

# BEST

VOLUNTARY SCHEME  
FOR BIODIVERSITY AND  
ECOSYSTEM SERVICES  
IN TERRITORIES OF  
EUROPEAN OVERSEAS



## REGIONAL INVESTMENT STRATEGY

### MACARONESIA

DRAFT VERSION

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## ABBREVIATIONS

AFD	French Development Agency (Agence Française de Développement)
BEST	Biodiversity and Ecosystem Services in Territories of European overseas
EC	European Commission
EP	Ecosystem profile
FRCT	<i>Fundo Regional da Ciência e Tecnologia</i> (Regional Fund for Science and Technology, Azores Government)
IUCN	International Union for the Conservation of Nature
OCT(s)	Overseas Countries and Territories
OR(s)	Outermost Region(s)
CR	Critically endangered (IUCN)
EN	Endangered (IUCN)
KBA	Key Biodiversity Area

## **EXECUTIVE SUMMARY**

To be drafted

## 1. MACARONESIA BEST PRIORITY AREAS FOR ACTION

Within the framework of the BEST III project, FRCT developed the Macaronesian Ecosystem Profile in consultation with stakeholders throughout the archipelagos of Azores, Madeira and the Canary Islands. Besides the assessment of threats and pressures and of the current status of conservation and investment, the work involved as well the identification of priorities for action. Within the ecosystem profiling process a list of 194 KBAs was identified (44 in the Azores, 18 in Madeira, and 132 in the Canary Islands), of which 46 were considered priority (6 in the Azores, 7 in Madeira, and 33 in the Canary Islands), because they are the only known sites (globally) where one or more endemic CR or EN species occur. This means that the loss of the natural values in these areas would result in the global extinction of at least one species.

Given the fact that the 3 regions that compose the Macaronesian region are politically and administratively autonomous, it has been considered pertinent to separate them on this basis (see Table 1).

Table 1 Priority areas for action identified in the BEST Macaronesian ecosystem profile

BEST priority area	Geographic Scope	KBA(s) and/or corridors included in priority area Name and reference	Size (km <sup>2</sup> )	Status: fully protected?	
				Yes	No
Azores	Autonomous Region of Azores (Portugal)	Great crater of Faial (FAI3)	1	X	
		Pico mountain crater (PIC4)	4	X	
		Pico da Esperança (SJM3)	32		X
		Pico Alto (SMA7)	1		X
		São Lourenço (SMA8)	1		X
		Pico da Vara (SMG4)	145		X
Madeira	Autonomous Region of Madeira (Portugal)	Desertas Islands (DES1)	14	X	
		Madeira Nature Park (MAD1)	475		X
		Coastal cliffs of Madeira island (MAD4)	32		X
		São João creek - Santa Luzia creek - João Gomes creek (MAD8)	15		X
		Network of Marine Protected Areas of Porto Santo (PSA2)	27	X	
		Northeast area of Porto Santo (PSA4)	11		X
		Selvagens Islands (SEL1)	1246	X	
Canaries	Autonomous Region of Canary Islands (Spain)	Jandía Peninsula (FUE1)	200	X	
		North area of Fuerteventura (FUE6)	222		X
		Island of Lobos (FUE8)	5	X	
		La Solana (GCA1)	110	X	
		Jinámar (GCA13)	2		X
		Las Palmas (GCA18)			
		Los Marteles (GCA2)	124		X
		Tamadaba - south (GCA4)	18		X
		Tamadaba - north (GCA5)	47		X
		Santo Andrés - Valle Seco (GCA7)	61		X
		Cruz de Pineda - Barranco del Pino (GCA8)	11		X
		Pino Santo (GCA9)	12		X
		Garajonay- Chejelipes (GOM1)	58		X
		Epina (GOM11)	13		X
		Taguluche (GOM13)	19		X
Garajonay - Central (GOM15)	14	X			

BEST priority area	Geographic Scope	KBA(s) and/or corridors included in priority area		Status: fully protected?	
		Name and reference	Size (km <sup>2</sup> )	Yes	No
		Los Chapines (GOM7)	7		X
		Frontera - central area (HIE1)	0,4		X
		Echedo (HIE2)	5		X
		Valverde (HIE6)	5		X
		Plains of Corona - La Hondura – Tegala Grande and Famara crag (LAN3)	106		X
		La Palma Central-northeast (PAL1)	270		X
		Teneguia Vucanos (PAL12)	2	X	
		Coast of Garafía (PAL15)	20		X
		El Teide (TEN1)	252	X	
		Guimar - La Esperanza (TEN16)	47		X
		La Viuda - Añaza (TEN19)	30		X
		Anága (TEN2)	159		X
		Garachico - La Montañeta (TEN21)	45		X
		San Cristoval de La Laguna (TEN24)	5		X
		Northern Buenavista (TEN3)	50		X
		Los Carrizales (TEN4)	45		X
		Adeje (TEN6)	20		X

Species records for all Macaronesian archipelagos are incomplete in terms of spatial distribution, abundance and assessment of conservation status. A significant number of species (especially marine species, for which data is extremely limited) were not taken into account for the definition of Macaronesian KBAs due to these gaps, which highlights a pressing need for an improved knowledge base. Without it, conservation actions may miss important species or area outcomes. Mapping and assessing the state of ecosystems and their services could not only sustain conservation proposals but also inform the development and implementation of related policies on water, climate, agriculture, forest and regional planning.

In the future, improved baseline data on species and ecosystems may lead to redrawing KBAs or creating new ones. A basic infrastructure of Biodiversity databanks is already in place to accommodate this information, although it needs to be reinforced in the Azores and extended to Madeira.

The thematic priorities for conservation investment in the region were based upon an analysis of the main threats to biodiversity in the hotspot and their root causes. Lack of species threat assessment, alien invasive species, habitat destruction due to urbanization, tourism expansion and agriculture (including livestock grazing), were ranked as the highest threats by stakeholders consulted during the ecosystem profiling process. Thus, critical areas for action in the Macaronesian region include:

- Baseline data collection & species threat assessment
- Creating (Madeira) and improving (Azores) Biodiversity Databanks
- Invasive alien species control and eradication
- Conservation and recovery plans for native species
- Creation of plant micro-reserves in areas of severely fragmented habitats
- Mapping and assessment of ecosystems and their services
- Information and environmental awareness campaigns
- Priority conservation actions addressing specific taxonomic groups and taxa

## 1.1 BEST Macaronesian priority area 1: Azores

The Azores archipelago is an autonomous region of the Republic of Portugal formed by nine islands: Santa Maria, São Miguel (that make up the Eastern Group), Terceira, Graciosa, São Jorge, Pico, Faial (Central Group), Flores and Corvo (Western Group), and some uninhabited islets, distributed diagonally over approximately 66,000 Km<sup>2</sup>, with a NW-SW orientation along approximately 600 km. The three island groups are separated by 1000-2000 m deep sea channels, except for Faial and Pico islands, between which the channel is, in many parts, only 20 to 50 m deep. With a total coast length of 943 Km and total surface area of 2,322 Km<sup>2</sup>, island size varies between 17 Km<sup>2</sup> in Corvo and 745 Km<sup>2</sup> in São Miguel, with Pico Island holding the highest mountain of Portugal, 2,351 m above sea level. It lies far out in the Atlantic Ocean, between 36°55'N, 39°43'N, 20°00'W and 31°16'W, a location that distinguishes it as the most remote group of islands in the North Atlantic. Flores is the westernmost island, at a distance of approximately 1,900 km from Newfoundland and Santa Maria the easternmost at a distance of approximately 1,570 km from mainland Europe.

The strategic location of the archipelago, halfway between North America and Europe, contributed to its historical role in trans-Atlantic navigation. Still today the maritime and oceanic dimension of the Azores - with an Economic Exclusion Zone (EEZ) of nearly one million km<sup>2</sup> (60% of the Portuguese EEZ and 30% of the EU EEZ) and located at the center of commercial routes between Europe, Africa and America - confer great importance to both the archipelago and Portugal, given its comparative advantage as a platform/hub to mobilize and create value associated with the sea.

Geologically the Azores lie on a 20-36 My old volcanic plateau where the American, Eurasian, and African lithospheric plates join at about 2000m depth. As a consequence, the archipelago is characterized by high volcanic activity typical of a ridge-hotspot interaction. The oldest emergent rocks are found in Santa Maria (8.120 million years), whereas the youngest island is Pico (having emerged about 250,000 years ago) -The eastern parts of all Azorean islands are geologically the oldest, as a result of the particular seismo-volcanic mechanisms of this archipelago. This tectonic feature is responsible for serious volcanic eruptions (e.g., Capelinhos, Faial Island, 1957-1958) and tectonic earthquakes (e.g., Terceira and S. Jorge islands, 1980; Faial and Pico islands, 1998) which have caused loss of life and propriety.

As a result of this complex history, there is a great concentration of extraordinary geological formations with unique biotic adaptations that lead to the recognition of their international significance and consequential establishment of the Azores Geopark in 2010 and its integration into the European and Global Geoparks Network in 2013 as the first archipelagic geopark. With the approval of the Programme for International Geoscience and Geoparks of UNESCO in November 2015, the Azores Geopark became an UNESCO territory, along with the World Heritage sites and Biosphere Reserves. There are 121 geosites in the Azores, scattered throughout the nine islands and surrounding seabed.

The temperate maritime climate of the Azores, heavily influenced by the Gulf Stream, is characterized by its small thermal range (14°C to 18°C in coastal areas and 6°C and 12°C at higher altitude, except for Pico Mountain, where it gets below 2°C), high humidity (80% annual average), persistent winds, and precipitation higher in November, December and January (over 500 mm and up to 1,665.6 mm on the western group; Climate Atlas, 2012; WWF, 2015d).

The Azores economy is based mainly on agriculture, fisheries and tourism. The primary sector has traditionally accounted for most of the archipelago's economic activity and is still relevant, although there's currently a growing concentration of activity in the tertiary sector. As a result

of the importance of the primary sector, the archipelago's main exports are based on the agricultural economy, through the production and sale of meat, milk, cheese and butter. Other exports are also important, such as tea, tobacco, pineapple, canned tuna and fish (PIC-INTERREG IIIB-2000/2006, 2001). Not surprisingly, industry in the Azores is also based mainly on dairy products (milk, cheese) and transformation of fisheries products, such as tuna.

Agricultural production in the Azores, mainly livestock and dairy production, covers over 100,000 ha. of farmland (EEA, 2002), most of the farms being relatively small (5-20 cattle heads). The sector accounts for about 25% of Portuguese milk production (i.e. 500 Mlof milk; SREA, 2015b). Some crops also deserve mentioning, as is the case of pineapples, vine plantations, potatoes, oranges, tobacco and tea (SREA, 2015a). In turn, forests occupy more than 30% of the territory of the Azores, two-thirds of which consists of production forests, primarily of *Cryptomeria japonica* (Japanese cedar) in public and private areas (Autonomous Region of the Azores, 2013). The 'Azorean Cryptomeria' brand has recently been created to promote the use of this timber, representing an important incentive to this activity.

Although with a decreasing trend in recent years, fisheries are also an important economic activity on all islands, with 2,831 registered fishermen and 762 motor vessels in 2014 (SREA, 2015b). Although the Azores archipelago accounts for the largest sub-area of the Portuguese EEZ, it is biologically fragile especially in terms of demersal and deep water species, due to the absence of a continental shelf and high average depths. Only 2.2% of this total area can potentially be used up to a depth of 1,000 m (Autonomous Region of the Azores, 2013) and fishing methods are highly traditional - hook and line still being the major fishing gear used. Fishing brings in an average revenue of about € 35 million for the region, with 9 to 19 tons of fish extracted annually between 2010 and 2014 (SREA, 2015a, 2015d).

The tourism industry is becoming of considerable importance to the economy of the archipelago, with an expressive contribution to wealth creation, employability and internationalization. Infrastructures have grown markedly over the last years, with the accommodation capacity more than doubling between 2000 and 2006 (SREA, 2012), reaching nearly 10,000 beds. Since then the accommodation capacity of traditional hotels have recorded a slow increase, but rural tourism kept growing steadily instead, nearly tripling its accommodation capacity since 2000 (SREA, 2012, 2015c). Nature, humanized space and intangible heritage of the Azores have resulted in more than 30 awards as a sustainable tourist destination from websites and internationally recognized magazines in the last years. However, the great efforts from the Azorean Government to promote the archipelago as a touristic destination in European and international markets and the arrival of low cost companies in 2015 are causing increasing pressures on natural areas (including protected ones) and a growing interest in the construction of ports and harbours and in coastal development.

### **1.1.1 Protected Areas**

The Regional Decree Law 15/2012/A, of April 2nd, transposes international and EU policy, promoting and strengthening synergies between various international conventions on biodiversity, especially the Convention on Biological Diversity, Bern, Bonn and Ramsar, and also establishes the necessary measures for compliance with and implementation of CITES and associated Regulations, the EUROBATS and AEWA in the Azores territory. The Azorean Network of Protected Areas was first created in 1993, long before the Habitats and Birds Directives were transposed into regional law. In the Autonomous Region, protected areas, Natura 2000 sites and others designated under local, national or international frameworks (such as the Ramsar Convention and the Man and Biosphere UNESCO Programme) are

integrated, for the purpose of administration and management, in the recent scheme of Nature Parks, one per island, that include all terrestrial protected sites located in the territory of the island as well as marine areas located within the limit of the territorial sea adjacent to the islands. The Protected Areas Network include 123 areas covering 560 km<sup>2</sup> on land (24 % of the terrestrial area of the archipelago) and 1,242 km<sup>2</sup> of the coastal sea. All Natura 2000 sites are included in the network of protected areas and have, in comparison, a relatively low coverage (3 SCI, 23 SAC and 15 SPA cover a land and marine area of 802 km<sup>2</sup>).

Additionally, there is the legal framework of the Azores Marine Park, created in 2011 following the Green and Blue Papers on Maritime Policy, the Marine Strategy Framework Directive and the National Strategy for the Sea, which includes all offshore MPAs (Government of the Azores, 2015). It covers 111,393 km<sup>2</sup> of offshore waters (DRAA, pers. com.; Government of the Azores, 2015), including seven OSPAR areas within national waters and four outside national jurisdiction but within the limits of the areas proposed for legal continental shelf extension that Portugal submitted to the United Nations Commission on the Limits of the Continental Shelf (Calado et al., 2011). Eight of these OSPAR MPAs incorporate the protection of the seafloor and sub-seafloor for two coastal areas, three seamounts and two hydrothermal vent fields within the EEZ, and for an additional hydrothermal vent field located outside the EEZ. Other four oceanic MPAs have recently been proposed: MPA of Princesa Alice Bank (370 km<sup>2</sup>); MPA of Condor Bank (242 km<sup>2</sup>); MPA of Meteor Submarine Archipelago (123,238 km<sup>2</sup>); MPA Southwest of Azores (11,030 km<sup>2</sup>).

### **1.1.2 Ecoregions, habitats and ecosystems**

The Azores archipelago contains one of the Ecoregions (Azores temperate mixed forests, PA0403) that have been classified as “Critical/Endangered” by the World Wildlife Fund (WWF) - . This palearctic ecoregion encompasses temperate broadleaf and mixed forests, composed of laurel forest, summit heath and scrub, lakes and ponds, mires and bogs and lava fields.

**Laurel forest** - comprising mainly arboreal and perennial shrubs with dark green coloured leaves associated with a complex community of trees, bushes, ferns, mosses, lichens, mushrooms and fungi. It thrives in damp conditions where water is abundant and the sub-tropical climate results in high humidity levels and a relatively high average temperature. It is mainly composed of the floristic genera *Laurus*, *Picconia*, *Myrica*, *Prunus* and *Ilex*. In the Azores, it is now only represented in small, fragmented patches on the summits of São Miguel, Terceira, Pico and Flores (Fernández-Palacios et al., 2011), and restricted to a dense cloud forest with low canopy (5-10 m). It distinguished itself due to the occurrence of *Juniperus brevifolia*, a single species of Lauraceae (*Laurus azorica*), several species of sclerophyllous and microphyllous trees and shrubs, and luxuriant bryophyte communities, covering all available substrata.

**Summit heath and scrub** – composed mainly by the floristic genera *Erica* and *Calluna*, it is restricted to Pico Island, the only island high enough to trespass the laurel forest altitudinal distribution.

**Lakes and ponds** – composed mainly by the floristic genera *Littorella*, *Potamogeton*, *Lemna* and *Juncus* – are a distinctive feature of the Azores archipelago due to their abundance.

**Mires and bogs** – composed mainly by the floristic genus *Sphagnum* they are an important element of the Azores’s volcanic landscape. Ca. 74% of the terrestrial areas in the Azores belonging to the Nature 2000 conservation network are above 500 m, where mires and bogs are a dominant feature (Mendes & Dias, 2013). These host several endangered species, among them juniper (*Juniperus brevifolia*), Azorean heath (*Erica azorica*) and fern species

(e.g. *Culcita macrocarpa*). In particular, peat bogs found on Flores and Terceira are very rich in endemic species and are also in immediate danger from overgrazing (WWF, 2015d).

**Lava fields** – colonized mainly by the floristic genus *Stereocaulon*, they are an abundant feature of the Azorean landscape.

According to the Marine Ecoregions of the World classification (Spalding et al., 2007), the Azores, Madeira and the Canaries are considered as one single Marine Ecoregion with an extension of 1,645,462 km<sup>2</sup>, part of the “Lusitanian” Marine Province, included in the “Temperate Northern Atlantic” Realm.

### 1.1.3 Terrestrial biodiversity

Of Palearctic and Macaronesian origin, terrestrial molluscs of the Azores add up to only 114 species but contain the highest percentage of endemism in the archipelago (Borges et al., 2008). Only four islands have typical island endemics, standing out among them Santa Maria with 70% of unique endemic species (Martins, 1981, 2002; Martins & Ripken, 1991; Mordan & Martins, 2001 in Martín et al., 2008), followed by São Miguel and Terceira with just over 20% and Faial with about 10%.

**Arthropoda**, the most diverse phylum in Azores as commonly worldwide, encompasses 2,298 species and subspecies, a great proportion of which are introduced (42%) and only 12% are endemic, whereas for 11% of the taxa there is not enough information to attribute a colonization status (Rego et al., 2015). In the Azores taxonomic experts on Coleoptera, Araneae and Lepidoptera have made a great effort during the last decades on the study of specimens from the several islands. However, for other groups, like Diptera and Hymenoptera, no such expertise is available (Lobo & Borges, 2010). The low diversification in Azores is probably related to the recent origin of this archipelago (a large proportion of the island areas is less than 1 My) and its greater isolation from colonization sources, among other factors (e.g. Borges & Hortal, 2009; Triantis et al., 2012, in Rego et al., 2015).

**Vascular plants** include over 1,100 taxa from which about 200 are native (Schaefer et al., 2011) and 73 currently recognized as endemic, with only one endemic genus - *Azorina* (Borges et al., 2009). The archipelago's flora shows affinities with Atlantic and Boreal Europe (Juncaceae, Cyperaceae, Sphagnum) and with Madeira and the Canaries (*Ilex*, *Juniperus*, *Laurus*, *Morella*, *Picconia*, *Prunus*, etc.) (Fernandes-Palacios & Dias, 2001; Schäffer, 2003 in Fernández-Palacios, 2010). In contrast with other archipelagos of the Macaronesian region, the Azores lack xerophytes of African origin, and instead show a significant affinity with the Iberian flora (EEA, 2002).

**Birds** of the Azores lists 414 species, containing good examples of insular speciation, given the number of endemic species (2) and subspecies (11) known (Barcelos et al., 2015). Among the regular breeding species, there is the Azores bullfinch *Pyrrhula murina*, the only Azorean endemic passerine species and one of the most threatened European species, restricted to a 83 km<sup>2</sup> patch of cloud forest on the eastern part of São Miguel Island (Ceia et al., 2011). Special reference also to the canary *Serinus canaria*, a passerine endemic to Macaronesia which led Birdlife International to designate the Azores as a Secondary Endemic Bird Area (EBA). Several endemic subspecies of Passeriformes are also present in the archipelago - 3 subspecies of the goldcrest *Regulus regulus* (*R. r. azoricus*, *R. r. inermis* and *R. r. sanctaemariae*), 1 subspecies of the grey wagtail *Motacilla cinerea patriciae*, the common blackbird *Turdus merula azorensis*, the blackcap *Sylvia atricapilla gularis*, the common starling *Sturnus vulgaris granti* and the common chaffinch *Fringilla coelebs moreletti* - a common feature in the majority of insular systems (Borges et al., 2010). There is also an endemic subspecies of Falconiformes, the Azorean common buzzard *Buteo buteo rothschildi*, the only



bird of prey in the region, and one of Columbiformes, the Azorean wood pigeon *Columba palumbus azorica*. Included in the species that sporadically nest in Azores, is the American black duck *Anas rubripes*. Recent introductions comprise the Eurasian collared dove *Streptopelia decaocto* on São Miguel and Terceira and the rose-ringed parakeet *Psittacula krameri* and the common waxbill *Estrilda astrild* in São Miguel Island.

The only species of **reptile** regularly found in Azores – *Lacerta dugesii* – was introduced from Madeira, where it is endemic. In 2002, the gecko *Tarentola mauritanica* was recorded for the first time and the establishment of natural populations has since been confirmed (Borges et al., 2010).

*Nyctalus azoreum* is the only **terrestrial mammal** endemic species occurring in the Azores. Of the 11 species of terrestrial mammals, there are 3 additional native species, all bats (Borges et al., 2010): *Pipistrellus pipistrellus*, *P. madeirensis* and *Myotis myotis* (the latter yet to be confirmed, Rainho et al., 2002) .

#### **1.1.4 Marine biodiversity**

There is one endemic species of sea bird in the Azores - Monteiro's storm-petrel *Hydrobates monteiroi* - with an estimated small population size (ca. 250-300 breeding pairs). It is known to breed only on two islets, but breeding is suspected on other islets as well (Bolton et al., 2008; BirdLife International, 2014). The Azores houses the largest population of Cory's shearwater *Calonectris borealis* in the world (ca. 80% of the European population; Bolton, 2001). Also important are the concentrations of angelito, *Hydrobates castro* (ca. 29% of the European population) and the Macaronesian shearwater, *Puffinus lherminieri*, (ca. 21% of the European population) and a residual population of Bulwer's Petrel, *Bulweria bulwerii* (ca. 50 to 70 pairs) (Miller et al, 1996, in Martín et al., 2008). Other two species nest in the Azores, which, although relatively common worldwide, are important populations at European and national level, respectively the roseate tern, *Sterna dougallii*, (about 1,000 couples, corresponding to 63% of the European population) and the common-tern, *Sterna hirundo* (about 2,000 couples, corresponding to 5% of the European population) (Gochfeld, 1983; Del Nevo et al., 1993, in Martín et al., 2008). Among the species that sporadically nest in Azores, there is the red-billed tropicbird *Phaethon aethereus*. The sooty tern *Onychoprion fuscatus* reaches the northern limit of its distribution in the Azores, where its presence has been known since 1902 (Borges et al., 2010), and regularly breeding in the archipelago since 2002.

A total of 353 marine mollusk and 291 marine arthropod species have been recorded in the Azores. In line with terrestrial biota, marine mollusks show the highest rate of endemism from all taxonomic groups in the Azores (74% of all of marine endemic species and/or subspecies from the archipelago - 29 species out of 39 in total; Borges et al., 2010).

A total of 327 macroalgae are listed for the Azores (51 Chlorophyceae, 62 Phaeophyceae and 214 Rhodophyceae), one of the most comprehensively studied marine groups in the Azores in the more recent years (Borges et al. 2010). *Predaea feldmannii* ssp. *azorica* is the only known endemic taxa to the Azores, with a few other (*Codium elisabethae*, *Laurencia viridis*, *Gelidiella tiniferensis*, *Phyllophora gelidioides*, *Meristotheca decumbens*, *Botryocladia macaronesica*) are listed as endemic to Macaronesia.

There is only one endemic species of marine fish, the coastal blue wrasse *Symphodus caeruleus* (Azevedo, 1999).

### 1.1.5 Main issues

The introduction of many species (some cosmopolitan and others with invasive potential) is strongly related to Azores' strategic location as a gateway for maritime traffic in the Atlantic, and also to the development of large romantic gardens, common among wealthy families in the eighteenth century. Today, the number of exotic species per km<sup>2</sup> is one or two times the number of indigenous species (Silva et al., 2008), with approximately 70% of the vascular plants and 58% of the arthropods found in the archipelago being exotic (Borges et al., 2009), as well as most of the mammals (except the Azorean bat) and all the amphibians and reptiles (Silva et al., 2008). The impact of species introduced for agriculture, forestry, and aesthetic purposes, in particular, invasive vascular plants can have dramatic consequences. A negative impact on the indigenous community of phytophagous insects is expected, as well as changes in vegetation structure, difficulties in the regeneration of endemic species, and competition for dispersal agents, leading to a reduction in the frequency and abundance of indigenous plant taxa (Borges et al., 2009). The continuous expansion of some invasive plants like kahili ginger (*Hedychium gardnerianum*), sweet pittosporum (*Pittosporum undulatum*) and *Hydrangea macrophylla*, is threatening several fragments of native vegetation, leading to the prediction that several communities of lichens, vascular plants, molluscs, and arthropods native and endemic to the Azores are under pressure (Silva et al., 2008). Introduced fauna also poses an important threat to native species. The main islands were once important breeding places for seabirds, but now most nesting sites are restricted to small islets or precipitous cliffs, probably due to predation by introduced mammals (Monteiro, 1999). Herbivory caused by wild goats is virtually eradicated, but the impact of rabbits in the native flora is still considered important. Furthermore, several exotic arthropods are considered as pests in the Azores, namely the Japanese beetle (*Popillia japonica*) which attacks pastureland and other crops, and is now expanding in several islands (Terceira, Faial and São Miguel); the armyworm (*Pseudaletia unipuncta*) in pastureland areas in several islands where it causes heavy annual damage in agriculture; the termites in urban areas, in particular *Cryptotermes brevis*, considered as the most dangerous dry wood termite in the world and that is presently considered as an urban pest in the cities of Angra do Heroísmo, Ponta Delgada and Horta (Borges & Myles, 2007).

Agriculture has traditionally accounted for most of the archipelago's economic activity. The initial intensive conversion to agricultural and grazing land, coupled with the later development of timber production, almost destroyed the laurel forest of the archipelago, which is now restricted to about 5% of its original coverage (Gaspar et al., 2008), represented only in small, fragmented patches on the summits of São Miguel, Terceira, Pico and Flores (Fernández-Palacios et al., 2011). A further negative impact originated from the expansion of dairy farms, which became the main economic activity in the Azores especially after Portugal's entry into the European Union in 1986 and subsequent availability of agricultural subsidies, grants, and quotas for which it is eligible. Aided by subsidies from the Common Agriculture Policy, large areas of pastures became the predominant land use (Figure 34), accounting on average for 42% of each island area (Rego et al., 2015), creating "green deserts" of low biodiversity. In some cases, the areas surrounding pastures are also vulnerable to grazing due to the lack of fences. Additionally, the associated increase in fertilizer use and chemical applications compromise freshwater quality, leading to serious eutrophication problems in freshwater lakes, even affecting the water supply. Furthermore, pesticide use, either in agricultural pest control, or to control livestock parasites (e.g. anthelmintics) contributes to reduce insect diversity and abundance. This is, moreover, one of the threats often associated with the conservation of bats (Rainho et al., 2002). Pesticides, in addition to decreasing the diversity and abundance of prey, can poison bats that eat contaminated insects. There are, however, ways to reconcile agricultural practices with biodiversity conservations: the semi-natural pastures of mid and

high altitude of some islands, for instance, allow the co-existence of endemic plant species and their associated invertebrate fauna (Borges et al., 2004).

## **1.2 BEST Macaronesian priority area 3: Madeira**

Madeira archipelago, an autonomous region of Portugal located at around 660 kilometres from the African coast, consists of 2 main islands, Madeira (742 km<sup>2</sup>) and Porto Santo (43 km<sup>2</sup>), three islets known as Desertas (an uninhabited 14 km<sup>2</sup> nature reserve), the sub-archipelago of Selvagens (a 3.6 km<sup>2</sup> nature reserve) and several small islets.

