



## **Project of Interest “NextData”**

### **Proposal for a research project Data-LTER-Mountain**

**Harmonisation and standards for existing and newly collected Data and MetaData on LTER sites in Italian Mountain ecosystems**

**Proposing Consortium: CNR-IBAF, CNR-IREA, CNR-ISE, Univ. of Torino, Univ. of Molise, Univ. of Parma**

**Scientific Coordinator: Giorgio Matteucci**

**Scientific Responsibles of Research Units:**

**Paola Carrara – CNR-IREA**

**Michela Rogora – CNR-ISE**

**Michele Freppaz – Univ. of Torino**

**Angela Stanisci – Univ. of Molise**

**Giampaolo Rossetti – Univ. of Parma**

**Topic (number and title):**

(1) “Armonizzazione e raccolta dei dati esistenti e conduzione di nuove misure sullo stato e i cambiamenti degli ecosistemi montani italiani, sviluppo di un sistema di archivi e servizi di accesso ai dati e risultati della ricerca sugli ecosistemi montani del territorio nazionale, con particolare attenzione ai siti di ricerche ecologiche a lungo termine, e messa a disposizione dei dati relativi in archivi coerenti con gli archivi del Progetto NextData”

**TITLE OF THE PROPOSED PROJECT:**

**Harmonisation and standards for existing and newly collected Data and MetaData on LTER sites in Italian Mountain ecosystems.**

**Acronym: Data-LTER-Mountain**

Project under *WP 1.7: Mountain ecosystems and biodiversity* of NextData, specifically on long-term mountain ecosystem monitoring

**Project duration: 2013-2015**

**start date (before 31 January 2014): 02/01/2014**

**end date (no later than 30 September 2015): 30/09/2015**

**Scientific coordinator of the proposed project:**

Giorgio Matteucci

(Senior Researcher at CNR, coordinator of LTER-Italy)

**CNR Institute coordinating the proposed project:**

Istituto di Biologia Agroambientale e Forestale –IBAF

**Participating units, indicating the scientific responsible for each unit and the motivation for the inclusion in the proposal (in particular, illustrating whether and how the expertise of non-CNR partners is not available at CNR):**

**Unit 1 (CNR coordinating Institute): CNR-IBAF**

**CNR-IBAF - Istituto di Biologia Agroambientale e Forestale**  
**Area della Ricerca Roma-1**  
**Via Salaria km 29,300**  
**00015 Monterotondo (Roma)**

**Scientific Responsible: Giorgio Matteucci – [giorgio.matteucci@cnr.it](mailto:giorgio.matteucci@cnr.it)**

Studying natural and planted ecosystems and their responses to ecological and climatic drivers is one of the mission of CNR-IBAF. The Institute is involved in the Italian Long Term Ecological Research network since 2004, when the Scientific Responsible, who is involved since 2000, joined CNR. In the recent years, IBAF has been involved in several projects related to LTER activities and long-term monitoring such as: the Italian network of monitoring of forest ecosystems CONECOFOR, since 2004 (the Scientific Responsible since 1997) with projects funded by European Union (Forest Focus 2005–2007; LIFE+ FutMon 2009-2011) and Corpo Forestale dello Stato (2004, 2008, 2012-2013); the LIFE+ project EnvEurope, focusing on LTER objectives and sites (2010-2013), where IBAF coordinated the Action devoted to field testing (> 65 LTER sites in Europe participating) and the I-3 EU project ExpeER (2010-2014) focusing on standardisation of protocols for ecosystem research and on providing access to long-term research sites. Furthermore, IBAF was involved in the Network of Excellence ALTER-Net who provided the framework for the formal start of LTER-Europe and LTER-Italia. IBAF is involved in the Italian component of the e-infrastructure LifeWatch-Ita, coordinating the Thematic Centers.

The Scientific Responsible is the current coordinator of LTER – Italia and of the LTER site IT03-000-T “Forest of the Apennines” and of its Research Site “Collelongo-Selva Piana” (IT03-001-T).

**Unit 2: CNR-IREA**

**CNR-IREA – Istituto per il Rilevamento Elettromagnetico dell’Ambiente**  
**Via Bassini, 15**  
**20133 Milano**

**Scientific Responsible: Paola Carrara - [carrara.p@irea.cnr.it](mailto:carrara.p@irea.cnr.it)**

The Institute for Electromagnetic Sensing of the Environment (CNR IREA) performs research activities in remote sensing, electromagnetic sensing and environmental monitoring <<http://www.irea.cnr.it>>. It develops applications and services based on remotely sensed imagery and products of COPERNICUS Program and exploiting ICT most advanced techniques (Spatial Data Infrastructures, smart applications, sensor enablement, and web 2.0).

Currently the Milan Unit of IREA coordinates the development of the interoperable infrastructure in the MIUR flagship Project RITMARE, aimed at enabling data management and sharing for the whole Project. It has also been consultant and active participant in the creation of the data infrastructure of LIFE+ Project EnvEurope, to allow access and exploitation of observations from LTER stations in Europe. It is also involved as coordinator in ICT actions within the European IR LifeWatch.

