

Integrating taxonomic research for biodiversity inventory & monitoring –

new approaches and (old) challenges for synergies between science and conservation

Christoph L. Häuser

Museum für Naturkunde, Invalidenstr. 43, 10115 Berlin, Germany

email: christoph.haeuser@mfn-berlin.de



Czech EPBRS – meeting:
„World Biodiversity and European Taxonomy“
19-22 May 2009, Pruhonice



This talk: a „*conceptual vision*“ – not a paper!

- Taxonomy – some background considerations
- Biodiversity inventory & monitoring – needs & challenges
- Examples for integrating taxonomy:
 - EDIT ATBI+M approach: integrating individual field work efforts - and new recording tools
 - The international level: making individual data sustainable: GBIF UNEP-WCMC collaboration
- Taxonomy – for the future of biodiversity!

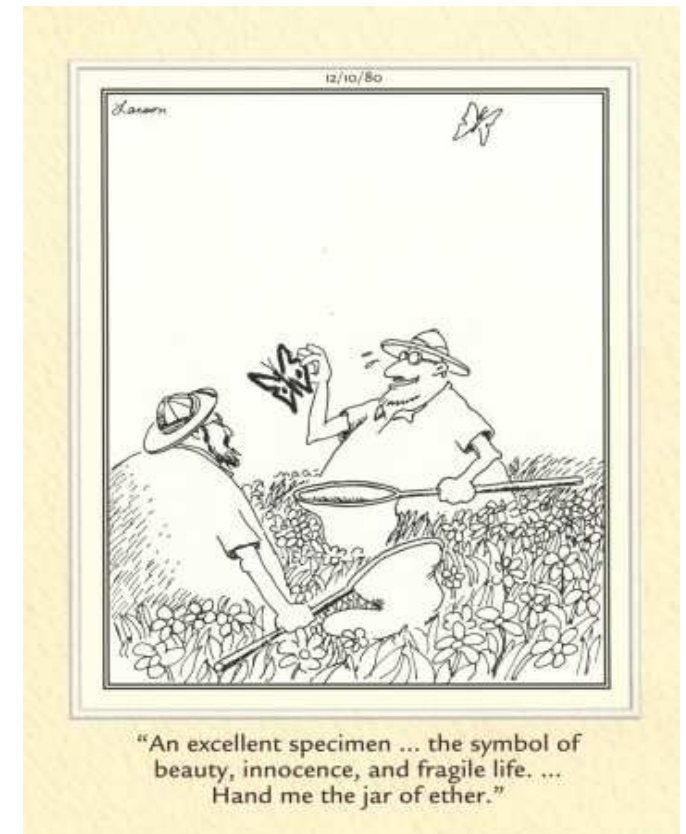


Czech EPBRS – meeting:
„World Biodiversity and European Taxonomy“
19-22 May 2009, Pruhonice



Taxonomy: some background

Some *pre-conceptions*:



Why taxonomy matters – it is important !

- Provides critical baseline information:
„you can't protect / use what you don't know“
- High economic relevance, especially for agriculture/fisheries/forestry, health, etc:
many real examples („case studies“):
 - <http://www.bionet-intl.org/opencms/opencms/caseStudies/default.jsp>
 - <http://www.gti-kontaktstelle.de/cases.html>
- Information backbone for all biological sciences



Czech EPBRS – meeting:
„World Biodiversity and European Taxonomy“
19-22 May 2009, Pruhonice



Why taxonomy matters

– the political mandate(s)

- CBD (2002): *Global Taxonomy Initiative (GTI)*
- G8 +5 (2007): „*Potsdam Initiative*“: calls for a Global Species Information System (**GSIS**)
- EPBRS Action Plan (Budapest, 2005)
- DIVERSITAS (2008): new „Core Project“ **bioGENESIS**

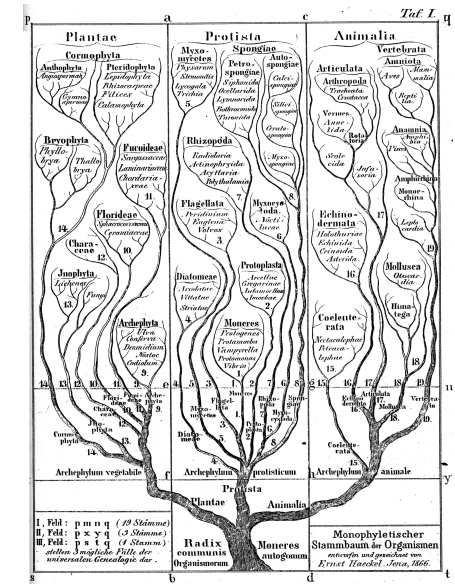


Czech EPBRS – meeting:
„World Biodiversity and European Taxonomy“
19-22 May 2009, Pruhonice



Why taxonomy *really* matters ...

- Provides a hierarchical (conceptual) representation for all life on Earth
- Sets reliable framework for making generalizations: allows for safe predictions on the living World – based on small samples sizes, without much statistical significance ...!
- Is often **the** basis for every day decisions in and about life ...!!



Czech EPBRS – meeting:
 „World Biodiversity and European Taxonomy“
 19-22 May 2009, Pruhonice



The *true* taxonomic „impediment“ ...

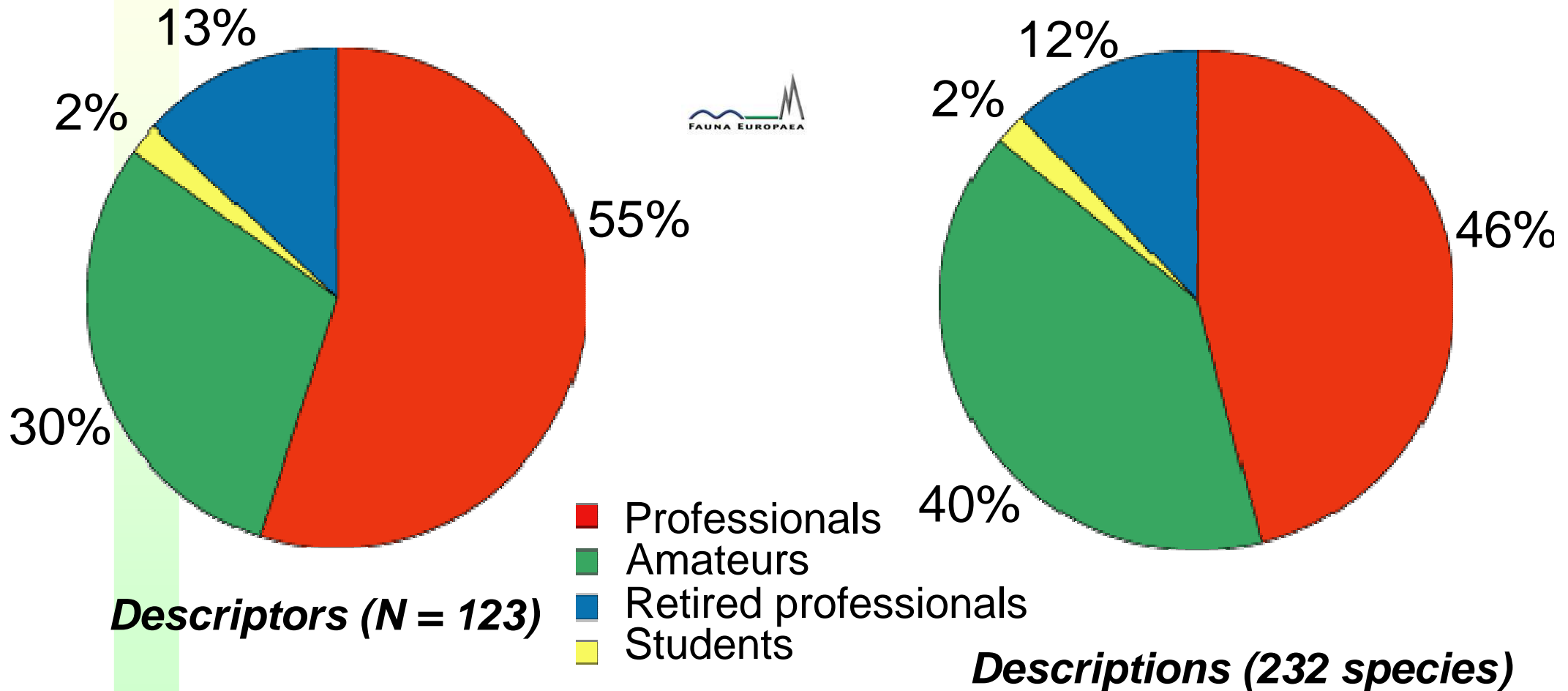
- Taxonomy = strong „individualistic“ science
- Activities & efforts continue highly fragmented & diversified
- Academic pressure(s) for high – individual – scientific excellence
- Lack of incentives / rewards for truly cooperative efforts



