	07	35	35	35	35	35	29
Italy	05	224	219	220	220	179	201
Lithuania	56	62	62	62	62	58	62
Latvia	64	95	95	95	95	88	95
Poland	53	438	432	431	438	408	438
Sweden	13	100	100		100	85	
Slovenia	60	44	40	40	44	40	39
Slovak Republic	54	108	107	107	108	104	108
United Kingdom	06	167	163	161	163	121	157
Sum of plots		3340	3189	3064	3214	2885	3123

[11] ICP Forests partners (code)

Table 7-5. Number of records included in the LI-BioDiv dataset by country\region and category.

Country	Code[12]	GPL	DBH	THT	CAN	DWD	GVG
Austria	14	136	3773	628	241	2176	3280
Belgium Flanders	102	10	223	46	20	173	153
Cyprus	66	19	239	95	57	201	478
Czech Republic	58	146	4874	436	417	3772	5692
Germany Baden-Württemberg	2804	50	1425	149	92	1253	1738
Germany Bavaria\Bayern	2904	97					3048
Germany Brandenburg-Berlin	2704	53	1927	160	82	446	429
Germany Hessen	3004	29	667	246	58	794	773
Germany Mecklenburg-Vorpommern	3104	17	532	103	34	289	820
Germany Niedersachsen	3204	42	1050	358	84	1048	1239
Germany Rheinland-Pfalz	3304	26	780	189	52	666	636
Germany Saarland	3504	9	292	292	18	186	
Denmark	08	22	699	80	66	8	274
Spain	11	151	2855	737	299	771	3807
Spain Canaries	95	4	105	20	8	15	58
Finland	15	630	20088	1844	1260	6817	18060
France	01	548	18111	2562	1206	6665	15917
Hungary	51	78	2488	284	159	1312	430
Ireland	07	35	1836	173	105	633	278
Italy	05	224	7933	825	1319	3663	17540
Lithuania	56	62	2369	291	186	646	2000
Latvia	64	95	3483	450	190	1182	2746
Poland	53	438	12929	1425	953	4640	13523
Sweden	13	100	2835		100	805	
Slovenia	60	44	1372	243	132	460	2391
Slovak Republic	54	108	2898	440	216	1537	2925
United Kingdom	06	167	5092	755	484	1454	2156
Sum of records		3340	100875	12831	7838	41612	100391

Transnational internal evaluation process

The discussion about a possible transnational internal evaluation process started at the Joint Meeting of the ICP Forests Expert Panels on Forest Growth and on Biodiversity and Ground Vegetation (Wien, October 23-25, 2012), when the experts agreed to a list of common evaluation items. Further improvements have been reached during the Combined Meeting of Expert Panels on Biodiversity and Ground Vegetation, Forest Growth and Meteorology, Phenology and LAI (Freising, June 17-19, 2013) and finalised at the Combined Meeting of the Expert Panels on Ambient Air Quality, Biodiversity and Ground Vegetation, Crown Condition and Damage Causes, Forest Growth, and Meteorology, Phenology and Leaf Area Index (Eberswalde, March 3-6, 2014).

The correct use of the LI-BioDiv dataset is linked to the aim of producing insights into European forests' biodiversity, covering continental-, landscape-, and stand-level definition. Biodiversity patterns through scales and their drivers are suggested as key focus, as well as contribution to functional diversity and mechanisms, which can be used to model the development of forest biodiversity, e.g. to face global changes.

[12] ICP Forests partners (code)

The scientific evaluations based on the new LI BioDiv dataset are open to participation by country experts of the EPs and external cooperation by the scientific community is foreseen, provided the needs of clear coordination by the Panels, and following the Intellectual Property Policy as defined in the Annex of Part I of the ICP Forests Manual (Hansen et al 2010).

