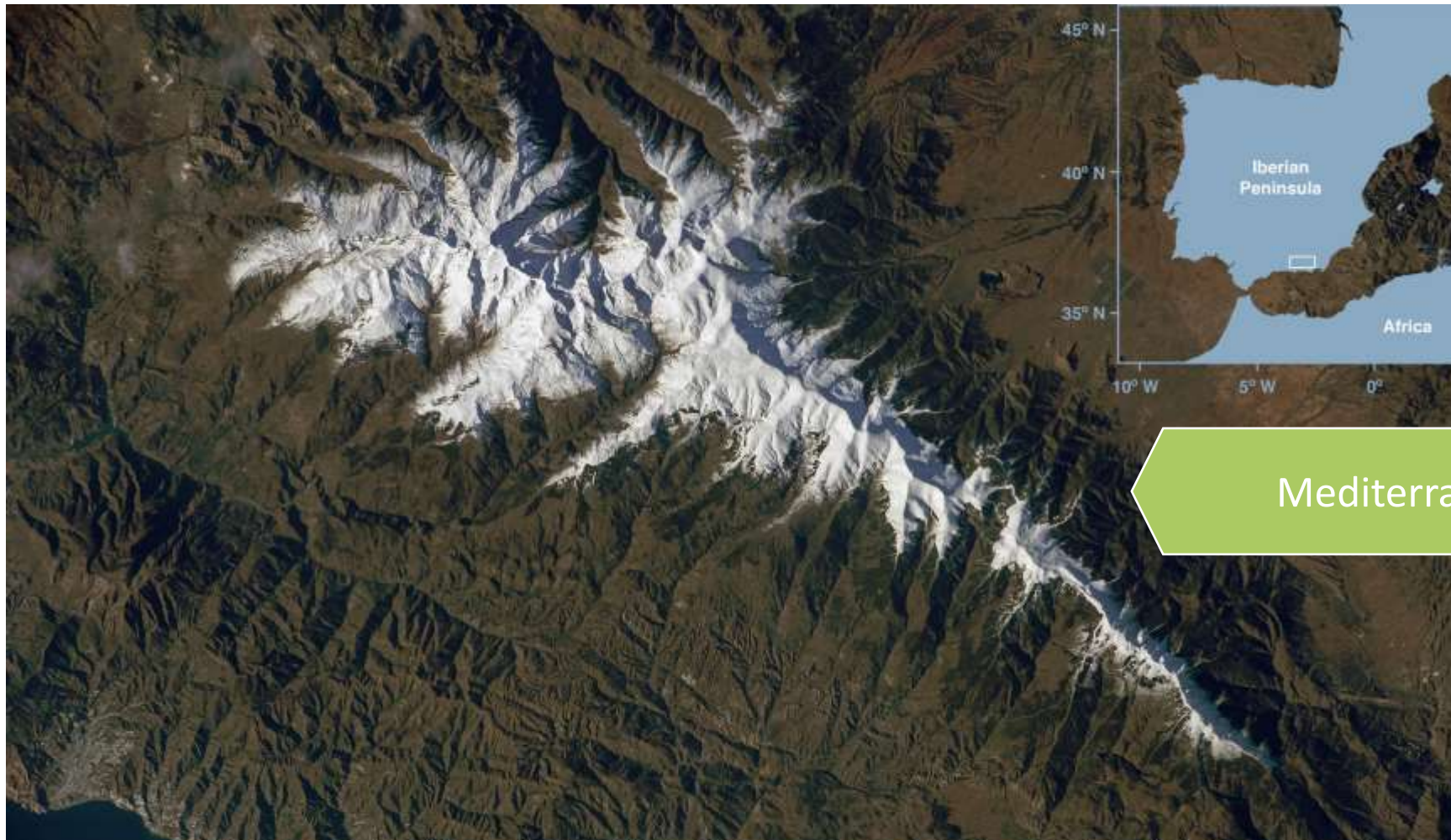




Observatorio
Cambio Global
Sierra Nevada

Convention on the Conservation of European Wildlife and Natural Habitats

Regino Zamora
University of Granada



Mediterranean biodiversity hotspot



It's the **highest mountain** (3482 *m* asl) in the south of Europe

One of the most important **biodiversity hotspot** in the Mediterranean region

(Blanca 1996, Blanca et al. 1998, Cañadas et al. 2014)

2100 species of vascular plant
(20 % of European flora)

High endemism rate:
105 endemic plant species
280 endemic insect species, 3 endemic genera.

High ecological diversity (from the alpine to the semidesert):
27 habitat types from the Habitat Directive



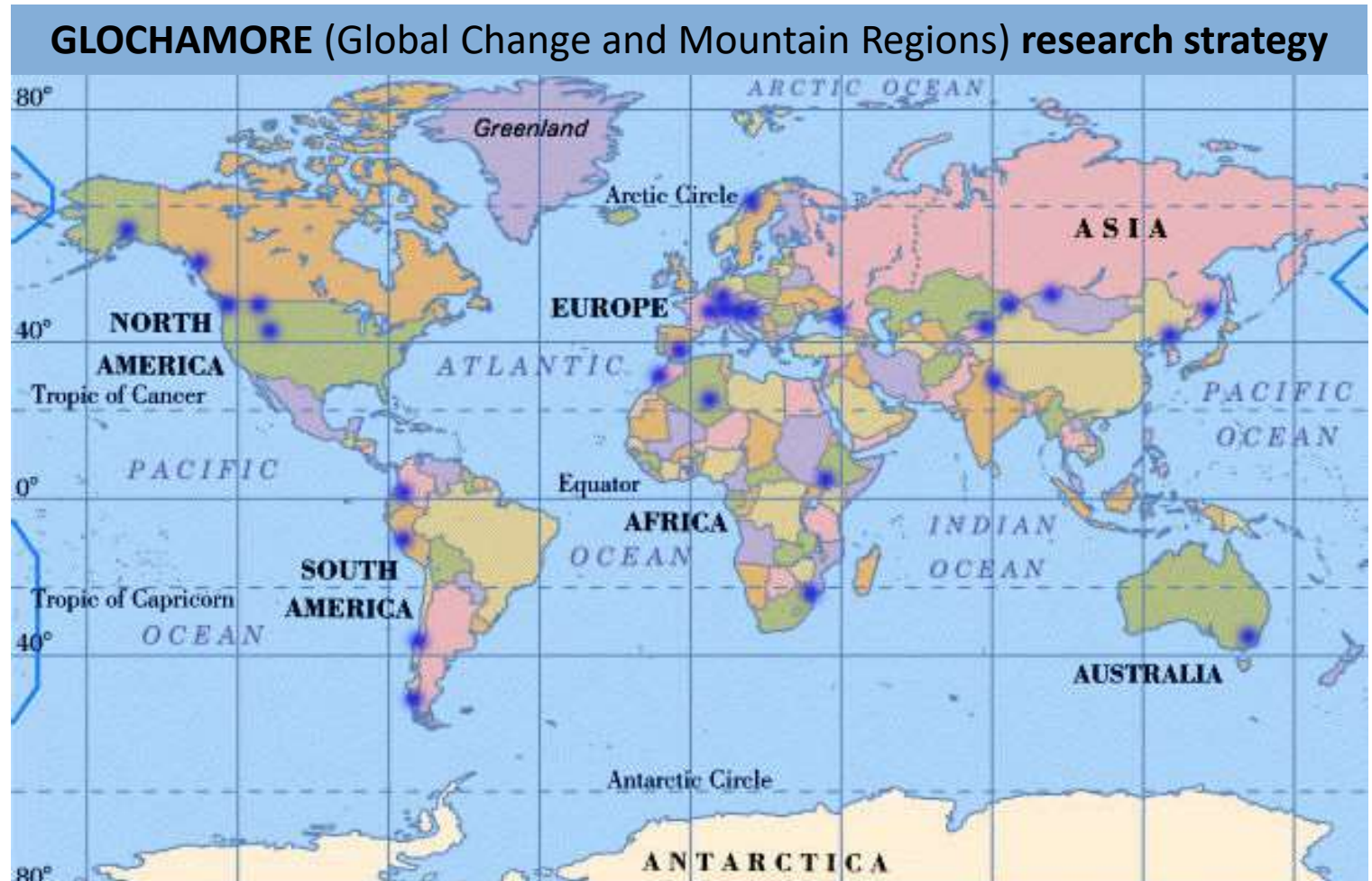
The area includes 61 municipalities with more than 90.000 inhabitants.