This archipelago sits on one volcanic complex, Porto Santo being the oldest island (14 My) and in an advanced destruction stage, whereas Madeira has experienced its last volcanic activity 25 ky ago (Prada & Serralheiro, 2000, in J.M. Fernández-Palacios, 2010) and is still rich in cliffs and ravines that have favoured the conservation stage of a nature. Selvagens islands (approximately 27 My old) were originated on the same hotspot as the Canary Islands, and are at present eroded almost to sea level.

The climate of Madeira is temperate to sub-tropical and greatly influenced by the anticyclone of the Azores. Being strongly governed by N and NE trade winds, there is a clear north-south differentiation - north slopes with high precipitation and persistent cloud cover and a dryer south. High dry winds and lower humid sea breezes generate a cloud layer at ca. 1,000 m altitude that favours the development of climax communities of native species and evergreen forest.

Madeira's economy is dominated by the tertiary sector, which concentrates 75% of the employed population, while industry and agriculture account for 12% and 13% respectively. Tourism has been a main driver with nearly 1.2 million visitors in 2014 (DREM, 2015). Industry is mostly related to the production of artisanal goods. The production of sugar, wine and bananas is the backbone of the agricultural economy of Madeira, together with numerous common European vegetables. Warm temperate fruits like oranges, lemons, guavas and mango, together with pineapple and figs are cultivated for export. Fisheries are of relatively low relevance in the archipelago as a result of unfavorable surrounding natural conditions and characteristics of the available fish resources (SRA, 2014).

### **1.2.1 Protected Areas**

The archipelago of Madeira has a network of 11 Natura 2000 sites that cover an area of 2,452 km<sup>2</sup>. A network of regional protected areas exist since 1982, of which the Madeira Nature Park (covering the Madeiran Central Massif and all the Laurisilva area) represents 60%, the rest being covered by 5 Nature Reserves (one a marine protected area). The Nature Park and the Nature Reserves cover about 701 km<sup>2</sup> that partially overlap the Natura 2000 sites. In addition to classified areas, Madeira's territorial waters have been (since 1987) designated as Marine Mammal Sanctuary in order to protect in particular the endangered Mediterranean monk seal. The creation of a "Network of Marine Protected Areas" is underway, envisaging the legal figures of marine nature reserves and marine parks. A large MPA (132,999 km<sup>2</sup>) has also been proposed to OSPAR for the Madeira-Tore geological complex - between Madeira and mainland Portugal, covering the submarine banks Tore, Ashton, Ormonde and Gettysburg (Gorringe), Josephine, Hirondelell, Lion, Unicorn, Seine and Dragon - of which the component within the Portuguese EEZ is to be designated as an SCI within Natura 2000 network.

### 1.2.2 Ecoregions, habitats and ecosystems

The Madeira archipelago constitutes one of the Ecoregions (Madeira evergreen forests - PA0425) identified by the World Wildlife Fund (Olson et al. 2001) as representing the most distinctive examples of biodiversity for a given major habitat type. The major elements of this Palearctic ecoregion are listed below:

**Coastal desert scrub** - the sub-desert succulent coastal scrub characterized by the dominance of endemic spurge shrubs (*Euphorbia piscatoria* in Madeira and *E. anachoreta* in Selvagens) is the African aspect of the Macaronesian islands. Due to their low altitude it is actually the unique ecosystem existing in the Selvagens, and only close to the sea in Madeira. The community of herbs and shrubs forming the coastal vegetation is found below 300 m across the archipelago and is dominated by *Euphorbia piscatoria*, *Echium nervosum*, and *Globularia salicina*, all endemic to Macaronesia (Aguin-Pombo & Carvalho, 2010).

**Thermophilous woodland** - directly above the coastal desert scrub, an open thermophilous woodland exists, dominated by tree species of Mediterranean origin such as *Olea*, *Dracaena*, *Sideroxylon*, and *Juniperus* (Fernández-Palacios et al., 2008).

**Laurel forest** – in Madeira the laurel forest is a dense cloud forest, with a high canopy (>30m) (Fernández-Palacios, 2010), the dominant trees including genera such as *Picconia*, *Laurus*, *Ilex*, *Prunus*, *Morella*, *Apollonias*, *Persea* and *Ocotea* (Dias et al., 2007) and several others, of which special reference should be made to the extremely rare Madeiran endemic *Goodyera macrophylla*. This archipelago hosts, within the Natural Park of Madeira, one of two sites declared by UNESCO as Natural World Heritage - Laurisilva of Madeira – considered as the largest surviving area of laurel forest and believed to be 90% primary forest (UNESCO, 1999), where a wealth of ecological niches and intact ecosystem processes play a predominant role in the hydrological balance on the Island of Madeira. In Madeira, the laurel forest can be divided into a dry evergreen component, mostly on south-facing slopes, characterized by *Apollonias barbujana*, *Visnea mocanera*, and *Picconia excelsa* and a moist evergreen component, mostly on north-facing slopes and gorges, characterized by *Laurus novocanariensis*, *Ocotea foetans* and *Persea indica* (WWF, 2015c). The dry evergreen vegetation has been much reduced, but the evergreen wet laurel forest still occupies 20% of the island (Aguin-Pombo & Carvalho, 2010).

**Summit** (heath and scrub) - in Madeira, at higher altitudes, the dry evergreen forest is replaced by an upland vegetation of herbaceous plants and shrubs, with *Erica arborea* being the dominant shrub species, and where bryophyte and lichen communities, especially epiphytes, are highly diverse (WWF, 2015c).

Madeira, together with the Azores and the Canary Islands, forms one of the Marine Ecoregions of the World, part of the “Lusitanian” Marine Province, included in the “Temperate Northern Atlantic” Realm (Spalding et al., 2007).

### 1.2.2 Terrestrial biodiversity

**Molluscs** - 295 terrestrial mollusc taxa are listed (187 on the island of Madeira, 104 in Porto Santo, 37 in Desertas and 8 in the Selvagens islands) with over 70% endemism, specific to each island (Borges et al., 2008), making it one of the oceanic islands with the greatest diversity of terrestrial molluscs per unit area on the planet (Waldén, 1983 in Martín et al., 2008). Porto Santo, the oldest island of the archipelago, is the one with more species and subspecies of terrestrial molluscs per unit area (104 taxa in only 43 km<sup>2</sup>), 80% of which are endemic (Borges et al., 2008). The most striking feature of Madeiran fauna is its pronounced relict character - most of the endemic taxa belong to

genera or subgenera which are now either extinct in Europe or have evolved from ancestors in Europe (Kay, 1995).

**Arthropods** - According to Borges et al. (2008), there are 3,891 taxa (species and subspecies) of terrestrial arthropods in Madeira archipelago - Coleoptera (1,040 taxa), Hymenoptera (610 taxa), Diptera (555 taxa), Lepidoptera (331 taxa) and Hemiptera (522), comprising 78% of all arthropod species and subspecies of the Madeira archipelago. The terrestrial arthropod fauna of the Madeira archipelago is dominated by indigenous taxa (68%) and only 28% of the taxa are considered exotic (Borges et al., 2008). Thirty-one arthropod genera have 5 or more endemic species and subspecies. Madeira island presents unique spider diversity with a high number of endemic species, many of which are still poorly known. The Desertas Islands are the sole home of one of the largest and rarest wolf spider species, *Hogna ingens*, a strict endemic present in a single valley of the Desertas (Crespo et al., 2014b).

**Plants** - 1,204 taxa (species and subspecies) of vascular plants have been recorded for the archipelago, of which 13% are endemic to the archipelago, 6% endemic to Macaronesia, 40% native, 6% probable native, 2,4% likely introduced and 33% introduced (Martín et al., 2008). Of special importance for Madeira is the high number of species of pteridophytes, with 75 species represented in the evergreen forest, 14 of them endemic (EEA, 2002). The vascular flora comprises paleo-endemics (e.g. *Laurus*, *Ocotea*, *Apollonias*, *Persea*, *Clethra*), neo-endemics, (many with adaptive radiation, e.g. *Aeonium*, *Sonchus*, *Echium*, *Sinapidendron*, *Euphorbia*, *Isoplexis*, *Musschia*), Mediterranean Flora (e.g. *Euphorbia*, *Olea*, *Maytenus*, *Myrtus*, *Teline*, *Genista*) and anthropic flora (introduced and naturalized plants like *Castanea*, *Pinus* and *Ulex*) (Jesus et al., 2009). At present, the bryophytes of the Madeira archipelago comprise about 512 taxa, of which 333 are mosses (11 endemic) and 179 are liverworts (4 endemic) and hornworts (Borges et al., 2008; Fontinha and Sim-Sim, 2011).

**Birds** - In Madeira, birds are the class of vertebrates with more taxa, registering 38 species and subspecies (62%) (Martín et al., 2008). Moreover, the comparison of the proportion of endemics per class of vertebrates shows that birds account for 50% of all the endemics present in this archipelago (Martín et al., 2008). Four of these are endemic to the archipelago (*Columba trocaz*, *Pterodroma madeira*, *P. feae* and *Regulus maderensis*), with an additional 2 species endemic to Macaronesia. In addition, there are also endemic subspecies such as *Fringilla coelebs maderensis* (Madeiran chaffinch).

**Reptiles** - seven species and subspecies of reptiles occur in the archipelago, of which two species were introduced - *Tarentola mauritanica* and *Hemidactylus mabouia* - and the remaining five native taxa are all endemic - *Tarentola bischoffi* in the Selvagens islands and *Teira dugesii* with distinct sub-species in each of the 4 island groups in the entire archipelago.

**Mammals** - there are 12 species and subspecies of mammals in the archipelago, representing 20% of the vertebrates (Borges et al., 2008). Endemic taxa comprise *Nyctalus leisleri verrucosus* (endemic to the archipelago) and *Pipistrellus maderensis* (endemic to Macaronesia). Native bats species are *Tadarida teniotis*, *Hypsugo savii* and *Plecotus austriacus*.

### 1.2.3 Marine biodiversity

**Sea birds** - Desertas islands are one of the most important nesting areas for seabirds in Macaronesia and the North Atlantic (SRA, 2014), having been classified as "Important Bird Area" (IBA) under the BirdLife International, due to their breeding importance for *Pterodroma feae* (endemic to these islands), *Calonectris borealis*, *Bulweria bulwerii*, *Oceanodroma castro*

and *Sterna hirundo*, all of European interest (SRA, 2014). Madeira is also particularly important for *Pterodroma madeira*.

**Invertebrates** - littoral shelled molluscs of particular importance, with about 750 species recorded from Madeira, 23 endemic to the archipelago (mostly in the Rissodae family) and another 23 species shared with other Macaronesian archipelagos (Segers et al., 2009).

**Flora** - 374 algae species have been listed, from which 68 Chlorophyceae, 68 Phaeophyceae and 238 Rhodophyceae (Ferreira et al., 2012). There are no endemic species.

**Fish** - a total of 226 species of littoral fish are recorded so far but no endemic species are known in the archipelago (SRA, 2014).

**Mammals** – Madeira host one of the only two populations of the Mediterranean Monk Seal (*Monachus monachus*) in the eastern Atlantic (the other is located on the Cape Blanco region, on West Africa) (González, 2015). From a low of less than 10 animals in the 1980s, the strict protection of the Desertas islets and the surrounding waters saved the colony from extinction. Today about 20-30 adults are estimated to live there, and the population is increasing (Pires, 2008)

### 1.2.5 Main issues

Invasive plant species constitute an important threat, mainly at the lowest altitudes of Laurisilva distribution, where species of *Acacia*, *Hedychium gardnerianum* and *Pittosporum undulatum*, *Ailanthus altissima*, and *Acer pseudoplatanus* are widely distributed. Higher regions are equally under pressure by other species such as *Ageratina* and *Erigeron*.

Among vertebrates, with the exception of five species of indigenous bats (Oliveira, 2008) all the terrestrial mammals were introduced, namely three rodent species (*Rattus rattus*, *R. norvegicus* and *Mus musculus*), rabbits, goats and cats (Oliveira, 2008). Species like the black rat and the domestic cat are known to have a strong negative impact on populations of native birds, which in turn are the main vectors for dispersal of seeds in the laurel forest. The introduction of rabbits in Porto Santo caused a degradation of the natural vegetation, a situation that has remained due to continued grazing by both rabbits and livestock, which has also led to severe regression of the endemic flora on Desertas and Salvages, consequently causing erosion of the coastline.

Most of the forest of Madeira has been destroyed through exploitation for agricultural purposes, ship-building, hydric resource exploitation and forestry management (Moore 2009). The native lowland vegetation and dry laurisilva are almost completely replaced by terraced agriculture, forest plantation of *Acacia* sp. and *Eucalyptus* sp., as well as by urban development. Only the mountain slopes on the northern side of Madeira still retain areas of humid Laurisilva (Wakeham-Dawson et al., 2002). The ensuing deforestation, linked to the steep orography and the occurrence of flash rains, has led to frequent mass floods (Baioni 2011). Additionally, as anthropogenic activity increased, fire and habitat fragmentation became more frequent (Fontinha et al. 2014) with a clear cumulative impact on the integrity of natural vegetation.

## 1.3 BEST Macaronesian priority area 2: Canary Islands

The Canary Islands archipelago is an autonomous region of Spain located 96 km off the NW coast of Africa. It consists of seven major islands divided into two administrative provinces - Las Palmas (composed of the islands Gran Canaria, Fuerteventura and Lanzarote) and Sta. Cruz de Tenerife (composed of the islands of La Gomera, Tenerife, La Palma and El Hierro). Additionally, there are 4 minor islands - La Graciosa (the only inhabited one), Alegranza, Montaña Clara and Lobos - and several small islets and rocks. With a 1,583 km long coastline, it covers a surface area of 7,447 km<sup>2</sup>, with island size ranging from 287 km<sup>2</sup> in El Hierro to 2,036 km<sup>2</sup> in Tenerife. The 3,718 m high El Teide volcano, on the island of Tenerife, is the highest summit in Spain. Evidence suggests colonization around 2500 BP by the Guanche people (Fernández-Palacios, 2010), followed by Castilian conquest and settlement in the 15th century, with over 2 million inhabitants at present.

The archipelago has never been connected to the mainland, and remains volcanically active despite its age (21 My for Fuerteventura). Pleistocene glaciation cycles have resulted in some fusions of neighbour islands (Mahan, comprised of Lanzarote, Fuerteventura and satellite islets), the emersion of submarine banks, and reduction of the distance to mainland Africa (García Talavera, 1999, in Fernández-Palacios, 2010), thus facilitating dispersal processes.

Climate varies greatly in the Canary Islands, due to its location on a transition zone between temperate and subtropical climate types. Mild average temperatures (18-21° C) can vary greatly due to orography and island orientation, getting as low 10-12 °C in the higher areas of the interior of the islands or even 4°C on Teide peak (Climate Atlas, 2012). The wide range of microclimates is strongly influenced by the NE-SW sea winds (trade winds) that become cooler and more humid as they pass over the cool sea (influenced by a current from cold southern latitudes). Humidity is captured in the north slopes of the higher islands (mountains posing natural barriers), thus leaving southern areas drier and warmer throughout the year, as is also the case of lower islands (<750 m) (WWF, 2015a). Average annual rainfall is strongly influenced by altitude - exceeding 1,000 mm at higher altitudes and shortfalling 100 mm near the coast (Climate Atlas, 2012) - and is highly seasonal - December and January being the rainiest months and July and August the driest.

The tertiary sector represents 86% of the economy of the Canary Islands - of which tourism is of particular importance, with about 12 million visitors a year - employing 87% of the population (ISTAC, 2016c). The expansion of tourism has promoted both construction and related services. Industry is scarce - mainly based on agricultural and food products and tobacco -with a relevant power subsector, based essentially on oil refinery. Agriculture plays a minor role in the archipelago's economy, being the scarcity of water and suitable land for cultivation the main constraints to its development. Only 10% of the surface is farmed, to a large extent dry land farming (barley, wheat, vines and potatoes) and a minority of irrigation farming (bananas, tomatoes), targeted at the Spanish and European markets (European Parliament, 2011a). Other crops for export include tropical fruits (avocados, pineapples, mangoes and other crops in green-houses) and flowers.

### 1.3.1 Protected Areas

In the Canary Islands, a network of Protected Natural Areas is officially under the responsibility of the Canarian Government, their management being delegated to each island's government (Cabildos). The same is to be applied to the Natura 2000 network when the skills are in place within the Cabildos. The marine Natura 2000 network, however, is managed directly by the Government of Spain (Ministry of Agriculture, Food and Environment) unless there is

"ecological continuity" with a terrestrial site, in which case the management is carried out by the Canarian government. The network of protected areas, 149 in total, covers 4,312 km<sup>2</sup> - 146 terrestrial (of which 4 are classified as national parks, from which 2 are part of the UNESCO World Heritage network), and 3 Marine Reserves with Fishery Interest. All seven islands are fully (Lanzarote, Fuerteventura, La Palma, La Gomera & El Hierro) or partly (Gran Canaria and Tenerife) classified as UNESCO Biosphere reserves.

### 1.3.2 Ecoregions, habitats and ecosystems

The Canary Islands archipelago contains two of the Ecoregions (Canary Islands dry woodlands and forests, PA1203 and Mediterranean acacia-argania dry woodlands and succulent thickets, PA1212) identified by the World Wildlife Fund (Olson et al. 2001). These Palearctic ecoregions encompass Mediterranean forests, woodlands and scrub composed of: 1) xerophytic shrub, thermophilous forest, laurel forest, pine forest and high mountain shrub on La Palma, Hierro, Gomera, Tenerife and Gran Canaria; and of 2) Argania spinosa forest and euphorbia-dominant succulent shrubland on Fuerteventura and Lanzarote.

**Coastal desert scrub** -The sub-desert succulent coastal scrub, characterized by the dominance of endemic spurge shrubs (*Euphorbia balsamifera*, *E. obtusifolia*, *E. lamarckii*), an African aspect of the Macaronesian islands, is well distributed on the Canaries. This low elevation arid woodland is present on all islands at low altitude (0 to 400 m on southern slopes, and a predominant coastal distribution on northern slopes) (Francisco-Ortega et al., 2010). This zone is devoid of large trees and is mostly filled with small shrubs and perennial plants with succulent leaves and stems (e.g., *Euphorbia* spp., *Kleinia neriifolia*, *Ceropegia* spp., *Aeonium* spp., *Plocama pendula*) or coriaceous leaves (e.g., *Rubia fruticosa*, *Cneorum pulverulentum*, *Echium* spp.).

**Thermophilous woodland** - occurring directly above the coastal desert scrub, it is dominated by tree species of Mediterranean origin such as *Olea*, *Dracaena*, *Sideroxylon*, *Phoenix*, *Pistacia* and *Juniperus* (J.M. Fernández-Palacios et al., 2008). Dry sclerophyllous forests (*Rhamno crenulatae*–*Oleetea cerasiformis*) occur between 400 and 600 m (on southern slopes) and between coastal areas and 600 m (on northern slopes) on all islands (Francisco-Ortega et al., 2010). With strong floristic links to the Mediterranean Thermophile forests, those on northern slopes richer than those on southern slopes, this community includes trees such *Visnea mocanera* and small shrubs such as *Cheirolophus* spp., *Crambe* spp., *Echium* spp., *Rhamnus crenulata*, and *Sideritis* spp. (Francisco-Ortega et al., 2010).

**Laurel forest** - comprising mainly arboreal and perennial shrubs with dark green coloured leaves associated with a complex community of trees, bushes, ferns, mosses, lichens, mushrooms and fungi. It thrives in damp conditions where water is abundant and the sub-tropical climate results in high humidity levels and a relatively high average temperature. It is mainly composed of the floristic genera *Laurus*, *Picconia*, *Morella*, *Prunus* and *Ilex*. These forests display a unique wealth of ecological niches, intact ecosystem processes, and play a predominant role in maintaining the hydrological balance, of which Garajonay National Park (UNESCO Natural World Heritage) preserves an outstanding example that covers about 70% of the park's area. In the Canary Islands, the humid evergreen forests (*Pruno hixa*–*Lauretea novocanariensis*) – with the highest number of endemic plants, invertebrates, and vertebrates (Francisco-Ortega et al., 2010) - grows between 500 and 1,400 m in elevation, with some species reaching more than 20 m in height (WWF, 2015a). Endemic Macaronesian heaths, also known as fayal-brezal, grow from 500 to 1,700 m, a transition vegetation between Laurisilva and Canarian endemic pine forests, with which they share some species (*Ilex canariensis*, *I. perado*, *Larus azorica*, and *Picconia excelsa*). There are three distinctive



species, *Morella faya*, *Erica arborea* and *E. scoparia*, with three different patterns of distribution: 1) the contact zone with Laurisilva, where *Morella* spp. are dominant, with some *Erica* spp.; 2) the typical fayal-brezal association (Morella-Erica); and 3) the contact zone with pine forests where *Erica* spp. are more common than *Morella* spp. (González et al., 1986). The humid evergreen forests are not found on the most easterly islands of Fuerteventura and Lanzarote.

**Pine forest** – endemic to the Canary Islands, they are dominated by the palaeoendemic Canary pine (*Pinus canariensis*) and are present at the higher Canary Islands (Gran Canaria, Tenerife, La Palma and El Hierro) in northern (1,200-2,000 m) and southern (600-2,300 m) slopes (Francisco-Ortega et al., 2010), while absent in Lanzarote and Fuerteventura, and restricted to a few small natural pockets on La Gomera. In their limited range they are mixed with *Adenocarpus* spp., Myrica-Erica associations, or even with Laurisilva forest (northern), or with *Chamaecytisus* spp., *Spartocytisus* spp., and *Ephedera* spp., or *Cistus* spp. or *Micromeria* spp. (southern). Pines can also be found mixed with *Juniperus cedrus* and *J. phoenicea* at higher elevations. Although Canary endemic pine forests contain a lower number of species compared with other vegetation formations in the Canaries, they have a large number of endemics in all plant groups, including fungi and lichens.

**Summit** (heath and scrub) - only on La Palma and Tenerife the pine forest is substituted in height by a summit scrub characterized by endemic, cushion-like legumes (*Adenocarpus viscosus* on La Palma and *Spartocytisus supranubius* on Tenerife) and several other endemic species such as *Echium wildpretii* (Fernández-Palacios, 2010). Having been almost driven to extinction for the extraction of timber, the Canary Island juniper, *Juniperus cedrus*, is mostly relegated to inaccessible landscapes on La Palma.

**Lakes** - although lakes or ponds are not a characterizing feature in the Canary Islands, there are permanent water fluxes where fresh water arthropods, including endemic species, may be found.

**Mires and bogs** – these formations are very scarce in the Canary Islands due to inappropriate environmental conditions for peat formation and the large human effect on the landscape.

**Lava fields** - young volcanic terrain is abundant as in all the Macaronesian archipelagos with several historical eruptions, some of them with in the last years or decades, usually dominated in their first stages by the lichen *Stereocaulon vesuvianum* (Fernández-Palacios et al., 2008).

The Canary Islands, together with the Azores and Madeira, forms one of the Marine Ecoregions of the World, part of the “Lusitanian” Marine Province, included in the “Temperate Northern Atlantic” Realm (Spalding et al., 2007).

### **1.3.3 Terrestrial Biodiversity**

In addition to protected areas, Spanish and Canary catalogues of protected species have been implemented with protection measures ranging from preventing the capture to active management through conservation or recovery plans.

**Molluscs** - in the Canary Islands, endemism is outstanding for gastropods: about 83% of the 285 species are endemic (Arechavaleta et al., 2010), of which the Canary snail genus *Hemicycla* has 76 species and is the second most species-rich genus of invertebrates in the archipelago (Francisco-Ortega et al., 2010). Six mollusc genera are endemic to the archipelago.

**Arthropods** - endemism is most spectacular among species of beetles and butterflies In the Canary Islands (Machado, 1998) - Tenerife harbours the highest number of endemic species

of beetles (Francisco-Ortega et al., 2010); the Geometridae family (Lepidoptera) contains approximately 50% endemism, and other groups like Orthoptera and Diptera species are almost 45% and 40% endemic respectively (Machado, 1998). The Arachnida are represented by approximately 800 native species, half of which are endemic (Francisco-Ortega et al., 2010), with 12 endemic genera. The extensive cave system composed mostly of volcanic tubes found in all islands is one of the most peculiar ecosystems in the Canary Islands. It has a highly endemic invertebrate fauna, terrestrial and aquatic, a great proportion of which are blind, lack any body pigmentation and have large legs and antennae (Francisco-Ortega et al., 2010).

**Plants** - The Canary Islands house a spectacular botanic diversity with over 1,300 species of native vascular plants found in approximately 102 families and 712 genera (Francisco-Ortega et al., 2010). There are over 600 endemic species of seed plants, comprising 40% of a native flora with clear affinities with the Mediterranean region. At least 22 whole genera of seed plants are endemic to the Canaries, with seven belonging to the daisy family, Asteraceae. Concerning non-vascular plants, approximately only 5% of the non-vascular native flora is endemic to the Canary Islands - 1,634 native species of fungi (107 endemics), 1,294 of lichens (26 endemics), and 464 of mosses and liverworts (Francisco-Ortega et al., 2010).

**Birds** - In the Canary Islands, 105 species and subspecies of breeding birds have been recorded (regular and occasional breeding), representing 67% of all vertebrates (Arechavaleta et al., 2010). Together with Madeira, the Canaries have been designated an Endemic Bird Area by Birdlife International, and an urgent priority area for conservation. Most restricted-range species on the Canarian islands are dependent on laurel forest, with the majority being found on Tenerife. Four birds are endemic, Bolle's pigeon (*Columba bollii*), Laurel pigeon (*Columba junoniae*), Canary Islands finch (blue chaffinch *Fringilla teydea*), and Canary Islands kinglet (*Regulus teneriffae*). Berthelot's pipit (*Anthus berthelotii*), plain swift (*Apus unicolor*), and common canary (*Serinus canaria*) are near-endemic to the Canary Islands Dry Woodlands and Forests (Machado, 1998). Bird subspecies restricted to the Canary Islands include a subspecies of kestrel (*Falco tinnunculus teneriffae*), a grey wagtail (*Motacilla cinerea canariensis*), a long-eared owl (*Asio otus canariensis*), three subspecies of chaffinches (*Fringilla coelebs tintillon*, *F.c. ombriosa*, *F.c. palmae*), a Chiffchaff (*Phylloscopus canariensis*) and two subspecies of great spotted woodpeckers (*Dendrocopos major canariensis*, *D. m. thanneri*) (Machado, 1998). The archipelago's ecoregion "Mediterranean Acacia-Argania Dry Woodland and Succulent Thicket" contains the endemic Fuerteventura chat (*Saxicola dacotiae*), and the following endemic bird sub-species: kestrel (*Falco tinnunculus dacotiae*), houbara bustard (*Chlamydotis undulata fuertaventurae*), barn owl (*Tyto alba gracilirostris*), stone-curlew (*Burhinus oedicephalus insularum*), and the cream-colored courser (*Cursorius cursor bannermani*) (WWF, 2015b). Other bird subspecies endemic to the Canaries include the buzzard (*Buteo buteo insularum*), spectacled warbler (*Sylvia conspicillata orbitalis*), great grey shrike (*Lanius excubitor koenigi*), lesser short-toed lark (*Calandrella rufescens polatzeki*), and linnet (*Acanthis canabina harteri*) (WWF, 2015b). A process of radiation has occurred in many birds, such as the blue tit *Parus caeruleus* that has evolved into three different subspecies: *P. c. teneriffae* in Gran Canaria, Tenerife and La Gomera, *P.c. ombriosus* in El Hierro and *P.c. palmensis* in La Palma (Moreno 1988).

**Reptiles** - there are 13 native species of reptiles in the Canary Islands, all of them endemic (Francisco-Ortega et al., 2010), whereby each island has endemics in the families Gekkonidae, Lacertidae and Scincidae. The reptiles include one endemic genus of lizard, *Gallotia* (seven living species), which exhibit gigantism, including the largest species of the family Lacertidae. Both the Eastern Canary gecko and the Haria lizard (*Gallotia atlantica*), and its subspecies *G. a. atlantica*, are endemic to the two larger islands (Fuerteventura and

Lanzarote) and associated smaller islets in the eastern Canaries (Clarke & Collins 1996, in WWF, 2015b).