The Internal Evaluation Level I-Biodiversity discussion group was created on the ICP Forests website[13] as a showcase to appreciate the state of the art on the internal evaluation process related to the new LI BioDiv dataset. The topics which have been launched are described and periodically updated. Each research topic, led by an internal member of the ICP Forests community, will be afforded within a strict Working Group (private), edited for merely information. Invited members, contributing to the elaboration themes, will share the operative information and discussions.

The working groups established for each evaluation item are voluntary based, according to the common objective of publishing sound scientific papers, increasing the visibility and the scientific relevance of the ICP Forests infrastructure.

Active internal evaluation projects are listed below, which are expected to be finalized, at least partially, within 2016.

UPSPEX, under the responsibility of Gherardo Chirici (University of Florence, WGFB), is dealing with up-scaling and spatially explicit estimation of biophysical variables with remote sensing; data consistency and some presentation at national and international congresses have been produced; a paper on testing a GIS expert-based algorithm for automatic classification of the overall ICP Forests Level I monitoring plots by EFCTs, was recently submitted. The working group is composed of up to 16 members[14].

Δ-Drivers BIOPART, under the responsibility of Roberto Canullo (University of Camerino, EPBDGV), is focused on the driving factors of beta-diversity in European forests, namely assessing interactive effects of ecology and biogeography in determining the total diversity of European forests. A paper was submitted to an international journal about plant species diversity of Italian forests as a first attempt for large scale analyses. European dataset analyses have been presented at various international congresses (EVS, IBS). At present, seven members have joined the related working group[15].

DWpools, led by Janusz Czerepko (IBLES, EPBDGV), proposes to analyse deadwood volume, decay, type and their diversity in relation to forest parameters across Europe. Results will be necessary to possibly explain the variation among forest types and to provide preliminary estimates of deadwood, which could be used as a reference for sustainable forest management. Data conformity and first general analyses have been performed, national attempts for deadwood estimates have been presented at the EPBDGV meetings. The working group was recently created on the ICP Forests website[16], aggregating interested colleagues.

NICHES, by Karl Mellert (LWF, EPBDGV), includes studies on the ecological characterisation of marginal (xeric limits) sites for tree species. Pre-evaluation of data structures is running, subsets of data have been already used within papers on modeling forest sensitivity to climate change, and will be used in running projects like MARGINS, for the specification of thresholds for the cultivation of tree species. A discussion about niche models is launched, based on the PROPS model.

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[13] To be found at http://icp-forests.net/group/inteval1biodiv

[14] Cf. http://icp-forests.net/group/upspex

[15] Cf. http://icp-forests.net/group/drivers-biopart

[16] Cf. http://icp-forests.net/group/dwpool

NICHES being a complex issue, a sub task is guided by Han van Dobben (ALTERRA, EPBDGV) who opened the discussion about the modelling approach. Abiotic model (VSD+) combined with niche model calibration should be expanded by using Level I and Level II ground vegetation together with soil data. Members are listed in the discussion group[17].

The full list of topics, including items on the early stage of progress, is given in Table 7-6. It is possible, of course, that some task or hypothesis which has been defined under a given item, may be merged while the process is underway, in agreement among the participants, for specific effort.

Some items have been acknowledged by EPs, but the leadership remained uncertain and they are likely to be included in some other running project. Namely, some multi-indicator approach to a naturalness description was indicated, as well as the linkage of the LI-BioDiv dataset to Natura 2000 (to inspect the distribution of forest habitat types inside and outside of Natura 2000 sites, inspect the relative incidence and changes of the endangered or alien plant species, etc.). Comparison of the representativeness of performances of the Level II with respect to the Level I network in terms of accuracy and representativeness was also commonly underlined as a possible target.

“Country effect” as one of the drivers of distribution patterns of biodiversity variables was also claimed due to previous studies underlying the possible differences in the methodology and socio-economic models (e.g. Ferretti 1998, Klap et al. 2000). Related to that, some evaluation of quality issues data (e.g. biased increase in the number of species, thresholds for significant trends, intercalibration of field surveyors, etc.) have been suggested, and some experts will possibly tackle the task.

