Chapter 2

The European Distributed Institute for Taxonomy (EDIT) and the "all taxa biodiversity inventory & monitoring" (ATBI+M) approach

by

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1. The European Distributed Institute of Taxonomy (EDIT)

While providing the overall framework for integrating the available knowledge on the Worlds' organisms and thereby linking all biological sciences, taxonomy has been and continues to be not a quickly delivering discipline of research. Rapid progress in taxonomy and systematic is still hampered by a huge degree of fragmentation both in effort, and its deliverables and products. While looking back over more than 250 years of continuing scholarly efforts to catalogue the Worlds organisms, still today there is no single global inventory or directory of just all known species available, and most countries and regions lack current up-to-date inventories for large parts of their biota (Soberón & Peterson, 2009). The general challenge facing taxonomy is integrating and making available a vast amount of information scattered across 250 years of literature, in countless biological collections all over the world, on a growing number of websites, and in the minds of taxonomists belonging to hundreds of institutions worldwide. Even today new species descriptions (ca 20,000 each year) are being published scattered across many hundreds of specialist journals and monographs, without even a globally universal index available (Polaszek, 2005). This hampers efficient work even for taxonomists and makes it harder for researchers to increase society's understanding of biodiversity and ecosystems functioning. The increasing need for overcoming this information bottleneck and transforming taxonomy towards a more integrative, modern information science have long been recognized and expressed by scholars within and outside taxonomy (*e.g.*, Godfrey, 2002; Mallet & Willmott, 2003; Scoble, 2004; Wheeler & Valdecasas, 2005; Mayo *et al.*, 2008; La Salle *et al*., 2009; Schlick-Steiner *et al*., 2010).

As taxonomy also provides elementary baseline data and an operational framework for biodiversity conservation, biological control, forest management, and many other applied fields (Rosen, 1986; New 1996; McNeely, 2002), this has direct and often far reaching consequences for efforts to reduce biodiversity loss and provide more environmental sustainability. Conservationists, ecologists, and other stakeholders of biodiversity need not only taxonomic checklists and revisions, but also integrated, user-friendly access to species names, as well as the means to identify them, their distribution, and their general biology (Golding & Timberlake, 2003). At present, such access is poor. The challenge for the taxonomic community is to find ways of increasing data quality and providing wider access to information through integration of effort and data sources.

With support from the European Commission under its 6th Framework Programme (FP6), the European Distributed Institute of Taxonomy (EDIT: www.e-taxonomy.eu) aims at addressing these problems of information access and management of knowledge in a rapidly changing environment. EDIT is the collective answer of a consortium of 29 leading European, North American and Russian taxonomic institutions to a dedicated call of the European Commission, issued in 2004, for a network in "Taxonomy for Biodiversity and Ecosystem Research" (Tillier *et al.*, 2005). The EDIT network started in 2006 with funding for five years, under the following operational and structural objectives:

- [1] To reduce fragmentation and to transform taxonomy into an integrated science
- [2] To strengthen the scientific, technological and information capacities needed for Europe to understand how biodiversity is modified through Global change
- [3] To progress toward a transnational entity by encouraging durable integration of the most important European taxonomic institutions, forming the nucleus of excellence around and from which institutions and taxonomists can integrate their activities
- [4] To promote the undertaking of collaborative research developing, improving and utilising the bio-informatics tools and technologies needed
- [5] To create a forum for stakeholders and end-users for taxonomy in biodiversity and ecosystem research
- [6] To promote the spreading of excellence to fulfil the needs of biodiversity and ecosystem research for taxonomy based information.

