

Why and how did LifeWatch emerge?

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Abstract

The original vision on what later became LifeWatch ERIC started about a quarter of a century ago in 1996. In those days, the promise of digital technologies entered biodiversity and ecosystem research. Not only by digitizing relevant information, but also with applications to process such data. While several (inter)national initiatives embarked on specific topics, there was also an idea that the upcoming view on grid computing provided attractive solutions for federated data sources, together with a strong computing capacity. This paper presents the history from conception to early actions, until actual preparations towards a research infrastructure on the European scale.

Keywords

LifeWatch, Research Infrastructure, data, computing, history

Overview and background

The early ideas to create virtual (data and analysing) environments for biodiversity and ecosystem research originated in a community of dedicated European scientists and ICT experts. They gradually concretised the vision which until now serves as a guidance for further developments. The short text below is a summary description of LifeWatch as drafted in July 2006, showing that this initiative was in focus through the past 20-25 years. This text contributed to the first Roadmap 2006 of the European Strategy Forum for

Research Infrastructures (https://www.esfri.eu/sites/default/files/esfri_roadmap_2006_en.pdf).

LIFE WATCH will construct and bring into operation the facilities, hardware and software and governance structures necessary to create a biodiversity research infrastructure, consisting of: Infrastructure networks for data generation and processing, facilities for data integration and interoperability, virtual laboratories to allow for utilising a range of analytical and modelling tools and a Service Centre to provide special services for scientists and to promote research opportunities for young scientists. Complex and multidisciplinary problems force scientists to collaborate in virtual organisations and the *LIFE WATCH* infrastructure is meant to facilitate the new developments of biodiversity science in this area.

LIFE WATCH will link ecological monitoring data collected from marine and terrestrial environments with the vast amount of data in physical collections. The wealth of large datasets from different (genetic, population, species and ecosystem) levels of biodiversity opens an unprecedented new area of research. Comparative data mining in these datasets will allow for interlinking the different levels of biodiversity and studying the existence and the mechanisms behind detected patterns.

Conception

The idea that information technology might provide a revolution in science arose in the early nineties of the previous century. In 1996, the US National Science Foundation put forward the proposal to consider international initiatives on biodiversity informatics and neuro-informatics. This was discussed in the OECD MegaScience Forum (currently the Global Science Forum) and it was concluded to establish an OECD working group to explore the ways to realise such initiatives. Later in 1996, the ESF-funded 'European Network on Systematic Biology' organised at the University of Amsterdam an international conference on 'Processing biodiversity information'. The OECD decision was publicly announced at the opening of this conference. This promoted acquaintance of the scientific community with what would end up with establishing GBIF.

The European representatives in the OECD working group had quite some interactions with officers of the European Commission to consider a call to fund and organise the relevant European efforts. When indeed such a call was published, the involved communities concluded to a single proposal to create a common platform for their diverse supporting activities: the European Network for Biodiversity Information (ENBI). The proposal was, at that time, also inspired by the developing digital grid technologies to federate digital resources from many locations. The analogy to the electric power grid, providing access to power on demand with economies of scale by bringing a large-scale federation of many suppliers and consumers together, was for many people inspiring. Key considerations were to coordinate federated resources that are not subject to centralised

control, to use open standards and general-purpose protocols and to deliver non-trivial qualities of service.

While in the meantime the GBIF plans matured, the negotiations between the initial funding countries revealed that the ambitions of the preparatory GBIF working groups could only partially be met. In the early 21st century, this triggered the start of related initiatives with activities that GBIF could not cover. Amongst these are the complementary initiatives of Encyclopaedia of Life, Catalogue of Life (covering Species2000 and ITIS - the Integrated Taxonomid Information System), Biodiversity Heritage Library, International Barcode of Life and, more recently, the Distributed System of Scientific Collections (DiSSCo). Similarly, the ENBI partnership gradually concluded that a European structure should come into place to continue and sustain the growing and maturing ENBI activities. The idea of a research infrastructure was raised to bring together access to the traditional biodiversity data sources with new genomic and IT (e-Bioscience) facilities in an infrastructure environment which allows for advanced data mining and knowledge development. Such a new large-scale infrastructure, together with an array of interpreting methodologies, should operate as an observatory of our environment.

A crucial coincidence at that time was the suggestion of a senior civil servant in the Dutch science ministry for the author of this paper to draft an outline plan for a new research infrastructure in the field of environmental sciences. ESFRI, the European Strategy Forum on Research Infrastructure, was established at that time and ideas for new types of infrastructure were invited. In the framework of ENBI, a one-pager was drafted with the suggestion to address the challenge of dealing with complexity of the biodiversity system, requiring a new e-science approach. It also argued the strong knowledge base in Europe with many supporting projects, with the necessity to bring these together in a distributed research infrastructure. This suggestion was submitted by the Netherlands to ESFRI and subsequently adopted. This resulted in the invitation by ESFRI to present a more detailed plan. The ENBI partnership did benefit from this momentum by preparing the plan as requested by ESFRI.