Vegetation response to nitrification was another interesting subject that was partially addressed by an integrated group with ICP Integrated Monitoring (ICP IM), including time series from the ICP Forests Level II network (Dirnböck et al. 2014); the availability of large scale representative datasets at Level I can be of great help for further gradient simulation analyses.

The influence of deadwood diversity on bryophytes and vascular plants diversity was the last proposed item, with the deadwood variables being proposed as a possible indicator of the forest ecosystem status.

[17] Cf. http://icp-forests.net/group/niche-model-calibration

Table 7-6. Updated topics for the internal evaluation of Level I-biodiversity datasets. An extended version is to be found at http://icp-forests.net/group/inteval1biodiv Participating scientists are listed upon their willingness to contribute to a given project.

Short name	Resp. persons	Title	Participation	Hypothesis being tested
Δ-Drivers BIOPART	Roberto Canullo	Driving factors of beta-diversity in European forests.	Chiarucci UNIBO, Landi & Giorgini UNISI, Wellstein UNIBZ, Campetella & Chelli UNICAM, Klinck NW-FVA, Grandin SLU, Salemaa & Tonteri LUKE, Oksanen UNIOULU, Wohlgemuth WSL, Kutnar GODZIS	Weight and assess interactive effects of ecology and biogeography in determining the total diversity of European forests using a spatially representative sample: the effects of ecological factors are less important than biogeographical factors.
PHYLOPAT	Roberto Canullo	Phylogenetic patterns at bio-geographical scale.	Mucina UWA, Campetella UNICAM, Wellstein UNIBZ	Competitive exclusion principle emphasises the limited coexistence of similar species. There is a similarity limit in the niches of competing species; species niches constrained by their evolutionary history. Hypothesis of limiting similarity at the phylogenetic level.
FORGUILD	Roberto Canullo	Plant Functional Groups and species diversity patterns.	Campetella UNICAM, Wellstein UNIBZ, Chiarucci UNIBO, Giorgini UNISI, Bartha MTA, Grandin SLU	Is evenness in Plant Functional Groups (guild) distribution associated with a higher species richness? Can this explain plant diversity patterns in European forests?
FUTPA	Roberto Canullo	Plant functional trait patterns in key EU forest types	Wellstein UNIBZ, Spada UNIR1, Chelli & Campetella UNICAM, Msalemaa & Tonteri LUKE, Wohlgemuth WSL, Kutnar GODZIS	The plant functional composition of forest phytocoenosis can be explained by soil parameters, present day climate and legacy of past climate.
NICHES	Walter Seidling	Main drivers of ground vegetation at local and continental scale	Fischer (?) TI	Drivers acting at different spatial scales are influencing floristic composition of ground vegetation
	Maija Salemaa	Niche definition prediction	Mäkipää & Jöksanen LUKE, vanDobben ALTERRA, Klinck NW-FVA, Dupouey INRA, Walthert WSL	Species with narrow niche as bioindicators
	Jean-Luc Dupouey	Soil and species		
	Han van Dobben	Calibration of niche models on EU scale (incl. non-forest vegetation)	Mellert LWF, Ewald HSWT, Canullo UNICAM, Wamelink ALTERRA	Species occurrence can be predicted from abiotic model (VSD+) combined with niche model
	Karl Mellert	Ecological characterisation of tree species marginal (xeric limits) sites	Ewald HSWT, Canullo UNICAM,	1) SDMs based on coarse resolution climate data require refinement; 2) Topography & soil conditions modulate tree sp. response to climate; 3) Ground vegetation provides proxies for site properties; 4) Refined site variables allow to identify false absences
	Han van Dobben	Indicator values, functional traits\groups	Wellstein UNIBZ, Canullo & Chelli UNICAM, Dupouey INRA	
DWpools	Janusz Czerepko	Deadwood estimation through forest ecosystems in Europe	Gawryś, Sokołowski & Cieśla IBLES, Herrmann WSL, Neumann BFW, Canullo, Campetella & Chelli UNICAM, Puletti CRA	What drives deadwood pools and C stocks? Reference patterns - classes; relations with climate gradient, plant richness, productivity?