CNR IREA staff is well qualified in the management of EU projects; relevant EC RTD experience in Earth Observation program GMES/Copernicus with coordination of FP4 SALMON (lakes) and FP6 AWARE (snow/water) projects; partnership in FP Geoland and GeoLand-2, Interreg IDE-Univers and EULAKES. International experience includes ESA Project Glasnowmap on monitoring Alpine snow.

CNR IREA is taking part in the ICT PSP project SABER aimed at tackling the Digital Divide, a great issue in mountainous areas.

### **Unit 3: CNR-ISE**

#### **CNR-ISE – Istituto per lo Studio degli Ecosistemi**

**L.go Tonolli 50**

**28922 Verbania Pallanza**

**Scientific Responsible: Michela Rogora – [m.rogora@ise.cnr.it](mailto:m.rogora@ise.cnr.it)**

The Istituto per lo Studio degli Ecosistemi carries out studies on ecosystem structure and dynamics and on its response to anthropogenic disturbance. It also develops methods of environmental monitoring. Since 1938, the main section in Verbania, formerly Istituto Italiano di Idrobiologia, carries out studies on lakes in Italy and in the World, and on their response to anthropogenic pressures. Study expertise covers all aspects of limnology, from community ecology, hydromorphology, chemistry to plankton, macrophytes, benthos and fish ecology.

CNR ISE has a long expertise in research on mountain lakes, in the Alps and in other remote regions (Himalaya, Andes, Svallbard Islands, Antarctica, Karakorum). It has been involved in several EU funded projects on mountain lakes, such as ALPE, ALPE2, MOLAR, EMERGE and EUROLIMPACS. CNR-ISE has been also involved in projects related to LTER and long-term monitoring of ecosystems, such as: the Italian network of monitoring of forest ecosystems (CONECOFOR), since 1997, the LIFE+ projects FutMon (2009-2011) and EnvEurope (2010-2013), the UN-ECE program ICP WATERS.

CNR ISE is responsible for freshwater sites within the case study “Alien species” in the LifeWatch-Ita research infrastructure. It is responsible for the LTER parent site “Himalayan lakes” (IT011-000-A) and for some research sites included in the parent sites “Subalpine lakes” (IT08-000-A) and “Mountain lakes”. (IT09-000-A). The scientific responsible in particular is coordinator of the LTER sites IT09-003-A, Lower Lake Paione and IT09-004-A, Upper Lake Paione

### **Unit 4: UniTO**

#### **UniTO – Università degli Studi di Torino - NatRisk**

**Via Leonardo da Vinci, 44**

**10095 Grugliasco (TO)**

**Scientific Responsible: Michele Freppaz – [michele.freppaz@unito.it](mailto:michele.freppaz@unito.it)**

The Interdepartmental Research Centre on Natural Risks in Mountain and Hilly Environments at the University of Torino it's a network of Departments for the theoretical and applied research on risk prevention and management in mountain areas. It's an interdisciplinary research team, specifically devoted to the analysis of the interactions between climate, pedological-geological environment and morphodynamic processes. UniTo has long-term expertise on mountain soil and snow investigations, with particular emphasis on the biogeochemistry of seasonally snow-covered areas

(gas fluxes, C and N dynamics in soil and soil solution). It has been involved in several national (e.g. PRIN) and EU funded projects (e.g. INTERREG).

Added expertise to CNR: Università degli Studi di Torino - NatRisk and its Scientific Responsible for the project are coordinating the LTER site “North-Western Italian Alps” (IT19-000-T) and will provide access to existing data and possible collection of new data for the research sites IT19-001-T “Mosso” and IT19-005 T “Torgnon”, in collaboration with the Environmental Protection Agency of the Valle d’Aosta Region. The Scientific Responsible is involved also in the research activity carried out at the LTER site “High elevation Apennines”, in the Majella National Park.

## **Unit 5: UniMol**

**UniMol – Università degli Studi del Molise**  
**Department of Bioscience and Territory**  
**University of Molise**  
**Contrada Fonte Lappone, Pesche - 86090 Isernia**

**Scientific Responsible: Angela Stanisci – [stanisci@unimol.it](mailto:stanisci@unimol.it)**

UniMol has long-term expertise on ecological research applied to the high elevation ecosystems of Apennines mountains, concerning the spatial pattern analysis of plant communities and its changes in the last decades, the effects of global warming on vascular plant diversity along elevation gradients, the anatomical plasticity of woody vegetation at high elevation, the detection of changes in tree cover and the influence of land use changes and global warming at the treeline ecotone.