**Mammals** - 21 mammal taxa have been reported for the Canary islands (Arechavaleta et al., 2010), of which 9 are native, including two endemics: the white-toothed shrew (*Crocidura canariensis*) endemic to the eastern islands Lanzarote, Fuerteventura, Lobos and Mount Clara (Hutterer, 2008) and the Canary Big-eared Bat (*Plecotus teneriffae*). Other native bats species are *Tadarida teniotis*, *Barbastella barbastellus*, *Hypsugo savii*, *Nyctalus leisleri*, *Pipistrellus kuhlii* and *Pipistrellus maderensis*.

### 1.3.4 Marine biodiversity

In the Canaries, animals clearly dominate the marine realm: molluscs are the most diverse marine taxa (1,170 species and 18 subspecies, from 227 families and 553 genera), followed by arthropods (1,096 species and 17 subspecies) and vertebrates (717 species and 15 subspecies) (Moro et al., 2003).

**Sea Birds** - Because of the short distance to Africa, the Canary Islands are visited every year by many migratory bird species that fly south in autumn in search of warmer places and go back to Europe in the spring. Others, mainly marine birds, use the archipelago as a nesting point only in the breeding season and after that return to the sea. This is the case with species of shearwater, such as *Puffinus puffinus* (Procellariidae), which nest in gullies of laurisilva (WWF, 2015a).

**Invertebrates** - approximately 1,180 of invertebrates in the marine environment are molluscs (42%), and about 1,100 are arthropods (38%) (Francisco-Ortega et al., 2010), very few of them are endemic to the Canaries.

**Flora** - The Canarian marine flora has approximately 700 species, including over 23 species of blue-green algae and three species of flowering plants (Francisco-Ortega et al., 2010), of which 16 algal species are endemic. The majority of the native marine flora is red algae (391 species).

**Fish** - The Canarian marine environment has a rich vertebrate fauna that includes 730 native species of fish, of which only 2 species are considered endemic (*Nettenchelys dionisi*; *Diplecogaster ctenocrypta*), although they could have a broader distribution, given their deep water occurrence (Francisco-Ortega et al., 2010).

### 1.3.5 Main issues

In the Canaries, about 11% the terrestrial biota corresponds to alien species, invasive or not, and are represented by 47% of invertebrates, about 46% of vascular plants, 4% of fungi and about 3% of vertebrates (Martín-Esquivel et al., 2005). The middle-oriental islands include the largest proportion of alien species, particularly Gran Canaria, where they represent 15.5% of the island biota. However the largest number of introduced species is found in Tenerife. Among those species, at least 151 are considered as invasive, of which 79 are phanerogames, 1 fern, 45 arthropods, 3 amphibians, 1 reptile, 10 birds and 12 mammals. Special reference should be made to the impact of mammals, particularly: 1) the feral cat threatening the survival of the giant lizards from El Hierro, La Gomera and Tenerife, and the bird populations; 2) herbivores like the mouflon (*Ovis aries*), Barbary sheep (*Ammotragus lervia*), rabbits or the Barbary ground squirrel (*Atlantoxerus getulus*) all greatly affect native vegetation (Martín et al., 2008) and 3) rodents, *Rattus rattus* in particular, that predate on seabirds and other animal species. Growing colonies of the very aggressive Argentine ant (*Linepithema humile*) are pushing out indigenous ants and other insects from their habitats

(Petit & Prudent, 2010). More recently an introduced snake (*Lampropeltis getula*) has been expanding in Gran Canaria (Cabrera-Pérez et al. 2001).

More than 50% of the Canary Islands' area has over time been used for agriculture purposes (EEA, 2002) - sugar cane, timber, pitch and torch poles. Vast areas of indigenous forest have also been transformed into managed forest due to the use of young timber in banana and California pine (*Pinus radiata*) plantations. Of special importance is also the cultivation of olive trees (*Olea* spp.) which form open woodlands on high south-facing slopes.

Fires have also dramatically reduced forests in the last decades, both accidentally and intentionally set for livestock grazing, crop planting, timber and real estate speculation.

## **2. CAPACITY IN THE REGION**

### **2.1 General**

Most of the financial resources used for nature conservation and biodiversity are provided by the regional authorities, and there is also a long and effective tradition in the use of co-financing from European programmes such as LIFE, INTERREG and MAC. INTERREG IIIB and PCT-Mac are excellent demonstrations of cooperative projects involving Madeira, the Azores (Portugal) and the Canary Islands (Spain) dealing with nature conservation and biodiversity at a regional (Macaronesian) level, including in some cases the Cape Verde Islands in these projects. This cooperation has led to the establishment of common strategies and the use of common methods in the management of biodiversity in these islands. Exotic and invasive species, joint management and conservation of marine mammals, and a common database of endangered and endemic species are among the most visible results obtained.

But while there have been some successes in species conservation, the populations of many taxonomic groups continue to decline, and the status of most threatened species has not improved. The main positive results have been achieved within the boundaries of protected areas, but a significant proportion of native and endemic species remains endangered, with populations still in decline. Despite the EU efforts to address species and habitats of Natura 2000 Network, a large number of globally threatened species do not occur in these sites as they are not listed as 'priority species' under the Birds and Habitats Directives (and many priority species are not globally threatened), and therefore are not considered as priorities for conservation at the EU level. This highlights the need for financing beyond for the Natura 2000 to tackle further biodiversity loss in the Macaronesian region.

Governmental institutions execute or coordinate most of the nature conservation activity in Macaronesia (e.g. creation and management of protected areas; legislative framework on biodiversity conservation). A number of important conservation programmes and research initiatives have nevertheless been undertaken in the region involving different stakeholders, including from the civil society. Much of these initiatives have been collaborations between academic institutions, NGOs and government departments.

This cooperation is well illustrated in the projects undertaken within the LIFE Nature Programme, the majority of which has been led by NGOs or regional authorities. These beneficiaries quite often establish partnerships with different stakeholders in order to fulfil the objectives of their projects. Another example of stakeholder cooperation for conservation is illustrated by the projects developed under the INTERREG / MAC programmes funded by the European Regional Development Fund (ERDF). This cooperation has led to the establishment

of common strategies and the use of common methods in the management of biodiversity in these islands.

## 2.2 Azores

### 2.2.1 Public sector

In the Azores the responsibility towards nature conservation rests with the Regional Government. Terrestrial and coastal protected areas are organized into 9 Island Parks, managed through the Directorate for the Environment. It has a group of about xxx Nature Guards responsible for inspecting the activities within the Island Park areas. Their action is complemented by that of SEPNA, an environmental police force. The offshore protected areas form the Marine Park, managed by the Directorate of Sea Affairs. The Directorate of Forest Resources<sup>1</sup> manages a large area of production forest, several recreational forest parks, hunting and inland fishing. They have a Service of Forest Guards of about xx persons and run 19 nursery gardens, covering 27 ha and producing (among others) endemic plants for reforestation efforts.

Table 2 Public budget for 20162

Regional Government	
Environment, of which	13,530,075 € (0.9 %)
• Directorate for Sea Affairs	497,200 €
• Directorate for Forest Resources	8,300,414 €
• Directorate for the Environment	4,732,461 €
Overall government expenses	1,577,888,654 €
Azorina SA	
Investment	875,380 € (16,6 %)
Total budget	5,289,059 €

A public company, Azorina, S.A., has been created to manage environmental interpretation centers and implement selected nature conservation actions in support of the Island Parks. The company will invest 875,380 € in 2016 in the following actions: (i) commercial promotion of the forest resources of the Azores, mainly the *Criptomeria* wood; (ii) management of the Development Plan for the Furnas Valley Watershed, namely the reforestation actions; (iii) management of the Faial Botanical Garden, including the seed bank and the rare plants propagation programme; (iv) environmental education.

<sup>1</sup> <http://drf-srrn.azores.gov.pt/Paginas/Home.aspx>

<sup>2</sup> <http://www.azores.gov.pt/Portal/pt/entidades/vp-drot/textoTabela/ORAA.htm>

### *Strategic priorities*

The intervention priorities foreseen for the period 2014-2020 take into account the goals and targets of an intelligent, sustainable and inclusive growth described in the Europe 2020 strategy, where the preservation of the natural heritage and environmental quality of the Azores, the sustainable and more environmentally friendly use of natural resources are essential goals and objectives.

The intervention of the Azores Government in the field of nature conservation takes place at the levels of the Directorates of Environment and of Forest Resources.

Actions at the environment protection level take place within the framework of the Azores Protected areas, all of which are included in the Natura 2000 network. The corresponding Prioritised Action Framework identifies 4 Strategic Conservation Priorities, each with a number of measures.

#### **1. Management and valorization of the Natura 2000 Network and the Regional Network of Protected Areas:**

- 1.1. Evaluate and review the Sector Plan of the RN 2000 and other territorial management instruments with an impact on RN 2000 and the Regional Network of Protected Areas.
- 1.2. To implement the Plans of Action for the conservation of species and habitats on the field.
- 1.3. Encourage the sustainable use of spaces.
- 1.4. To elaborate in a GIS system the cartography for all ecosystems and their conservation status, with permanent mapping of all the actions that affect the territory and the ecosystems, in particular, alterations of soil use and morphology, cuts and plantations of natural and exotic species.
- 1.5. Provide the management structures of the RN 2000 and the Protected Areas of effective and efficient human resources.
- 1.6. Preparation of a Training Plan on the patrimonial values and legal bases of RN 2000 and the Regional Network of Protected Areas.
- 1.7. Implementation of a signaling system that allows the identification and interpretation of areas and associated conservation objectives.

#### **2. Reinforcement of the biodiversity knowledge and its monitoring and surveillance:**

- 2.1. Filling knowledge gaps on the distribution and conservation status of protected species and habitats.
- 2.2. Systematic monitoring of species and habitats in particular the priority ones, with the implementation of indicators for their conservation status.
- 2.3. Reinforcement of the RN 2000 Surveillance System, in particular by providing the Body of Nature Watchers, Forest Guards, the Inspection of Fisheries and the Inspection of the Environment with human and material resources that would allow a more effective and efficient activity.
- 2.4. Reinforce the integration of the Nature Conservation and Sustainable Development concepts into the various sectoral policies.

#### **3. Preserve and recover natural heritage and biological diversity:**

- 3.1. Perform actions to monitor and control invasive alien species of fauna and flora.
- 3.2. Perform actions to recover species and priority habitats.
- 3.3. To carry out ex-situ conservation actions, in particular by the collection and conservation of seeds for 80% of the endemic species in all Azores islands, in the Bank of Germplasm of Faial Botanic Garden.

#### **4. Promotion of the harmonious and sustainable development in the territory:**

- 4.1. To promote the improvement of the conditions for sustainable exploitation and profitability of the agents included in the RN 2000, especially in the agricultural, forestry and services sector, in particular linked to tourism activity;
- 4.2. Promote energy efficiency and the production of alternative energies
- 4.3. To promote the population and local agents awareness of the RN 2000 heritage values and its surplus value as a tool for improving their living conditions, in a sustainable development perspective.
- 4.4. Make local actors aware of the rural development supporting systems, included in the various regional and community programs.

At the Forest Resources level, a Forestry Strategy<sup>3</sup> has been developed, which contains the following objectives and measures which are relevant for biodiversity conservation:

#### **Objective 2: Increase of the forest sector competitiveness through the sustainable use of forest resources**

2.6 Revitalize indigenous forest ecosystems Continue the domestication process of native forest species. Plans for afforestation of public and private spaces and also the recovery and conservation of existing sensitive habitats, in particular through the control of invasive vegetation.

2.9 Encourage the valorisation of forest biomass. Stimulate the use of forest exploitation residues, by-products of the timber industry and material from areas occupied by invasive woody species, with a view to their recovery as a source of income and use for the energy production and other derivative products.

#### **Objective 3: Encourage Active Forest Management**

3.1 To provide the Autonomous Region of the Azores with a Regional Forestry Plan (PROF) reinforcing the need to ensure the forest's regulatory role in the water cycle and soil protection, as well as the conservation, expansion and revitalization of habitats and biodiversity associated with natural forest areas.

#### **Objective 4: Streamline multiple forest use.**

4.1 Value the Forest as a carbon sink to quantify the carbon sequestration of the main Azorean forest species;

4.2 Compensation for forest ecosystem services. Support forest owners in the conservation and promotion of nature high value ecosystems, in the preservation of forest genetic resources and in the enhancement of the ecosystems potential;

4.3 Promote the sustainable management of the fish resources in inland waters.

4.4 Enhance the recreational forest. Enhance the use and maintenance of recreational forest reserves by streamlining these forest spaces with the resident and visiting population, namely through the dissemination of such flowers, adventure sports, ecological camping, geocaching, interpretive trails, among others activities, which promote this forest approach.

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<sup>3</sup> [http://servicos-sraa.azores.gov.pt/grastore/DRRF/Estrategia\\_Florestal\\_Acores.pdf](http://servicos-sraa.azores.gov.pt/grastore/DRRF/Estrategia_Florestal_Acores.pdf)

### **2.2.2 Research**

The University of the Azores is the main research entity in the archipelago. It has three campi in the islands of São Miguel, Terceira and Faial, but the research is organized in centers recognized and evaluated by the Portuguese funding agency, FCT. There are 3 main research centers in the area of conservation biology: CIBIO, GBA and OKEANOS.

### **2.2.3 NGOs**

The environmental NGOs most active in conservation actions is SPEA. Other entities include, **Rebikoff-Niggeler Foundation, Azorica, Quercus**, Montanheiros and Amigos dos Açores.

**Several Local Action Groups are also active, such as Adeliãçor, Arde and Grater.** These are “Community-Led Local Development” (CLLD) initiatives dedicated to rural development.

### **2.2.4 Private sector**

Some examples of involvement of the private sector in conservation actions are the following:

- Programme "Natural Park - Partner for Sustainable Development": is a partnership program between Island Nature Parks and regional companies in the Azores to disseminate the natural values and promote an economic development compatible with biodiversity conservation. These partnerships aim to create the necessary conditions to fulfil identified needs and promote the Azores destination, thus ensuring the growth of the tourism sector and its contribution to the economic and social development of the archipelago in addition to the preserving environmental excellence. All individual or collective organisations, either profit or non-profit, may become partners of Island Natural Parks as long as they develop their activities within Natural Parks and commit themselves to actively contribute to their sustainable development; these are typically travel agencies, tourism enterprises, agro- food producing entities, catering entities, local development associations, sports clubs, environmental NGOs, schools, local authorities and the media.
- Priolo (Azorean bullfinch) Brand: is a trademark registered by the Regional Government of Azores. This brand was created within the actions of the LIFE Sustainable Laurel Forest project aiming to be a quality seal for those companies that establish a partnership with the São Miguel Island Natural Park in order to contribute to the conservation of the protected areas in the councils of Nordeste and Povoação (Priolo Lands). This trademark aims, as well, to promote a sustainable tourism activity in these two councils, according to the objectives contained in the Strategy of the European Charter of Sustainable Tourism (ECTS) in the Lands of Priolo.

## **2.3 Madeira**

### **2.3.1 Public sector**

In May 2016 the Madeira Government created the Institute for Forests and Nature Conservation by merging the Madeira Natural Park and the Regional Directorate for Forests. This public entity will be responsible for managing the protected areas but also the Botanical Garden, the Forest Parks and the network of Nature Trails.



Table 3. Government budget for 2016<sup>4</sup>

Secretariat for Environment and Natural Resources	15,612,817 €
Valuation of forests, biodiversity and protected areas	1,748,357 €
Adaptation to climate change	635,729 €
Water and waste	7,577,935 €
Natural Park of Madeira	2,901,398 €
Overall government expenses	1,647,487,000 €

Table 4. CMF budget for 2016

Museu Municipal do Funchal / Estação de Biologia Marinha	596,388 €
Overall expenses	84,250,000 €

### *Strategic priorities*

The Madeira Government has produced a Prioritised Action Framework for the Natura 2000 network. In this document, several Strategic Conservation Priorities were identified, including:

1. Promote scientific research and natural heritage knowledge, as well as the monitoring of priority species and habitats;
2. Develop specific actions for the conservation and management of priority species and habitats, in order to prevent the deterioration of their status;
3. Promote the maintenance and recovery of ecosystems and their services;
4. Ensure the conservation and enhancement of the natural heritage for the areas included in the Natura 2000 network;
5. Promote the nature conservation policy integration and the principle for sustainable use of biological resources in different sectoral policies;
6. Promote education, training and research on nature conservation and biodiversity;
7. Ensure information, awareness and participation of the public, as well as mobilize and stimulate civil society;
8. Promote the management and prevention of natural and technological risks;
9. To promote the enjoyment for natural spaces by promoting the development of activities that might leverage sustainable tourism;
10. Promote energy efficiency and alternative energies production.
11. Promote scientific research and natural heritage knowledge, as well as the monitoring of priority species and habitats

### **2.3.2 Research**

The University of Madeira (UMA) is the main research institution of the archipelago. It has no research unit specifically dedicated to biodiversity or natural living resources, but the ISOPlaxis Germ Bank works in the domain of biodiversity, sustainable use and biotechnology

<sup>4</sup> <http://srpf.gov-madeira.pt/?modo=areas&area=orcamento-da-ram-47>

of plant genetic resources and agro-eco systems. In addition, UMA harbours the Madeira Interactive Technologies Institute (M-ITI), operating in the interdisciplinary domain of human-computer interaction which has produced some work on environmental subjects. Finally, a recently created Regional Agency for the Development of Research, Technology and Innovation (ARDITI) has created two research hubs, one in agriculture and food technology (Centre for research and innovation in agriculture and food technology) and another on ocean monitoring and research (Madeira Oceanic Observatory).

### **2.3.3 NGOs**

The most active nature conservation NGO in Madeira, and the only one with capacity to conduct conservation projects, is the local branch of the Portuguese Society for the Study of Birds (SPEA).

Two Local Action Groups, established under the LEADER Programme, are active<sup>5</sup>: ACAPORAMA and ADRAMA. These are “Community-Led Local Development” (CLLD) initiatives dedicated to rural development. (lists of projects have been requested).

### **2.3.4 Private sector**

No relevant investments have been identified in the private sector.

## **2.4. Canary Islands**

### **2.4.1 Public sector<sup>6</sup>**

The responsibility of managing protected areas and species in the Canaries is shared among different agencies.

The Marine Protected Areas are co-managed between the Canary Islands Government and the Spanish Government when they include areas inside the territorial waters; the Marine Reserve of La Palma Island, located outside these waters is managed entirely by the Spanish Government<sup>7</sup>.

The responsibility for managing the Canaries Network of Protected Natural Spaces has been transferred from the Canaries Government to the Island Administrations (the Cabildos). The National Parks<sup>8</sup> remained under regional administration, but are currently also being transferred to the Cabildos.

#### *Regional Government*

Nature conservation is coordinated by a General Directorate within the Department of Territorial Policy, Sustainability and Safety. The Spanish Strategic Plan for Natural Heritage and Biodiversity 2011-2017<sup>9</sup> lists 8 targets and their respective objectives. The budget for this plan is 750 M€, but it is not possible to know how much is allocated for the Canary Islands.

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<sup>5</sup> <http://proderam2020.madeira.gov.pt/index.php/apoios-proderam-2020/desenvolvimento-local-leader#candidatura>

<sup>6</sup> <http://www.gobiernodecanarias.org/educacion/CULTURACANARIA/espacios/espanat.htm>

<sup>7</sup> <http://www.gobiernodecanarias.org/agricultura/pesca/reservasmarinas/>

<sup>8</sup> <http://www.cabildodelanzarote.com/tema.asp?idTema=184>

<sup>9</sup> <https://goo.gl/k97t9I>

Table 5. Government budget for 2016<sup>10</sup>

456 Actuaciones medioambientales	40,790,363 €
Overall government expenses	6,772,098,339 €

Species conservation in the Canary Islands follows the bases established in Law 4/1989 of 27 March, on the Conservation of Natural Spaces and Flora and Wildlife, which states that the inclusion of a species, subspecies or population in the Catalog of Threatened Species of the Canary Islands will require the drafting of the specific plans (Table 6).

Table 6. Types of plans for the conservation of threatened species in the Canary Islands

Threat category	Action
In danger of extinction	Recovery plan
Sensitive to habitat change	Habitat conservation plan
Vulnerable	Conservation plan
Of special interest	Management plan

The catalog of Threatened Species of the Canaries was created on July 2001 and includes 111 species in danger of extinction, 54 vulnerable species, 149 species of interest for the Canaries ecosystems and 19 species requiring special protection. However only 26 Recovery Plans have been approved since then<sup>11</sup>.

The protection of Canary Islands valuable ecosystems requires that a high percentage of the territories needed to be assigned to different categories of protection, both at an international level (Canary Islands Network of Biosphere Reserves) and European (Red Natura 2000), national (National Parks) and autonomous (Canarian Network of Protected Natural Areas). The only strategic document on ecosystem conservation, however is the Prioritised Action Framework, produced by the Spanish Government for the Natura 2000 network. In this document, applicable to the entire country (including the Canary Islands), 5 Strategic Conservation Priorities are identified, each with a number of measures.

## 1. Improve knowledge necessary for management

- 1.1. Characterize and evaluate the conservation status of Natura 2000 habitats and species.
- 1.2. Assess the status and integrity of each Natura 2000 area and its value and relevance in the network, as a whole.
- 1.3. Evaluate the global coherence and ecological connectivity of the Natura Network 2000 in each biogeographic region and in the peninsular scope.
- 1.4. Create a public data storage system (ICT instrument, Geographic Information System, Databases, etc.), where all the information related to habitat types, species and the Natura 2000 network are collected.
- 1.5. Develop methods and procedures to improve the evaluation of plans and projects in the Natura 2000 network, and to draw up a technical manual or a good practice guide.

<sup>10</sup> <http://www.gobiernodecanarias.org/hacienda/dgplani/presupuestos/2016/ley/index.jsp>

<sup>11</sup> <https://goo.gl/HnkYJE>

- 1.6. Evaluate and quantify the ecosystem goods and services which Natura 2000 network provides at different levels.
- 1.7. Do studies to improve knowledge about space use, capacity, demography and mortality applied in the conservation of species.
- 1.8. Evaluate the effects of biocides and other pollutants and their impact on bird species conservation. Perform the physiological, sanitary and toxicological control for biocides and other contaminants (in species belonging to Wildlife Recovery Centers, dead chickens, pellets or captured specimens).

## **2. Ensure the effective management of the network**

- 2.1. Write a plan for the maintenance or restoration of favorable conservation status for each type of habitat and species, on every biogeographic region.
- 2.2. Develop, revise or update management plans to preserve the integrity of each Natura 2000 areas, defining the conservation objectives for each area, taking into account its relevance within the network and territorial continuity within areas, and involving the relevant social and economic actors in the plans preparation.
- 2.3. Develop a plan for maintaining or improving overall coherence and connectivity of the Natura 2000 Network.
- 2.4. Include the conservation objectives of the Natura 2000 network in different planning sections (forestry, hydrological, coastal, marine, urbanism, industrial, public works, agricultural, hunting, rural development, etc.) as well as in other planning instruments (Spanish Inventory of Natural Heritage and Biodiversity-IEPNB, Indicators System for Natural Heritage and Biodiversity, etc.)
- 2.5. Create management teams for each area or group of Natura 2000 habitats, with sufficient human resources and involving the relevant actors in the territory (ex. through governing bodies, local advisory councils, expert commissions, etc.) and coordinated at the biogeographical region level, for the creation of partnerships and lines of work between the different administration parties.
- 2.6. Establish agreements to promote the shared management and put in place the conservation and restoration measures, for example through territorial contracts, custody territory agreements, agreements with the owners, etc.

## **3. Ensure the maintenance or recovering of the favorable conservation status for the habitat types with communal interest and Natura 2000 network species through the implementation of necessary conservation or restoration measures, including improving connectivity, avoiding alien species introduction, etc**

- 3.1. Develop and implement conservation and restoration plans for habitat types and species in an unfavorable status, including measures aimed at restoring favorable conservation status throughout the network.
- 3.2. Analyse vertebrate displacement flows and existing barriers between the Natura 2000 areas and putting in place measures to promote the connection between areas which include habitats and species populations affected by those disruptions (removal or permeabilization of barriers, etc.)
- 3.3. Promote actions for the elimination or risk reduction to the species, such as adaptation and transformation of electrical lines in important areas for birds, identification of the critical areas to avoid installation or enhancement of wind farms and photovoltaic plants, identification and correction of black spots of mortality, prevention and use control of poisons, toxic substances and banned lead ammunition, etc.

- 3.4. Write and implement a risk management plan for non-native and invasive species in the Natura 2000 network, including a detection system and monitoring, as well as control and eradication actions when necessary.
  - 3.5. Ensure trophic resources for necrophagous birds, evaluating the density that the ecosystem would naturally support.
- 4. Improve monitoring and follow-up of Natura 2000 areas and the conservation status for the habitat types with communal interest and Natura 2000 species**
- 4.1. Define standardized protocols for the conservation status monitoring of all habitat types and species, at different scales (Local, Natura 2000 area, Biogeographic Region) and defining appropriate indicators. Elaborate in a coordinated and standardized way, with all competent authorities, an evaluation report on the conservation status.
  - 4.2. Improve the monitoring of Natura 2000 Network protected areas to avoid the change or destruction of habitat types and species death including, but not limited to, measures to prevent the hunting impacts, tourist activities and sports. Strengthen follow-up on the compliance and effectiveness of the corrective measures, used to correct the existing significant impacts on the Natura 2000 network.
- 5. Provide adequate information, training and awareness for the achievement of the conservation objectives established in Natura 2000 areas**
- 5.1. Carry out information and awareness-raising programs and activities at all levels (national, regional and local) to communicate the conservation objectives of the Natura 2000 Network and the environmental, economic and social benefits it provides, targeting relevant groups and actors.
  - 5.2. Carry out active campaigns directed especially at hunters and ranchers, on the use of poisons and their legal, environmental and public health consequences
  - 5.3. Providing equipment and information and interpretation services adapted to the natural characteristics of the Network's areas, management objectives and protection standards (interpretive trails, information panels, visitor centers, recreational areas, observatories, etc.)
  - 5.4. Promote the training of the Natura 2000 Network managers as well as other managers or entities with competences in the Network areas (forestry, agricultural, hydrographic confederations, etc.) in relation to the ZEC planning and management, foster skills for citizen participation, concerted management and local development.
  - 5.5. Promote the agents training to improve surveillance and combat those activities harmful to the habitats and species, as well as illegal hunting and use of poisons.
  - 5.6. To create networks for cooperation and information exchange between Natura 2000 Network managers (nationally and internationally) and other sectorial administrations for the coordination of activities and the exchange of knowledge and experiences.

Table 7. Summary of public sector investments in nature conservation in the Canary Islands (2016 budget)

Cabildo	Topic	Value	%
<b>La Palma</b>	Total budget <sup>12</sup>	91,905,000 €	
	Environment, of which	9,280,358 €	10.1 %
	• fixed costs	7,786,130 €	
	• investment	1,494,228 €	
<b>El Hierro</b>	Total budget		
	Environment, of which		
	• fixed costs		
	• investment		
<b>La Gomera</b>	Total budget		
	Environment, of which		
	• fixed costs		
	• investment		
<b>Tenerife</b>	Total budget <sup>13</sup>	648,048,000 €	
	Environment, of which	33,429,838 €	5.2 %
	• Fixed costs	25,423,442 €	
	• Investment	8,006,396 €	
<b>Gran Canaria</b>	Total budget <sup>14</sup>		
	Environment, of which		
	• fixed costs		
	• investment		
<b>Fuerteventura</b>	Total budget <sup>15</sup>	79,525,000 €	
	Environment, of which	2,093,097 €	2.6 %
	• Fixed costs	2,078,097 €	
	• Investment	15,000 €	
<b>Lanzarote</b>	Total Budget <sup>16</sup>	145,258,082 €	
	Environment, of which	3,435,785 €	2.4 %
	• Fixed costs	2,710,785 €	
	• Investment	725,000 €	

<sup>12</sup> Personal information by contact person, and also <http://transparencia.cabildodelapalma.es/informacion-economica-financiera/2016/es/261>;  
[http://transparencia.cabildodelapalma.es/documentos/1xw13gpk/04%20PRESUPUESTO%20DE%20GASTOS.p](http://transparencia.cabildodelapalma.es/documentos/1xw13gpk/04%20PRESUPUESTO%20DE%20GASTOS.pdf)

<sup>13</sup> <http://www.tenerife.es/portalcabtfe/es/el-cabildo/presupuesto-2016>

<sup>14</sup> <http://www.gobiernodecanarias.org/hacienda/dgplani/presupuestos/2016/ley/>

<sup>15</sup> [https://sede.cabildofuer.es/portal/transparencia/RecursosWeb/DOCUMENTOS/1/0\\_141\\_1.pdf](https://sede.cabildofuer.es/portal/transparencia/RecursosWeb/DOCUMENTOS/1/0_141_1.pdf)

<sup>16</sup> <http://www.cabildodelanzarote.com/Uploads/doc/20160906102836187.pdf>

### *Cabildo of La Palma*

Work on the recovery of species and habitats is being carried out by the local Environment Service. Much of the effort is being made by the Cumbres Recovery Plan in collaboration with the National Park Agency.