Short name	Resp. persons	Title	Participation	Hypothesis being tested
WP-KS-KW	Henning Meesenburg	Forest Productivity, Carbon Sequestration, Climate Change	De Vos & Cools INBO, Canullo UNICAM, Michopoulos FRIA, Graf Pannatier WSL, Ilvesniemi & Lindroos LUKE, Mette LWF, Schmidt-Walter NFV	Forest productivity is driven by several climatic and site (soil) specific variables; forest growth models can lead to estimates of the future potential of raw timber stocks and carbon storage of forests and face future climate.
UPSPEX	Gherardo Chirici	Upscaling & spatially explicit estimation of biophysical variables with remote sensing	Travaglini & Giannetti UNIFI, Attorre UNIR1, Canullo & Campetella UNICAM, Bastrup-Birk EEA, Puletti CRA, Barbati, Corona & Mancini UNITUS, Galic UNS	Nearest neighbors techniques for predicting forest variables from satellite imagery and Level I ground data. Population unit predictions as combinations of sample observations (most similar, or nearest, in a space of ancillary variables, to predicted unit)
Small Scale	Maija Salemaa	Small-scale variation of forest floristic diversity under different environmental conditions	Thimonier WSL, Canullo UNICAM, Seidling TI	Null-hypotheses: z-values and intercepts may not depend on forest type, climatic or edaphic climatic conditions, or anthropogenic influences

7.4 Conclusions

Some conclusions can be considered in terms of lessons learned from the process of validation and evaluation of the LI-BioDiv dataset and the definition and implementation of the system of checkroutines.

A noteworthy remark would be that a harmonized large-scale survey is feasible, and the good cooperation among countries enabled ICP Forests to get valuable insights into biodiversity indicators of the European forest systems. To this respect, the BioSoil-Biodiversity experience should be regarded as a funding milestone, and can be used also to avoid the problems linked to incorrect interpretation and lack of logical univocal descriptions, e.g. between the manual and the data forms.

The possibility to include, after validation routines, the Level I dataset on biodiversity within the most developed and experienced infrastructure for forest research and monitoring, was the next important step to this respect. The work behind this is an investment that must be structurally included in further projects, as well as the evaluation process.

The improved documentation of the methodology and the implementation of the system of checkroutines enables to consider a standard for next biodiversity surveys on the Level I network. During the process of validation it became evident that also a bottom-up approach can be considered, enabling the inclusion of other comparable datasets.

For such kind of international surveys, it seems essential to prepare conveniently in advance a manual implementation with clear background, common definitions and the explanation of admissible values, thresholds and selection criteria, to be tested in the field. The experience of the last update of the ICP Forests manual can be of reference for that issue. Any international manual should be translated into an operational field manual for field crews, and the observer errors, both in the application of the sequence of protocols and the field surveys, is a relevant target to be afforded at this level by means of standard field training and intercalibration workshops.

The variables to be considered as mandatory must be fixed, and their number, as used in the BioSoil-Biodiversity project, was probably the best agreement between effort and results. Optional parameters and alternative designs must be well regulated as well. The high number of sites (3340) and the hundreds of thousands of records must be somehow optimized in terms of time spent in the field, simplification of the procedures, and selection of the best representative network, in a way that the feasibility can considerably increase, together with the comparability across Europe. The latter issue is the target of a running Life+ project for the Italian CONECOFOR network (SMART4Action[1]), the results of which could suggest a similar approach for the European Level I network.

As for the BioSoil-Soil module (Blust et al. 2013) here we can highlight the need for clear rules in the ownership and distributed rights, according to internationally accepted rules and standards: data availability and engagement for sharing datasets are relevant issues to ensure continuity and benefit for the community.

[1] http://www.corpoforestale.it/smart4action

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