Legal protected Area:

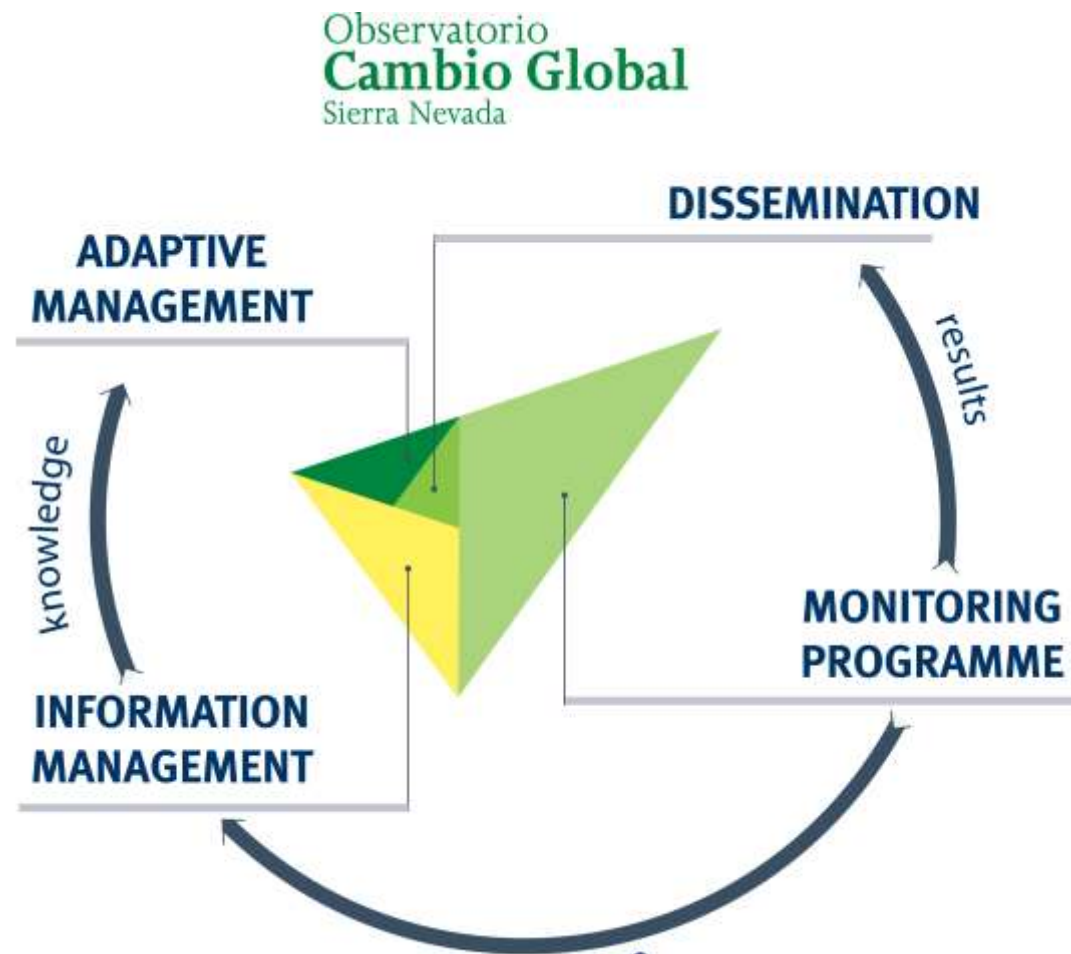
- Biosphere Reserve (MAB UNESCO)
- Special Protection Area
- Site of Community Importance
- (Natura 2000 network)
- National Park
- Natural Park
- IUCN Green List of Protected Areas, **because Sierra Nevada has a management model based on the transfer of scientific knowledge, social participation, and institutional coordination.**