EDIT aims at building a virtual centre of excellence in taxonomy, facilitating interaction and access for providers – the researchers in taxonomy, inside and outside the consortium – as well as for users – researchers in biodiversity and ecosystems, but also all stakeholders involved in biodiversity conservation. The means and activities to progress toward these objectives are structured in seven interacting work packages (WPs) defined by specific integrative objectives (Fig. 1):

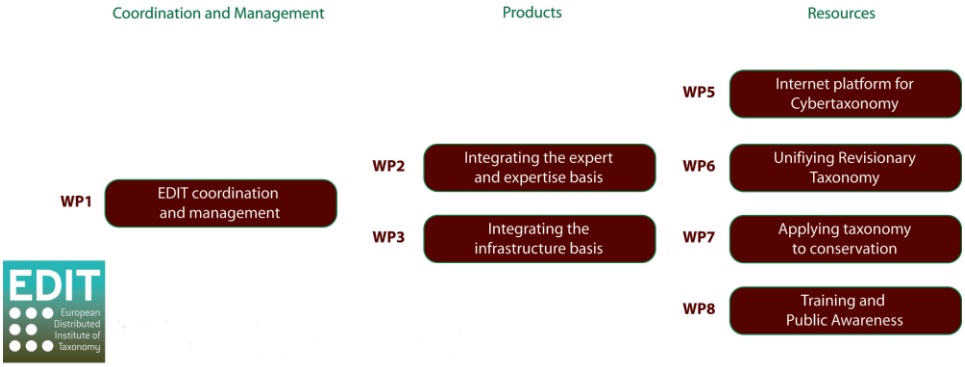

Fig. 1. The organizational structure of EDIT.

The scientific management and coordination of joint activities is conducted by the Network Office (WP1) and the Network Steering Committee (NSC), coordinated by the Project Leader according to advice provided by the Scientific Advisory Council (SAC), and strategic decisions taken by the Board of Directors (BoD). The organizational structure of EDIT is designed not only to facilitate effective monitoring and reporting of progress, but also to allow the network to develop and flourish over the 5 years of integration, thereby enabling the EDIT network to become the basis of lasting collaboration. The structure allows flexibility for

institutional members and also promotes shared responsibility for the network's sustainability as well as encouraging both formal and informal channels of communication.

EDIT specifically aims to strengthen the input of taxonomic expertise for biodiversity conservation. Therefore it organizes and supports the participation of taxonomists and other experts in biodiversity inventory and monitoring efforts in protected areas through its Workpackage 7, "Taxonomy for Conservation". The mechanism for achieving this objective is the establishment of "All Taxa Biodiversity Inventories + Monitoring" (ATBI+M) sites for selected protected areas and other areas of specific conservation concern.

2. All Taxa Biodiversity Inventories + Monitoring: The ATBI+M approach

The increasing need of sound taxonomic information and expertise for the successful implementation of biodiversity policies and, especially, conservation management programmes has been expressed widely at European and international fora. With the prevailing political focus on the establishment of an effective global network of protected areas for biodiversity conservation, efforts supporting an efficient inventorying and monitoring of biodiversity in existing and proposed protected areas seem particularly pertinent.

The current state of baseline inventory data and sound monitoring systems for most protected areas, however, is still highly inadequate. Even for generally well-studied and documented taxa like mammals, birds, vascular plants or groups of special conservation concern, such as species included in red lists or targeted in the European Natura 2000 initiative, existing inventories are not always regularly updated. Often, comparable data sets over larger time intervals documenting changes of the respective species and populations are not available or incomplete, due to the absence of monitoring programmes (Henry et al. 2008). Furthermore, most areas still lack basic inventory data usually for many groups, often comprising the largest parts of biodiversity (e.g., insects, fungi, micro-organisms), both in terms of species numbers, biomass, and ecological impact. Sound baseline inventory and monitoring data can provide the most reliable indicators for assessing effects of global environmental change on biodiversity. In more general terms, sound biodiversity inventories based on reliable species identification present elementary pre-requisites for implementing any taxon-specific conservation policy or management, such as the Natura 2000 directive.