UniMol has been involved in several EU funded projects related to LTER activities and long-term monitoring such as: GLORIA-Europe, the European dimension of the Global Observation Research Initiative in Alpine Environments (2001-2003), Resurvey of GLORIA-Europe (2008-2009), LIFEWATCH (2010), LIFE+08/ENV/IT/000399 ENVEUROPE as external assistance (2011-2012), COST Action ES1203 SENSFOR(2012-2016), COST ActionsFP0703 ECHOES (2009-2012), COST ActionsE27 PROFOR (2002-2006), COST Action E43 Harmonisation of National Forest Inventories in Europe: Techniques for Common Reporting; (2006-2010). LIFE09 ENV/IT000078 ManFor; FP7 INTEGRAL (2011-2014), FORMIT- FP7 (2012-2016). NEFIS-Network for a European Forest Information System 2002.

The involved sites consists of “orographic islands” with high elevation vegetation in central Mediterranean basin, along the Central and Southern Apennine mountain range, and permanent plots are placed between 2000 and 2700 m a.s.l., providing a consistent temporal series of biological and ecological data, referring to vascular plants diversity, soil and air temperature, snow cover, land cover maps, dendrochronological measurements and intra-annual increment

Added expertise to CNR: the Department of Bioscience and Territory of University of Molise and its Scientific Responsible for the project are coordinating the LTER parent-site “Apennines: high-elevation ecosystems” and will provide access to existing data and possible collection of new data for the sites “IT01-001-T” Majella-Matese mountains, “IT01-002-T” Velino-Duchessa mountains and “IT01-003-T” Gran Sasso massif.

**Unit 6:**  
**UniPar – Università degli Studi di Parma**

**Department of Life Sciences**  
**University of Parma**  
**Parco Area delle Scienze 11A**  
**43124 Parma**

**Scientific Responsible: Giampaolo Rossetti- [giampaolo.rossetti@unipr.it](mailto:giampaolo.rossetti@unipr.it)**

The Department of Life Sciences at the University of Parma has gained extensive expertise in the study of terrestrial and aquatic ecosystems in mountain regions. One of the most important research areas is the study of Northern Apennine water bodies. Systematic surveys were first begun in the 1950s, when the research was oriented to the physiographic and hydrochemical characterization of temporary and permanent lentic systems as well as to the description of the seasonal succession and distribution of zooplankton at a regional scale. In the following decades, investigations have been extended to the study of other aquatic communities and ecosystems. More recently, the analysis of biodiversity and biogeographical patterns of invertebrates in both lentic and lotic (including springs) ecosystems has been addressed using a rigorous taxonomic approach. Other currently active research topics include population and community ecology of plankton, phenological responses to climate change, whole-ecosystem analysis using trophic flow networks.

Added expertise to CNR: Università degli Studi di Parma and its Scientific Responsible for the project are coordinating the LTER site “Mountain lakes” and will provide access to existing data and possible collection of new data for the site “Lago Santo Parmense” (IT09-001-A) and “Lago Scuro Parmense” (IT09-002-A) (in cooperation with CNR-ISE). Furthermore, the Scientific Responsible has developed expertise on taxonomy and ecology of aquatic invertebrates, limnology of Northern Apennine lentic waters, and community structure and trophic relationships in aquatic ecosystems.

**Coordination Plan**

Working as a coordinated group

The project consortium is well balanced among CNR and non-CNR units and has on board the relevant groups to address the call contents.

CNR-IBAF, CNR-ISE, UniTo, UniMol and UniPar all have long-term experience in collection of data in mountain ecosystems. All are formally involved in the activities of LTER Italy. CNR-IREA is involved in LTER activities mainly for information management aspects (data and metadata standards) and through the LIFE+ EnvEurope project has developed several tools that will be consolidated and made operational, in agreement with NextData expectations and international standardisation efforts. All the Units have been involved in the LIFE+ EnvEurope project.

The grant holders who will be hired by the CNR units will work as a common resource (task group) for the project, to:

- i) Contribute to the definition of standards/models for bio-ecological data and metadata;
- ii) develop the system of mountain LTER sites' archives and access services to the results of research in mountainous ecosystems;
- iii) organise the provision and collection of data on mountain terrestrial and freshwater sites
- iv) liaise with other LTER sites manager to promote/illustrate the data approaches developed in the project for implementation at the national scale

Grant holders will visit the other project units to train and support local staff in implementing their own system components, in entering data and metadata and, if needed, help in collection of new data.

The importance of the grant-holder task group is emphasized by the fact that 65% of total project budget (excluding 20% overheads and 40% CNR permanent staff contribution) is dedicated to that group.

#### Steering Committee

The Project Coordinator and the Scientific Responsibles of the Units will form the Steering Committee (SC) of the Project.

The SC will meet during project meetings (see below). Teleconferences will be regularly organised for project coordination. When and if necessary, SC meetings will be enlarged to the participation of other staff and to the grant-holders.

## 1. GENERAL INFORMATION

### Abstract of the proposed project (max 1000 characters)

The project Data-LTER-Mountain will develop a distributed systems of archives and access services to data and metadata collected in Long Term Ecological Research (LTER) sites located in mountain ecosystems in Italy. Archives and services will be developed starting from the experience of the EnvEurope project and will be harmonised to national and international approaches, in connection to NextData tools.