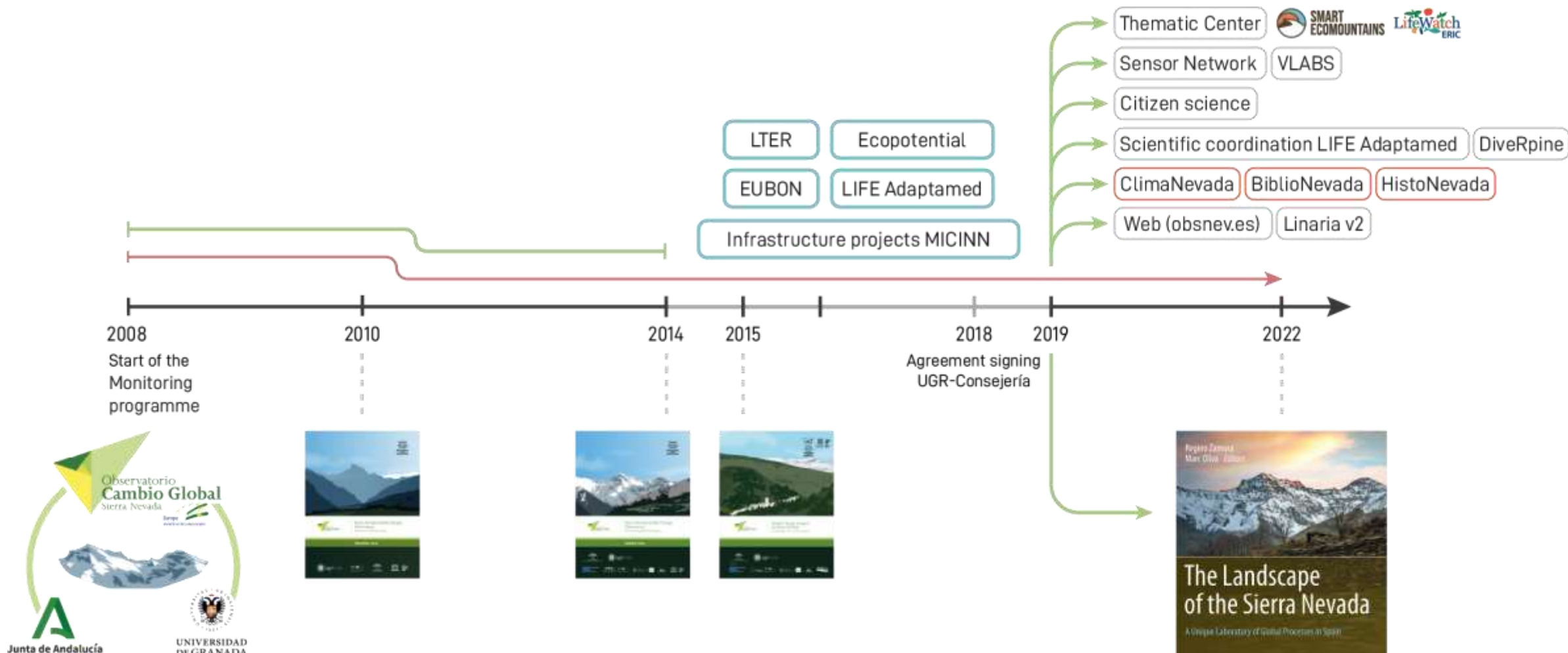


- **GLOCHAMORE** site
- **GLORIA** site
- **LTER** site
- **Lifewatch** site
- **ICOS** site
- **ACTRIS** site



Since 2008, Sierra Nevada Global Change Observatory has undergone an ambitious project promoted by the Consejería de Sostenibilidad, Junta de Andalucía, and the University of Granada, in order to develop a Monitoring and Information Management Programme.