2.1. What are ATBI+Ms?

ATBIs are intensive, large-scale efforts to record, identify, and document the entire biodiversity of a given area. EDIT's ATBI+M sites are different from traditional approaches in their longer-term orientation: from an initial species inventory, they will form the basis for future monitoring biodiversity changes over time in an era of global change. Furthermore, all species inventories are based not on mere presence-absence statements, but have to build on geo- and time-referenced primary occurrence data, i.e., actual records of individual organisms at a specific place and time, which can easily be tied to soil, climate, and other

abiotic information. It is important to understand that the goals of an ATBI+M include compiling species lists, but that such lists by themselves are of little direct conservation value. An ATBI+M collects information on habitat, distribution, time and date of occurrence for the species observed, abundance, and where possible, life history information. All groups are included and eventually targeted for research, but no one is under the illusion that every single species will be found, at least not over a shorter time span.

2.2. How did ATBIs arise?

The rationale leading to the concept of ATBI is expressed by White & Langdon (2006) as follows: “There is a fundamental flaw in how most parks and other natural reserves have been managed. In general, we have ignored a basic principle that would be fatal in the competitive world of business: we have never attempted a comprehensive inventory of our resources. This is surprising since the clearly stated purpose of most governmental and non-governmental conservation organizations has always been to protect and preserve the natural and cultural resources entrusted to their stewardship. How can we be intelligent stewards if we do not even know what kinds of resources we have, where they are found, their rarity, or, in the case of natural resources, some inkling of their ecological role?”

Dan Janzen, a renowned US ecologist, first conceived the idea and coined the expression of an All Taxa Biodiversity Inventory (ATBI) while conducting research in Costa Rica. Janzen’s concern about the rapid loss of tropical biodiversity prompted him to convene an international workshop to develop an approach for completing comprehensive inventories in a short amount of time (Janzen & Hallwachs, 1994). However, an initial attempt for an ATBI in the Area de Conservación Guanacaste in northwestern Costa Rica was terminated in 1996, when the organization responsible for receiving international funding and donations re-directed funds to other scientific endeavours.

In the fall of 1997 a call was issued to interested scientists and other partners to attend a rapidly convened, multi-day conference on the possibility of establishing an ATBI at the Great Smoky Mountains National Park (USA). Conference participants including Dan Janzen and Winnie Hallwachs who attended as advisors agreed that a second attempt for an ATBI was imperative, and that the Smokies was a good venue for such an attempt. As this project was too large for any one park, university, or museum to plan and manage, a new private, non-profit organization, Discover Life in America (DLIA), was created and eventually incorporated. There were to be three major thrusts or beneficiaries of the project: stewardship, science, and education. Following its establishment the project has seen increased participation, and 6,339 species new to the park have been recorded and 890 new species have been described (Sharkey, 2001; White & Langdon, 2006).

2.3. How are EDIT ATBI+M pilot sites initiated and how to participate?

Initially two EDIT workshops were held in 2006 and 2007 at the State Museum of Natural History in Stuttgart for interested partners, where 22 European and 11 non-European protected areas were proposed as potential ATBI+M pilot sites (see www.atbi.eu/forum/?q=node/682). All proposals were evaluated by participants and EDIT partners according to their scientific (taxonomic) interest, accessibility and logistics, local interest and support, as well as the state of knowledge and available data (Häuser *et al*. 2007). Following a ranking and further considerations of budget and feasibility, negotiations towards signing a Memorandum of Understanding (MoU) with the relevant authorities and counterpart institutions were conducted for selected sites, which specified conditions under which inventory and monitoring field work would be carried out, including possibilities of collecting biological specimens and obligations of data-sharing between EDIT's ATBI+M participants and the other partners. In generic terms, the EDIT ATBI+M approach provides individual taxonomists and other experts with opportunities to conduct their research under specific conditions at the pilot sites while agreeing to deliver and share all primary occurrence data and records with the relevant authorities and the project. As an additional incentive for participation, EDIT also provides limited support for travel and accommodation, as well as for logistics and equipment also encouraging the use of new recording tools and techniques. While participants can use the data and materials generated for their own research, they are obliged to provide the primary observation and collection data in a defined digital format, which allows for easy integration of records from many individual participants (Häuser *et al*. 2009).