Sites will be from high elevation grasslands and nival ecosystems, mountain forests, mountain lakes, from Apennines and Alps. All sites are included in the LTER-Italy network.

The project will: i) contribute to the definitions of standards and models for biological and ecological data and metadata in mountain sites; ii) provide mountain LTER sites of their own data and metadata systems, according to defined standards and models; iii) entry of metadata and data in the system, using already available data and data collected in new campaigns; iv) Outreach actions to make available services for the larger LTER communities at national and international level

### Main goals of the project (max 1000 characters)

1. Evaluation of the existing data standards to publish and make available data and metadata, integration with existing systems adopted and shared by other national/international communities
2. Contribution to the definitions of standards and models for biological and ecological data and metadata collected in mountain sites
3. Provide mountain LTER sites of their own data and metadata systems, according to defined standards and models, in connection to NextData tools, so that each site can contribute to a wider archive of metadata useful to browse ecological and biological data.
4. Entry of metadata and data in the system, using already available data and with data collected during new measurements campaigns with particular attention to ecosystem processes and functional properties.
5. Outreach actions of data and metadata standards and models for the bio-ecological realm to be made available for the larger LTER communities, beyond mountain sites, at national and international level

### Expected results of the project (max 2000 characters)

One of the Expert Panels of LTER Europe (European Long Term Ecosystem Research network) has the main objective to foster information management issues at all level of the network, starting from the sites up to the platforms and national networks.

The LIFE+ project EnvEurope, among others, provided the support to the LTER Expert Panels work. EnvEurope DataManagement action (Action 1) was designed to provide tools and services for the exchange of metadata and data collected during the project, that, in the future, may be used for the entire European network.

The project Data-LTER-Mountain will provide the framework and resources to develop further, move forward and put into practice data and metadata standards, with a specific focus on mountain ecosystems. The expected results are:



- Definition/selection of standards/models to suitably describe and harmonize bio-ecological data and metadata in mountain ecosystems, in accordance with national and international approaches
- Development of the system of mountain LTER sites archives and access services to the results of research in mountain LTER sites in connection with the archives of NextData
- Data- and metadata-sets of ecological and biological variables from selected research sites within the four LTER – Italy parent sites working in mountain ecosystems. Data from different ecoregions (forest, high elevation grasslands and meadows, mountain lakes) will provide test-cases for several type of biological and ecological data, coupled to basic site-data, that will be useful for adoption from a larger user-community.
- Consolidation of existing data-sets according to the proposed standards and collection of new data on selected sites among the LTER – Italy parent sites working in mountain ecosystems.
- Population of the system of LTER archives with old and newly collected data

Test cases will be from mountain and high elevation ecosystems in the Alps and Apennines, both terrestrial (forests, meadows, pastures) and aquatic (lakes).

## **Role of the different units (max 2000 characters)**

### **Unit 1 – CNR - IBAF**

Contact to LTER–Italia; Coordinator of LTER Site “Forests of the Apennines”; Link to Corpo Forestale dello Stato; grant holder contract for organisation, provision and collection of data on terrestrial sites (in cooperation with the other two grant-holders at CNR-ISE and CNR-IREA) and providing support to all Units.

### **Unit 2 – CNR - IREA**

Defining standards/models to suitably describe and harmonize bio-ecological data and metadata; developing the system of mountain LTER sites’ archives and access services to the results of research in mountainous ecosystems, in connection with the archives of NextData; grant holder contract for data standards and information management tools (in cooperation with the other two grant-holders at CNR-IBAF and CNR-ISE) and providing support to all Units.

### **Unit 3 – CNR - ISE**

Coordinator of two research sites within the parent site IT09 “Mountain lakes”; grant holder contract for organisation, provision and collection of data on high mountain freshwater sites (in cooperation with the other two grant-holders at CNR-IBAF and CNR-IREA) and providing support to all Units.

### **Unit 4 – UniTO**

Coordinator of LTER Site “North-Western Italian Alps”; organization, provision and collection of data on high mountain sites, in collaboration with the Regional Environmental Agency of the Aosta Valley (supported from and in cooperation with grant-holders at CNR-ISE and CNR-IREA), specific expertise on soil and snow data.