Early actions

In 2005, France organised an international meeting on biodiversity governance where Jacques Chirac, the then French president, expressed his view on an intergovernmental group on biodiversity change which later evolved to IPBES, the Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services. Since several European colleagues from biodiversity research networks were present at this meeting, the opportunity was taken to discuss the opportunity as offered by ESFRI. The networks represented were:

Network of Excellence 'Marine Biodiversity and Ecosystem Functioning' – MARBEF;

Network of Excellence, Marine Genomics Europe - MGE;

Network of Excellence, Ocean Ecosystems Analysis EUR-OCEANS;

Network of Excellence 'Terrestrial Biodiversity' - AlterNET;

Network of Excellence 'European Distributed Institute of Taxonomy' - EDIT;

Infrastructure network SYNTHESYS;

European Network for Biodiversity Information - ENBI;

Biological Collection Access Service for Europe - BioCASE.

Two follow-up meetings of these networks in Amsterdam and in Paris were chaired by Prof. Carlo Heip, professor at the University of Ghent and Director of the marine institute of the Netherlands Institute of Ecology NIOO in Yerseke. Subsequently, the ENBI project presented the agreed design study "Biodiversity data and observatories for European Research, BIODOBS". This plan brought together the existing separate components (species-level and ecosystem-level data; data integration facilities; on-line analytical and modelling tools) to add scientific value for the next generation infrastructure and operating as an observatory of our environment. By putting into place the essential infrastructure and information systems with analytical and modelling capabilities, the goal was to support the scientific community and other users in the public, commercial and policy sectors. The construction plan was expected to benefit from the increasing services by the Global Biodiversity Information Facility. While data capture itself would mostly be a national task, the new infrastructure should provide technologies to accelerate this, to integrate data and make databases interoperable and to bring these in a virtual laboratory environment to allow for analysing, modelling and experimenting.

The European Strategy Forum on Research Infrastructures

The original BIODOBS plan may be regarded as the initial LifeWatch design study and was subsequently assessed by the ESFRI Strategy Working Group for environmental sciences. The ESFRI Roadmap as published in 2006 presented LifeWatch as a selected potential research infrastructure. It is interesting how the infrastructure architecture was seen at that time. Building upon diverse (inter)national data providers, the proposed sequence of functionalities was: data access & interoperability, analytical tools, models, up to applications. Subsequently, lobbying activities started to raise publicity and further interest. At that time, an influential advisory body of the European Commission was the European Platform for Biodiversity Research Strategy. In its meeting of November 2006 in Finland, the EPBRS adopted the so-called Hanasaari Declaration on Biodiversity Research with the text:

"Biodiversity research is a necessity for ensuring a sustainable future.

European Union Member States and the Commission are committed to halt the loss of biodiversity (Commission Communication COM2006/216 final). This calls for an unprecedented effort from governments, the Commission, NGOs, researchers, business community and citizens. European scientists are ready to step up their efforts to answer the challenge through the acquisition and application of biodiversity research. Large-scale

and long-term multiple and integrated research involving experts from natural and socio-economic sciences and humanities is needed. This research depends on adequate and sustained funding from public and private sources, as well as institutional commitment. Large-scale and long-term research requires corresponding methods and networks. At the national level, this would imply, *inter alia*, securing biodiversity monitoring networks and data collection. At the European level, a research infrastructure for integration of data, methods and scientific communities is necessary to complement the national efforts (as suggested in the LifeWatch proposal which has been selected by the European strategic forum for research infrastructure, ESFRI). At the global level, biodiversity research capacity must be further strengthened. Thus, knowledge and science-policy interfaces are essential to support the decision-making processes”.

Towards the Preparatory Project

The ESFRI Roadmap 2006 and the expressed support as by the Hanasaari declaration assisted in actions to raise letters of interest for LifeWatch from European countries, as these were deemed as crucial first steps to explore the potential (funding) interest from countries. Nineteen European countries expressed their interest in the prospect of LifeWatch. As usual, ESFRI initiatives were invited to submit a European proposal for a preparatory project. On request of the collaborating scientific networks, the University of Amsterdam prepared a proposal for a FP7 LifeWatch preparatory project. Scientific and technical institutes from France, Germany, Italy, the Netherlands, Spain, Sweden and the UK were assigned to contribute to workpackages directed at:

- Elaborating the details of the construction plan (data resources, technical architecture, service organisation, legal structure, financial plan);
- Securing sufficient (potential) national commitments to establish LifeWatch and to start the construction.

An initial group of countries signed a memorandum of Intent to establish a Stakeholders Board with their representatives as provisional governing board. The proposal was subsequently funded for three years (January 2008 – January 2011). See CORDIS website: <https://cordis.europa.eu/project/id/211372>.

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Conflicts of interest

The authors have declared that no competing interests exist.