



5<sup>th</sup> Meeting of the World Network of Coastal and Island Biosphere Reserves,  
Attard, Malta, 24-26 March 2015

# The Impact of Climate Change and Sustainable Development of Island and Coastal Biosphere Reserves





CONSELL INSULAR DE MENORCA



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Young-Hoan, Yang

Director of World Heritage Mt. Hallasan Research Institute

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## Foreword



### Dr. Miguel Clüsener-Godt

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Several months ago, we participated in the exciting 5th Meeting of the World Network of Island and Coastal Biosphere Reserves held in the Malta. This meeting provided, as the meetings held in former years, an excellent opportunity for the Island and Coastal Biosphere Reserves Network, to share experiences of recent results elaborated in biosphere reserves (BRs) and bring this joint knowledge to the islands of Malta and Gozo in the Mediterranean. Although Malta has so far not established a functioning BR, there are encouraging signs that this will be achieved in the future.

For UNESCO's Man and the Biosphere Programme, this meeting provided an excellent opportunity to invite additional countries to the network in order to share best practices that may be useful in island countries in the world.

The presentations of this meeting are compiled in the present publication, which will guide the Network to a very important event where it will meet again: the 4th World Congress of Biosphere Reserves, to be held in Lima, Peru, 14-17th March 2016. I hope that many island and coastal BRs will be able to attend in this world-wide get-together that will be joined by around 1500 participants.

Finally, I would like to express my gratitude to the National Commission of Malta to UNESCO, to the Maltese Government and especially to the Minister of Education, Mr Evarist Bartolo, and the Minister of the Environment, Mr Leo Brincat. This high-level participation shows the great emphasis that Malta gives to the MAB Programme. Again my gratitude goes to the Jeju Autonomous Province, the Republic of Korea and its National Park Service, the Island Council of Menorca, and the Spanish Ministry for Agriculture, Food and Environment Programme and its Organism for National Parks. This unconditional support from all the partners has made the World Network of Island and Coastal Biosphere Reserves become a truly functioning reality.

So let us meet again in Peru for the 4th World Congress of Biosphere Reserves in order to elaborate the new Biosphere Reserve Lima Action Plan for the upcoming decade 2016-2025.

A handwritten signature in blue ink, which appears to read "Miguel Clüsener-Godt".

## Foreword



**EVARIST BARTOLO**

Minister for Education and  
Employment

As the Minister of Education and Employment, responsible for Malta's UNESCO National Commission, I am pleased and honoured to contribute a Foreword to this publication of the proceedings of the 5<sup>1</sup> Network Meeting on island and coastal biosphere reserves.

This encounter under the aegis of UNESCO, held in MaIta in March 2015 on the 70<sup>th</sup> anniversary of UNESCO, was a great success. It saw the participation of some twenty countries from all continents who spoke instructively - and indeed visually - about the biosphere reserves in their respective countries. They alerted us all to the wholesome relationship between man and nature which our world increasingly needs, and to prospects in this area of environmental work and commitment.

This event was made possible through the assistance of Dr Miguel Clusener-Godt from UNESCO's Paris-based Division of Ecological and Earth Sciences in the Network of Island and Coastal Biosphere Reserves, as well as some of the major donors and contributors including, among others, Professor Do-Soon Cho, of the Madrid Action Plan, and Mr Young-Hoan Wang, Head of the Jeju Biosphere Reserve in Korea, Dr Francisco Cantos from Spain and Mr Ferdinando Villalonga, specifically from Menorca, as well as various other experts and national committees.

On behalf of my Ministry and that of the Environment, headed by my colleague the Hon Leo Brincat, who also addressed the conference, I would like to thank and congratulate those concerned in the organization of this event. These include the UNESCO National Commission of Malta, in particular its chairman, Professor Henry Frendo, and its executive secretary, Mr Philip Cassar.

Although Malta is a small archipelago and does not have a biosphere reserve as such, participants were taken on a conducted tour by Professor Alain Deidun of Dwejra, in Gozo, which is the closest to one, and which could eventually be further enriched to qualify as one. We also have two other sites which could benefit from the expertise shared throughout this conference.