Czech EPBRS – meeting:
„World Biodiversity and European Taxonomy“
19-22 May 2009, Pruhonice



EU capacities: professional status of descriptors



In Europe more than half of the new species are described by non-professionals (i.e., people who are not paid for that)!

Source: FaunaEuropaea, P. Bouchet

The *real* challenge: biodiversity loss

- **Mammals:** [IUCN „red lists“ - www.iucnredlist.org]
 - (1990): threatened + endangered: 647 spp.
 - (2008): threatened (CR, EN, VU): 1141 spp.
(= **23% of all mammal species known!**)
 - **Reptiles:**
 - (1990): threatened (+ endangered): 207 spp.
 - (2003): threatened: 293 spp.
 - (2008): threatened: 423 spp.
 - **increases from:** **2000 - 2003 - 2008**
 - plants: 5,611 : 6,774 : 8,457 spp.
 - vertebrates: 3,507 : 3,524 : 5,966 spp.
 - invertebrates: 1,928 : 1,959 : 2,496 spp.
- n.b.: **insects** (= 950,000 spp.): only 0.02% of all insect species could yet be evaluated!!



Czech EPBRS – meeting:
„World Biodiversity and European Taxonomy“
19-22 May 2009, Pruhonice



Inventories – some shortcomings

Scientific (taxonomic) biodiversity inventory ongoing since > 250 years (1753 / 1758) :

- no global checklist yet available!
- most countries without accurate / up-to-date national faunas / floras (inventories, checklists)!
- no complete species inventory for any Protected Area in the World?!!
- majority of described species known 1-5 specimens / records / publications

➔ Biodiversity crisis = information crisis !?!

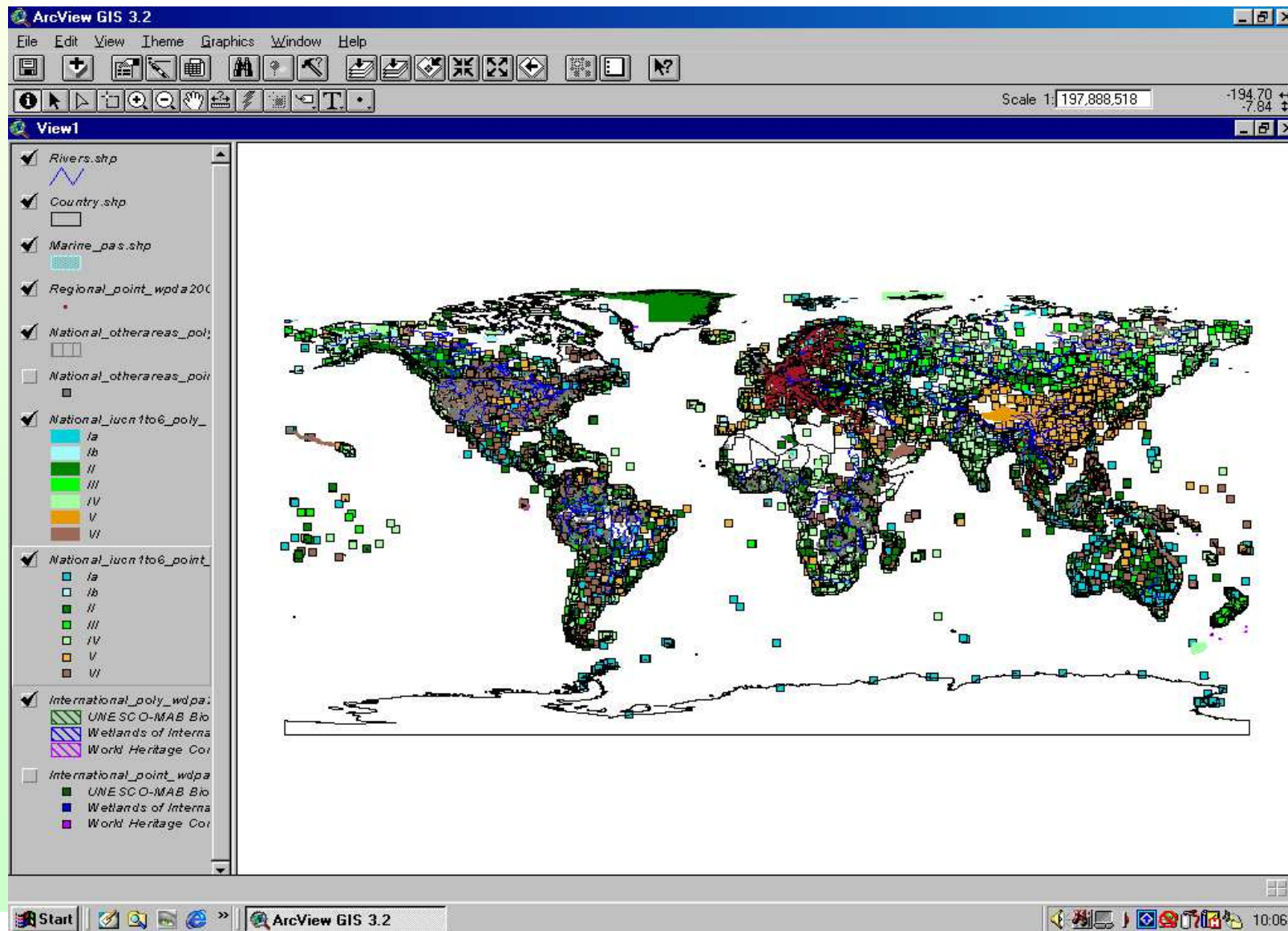


Czech EPBRS – meeting:
„World Biodiversity and European Taxonomy“
19-22 May 2009, Pruhonice



The state of inventories: Protected Areas

IUCN / WCMC - World Database of Protected Areas [- 2008]



Czech EPBRS – meeting:
„World Biodiversity and European Taxonomy“
19-22 May 2009, Pruhonice



No/few **inventory** data *available* yet for most **protected areas** ...