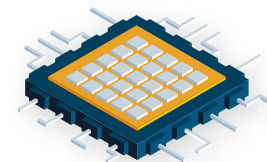
Data collection



**Data
documentation
and validation**



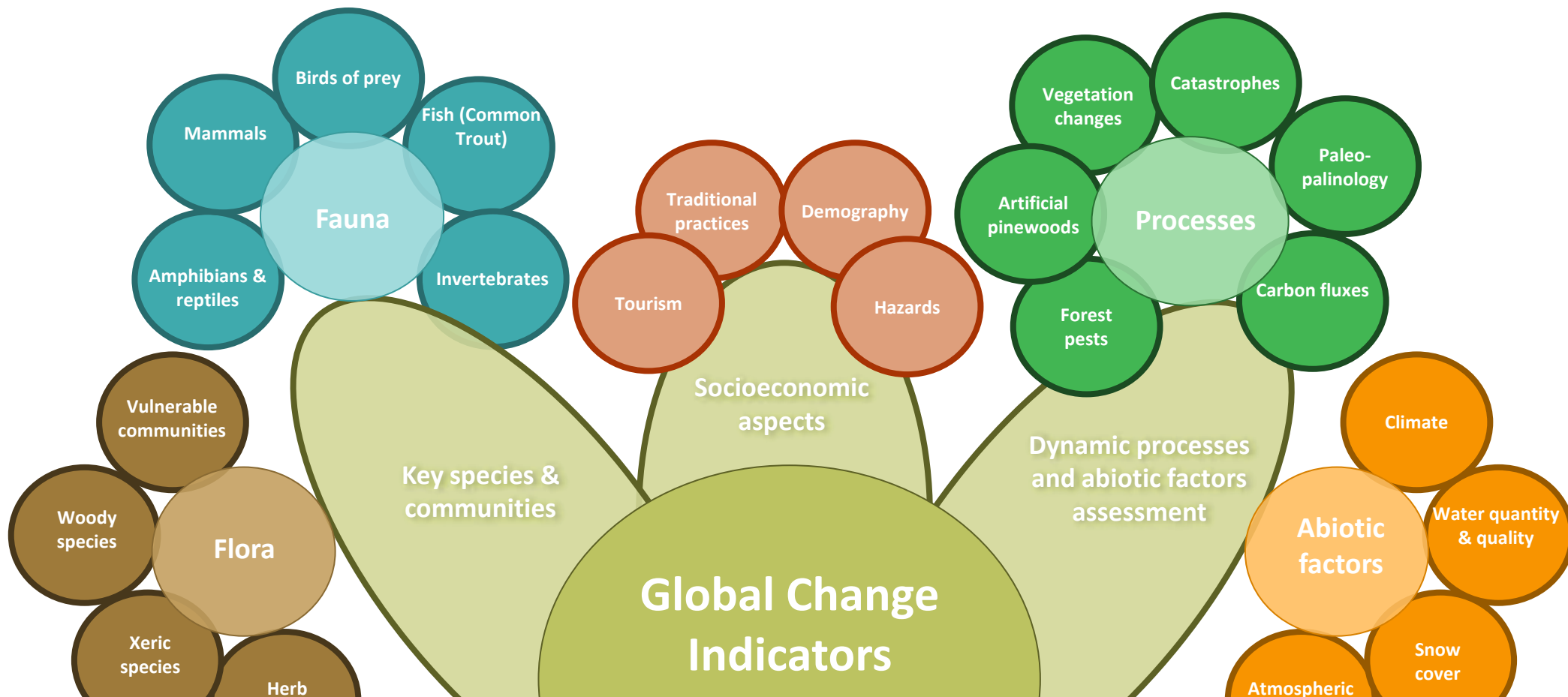
**Data
normalization and
integration**



**Data analysis in a
scientific context**



**Products for
scientists, managers**





Data Collection



Observational Sampling



Automated Instruments



Remote Sensing



Data Documentation

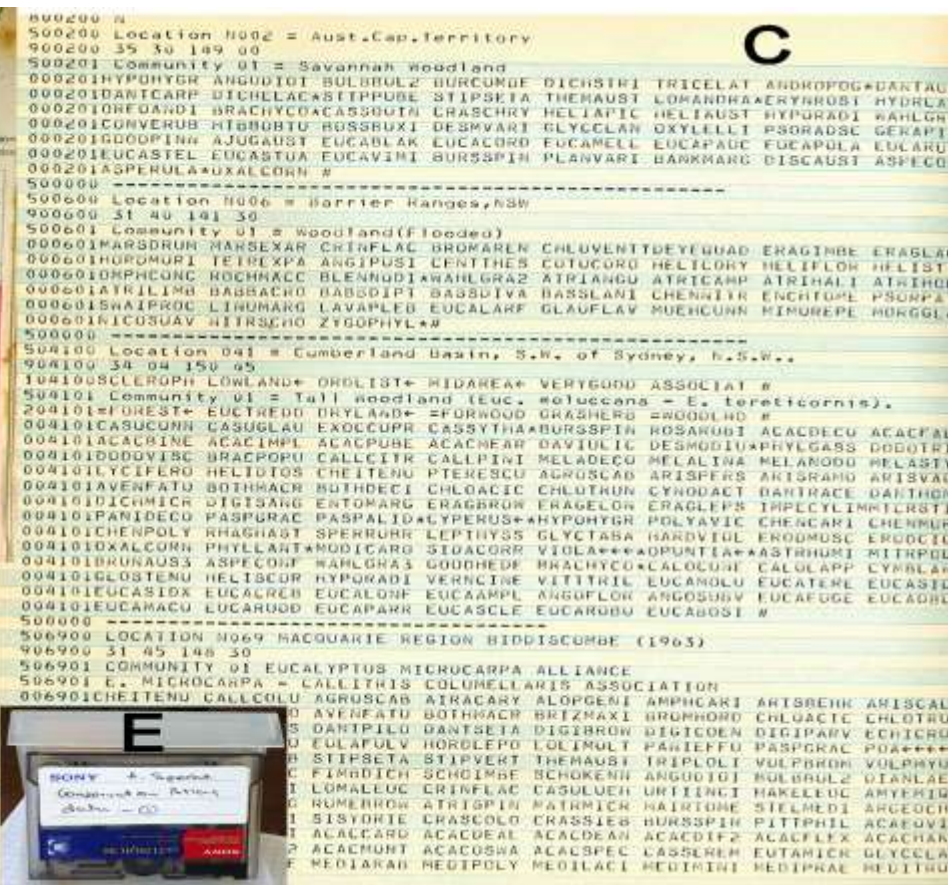
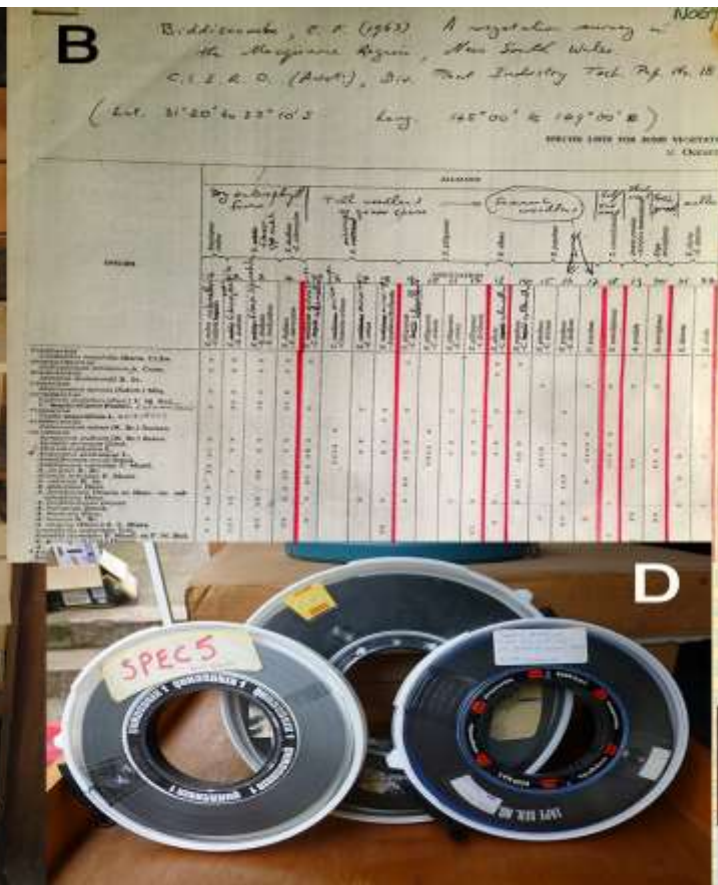
Metadata Catalogue



Data Integration

Data Portal & Repositories





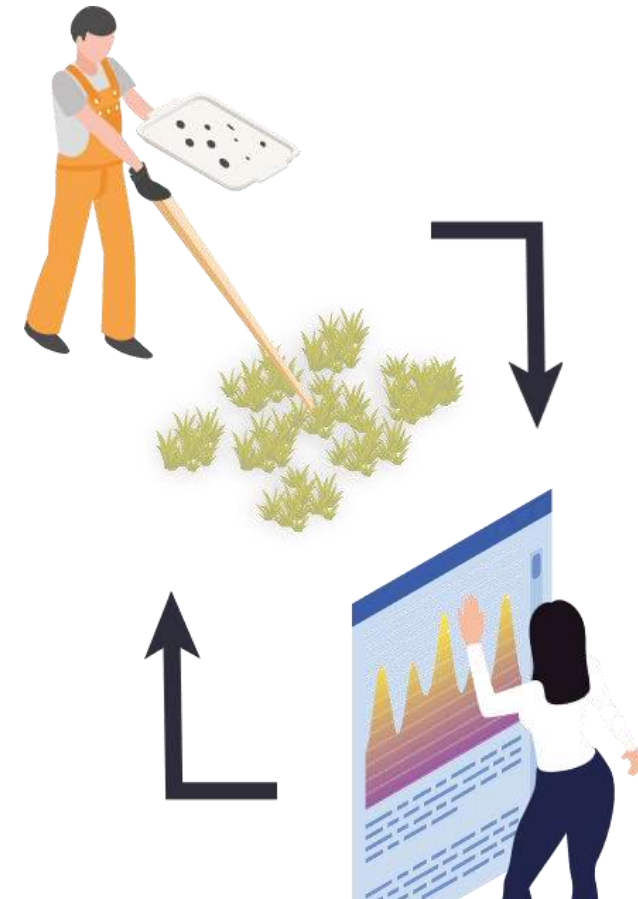
1. To create a **physical** and **virtual research infrastructure** that combines new technological tools and traditional field monitoring, to enable the incorporation of all existing sources of mountain biodiversity information for their analysis, interpretation and transference to managers and citizens.
2. To develop new **technological tools and services** to facilitate **mountain scientific** research, and to inform **society** and support **policymakers** in science-based decision making.



Figure: 10.1002/bes2.1308

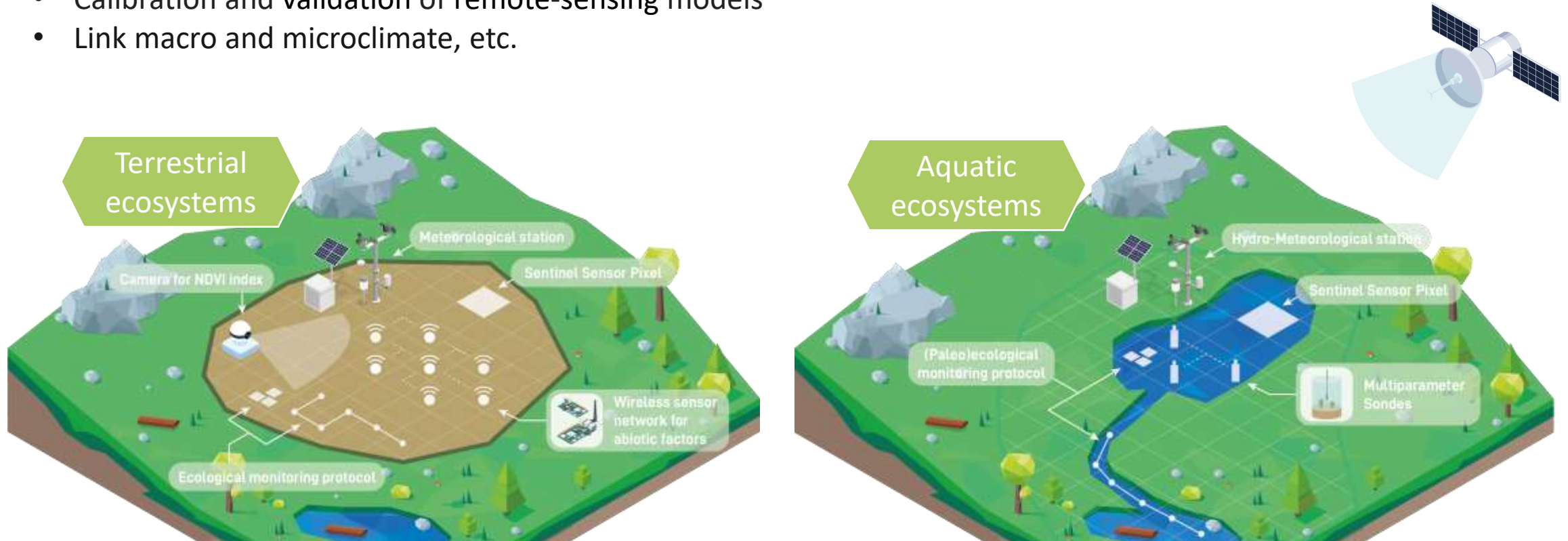
Image: Earth Science and Remote Sensing Unit NASA Johnson Space Center (December 2014)