Potential participants can register their interest at a dedicated website, a so-called "ATBI+M forum", where they can indicate their expertise, specific research interests and preferences, and also download relevant information guidelines and documents (www.atbi.eu/?q=node/1026). To initiate their participation all individual participants have to sign and submit detailed Terms of Reference which specify responsibilities and obligations, both for the participant, the EDIT project, and relevant authorities and counterparts. Arrangements for field work are made directly with project managers at the pilot site, whereas financial aspects are handled by the EDIT WP7 project management. EDIT's funding-schemes for supporting participants is adapted to each ATBI+M pilot site. Basically, transportation costs, accommodation and daily allowances are granted up to a fix amount for individual visits up to 2 weeks. All participants need to familiarize themselves with the data guidelines before embarking on any field work (see Chapter 4, for details). Reimbursement of costs claimed by participants occurs only in return for data delivered.

Filled-in tables of the localities visited and the collecting events from each field trip or session, at least, need to be submitted when asking for reimbursement, for which 70% of the costs claimed can be reimbursed directly following the fieldwork. Full reimbursement or reimbursement of the remaining 30% of costs will only occur after submitting the complete inventory/monitoring data.

All data delivered by participants have to undergo a data checking and cleaning procedure during which a close contact between the EDIT WP7 management and the individual scientist is maintained, which generally results in improved datasets which are subsequently uploaded to dedicated websites for individual ATBI+M pilot sites. The data generated from EDIT ATBI+M pilot sites are also made accessible through the Global Biodiversity Information Facility (GBIF: http://data.gbif.org), which also offers a means of immediate publication of the original data while crediting the individual researcher or recorder. Another possibility to search for these data is via the 'EDIT Specimen and Observation Explorer for Taxonomists' developed as part of EDIT WP5 activities (Zippel *et al*., 2009). Further to these presentations of data for scientists and other users, all primary data generated through the project are also provided directly to the park and relevant authorities, which can directly incorporate the data into their geographic information systems and other applications for more effective park management. The availability of new, accurately timed and geo-referenced, digital biodiversity data greatly enhances capabilities for efficient and timely protected area management, at least for the active ATBI+M pilot sites.

3. First experiences from EDIT ATBI+M pilot sites

EDIT has established between 2007 and 2008 two larger European ATBI+M pilot sites, which both remain fully operational. The first pilot site comprise the Natural Parks Mercantour (France) (Fig. 2A) and Alpi Marittime (Italy) (Fig. 2B), and the second one is located in the Gemer region (Slovakia). The latter is composed of the three Slovakian National Parks "Muránska Planina", "Slovenský Kras", and "Slovenský Raj" (Fig. 3).

Fig. 2. A. Impression of Mercantour National Park. **2. B.** Impression of Alpi Marittime National Park. (Photos by Anke Hoffmann).

Fig. 3. Impressions of the Gemer area (Photos by Anke Hoffmann).

More detailed information about these European ATBI+M pilot sites can be found on the following dedicated EDIT and park websites:

Mercantour/Alpi Marittime: www.atbi.eu/mercantour-marittime
Gemer: www.atbi.eu/gemer
Mercantour: www.mercantour.eu
Alpi Marittime: www.parks.it/parco.alpi.marittime/Eindex.html
Muránska Planina: www.gemer.sk/ciele/mplanina/en.html
Slovenský Kras: www.gemer.sk/ciele/skras/en.html
Slovenský Raj: www.slovenskyraj.sk/en.html

3.1. ATBI+M pilot site Mercantour / Alpi Marittime (France / Italy)

Following the signing of a Memorandum of Understanding between representatives of the Mercantour and Alpi Marittime Natural Parks and EDIT, activities at this bi-national ATBI+M site started in 2007. Since its establishment participation at this site has constantly increased, especially for the number of involved scientists (Fig. 4). As of December 2009, 170 scientists from 12 countries (42 institutions) had visited the two parks having spent a total of 1,561 field days. During this time period, a total number of 4,772 species have been recorded and 25,583 individual data sets on their distribution within the parks have been delivered (Fig. 5). The strong increase in both the number of recorded species and data sets between 2007 and 2008 is explained by the time needed to identify the collected specimens, usually during winter and spring. Still a good number of data sets are expected to be delivered until the spring of 2010 and field surveys during the vegetation period of this year will result in a further increase of both the number of recorded species and individual data sets.