Species details:

Poland - Białowieża - Microsoft Internet Explorer

Adresse: <http://sea.unep-wcmc.org/wdpa/sitedetails.cfm?siteid=854&level=nat>

Anmerkungen

Information Sources Latest Info: CDDA European Update, August 2004.

Map

Legend

- Białowieża
- Other Protected Areas in Poland

Udvardy's Realms, provinces and biomes details

Realm	Palearctic (2)	Province	Doreonemoral (10)	Biome	Temperate broad-leaf forests (05)
--------------	----------------	-----------------	-------------------	--------------	-----------------------------------

Historical details

Date	1 January 1948				
Designation	National Park	IUCN Category	II		
Event	Designated	Area	10,502 hectares		
Management	Management	Public - National			
	Administration	Public - National			
	Ownership	Unknown			
Source	Latest Info: CDDA European Update, August 2004.				

Species details

No details are currently available for any species. If you know of a species which exists in this protected area please complete the comment form.

Related site details

Adjacent

- [Belovezhskaya Pushcha / Bialowieża Forest](#) (World Heritage Convention)
- [Belovezhskaya Pushcha / Bialowieża Forest](#) (World Heritage Convention)

„No details are currently available for any species. If you know of a species which exists in this protected area please complete the comment form.“



Czech EPBRS – meeting:
„World Biodiversity and European Taxonomy“
19-22 May 2009, Pruhonice



Taxonomic potential - resources

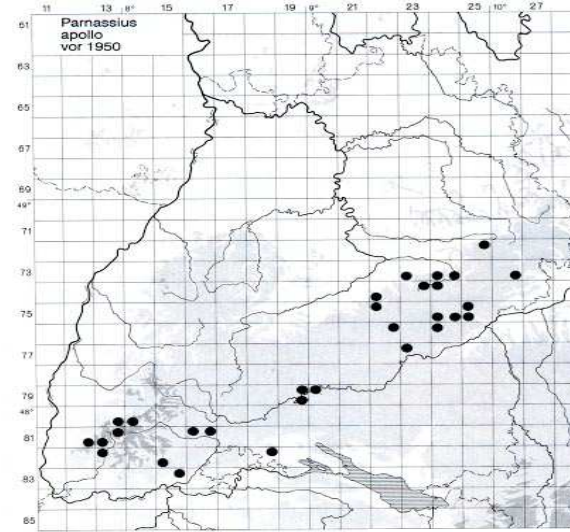
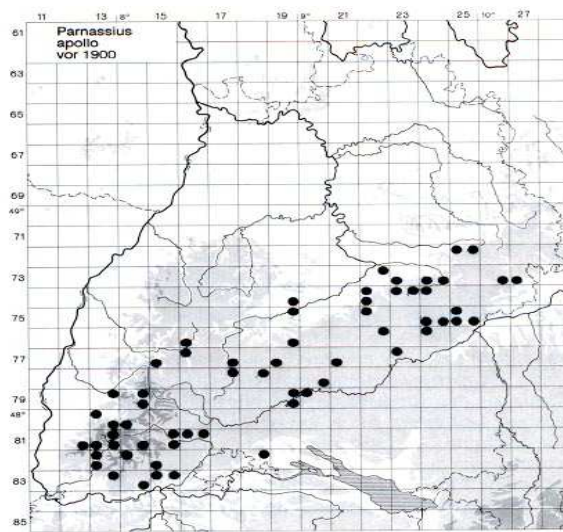
- Institutions:
 - 3,382 herbaria included in Index Herbariorum (<http://sciweb.nybg.org/science2/IndexHerbariorum.asp>)
 - EU natural history collections: > 1 bio specimens
- > 4,700 individual taxonomists listed in ETI World Taxonomist database (<http://www.eti.uva.nl/tools/wtd.php>)
- > 15,000 (animal) species newly described every year



Czech EPBRS – meeting:
„World Biodiversity and European Taxonomy“
19-22 May 2009, Pruhonice

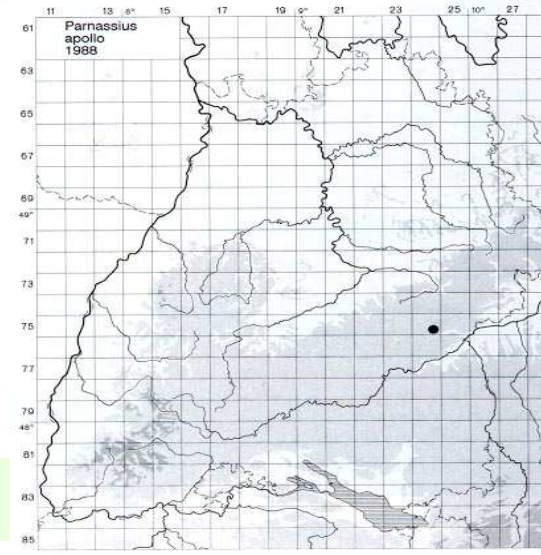
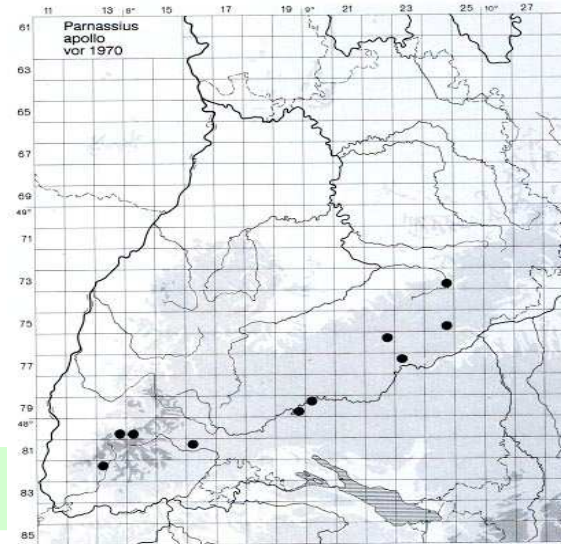


The value of collection / historical biodiversity data: *time series*: documenting & analysing changes



Example:

Decline of the
Apollo Butterfly
in Baden-
Württemberg
(1880 – 1990)



Czech EPBRS – meeting:
„World Biodiversity and European Taxonomy“
19-22 May 2009, Pruhonice



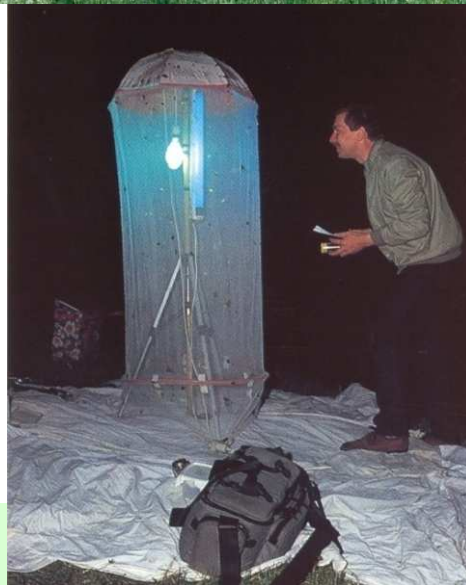
Ongoing field work >100.000 data records every day ??!