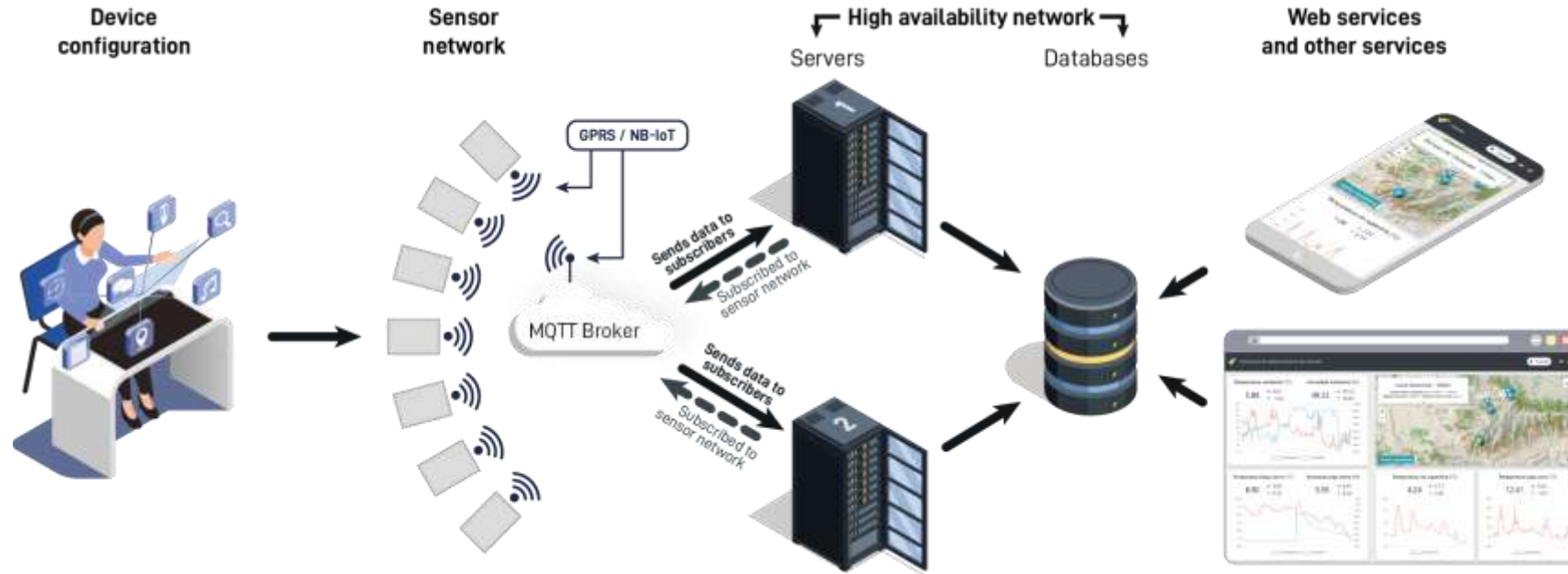
- Breaking closed research and manager spaces:
OBSNEV is a space for collaboration.
- Take the researcher and managers out of his traditional routine and encourage him to look at the border of his discipline with other disciplines:
Promotes transversality, interdisciplinarity and a holistic vision.
- Promotes the **use of new information and communication technologies** to analyze and make information visible.
- **Identify different end users: researchers, managers**



Plots in which biotic and abiotic data are collected in the same spatial location

- Spatial and temporal associations among closely-related variables
- Calibration and validation of remote-sensing models
- Link macro and microclimate, etc.



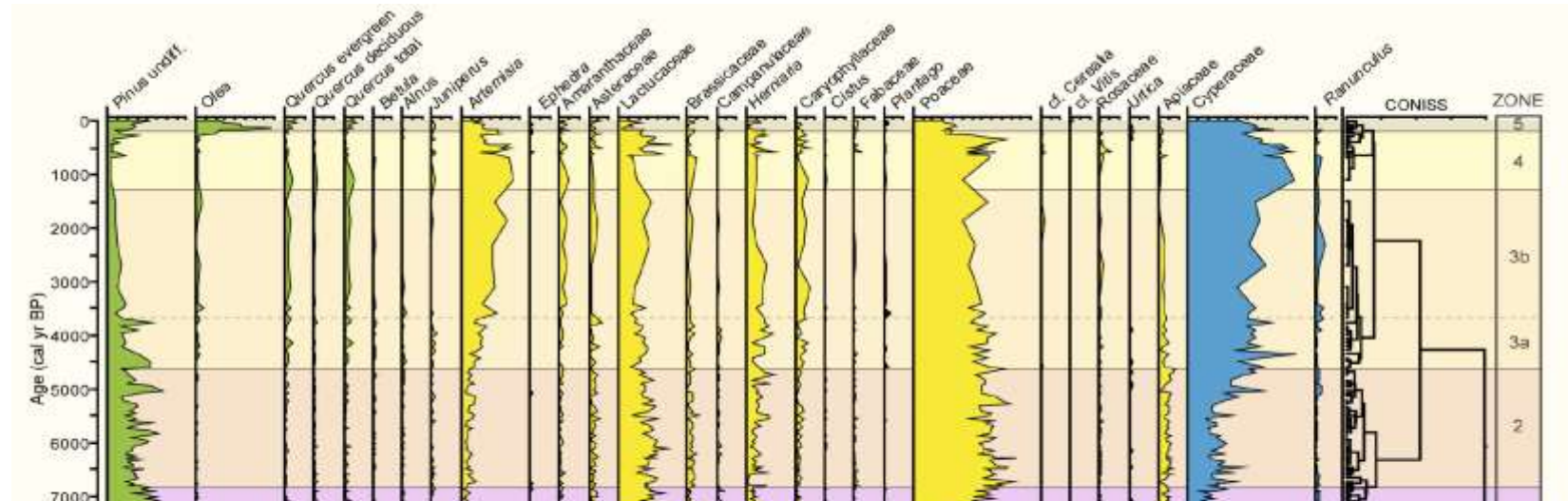


- Easy device configuration.
- Metadata generated automatically.
- Automatic publication in data repositories.

- Makes device configuration, data management and publication easier and less costly.