In the Nursery of Indigenous Flora, these works are carried out, through the production of native vascular flora, with two main objectives: (1) conservation actions such as campaigns to repopulate or reinforce populations of threatened species; (2) an eminently educational and prevention action, such as giving plants to individuals and official organizations, in order to avoid the introduction and proliferation of exotic species in the natural environment of the island. A high proportion of the plants produced (43.8%) is related to the conservation work related to the recovery of the flora of the summits. There are almost 40,000 plants belonging to 8 endemic species.

Moreover, the Wildlife Rehabilitation Center complements the infrastructures of flora and fauna, with the same being done the recovery of those animals that need shelter or healthcare due to accidents, health problems, etc., while avoiding the proliferation of company animals in the natural environment. It is, therefore, a reference center where animals collected in the wild that need specialized care can be housed and treated so that, if possible, they can be reintegrated in their natural habitat.

An environmental education program is also being carried out and the Cabildo has developed a document that tries to implement a methodology and action tools to make the path of sustainable development possible, which is the Plan for Environmental Awareness and Information of La Palma (PLASIA)<sup>17</sup>. Its lines of action are:

- **PLASIA management:** Its creation allows directing, controlling and promoting Environmental Education, orienting it towards sustainability policies marked at island level.
- **Environmental Education:** To help people and social groups acquire knowledge, social values, participation and greater sensitivity and awareness of the environment in general and related problems.
- **Environmental Interpretation:** A public service through ample environmental information in a recreational context. This requires knowledge of the environment, public needs and of the messages to be transmitted.
- **Environmental Education Resources:** an information center, institutional resources, human resources, materials and programs.
- **EA equipments:** Set of organized resources that offer physical spaces, an organized pedagogical scenario and an educational project. They usually offer the possibility of carrying out one or several day activities.
- **Environmental Training:** Promote of the awareness, values and behaviours that favour the effective population participation in the decision-making process.
- **Environmental Volunteering:** Initiatives carried out individually or collectively, altruistically and non-profit making, devoting part of their time to improve the environment and conservation through direct actions.

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[http://www.cabildodelapalma.es/portal/contenedor\\_ficha.jsp?seccion=s\\_fdes\\_d4\\_v1.jsp&codbusqueda=616&language=es&codResi=1&codMenuPN=457&codMenuSN=484&codMenu=665&layout=contenedor\\_ficha.jsp&ca=23](http://www.cabildodelapalma.es/portal/contenedor_ficha.jsp?seccion=s_fdes_d4_v1.jsp&codbusqueda=616&language=es&codResi=1&codMenuPN=457&codMenuSN=484&codMenu=665&layout=contenedor_ficha.jsp&ca=23)

### *Cabildo of El Hierro*

Has a sustainable development plan<sup>18</sup>, covering the period of 2007-2020, but no specific measures for the conservation of nature are listed.

### *Cabildo of La Gomera*

La Gomera Island was declared a Biosphere Reserve by UNESCO on 11<sup>st</sup> June 2012, becoming the sixth Reserve of the Canary Islands Archipelago. The European Union has recognized the importance of La Gomera, as the island has 20 habitats of community interest, 7 of which are a priority.

As part of Biosphere Reserve admission, it was drawn up a Strategic Plan<sup>19</sup> which includes the first major objectives for La Gomera Biosphere Reserve. The Strategic Plan responds to the 3 functions of the Reserve (conservation, development, logistic support), with the opinions of administrations, entities and island organizations and includes the following measures related in some way to biodiversity conservation:

#### **3. Improvement of the environmental and scenic quality of the island:**

- 3.1 Protection, management and conservation of the island's landscapes
- 3.2 Conservation and improvement of natural resources
- 3.3 Environmental management

#### **4. Conservation and use of natural heritage:**

- 4.1 Appropriate management of habitats and ecosystems
- 4.2 Conservation of threatened species

#### **6. Recovery, optimization and maintenance of the primary sector:**

- 6.2 Diversification of the primary sector

#### **7. Promote tourism sustainability:**

- 7.3 Create specific tourist products that allow understanding of the La Gomera Biosphere Reserve

#### **8. Streamline of the La Gomera Biosphere Reserve:**

- 8.1 Inform about the La Gomera Biosphere Reserve to the local population
- 8.2 Increase knowledge of population and environment interactions

### *Cabildo of Tenerife*

The recently approved Strategic Framework for Regional Development<sup>20</sup> 2016-2025 gathers pluriannual actions focused on 5 strategic axis, one of which is Sustainability and Environment. Within it, Program 5.3 Action Strategy Against Climate Change contains the following measures, directed specifically to the management and conservation of island biodiversity:

- 5.3.1 Recovering and ecological consolidation of the “monteverde” (laurisilva)- action in laurisilva strands to improve its conservation status, increase its biodiversity and making them more resistant to the effects of climate change.

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<sup>18</sup> <http://www.elhierro.es/files/Plan%20desarrollo%20sostenible/PDS.pdf>

<sup>19</sup> <http://www.biosferalagomera.com/plan-estrategico/>

<sup>20</sup> <http://www.tenerife.es/portalcabtfe/es/component/content/article/60-temas/cabildo/3259-marco-estrategico-de-desarrollo-insular-medi-2016-2025>



- 5.3.2 Forest treatments- improving the strands of canary pine which have been planted to allow the establishment of other species of autochthonous flora.
- 5.3.3 Improving basic infrastructures- forest tracks, draining systems, signaling.
- 5.3.4 Reforestation to strengthen the island forest ring- annual reforestation campaigns in the north and south of the island.
- 5.3.6 Managing biodiversity and adapting to climate change- protect, conserve and preserve insular biodiversity and the Natura 2000 network.
- 5.3.7 Fighting invasive flora
- 5.3.8 Fighting invasive fauna

### *Cabildo of Gran Canaria*

A Biosphere Reserve was also designated by UNESCO in 2005. It covers 43 percent of the island's surface area, as well as an extensive marine area off the southwest coast.

To preserve the natural ecosystems, including the geodiversity and biodiversity in the broadest sense, clear objectives for different areas of action, included in the Action Plan 2013-2020 of the Gran Canaria Biosphere Reserve<sup>21</sup> were set:

#### **Forestry areas**

##### **1. Maintain the quality and safety of the forest areas:**

- 1.1. Improvement of infrastructures for the prevention and fire fighting.
- 1.2. Carrying out silvicultural activities.

##### **2. Expand, improve and diversify the forest masses of the territory of the Gran Canaria Biosphere Reserve:**

- 2.1. Census extension for farm owners interested in participating in reforestation actions within their lands.
- 2.2. Re-population of a total of 500 hectares based on the Insular Management Plan (PIO), both in collaboration with different groups and with their own resources.

#### **Flora**

##### **1. Analyse in-depth the natural plant diversity of the RBGC, setting objectives for: the conservation of renewable wild genetic resources of endemic species, their habitats and ecosystems; the conservation of all information, data and samples available on these species:**

- 1.1. Elaboration of an inventory of the natural plant diversity of the RBGC, including the preparation of an accurate cartography of distribution and means for the specie identification.
- 1.2. Preparation of the relationship of special interest areas for plant conservation within the RBGC, based on the PIO. Also, increase their protection and promote sustainable development in adjacent areas.
- 1.3. Research on endemic species, establishing a list of priorities for the conservation and improvement of their populations, with special emphasis on those most threatened.
- 1.4. LIFE + CEDRO project for the recovery and promotion of cedar as an arboreal species in the Güigüí massif.
- 1.5. Development of ex-situ conservation measures for components of biological diversity (seed banks, living plant collections, etc.).

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<sup>21</sup> <http://reserva-biosfera.grancanaria.com/conservar>

1.6. Protocols for the control of invasive species.

**2. Analyze the genetic diversity of the *Cymodocea nodosa* in the RBGC for the conservation of the genetic resources of this species:**

2.1. Establishment of a network of genetic reserves of seabeds as an in-situ conservation method. Microsatellite markers based study already tested for the species.

**3. Analyze the genetic diversity of seed banks in seabeds of the RBGC as a necessity in the establishment of a Genetic Reserves Network:**

3.1. Estimation of densities and genetic diversity of seed banks of *C. nodosa* in seabedws.

3.2. Reproductive and genetic study of the evolutionary potential of *C. nodosa* populations.

## **Fauna**

**1. Intensify scientific research, observation and monitoring of animal diversity of the RBGC, setting objectives for the conservation of wild genetic resources of endemic species, their habitats and ecosystems:**

1.1. Recovery Plan of the Gran Canaria blue finch.

1.2. LIFE + RABICHE project for the reintroduction of the pigeon rabiche and the recovery of its habitat.

1.3. Beginning of the studies for the reintroduction of the white scavenger vulture and the raven.

1.4. Protocols for the control of invasive species.

1.5. Elaboration of a catalog of cavities for fauna interest and an hypogeal fauna inventory.

## **Marine and Costal Areas**

**1. To recover degraded areas of the marine and coastal environment, both within the Reserve and outside it:**

1.1. Restoration of the priority coastal areas according to the IPO, restoring accessibility for citizens and carrying out a correct waste management.

1.2. Development of a periodic monitoring program and strict control on the quality of the water and discharges, with special attention to the submarine emissaries.

1.3. Carry out awareness campaigns and underwater cleaning (extraction of waste) in ports and beaches.

**2. Intensify the investigation on marine species and ecosystems, comprehensively analysing the natural, vegetal and animal biodiversity existing in the seabed of the Biosphere Reserve of Gran Canaria:**

2.1. Completion of a catalog, as exhaustive as possible, of the marine and coastal biological diversity of the Gran Canaria Biosphere Reserve, with preparation of accurate mapping of distribution and means for the identification of species.

2.2. Elaboration of inventory of habitats and areas of special interest for conservation within the Gran Canaria Biosphere Reserve, based on IPO.

2.3. Studies to reinforce the populations of seabirds and their nesting areas within the Reserve.

2.4. Creation of catalog of coastal and marine caves of interest for conservation within the Reserve, according to the Natura 2000 Network criteria.

- 3. Rehabilitate and restore the habitats of degraded marine seagrass meadows in the area of the Mogán Marina Strip of the Gran Canaria Biosphere Reserve:**
  - 3.1. Implementation of the protocols developed for the production of *Cymodosea nodosa* seedlings. Doctoral thesis on ex-situ conservation of *Cymodosea nodosa*; In-vitro seed propagation and establishment of cell cultures.
  - 3.2. Implementation of the systems developed to minimize the impact of the desalination plants in prairie areas of *Cymodosea nodosa* - Venturi Project.
  
- 4. Analyze the importance of the Gran Canaria Biosphere Reserve in the connectivity of populations of key marine species, as an essential aspect for the preservation of ecological-evolutionary processes:**
  - 4.1. Hierarchical study of the spatial levels of marine species connectivity in the Gran Canaria Biosphere Reserve, mainly those with very restricted dispersal capacities such as the *Cymodosea nodosa* and its relationship with other populations in Gran Canaria and in the archipelago
  
- 5. Analyze the temporal evolution of *Cymodosea nodosa* populations to estimate their effective population size:**
  - 5.1. Genetic monitoring of the allelic frequencies of microsatellite markers on the *Cymodosea nodosa* populations in Gran Canaria.
  
- 6. Develop protocols for the control of invasive marine species. Monitor for invasive species larvae:**
  - 6.1. Genetic monitoring in marine plankton to detect invasive species larvae; Genetic analysis protocol for the detection and quantification of invasive species larvae.

## **Landscape**

- 1. Analyze in-depth the geodiversity of the RBGC, setting objectives for the conservation of aspects, elements and singularities of geological and geomorphological interest:**
  - 1.1. Elaboration of an geodiversity inventory for the RBGC, including the preparation of an accurate cartography of elements and singularities of geological and geomorphological interest.
  - 1.2. Preparation of a list of special interest areas, for their conservation and valorization.

## **Water Resources**

- 1. Preserve and guard public waterways and fight against soil loss:**
  - 1.1. Hydrological-forest restoration actions and soil corrections.

## *Cabildo of Fuerteventura*

Fuerteventura have also been declared by the UNESCO as a Biosphere Reserve in 2009. An Action Plan for the Biosphere Reserve<sup>22</sup> was set and includes the following conservation action measures:

### **Soil protection**

1. Promote soil conservation measures in traditional agricultural practices and agro-systems.
2. Promote the conservation of traditional agro-systems that allow soil conservation.
3. Promote soil conservation measures in livestock use.
4. Promote conservation measures of fertile soil affected by irreversible actions (mining, residential and industrial use).
5. Better knowledge of the services provided by agricultural ecosystems / soil formation and water supply.

### **Protection and valorization of the landscape**

1. Improve the perceptual quality of the landscapes.
2. Value and protect the most relevant landscapes
3. Maintenance of landscapes of ecological and/or cultural interest.
4. Evaluate and recognize cultural and tourism services provided by landscapes.

### **Flora biodiversity**

1. Ensure the viability and improvement of endemic species populations.
2. Ensure the good condition of community interest habitats present in the Biosphere Reserve.

### **Fauna biodiversity**

1. Improve the status of threatened populations.
2. Reintroduce disappearing nidificant species.
3. Improve the habitats used by threatened species.

### **Marine environment**

1. Provide management tools for marine core areas.
2. Improve knowledge on the value and marine ecosystems functioning of the Biosphere Reserve.
3. Compatibilize the marine areas protection with the tourism development and fishing activities.
4. Consolidate Fuerteventura as a node of the great Macaronesia Marine Sanctuary in the WATCH initiative framework.

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<sup>22</sup>

[http://gestion.cabildofuer.es/fuerteventurabiosfera/visitavirtual/interactivo\\_reserva\\_biosfera/descargas/folleto\\_plan\\_accion\\_rb.pdf](http://gestion.cabildofuer.es/fuerteventurabiosfera/visitavirtual/interactivo_reserva_biosfera/descargas/folleto_plan_accion_rb.pdf)

## **Culture Heritage**

1. To manage, recover and maintain the cultural heritage in an adequate manner.
2. Use cultural heritage as an economic and educational resource.

## **Protected areas**

1. Facilitate the public use of these spaces by providing the necessary infrastructure and enhancing their pedagogical capacity.
2. Facilitate the development of research, education and training.
3. Encourage sustainable economic activities.
4. Promotion of research, monitoring and implementation of results.

### *Cabildo of Lanzarote*

Along with the other islands, Lanzarote was also declared in 1993 by the UNESCO, as a Biosphere Reserve. The "Lanzarote in the Biosphere" Strategy, approved in 1998 and the Lanzarote Sustainable Development Plan, approved in 2008, were the first working tools promoted by the Cabildo of Lanzarote to consolidate sustainable development and a change of model in the Island.

In November 2013 the Action Plan for the Lanzarote Biosphere Reserve and for the Lanzarote municipalities<sup>23</sup> were drawn up on the basis of the framework set out in The Lanzarote 2020 Strategy, which was the result of the European Integrated Management for Sustainability - SIGS) implemented in the island between February and July 2013. This action plan includes an item directed to the conservation of island biodiversity, with the following objectives:

### **Item 9 – Biodiversity**

1. Greater compliance with the current legislation and actions established in the protected natural areas management instruments.
2. Development of management tools for threatened species populations.
3. Increased awareness among residents and tourists about the island's high biodiversity, its importance and the negative and positive impacts of individual actions and behaviours at the individual level.
4. Increased staffing and budgetary allocations to increase the scope and work results carried out by the Biosphere Reserve Office.
5. Consolidate the implementation of joint projects with other agencies and institutions for a greater appreciation of the natural heritage and biodiversity.
6. Promote agreements with organizations and neighbour associations to carry out voluntary actions in protected natural areas.
7. Development of a work methodology and citizen participation promoted by the United Nations Campaign for more resilient cities, based on a better planning and response to possible natural disasters arising from climate change effects.

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<sup>23</sup> <http://www.lanzarotebiosfera.org/wp-content/uploads/2013/11/CABILDO-Plan-de-Acci%C3%B3n-para-la-ORB-2014-2020.pdf>

### **2.4.2 Research**

There are two universities in the Canary Islands: the oldest in Tenerife, the Universidad de La Laguna, and the youngest in Gran Canaria, the Universidad de Las Palmas de Gran Canaria.

### **2.4.3 NGOs**

Environmental NGOs most active in conservation actions include Canarias Conservacion, CEAMAR, Loro Parque Foundation, WWF Canarias, SEO/Birdlife.

Several Local Action Groups are also active, such as Federacion Canaria de Desarrollo Rural. This is a “Community-Led Local Development” (CLLD) initiative dedicated to rural development.

### **2.4.4 Private sector**

Some examples of collaboration between NGOs or the government and the private sector in the region are the following:

- Biodiversity audits for the integration of biodiversity parameters and ecosystem services in the management of Spanish companies: the Global Nature Foundation, in collaboration with companies such as Cepsa, Ence, Herdade do Freixo do Meio, Cooperativa Agraria de Vive, Iberdrola and Red Eléctrica de España, has carried out audits (50% of the cost financed by the LIFE project and 50% by the Biodiversity Foundation) in which it conducts an analysis of the relationship between the company and the biodiversity that affects its business, then providing the basis for integrating biodiversity in the environmental management of the company and undertaking actions aimed at the sustainable use of resources and protection of nature. Following the implementation of the audits, the companies have developed actions to improve their business management of biodiversity, both in terms of communication with their stakeholders and with specific actions in the ecosystems related to their business activity. This has led to an improvement in terms of biodiversity conservation. As a recent example, Cepsa has financed a communication and awareness campaign on the conservation of bats in the Canary Islands, which extends the range of environmental actions undertaken by the company.

- Micro Marine Areas (MMAs)<sup>26</sup> are a marine management strategy in the Canary Islands that proposes coexistence between conservation, commercial fishing and ecotourism uses. It is an innovative model of coastal management proposed in conjunction with the Eco Oceans Association, based on small-scale protected marine areas, promoted by local governments and associations, monitored by the users and designed to promote the economic development of various sectors by encouraging ecotourism and recreational activities within the area. It also promotes traditional fisheries in adjacent areas, research and development of the local community and the culture of management through Protected Marine Areas (PMAs). Six micro marine areas are currently being worked on simultaneously and another six are being studied. The project is promoted by seven public institutions: Fundación Obra Social Caja Canarias, Canary Islands Government, Tenerife Inter-island Council, Gran Canaria Inter-island Council, Palmas de Gran Canaria University (ULPGC), UNESCO Chair in Sustainable Tourism, Fisheries Biology Research Group of the Canary Island Institute of Marine Science.

## 3. REGIONAL BEST PRIORITIES FOR INVESTMENT IN CONSERVATION AND SUSTAINABLE DEVELOPMENT

### 3.1 Methodology

Through in-depth stakeholder consultations a data-driven conservation planning process has been coordinated by Fundo Regional para a Ciência e Tecnologia in collaboration with the BEST Central team and CEPF experts.

An assessment of conservation investment patterns over the last decade was made and a comprehensive suite of measurable conservation outcomes at species, site and corridor scales have been identified, as well as priorities for conservation investment.

A compilation of an extensive list of references, relevant stakeholders for the consultation process, comprehensive databases on globally threatened species and sites under protection status in Macaronesia, and collection of distribution data of target species were the starting point to define BEST priorities for investment in Macaronesia. The project was disseminated to stakeholders by email and in local newspapers and the consultation process included two rounds of workshops. In total 20 workshops were carried out in five Macaronesian cities mobilizing the conservation community, including NGOs, scientists, public regional and local authorities and the private sector. The workshop consultations were complemented by small group skype meetings with stakeholders, one-to-one interviews and email correspondence with local actors and experts. Moreover, a Macaronesian Hub webpage<sup>24</sup> was created to promote the BEST III project and to facilitate information sharing and communication with stakeholders. In addition, regular consortium and bilateral meetings were conducted between the BEST central team, CEPF experts and the regional hubs to provide information and support.

In August and September 2016 a round of consultation by email and phone was directed at the identified agents in conservation: public entities, research groups and environmental NGOs. Information was requested on recent expenditure in conservation and sustainable development projects, as well as on proposals for future projects that could fit the BEST objectives and modes of action.

### 3.2 Threats and pressures

The Macaronesia Ecosystem Profile identified the following threats and pressures on Macaronesian biodiversity.

#### 3.2.1 *Overexploitation of natural resources*

Historical records show how many of the current biodiversity conservation problems of the Macaronesian islands can be traced back to the extensive deforestation (see e.g. the case of Madeira Island as told in Moore, 2009 and Goodfriend et al. 1994) and intense hunt of native animals, including marine birds, held by the early colonizers. Except for large, vulnerable animals like sea turtles, the monk seal, and whales, the marine environment was relatively protected from overexploitation until the XXth century, when overfishing and destructive fishing practices became (and still is, to this day) a major issue (e.g. Hernández et al. 2008).

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<sup>24</sup> [http://www.azores.gov.pt/Gra/BEST\\_III\\_Macaronesia/](http://www.azores.gov.pt/Gra/BEST_III_Macaronesia/)

### **3.2.2 Invasive Alien Species (IAS)**

Introduced rats were a major factor in the extinction of two species of endemic rodents in the Canary Islands (Bocherens et al. 2006; Rando et al. 2008), and feral cats are to this day a threat to endemic and endangered birds and reptiles (Medina & Nogales, 2009). The uncontrolled spread of invasive plants species is also threatening the island's native vegetation, endangering natural habitats and endemic species (e.g. Francisco-Ortega et al. 2000). Rabbits are considered one of the main threats to a number of critically endangered plant species (Nogales et al. 2006).

### **3.2.3 Urban and tourism development**

Land use changes, started with human occupation of the Macaronesian islands, have continued to this day. In general, higher altitude ecosystems have withstood a smaller impact than coastal ones, given that urban and rural development has been concentrated in the littoral and low altitude areas. Thus, although relatively large proportions of the islands are currently protected, some representative ecosystems have been (and continue to be) severely reduced, with little possibility of recovery (del Arco Aguilar et al. 2010). The urban expansion is also affecting the marine environment. Seagrass meadows, for instance, are retreating in connection with human impacts, both direct (harbor construction) and indirect (sewage and desalination outfalls) (Fabri et al. 2015)

### **3.2.4 Agriculture and forestry**

Agricultural and forestry practices were introduced in the Macaronesian islands from a colonial perspective, and only in the last decades have they been restricted by legal protection of certain areas and species. However, and to this day, conflicts persist between rural interventions and nature conservation. The traditional extensive goat exploitations in the Canary Islands, for instance, have witnessed a sharp increase, with densities up to 53 heads/km<sup>2</sup>. Overgrazing and trampling have heavily affected eleven island endemic plant species, with some populations reduced to less than 10 viable individuals (Gangoso et al. 2008). In the Azores, the intensification of cattle raising has led to serious eutrophication on the main lakes of São Miguel Island, affecting biodiversity and ecosystem services (Cruz et al. 2015).

### **3.2.5 Maritime traffic and ship-strikes**

The rapid expansion in fast and high speed ferry traffic during the past few years in the Canary Islands has been linked to an increase in vessel-whale collisions, resulting in the documented death of 59 animals between 1991 and 2007, mostly sperm whales (Carrillho, 2010). Fais et al. (2016) estimate that the mortality rate of this species by ship strikes exceeds the recruitment capabilities, and urge the application of mitigation measures. Marine traffic is increasing on the other Macaronesian archipelagoes as well, making this a regional issue.

### **3.2.6 Fisheries by-catch and entanglements in fishing gear**

Several problems have been highlighted recently concerning fisheries impact on endangered species. In the Azores, the main concern is the bycatch of loggerhead sea turtles in the blue shark fishery (Ferreira et al. 2011), because cetacean interference is probably small (Silva et al. 2011). On the other hand in the Canary Islands, where necropsies are routinely performed on many stranded cetaceans, fishing interactions have been linked to the death of 19 animals, mostly dolphins, between 1999 and 2005 (Arbelo et al. 2013).



### **3.2.7 Climate change**

The main effects of climate change in Macaronesia will be an increase in temperature up to 3.2°C by 2100, and a reduction in winter precipitation of up to 37% (Cropper, 2013). These changes will have a multitude of effects, summarized by Petit and Prudent (2008) and Harter et al. (2015). The latter authors state that the higher threat potentials come from synergistic interactions, especially with anthropogenic pressures on native species and ecosystems. Human responses to climate change can themselves cause strong indirect impacts on island floras, particularly in highly populated islands.

## **3.3 Thematic priorities**

To address the threats and pressures identified above, the following areas were deemed priority in the consultation process.

### **3.3.1 Baseline data collection and species assessment**

Species records for all Macaronesian archipelagos are incomplete in terms of spatial distribution, abundance and assessment of conservation status. A significant number of species (especially marine species, for which data is extremely limited) were not taken into account for the definition of Macaronesia KBAs due to these gaps, which highlight a pressing need for an improved knowledge base. Without it, meaningful conservation action cannot be undertaken. In the future, an improved baseline data may lead to redrawing KBAs or creating new ones.

### **3.3.2 Improving biodiversity databanks**

The existing Biodiversity databanks in the Azores and the Canary Islands provide access to the detailed distribution of all Azorean and Canarian plant and animal species mapped (when possible) on a 500x500 m grid. These databanks have proved to be a unique means for fundamental research in systematics, biodiversity, conservation management and education. The foreseen development of a databank also for Madeira was never completed. The intention of Madeiran authorities to join PORBIOTA (Portuguese E-Infrastructure for Information and Research on Biodiversity) could address this issue. The Azores Biodiversity Database, in turn, needs to be brought up to date for many taxonomic groups, particularly in the marine realm. A more institutional framing, similar to the one in the Canary Islands, could improve the situation.

### **3.3.3 Mapping of marine habitats and redesign of MPAs**

The need for a comprehensive mapping of marine habitats and species distribution has been particularly highlighted during stakeholder consultation in the Canary Islands. Crossing this mapping with information from ecosystem services and human uses has highlighted the need to redesign outdated conservation strategies by redefining the size, shape and location of MPAs (e.g. Martín-García et al. 2013). This can be of extreme importance taking into account that the Azores, Madeira and Canary Archipelagos contribute with the largest marine surface to the EU, which is vital for conservation and sustainable management policies.

### **3.3.4 Mapping and assessment of ecosystems and their services**

A consensus was reached by the stakeholders about the need to identify and quantify the services of natural and modified ecosystems of the Macaronesia so as to understand their

relative contribution in food production, clean water, carbon sequestration, ground maintenance, recreation and tourism. These assessments are scarce in the region but are essential not only to sustain conservation proposals but also to inform the development and implementation of related policies on water, climate, agriculture, forest and regional planning.

### ***3.3.5 Species conservation and recovery plans***

The importance of creating a legal coverage to the conservation of threatened species has been stressed for the Azores and Madeira. In these archipelagos most protected species have this status as a result of the implementation at national level of European Habitats and Birds Directives. However, these Directives do not cover many threatened and endemic species occurring on the Macaronesian islands that have restricted distributions. Conservation/recovery plans similar to the ones existing in the Canary Islands, addressing local priority species, could be implemented. Baseline work for some species is already available.

In the Canaries, where such plans have already been implemented as an outcome of the Spanish and Canarian catalogues of threatened species, supported by a legal framework, it's necessary to extend them to all listed species. In addition, the implementation of complementing monitoring plans has been suggested. These plans should monitor the distribution, phenology and dynamics of the terrestrial threatened populations.

### ***3.3.6 Control and eradication of invasive alien species***

Control measures include the introduction of nets and other forms of control of herbivores (rabbits, goats, sheep, etc.) that affect plant populations, as well as eradication or reduction of populations of alien species, both introduced vertebrates (rats, mice, cats, etc.) that prey on endangered animal species, and invasive plants that colonize natural and semi-natural habitats. A more recent approach is that of using certain invasive species for economic benefits, which contributes to control the infestation, and helps to confine them to certain areas. In addition to control measures, biosecurity frameworks, which are lacking in region, should be implemented to contribute to mitigating new invasions.