Czech EPBRS – meeting:
„World Biodiversity and European Taxonomy“
19-22 May 2009, Pruhonice



>1.000.000 field generated data records every day !??



Czech EPBRS – meeting:
„World Biodiversity and European Taxonomy“
19-22 May 2009, Pruhonice



The Challenge – new ways for biodiversity science („*new taxonomy*“)

Impediments & bottlenecks:

- biodiversity inventories / assessments (systematics, taxonomy) = cumulative science (!!)
- contemporary biodiversity science = individualistic, hypothesis / analysis driven research
- no / little incentives yet for *sustainable* collection, management & maintenance of data

However, opportunities for improving efficiency through recent technological developments (ICT, www), particularly for *field* and *inventory* work!



Czech EPBRS – meeting:
„World Biodiversity and European Taxonomy“
19-22 May 2009, Pruhonice



The issues – for more efficient biodiversity *inventories*

- **Work flow**
 - field protocols for data capture / recording
 - referencing metadata (time & place)
- *Data standards*
 - *Darwin Core (DiGIR), ABCD (BioCASE), TAPIR*
 - *GUIDs, LSIDs*
- **Integration: data sustainability**
 - data policy
 - best practices and responsibilities



Czech EPBRS – meeting:
„World Biodiversity and European Taxonomy“
19-22 May 2009, Pruhonice



Work flow (field work) - analysis

- every day >100.000 scientific primary biological datasets / records / specimens are newly observed / collected / recorded
- many / most of these data are - still – not recorded digitally ...
- majority of these data are not recorded using standard protocols or proper (geo-)referencing
- nearly all of these data (ca 90%) are still not shared or managed / maintained sustainably ...



Czech EPBRS – meeting:
„World Biodiversity and European Taxonomy“
19-22 May 2009, Pruhonice



Data sustainability

- most biodiversity field data are only collected for a specific purpose (i.e., to answer a single „scientific” hypothesis / question ...)
- usually, no protocols or standards applied beyond those connected to research question(s)
- no longer-term vision for use of primary data
- incentives / requirements for providing (long term) access and sharing primary data needed !!



Czech EPBRS – meeting:
„World Biodiversity and European Taxonomy“
19-22 May 2009, Pruhonice





EDIT: *Towards* The European Distributed Institute of Taxonomy <http://www.e-taxonomy.eu>

- a « network of excellence » supported by the European Commission (FP6)
- funded for 5 years (2007 – 2011)
- 28 partner institutions (19 EU, 2 Russian & 2 US museums + biological collections, + orgs.)
- coordinated by the Museum National d'Histoire Naturelle, Paris (Prof. Simon Tillier)



Czech EPBRS – meeting:
„World Biodiversity and European Taxonomy“
19-22 May 2009, Pruhonice



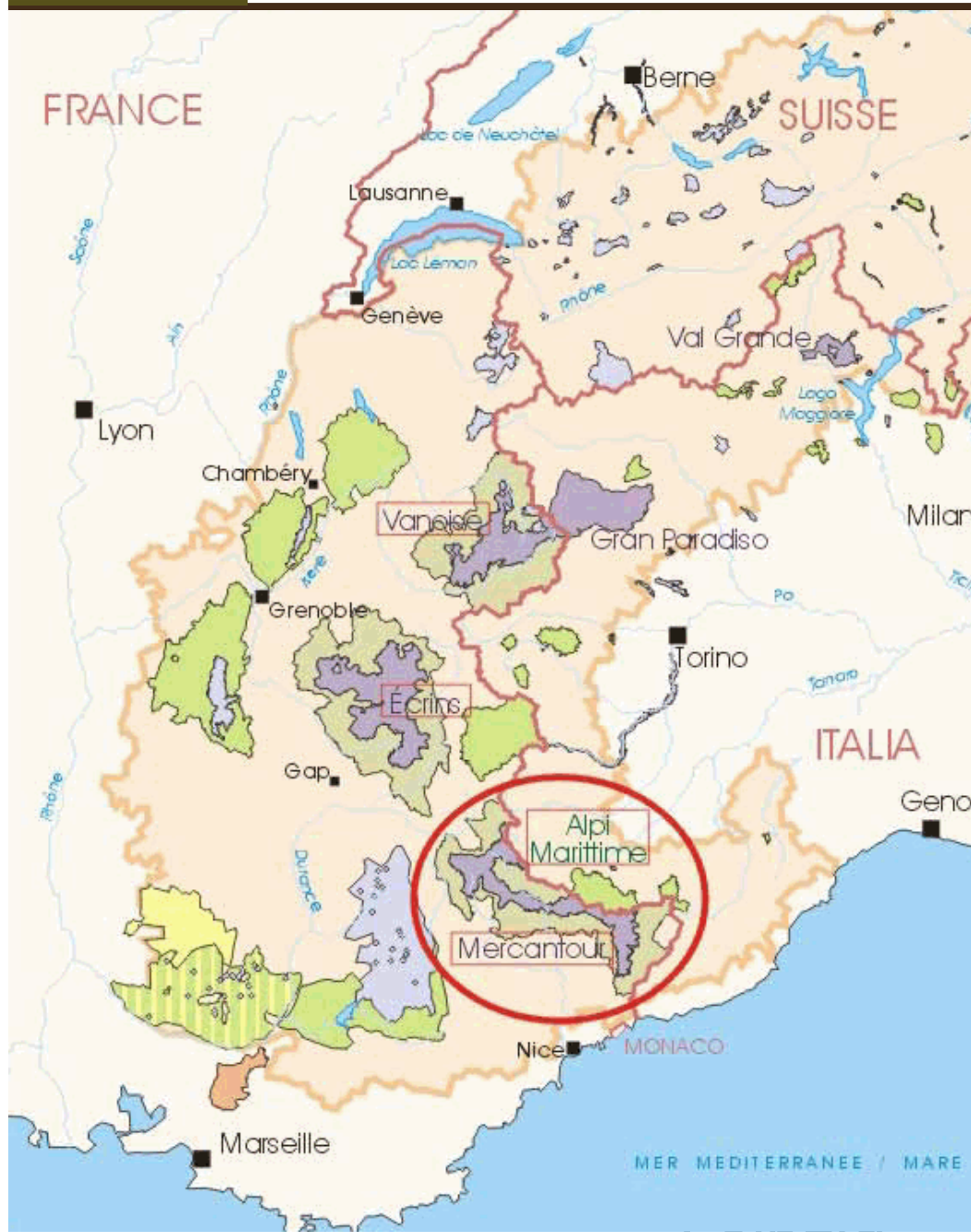
EDIT WP7 (ATBI+M) approach

- organizes “all taxa biodiversity inventory” and monitoring (ATBI+M) projects at selected conservation areas in and outside Europe in need of inventories
- organizes and supports **teams** of taxonomic experts for **field work** to update/complete inventories at ATBI+M pilot sites
- tests and develops new **standards, protocols, and tools** for efficient field recording techniques (geo-referencing, field-based ID techniques, **GUIDs** for records & specimens, etc.)
- delivers **primary occurrence data** as digital records (compatible with BioCASE/DiGIR/TAPIR protocols) hosted in openly accessible web-based information systems (**GBIF: www.gbif.org**) - for actual + future use