Multiple evidence from **sediments of the high-mountain lagoons** indicate that, **from about 3,000 years ago to the present, human activity intensified on Sierra Nevada until early 20th century.**

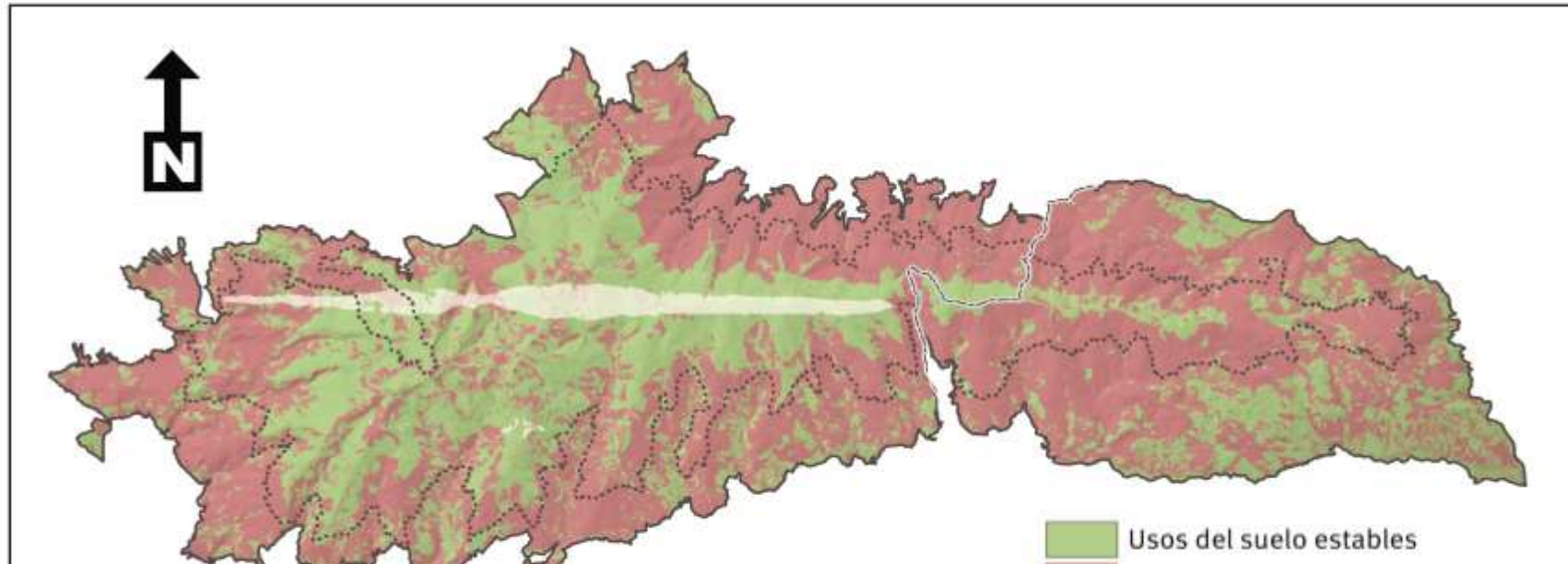
- Increase of the frequency of fires
- Increase of grazing and mining
- Increase of olive cultivation at low elevations
- Increase of reforestations



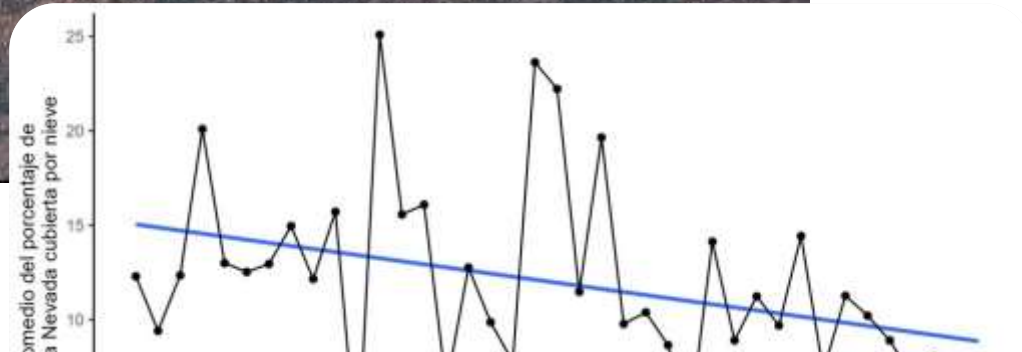
Land use change in Sierra Nevada over the last 50 years and landscape changes