### ***3.3.7 Creation of micro-reserves in areas of severely fragmented habitats***

Since the preservation of certain types of habitats may be difficult in certain areas (e.g., urban areas, coastal areas due to tourism pressure), the creation of public or private Plant Micro-Reserves (PMRs) can be implemented. These reserves could facilitate the implementation of eradication activities, delimitation, re-colonization, etc., and would contribute also to the conservation of other taxa, in particular molluscs and arthropods.

### ***3.3.8 Information and environmental awareness campaigns***

Information and environmental awareness campaigns are considered essential as the conservation of species necessarily involves knowledge and understanding by the public about the importance of their natural heritage. The local population of the islands should be more involved and made more aware of the problems of nature conservation and biodiversity, and of possible solutions. There is a need for significant investments in capacity development in governmental as well as non-governmental organizations. These actions can facilitate the recovery of threatened species and thereby allow a more participatory management by the public.

## 3.4 Azores: BEST Macaronesian priority area 1

### 3.4.1 Objectives and desired outcomes

In addition to the general thematic priorities identified for the whole region, the consultation process in the Azores region identified the following major issues as a basis for the definition of priority projects, namely the need for:

- Taxonomic work on many taxa, particularly invertebrates.
- Revise and update the conservation status of Macaronesian endemic species.
- Complete and update the geographic information on threatened species. The Azores Biodiversity Database needs updating for many taxonomic groups, particularly in the marine realm. A more institutional framing, similar to the one in the Canary Islands, could improve the situation. This action is particularly critical in the marine realm. Creating or improving programs for recording opportunistic observations (including citizen science) could be an important addition to more formal evaluations.
  - Actions to control predators and removing invasive plant species in selected areas are critical.
  - Draft and implement conservation or recovery plans of specific habitats or species.

### 3.4.2 Relevant existing initiatives and projects

*Azorean Biodiversity Group (GBA-cE3c)*

<http://gba.uac.pt/>

Contact person: Paulo A. V. Borges, [paulo.av.borges@uac.pt](mailto:paulo.av.borges@uac.pt)

The Azorean Biodiversity Group engages in complementary research with cE3c using methods such as community ecology, molecular ecology and functional ecology to ensure scientific progress, and health impact assessment, biomonitoring (development of biomarkers), ecological impact assessments, integrated pest management, and, risk management and communication to support policy-making. Collaboration is facilitated by shared resources and facilities, including the following: Unique standardized field databases (with abundance data) for arthropods (BALA, ISLANDBIODIV and EDEN), bryophytes (MOVECLIM altitudinal gradients database) and vascular plants (ISLANDBIODIV) and unique databases on the spatial distribution of Azorean species in 500x500 m grid; Ecological, molecular and taxonomical laboratories; Permanent plots of diverse land-use areas in seven of the nine Azorean Islands with long-term data.

The group leads the Azorean Biodiversity Portal (<http://azoresbioportal.uac.pt/>, with a database of verified distribution records) and the ISLANDLAB (<http://islandlab.uac.pt/index.php>, Virtual Laboratory for Island Biodiversity).

A collaborative, international network of colleagues studying these issues on other oceanic islands (e.g., Madeira, Canary Islands, Hawaii), rely on the laboratory facilities and theoretical knowledge of colleagues in Ce3C's other research groups. Collaborations with all the Nature Parks of the nine Azorean Islands.

Table 3.1. Selected research and conservation projects by GBA-cE3c

<p><b>Biodiversity on oceanic islands: towards a unified theory</b></p>	<p><b>Understanding biodiversity dynamics in tropical and subtropical islands as an aid to science based conservation action</b></p>
<p><i>EU Overseas entities targeted:</i> All oceanic islands</p>	<p><i>EU Overseas entities targeted:</i> Azores, Canary Islands, La Réunion</p>
<p><i>Objectives</i></p>	<p><i>Objectives</i></p>
<p>In this project we will first explicitly mathematically model GDM, based mostly on neutral and niche theory and second, based on an extensive amount of data sets including species richness, abundance and genetic diversity, we will test the predictions of GDM along with the quantitative predictions arising from the mathematical models</p>	<p>The short-term objective of ISLAND-BIODIV was to develop the necessary methodology and undertake a series of intra-regional biodiversity assessments. Embedded in this objective was the coordination of sampling effort to address specific biodiversity needs and concerns at the level of stakeholders and policy makers. Longer-term objectives are the implementation of standardised procedures for science-led biodiversity evaluation, and the establishment of sampling plots for long-term monitoring and/or complementary biological analyses.</p>
<p><i>Budget:</i> 99,000 €</p>	<p><i>Budget:</i> 61,000 €</p>
<p><i>Funding source:</i> Portuguese Foundation for Science and Technology (FCT) -PTDC/BIA-BIC/119255/2010</p>	<p><i>Funding source:</i> NETBIOME (FCT NETBIOME/0003/2011)</p>
<p><b>Montane vegetation as listening posts for climate change</b></p>	<p><b>Conflict between human activities and the conservation of island endemics in a global biodiversity hotspot</b></p>
<p><i>EU Overseas entities targeted:</i> La Réunion (Mascarenes), Guadeloupe (Antilles), Pico (Azores), La Palma (Canaries) and Tahiti (French Polynesia)</p>	<p><i>EU Overseas entities targeted:</i> Madeira</p>
<p><i>Objectives</i></p>	<p><i>Objectives</i></p>
<p>This project sets up the first comparative analysis of tropical biodiversity along altitudinal gradients in multiple islands. It assembled an international and multidisciplinary network across the islands. The intended project specifically aimed at: (1) Characterise bryophyte and fern diversity along altitudinal gradients from lowland to summit and from the gene to community level, (2) Relate species diversity and distribution patterns to relevant life-history and functional traits, (3) Compare relationships between diversity and predictors across the islands, (4) Model species response to climate change in terms of range shifts, (5) Establish permanent plots for long-term vegetation monitoring.</p>	<p>Comparative analysis of the biodiversity of selected indicator groups in natural and artificial habitats in Madeira; assess important areas for conservation using species richness, endemism and rarity metrics; engage the public and decision makers in the conservation of Madeira biodiversity</p>
<p><i>Budget:</i> 70,000 €</p>	<p><i>Budget:</i> 198,000 €</p>
	<p><i>Funding source:</i> Portuguese Foundation for Science and Technology (FCT)</p>

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*Funding source: NETBIOME (DRCT, Azores government)*

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**Implications of climate change for Azorean Biodiversity**

*EU Overseas entities targeted: Azores*

*Objectives*

The main goal of this Project was to evaluate the implications of climate changes for Azorean biodiversity, using the A2 and B2 temperature and precipitation scenarios, in the 2070-2099 period, for Terceira and São Miguel Islands. Arthropods, bryophytes and vascular plants were the target taxonomic groups.

*Budget*

36,000 €

*Funding source: DRCT, Azores Government*

**Genetic structure of Azorean limpets: Implications for conservation and Marine Protected Areas**

*EU Overseas entities targeted: Azores*

*Objectives*

The project was aimed at examining limpet population's connectivity at a number of locations spanning 3 spatial scales at Azores (NE Atlantic): within islands, among islands and among groups of islands. We used a fast-evolving molecular technique such as microsatellites to examine patterns of gene flow at these spatial scales.

Overall, it provided information of theoretical and practical importance to be used to inform conservation strategies and promote the sustainable exploitation of limpets.

*Budget 140,000 €*

*Funding source FCT-Fundação para a Ciência e a Tecnologia*

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**Urban Structures: a driver of biodiversity change in coastal ecosystems?**

*EU Overseas entities targeted: Azores, but applicable to all.*

*Objectives*

The project was aimed at assessing the extent of differences among urban structures and nearby rocky shores in terms of species composition, relative abundances and scales of variability in space and to predict the influence of habitat change on the distribution, abundance, dynamics and structure of intertidal communities on oceanic islands

*Budget: 84,000 €*

*Funding source: The Portuguese Science and Technology Foundation (FCT- PTDC/MAR-EST/2160/2012*

**Changes in submersed vegetation: Assessing loss in ecosystem services from frondose to depauperate systems dominated by opportunistic vegetation**

*EU Overseas entities targeted: Azores, Canary Islands, Guadeloupe*

*Objectives*

The aim of this project was to empirically quantify changes in the magnitude of ecosystem services, including supply of primary production, provision of habitat for epifauna, quality of food for epifauna, provision of habitat for juvenile fishes and water clarity, between frondose vegetated systems and those dominated by opportunistic vegetation.

*Budget: 168,500 €*

*Funding source: BEST Preparatory Action*

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**Effects of habitat destruction on marine benthic metacommunities**

*EU Overseas entities targeted: Azores*

*Objectives*

The project focused on the empirical

**Stock evaluation of abalone: towards a sustainable fishery**

*EU Overseas entities targeted: Azores*

*Objectives*

The project was aimed at providing a

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test of hypotheses about the interactive effects of habitat structure and connectivity (or isolation) using subtidal benthic communities as model systems. Results greatly contributed to understanding and predicting the response of assemblages at multiple spatial scales to anthropogenic impacts and will provide relevant insights for conservation and management decisions aimed at preventing or mitigating their potential impact.

*Budget:* 62,000 €

*Funding source:*The Portuguese Science and Technology Foundation (PTDC/MAR/120770/2010)

reference state to which future studies can be compared and thus accurately assess the impact of a potential fishery. This involved examining the biology and ecology of *Haliotis tuberculata* and creating a dynamic population model that will inform the authorities and provide valuable information that fosters sustainable harvest rates. The project provided recommendations for the future management of the fishery, based on a literature review and the field information collected.

*Budget:* 38,500 €

*Funding source:* Regional Directorate for Science and Technology (M.2.1/F/004/2001)

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### **Ecosystem impacts and socioeconomic benefits of *Asparagopsis armata* in the Azores**

*EU Overseas entities targeted:* Azores

#### *Objectives*

The project aims to understand the effects of the invasive species *A. armata* on the Azorean littoral communities, and predict how the species abundance will influence the islands' coastal biodiversity under future climate change scenarios. In addition, this project evaluates *Asparagopsis* potential as an alternative resource for commercial exploitation. A major outcome will be to provide advice towards the establishment of innovative and profitable investments in sectors with economic and societal benefits to the Azorean population, while mitigating the species negative impact in coastal communities

*Budget:* 139,000 €

*Funding source:*European Regional Development Fund, Regional Fund for Science and Technology of the Azorean Government

### **Macaronesian Islands as a testing ground to assess biodiversity drivers at multiple scales**

*EU Overseas entities targeted:*Macaronesia, but applicable to all

#### *Objectives*

MACDIV intends to dissect the taxonomic, evolutionary and functional basis of spatial heterogeneity in diversity, providing opportunities to understand some of the key processes that have led to the great diversification of life in Macaronesia. Further, given that the 'biodiversity crisis' is nowhere more apparent and need of urgent actions on oceanic islands, we expect that MACDIV will provide part of the basis for the development of future conservation strategies for this unique ecosystem

*Budget:* 197,000 €

*Funding source:* Science and Technology Foundation FCT - (PTDC/BIABIC/0054/2014)

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### *Biotechnology Centre of Azores*

Contact person: Artur da Câmara Machado, artur.c.machado@uac.pt

The CBA has as a mission to promote and develop basic and applied scientific research, regarding the development of the industry, health, agricultural and environmental sectors; by producing knowledge and developing advanced techniques for the biotechnological use of the natural resources available, transforming them into a source of added value and well-being. The biotechnology, by its multidisciplinary character, it's a basilar concept to attain this goals.

The general objective of the CBA is to take advantage of the natural biological resources of the Azores Archipelago, indigenous or adapted to local conditions during centuries of colonization; to implement and develop appropriate advanced technologies and to transform resources in added value products to improve life quality. Therefore, we can summarize the objectives of CBA on the characterization and use of biodiversity with biotechnological potential through the following major topics: a) Biological resources preservation and exploitation; b) Genetic variability; c) Plant and animal biotechnology; d) Food quality, safety and traceability.

The CBA has competences and skills in: a) valorization on genetic resources; b) conservation and recovery of autochthonous species (animal and plants); c) Identification of bioactive compounds and molecules with commercial interest; d) conservation of genetic resources; e) conservation ecology; f) molecular ecology; g) GIS data analysis; g) molecular biology; h) plant tissue culture; i) confocal microscopy; and i) protein analysis.

Potential partners to complement CBA development of projects are: Thünen Institute of Biodiversity, Federal Research Institute for Rural Areas, Forestry and Fisheries; BFP - INRA Centre Bordeaux Aquitaine Biologie du Fruit et Pathologie INRA Centre Bordeaux Aquitaine; BGPI CIRAD Biologie et Génétique des Interactions Plante-Parasite; CIRAD UMR PVBMT Centre de Coopération Internationale en Recherche Agronomique pour le Développement, UMR PVBMT; ISOPlexis - Universidade da Madeira; ASTRO INRA Antilles Unité de Recherches Agrosystèmes tropicaux; CIRAD AGAP Unité 'Amélioration Génétique et Adaptation des Plantes; Universidade de Coimbra (UC) - Centro de Ecologia Funcional; Universidade de La Laguna; Ghent University; Instituto Canario de Investigaciones Agrarias; Université catholique de Louvain (UCL); University of Copenhagen; Denmark Technical University, CBS; BOKU Wien, U. Natural Resources & Life Sciences; University of Iceland; University of Bangor; Computomics; Bio-Product; Bio-Based Pilot Plant; EntreChem; CLEA; EMBL-EBI; Institute for Phytopathology & Applied Zoology (IPAZ), Justus-Liebig-University.

Table 3.2. Selected research and conservation projects by CBA

<p><b>Valuation and recovery of the endemic Azores flora</b></p> <p><i>EU Overseas entities targeted: Azores</i></p> <p><i>Objectives</i></p> <p>This project used biotechnological methods to recover and preserve endemic plant species, considered critically endangered, and on the other hand, evaluated the agronomical potential of certain species.</p> <p><i>Budget: 74,900 €</i></p> <p><i>Funding source: Direcção Regional de Ambiente, Azores Government.</i></p>	<p><b>Diversity of arbuscular mycorrhizal fungi (AMF) in native forest of Azores and their biotechnological application</b></p> <p><i>EU Overseas entities targeted: Azores</i></p> <p><i>Objectives</i></p> <p>The symbiotic association between arbuscular mycorrhizal fungi (AMF) and plant roots is widespread in nature. The main goal of this project was to make the first attempt to study the mycorrhizal community associated to four endemic plants (<i>Juniperus brevifolia</i>, <i>Picconia azorica</i>, <i>Prunus azorica</i> and <i>Vaccinium cylindraceum</i>): (i) Investigate patterns of AMF diversity and distribution in native forest; (ii) Establishment of AMF monospecific cultures and production of native inoculum for micropropagated endemics plants.</p> <p><i>Budget: 143,500 €</i></p>
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*Funding source:* Fundação para a Ciência e Tecnologia

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**Improving co-digestion of local wastes to produce methane and to reduce environmental impact**

*EU Overseas entities targeted:* Azores

*Objectives*

Optimize the bio-transformation of residues for energy production using hydrolytic microorganisms from the Azores thermal springs.

*Budget:* 39,600 €

*Funding source:* FRCT, Azores Government

**Molecular characterization and genetic study of populations of endemic plants from different Azorean islands**

*EU Overseas entities targeted:* Azores

*Objectives*

this project studied the populations of *Juniperus brevifolia* and *Picconia azorica* of S. Miguel, Terceira and Pico islands, with the objectives of: a) evaluate the patterns of genetic variation at the intra-population level, inter-population level and between islands; b) evaluate the existence or not of sub-species; c) study the philogeography of each species; and d) infer the colonization strategies and their consequences in the evolutionary process of each species. The resulting information is crucial for the establishment of conservations strategies.

*Budget:* 80,000 €

*Funding source:* Government of the Azores (Regional Secretariat for the Sea, Science and Technology)

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*CIBIO - Research Center in Biodiversity & Genetic Resources*

InBIO - Associate Laboratory, <http://cibio.inazores.net/>

Contact person: Ana Cristina Costa, [ana.cm.costa@uac.pt](mailto:ana.cm.costa@uac.pt)

CIBIO-Açores is a research centre of the University of the Azores; at the same time, it is a Group (BIOISLE) within the Associate Laboratory InBIO – Research Network in Biodiversity and Evolutionary Biology; it is officially recognized by the Regional Government of the Açores as a specialized research group. Its main objective is to understand the evolutionary and ecologic processes that determine the biodiversity patterns in island ecosystems, and to develop strategies to manage and preserve island biodiversity. This broad objective is pursued in two main areas: a) foundation and dynamics of biodiversity, integrating three themes: systematics which identifies who's who in the Azorean biota; evolution which finds patterns, proposes processes and identifies mechanisms of speciation; and biogeography which deals with the distribution of species and their origin; b) conservation and environment management, integrating three themes: ecology which studies the interactions of species and the reasons for their distributions; management of the biological resources so as to assure their sustainable use; and planning that proposes adequate methodologies for allocation of space to human activities integrated in a natural scenario. Transversal to all activities is the promotion of environmental awareness in the community so as to foster the sustainable use of our natural heritage.



Ongoing collaborations include: Natural History Museum, London; Kew Gardens, London; Jardín Botánico Canario Viera y Clavijo, Las Palmas de Gran Canaria; Biodiversität der Pflanzen, Technische Universität München; Biodiversity Institute, University of Kansas.

Table 3.3. Selected research and conservation projects by CIBIO

<p><b>eAZFlora - Electronic Flora of the Azores for Smartphones and Tablets</b></p> <p><i>EU Overseas entities targeted: Azores</i></p> <p><i>Objectives</i></p> <p>To fill a knowledge gap in Azorean science by developing a Flora of the Azores, while taking advantage of state-of-the-art internet and mobile technologies. We propose to make scientific data accessible to tourists and non-professional botanists through a mobile application provided with plant identification tools, such as identification by image recognition. The potential of this application extends into the education field by making botany study a captivating activity for younger students.</p> <p><i>Budget: 113,000 €</i></p> <p><i>Funding source: ACORES-01-0145-FEDER-000007</i></p>	<p><b>Conservation of plant biodiversity in the Macaronesian Hotspot: Integrating phylogenetic, taxonomic, and ecological approaches to study the Cape Verde endemic flora</b></p> <p><i>EU Overseas entities targeted: Azores</i></p> <p><i>Objectives</i></p> <p>The main goal of this project is to improve our knowledge on species evolution by using endemic species to test key hypotheses of island biogeography with an integrative approach that combines phylogenetic, taxonomy, and ecological data. In addition, a DNA barcoding study will contribute to identify and characterize the endemic flora. Finally, the compilation and analysis of data [e.g. taxonomic, ecological, distribution, and molecular data] for each endemic taxon, will be available in form of database to the international scientific community..</p> <p><i>Budget: 110,000 €</i></p> <p><i>Funding source: FCT-PTDC/BIABIC/4113/2012</i></p>
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*Okeanos Research Center*

University of the Azores, <http://www.okeanos.uac.pt>  
 Contact person: João M. Gonçalves, [joao.ma.goncalves@uac.pt](mailto:joao.ma.goncalves@uac.pt)

This R&D centre of the of the University of the Azores is engaged in the production, facilitation and promotion scientific research, innovation and dissemination of knowledge in marine science and sea technologies, in the Atlantic area surrounding the Azores. Despite being recently created, within the University organizational research reform (2015), this center is the successor of IMAR research center, created in the 80's. During this path we demonstrated a consistent ability to, in a competitive manner, obtain regional, national and international research projects, especially within the European Research Framework Program.

Nowadays, this center comprises 23 Ph.D.'s associated researchers and 30 technical and administration collaborators. The observational and research resources that we gathered through time resulted in considerable capacity to study the surrounding ocean. In fact, the research vessels (vessels ("Arquipélago" 28 m, "Águas-Vivas" – 12 m, and three other smaller ones), the biological, chemical and oceanographic equipment (CTD's, ROV, etc.), and local environmental data (hydrological, biological databases and fisheries) are a relevant scientific

capital. This center supports and facilitates both pure and applied research. It is also involved in cooperative activities with public and private entities, national and international, including universities, research institutes and centers. The services provided to industry and public administration have been, and are, very relevant, as well as their cultural and outreach activities of research in the field of marine science (museums, school system, national and international newspapers, radio stations, public television, etc.).

Our members also integrates the MARE research center (UID / MARE / 04292/2013), which reached the highest rank in the last marine science evaluation by the national science foundation (FCT). We are also collaborating with the Rebikoff-Niggeler foundation, based in Faial island, that operates the only manned submersible in the Azores (LULA-1000). He have established regular collaboration programs with regional public bodies (Fisheries Directorate, Sea-Affairs Directorate, Environment Directorate) in order to establish marine conservation programs and fisheries projects to achieve a sustainable development of the blue economy.

Table 3.4. Selected research and conservation projects by OKEANOS

<p><b>EMSODEV “EMSO implementation and operation: DEvelopment of instrument module “</b></p>	<p><b>Sponges “Deep-sea Sponge Grounds Ecosystems of the North Atlantic: an integrated approach towards their preservation and sustainable exploitation’</b></p>
<p><i>EU Overseas entities targeted:</i> North Atlantic</p>	<p><i>EU Overseas entities targeted:</i> Azores</p>
<p><i>Objectives</i></p>	<p><i>Objectives</i></p>
<p>The EMSODEV general objective is to catalyse the full operations of the EMSO distributed Research Infrastructure, through the development and deployment of the EMSO Generic Instrument Module (EGIM). EGIM will provide accurate, consistent, comparable, long-term measurements of ocean parameters, which are key to addressing urgent societal and scientific challenges (e.g. climate change and hazards). This will lead to an increased interoperability of EMSO nodes and to the common collection of ocean essential variable time series.</p>	<p>The objective of SponGES is to develop an integrated ecosystem-based approach to preserve and sustainably use vulnerable sponge ecosystems of the North Atlantic. The SponGES consortium, an international and interdisciplinary collaboration of research institutions, environmental non-governmental and intergovernmental organizations, will focus on one of the most diverse, ecologically and biologically important and vulnerable marine ecosystems of the deep-sea - sponge grounds – that to date have received very little research and conservation attention..</p>
<p><i>Budget:</i> not available</p>	<p><i>Budget:</i> 524,330 €</p>
<p><i>Funding source:</i> H2020.</p>	<p><i>Funding source:</i> H2020</p>
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<p><b>EMBREC</b></p>	
<p><i>EU Overseas entities targeted:</i> North Atlantic</p>	
<p><i>Objectives</i></p>	
<p>The European Marine Biological Resource Centre (EMBRC) is a distributed research infrastructure that aims to provide a strategic delivery mechanism for excellent and large-scale marine science in Europe. With its services, EMBRC will support both</p>	

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fundamental and applied research based on marine bioresources and marine ecosystems. In particular, EMBRC aims to drive forward the development of blue biotechnologies. EMBRC will provide the suitable research environment for users from academia, industry, technology and additional sectors..

*Budget:* not available

*Funding source:* H2020.

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*Rebikoff-Niggeler Foundation*

<http://www.rebikoff.org>

Contact person: Kirsten Jakobsen, [info@rebikoff.org](mailto:info@rebikoff.org)

The Rebikoff-Niggeler Foundation (FRN) was created in 1994 and is a nonprofit organisation declared of public benefit by the Government of the Azores in the year 2000. The foundation is the owner and operator of the LULA1000 submersible system, and develops multiple scientific, technological and natural heritage activities, aiming to improve knowledge on deep-water ecosystems and to contribute to a sustainable ocean management.

Located on Faial/Azores, in the central northeast Atlantic, this infrastructure provides fast access to a great number of habitats of ecological importance (e.g. seamounts, deep-sea coral gardens and reefs, sponge aggregations) assuming a strategic position for marine research and conservation actions. The FRN is composed of a dynamic and multidisciplinary team which is used to work with national and international research and media partners. It has a strong and growing network of external collaborations (e.g. Regional Government of the Azores; Senckenberg, German Center for Marine Biodiversity Research; Department of Oceanography and Fisheries of the University of the Azores; Ecological Centre of the University of Cologne, BBC and others).

The LULA1000 is a one-of-a-kind vehicle and the only manned research submersible operating in Portugal, classed for 1000 metres of depth and a crew of three by DNV-GL (Grmanischer Lloyd Hamburg/Germany). The vehicle was developed and constructed by FRN. It is also one of only two manned submersibles operated in the EU and capable of reaching 1000 metres of depth.

The following research activities and services can be realized: (i) Video Surveys, (ii) Collecting samples, data acquisition; (iii) Multibeam surveys (<3, 000 m depth), Side Scan Sonar surveys (<1,000 m depth); (iv) In-situ experiments; (v) participation in diving missions (dive time).

Table 3.5. Selected research and conservation projects by FRN

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<p><b>Biodiversity inventory and comprehensive characterization of habitats on the islands' slopes of the Azores Archipelago between 300 and 1000 metres of depth</b></p> <p><i>EU Overseas entities targeted:</i> Azores</p> <p><i>Objectives</i></p>	<p><b>Monitoring carbonate production and degradation (Azores, Portugal) 2006-2011</b></p> <p><i>EU Overseas entities targeted:</i> Azores</p> <p><i>Objectives</i></p> <p>The summits and flanks of the non-</p>
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The main goal is to enhance knowledge on deep-sea habitats on the Azores islands' slopes down to 1000 metres of depth. Identification of new habitats of ecological value and vulnerable marine ecosystems, according European priorities for improvement of knowledge on marine habitats, with the purpose to help developing regional strategies for the protection of ecologically relevant habitats.

*Budget:* Estimated investment in this project by FRN since 2003: 1.5 million Euros, not considering technological investments.

*Funding source:* FRN own resources.

tropical Azores seamounts and volcanic islands provide a framework for intense biogenic carbonate-production and accumulation, classifying them as important 'carbonate factory' of the C factory type (cool water + controlled precipitate).

It was intended to carry out budgeting of carbonate-accretion and bioerosion rates with an experimental approach, to yield (1) warm-temperate carbonate production and bioerosion rates, (2) enhanced insight in the suitability of stable isotopes for growth rate studies and high-resolution climate variability analyses, (3) knowledge on the bathymetric as well as biogeographic distribution of bioeroding and carbonate-accreting agents and (4) new insights in the relative contribution of boring organisms versus grazers on different substrate orientations to the process of bioerosion.

*Budget:* 50,000 €

*Funding source:* Deutsche Forschungsgemeinschaft (DFG), Germany

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### **Mid-depth benthic communities of conservation importance in the Azores: cold-water coral ecosystems**

*EU Overseas entities targeted:* Azores, but applicable to any with deep water habitats

#### *Objectives*

In-situ study of cold-water coral habitats; Seabed mapping by simultaneous use of remote technologies (side-scan sonar) and video recording onboard the LULA submersible (Faial-Pico Channel); Sampling of live corals using LULA's manipulator with the purpose of transfer to Corallab; Experimental studies on coral calcification under different acidity and temperature conditions, at IMAR-DOP coral aquarium facilities (Corallab), will help predict how corals will respond to future environmental changes.

*Budget:* 50,000 €

*Funding source:* FCT – Fundação para a Ciência e Tecnologia

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### **Monitorization of Litter on the Seabed of the Azores Islands' slopes**

*EU Overseas entities targeted:* Azores, but applicable to all

#### *Objectives*

Monitorization and documentation of litter during diving mission with the LULA1000 submersible on the Ayores islands slopes; dissemination of FRN's video archive with regard to information on litter on the seabed.