### **Unit 5 – UniMol**

Coordinator of LTER Site “High-Elevation Apennines”; organisation, provision and collection of data on high elevation sites in the Apennines, (supported from and in cooperation with grant-

holders at CNR-IBAF and CNR-IREA), specific expertise on plant diversity data, dendroecological analysis, wood anatomy and land-cover changes

**Unit 6 - UniPar**

Coordinator of LTER Site “Mountain lakes”; organisation, provision and collection of data on high elevation sites in the Apennines, (supported from and in cooperation with the grant-holders at CNR-ISE and CNR-IBAF), specific expertise on lake diversity data

## 2. DETAILED PROJECT DESCRIPTION

### State of the art and motivations (max 5000 characters)

#### ILTER research in Italy

Since the beginning of the last century, institutions started regular collection of environmental data. Building on this context, the Italian network for Long-Term Ecosystem Research (ILTER-Italy) was created to bring together scientists and institutions carrying out research on structure and functioning of ecosystems. ILTER-Italy is a network of terrestrial, freshwater and marine ecosystems. Within the network, ecological research is conducted to ensure the continuity of the long-term data acquisition, satisfy the requirements of scientific quality and provide information to society.

ILTER Italy currently consists of 22 ILTER sites, including the main ecosystem typologies. Some of these are "complex sites", consisting of several research sites, for a total of more than 70 sites.

Long term ecological studies on mountain areas are carried in five ILTER parent sites (table 1).

Site Code	Parent Site name	Coordinating person and Institution	Number of Research Sites
IT01-000-T	Apennines - High elevation ecosystems	A. Stanisci - UniMolise	4
IT02-000-T	Forests of the Alps	E. Pompei – C.Cindolo CFS	5
IT03-000-T	Forests of the Apennines	G. Matteucci CNR IBAF	3
IT09-000-A	Mountain Lakes	G. Rossetti Univ. Parma	8
IT19-000-T	High elevation sites in the North-Western Alps	E. Zanini/M.Freppaz Univ. of Torino	6

Table 1. List of ILTER-Italy parent sites located in mountain ecosystems

#### Development of data and metadata standards and tools in the ILTER community

Within the LIFE+ project EnvEurope, coordinated by CNR, Action 1 on data management was designed to provide tools and services for the exchange of metadata and data, with the goal to make services available for ILTER networks and ILTER. The latter is mentioned among the research initiatives with which NextData has clear synergies.

The biggest challenge of Action 1 was the reconciliation of definitions and practices of ecological community with the need to be in accordance with European directives and global projects' approaches. In particular, one of the main issues was to reconcile the metadata profile and tools of ILTER (EML metadata, Drupal CMS) with the requirements of the European Directive INSPIRE, within the framework of SEIS (Shared Environmental Information System).

A general architecture for the management of data and metadata has been established, with 3 components (on line applications, <http://deims.enveurope.eu>; now officially released at [data.ilter-europe.net/deims/](http://data.ilter-europe.net/deims/)):

1. *MetaData editor*: allows data entry of metadata for datasets, people (network operators) and research Sites.
2. *Discovery client*: allows searching the available resources.
3. *GeoViewer*: allows to visualize geographic information stored in the modules for data and research sites (<http://sp7.irea.cnr.it/wp4/az2/geoportal/public/>).

EnvEurope worked especially on metadata, also to obtain full compatibility with ISO/INSPIRE XML, with the possibility to export the metadata of datasets in any other standardized catalogue (OCG CSW) for a Spatial Data Infrastructure (SDI).

Furthermore, some more advanced features on interoperable ecological data from distributed archives have been tested in two use cases related to phenology and eutrophication of aquatic environments. The interoperability testing involved the implementation of Sensor Web services (in particular OGC Sensor Observation Service - SOS) for chemical and physical data. The interoperability supports the processing of long time series, according to a common data model that so far was used to derive phenological indicators of eutrophication for several European sites.

It should be noted that the issues related to the management and deployment of interoperable specific biological and ecological data (e.g. distribution, abundances and density of species, productivity, structure, etc.) remain an open issue in LTER and in EnvEurope and are only partially resolved by working groups such as INSPIRE Thematic Working Group (TWG) and GBIF.

#### Motivations for project Data-LTER-Mountain

The proposed project, starting from this framework, and with strategic timing, will propose and implement data- and metadata-set solutions for ecological and biological variables collected in mountain ecosystems in Italy. A specific data/metadata management system will be developed for mountain sites, according to defined standards and models. It will allow data discovery, access and geoviewing.

Target ecosystems will be selected among the research sites of mountain LTER parent sites (table 1) in different terrestrial and freshwater eco-domains, so to provide examples and standards for data of different types (parameters collected continuously; one-shot variables, e.g. productivity; species diversity data, etc.). The collected data (historical and from new campaigns) will be analysed to check status and long-term changes in mountain ecosystems, trying to derive indicators of the ecosystem response to different drivers: climate change, atmospheric pollution, land use change, invasive species.

## Detailed description of the project, including the work plan, deliverables and milestones (explicitly indicating the activities of the different years) (max 8000 characters)

The project is organised in three tasks. The overall timetable is reported below (D, Deliverable; M, Milestone)

Year	2014												2015										
	Month	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	
Task 1. Data tools and standards			D			D,M			D,M						D,M								D,M
Task 2. Data and metadata from mountain ecosystems: test cases from LTER Italy sites in mountain ecosystems		M	D							D,M					D,M								D,M
Task 3. Collection of new data sets from LTER Italy sites in mountain ecosystems						M							D										D
Project meetings	X				X							X					X					X	

Meetings at month 5 and 17 will be used also to present the project and its results to the whole LTER Italy community.