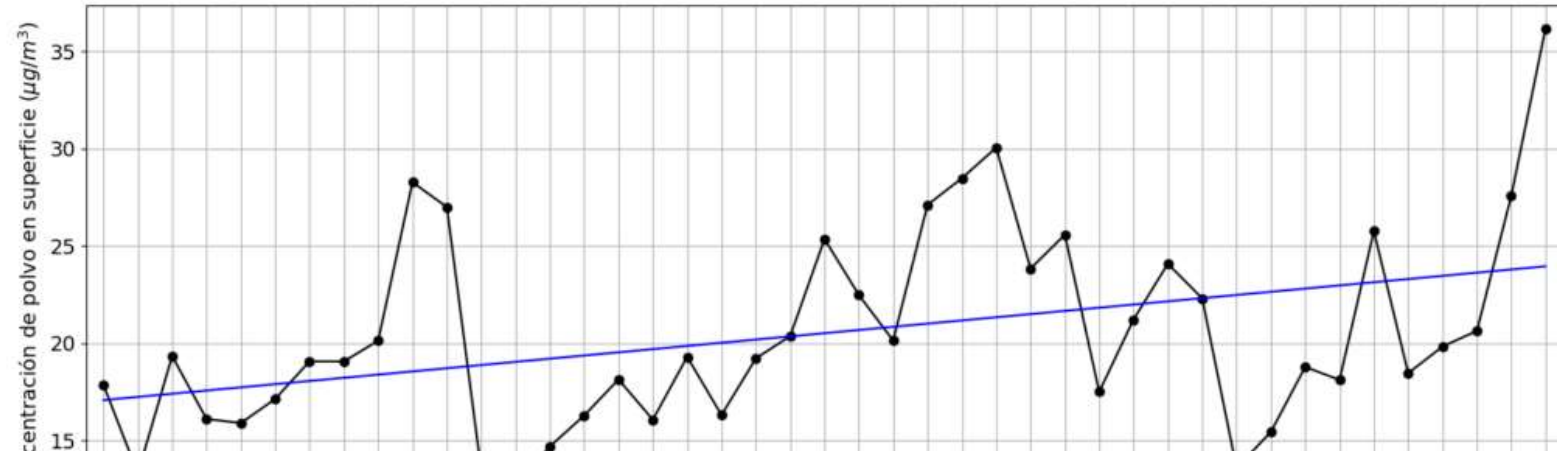
Land-use maps

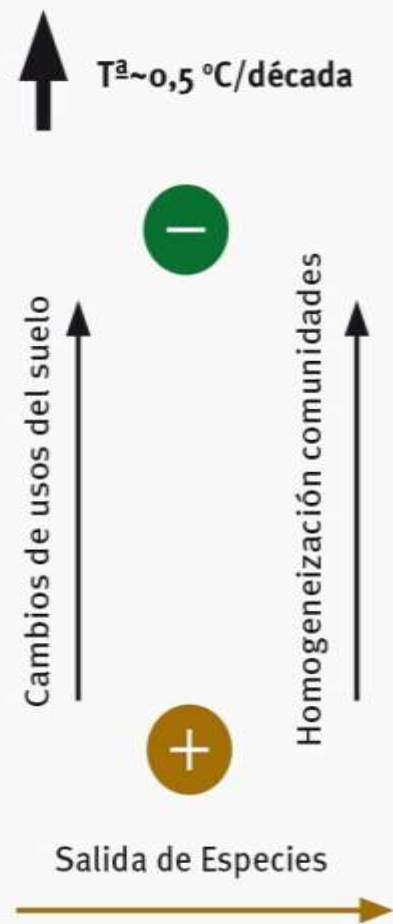
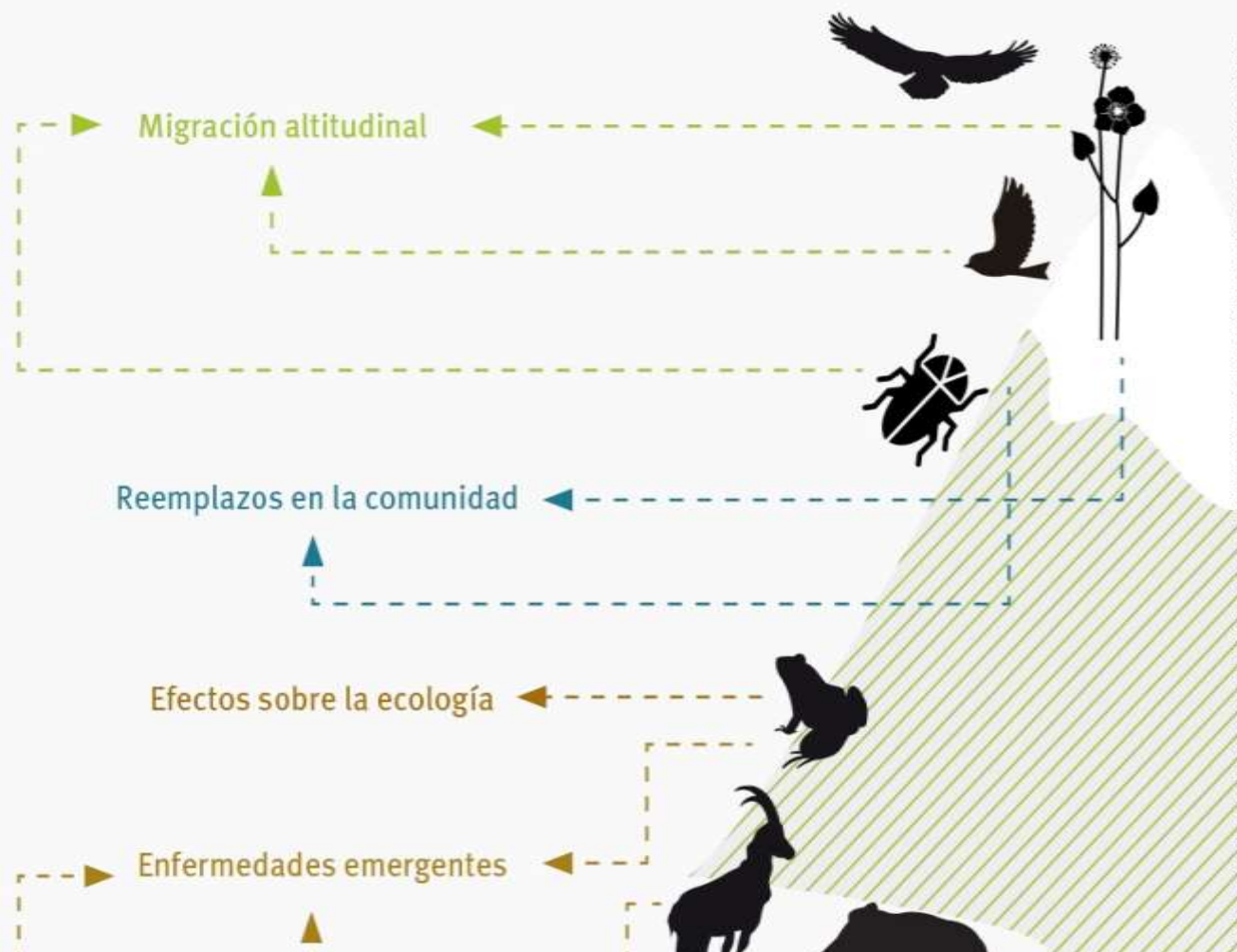
- Detailed (1:5 000 to 1:15 000) interpretation of the Ortophotographs from the years 1956, 2006 and 2011
- **Nearly 50% of the mountain area has undergone a major change in the land-use over the last 50 years**





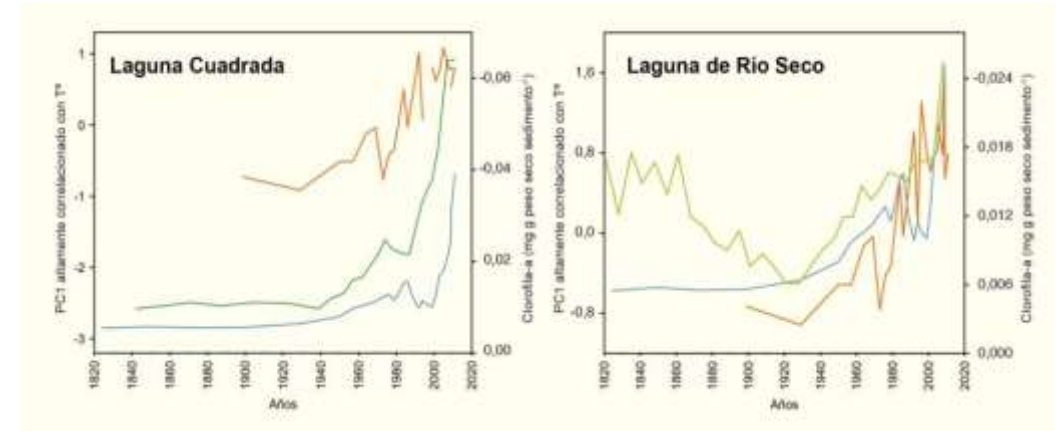




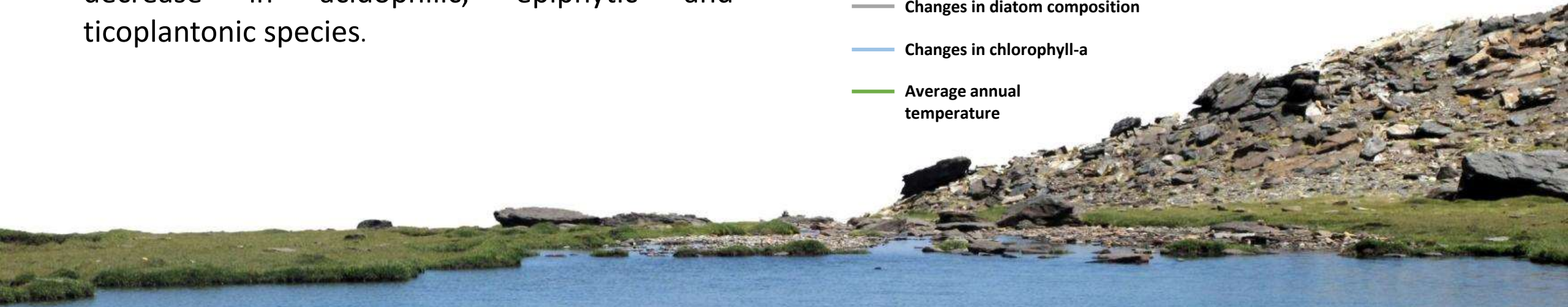


Lagoons are the mirror of Global Change...