*Budget:* 45,000 €

*Funding source:* Government of the Azores (Regional Secretariat for the Sea, Science and Technology)

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**3.4.3 BEST niches: new and complementary actions to be funded to achieve the objectives of the priority area**

Table 3.6. Project overview

Thematic priorities	Projects	Budget (€)
<b>Baseline data collection and species assessment</b>		
	Food webs in Atlantic Reef Fishes (GBA – cE3c)	100,000
	Plant extremophiles – adaptations to harsher environments (CBA)	1,500,000
	Impact of soil intensification (from pristine to agricultural soils) on the rhizosphere microbial diversity and ecosystem services (CBA)	950,000
	Jellyfish biodiversity & monitoring in the Azores (OKEANOS)	90,250
	Using metagenomics to evaluate the ecological impact of deep sea mining activities on indigenous microbial communities in the Azores region (OKEANOS)	191,300
<b>Improving biodiversity databanks</b>		
	Population genetic structure database of Azorean endemic plant taxa (CIBIO)	600,000
	Improving biodiversity databanks (GBA – cE3c)	350,000
<b>Mapping of marine habitats and redesign of MPAs</b>		
	The role of marine protected areas for the conservation of Macaronesian coastal habitat biodiversity (GBA – cE3c)	200,000
	Biodiversity inventory and comprehensive characterization of habitats on the islands' slopes of the Azores and Madeira Archipelagoes between 300 and 1000 m depth (RNF)	525,000
	Deep Reef (RNF)	150,000
<b>Mapping and assessment of ecosystems and their services</b>		
	Ecological indicators of climate change in forests ecosystems (GBA – cE3c)	150,000
	Monitoring of Macaronesian native forest biodiversity (GBA – cE3c)	300,000
	Azorean limpets sustainability: monitoring of artisanal exploitation (OKEANOS)	75,750
<b>Species conservation and recovery plans</b>		
	Conservation assessment of endemic Azores species (GBA – cE3c)	360,000
<b>Control and eradication of invasive alien species</b>		
<b>Creation of micro-reserves in areas of severely fragmented habitats</b>		
<b>Information and environmental awareness campaigns</b>		

Table 3.7. Projects proposed by Azores stakeholders

CIBIO - Research Center in Biodiversity & Genetic Resources, InBIO - Associate Laboratory	
<p><b>Population genetic structure database of Azorean endemic plant taxa</b></p> <p><i>KBAs targeted:</i> None in particular, focused in endemic plants</p> <p><i>EU Overseas entities targeted:</i> Azores</p> <p><i>Main actions</i></p> <p>The main objective of this project to develop an open access systematised internet database to harbour the molecular genetic information of top priority for conservation Azorean endemic plants. The database will contain data already provided by previous studies led by this project's PI and new data, specifically developed for STRUCTUS, will be added throughout the duration of the project. The target taxa will be selected according to their priority status for conservation and the 20 top priority species selected (approximately 10), excluding those already studied or no longer considered to be endemics.</p> <p><i>Estimated duration:</i> 3 years</p> <p><i>Indicative budget:</i> 600,000€</p>	
GBA - cE3c	
<p><b>Ecological indicators of climate change in forests ecosystems</b></p> <p><i>KBAs targeted:</i> Terceira</p> <p><i>EU Overseas entities targeted:</i> Azores</p> <p><i>Main actions</i></p> <p>Changes in rain patterns and rising temperatures are some of the predicted consequences of climate change. The project will identify a set of ecological indicators of climate change in forests through a multi-level evaluation of the ecosystems' responses to rising temperatures and changing rain patterns. Using controlled in situ experiments it will be able to: Determine the consequences for soil nutrient availability; Evaluate changes in bryophyte, vascular plants and arthropod communities; Understand the ecophysiological responses of vascular plant species; Generate field data to predict the consequences of climate change, its impacts on ecosystem</p>	<p><b>The role of marine protected areas for the conservation of Macaronesian coastal habitat biodiversity</b></p> <p><i>KBAs targeted:</i> All Azorean KBAs with a coastal marine component.</p> <p><i>EU Overseas entities targeted:</i> Azores</p> <p><i>Main actions</i></p> <p>Sample all Macaronesian islands both inside and outside marine protected areas using standardized sampling techniques. Assess how much of the overall biodiversity is currently considered within the existing network of marine protected areas. Assess the role of the different typologies of marine protected areas for the conservation of biodiversity.</p> <p><i>Estimated duration:</i> 2-3 years</p> <p><i>Indicative budget:</i> 200,000 €</p>

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services and how these can be addressed by decision makers; Start long-term monitoring of climate changes in the Azores.

*Estimated duration:* 3 years

*Indicative budget:* 150,000€

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### **Monitoring of Macaronesian native forest biodiversity**

*KBAs targeted:* Terceira

*EU Overseas entities targeted:* Azores

#### *Main actions*

Assess the impact of invasive species and climate change on mid-high altitude island native forests

Sample permanent plots in several macaronesian islands using standardized sampling techniques: (i) the establishment of permanent plots covering diverse ecological gradients (e.g. disturbance or elevational); (ii) an approach based around multiple taxa with adequate standardized and replicable protocols; (iii) establishment of a common set of species indicators and community properties specific for island forests, building on, and harmonized with, existing sampling and monitoring efforts, and linked as far as possible to indicators for other biomes; (iv) capacity building of locally-based researchers qualified to promote collaboration and continuous dialogue with local conservation practitioners, policy makers and environmental agencies.

*Estimated duration:* 3 years

*Indicative budget:* 300,000 €

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### **Improving biodiversity databanks**

*KBAs targeted:* none in particular

*EU Overseas entities targeted:* Azores and Madeira

#### *Main actions*

Hire technicians to compile bibliographic information on biodiversity distribution into a dedicated, open access database.

*Estimated duration:* 3 years

*Indicative budget:* 350,000 €

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*Foundation Rebikoff-Niggeler*

### **Food webs in Atlantic Reef Fishes**

*KBAs targeted:* No specific KBA target

*EU Overseas entities targeted:* Azores

#### *Main actions*

The main goal consists of studying a vast database with more than 3,000 species for 500 locations. We expect to obtain results indicating historic developments of energy transference in reef fishes from all over the Atlantic mid-temperate to equatorial latitudes. Overfishing and climate change may be a cause for change as well as biased protection of emblematic species and lack of sufficient marine protected areas..

*Estimated duration:* 3-4 years

*Indicative budget:* 100,000 €

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### **Conservation assessment of endemic Azores species**

*KBAs targeted:* none in particular

*EU Overseas entities targeted:* Azores

#### *Main actions*

Field work to obtain estimates of population size and geographic distribution for endemic species.

*Estimated duration:* 3 years

*Indicative budget:* 360,000 €

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**Biodiversity inventory and comprehensive characterization of habitats on the islands' slopes of the Azores and Madeira Archipelagoes between 300 and 1000 m depth.**

*KBAs targeted:* Not specific to any particular KBA

*EU Overseas entities targeted:* Azores and Madeira

*Main actions*

Our main goal is to enhance knowledge on deep-sea habitats of the Portuguese EEZ down to 1000 m depth contributing with valuable inputs for efficient regional policies within the Marine Directive aiming to achieve "Good Environmental Status" of the EU's marine waters by 2020.

Identification of new habitats of ecological value and vulnerable marine ecosystems, according European priorities for improvement of knowledge on marine habitats.

*Estimated duration:* 4 years

*Indicative budget:* 525,000 €

**Deep Reef**

*KBAs targeted:* Not specific to any particular KBA

*EU Overseas entities targeted:* Azores

*Main actions*

Researching conditions for the forming of deep-water reefs and coral gardens and determination of coral growth. The object of study is the wreck of a German WWII submarine sunk off Pico Island on 2nd February, 1942, representing an authentic artificial deep-water reef, located in 870 m of depth. The fact that the exact date of sinking is known, makes possible dating of sessile organisms, a large diversity of deep-water corals and sponges.

*Estimated duration:* 2 years

*Indicative budget:* 150,000 €

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*Biotechnology Centre of Azores (CBA)*

**Impact of soil intensification (from pristine to agricultural soils) on the rhizosphere microbial diversity and ecosystem services**

*KBAs targeted:* None in particular

*EU Overseas entities targeted:* Azores, but could be extended

*Main actions*

To characterize the fungal and prokaryotic community from mycorrhizosphere soils collected on different islands from sites, which include primary and secondary forest, permanent grassland, and cropping areas. The microbial diversity will be assessed in depth by high-throughput sequencing of PCR amplicons linked to community structure and function. Furthermore, the rhizomicrobiome of selected endemic plants will be analysed in more detail by metagenomics to unveil the yet unknown structure, functional

**Plant extremophiles – adaptations to harsher environments**

*KBAs targeted:* None in particular

*EU Overseas entities targeted:* Azores, but could be extended

*Main actions*

To screen Azorean hot spring plants for thermotolerant enzymes using high-throughput (HTP) transcriptomic and proteomic techniques. These approaches will identify novel, thermostable molecules representing a new source of biodiversity.

Expected results: 1) identify the biodiversity and analyse the responses and adaptations to abiotic stresses of plants growing in hot springs; and 2) enhance knowledge and research tools for crop breeding programs favouring broader tolerances to environmental stress.

*Estimated duration:* 3 years



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characteristics and beneficial potentials hidden in these communities.

*Indicative budget: 1,500,000€*

*Estimated duration: 3 years*

*Indicative budget: 950,000€*

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## OKEANOS

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### **Jellyfish biodiversity & monitoring in the Azores**

*KBAs targeted:* None in particular

*EU Overseas entities targeted:* Azores, but could be extended

#### *Main actions*

To update the knowledge on the jellyfish biodiversity and biology in the Azores, paying attention to the occurrence of new dangerous tropical species (ex. box-jellies). Create a web page to register the occurrence of jellyfish in the Azores archipelago, that can be used to check in advance the presence of these organisms in bathing areas (contribution to the tourism activity). To know the impact of jellyfish predation on commercial fish species (contribution to the local fisheries).

*Estimated duration: 3 years*

*Indicative budget: 90,250 €*

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### **Using metagenomics to evaluate the ecological impact of deep sea mining activities on indigenous microbial communities in the Azores region**

*KBAs targeted:* None in particular

*EU Overseas entities targeted:* Azores, but could be extended

#### *Main actions*

This work will serve as an ecological evaluation by sampling distinct and key areas to be potentially mined in the Region of the Azores, for example, the Menez Gwen, Lucky Strike and Rainbow hydrothermal vent fields and compare different bacterial community “snapshots” prior to, during and after-mining operations and in this way, based on real data, help marine biologists and marine conservationists seeking scientific support for the conservancy and sustainable use of the oceans, seas and marine resources for sustainable development.

*Estimated duration: 3 years*

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### **Azorean limpets sustainability: monitoring of artisanal exploitation**

*KBAs targeted:* None in particular

*EU Overseas entities targeted:* Azores, but could be extended

#### *Main actions*

To improve the sustainability of the limpets fishery in the Azores and simultaneously to contribute for the conservation of these species. Creation of a simple monitoring program that can be later applied by fishing associations and NGOs. To diminish the illegal catches of limpets in the region, creating a more regulated market for these species.

*Estimated duration: 3 years*

*Indicative budget: 75,750 €*

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## **3.5 Madeira: BEST Macaronesian priority area 2**

### **3.5.1 Objectives and desired outcomes**

In addition to the general thematic priorities identified for the whole region, the consultation process in Madeira region identified the following major issues as a basis for the definition of priority projects:

- Need for comprehensive baseline habitat and species distribution and abundance information (both terrestrial and marine). Consider citizen science initiatives for this purpose and include human usage of land. Species with wide distribution ranges (e.g. cetaceans and sea turtles) have no critical habitats known in European Macaronesia (e.g. nesting places for sea turtles). The focus should therefore be on areas that pose main threats or where oceanic animals spend more time, i.e. submarine banks.
- Need of electronic platform to compile existing and future information on the geographical distribution of species that is compatible with the ones existing in the Azores and the Canaries, ideally with the possibility of joining a Macaronesia-wide infrastructure.
- Planning and implementing Valencian-type plant micro-reserves (Laguna, et al., 2004) to manage small areas with conservation value scattered throughout fragmented habitats, e.g. within urban areas.

### **3.5.2 Relevant existing initiatives and projects**

*CIIMAR – Madeira Oceanic Observatory*

<http://oom.arditi.pt/>

Contact person: Claudia Ribeiro, [c\\_castanheta@hotmail.com](mailto:c_castanheta@hotmail.com)

The Madeira Ocean Observatory (OOM) aims to set its position as a pole of excellence dedicated to research and permanent monitoring of the ocean. This initiative brings together a multidisciplinary scientific community, joining several entities in order to promote cooperation and profitability of resources. It began in January 2014 to consolidate historical data, observations and forecasts on a common platform, enabling the Autonomous Region of Madeira (RAM) to respond more effectively to the requirements of evaluation and management of marine resources and empowering RAM of the suitable means needed for a sustainable development.

OOM has participated in several projects over the recent years, under the Portugal 2020 strategy, through the European Regional Development Fund (FEDER). Anchoring its activities in the knowledge and experience existing in the RAM, the proposed lines of work aim to develop research in Biodiversity, Fisheries and Aquaculture, Remote sensing of marine animals and Meteo-Oceanographic Models and Forecasts.

Table 3.8. Selected research and conservation projects by CIIMAR - Madeira Oceanic Observatory

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**Biodiversity in the seamounts: The Madeira-Tore and Great Meteor – BIOMETORE**

*EU Overseas entities targeted:* Madeira

*Objectives*

Acquisition of physical, chemical and biological data in selected areas of the Great Meteor and Madeira-Tore seamounts to gain knowledge of biodiversity, species, pelagic and benthic ecosystems as well as human pressures in these areas. Mapping of oceanic areas with a view to better understanding of deep marine ecosystems. Draw up a sustainability and management plan for the marine areas of the study and support the assessment of good environmental status under the Marine Strategy Framework Directive (WFDD).

*Budget:* 5.308.515 €

*Funding source:* EEA Grants

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*IFCN (Instituto das Florestas e Conservação da Natureza) – IP-RAM*

<http://www.sra.pt/drf/>

Contact person: Dinarte Teixeira, [dinarteteixeira.sra@gov-madeira.pt](mailto:dinarteteixeira.sra@gov-madeira.pt)

The Institute for the Conservation of Nature and Forests, I. P. is a public institute integrated in the indirect administration of the State, having its own administrative and financial autonomy. IFCN mission is to propose, monitor and ensure the implementation of nature conservation and forest policies, aiming at the conservation, sustainable use, valorization, enjoyment and public recognition of the natural heritage, promoting the sustainable development of forestry spaces and associated resources, to promote the competitiveness of forest ranks, performing concerted planning and action in the field of forest protection and water resource usage, as well as other activities directly associated with forest and forestry activities.

The IFCN intervenes in the management of Nature Conservation and Biodiversity through active conservation actions and support actions. The actions of active conservation imply the direct management of individuals or populations, of habitats or, still, of ecosystems. Several Programs and Projects for the management of Nature and Biodiversity count on the involvement of the ICNF in the past, such as 3 LIFE projects in the last 6 years as coordinator of conservation and monitoring actions for priority species included in the Annex II of the Habitats Directive. These projects were/are being implemented in Porto Santo (LIPS 2010-2015), Desertas Islands (Recover Natura 2013-2019) and Madeira Island (Maciço Montanhoso 2013-2017).

Table 3.9. Selected research and conservation projects by IFCN-IP-RAM

<p><b>LIPS (LIFE+09 NAT/P/000041) - Halt the loss of European Biodiversity through the recovery of habitats and species of the Islets of Porto Santo and surrounding marine area</b></p>	<p><b>LIFE RECOVER NATURA (LIFE12/NAT/PT/000195)</b></p>
<p><i>EU Overseas entities targeted: Madeira</i></p>	<p><i>EU Overseas entities targeted: Madeira</i></p>
<p><i>Objectives</i></p>	<p><i>Objectives</i></p>
<p>The recovery of habitats and species from the Natura 2000 Network site "Ilhéus do Porto Santo". It occurs predominantly in the land area of the six islets of Porto Santo in the Madeira Archipelago: Ilhéu da Cal, Ilhéu do Farol, Ilhéu de Ferro, Ilhéu da Fonte da Areia, Ilhéu das Carrots and Ilhéu de Fora..</p>	<p>Ensure that the ecosystems of the Natura 2000 sites of the Ponta de São Lourenço (PTMAD0003) and the Desertas Islands (Deserta Grande and Islet Chão) (PTDES0001), achieve a stable, favorable and self-sustaining conservation status.</p>
<p><i>Budget: 571.163 €</i></p>	<p><i>Budget: 658.798€</i></p>
<p><i>Funding source: LIFE Program</i></p>	<p><i>Funding source: LIFE Program</i></p>
<hr/> <p><b>Madeira Mountainous Massif (LIFE11 NAT / PT / 327) - Recovery and conservation of species and habitats of the Massif Central Mountain Range of Madeira</b></p>	
<p><i>EU Overseas entities targeted: Madeira</i></p>	
<p><i>Objectives</i></p>	
<p>Conservation of the fragile natural resources of the Oriental Madeira Mountain Massif (MMO). Creation of seeds bank; plants production; eradication of invasive species and growing native ones in situ; conservation actions for endemic land-snails endemics to the area, in particular <i>Leiostyla Cassida</i>; conservation actions targeting Zino's petrel.</p>	
<p><i>Budget: 593.487 €</i></p>	
<p><i>Funding source: LIFE Program</i></p> <hr/>	

MITI – Madeira Interactive Technologies Institute

www.m-iti.org

Contact person: José Luís Sousa Freitas; jose.l.freitas@m-iti.org

The research mission of M-ITI is to expand understanding of human experience and interactive technologies through basic and applied research that is innovative and responsive to manifest real-world needs using multi-disciplinary collaboration drawing on varied perspectives. The institute draws on three core competencies or perspectives (Human Sciences, Computer Science and Software Engineering, and Design and Creativity) that provide a broad expertise in different domains. A number of application areas are defined that are transversal to M-ITI's core competencies (Sustainability, Assistive Technologies, and

Digital Culture), drawing from the different perspectives to achieve the interdisciplinarity required today for having a real world impact on human experience through the use of interactive technologies.

M-ITI's capacities in conservation and sustainable development are mostly focused on Sustainable Energy, Education for Sustainability and Social media and citizenship.

M-ITI has 38 faculty members, Total people working in R&D is around 70 people. Our ERAChair has set up a Critical Technical Practices Lab. It works as a Fab Lab bridging R&D with the advantages of with the Madeira Living Lab as a whole.

M-ITI's main partners in the academic and R&D side are the Carnegie Mellon University, The University of Texas at Austin, University College London, IST/LARSyS, Universidade da Madeira, Universidade dos Açores, ARDITI-OOM, PLOCA, University of Gran Canaria and University of Trento. On the public sector, Proteção Civil, Parque Natural, Empresa de Electricidade da Madeira, Parque Temático. Industrial partners, Novabase, Vodafone, PT/Altice Labs, AREAM, ACIF, Exictos, etc.

Table 3.10. Selected research and conservation projects by MITI

<b>Powerhouse</b>	<b>SINAIS (Sustainable Interaction with social Networks, context Awareness and Innovative Service)</b>
<i>EU Overseas entities targeted:</i> Madeira	<i>EU Overseas entities targeted:</i> Madeira
<i>Objectives</i>	<i>Objectives</i>
Power House is a project whose goal is to create an interactive exhibit the Casa da Luz electricity museum to provide an entertaining experience that simultaneously educates guests on the challenge of managing an isolated power grid, like the one on the Island of Madeira. Players also experience how weather and seasonal conditions impact how different kinds of renewable power operate, including solar power, wind, and hydroelectric.	M-ITI showed how research in the domains of Electrical Engineering, Computer Science, Psychology, Service Design, and Human-Computer-Interaction can be used to develop solutions to the sustainability problem of our society. Special emphasis was put on energy conservation, a problem especially important for an isolated region like Madeira, where limited resources and space enforce the development of new solutions.
<i>Budget:</i> 50,000 €	<i>Budget:</i> 260,000 €
<i>Funding source:</i> Eletricidade da Madeira	<i>Funding source:</i> FCT

*Museu da Baleia da Madeira*

<http://museudabaleia.org>

Contact person: Luís Freitas, [luisfreitas@museudabaleia.org](mailto:luisfreitas@museudabaleia.org)

The Madeira Whale Museum (MBM) is the leading institution in the study of cetacean biology and ecology of in the Madeira archipelago, over the last 20 years. During that period the Museum implemented or has been involved in several research and conservation projects with strong implications for the conservation of cetaceans in Madeira archipelago waters. Its scientific work resulted in the update of cetacean species check-list, on the establishment of legislation for the whale-watching activity, the definition of areas of operation and respective carrying capacity, the designation of the Madeira inshore waters an SCI for the bottlenose

dolphin and other cetacean species, as well as the study of human activities with impact on this group of species. The institution has also generated knowledge on the abundance, distribution and habitat use of the main cetacean species with the aim of monitoring these species populational trends and impacts of human activities; has promoted the study of population structure and ecology behaviour of some of those species.

These and other studies are carried out by the institution Science Unit that also runs and coordinates RACAM – The Madeira Cetacean Stranding Network.

Table 3.11. Selected research and conservation projects by Museu da Baleia da Madeira - MBM

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**Identification of critical marine areas for the bottlenose dolphin and the surveillance of the conservation status of cetaceans in Madeira archipelago**

*EU Overseas entities targeted:* Madeira

*Objectives*

Identify the areas of importance for the bottlenose dolphin in the coastal waters of Madeira archipelago, with the aim of establishing adequate marine Nature 2000 sites for this species; Define areas of operation for the whale-watching boats in Madeira archipelago waters and establish the respective carrying capacity; Surveillance of the conservation status of cetaceans' species in Madeira offshore waters.

*Budget:* 795.074 €

*Funding source:* Life Program

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*Science and Natural Resources Department, Funchal Municipality*

<http://www.cm-funchal.pt/ciencia/index.php>

Contact person: Manuel Biscoito, [manuel.biscoito@cm-funchal.pt](mailto:manuel.biscoito@cm-funchal.pt)

Funchal is the only municipality in Portugal with a Science department. Its history starts in the early XXth century, with the opening of the Natural History Museum of Funchal (MHNF) in 1933. The Museum today holds a collection of over 40,000 specimens, keeps a public aquarium and a botanical garden, and maintains a relevant scientific action which extends to the edition of two scientific journals, Boletim do Museu Municipal do Funchal and Bocagiana. In September 1999 the Marine Biology Station of Funchal (EBMF) increased the competences of the municipality to the sciences and technologies of the sea, particularly the biology and ecology of coastal and deep sea waters.

Table 3.12. Selected research and conservation projects by MHNF and EBMF

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**Biodiversity in the seamounts: The Madeira-Tore and Great Meteor – BIOMETORE**

*EU Overseas entities targeted:* Madeira

**Potential of the New Deepwater Fisheries Resources of Cape Verde, Bases for its Sustainable Management and Gastronomic Appreciation - MARPROF-CV**

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*Objectives*

Acquisition of physical, chemical and biological data in selected areas of the Great Meteor and Madeira-Tore seamounts to gain knowledge of biodiversity, species, pelagic and benthic ecosystems as well as human pressures in these areas. Mapping of oceanic areas with a view to better understanding of deep marine ecosystems. Draw up a sustainability and management plan for the marine areas of the study and support the assessment of good environmental status under the Marine Strategy Framework Directive (WFDD).

*Budget:* 5.308.515 €

*Funding source:* EEA Grants

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**Deepwater Fisheries in the Mid-East Atlantic: Alternatives to Fisheries in Macaronesia - PESCPROF-1**

*EU Overseas entities targeted:* Madeira

*Objectives*

Development of a research series, technology transfer and innovation actions to enable the sustainable use of new deep-water fisheries resources as an alternative to traditional fisheries, some of which are in the process of over-exploitation. Exploration of new fishing areas, exploration of unconventional deep marine resources, testing and technology transfer procedures for selective fishing methods, pilot fishing plans, initiation of studies on conservation and captures processing (on-board and in-land) and preliminary commercialization experiments.

*Budget:* 207.173 €

*Funding source:* FEDER –Interreg III-B

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**Deep-water fisheries in the Mid-East Atlantic: Assessment of their potential and results - PESCPROF-3**

*EU Overseas entities targeted:* Madeira

*Objectives*

Follow the guidelines set out in the previous projects and will undertake new actions which will include: exploratory and experimental fishery of

*EU Overseas entities targeted:* Madeira, Cape Verde

*Objectives*

Establishment of scientific and technological bases for the sustainable use of Cape Verde's new fishery and fishing resources and their gastronomic value. The target species were Madeira shrimp (*Plesionika edwardsii*) and black-swordfish (*Aphanopus spp.*).

*Budget:* 35.294,12 €

*Funding source:* FEDER – PCT-MAC

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**Deepwater Fisheries in the Mid-East Atlantic: Alternatives to Fisheries in Macaronesia - PESCPROF-2**

*EU Overseas entities targeted:* Madeira

*Objectives*

Follow the guidelines set out for its precursor project by undertaking new actions including exploration of new fishing areas, exploration of new unconventional deep marine resources, testing and technology transfer related to traditional selective fishing methods. Initiate studies on the conservation and processing of on-board and shore-based catches and the continuation of commercialization trials of the captured resources.

*Budget:* 189.494,50 €

*Funding source:* FEDER –Interreg III-B

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**Sustainable Management of Marine Resources – GESMAR**

*EU Overseas entities targeted:* Macaronesia

*Objectives*

Design and implement a strategy for Macaronesian coast and marine environment integrated management, in order to conserve and revalue their natural resources. Evaluate the current

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top lobster, alfonsins and black swordfish; The evaluation of stocks of Madeira prawn *Plesionika edwardsii*; And the valorisation and dissemination of the PESCPROF program results (2003-2006).

*Budget:* 340.821,28 €

*Funding source:* FEDER –Interreg III-B

state of marine resources and promote the use of new technologies for their conservation and management. Characterize the high productivity infralittoral and circalittoral rocky bottoms or special biological interest ones. Raise awareness for the sustainable management of marine resources. Contribute to the transfer of knowledge and information among macaronesian archipelagos

*Budget:* 55.250,00 €

*Funding source:* FEDER – PCT-MAC

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### **BANGEMAC Network: Macaronesia Marine Genetic Bank – BANGEN**

*EU Overseas entities targeted:* Macaronesia

#### *Objectives*

Genetic characterization of the target species, linked to the sustainability of marine resources and the understanding and maintenance of biodiversity in Macaronesia, in order to improve the socioeconomic conditions of the area. Development and implementation of molecular tools to detect and identify target species in planktonic samples, to be applied to the reproductive ecology studies, Transfer results and technology, through ICT, to the business community, administration, educational space and interested entities of the Macaronesian area, with application in biodiversity management, fisheries, aquaculture and food traceability.

*Budget:* 26.860 €

*Funding source:* FEDER – PCT-MAC

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### **Integrated Management of *Aedes aegypti* Vector – MOSQIMAC**

*EU Overseas entities targeted:* Macaronesia

#### *Objectives*

Prevention, surveillance and control of the *Aedes aegypti* vector. Creation of a vector surveillance / monitoring network in Macaronesia Region. Establishment of a reference epidemiological database. Exploitation of alternative control methods to synthetic insecticides. Analyze the density, distribution and determination of Culícideos as possible vectors of emerging and / or re-emergent diseases, in order to establish a surveillance system to prevent the risk of introduction of these diseases in the Canary Islands.

*Budget:* 96.616,67 €

*Funding source:* FEDER – PCT-MAC

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### **Valorization, control and management of the Macaronesian marine resources - BIOVAL**

*EU Overseas entities targeted:* Macaronesia

#### *Objectives*

Apply the research and technological development as engines for economic enhancement and support for the sustainable exploitation of marine resources. Design strategies to improve the control, management and valorization of marine resources in Macaronesia. Biotechnological impact of *Dunaliella* for the saline activity in the Canary Islands.

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Budget: 25.000 €

Funding source: FEDER – PCT-MAC

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*Sociedade Portuguesa para o Estudo das Aves (SPEA)*

Non-profit scientific association, <http://www.spea.pt>

Cátia Gouveia; [catia.gouveia@spea.pt](mailto:catia.gouveia@spea.pt)

The Society for the Study of Birds (SPEA) is a nonprofit scientific association that promotes the study and conservation of birds in Portugal. It was founded on November 25 of 1993 and corresponds to a desire expressed by a large number of professionals and amateurs that developed activities in the field of ornithology and conservation of Nature. Our mission is to work towards the study and the conservation of wild birds and their habitats by promoting sustainable development for the benefit of the future generations.