### Task 1. Data tools and standards

This task will move from the methods, architecture and tools created to collect, manage and query metadata of the ecological dataset, following the metadata profile identified by the LTER community, within the EnvEurope Action 1.

These tools allow metadata compliance with GBIF and the possibility to export them in a *GeoNetwork opensource application* in order to obtain a *Catalog Service for the Web (CSW)* interface, to enable a complete interconnection with the system already maintained by the University of Cagliari for NextData, following the INSPIRE Directive and any other OGC standard Catalogue for a Spatial Data Infrastructure.

These tools will be used by partners to enter metadata of the datasets of participating LTER sites and to obtain a catalogue of the information. Parameters selection will be performed by all partners (see Task 2).

In the meanwhile, Task 1 will perform an analysis to evaluate standards and models for bio-ecological data both proposed by national and international initiatives and adopted by the participating units, with the aim to identify the most suitable for the project purposes. In case of unsuitability, new definitions and proposals will be created and tested. In particular, compliance with GBIF initiative and INSPIRE Thematic Working Group (TWG) will be a target issue.

On this basis, a system composed by different, distributed web services will be designed and implemented, to allow partners to store their own selected datasets, to deliver them in an interoperable way, and to let them being geoviewed and analysed. It will allow connection with NextData General Portal.

The system is based on the architecture, components and standards developed and adopted in the LIFE+ project EnvEurope (2010-2013): in compliance with the INSPIRE Directive principles, datasets will be stored, managed and distributed where they are produced and maintained at best. To this purpose each involved partner and site will implement and maintain an OGC (Open Geospatial Consortium) web service to allow standard and interoperable access to its datasets by Nextdata standard clients. Metadata of the dataset will be entered by exploiting the metadata managing facilities of EnvEurope (DEIMS, <http://deims.enveurope.eu>, now adopted within LTER-Europe, <http://data.lter-europe.net/deims/>); data will be then exported in the standard format of Catalog Service for the Web (CSW) interfaces, in order to allow discovery from NextData catalogue facilities"

Definitions, methods and tools will be evaluated by all participants and outreach actions will be performed to offer results of task 1 to the whole LTER community.

Task 1 will operate since its starting phase in connection with the University of Cagliari to share and harmonize infrastructural choices and ease a seamless connection to Nextdata General Portal

#### Involved units:

CNR-IREA for coordination of the Task, standards/models definition and system development; all units for analysis of current practices, for provision of information and analysis.

#### Deliverables

1. Evaluation of the existing data standards/models and of partners practices  
Type: report  
Month 3
2. Definitions of standards and models for biological and ecological data and metadata collected in mountain sites  
Type: report  
Month 6
3. Data and metadata systems, according to defined standards and models, in connection to NextData tools  
Type: tools for metadata entry and discovery; services for dataset storage and delivery  
Month 9  
Type: discovery and geoviewing online tools  
Month: 14, 21

#### Milestones

- a. Standards and models for data and metadata defined  
Month 6
- b. Data system developed (three stages: empty tools, archives with basic variables, archives with bio-eco variables)  
Month 9, 14, 21

## **Task 2. Data and metadata from mountain ecosystems: test cases from LTER Italy sites in mountain ecosystems**

Data and metadata will be primarily provided by the following mountain sites of LTER Italy:

### **Site IT01-000-T Apennines - High elevation ecosystems**

**Ecosystem typology:** terrestrial ecosystems at high elevation along the Apennine mountain range

**Site description:** The site consists of “orographic islands” with high elevation vegetation in central Mediterranean basin, along the Apennines mountain range (overall elevation range: 1800-2700 m a.s.l.). It includes 154 plots distributed in the three geographical sectors of Apennines (Northern, 57 plots; Central, 87 plots; Southern, 10 plots).

#### **Primarily involved Research Sites:**

IT01-001-T Central-Southern Apennine – Majella - Matese

IT01-002-T Central Apennine: Velino-Duchessa

IT01-003-T Central Apennine: Gran Sasso

**LTER Topics:** vascular plant diversity and population biology, EC interest habitats, global and land use change, snow chemistry, snow cover duration, soil composition and structure, The sites are involved in the world network of GLORIA project (GLObal Research Initiative in Alpine

ecosystems).

#### **Site IT03-000-T Forests of the Apennines**

**Ecosystem typology:** Apennines beech forests, Apennines meadows, mixed meadows-forest systems

**Site description:** The Site is made of three Research Sites (RS) located along the Central and Southern Apennines, mainly characterised by *Fagus sylvatica* L. forests (between 800 and 1700 m a.s.l.) and high-elevation meadows.