The increase in temperature over the last 150 years has led to an increase in chlorophyll-a values in the Sierra Nevada lagoons. Changes in diatom communities have also been detected, involving an increase in alkalophilic species and a decrease in acidophilic, epiphytic and picoplanktonic species.

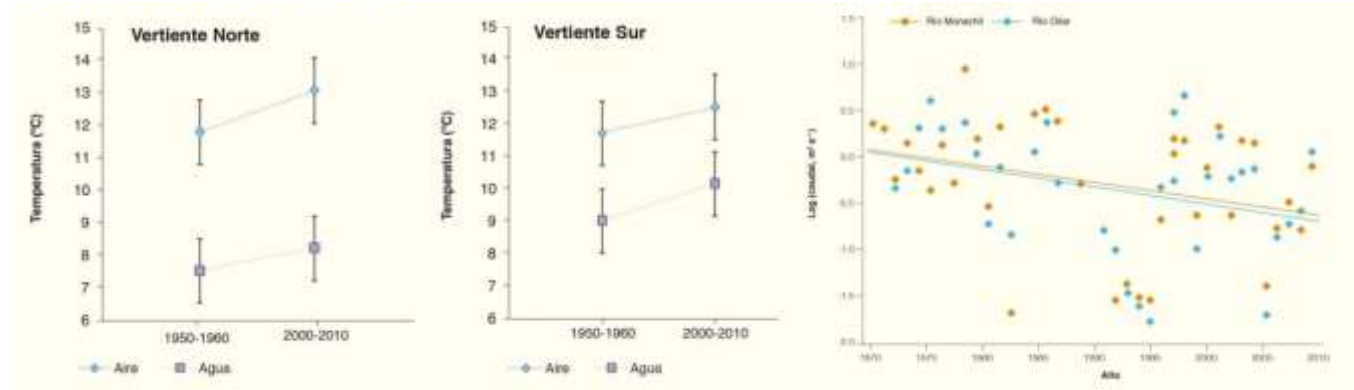


- Changes in diatom composition
- Changes in chlorophyll-a
- Average annual temperature



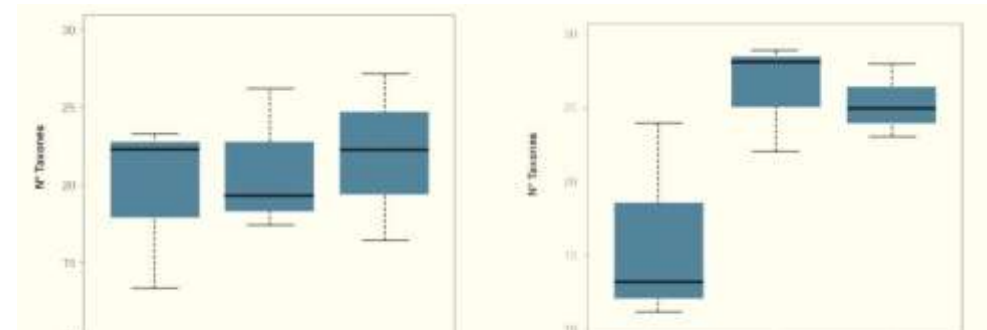
The temperature of the rivers rises while the flow decreases

- It has been estimated that the mean water temperature has increased between previous and current decades by more than 0.5°C.
- The flow has not stopped decreasing in the 1970-2010 period.



- Macroinvertebrate communities tend to diversify at higher elevations: the distribution range of species from middle to upper reaches widens and colonization processes from nearby mountain ranges are detected

Riqueza de especies macroinvertebrados en el río Monachil





Histonevada



Archivo Histórico
Provincial de Granada



CENTRO UNESCO
DE ANDALUCÍA

Miembro del Movimiento
de Ciudades, Centros y Asociaciones
para la UNESCO

HistoNevada is a participatory science tool, which aims to collect and display all the historical information of Sierra Nevada related to Biodiversity, Ecosystems, Environment, Landscape and the use of

Biblionevada



Scopus



WEB OF SCIENCE



Google Scholar

BiblioNevada is an application for the consultation of the scientific production published in relation to Biodiversity, environment and ecological aspects derived from Global Change in Sierra

Climanevada



ClimaNevada is a database that compiles meteorological data around Sierra Nevada mountain range (southern Spain). The aim of this database is the harmonization, standardization, documentation and integration of existing climatic

We have developped new tools to support decision making

The problems of pine plantations:

- Spatial uniformity
- Low diversity
- High density
- breeding ground for pests
- Fires
- forest decay

¿How to diversify pine plantations?

- Diversity of species
- Structural Diversity
- Funcional Diversity



Seed dispersal

Pérez-Luque and Zamora, 2023. diveRpine: Diversification of pine plantations in Mediterranean mountains. An interactive R tool to help decision makers. Ecological Indicators.

doi:10.1016/j.ecolind.2023.110021



Elevation (DEM)

Annual Radiation (Global Solar Atlas)

Tree Density (LiDAR)

Pine plantation patches

Natural Forest patches

Cropland patches

Past Land Cover

Abundance of dispersers (based on literature)



Bridging the gap between scientists and managers

Project title: ***Protection of key ecosystem services by adaptive management of Climate Change endangered Mediterranean socioecosystems*** (LIFE14 CCA/ES/000612)

Subprogram: Life Climate Change Adaptation

Sector: Ecosystem-based approaches

Goal: To **implement management actions for the long-term protection of ecosystem services** vulnerable to climate change by **improving resilience** of key ecosystems.

Period: 2015-2020

Partners: Consejería de Medio Ambiente y Ordenación del Territorio y Agencia de Medio Ambiente y Agua (Junta de Andalucía), **Universidad de Granada**, Universidad de Almería – CAESCG, EBD – CSIC, Centro de Cooperación del Mediterráneo de UICN, Parque de las Ciencias

Budget: 5,462,678 Euros



Bridging the gap between scientists and managers

3 protected areas threatened by climate change along an altitudinal and aridity gradient.



Doñana



Sierra Nevada



Cabo de Gata



What does OBSNEV brings to European protected Areas?:

- 1) A mediterranean mountain, Sierra Nevada, with a privileged natural and historical heritage.
- 2) A lot of scientific information about its ecosystems in a very vulnerable region.
- 3) A place with a long experience in bridging the gap between scientists, managers and citizens.
- 4) An exceptional laboratory of global change, where innovative initiatives with a strong technological base are being developed for the preservation and sustainable use of the natural heritage.

<https://obsnev.es/>

<https://smartecomountains.lifewatch.dev>



Foto: Guido Montañés



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