Current collaborations with Instituto das Florestas e Conservação da Natureza (Madeira government); University of Madeira; SEO/BirdLife Canárias, municipalities and active tourism companies

Table 3.13. Selected research and conservation projects by SPEA-Madeira

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<p><b>Sustainability of socio economic activities, human use and biodiversity in Natura 2000 network sites in Madeira Archipelago (LIFE09 INF/PT/000045)</b></p> <p><i>EU Overseas entities targeted: Madeira</i></p> <p><i>Objectives</i></p> <p>Ensuring compatibility and promoting the traditional economic activities and biodiversity in Natura 2000 sites. Adopt appropriate behavior for sustainable development. Increase social involvement in nature conservation.</p> <p><i>Budget: 13,456 € of 607,792.00 €</i></p> <p><i>Duration: 01/10/2010 to 30/09/2015</i></p> <p><i>Funding source: LIFE Program</i></p>	<p><b>Halt the loss of European Biodiversity through the recovery of habitats and species of the islets of Porto Santo and surrounding marine area (LIFE09 NAT/PT/000041)</b></p> <p><i>EU Overseas entities targeted: Madeira</i></p> <p><i>Objectives</i></p> <p>Use of mechanical means to eradicate/control invasive species; gather seeds, germinate and reintroduce indigenous flora; nautical and land surveys, analyses of the diet, molecular analyses and ecological modelling for the study of the various species and areas of distribution; mark of areas for visits and environmental awareness actions.</p> <p><i>Duration: 01/09/2010 to 31/12/2015</i></p> <p><i>Budget: 123,741 € of 1,150,016 €</i></p> <p><i>Funding source: LIFE Program</i></p>
<p><b>Recovery of the species and land habitats of the Natura 2000 sites Ponta de São Lourenço and Desertas Islands (LIFE09 INF/PT/000045)</b></p> <p><i>EU Overseas entities targeted: Madeira</i></p> <p><i>Objectives</i></p> <p>Creation of an area free of introduced vertebrates on Ponta de São Lourenço;</p>	<p><b>Conservation of Macaronesian Sparrowhawk and Laurissilva habitat in Madeira Island</b></p> <p><i>EU Overseas entities targeted: Madeira</i></p> <p><i>Objectives</i></p> <p>The main objective of this project is the increased knowledge about the distribution, ecology and population</p>

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significant reduction of the populations of invasive plants; control and stabilisation of the populations of yellow-legged gulls; control of the populations of Argentine ants; removal of the overhead power line located in the Ponta de São Lourenço.	trends of the Macaronesian Sparrowhawk in Madeira and the Canary Islands, and its conservation through the recovery and protection of their natural habitat - the Madeira Laurel Forest.
<i>Budget:</i> 13,456 € of 607,792.00 €	<i>Budget:</i> 558,226 € of 1,629,198.00 €
<i>Duration:</i> 01/10/2010 to 30/09/2015	<i>Duration:</i> 01/07/2013 to 30/06/2017
<i>Funding source:</i> LIFE Program	<i>Funding source:</i> LIFE Program

### 3.5.3 BEST niches: new and complementary actions to be funded to achieve the objectives of the priority area

Table 3.14. Project overview

Thematic priorities	Projects	Budget (€)
<b>Baseline data collection and species assessment</b>		
	Assessment of species and habitats of the Madeira archipelago which are included in the Natura 2000 network (IFCN – IP-RAM)	80,000
	Luminaves (SPEA)	400,000
	Improving the knowledge on the populations of birds in Madeira archipelago (SPEA)	150,000
	Conservation status of Madeira seabirds (SPEA)	300,000
	Terrestrial molluscs of Madeira and Selvagens archipelagos (MHNF)	130,000
	Cetaceans in movement in the Canary Islands and Madeira: completing population structure identification (MBM)	357,000
<b>Improving biodiversity databanks</b>		
	PORBIOTA Database (IFCN – IP-RAM)	60,000
<b>Mapping of marine habitats and redesign of MPAs</b>		
	<i>Cymodocea nodosa</i> meadows in Madeira island: human-induced pressures and its effects on ecosystem functions (CIIMAR)	100,000
	Assessment of maërl beds, sensitive subtidal habitats: pilot study to develop a monitoring programme for the Macaronesian archipelagos (CIIMAR)	400,000
	Mesophotic coral ecosystems of Madeira Island (CIIMAR)	100,000
	Marine Protected Areas for seabirds (SPEA)	200,000
<b>Mapping and assessment of ecosystems and their services</b>		
	Implementation of a program to identify and quantify the services of natural forests ecosystems in Madeira islands (IFCN – IP-RAM)	50,000
	Ecosystem services of Laurisilva (SPEA)	150,000
	Sensor Network for Madeira Birds (M-ITI)	120,000
<b>Species conservation and recovery plans</b>		
	List of threatened terrestrial species from the archipelago of	50,000

Thematic priorities	Projects	Budget (€)
	Madeira (IFCN – IP-RAM)	
	Elaboration of the manage and conservation program for the seven new Sites of Community Importance of Natura 2000 areas of Madeira island (IFCN – IP-RAM)	50,000
<b>Control and eradication of invasive alien species</b>		
	Implementation of a pilot-study to test a number of technical tools and strategies for manage/control of invasive species in protected areas (IFCN – IP-RAM)	80,000
<b>Creation of micro-reserves in areas of severely fragmented habitats</b>		
	Identification of new potential protected areas and/or micro-reserves in Madeira and Porto Santo islands directed to local priority species (IFCN – IP-RAM)	25,000
	Creation of micro-reserves in areas of severely fragmented habitats in the Funchal Municipality (MHNF)	50,000
<b>Information and environmental awareness campaigns</b>		
	Environmental and public awareness campaign directed to the biodiversity heritage of Madeira archipelago (IFCN – IP-RAM)	25,000
	Environmental education: reconnecting people with nature (SPEA)	200,000
	Madeira Ecological Tourism (M-ITI)	50,000

Table 3.15 Projects proposed by Madeira Island stakeholders

<b>CIIMAR- Madeira Oceanic Observatory</b>	
<p><b><i>Cymodocea nodosa</i> meadows in Madeira island: human-induced pressures and its effects on ecosystem functions</b></p> <p><i>KBAs targeted:</i> None specifically</p> <p><i>EU Overseas entities targeted:</i> Madeira</p> <p><i>Main actions</i></p> <p>Identify the areas of occurrence of <i>Cymodocea nodosa</i> in Madeira archipelago and propose key important areas for the preservation of seagrass and therefore contribute to its suitable management in Madeira archipelago.</p> <p><i>Estimated duration:</i> 2 years</p> <p><i>Indicative budget:</i> 100,000 €</p>	<p><b><i>Assessment of maërl beds, sensitive subtidal habitats: pilot study to develop a monitoring programme for the Macaronesian archipelagos</i></b></p> <p><i>KBAs targeted:</i> None specifically</p> <p><i>EU Overseas entities targeted:</i> Macaronesia</p> <p><i>Main actions</i></p> <p>Assessment of maërl for the Macaronesian archipelagos in terms of its distribution and extent. Evaluation of the conservation status of the related species and habitats. Development of a joint monitoring programme.</p> <p><i>Estimated duration:</i> 3 years</p> <p><i>Indicative budget:</i> 400,000 €</p>
<b>Mesophotic coral ecosystems of Madeira Island</b>	
<p><i>KBAs targeted:</i> None specifically</p> <p><i>EU Overseas entities targeted:</i> Madeira</p> <p><i>Main actions</i></p>	

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Describe, map and estimate species densities of antipatharian corals occurring in the mesophotic depths; Characterize the abiotic environment using in-situ data loggers and collecting water samples; Describe the reproductive cycle of the dominant antipatharian species as well as estimate its growth rate using image analysis. Furthermore, the production of distribution maps will supply researchers and decision makers with strong indicators for further studies and subsequent ecosystem monitoring in Macaronesian waters.

*Estimated duration: 3 years*

*Indicative budget: 400,000 €*

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Instituto das Florestas e Conservação da Natureza, IP-RAM

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**Assessment of species and habitats of the Madeira archipelago which are included in the Natura 2000 network *KBAs targeted: None specifically***

*EU Overseas entities targeted: Madeira*

*Main actions*

The main goal is to identify the distribution area of the species and habitats from the annexes of Habitats and Birds Directive, evaluate their conservation status, define a conservation strategy and study the best form to implement the conservation/recovery measures identified in the study.

***Estimated duration: ??***

*Partners needed: Universidade da Madeira (UMa), SPEA, CE3C, Observatório Oceanográfico da Madeira (OOM), Museu da Baleia da Madeira*

*Indicative budget: 80,000 €*

**PORBIOTA Database**

*EU Overseas entities targeted: Madeira*

*Main actions*

Creation of a database for terrestrial and marine biodiversity of the Madeira archipelago, supported by the PORBIOTA consortium. This is intended to lay the groundwork for the migration of BIOBASE data (Madeira archipelago Biodiversity Database) to a national platform, which will be online, with the creation of a regional database which will include species distribution maps (on a free-user SIG platform), associated to a bibliographic bank and an image library.

***Estimated duration: ??***

*Partners needed: Consortium PORBIOTA*

*Indicative budget: 60,000 €*

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**Implementation of a program to identify and quantify the services of natural forests ecosystems in Madeira islands.**

*EU Overseas entities targeted:* Madeira

*Main actions*

Identify and quantify the services of natural forests ecosystems in Madeira islands.

**Estimated duration: ??**

*Partners needed:* Universidade da Madeira (UMa), SPEA, CE3C

*Indicative budget:* 50,000 €

**List of threatened terrestrial species from the archipelago of Madeira.**

*EU Overseas entities targeted:* Madeira

*Main actions*

This project will allow the identification of the local priority species, their distribution areas and the elaboration of conservation/recovery strategies/plans and measures directed to the target species.

**Estimated duration: ??**

*Partners needed:* Universidade da Madeira (UMa), SPEA, CE3C

*Indicative budget:* 50,000 €

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**Elaboration of the manage and conservation program for the seven (7) new Sites of Community Importance of Natura 2000 areas of Madeira island.**

*EU Overseas entities targeted:* Madeira

*Main actions*

Elaboration of the manage and conservation program for the seven (7) new Sites of Community Importance of Natura 2000 areas of Madeira island.

**Estimated duration: ??**

*Partners needed:* Universidade da Madeira (UMa), SPEA, CE3C

*Indicative budget:* 50,000 €

**Identification of new potential protected areas and/or micro-reserves in Madeira and Porto Santo islands directed to local priority species.**

*EU Overseas entities targeted:* Madeira

*Main actions*

The goal is to identify new key biodiversity areas which includes local priority species whom were not covered on the actual protect network areas, using the outputs from the red list of terrestrial species from Madeira archipelago (to be concluded) and IUCN Macaronesian KBA report.

It shall be identified the legal framework of each area and the feasibility of implementing a protected area will be evaluated. As a result we shall obtain a list where the new nature reserve candidates are listed in order of biodiversity importance and economic viability.

**Estimated duration: ??**

*Partners needed:* Universidade da Madeira (UMa), SPEA, CE3C

*Indicative budget:* 25,000 €

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**Implementation of a pilot-study to test a number of technical tools and strategies for manage/control of invasive species in protected areas.**

*EU Overseas entities targeted:* Madeira

*Main actions*

The main goal is to test a number of technical solutions to manage/control the vertebrate and plant invasive species on the following sites:

1. A pilot experience will address the mice and goat communities on Deserta Grande islet;
2. A pilot experience will be directed to the invasive plant communities on the border of the Laurel Forest in Madeira island.

**Estimated duration: ??**

*Partners needed:* Universidade da Madeira (UMa)

*Indicative budget:* 80,000 €

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**Environmental and public awareness campaign directed to the biodiversity heritage of Madeira archipelago.**

*EU Overseas entities targeted:* Madeira

**Main actions**

**Estimated duration: ??**

*Indicative budget:* 25,000 €

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**SPEA Madeira**

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**Luminaves**

*KBAs targeted:* None specifically

*EU Overseas entities targeted:* Madeira

*Main actions*

Reduce the negative effects of artificial light on the populations of marine birds of Macaronesian archipelagos. Improve the rescue and recuperation system for birds affected by light contamination.

*Estimated duration:* 3 years

*Indicative budget:* 400,000 €

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**Improving the knowledge on the populations of birds in Madeira archipelago**

*KBAs targeted:* None specifically

*EU Overseas entities targeted:* Madeira

*Main actions*

Improving the knowledge on the populations of birds in Madeira archipelago.

*Estimated duration:* 2 years

*Indicative budget:* 150,000 €

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**Conservation status of Madeira seabirds**

*KBAs targeted:* None specifically

*EU Overseas entities targeted:* Madeira

*Main actions:*

Improving the knowledge on the populations of birds in Madeira archipelago: seabirds distribution, abundance and conservation status is poorly known within Madeira Island. A wide study in order to collect this information is crucial to identify threats and mitigation actions for the most endangered group of animals in the world.

*Estimated duration:* 3 years

*Indicative budget:* 300,000 €

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**Marine Protected Areas for seabirds**

*KBAs targeted:* None specifically

*EU Overseas entities targeted:* Madeira

*Main actions:*

In the last years, SPEA has been developing the identification of Marine Important Bird Areas within LIFE programme. However, a more comprehensive mapping of seabirds is needed in order to ensure conservation strategies by redefining the size, shape and location of MPAs. Data-loggers and marine census will be determinant in order to collect data.

*Estimated duration:* 3 years

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*Indicative budget: 200,000 €*

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### **Ecosystem services of Laurisilva**

*KBAs targeted:* Madeira Nature Park (MAD1), but can be extended to other Laurisilva KBAs

*EU Overseas entities targeted:* Madeira, but can be applied elsewhere in Macaronesia

*Main actions:*

Protected areas play an important role in the conservation of species. However, assessing its ecosystem services is crucial in order to ensure a long term conservation strategy and self-sustainable conservation related economy. Starting with Laurel Forest SPA, we would like to identify all the ecosystem services and evaluate the socioeconomic impact of this protected area in the regional economy.

*Estimated duration:* 3 years

*Indicative budget:* 150,000 €

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### **Environmental education: reconnecting people with nature**

*KBAs targeted:* None specifically

*EU Overseas entities targeted:* Madeira, but can be extended to all other entities

*Main actions:*

SPEA Madeira has been developing several education programmes for schools and general public. Despite this program, there is a general lack of connection between the population and nature. Within this project we would to perform a more integrative program to develop topics related to nature conservation, illegal hunting, seabirds and marine animals bycatch, pollution, citizen science and its contribution for nature conservation.

*Estimated duration:* 3 years

*Indicative budget:* 200,000 €

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## **MITI – Madeira Interactive Technologies Institute**

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### **Sensor Network for Madeira Birds**

*KBAs targeted:* none in particular

*EU Overseas entities targeted:* Madeira, but can be extended

*Main actions*

Environmental monitoring using animals as sensors is becoming a growing area of research, in particular since new sensing technologies are making the development of small and energy efficient sensors easier. In this internship we are looking at developing a new type of sensor to be used in seagulls in Madeira Island for tracking environmental parameters and also increasing our understanding of how these birds move in their ecosystem.

*Estimated duration:* 2 years

*Indicative budget:* 120,000 €

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### **Madeira Ecological Tourism**

*KBAs targeted:* none in particular

*EU Overseas entities targeted:* Madeira

*Main actions*

Creating an infrastructure to track the flow of people around the island through anonymous passive Wi-Fi, and using the tracking information to develop a multichannel application that will inform users about sustainable ways to explore and make most of the island, taking into account the major events that are happening throughout the Island. This will be done from the point of view of the tourism actors in Madeira facilitating sustainable and ecological forms of tourism on the island.

*Estimated duration:* 1 year

*Indicative budget:* 50,000 €

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## **Science and Natural Resources Department, Funchal Municipality - MHNF**

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### **Creation of micro-reserves in areas of severely fragmented habitats in the Funchal Municipality**

*KBAs targeted:* none in particular

*EU Overseas entities targeted:* Madeira

*Main actions*

### **Terrestrial molluscs of Madeira and Selvagens archipelagos**

*KBAs targeted:* none in particular

*EU Overseas entities targeted:* Madeira

*Main actions*

Mapping the distribution of each

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To obtain an inventory and cartography of the areas of natural or semi-natural vegetation cover in order to propose a network of micro-reserves of the local flora and vegetation (PMRs). The main objective is to conserve the sites of ecological interest that still remain on the limits of the municipality of Funchal below 350 m a.s.l. in order to facilitate the implementation of eradication programs (exotic plants and animals), delimitation, re-colonization with native species and, therefore, to contribute to the conservation of other taxa, namely molluscs, arthropods, bats and birds.

*Estimated duration:* 3 years

*Indicative budget:* 50,000 €

endemic species. Review of conservation status of each endemic species. Contribution and cataloguing the collection of the Funchal Natural History Museum. Sensitization of populations to the importance of malacological biodiversity conservation. Elaboration of a monitoring plan for the terrestrial molluscs of these archipelagos

*Estimated duration:* 3 year

*Indicative budget:* 130,000 €

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*Museu da Baleia da Madeira - MBM*

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**Cetaceans in movement in the Canary Islands and Madeira: completing population structure identification.**

*KBAs targeted:* none in particular

*EU Overseas entities targeted:* Madeira and Canary Islands

*Main actions*

The project includes an initial period of field work in both archipelagos, with sea surveys to collect sighting data, biopsies samples of the target species, and implementation of 20 satellite tags (on pilot whales and Bryde's whales). Following, the analysis of the data through appropriate analytic techniques would consider the population genetic aspects of the target populations, description and interpretation of the satellite tracks obtained in relation to their habitat features, and identification and quantification of the high-density areas of the target species (short-finned pilot whales and Bryde's whales). Finally, management consideration and conservation suggestions would be elaborate to promote specific mitigation actions in the two Archipelagos.

*Estimated duration:* 2 years

*Partners needed:* CEAMAR

*Indicative budget:* 357,000 €

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## 3.6 Canary Islands: BEST Macaronesian priority area 3

### 3.6.1 Objectives & desired outcomes

In addition to the general thematic priorities identified for the whole region, the consultation process in the Canary Islands identified the following major issues as a basis for the definition of priority projects:

- Complete the writing of recovery plans for threatened species, and implement the priority ones.
- Monitor efforts to assess the conservation state of species based on basic population and phenological parameters.
- Species with wide distribution ranges (e.g. cetaceans and sea turtles) have no critical habitats known in European Macaronesia (e.g. nesting places for sea turtles). The focus of conservation should therefore be on areas that pose major threats (e.g. ship strikes in the Canaries) and areas where oceanic animals spend more time, e.g. submarine banks.

### 3.6.2 Relevant existing initiatives and projects

#### BIOECOMAC-ULL

Research group on biodiversity, marine ecology and conservation, University of La Laguna

Contact persons: Francisco Almeida Rodríguez (vicerrectorado.investigacion@ull.edu.es), Alberto Brito Hernández (abrito@ull.es)

A team of 9 researchers specialized in the development of research on the Canarian marine biodiversity and their conservation, including the design of marine protected areas.

The BIOECOMAC research group maintains direct research relations with various universities and centers of the Canary Islands (IEO, University of Las Palmas de Gran Canaria, Museum of Natural Sciences of Tenerife) and continental Spain (eg University of Alicante, Studies Advanced of Blanes of the CSIC, University of Barcelona), as well as of the Azores islands, Madeira and Cape Verde, the University of St. Andrews and the University of Aarhus. Currently participating in projects shared with these two last European universities.

Table 3.16. Selected research and conservation projects by BIOECOMAC

<p><b>Assessing resilience of beaked whale populations to human impacts: population structure and genetic diversity in impacted and semi-pristine areas</b></p> <p><i>EU Overseas entities targeted:</i> Canary Islands</p> <p><i>Objectives</i></p> <p>To study the population structure and population genetics of Blainville's beaked whale (<i>Mesoplodon densirostris</i>) in the Canaries, comparing</p>	<p><b>Estimating beaked whale density from passive acoustic recordings</b></p> <p><i>EU Overseas entities targeted:</i> Canary Islands.</p> <p><i>Objectives</i></p> <p>Estimate the density and hábitat use by beaked whales (<i>Mesoplodon densirostris</i> and <i>Ziphius cavirostris</i>) in El Hierro Island.</p> <p><i>Budget:</i> 100,000 €</p>
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<p>environments with high and low human pressure.</p> <p><i>Budget:</i> 120,000 €</p> <p><i>Funding source:</i> ONR (Office of Naval Research, USA).</p>	<p><i>Funding source:</i> ONR (Office of Naval Research, USA).</p>
<p><b>Effect of climate change on the marine littoral ecosystems of the Canary Islands- indicators of tropicalization</b></p> <p><i>EU Overseas entities targeted:</i> Canary Islands</p> <p><i>Objectives</i></p> <p>Analyze, in different islands of the Canaries, the population status of species of algae, invertebrates or fishes whose geographical distribution and biology makes them good indicators of the increase in sea temperature.</p> <p><i>Budget:</i> 50,000 €</p> <p><i>Funding source:</i> Fundación CajaCanarias.</p>	<p><b>Evaluation of the benthic communities of the rocky littoral as a carbon source: sensitivity to climate change and mitigation strategy.</b></p> <p><i>EU Overseas entities targeted:</i> Canary Islands</p> <p><i>Objectives</i></p> <p>Evaluate the capacity of macroalgae communities to act as carbon sinks, and the sensitivity of their main components to the increasing sea temperature and saltwater acidification.</p> <p><i>Budget:</i> 133,000 €</p> <p><i>Funding source:</i> Plan Nacional del Ministerio Español de Ciencia e Innovación.</p>
<p><b>Influence of rocky littoral phytocenosis in pH variation and its relevance for the populations of calcareous invertebrates in a context of climate change</b></p> <p><i>EU Overseas entities targeted:</i> Canary Islands</p> <p><i>Objectives</i></p> <p>Laboratory experiments and field measurements have analyzed the role of macroalgae in regulating seawater pH, and the effect of this on the calcareous skeleton of marine invertebrates.</p> <p><i>Budget:</i> 133,000 €</p> <p><i>Funding source:</i> Plan Nacional del Ministerio Español de Ciencia e Innovación.</p>	<p><b>Documenting key áreas for elasmobranch conservation in Canary Islands</b></p> <p><i>EU Overseas entities targeted:</i> Canary Islands</p> <p><i>Objectives</i></p> <p>Desk research, field work and analysis of coastal fishing landings led to the delimitation of reproduction areas for protected sharks and rays, such as <i>Squatina squatina</i>. General conservation measures were also proposed for those spaces.</p> <p><i>Budget:</i> 19,000 €</p> <p><i>Funding source:</i> Ministerio español de Agricultura, Medioambiente y Alimentación (MAGRAMA).</p>

#### BIOVEG-ULL

**Department of Botany, Ecology and Plant Physiology.** University of La Laguna, [http://www.ull.es/view/institucional/ull/Botanica\\_\\_Ecologia\\_y\\_Fisiologia\\_Vegetal/es](http://www.ull.es/view/institucional/ull/Botanica__Ecologia_y_Fisiologia_Vegetal/es)

Contact person: Marcelino José del Arco Aguilar, (marco@ull.edu.es)

Institutional Herbarium (TFC). Taxonomy of vascular and nonvascular plants. Plant communities. Plant Conservation and Biogeography. Teaching. Science outreach. Collaboration with Canary Government, Islands' Cabildo. Natural Reserves Net including National Parks. Orotava Botanical Garden.

Table 3.17. Selected research and conservation projects by BIOVEG

<p><b>A predictive study on distribution of vegetation belts in Tenerife and Gran Canaria for different scenarios of climate change</b></p> <p><i>EU Overseas entities targeted:</i> Canary Islands</p> <p><i>Objectives</i></p> <p>The evolution of vegetation in several scenarios of change of temperature and rainfall is analyzed. Several predictive maps of spatial evolution of the main climatophilous communities of Tenerife and Gran Canaria are performed. Objective: Provide a base for future actions to mitigate effect on climate change in individual plants and plant communities.</p> <p><i>Budget:</i> unreported</p> <p><i>Funding source:</i> INTERREG IIIB</p>	<p><b>Montane Vegetation as listening posts for climate change</b></p> <p><i>EU Overseas entities targeted:</i> La Réunion, Guadeloupe, Azores, Canaries and French Polynesia.</p> <p><i>Objectives</i></p> <p>(1) Characterize the biodiversity of poorly known but rich groups of plants (bryophytes and ferns), (2) Elucidate the processes which govern species richness and distribution along altitudinal transects (from the gene to community structuring), and relate them to life history and functional traits of species, (3) Link richness patterns to environmental and spatial predictors along elevational gradients between the islands, (4) Model the shift of species range with temperature and precipitation , (5) Establish permanent plots for long-term monitoring, managing responses for vegetation and raising new conservation directions for decision making.</p> <p><i>Budget:</i> 646,600 €</p> <p><i>Funding source:</i> NetBiome</p>
<p><b>Answers of the structuring and threatened vegetation to invasive herbivores: searching for a strategy to recover the ecosystems</b></p> <p><i>EU Overseas entities targeted:</i> Canary Islands</p> <p><i>Objectives</i></p> <p>To assess the impact of rabbits in the main ecosystems of the Canary Islands, and contributes to the restoration of the original and largely unknown ecosystems of the islands such as the pine forest, the coastal vegetation or the montane wet laurel forest. It shall examine in particular to what extent the rabbit acts as ecosystem engineer of the high mountain ecosystem, analyzing its role in modifying structuring and dominant vegetation abundance and, in general, the current landscape.</p> <p><i>Budget:</i> 56,500 €</p> <p><i>Funding source:</i> Ministerio de Agricultura,</p>	<p><b>Quantifying the effects of forest fires on the communities of plants and arthropods in the laurisilva of Garajonay National Park</b></p> <p><i>EU Overseas entities targeted:</i> Canary Islands</p> <p><i>Objectives</i></p> <p>Analyze the effects of fire in vegetation structure and species composition of plant communities. Study the recolonization dynamics in bryofites, vascular plants and invertebrates. Quantify community structure evolution through temporal gradients of fire perturbation, particularly the ration between native and non-native species.</p> <p><i>Budget:</i> 79,800 €</p> <p><i>Funding source:</i> Ministerio de Agricultura, alimentación y Medio Ambiente</p>

*Canarias Conservación*

www.canariasconservacion.org

Contact person: Manuel Carrillo, canariasconservacion@yahoo.es

Canarias Conservacion, based in La Laguna. Tenerife, Canary Islands is a technical consulting company specializing in marine ecology issues. Biologists and veterinarians who are part of our team working to provide solutions to issues of population size estimates of cetacean and sea turtles, analysis of pollutants, waste and environmental impacts. We also developed awareness programs and environmental education. In the last 15 years we have coordinated the Stranding Cetacean Network

The necessary staff and equipment are available (Ship, material of capture and analysis of samples) and have technical personnel (veterinarian) with wide experience in investigation of the biodiversity in the Canary Islands.

Complementing organizations: Dirección General de Protección de la Naturaleza del Gobierno de Canarias, Instituto Universitario de Sanidad Animal. Facultad de Veterinaria. Universidad de Las Palmas de Gran Canaria (IUSA), Sociedad Estudio de Cetáceos en Canarias (SECAC), Centro de Recuperación de Fauna Silvestre del Cabildo de Tenerife.

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Table 3.18. Selected research and conservation projects by Canarias Conservación

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**Study and follow-up of cetacean stranding in Canary Islands**

*EU Overseas entities targeted:* Canary Islands

*Objectives*

The assistance to the stranding of cetacean, determination of biological parameters and factors of mortality.

*Budget:* 54,000 €

*Funding source:* FEDER 2007-2014 across a commission a MAGRAMA (Ministerio de Agricultura, Alimentación y Medio Ambiente) to TRAGSATEC.

**Monitoring Plan of loggerhead turtle (*Caretta caretta*) to evaluate its condition of conservation in the Canary Islands**

*EU Overseas entities targeted:* Canary Islands.

*Objectives*

The partial aim inside the project is the accomplishment of nautical censuses by means of transectos linear in the SAC of Tenerife (ES.7020017), Gran Canaria (ES.7010017) and Fuerteventura (ES.7010035).

*Budget:* 22,500 €

*Funding source:* Environmental Observatory Granadilla and industrial port of Granadilla, as a compensatory measure imposed by the European Commission.

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**CEAMAR**

www.ceamar.org

Contact person: Mónica Pérez Gil, monica@ceamar.org

CEAMAR is a scientific organization founded in 2013 by a group of researchers with over 10 years of professional experience with cetaceans and sea turtles, which works internationally developing research projects, education and outreach for the conservation of these species and their habitats.