EDIT

European
Distributed
Institute of
Taxonomy

1st EDIT European ATBI+M pilot site: Mercantour / Alpi Maritimi NP



2nd European ATBI+M pilot site: Gemer area, Slovakia (3 parks)



© M.M. Bos, 2007

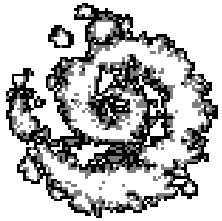


© E.S. Bukal, 2007

Czech EPBRS – meeting:
„World Biodiversity and European Taxonomy“
19-22 May 2009, Pruhonice



(ATBI+M) participation and results



ATBI+M site Mercantour/Alpi Marittime (France, Italy; 2007-2008):

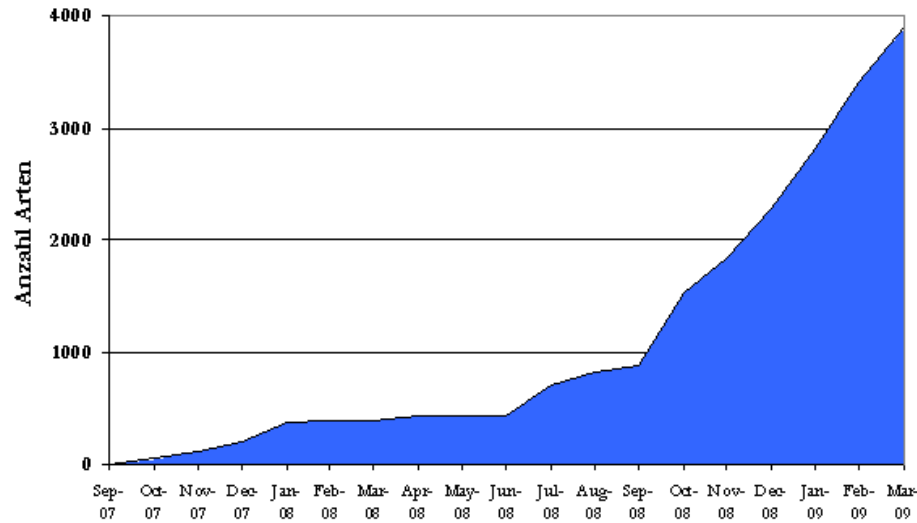
- > 90 individual field visits
- > 19,000 data records, for ca 4,000 spp. generated + delivered

ATBI+M site Gemer (Slovakia; 2008):

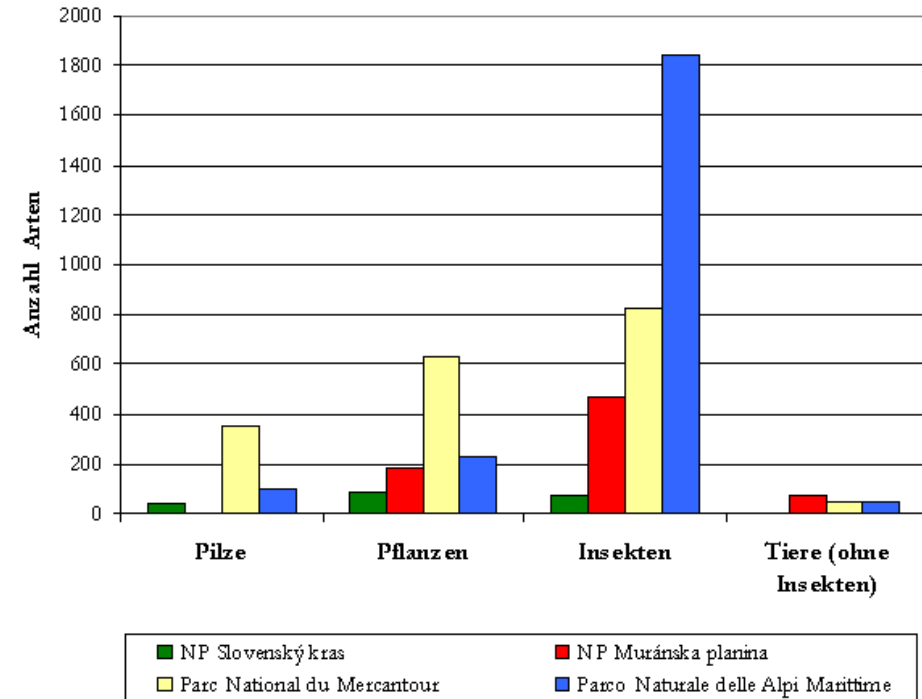
- > 25 individual field visits
- > 1,600 data records, for ca 900 spp. generated + delivered



EDIT ATBI+M data generation



Cumulative increase in species recorded
(Sept. 2007 – March 2009)



EDIT ATBI+M data portal

Biodiversity in the Mercantour and Alpi Maritime natural parks | ATBI: All Taxa Biodiversity Inventories - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://www.atbi.eu/mercantour-maritime/?q=node/13&tree_s=511

Most Visited Links anpassen

Mercantour/Alpi Maritime ATBI+M | ED... BIOSYST.EU Biodiversity in the Mercantour a...

ATBI: All Taxa Biodiversity Inventories
in the Mercantour/Alpi Maritime natural parks

What is an ATBI? How to participate

Main menu

- News
- Park biodiversity
 - Taxonomic details
- Contributing scientists
- Photogalleries
- Info for scientists
- Links
- Site map
- Contacts
- Press

New:

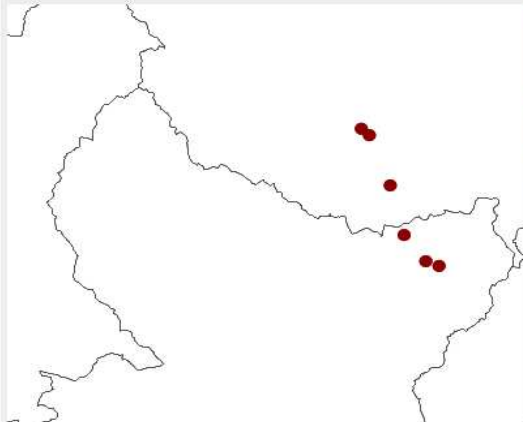

- Monday April 20th 2009 12:26:36 PM 20.4.'09 12:26pm
- First day in PNAM 17.4.'09 10:52am
- Image 9.4.'09 1:42pm
- Ristorante San Lorenzo 18.3.'09 2:24pm
- Hôtel Restaurant Terminus 5.2.'09 1:38pm

Admin log in

Biodiversity in the Mercantour and Alpi Maritime natural parks

[back](#)

***Antaxius pedestris* (Fabricius, 1787)**

© Yoan Braud
September 2007

Parc National du Mercantour (France)

Longitude	Latitude	Altitude	Date	Number	Collector (s)
0 7.47407	N 44.11364	1860m	04.09.2007	r	BRAUD Yoan
Locality name		Tende, Valmasque			
Macrohabitat notes		grasslands, stony slope			
Collection method		diurnal visual and auditive research			
Determinator		BRAUD Yoan			
Deposit		Yoan BRAUD, 04200 Theze (France)			
0 7.52187	N 44.06996	1391m	01.09.2007		BRAUD Yoan
0 7.55091	N 44.06235	1101m	01.09.2007	a	BRAUD Yoan
0 7.55091	N 44.06235	1101m	05.09.2007	r	BRAUD Yoan

Images by (in order of appearance):

- M.M. Bos, 2007;
- M. De Biaggi, 2007;
- M.M. Bos, 2007;
- M.M. Bos, 2007;

[Submit your own images!](#)

Done

Start Component Reports 2009 Biodiversity in the Me... Posteingang - Microsoft ... Microsoft PowerPoint - [J...