**Primarily involved Research Sites:** IT03-001-T Collelongo – Selva Piana

**LTER Topics:** Meteorology, vegetation, phenology, forest structure (all three research sites). Long term monitoring according to ICP Forests and ICP IM protocols (IT03-001-T and 002-T). Land-use change dynamics, faunal (IT03-003-T). Primary productivity; carbon, water vapour and energy exchange; beech ecophysiology; soil processes (IT03-001-T).

#### **Site IT09-000-A Mountain Lakes**

**Ecosystem typology:** Freshwater, lentic mountain ecosystems

**Site description:** This site includes i) lakes and temporary pools of the northern slope of Northern Apennines (between 1000 and 1850 m a.s.l.). Most are of glacial origin, some still in pristine conditions (Alta Val Parma, Alta Val Cedra Regional Park and the Tuscan-Emilian Apennines National Park); ii) more than 30 high altitude lakes, located in the Ossola and Sesia Valleys, Piedmont (between 1900 and 2700 m a.s.l.) They are all of glacial origin and located in remote areas; iii) Lake Tovel; iv) 14 lakes of the province of Bolzano (from 216 to 1642 m a.s.l.), mostly of glacial origin.

**Primarily involved Research Sites:**

IT09-001-A Lake Santo Parmense

IT09-002-A Lake Scuro Parmense

IT09-003-A Lower Lake Paione

IT09-004-A Upper Lake Paione

**LTER Topics:** Hydrology, water chemistry, eutrophication and acidification risk, plankton communities and population dynamics, trophic structure, biodiversity, functional diversity, atmospheric deposition, climate change.

#### **Site IT19-000-T High elevation sites in the North-Western Alps**

**Ecosystem typology:** Terrestrial, high elevation

**Site description:** This site is representative of high altitude environments of the North-Western Alps, with six research sites (altitude from 2100 to 3100 m a.s.l.). Soils are snow covered for five to eight months per year. Vegetation cover ranges from larch and spruce stands, to alpine grasslands

**Primarily involved Research Sites:**

IT19-001-T Istituto Scientifico Angelo Mosso (MOSSO)

IT19-005-T Torgnon (TELLINOD)

**LTER Topics:** Soil properties, snow chemical and physical properties, biogeochemical cycling, phenology and carbon fluxes in forest and grassland ecosystems, permafrost monitoring.

Apart from providing basic data and metadata (sites descriptions, meteorology) and historical datasets, the four sites will provide specific test cases for ecological and biological data, among which we cite particularly the following:

**Site IT01-000-T:** Vascular plant diversity: species lists, abundances

**Site IT03-000-T:** Primary productivity, Leaf Area Index, Litter production, Deposition chemistry

**Site IT09-000-A Mountain Lakes:** Water chemistry, plankton and benthos communities, trophic structure

**Site IT19-000-T:** Soil chemistry, plant phenology

Additional involved sites

The site IT02-000-T Forests of the Alps will be involved through CNR-IBAF (connection to CFS) and UniTo.

Within Task 2, we will also provide a “scientific” deliverable, based on data analysis.

The Deliverable “Analysis of the effects of a common driver/impact on mountain LTER sites” will i) identify a common driver or impact to be analysed in relation to available data (possible candidates are: nitrogen deposition, extreme or episodic climatic events) and ii) compare the responses of the different sites/ecosystems to the driver/impact.

#### Involved units:

CNR-IBAF for Forests of the Apennines and connection to Forest of the Alps; CNR-ISE and UniPar for mountain Lakes; UniTo for North Western Alps; UniMol for High elevation ecosystems in the Apennines. CNR-IREA for data standards and tools

#### Deliverables

1. Description of the sites  
Type: Report  
Month 3
2. Site metadata available in the Data-LTER-Mountain data system  
Type: data entry, brief report  
Month 10
3. Data- and metadata-sets of basic variables  
Type: data and metadata set  
Month 10, month 21
4. Data- and metadata-sets of ecological and biological variables  
Type: data and metadata set  
Month 14, month 21
5. Analysis of the effects of a common driver/impact on mountain LTER sites  
Type: scientific analysis and report  
Month 21

#### Milestones

- a. Selection of the sites  
Month 2
- b. Provision of data- and metadata-sets of basic variables  
Month: 10, 21
- c. Provision of data- and metadata-sets of ecological and biological variables  
Month: 14, 21



### **Task 3. Collection of new data sets from LTER Italy sites in mountain ecosystems**

Within task 3, new set of data will be collected, taking into account metadata standards developed within Task 1.

The new set of data will be collected in the growing season (ice-free period for mountain lakes) of year 1 and year 2 of the project.

Data collection will be focused particularly on the specific test cases for ecological and biological data listed under task 2.

#### Involved units:

CNR-IBAF for Forests of the Apennines and connection to Forest of the Alps; CNR-ISE and UniPar for mountain Lakes; UniTo for North Western Alps; UniMol for High elevation ecosystems in the Apennines.