The main goal is to contribute to the conservation of the marine environment in general, and populations of cetaceans and sea turtles in particular. To achieve it was defined four action priorities: a) to conduct scientific research on cetaceans and their natural environment; b) to foster scientific knowledge at the local, national and European level; c) to participate actively and directly by submitting technical and scientific proposals, requests, or direct advice to the public and private entities responsible of the management of these species and spaces, and d) to develop all kind of actions and activities for awareness, outreach and training on issues related to marine conservation and cetaceans. Our experience qualifies us to develop projects covering different aspects of the biology and ecology of cetaceans and turtles, design and implementation of specific research and analysis methodologies, census from land and sea, photo-identification analysis, satellite tagging, acoustic monitoring, spatial modelling, estimates of abundance and population trends, etc. We also work in the field of training, awareness and outreach, designing and conducting all kinds of workshops, seminars, courses, seminars and materials, according to the objectives pursued. In CEAMAR we have a department specialized in GIS tools applied to the study of cetaceans and turtles, with possibility to develop applications and specialized software.

Being a newly created entity, CEAMAR does not have experience in itself, but the team that compose it has participated in numerous successful projects, among which two LIFE projects (LIFE03 / NAT / E / 000062 "Conservation of the bottlenose dolphin and the loggerhead turtle in La Gomera" and LIFE07 / NAT / E / 000732 INDEMARES "Inventory and designation of Natura 2000 network in Spanish marine areas", five INTERREG IIIB AMC projects (EMECETUS "Study, monitoring and education for the conservation of cetaceans of Macaronesia ", MACETUS "Study of the population structure, distribution, movements and habitat use of *Physeter macrocephalus*, *Globicephala macrorhynchus*, *Tursiops truncatus* and *Stenella frontalis* in the Canary Islands "- developed by SECAC - AEGINA "Management of protected marine areas through critical species", HYDROCARPO "Sustainable management of the coastal natural heritage and the marine resources of the Republic of Cape Verde" and OGAMP "Management and Management of Protected Marine Natural Areas", several financed by the Biodiversity Foundation or the Ministry of Agriculture, Food and Environment (CETOCAN Projects, ZEC-Tursiops, Collaboration Agreement between the Ministry of Defense, the Ministry of the Environment and the Ministry of the Environment and Spatial Planning of Canary Government, as well as a multitude of works and reports developed for the Autonomous Community of the Canary Islands.

Table 3.22. Selected research and conservation projects by CEAMAR

<p><b>SCANS-III. Small Cetaceans in the European Atlantic and North Sea</b></p> <p><i>EU Overseas entities targeted:</i> Canary Islands, but is applicable elsewhere</p> <p><i>Objectives</i></p> <p>Project coordinated by the University of St Andrews (Scotland), with the objective of estimating small cetacean</p>	<p><b>Census of cetaceans, birds, and marine turtles in the eastern waters of Lanzarote and Fuerteventura <i>EU Overseas entities targeted:</i> Macaronesia.</b></p> <p><i>EU Overseas entities targeted:</i> Macaronesia</p> <p><i>Objectives</i></p> <p>The Canary Islands are already widely recognized as an important enclave for</p>
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abundance in the European Atlantic waters, in order to assess the impact of by catch in fishing gear and other anthropogenic threats. The survey area covered the whole European Atlantic continental shelf; French, Spanish and UK offshore waters; and Norwegian coastal waters north to Vestfjorden.

*Budget:* 9,000 €

*Funding source:* SCANS-III was coordinated by the Sea Mammal Research Unit at the University of St Andrews in Scotland, and supported by the governments of Denmark, France, Germany, the Netherlands, Norway, Portugal, Spain, Sweden and the UK.

their high fauna biodiversity. While the coastal waters of Lanzarote and Fuerteventura have been extensively studied, the offshore waters between the Canaries and Morocco were still unsurveyed. The first visual and acoustic census of cetaceans, birds and sea turtles was carried out on the channel to test the high biodiversity. The covered area of 261,832 hectares was located around 3 points authorized for the exploration of hydrocarbons.

*Budget:* 22,000 €

*Funding source:* Fuerteventura Cabildo

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### **On-line course for cetacean tourist guide**

*EU Overseas entities targeted:* Canary Islands

#### *Objectives*

CEAMAR took care of the writing of three chapters of the on-line course: sperm whales, beaked whales, and pigmy sperm whales; short-finned pilot whales and Risso's dolphins; sea turtles.

*Budget:* 1,200 €

*Funding source:* Tecnología y servicios agrarios S.A. (Tragsatec)

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### *ECOAQUA-ULPGC*

Research Institute in Sustainable Aquaculture and Marine Ecosystems, <http://www.ecoaqua.es>  
Contact persons: Ricardo Haroun ([ricardo.haroun@ulpgc.es](mailto:ricardo.haroun@ulpgc.es)), May Gómez ([may.gomez@ulpgc.es](mailto:may.gomez@ulpgc.es))

IU-ECOAQUA belongs to the University of Las Palmas de Gran Canaria (ULPGC) and it is composed of four research teams: GIA (Group for Aquaculture Research); BIOCON (Biodiversity and Conservation Research Group); EOMAR (Marine Ecophysiology Group); and the Legal, Maritime and Environmental Sustainability Law research group (TOTMA).

The main objective of the IU-ECOAQUA is to contribute to the Economic Development of Canary Islands through the generation of applied knowledge on conservation and sustainable exploitation of coastal resources and aquaculture, fostering its transfer to civil society and supporting smart and innovative business opportunities. All the research lines of IU-ECOAQUA are framed in the European 2020 Strategy, the Atlantic Marine Strategy, the Commission Strategy Framework for the Cohesion and Structural Funds, better known as RIS3, and the Strategic Guidelines for the sustainable development of EU aquaculture. The excellence of IU-ECOAQUA scientific outputs support a regional growth process based on marine biological resources, which is intelligent, sustainable and integrated, leading to a blue economy more focused on knowledge and innovation, and with strong networking actions with European and other international partners.

In particular, IU-ECOQUA coordinates different research groups devoted to marine conservation, resources management and spatial planning, underpinning a sustainable development of artisanal fisheries, aquaculture practices and marine ecotourism under an ecosystem approach. In this sense, EOMAR's research activities focus on biological and chemical rate processes in aquatic systems allowing it to address conservation and sustainable development in oceans and coastal waters. In addition, BIOCON's research lines are mainly linked to systematics, biogeography, macroecology and responsible uses of biological marine species, habitats and ecosystems.

The ECOQUA Institute is staffed by 76 professors, researchers, technicians, investigators, administrators, and students collectively characterized by a high level of scientific productivity. In the last 30 years they have produced more than 500 scientific publications in internationally prestigious peer-reviewed journals and more than 70 PhDs have been awarded to national and international postgraduate students.

The research staff of ECOQUA has a large network of collaborating institutions dedicated to nature conservation, such as IUCN, diverse European universities (Wageningen, Leiden, Açores, Stirling, Trodheim, La Laguna, Ghent among others) as well as Natural History Museum, Naturalis, Smithsonian Tropical Research Institution, WWF, Oceana, etc. At the same time, close relationships are established with relevant partners in the Macaronesian Archipelagos (including the Cape Verde Islands) dealing with conservation and sustainable use of marine and terrestrial species / habitats.

Table 3.19. Selected research and conservation projects by ECOQUA

<p><b>Canary Islands marine deep habitats: Structure and biodiversity of rhodolith sea-beds</b></p>	<p><b>PROGRAMA POSEIDÓN: Participación ciudadana en la conservación de la biodiversidad marina</b></p>
<p><i>EU Overseas entities targeted:</i> Canary Islands</p>	<p><i>EU Overseas entities targeted:</i> Canary Islands, but can be extended.</p>
<p><i>Objectives</i></p>	<p><i>Objectives</i></p>
<p>The main objective of this project is to generate new knowledge about the structure and biodiversity of Canary Islands rhodolith sea-beds, combining different technologies such as side scan sonar devices and deep dive techniques.</p>	<p>POSEIDON is a citizen science program for members of the public to submit sightings of marine species in the Canary Islands. The following elements are included in each sighting: GPS coordinate, sighting date, sighting time, dive duration, the minimum depth, the maximum depth, water temperature, species seen, the size of the species (classified into juvenile and adult), the number of individuals seen, whether a photograph was taken and the environment it was seen in. Each sighting is then validated by a researcher in ULPGC to ensure the species reported corresponds with the photo uploaded.</p>
<p><i>Budget:</i> 10,500 €</p>	<p><i>Budget:</i> 24,000 €</p>
<p><i>Funding source:</i> CEI-Canarias, the Agency for Research, Innovation and Information Society of Canary Islands and European Regional Development Fund-ERDF (2016)</p>	<p><i>Funding source:</i> Biodiversity Foundation, Spanish Ministry of Agriculture, Food and Environment</p>
<p><b>Plankton metabolism: Biochemical</b></p>	<p><b>Response to temperature and acidity</b></p>

<p><b>regulation and oceanographic impact in the Biological Pump (BIOMBA).</b></p>	<p><b>changes in the physiology and enzymology of marine macroalgae.</b></p>
<p><i>EU Overseas entities targeted:</i> Canary Islands, but can be applied elsewhere.</p>	<p><i>EU Overseas entities targeted:</i> Canary Islands, but can be applied elsewhere.</p>
<p><i>Objectives</i></p>	<p><i>Objectives</i></p>
<p>By producing CO<sub>2</sub>, zooplankton metabolism acidifies the ambient seawater. It leads to the release of particulate and dissolved organic carbon and nitrogen which, in turn, augments carbon and nitrogen fluxes in the ocean. This process modulates the CO<sub>2</sub> buildup in the atmosphere. This proposal is concerned with respiration and ammonium excretion, both major facets of plankton metabolism To apply and to test the advances we make in the laboratory we will measure respiration and ammonium excretion at an ocean station near Gran Canaria. Carbon flux will be calculated using the respiration data.</p>	<p>The research will develop new enzyme-based tools to detect and measure the physiological processes of respiratory CO<sub>2</sub> production, respiratory O<sub>2</sub> consumption and nitrate reduction in key species of macroalgae important to the Canary Island coastal ecosystem. Once developed we will use these enzyme assays to assess the impact of high CO<sub>2</sub> concentrations and high acidity (low pH) on Canary Island macroalgal communities.</p>
<p><i>Budget:</i> 72.500 €</p>	<p><i>Budget:</i> 30,000 €</p>
<p><i>Funding source:</i> Spanish Ministry of Science and Technology</p>	<p><i>Funding source:</i> CEI CANARIAS: Campus Atlántico Tricontinental</p>

**GBVa- ULL**

Applied Plant Biology Group, University of La Laguna

Contact person: Francisco Valdés González, fvaldes@ull.es

The research team has experience plant conservation of threatened species by using both in vitro and ex vitro techniques. In addition, we are able to work with plant species of agronomic interest by using the same approach. In recent years we are interested in seed priming and its potential on seed vigor and plant growth and productivity.

We are looking for potential collaborations with organizations with seeds banks of endemic or threatened species and also with agronomic interest. We have access to finding from National or European agencies through different programs.

Table 3.20. Selected research and conservation projects by GBVa, Applied Plant Biology Group

<p><b>Germobanco Agrícola de la Macaronesia</b></p>	<p><b>Adaptabilidad de la especie <i>Jatropha curcas</i> L. a diferentes condiciones de crecimiento y estudio de su potencial químico</b></p>
<p><i>EU Overseas entities targeted:</i> Canary Islands</p>	<p><i>EU Overseas entities targeted:</i> Canary Islands.</p>
<p><i>Objectives</i></p>	<p><i>Objectives</i></p>
<p>Setting up a seed bank for the conservation of plant species with agronomic and economic interest.</p>	



*Budget:* 1,432,000 €  
*Funding source:* INTERREG Program EU.

Germination, growth and chemical analysis.

*Budget:* 16,500 €

*Funding source:* Canary Island Public funding

*Loro Parque Fundación*

www.loroparque-fundacion.org

Contact person: Javier Almunia Portolés, javieralmunia@mac.com

Loro Parque Fundación has addressed to conservation projects over 17.000.000 USD in their 22 years of existence. The projects are mainly directed to terrestrial ecosystems linked to parrots as flagship species, but since 2006 a significative part of the funding is focused in the marine fauna of the Macaronesia, specially cetaceans. The foundation implements projects in a very limited way, but has an extensive experience in funding third parties in order to accomplish its conservation goals. Loro Parque Fundación collaborates with over 100 universities and research institutes all around the world in order to accomplish its conservation goals. In the Macaronesia we collaborate with the University of Las Palmas de Gran Canaria, University of La Laguna, PLOCAN, Spanish Oceanographic Institute, Island and Regional governments, and local NGOs.

Table 3.21. Selected research and conservation projects by Loro Parque Fundación

**Development of bioacoustic tools to automatically detect and classify cetacean vocalizations**

*EU Overseas entities targeted:* Canary Islands, but is applicable elsewhere

*Objectives*

Develop an automatic system to detect and classify cetacean sounds using a physical model.

*Budget:* 300,000 €

*Funding source:* Loro Parque Fundación

**Marine Sanctuary for Macaronesia**

*EU Overseas entities targeted:* Macaronesia.

*Objectives*

Encourage the creation of a marine protected area in Macaronesia, which becomes a sanctuary for the cetaceans that inhabit it.

*Budget:* 178,000 € (since 2000)

*Funding source:* Loro Parque Fundación

**3.6.3 BEST niches: new and complementary actions to be funded for achieving objectives of the priority area**

Table 3.22 Project overview

Thematic priorities	Projects	Budget (€)
<b>Baseline data collection and species assessment</b>		
	Identification and monitoring of allochthonous species of algae, invertebrates and fishes, and evaluation of their capacity for invading and transforming the marine biodiversity of the Canary Islands (BIOECOMAC-ULL)	200,000

Jellyfish metabolism, growth, and impact on predator development (ULPGC ECOAQUA)	126,000
The physiological and ecological performance of 'ecosystem engineers' change from local to biogeographical scales, in response to contemporary and past processes (ULPGC ECOAQUA)	278,000
Hematological values in healthy individuals of loggerhead turtle <i>Caretta caretta</i> in Canary Islands to establish the physiological normal values (Canarias Conservación)	29,300
Using synthetic or natural chemical compounds in order to increase productivity of crops under stress (GBVa-ULL)	60,000
Increasing organoleptic quality of Canary tomato varieties, by using brine from desalination plants in soilless systems (GBVa-ULL)	60,000
<b>Improving biodiversity databanks</b>	
<b>Mapping of marine habitats and redesign of MPAs</b>	
Characterization and distribution of the main marine benthic communities in the Canaries, as a basis for a proposal of marine protected area network that would be resilient to climate change (BIOECOMAC-ULL)	600,000
Blue Marine Infrastructures as a tool for biodiversity conservation and sustainable use of coastal and marine areas (ULPGC ECOAQUA)	380,000
Evaluation of underwater calcareous habitats (rhodoliths) ecosystem services in Macaronesia region (ULPGC ECOAQUA)	250,000
Black coral forests as deep water biodiversity hotspots: Insights on its structure, functions and ecosystem services (ULPGC ECOAQUA)	150,000
Automatic surveillance of Marine Protected Areas (Loro Parque Foundation)	500,000
"Tracking down" sperm whales in the Canary Islands (CEAMAR)	354,000
<b>Mapping and assessment of ecosystems and their services</b>	
Looking for the original flowering plant composition of the Canary Islands ecosystems. A case of study along an elevational gradient on Tenerife (BIOVEG-ULL)	90,000
Canopy-forming seaweeds long-term dynamics and relationships with global and local disturbances (Botanica Marina-ULL)	100,200
Sustainable management of benthic fish around aquaculture facilities to boost delivery of Ecosystem Services (ULPGC ECOAQUA)	130,000
Microplastic pollution study and its incorporation into marine food webs (ULPGC ECOAQUA)	150,000
Marine Sanctuary for Macaronesia (Loro Parque Foundation)	250,000
<b>Species conservation and recovery plans</b>	
<b>Control and eradication of invasive alien species</b>	

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## Creation of micro-reserves in areas of severely fragmented habitats

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### Information and environmental awareness campaigns

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Blue Economy in the EU Overseas: Identification of sustainable strategies to foster tourism industry growth based on nature solutions (ULPGC ECOAQUA)	167,000
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Table 3.23. Projects proposed by Canary Island stakeholders

#### BIOECOMAC-ULL

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**Characterization and distribution of the main marine benthic communities in the Canaries, as a basis for a proposal of marine protected area network that would be resilient to climate change.**

*KBAs targeted:* None specifically- it may lead to a redesign of marine KBAs.

*EU Overseas entities targeted:* Canary Islands

*Main actions*

(1) Identify, characterize and cartograph the marine benthic communities down to 50 m. (2) Identify and quantify the anthropic use and its intensity in each areas. (3) Obtain environmental data of each section, and relate them to the biotic communities at that site.

*Estimated duration:* 4 years

*Indicative budget:* 600,000 €

**Identification and monitoring of allochthonous species of algae, invertebrates and fishes, and evaluation of their capacity for invading and transforming the marine biodiversity of the Canary Islands**

*KBAs targeted:* None specifically

*EU Overseas entities targeted:* Canary Islands

*Main actions*

Sampling on different islands to map the distribution and abundance of allochthonous species. Analyze the citizen-data information on the RedPromares site. Evaluate the invasive potential of each species based on its biology and ecology and draft a risk analysis.

*Estimated duration:* 3 years

*Indicative budget:* 200,000 €

#### BIOVEG-ULL

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**Looking for the original flowering plant composition of the Canary Islands ecosystems. A case of study along an elevational gradient on Tenerife.**

*KBAs targeted:* None specifically

*EU Overseas entities targeted:* Canary Islands

*Main actions:* The results of this project allow us to have “islands of biodiversity” along the entire elevation gradient on Tenerife island. We expect to confirm the hypothesis that dominant plant species in the current ecosystems are the less palatable for this especially dangerous invasive species. Through a preliminary

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analysis we can evaluate the effects of rabbit in the disturbance of the original floristic composition of the ecosystems, and to know until what point the ecosystems are far to be in a their desirable stage, which will allow us to recognize priority actions for restoration and general conservation actions.

*Estimated duration:* 3 years

*Indicative budget:* 90,000 €

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*Botanica Marina- ULL*

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**Canopy-forming seaweeds long-term dynamics and relationships with global and local disturbances**

*KBAs targeted:* None specifically

*EU Overseas entities targeted:* Canary Islands, but applicable elsewhere

*Main actions*

The hypothesis we want to test, studying changes in the distribution of this group of species, is that some local and global factors are contributing to this impoverishment of these macroalgae populations. To validate this hypothesis we have designed a process that includes: (1) Historical reconstruction of long-term changes in the distribution of communities dominated by *Cystoseira* and *Gelidium*. Determination of changes in the community structure, and the study of changes in the phenology of this foundation species. (2) Determination of the actual status of *Cystoseira* and *Gelidium* communities, their spatial variability and community structure. (3) Identification of factors driving changes and the resilience of these communities.

*Estimated duration:* 3 years

*Indicative budget:* 100,200 €

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ECOQUA, Research Institute in Sustainable Aquaculture and Marine Ecosystems

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**Blue Marine Infrastructures as a tool for biodiversity conservation and sustainable use of coastal and marine areas**

*KBAs targeted:* None specifically

*EU Overseas entities targeted:* Azores, Madeira and the Canary Islands

*Main actions*

(1) To score the expected and induced Ecosystem Services in existing targeted

**Evaluation of underwater calcareous habitats (rhodoliths) ecosystem services in Macaronesia region**

*KBAs targeted:* None specifically

*EU Overseas entities targeted:* Azores, Madeira and the Canary Islands

*Main actions*

(1) To determine the role of rhodolith seabeds as ecosystem engineers

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Marine Blue Infrastructures, (2) to quantify the connectivity role in the induced Ecosystem Services in existing targeted Marine Blue Infrastructures and (3) to forecast the evolution of induced ES within the existing Marine Blue Infrastructures network in the scope of marine spatial planning. Canary Islands & Madeira will be the sampling areas for sea-cages/artificial reefs and Azores will be for break-waters (also Control pristine area).

*Estimated duration:* 2.5 years

*Indicative budget:* 380,000 €

providing habitats for young specimens (nursery area effect), (2) to estimate their function as carbonate factories (Blue Carbon) and (3) to calculate the economic value of the Ecosystem Services evaluated along spatial and seasonal scale. Three areas will be selected in Açores, Madeira and Canary Islands (Subtropical Atlantic) as sampling areas. Additionally one more area in Tropical Atlantic region (e.g. Sao Tome & Principe) could be selected to compare results with northern latitudes.

*Estimated duration:* 2 years

*Indicative budget:* 250,000 €

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### **Sustainable management of benthic fish around aquaculture facilities to boost delivery of Ecosystem Services**

*KBAs targeted:* None specifically

*EU Overseas entities targeted:* Azores and the Canary Islands

*Main actions*

The Fish Eco-Boost project aims 1) to deepen the knowledge of biological and the ecological functions of various elasmobranchs threatened species found around the aquaculture cages, and 2) to improve the knowledge of their capacity to reduce the effects of eutrophication of the sediment. Canary Islands will be the sampling areas for Sea-cages studies and Azores will be the control area to compare Ecosystem Services evaluation.

*Estimated duration:* 2 years

*Indicative budget:* 130,000 €

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### **Jellyfish metabolism, growth, and impact on predator development**

*KBAs targeted:* None specifically

*EU Overseas entities targeted:* Canary Islands, but applicable elsewhere

*Main actions*

Determine the life cycle variability and the physiological rates in *Pelagia noctiluca* and *Aurelia aurita*. Study the variability of the protein and fatty acid content of jellyfish throughout their life cycles. Study the CO<sub>2</sub> production, and O<sub>2</sub> consumption in jellyfish and their relationship with their underlying

### **Microplastic pollution study and its incorporation into marine food webs**

*KBAs targeted:* None specifically

*EU Overseas entities targeted:* Canary Islands, but applicable elsewhere

*Main actions*

Sampling and preparation. Describe the impact of marine microplastics in the Macaronesia area. Identification and quantification of microplastics, development and application. Applied characterization of microplastics in biotic systems under regard of ecotoxicological aspects

*Estimated duration:* 3 years

*Indicative budget:* 150,000 €

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### **Blue Economy in the EU Overseas: Identification of sustainable strategies to foster tourism industry growth based on nature solutions**

*KBAs targeted:* None specifically

*EU Overseas entities targeted:* Canary Islands, but applicable elsewhere

*Main actions*

Identify, define and develop the corresponding Sustainable Blue Growth Strategies in the EU Overseas taking into consideration the different stakeholders involved. Networking actions, both inside and outside the

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biochemical drivers. Measure growth rates and secondary production. Develop extraction procedures for different organic-chemical fractions and determine heavy metals in different parts of the jellyfish.

*Estimated duration:* 3 years

*Indicative budget:* 126,000 €

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concerned archipelago, will bring up and facilitate the adoption of Best Nature-based Tourism practices.

*Estimated duration:* 3 years

*Indicative budget:* 167,000 €

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**The physiological and ecological performance of 'ecosystem engineers' change from local to biogeographical scales, in response to contemporary and past processes**

*KBAs targeted:* Marine, with *Cymodocea nodosa* seagrass

*EU Overseas entities targeted:* Canary Islands

*Main actions*

Empirically assess whether genetic diversity, physiological versatility and ecological stability and resilience of an 'ecosystem engineer' (here, the seagrass *Cymodocea nodosa*) are connected from local to biogeographical scales.

*Estimated duration:* 3 years

*Indicative budget:* 278,000 €

**Black coral forests as deep water biodiversity hotspots: Insights on its structure, functions and ecosystem services**

*KBAs targeted:* Marine, deep water

*EU Overseas entities targeted:* Azores and the Canary Islands, but applicable elsewhere

*Main actions*

Increase the knowledge of structure and density of black coral forest (*Anthipathella wollastoni*) in the Macaronesian region along spatial scale. To understand potential mechanism of connectivity between populations. To score the ecosystemic services able to deliver by these habitats (e.g. fishery grounds, carbon and phosphate burial habitat, nursery, leisure activities, etc. To set up the baseline conservation status of these keystone habitat.

*Estimated duration:* 3 years

*Indicative budget:* 150,000 €

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*Canarias Conservación*

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**Hematological values in healthy individuals of loggerhead turtle *Caretta caretta* in Canary Islands to establish the physiological normal values**

*KBAs targeted:* None in particular

*EU Overseas entities targeted:* Canary Islands

*Main actions*

To establish a table of normal hematological values in healthy turtles on the coast of Canary islands. This project will help the veterinary community in rehabilitation centres with the diagnosis, treatment and prognosis of loggerhead turtles.

*Estimated duration:* 1 year

*Indicative budget:* 29,300 €

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**Using synthetic or natural chemical compounds in order to increase productivity of crops under stress**

*KBAs targeted:* None in particular

*EU Overseas entities targeted:* Canary Islands, but applicable elsewhere

*Main actions*

GBVa-ULL and Instituto de Productos Naturales y Agrobiología del Consejo Superior de Investigaciones Científicas have developed a model which allowed to identify, test and patent several molecules with the ability to enhance plant response under salinity stress.

Using a fast tracking experiments we will be able to screen natural and synthetic compounds libraries to identify the best candidates for priming experiments. Later by using well-known crops we will be able to see their effects on growth, development and productivity under salinity stress.

*Estimated duration:* 3 years

*Indicative budget:* 60,000 €

**Increasing organoleptic quality of Canary tomato varieties, by using brine from desalination plants in soilless systems**

*KBAs targeted:* Not applicable

*EU Overseas entities targeted:* Canary Islands

*Main actions*

We think we can use the high salt solution from desalination plants in order to be used in hydroponics systems to improve the organoleptic quality of crops.

*Estimated duration:* 3 years

*Indicative budget:* 60,000 €

Loro Park Foundation

**Automatic surveillance of Marine Protected Areas**

*KBAs targeted:* None in particular

*EU Overseas entities targeted:* Macaronesia

*Main actions*

Integration of the hardware and software developed by LPF and the University of La Laguna in a wave glider to build noise maps and map cetacean abundance in the area. Test the feasibility of the system in order to cover the whole Macaronesia.

*Estimated duration:* 2 years

*Indicative budget:* 500,000 €

**Marine Sanctuary for Macaronesia**

*KBAs targeted:* None in particular

*EU Overseas entities targeted:* Macaronesia

*Main actions*

Creation of an UNESCO Centre Category II to energize the conservation activities on the Macaronesia and give support to the Biosphere Reserves in the area.

*Estimated duration:* 3 years

*Indicative budget:* 250,000 €

CEAMAR

**“Tracking down” sperm whales in the Canary Islands.**

*KBAs targeted:* None in particular

*EU Overseas entities targeted:* Canary Islands

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### *Main actions*

This project aims to significantly contribute to the conservation of sperm whales in the Canary Islands and in Macaronesian waters, by increasing the general knowledge about the biology and ecology of this species in the archipelago. In order to study sperm whale distribution and abundance, the off-shore oceanic waters around the Canary Archipelago will be covered following the distance sampling methodology with combined acoustic and visual line-transect surveys. 20 satellite-monitored tags on sperm whales will be deployed. Biopsy samples will be collected to analyse genetics, social structure and contaminants.

*Estimated duration:* 2 years

*Indicative budget:* 354,000 €

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## **3.7 Overview of BEST niches**

Table 3.24. Overview of all proposed projects to be funded by BEST niches

Proposed project (Priority Areas for Action 1/BEST investments)	Indicative budget <sup>25</sup> (in €)
Project 1 (Name of priority area for action/ BEST Investment)	
Project 2 (Name of priority area for action/ BEST Investment)	
Project 3 (Name of priority area for action/ BEST Investment)	
...	
...	
	Total

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<sup>25</sup> Based on similar projects in the region, for a full list of references see annex 2



## **4. CONCLUSIONS AND RECOMMENDATIONS**

*Recap/Summary of refined priority areas for action with examples of identified projects/ activities, capacity in the region to implement these projects and estimated costs.*

*State current investment in conservation and sustainable development in the region a) in total and b) by priority area for action. Clearly present the funding needs in order to address the priorities, current gaps (in conservation activities) and how these gaps could present investment opportunities. This should be seen as a pitching chapter to potential investors.*

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#### Online resources and databases

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## **ANNEX 1: EXAMPLES OF READY TO BE FUNDED PROJECTS**

Capitalisation of relevant existing concept notes.

## **ANNEX 2: REFERENCE OF EXISTING BUDGETS**

Please provide data of existing projects and any additional information, which was used to estimate the indicative budget of the proposed projects. A short overview should be given as a list and include a link to the referred project(s) and/or other source of information supporting your budget estimation.