DE << >> 14:51



Czech EPBRS – meeting:
„World Biodiversity and European Taxonomy“
19-22 May 2009, Pruhonice



(ATBI+M) improving work flow for field recording

1. **Localities** : **Automated** geo-referencing (GPS receivers in cameras, PDAs, notebook PCs)
2. **Events** : **Automated** dating/timing of events, simultaneously with geo-referencing of localities; individual recording of techniques, names of recorders, special circumstances, etc.;
3. **Field records** : **Automated** ID generation, at least for automated sampling / recording methods (e.g., digital photos, measurements, etc), individual assigning of unique IDs to field samples



➔ **combine 1. – 3. in a single device / tool !**

Mobile GIS-biodiversity data system

First approach



Czech EPBRS – meeting:
„World Biodiversity and European Taxonomy“
19-22 May 2009, Pruhonice



Mobile GIS/PC-System

One possible solution



MobileMapper 6

- Pocket PC from Magellan
- PDA and GPS in one tool, camera
- Windows Mobile 6



Rangefinder-System

Recording moving objects / animals



Vector 1500

- Distance measurement (up to 2km)
- Direction and slope are recorded
- Supplementary to GPS
- Battery capacity up to several days

New opportunities: Global data integration

www.data.gbif.org

GBIF data portal links to:

- > 280 data provider
- > 7.400 data sets
- > 170 mio data records (individual organisms from practically all countries and regions)

GLOBAL BIODIVERSITY INFORMATION FACILITY

SPECIES COUNTRIES DATASETS OCCURRENCES SETTINGS ABOUT

... free and open access to biodiversity data

Welcome to the GBIF Data Portal
Access millions of data records shared via the GBIF network.
To learn how to use this site, please see [About](#).
To tune this site for smaller displays, see [Settings](#).

Search species/country/dataset

Search

Explore Species
Find data for a species or other group of organisms.
Species
Information on species and other groups of plants, animals, fungi and micro-organisms, including species occurrence records, as well as classifications and scientific and common names.
Example species:
Puma concolor (Linnaeus, 1771)

Explore Countries
Find data on the species recorded in a particular country.
Countries
Information on the species recorded in each country, including records shared by providers from throughout the GBIF network.
See data for:
[Germany](#)

Explore Datasets
Find data from a data provider, dataset or data network.
Datasets
Information on the data providers, datasets and data networks that share data through GBIF, including summary information on 1693 datasets from 235 data providers.
Latest dataset added:
[Lichenes North-Eastern Poland](#)



Czech EPBRS – meeting:
„World Biodiversity and European Taxonomy“
19-22 May 2009, Pruhonice



New: GIBF / UNEP-WCMC collaboration:

World Database On Protected Areas
incorporating the UN List of Protected Areas

Email:
 Password: [Forgot Password?](#)

[Home](#) | [Maps](#) | [Search](#) | [Download](#) | [Upload](#)

2009 WDPA RELEASED

Quick Protected Area Search:

Welcome

The World Database on Protected Areas is a foundation dataset for conservation decision making. It contains crucial information from national governments, non-governmental organizations, academic institutions, international biodiversity convention secretariats and many others. It is used for ecological gap analysis, environmental impact analysis and is increasingly used for private sector decision-making. For more information [click here](#).

Tools

- [Rapid Assessment Of Land Use Change In and Around Protected Areas \(RALUCIAPA\)](#)
- [The Fire Information for Resource Management System \(FIRMS\)](#)
- [Protected Areas Management Effectiveness Information Module](#)
- [Integrated Biodiversity Assessment Tool \(IBAT\)](#)
- [World Database on Marine Protected Areas](#)

Maps

Explore and visualize protected areas through our map viewers.

[2D Maps](#)

What's New

Looking for a global dataset of all terrestrial and marine protected areas? [The WDPA Annual Release 2009](#), including a global marine protected areas layer, is now available to download.

Search

Search for protected areas by many criteria with our [advanced search tool](#).

The WDPA Supporters *The WDPA is powered by software donated by ESRI and Safe Software*

[Terms of Use](#) | [Site Map](#) | [FAQ](#) | [Contact](#) | [Feedback](#)

UNEP WCMC IUCN WCPA WORLD COMMISSION ON PROTECTED AREAS



Czech EPBRS – meeting:
 „World Biodiversity and European Taxonomy“
 19-22 May 2009, Pruhonice



Select any area (PA):

World Database On Protected Areas
 incorporating the UN List of Protected Areas

Email:
 Password: [Forgot Password?](#)

Home | Maps | Search | Download | Upload

Quick Protected Area Search:

The Mercantour National Park - Central Area

The Mercantour National Park - Central Area is found in France. It was established in 1979. This site is 68500.00ha.

WDPA Info | **WDPA Info Flash (Beta)** | GBIF Species Info | MetaData

Choose Background ▾

[View in Google Earth \(Desktop\)](#)

Site ID	664
Site Name (ENG)	Mercantour
Country	France
Longitude (DD)	7.04971345
Latitude (DD)	44.18108621
Designation	National Park - Central Area
Status	Designated
Establishment Year	1979
IUCN Category	II
Total Area (ha)	68500.00
Site Governance	Government Managed Protected Areas
Management Effectiveness Assessed	No / Information not available

The WDPA is powered by software donated by ESRI and Safe Software

The WDPA Supporters

Terms of Use | Site Map | FAQ | Contact | Feedback

UNEP WCMC IUCN WCPA WORLD COMMISSION ON PROTECTED AREAS



Czech EPBRS – meeting:
 „World Biodiversity and European Taxonomy“
 19-22 May 2009, Pruhonice



The Mercantour National Park - Central Area

The Mercantour National Park - Central Area is found in France. It was established in 1979. This site is 68500.00ha.

Protected areas in **Frankreich. Mercantour**

About this widget

UNEP WCMC WCPA GBIF

← Species Data sources Download data View all Areas Pictures →

Karte Satellit Hybrid Gelände

Total: 445 occurrences

Specimens: 95% (422)	Plants: 94% (417)
Observations: 5% (23)	Animals: 5% (23)
Other types: 0% (0)	Other kingdoms: 1% (0)

GBIF DATA SUMMARY

2,263 total occ.