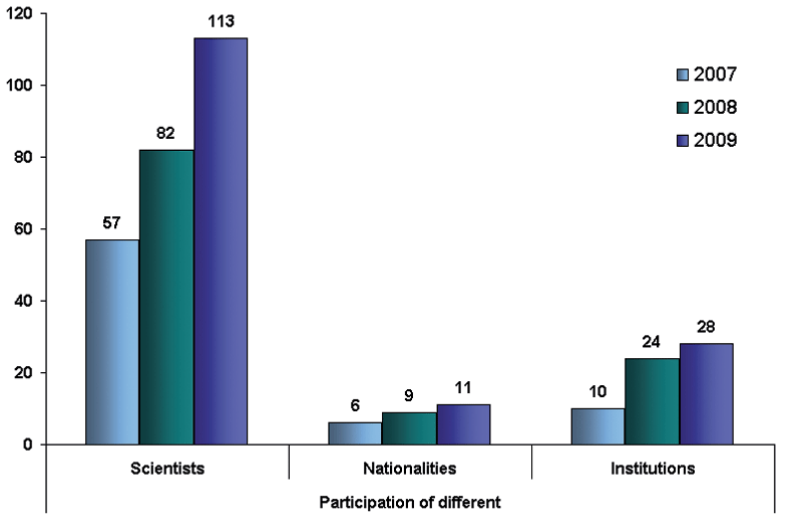

Fig. 4. Participation at the ATBI+M pilot site Mercantour / Alpi Marittime (2007 – 2009).

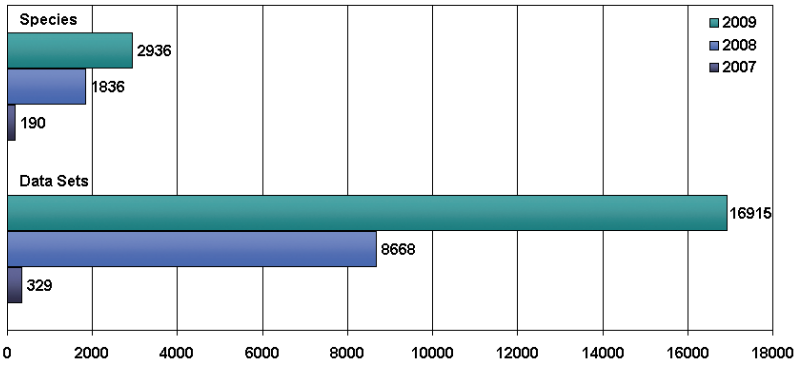

Fig. 5. Number of identified species and delivered data sets and their annual distribution (2007 – 2009) for Mercantour / Alpi Marittime pilot site.

Animals comprise almost two thirds of the reported species (n = 3092, Fig. 6), with insects being the largest represented group (91.1%). The insect groups with the highest species numbers recorded so far correspond to the Lepidoptera (n = 1890), and the Coleoptera (n = 489). In summary, important additions to the knowledge on the flora and fauna of this ATBI+M pilot site have been achieved so far:

- 59 new species records for the parks;
- 33 new species records for France/Italy;
- 2 species, at least, new to science.

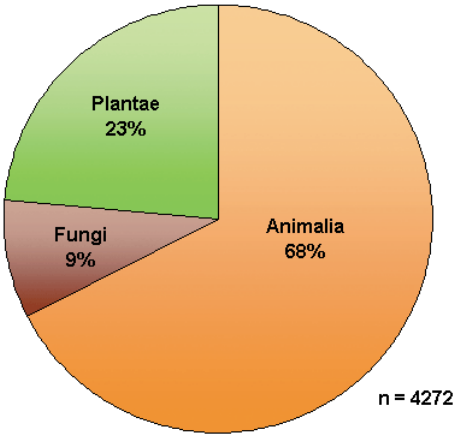

Fig. 6. Proportion of records for different kingdoms for total number of species for Mercantour / Alpi Marittime pilot site.

