

# DOÑANA AND LifeWatch INFRASTRUCTURE: A KEY DRIVER IN GLOBAL BIODIVERSITY RESEARCH



Communication networks provided by RedIRIS, serving science for the conservation of biodiversity and to improve the environment

Biodiversity, wildlife conservation, protected spaces, ecosystems, genetic resources and desertification are all scientific fields studied to learn about and preserve a balanced and sustainable environment for the Earth's present and future generations.

Biodiversity is understood as the wide variety of living things (plants, animals, fungi and microorganisms) and their interaction with the ecosystems they inhabit. These beings are subject to classification, study and monitoring; their natural patterns, their genetic variability, the ecosystems of which they are part and the landscapes or regions where they are located are all analysed.

## Doñana Park, an extraordinary area brimming with biodiversity

The Spanish territory is privileged to possess a biodiversity unique to Europe in Doñana Park, located in Andalusia between the provinces of Huelva and Seville in the Guadalquivir river delta. Of its 543 km<sup>2</sup>, 135 km<sup>2</sup> are protected.

Doñana is a mosaic of ecosystems made up of marshes, beaches, mobile and fixed dunes, scrubland, underbrush, hunting reserves and riverine habitats. In particular, the marsh has an extraordinary importance as each year it is a place of passage, breeding and winter refuge for over 500,000 European and African water birds. Living in the park you can find unique and endangered species, such as the Iberian imperial eagle and the Iberian lynx.

Doñana is named after Doña Ana de Mendoza, the wife of the VII Duke of Medina-Sidonia, who retired to this paradise in the 16th century. In 1964, the illustrious Spanish scientist José Antonio Valverde, together with the Higher Council for Scientific Research (CSIC) and with the financial support of the ecological organisation the World Wildlife Fund (WWF), created the Doñana Biological Reserve (RBD) in Almonte, Huelva. Since then, various international environmental protection institutions work in this area.

The Doñana Biological Station (EBD) is a research centre of the Higher Council for Scientific Research (CSIC), whose mission is to coordinate multidisciplinary research projects of the highest level in the Biological Reserve and provide logistical support to the scientific community.

## Origin, development and launch of the LifeWatch initiative

At the start of 2005, numerous scientific networks gathered in Amsterdam to propose a joint European research infrastructure on biodiversity, a project that was only possible through international



Doñana Biological Reserve

→ *"The inclusion of the Doñana Biological Reserve facilities in the RedIRIS-NOVA fibre footprint is a new milestone for its connectivity on a global scale, within RedIRIS and in the world-wide research Intranet. The almost unlimited band width provided by the new connection allows for the management and use of video images and all the sensors deployed in Doñana to be carried out under optimum conditions of quality, simultaneity and safety so they can be used by researchers in the most ambitious projects and to transfer knowledge to society".*

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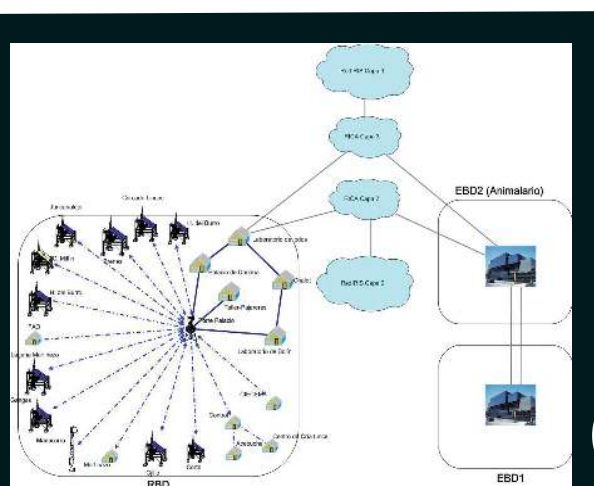
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cooperation, in which ICT (information and communications technology) needed to play a key role. This is how the LifeWatch initiative was born, within the framework of the European research infrastructure roadmap developed by ESFRI (European Strategy Forum on Research Infrastructures).

LifeWatch (e-Science European Infrastructure for Biodiversity and Ecosystem Research) is a European electronic infrastructure for scientific research on biodiversity and ecosystems, which will integrate everything from museum information to systems complete with sensors in "real time", such as Doñana Park. LifeWatch required an initial three-year preparation period (2008-2010) which was funded by the Seventh Framework Programme of the European Union (EU).



Topology of the EBD-RBD network

From the beginning the Doñana Biological Reserve was considered one of the most important natural areas in the world. In 1994 it was declared a World Heritage Site and Biosphere Reserve by UNESCO; the same year was included in the network of Major Scientific Spaces of the European Union; and in 2006 the Ministry of Education and Science recognised it as a Singular Scientific and Technological Infrastructure (ICTS).

#### Data collection techniques

Doñana's biodiversity and its special natural configuration require multiple data collection tools: cameras, microphones, radios, GPS and GSM, and radar (surface, air, marine, harmonics, etc.), as well as the deployment of location sensors for fauna and flora, meteorology and soil, water and atmosphere (with special attention to contaminants), etc., plus traditional rings and, more recently, new devices like mobile CyberTrackers.

Next, between 2011 and 2013, various activities were undertaken to launch the initiative so that it would become an operative infrastructure.

Through a Memorandum of Understanding, LifeWatch is currently made up of Belgium, the Netherlands, Italy, Greece, Romania and Spain, with Germany, Denmark, Finland, France, Iceland, Norway and Sweden showing interest in participating. The management of LifeWatch will be led by Spain (through the CSIC), the Netherlands and Italy.

Doñana, the leading centre in LifeWatch, entered a new technological stage in 2010 when RedIRIS, the Spanish academic and scientific network, installed a transmission network for images, voice and data in the Reserve, significantly improving its traditional connections. In that year alone it reached nearly 900 connected sensors.

Only four years later, in 2014, another research phase began in Doñana when the Ministry of Economy and Competitiveness financed the project "Adaptation and

improvement of the internationalisation of the ICTS-RBD e-infrastructure for ESFRI Lifewatch" with four actions: 1. Development of an ICT infrastructure (to support the ICTS monitoring processes), 2. Creation of a microsensor distribution network (for monitoring large-scale global change), 3. Improvement of the ICTS RBD facilities (Data Processing Centre, e-Laboratories, etc.) and 4. Demonstration activities.

These basic elements of the Doñana-LifeWatch project can not be sustained without a horizontal foundation, consisting in new fibre optic networks provided by RedIRIS-NOVA. These networks will optimise the existing infrastructure for the storage, processing and retrieval of data; provide unique and open access to a lot of information distributed throughout interconnected databases; improve the use and monitoring of data; enrich the exchange of information among researchers and enable real-time monitoring of observations.