696 animals

1,481 plants

35 other kingdoms

VIEW SPECIES

size 723,521 (ha) natural park

OVERLAY

- Flickr pics
- Panoramio pics
- Wikipedia info

VIEW PICTURES

Powered by: UNEP | WCMC | GBIF report bug developed by vizzuality share on facebook



Czech EPBRS – meeting:
 „World Biodiversity and European Taxonomy“
 19-22 May 2009, Pruhonice










The Mercantour National Park - Central Area


The Mercantour National Park - Central Area is found in France. It was established in 1979. This site is 68500.00ha.













WDPA Info | WDPA Info Flash (Beta) | **GBIF Species Info** | MetaData

Protected areas in **Frankreich.** Mercantour



About this widget |   

← Species | Data sources | Download Data | View All Areas | Pictures → 

Data sources	Occurrences
-  Biologiezentrum der Oberoesterreichischen Landesmuseen	47
 Biologiezentrum Linz	47
-  European Environment Agency	181
 EUNIS	181
-  Muséum national d'histoire naturelle et Réseau des Herbiers de France	2
 Phanerogamie	2
•  NLBIF	5
-  Staatliches Museum fr Naturkunde Stuttgart	1,897
 EDIT - ATBI in Mercantour/Alpi Marittime (France/Italy)	1,897
•  Steiermrkisches Landesmuseum Joanneum - Herbarium GJO	1
•  Tiroler Landesmuseum Ferdinandeum	127
•  University of Vienna, Institute for Botany - Herbarium WU	3

Protected areas in Spain.

About this widget   



← Species

Pictures →



Protected areas in Spain.

About this widget






← Species

Pictures →



Protected areas in Spain. Sumava CHKO

About this widget   



← Species

Data sources



Download data

View all Areas

Pictures →



Protected areas in
Spain. Sumava CHKO
















About this widget  



[back to map](#) →

list tree

 219 Observations  979 Specimens  814 Other  2,012 Total

Taxon				
-  Animalia	0	176	44	220
-  Arthropoda	0	162	34	196
-  Crustacea	0	0	1	1
 Ostracoda	0	0	1	1
 Insecta	0	162	32	194
 Merostomata	0	0	1	1
 Brachiopoda	0	0	3	3
-  Chordata	0	14	2	16
-  Actinopterygii	0	8	0	8
 Salmoniformes	0	7	0	7
 Salmonidae	0	7	0	7
 Salmo	0	7	0	7
 Salmo trutta	0	7	0	7
 Scorpaeniformes	0	1	0	1
 Aves	0	6	2	8
 Hemichordata	0	0	1	1
 Mollusca	0	0	4	4
 Fungi	1	2	658	661

Protected areas in Spain. Sumava CHKO

About this widget  



Species

Data sources

Download data



View all Areas

Pictures



Data sources	Occurrences
• Biologiezentrum der Oberoesterreichischen Landesmuseen	946
- Bioersity International	2
EURISCO, The European Genetic Resources Search Catalogue	2
- Bundesamt fr Naturschutz / Netzwerk Phytodiversitt Deutschland	1,027
Bundesamt fuer Naturschutz / Netzwerk Phytodiversitaet Deutschland	1,027
- Marine Science Institute, UCSB	10
Paleobiology Database	10
- Muséum national d'histoire naturelle et Réseau des Herbiers de France	1
Phanerogamie	1
- Natural History Museum, University of Oslo	2
Lichen herbarium, Bergen (BG)	2
- Prirodoslovni muzej Slovenije	3
World flea collection of Slovenian Museum of Natural History (excluding Slovenia)	3
- Steiermrkisches Landesmuseum Joanneum - Herbarium GJO	1
Herbarium GJO	1
- SysTax	1
SysTax	1
• Tiroler Landesmuseum Ferdinandeum	4
• University of Vienna, Institute for Botany - Herbarium WU	1

Protected areas in Spain. Sumava CHKO

About this widget  



[Species](#) [Data sources](#) [Download data](#) [View all Areas](#)

[Map](#) [Satellite](#) [Hybrid](#) [Terrain](#)

Select your preferred download format



[or cancel and continue browsing](#)

GBIF DATA SUMMARY

2,012 total occ.

220 animals

797 plants

574 other kingdoms

[VIEW SPECIES](#)

723 521 (tax) total pres.

OVERLAY

- Flickr pics
- Panoramio pics
- Wikipedia info

[VIEW PICTURES](#)



Download ready

Your download is now ready

Please **click the link** to download your search results. This link will be valid for the next **24 hours**.

Occurrences download

Description: Coordinate status is Includes coordinates, Protected Area is Sumava CHKO ([Original search](#))

▸ [occurrence-search-12409198515341131470790360490623.zip](#) (approx file size 67 KB)

Download generated in 8 seconds

Recently viewed

▾ [Preparing download...](#)

Conclusions: Taxonomy – for the future of biodiversity!

Taxonomic research needs

- 1) to **transform** into a more efficient and *sustainable information science*, through:
 - accelerating rapidly the generation & exchange of data / information by applying new technologies
 - integrating data & collections towards common research infrastructures (GBIF, LifeWatch, CBOL)
 - scaling up from individual driven research - towards international cooperative efforts !
- 2) to become fully **integrated** into mainstream biodiversity **conservation** and **politics**



Czech EPBRS – meeting:
„World Biodiversity and European Taxonomy“
19-22 May 2009, Pruhonice



The science side: how to transform taxonomy

DIVERSITAS

CP „bioGENESIS“

– new „science plan“



Czech EPBRS – meeting:
„World Biodiversity and European Taxonomy“
19-22 May 2009, Pruhonice



Focus 1. New strategies and tools for documenting biodiversity

TASK 1.1 Discovering the unknown

DIVERSITAS, through bioGENESIS, will play a key role in establishing and maintaining international expertise, protocols, infrastructure, and data sharing mechanisms relevant to the discovery and description of biodiversity. Through bioGENESIS working groups and the formation of strategic partnerships with other relevant organizations (GBIF, TDWG, IBOL, GTI, GEO, CoML, EDIT, etc.), we envision the development of international standards for biodiversity repositories and "species discovery" centres, including best-practices for field work, for the collection and curation of voucher specimens, for imaging and DNA sequencing technologies, for the digitization of legacy data, for tissue – and DNA – banking and microbial culture facilities, and for the development, maintenance, and connectivity of relevant databases.

We will especially promote efforts to document the biodiversity of bacteria (Box 1), fungi (Box 2), and other microbes. These groups are expected to contain the majority of unknown taxa (SBox S1), some of which will prove to be of enormous value to humans (e.g., in the development of new drugs and bio fuels; e.g., Smith et al. 2008; Box S2). As biological communities are generally composed of few dominant species, and many more that are rare, special attention must be given to improving the efficiency of discovering and describing low-abundance organisms. For microbes, the sequencing of environmental samples (metagenomics) has created the possibility of advancing our understanding of microbial diversity by orders of magnitude. Likewise, for small plants and animals, new "industrial-strength" sampling protocols have greatly accelerated the discovery of unknowns (e.g., Bouchet et al. 2002; Box S3).

bioGENESIS working groups will also address issues surrounding (1) access to materials and collection, which currently present impediments to progress in the discovery



© National Geographic

and description of biodiversity: (2) the development of local taxonomic capacity (including the work-force of in-country para-taxonomists; Box S1), focusing on providing training in low- and high-tech field, museum, and laboratory methods; and (3) access to, and utilisation of, spatial, environmental information and new tools for spatial analysis, including GIS-based niche-modelling and prediction techniques, to increase the efficiency of field-sampling and discovery.