Individual data sets of all recorded species can be found on the Mercantour/Alpi Marittime website www.atbi.eu/mercantour-marittime/ under "park biodiversity" and "taxonomic details". At the GBIF portal, the respective data are available at: data.gbif.org/datasets/resource/7949/.

3.2. ATBI+M pilot site Gemer region (Slovakia)

In January 2007, the Memorandum of Understanding was signed by representatives of EDIT and the Slovakian national nature conservancy, and field activities started fully in 2008. Up-to-date 39 researchers from 12 countries (26 institutions) have visited 75 times the ATBI+M Gemer area, and have spent more than 500 days in the field. From 2008 to 2009 the amount of field days has increased by 67%. The main focus of research was on the Muránska Planina National Park, only a third of the research was pursued in the two other National Parks of the Gemer area. In 2009, the interest for Slovenský Raj and Slovenský Kras has increased, but further promotion for those sites is needed. The preference by researchers for the Muránska Planina National Park is probably based on the ideal logistics at this site, which includes a field station (Fig. 7). The field station with some laboratory infrastructure is part of the information centre of the Muránska Planina National Park at Murán village, where accommodation is also available for participants.

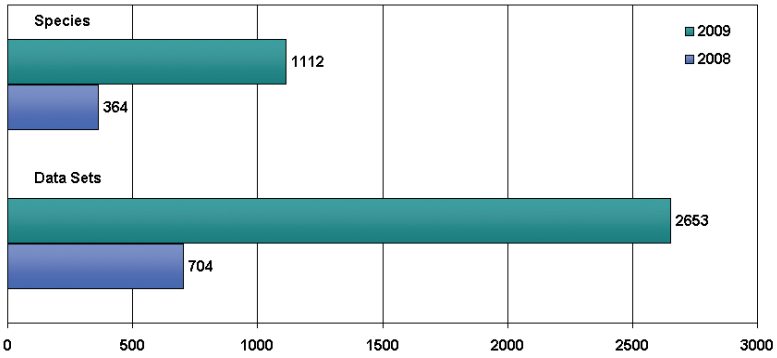

Fig. 7. Number of identified species and delivered data sets and their annual distribution (2007 – 2008) for the Gemer ATBI+M pilot site.

So far, a total of 1,360 species (3,357 data sets) have been documented for the Gemer ATBI+M pilot site to date (Fig. 8). Animals represent more than half of all recorded species (n = 751) (Fig. 9), whereas 83% of this group are made up of insects, mainly Diptera (n = 318) and Lepidoptera (n = 305). These results indicate that there is still a high demand for further experts targeting other groups at the Slovakian ATBI+M sites. Individual data sets of all recorded species can be found on the EDIT Gemer website: www.atbi.eu/gemer/ under "park biodiversity" and "taxonomic details". At the GBIF portal, the respective data are available at data.gbif.org/datasets/resource/7950/.

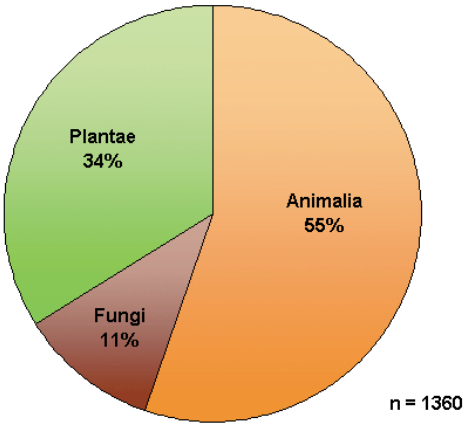

Fig. 8. Proportion of records for different kingdoms for total number of species for the Gemer ATBI+M pilot site.

Fig. 9: Field station for ATBI+M participants in Murán village. (Photos by Lellani Farinas and Anke Hoffmann).

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