The illustrated publication of these proceedings under the direction of the Network's Jeju Secretariat led by Mr Sung-Jun Pang, constitutes a lasting testimony to the historic importance of this Malta conference, which also opens up avenues for further cooperation in future.

Valletta, 15 August 2015

A handwritten signature in dark ink, appearing to read 'Evarist Bartolo', written in a cursive style.

# Introduction to Jeju Biosphere Reserve - With a Special Reference to Conservation, Sustainable Use, and Climate Change Impact

Dai-Yeun Jeong



5<sup>th</sup> Meeting of the World Network of Island and Coastal Biosphere Reserves,  
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# Introduction to Jeju Biosphere Reserve - With a Special Reference to Conservation, Sustainable Use, and Climate Change Impact



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## I. About Jeju Island BR

### 1. Location

South Korea is composed of nine provinces and six metropolitan cities. Jeju Island is a special self-governing province located in the southernmost part of the Korean peninsula (<Map 1>). It is 73km from east to west, 41km from south to north, and its total area is 1,847km<sup>2</sup>, which is about 1.83% of South Korea.

In 2002, a total of 830.94km<sup>2</sup>, which is about 45% of the island, was designated as Biosphere Reserve site (<Map 2>). Jeju Island BR is composed of three areas; the core area covers 151.58km<sup>2</sup>, the buffer zone covers 146.01km<sup>2</sup>, and the transition area covers 533.358km<sup>2</sup> (JSSGP, 2012: 45).

Except BR, UNESCE designated Jeju Island as a World Natural Heritage site in 2007 and World Geopark in 2010. In addition, Jeju Island hold five Ramsar wetlands and was designated as a New 7 Wonders of Nature in 2011.



Map 1. Geographical Location of Jeju Island

## 2. Unique Geological Features

Jeju is a volcanic island, formed approximately two million years ago until historic times, by a volcanic eruption and shows the following characteristics (JSSGP, 2012: 10-15).

Jeju is a typical shield volcanic island that has a gentle topography with an oval shape that stretches in an east-northeast direction. The lavas including the quality of trachyte as basalt are distributed widely in Jeju Island. The lavas form a wide range of volcanic topographies and about 360 small volcanoes called Oreum (<Figure 1>), including Mt. Hallasan (1,950m above sea level) being located in the center of Jeju Island. In relation to the conditions and time of the volcano, the mountain system, the water system, and the coastal topography show various characteristics.

Some of them are Gotjawal (Stony Lava Forest) (<Figure 2>), Inland Ramsar Wetland (<Figure 3>), and Soft Coral Community (<Figure 4>).

The mountain system shows a gentle slope on the east-west side (3-5 °C) and relatively a steeper slope on the south-north side (5-10 °C). Except for the southern coastal area of Jeju Island, approximately 120 small and large lava caves are distributed on the entire island. The representative cave is Geomunoreum lava tubes which were registered as a World Natural Heritage site in 2007.

Jeju Island has a radial water system with Mt. Hallasan as apex. A wide lava plateau is developed in the east-west side of Mt. Hallasan which has a gentle slope.

Most soils are of typical volcanic ash soil. The major parent material of the soil is basalt



Map 2. Geographical Location of Jeju Island Biosphere Reserve



Figure 1. Oreum (Small Volcanic Hill)



Figure 2. Gotjawal (Stony Lava Forest) - Dongbaekdongsan Hill

even though some ingredient includes tuff. Jeju Island was formed by numerous volcanic activities for about 1.8 million years, which resulted in the parent materials of volcanic ash soil crumbling in different forms at different times.

### 3. Rich Biological Diversity

There are various types of land cover maintaining biological diversity in Jeju Island. They are alpine coniferous forest, shrubbery zone, temperate deciduous broadleaf forest, warm temperate evergreen lucidophyll forest, and coastal habitat with peculiar landscape, etc.