Research Objectives and Activities

- Develop improved strategies and best-practices for global inventory and the discovery and description of biodiversity, increasing the efficiency of field sampling and the quality and accessibility of collections. This objective integrates with activities being carried out under the GTI and in GBIF, and links directly with the bioDISCOVERY Core Project and its ongoing involvements in the GEOSS effort (GEO BON).
- Promote the application of next generation DNA sequencing technologies to reveal the biodiversity and functions of microbes. This initiative relates directly to the assessment of global genetic diversity described below under Task 3.4.
- Facilitate the formulation of new policies regarding the collection of biological specimens for scientific research. This relates directly to Access and Benefit Sharing (ABS) under the CBD. bioGENESIS activities have already stimulated discussions that are informing the development of an international ABS regime.

BOX 1. Molecular approaches to discovering microbial diversity in the oceans

From the very beginning of life on Earth, microorganisms have been responsible for the cycling of materials through the biosphere. Although knowledge of the diversity and functioning of microbes is indispensable for understanding biological processes in the ocean, relatively little is known to date. Most microbes are not yet cultured and the function of most of their genes is still unknown. It is highly likely that undiscovered microbial diversity will reveal entirely new biological functions and chemical compounds, some of which will provide the raw material for human innovation into the future.

Recent studies conducted in the Sargasso Sea using whole genome shotgun sequencing revealed the presence of 148 previously unknown bacterial phylotypes (Venter et al. 2004; Fig. 1.1). In addition, more than 1.2 million previously unknown genes were identified. The application of molecular techniques, especially metagenomic approaches, has revealed an enormous diversity of undescribed, mostly uncultivable microbes (National Research Council 2007). Progress in sequencing technology has made it possible to analyse huge numbers of genes very rapidly. Sogin et al. (2006), for example, developed the parallel tag sequence method and used this in combination with pyrosequencing technology. Their analyses revealed the presence of an immense number of low-abundance populations, which accounted for most of the observed phylogenetic diversity in deep-sea samples from the Atlantic (Fig. 1.2).

References

National Research Council. 2007. The new science of metagenomics: revealing the secrets of our microbial planet. Committee on Metagenomics: Challenges and Functional Applications, National Research Council, National Academies Press.

Sogin ML, Morrison HG, Huber JA, Welch DB, Huse SM, Neal PR, Arrieta JM and Remdel GJ. 2006. Microbial diversity in the deep sea and the unexplored "rare biosphere." *Proceedings of the National Academy of Sciences USA* 103:12215-12220.

Venter JC, Remington K, Heidelberg JF, Halpern AL, Rusch D, Eisen JA, Wu D, Paulsen O, Nelson KE, Nelson W, Fouts DE, Levy S, Knap AH, Lomas MW, Nealson K, White O, Peterson J, Hoffman J, Parsons R, Baden-Hilson H, Pfannkuch C, Rogers YH and Smith HD. 2004. Environmental genome shotgun sequencing of the Sargasso Sea. *Science* 304:66-74.



FIG. 1.1. Collection of seawater for metagenomic analysis. ©Klogre.

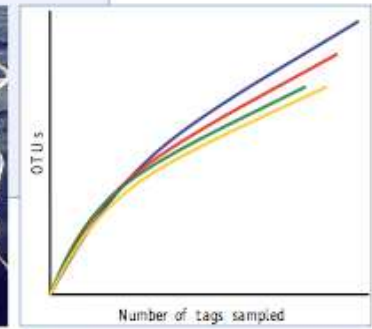


FIG. 1.2. Rarefaction of microbes (after Sogin et al. 2006). ©Klogre. OTU: Operational Taxonomic Units.



Czech EPBRS – meeting:
„World Biodiversity and European Taxonomy“
19-22 May 2009, Pruhonice



Recommendations *for „integration“ of taxonomy: taxonomists*

- Collect all your (field) data immediately digitally and fully geo-references conforming to recognized data standards and protocols and applying available new technologies & tools;
- Overcome personal “ownership” feeling of data, contribute to and enjoy freely sharing of “your” data
- Contribute to and participate in international / global research information infrastructures (FishBase, GBIF, LifeWatch, CBOL, etc)



Czech EPBRS – meeting:
„World Biodiversity and European Taxonomy“
19-22 May 2009, Pruhonice



Recommendations

for „integration“ of taxonomy: (science) policy

- Provide/set clear incentives for contributing and sharing (taxonomic) data: new crediting schemes and data management policies – for/from research funding organizations!
- Mainstream non-professional “taxonomic” bodies / communities / initiatives in biodiversity inventories, (field) assessment & monitoring programs
- Sustain and expand international biodiversity information infrastructures (GBIF, LifeWatch)
- Maintain/increase taxonomic education & training at all levels, particularly at high schools / universities



Czech EPBRS – meeting:
„World Biodiversity and European Taxonomy“
19-22 May 2009, Pruhonice



Acknowledgements

Many thanks to:

- funding organizations: **EC (DG RTD)**, **BMBF / DLR**;
- all **EDIT** partners + colleagues participating in WP7 (ATBIs)!
- Anke Hoffmann, Alexander Kroupa, Andreas Kunkel: MfN, Berlin
- Jutta Eymann, Joachim Holstein, Carlos Monje, Martin Nebel, Monika Pfeffer, Marcus Preussing, Axel Steiner: SMNS, Stuttgart
- Klaus Riede: ZFMK, Bonn; Robert Trusch: SMNK, Karlsruhe
- Eduard Stloukal, Comenius University, Bratislava
- Pierre Commenville, Marie-France Leccia: Parc national du Mercantour
- Marta De Biaggi, Luca Giraud, Patrizia Rossi: Parco Naturale Alpi Marittime
- Philippe Bouchet, Simon Tillier: MNHN, Paris
- Swen Renner, Peter Herkenrath: BirdLife International
- Samy Gaiji, Nick King: GBIF Secretariat, Copenhagen
- Anne-Helène Prieur-Richard, Bruno Walter: DIVERSITAS Secretariat, Paris
- Michael Donoghue, Yale & all colleagues of the DIVERSITAS “bioGENESIS” Science Committee



Czech EPBRS – meeting:
„World Biodiversity and European Taxonomy“
19-22 May 2009, Pruhonice



EDIT

European
Distributed
Institute of
Taxonomy

1st EDIT WP7 ATBI+M pilot site (www.atbi.eu):

Mercantour / Alpi Marittime NPs



**Thank you
for your attention!**

Taxonomic Associations & Societies

Membership

- ETI World Taxonomists Database: 4,800
- American Ornithologists' Union (AOU): 3,600
- The American Society of Plant Taxonomists: >1,300
- The Orchid Society of Great Britain: >1,000
- Societas Europaea Lepidopterologica [= butterflies & moths] (SEL): >650
- [German] national birdcounts (2008): >45,000 recorders/participants



Czech EPBRS – meeting:
„World Biodiversity and European Taxonomy“
19-22 May 2009, Pruhonice