#### Deliverables

1. Data- and metadata-sets of newly collected ecological and biological variables  
Type: data and metadata set  
Month 12, 21

#### Milestones

- a. Collection of new data sets started  
Month: 6
- b. Provision of data- and metadata-sets of ecological and biological variables  
Month: 12, 21

### **Outreach: NextData and overall services for LTER Italy and beyond**

The project will provide access and services to mountain ecosystems information to NextData. Furthermore, the developed system will be proposed to LTER–Italy for adoption for all sites. The previous involvement in EnvEurope, that developed approaches for LTER-Europe, will provide the opportunity for sharing results at European level.

LTER Italy has one high elevation site (IT11) located in the Himalayan region, Nepal (2 lakes above 5000 m a.s.l.). Results gathered at site IT09 – Mountain lakes within this project can be compared to those collected at the Himalayan sites, providing potential for “teleconnections” among different mountain regions.

## **Motivations for the required budget and budget on a unit and year-by-year basis (max 5000 characters)**

### **Unit 1 – CNR-IBAF (Coordinator)**

The required budget will be used to:

Support of permanent personnel to the project (existing know-how, historical data sets, coordination, contacts with LTER Italia and other external Institutions): 51'340 Euro (40%)

Overheads: 20'020 Euro (20%)

Hiring of grant holder (assegno di ricerca) for one year for organisation, provision and collection of data on terrestrial sites (in cooperation with the other two grant-holders at CNR-ISE and CNR-IREA and with the other project Units): 23'000 Euro

Travel and subsistence to visit other institutions involved in LTER – Italia and LTER sites for data collection, participation to project meetings and scientific conferences: 5'740 Euro

### **Unit 2 – CNR-IREA**

The required budget will be used to:

Support of permanent personnel to the project (existing know-how, contact with coordination and LTER sites involved, tutoring of grant personnel): 37'330 Euro (40%)

Overheads: 21'665 Euro (20%)

Hiring of grant holder (assegno di ricerca) for two years for defining standards/models to suitably describe and harmonize bio-ecological data and metadata, and for developing the system of mountain LTER sites' archives and access services (in cooperation with the other two grant-holders at CNR-ISE and CNR-IBAF and with all project units): 46'000 Euro

Travel and subsistence to visit other institutions involved in LTER – Italia: 3'330 Euro

### **Unit 3 – CNR-ISE**

The required budget will be used to:

Support of permanent personnel to the project (existing know-how, management of existing long-term data series, contacts with LTER Italia and other external institutions): 51'330 Euro (40%)

Overheads: 20'015 Euro (20%)

Hiring of grant holder (assegno di ricerca) for one year for collection, organization, and elaboration of chemical and biological data on high mountain freshwater sites (in cooperation with the other two grant-holders at CNR-IBAF and CNR-IREA and with the other project Units): 23'000 Euro

Travel and subsistence to visit other institutions involved in LTER – Italia and LTER sites for data collection, participation to project meetings and scientific conferences: 5'730 Euro

### **Unit 4 – UniTO**

The required budget will be used to:

Overheads: 3'300 Euro (20%)

Purchase of consumables: 3'500 Euro

Purchase of durable goods: 3'100 Euro

Travel and subsistence to visit other institution involved in LTER – Italia and LTER sites for data collection and participation in scientific conferences and meetings: 6'600

### **Unit 5 – UniMol**

The required budget will be used to:

Overheads: 3'400 Euro (20%)

Support a scholarship for helping the management of existing long-term data series, provision and collection of data: 6'000 Euro

Purchase of consumable and durable goods, such as data-loggers for soil and air temperature recording: 7'600 Euro

#### **Unit 6 – UniPar**

The required budget will be used to:

Overheads: 1'600 Euro (20%)

Support a scholarship for the organisation, provision and collection of data on lacustrine and high mountain sites: 3'000 Euro

Purchase of consumable and durable goods: 1'000 Euro

Travel and subsistence to visit other institution involved in LTER – Italia and LTER sites for data collection and participation in scientific conferences and meetings: 2'400 Euro.

	<b>first year (2014)</b>	<b>second year (2015)</b>
Unit 1 (coordinator) CNR-IBAF	73'350	26'750
Unit 2 CNR – IREA	73'325	35'000
Unit 3 CNR – ISE	73'325	26'750
Unit 4 – UniTO	11'900	4'600
Unit 5 – UniMol	12'300	4'700
Unit 6 – UniPar	5'800	2'200
<b>Total amount</b>	<b>250'000</b>	<b>100'000</b>

**Please attach the curricula and the list of relevant publications of the project coordinator and of the responsables of each participating unit, and the summary budget table in attachment.**

**See:**

**Annex 1 – Curricula and list of relevant publications**

**Annex 2 – Summary and Units budget tables**

**Signatures:**

**Project coordinator:**

**Dottor Giorgio Matteucci**



**Director of the CNR Institute coordinating the proposal:**

**Dottor Angelo Massacci, Acting Director of CNR-IBAF**