Many number of species inhabit in Jeju Island. There are about 1,750 species of plant and about 2,200 species of animal. In addition, there are 397 species of Jeju endemic plants.

According to *Research on Red list of Wild Plants in Jeju Island for Construction of Ecological Geographic Information System*, a total of 536 taxonomic groups were evaluated at a regional level. The groups are: Extinct (1 species), Extinct in the Wild (2 species), Regional Extinct (2 species), Critically Endangered (61 taxonomic groups), Endangered (13 taxonomic groups), Vulnerable (83 taxonomic groups), and Least Concern (374 taxonomic groups). Meanwhile, a total of 157 taxonomic groups were evaluated at a district level. The groups are: Critically Endangered (19), Extinct (4), Vulnerable (1), and Least Concern (133).

Among the animals listed in the IUCN Red List, a total of 103 species inhabit in Jeju Island (Jeong, et. al., 2014: 15-16). They are 1 Pisces, 6 Amphibia, 5 Reptilia, 86 Aves, and 5 Mammalia by taxonomic group. On the other hand, 133 species are listed in Korea Red Data, and is composed of 3 Pisces, 6 Amphibia, 13 Reptilia, 86 Aves, and 5 Mamalia. Among them, Leopard Cat (*Prionailurus bengalensis*) lives in the wild, but is extinct in Jeju Island.

In South Korea, endangered wild plants and animals are protected and monitored by the Wild Animal and Plant Protection Law. South Korea's criteria for classifying endangered wild animals and plants for the Wild Animal and Plant Protect law is different from IUCN's criteria. There are 31 species in Jeju Island (the first grade endangered wild plant: 6 species, the second grade endangered wild plant: 25 species) from the total 77 endangered wild plants that are classified under this law (Jeong, et. al., 2014: 16). There are 87 endangered wild animals in Jeju Island among the total of 165 species that are designated by this law (Jeong, et. al., 2014: 16).



Figure 3. Inland Ramsar Wetland - Mulyoungari Wetland



Figure 4. Soft Coral Community

## II. Conservation Measures

“Conservation is Prior to Development” is the principal strategy Jeju Government adopts for conserving Jeju Island. The measures being launched for realizing the principal strategy are Land-use based on Geographic Information System being regulated as absolute and relative conservation area, Prior Location Review of Urban Management Plan, Development based on Environmental Resources as a Whole, and Research and Monitoring by period, etc.

In addition, various policies of conservation and sustainable use policies are being implemented on the basis of residents' and community organizations' participation.

For conservation of biosphere reserve, different specific measures are launched. The measures being launched for conserving core area are: core area is designated as a National Park by Natural Parks Act, designated as a Seogwipo Provincial Marine Park, and Cultural Heritage Protection Act is applied to core area.

Buffer zone is designated as a Conservative Mountainous District, designated as a Seogwipo Provincial Marine Park, and managed by Mountainous Districts Act

Transition area is managed as a zonation of Relative/Absolute Conservation in Land-use, and managed by the Plan of Environment Resources as a Whole.

## III. Sustainable Use

### 1. Core Area (JSSG, 2012: 50-51)

Hiking, visiting, rest area, and academic monitoring and research, etc. are allowed, using the designated tracking path in Mt. Hallasan National Park which is the core area of Biosphere Reserve. Shiitake Mushroom is cultivated in some parts of Mt. Hallasan National Park. The three islands (Munseom Island, Beomseom Island, Supseom Island) which is the marine core area, were established as a district of off-limits and not to be open to the public for 10 years from 2012 to December 31, 2021. Except the case permitted by law such as for the purpose of research and survey, the entrance to the three islands are not allowed. Some parts of the stream are used as a picnic area during summer.

There are 6 tracking paths reaching 40.7km in Mt. Hallasan National Park and 4 temples. The 4 temples are Gwaneumsa Temple (established in 1908) which is a traditional one, Cheonwangsa Temple (established in 1955), Jonjaam Temple (established between the last period of Goryeo and the early period of Yi Dynasty) which is a provincial cultural properties, and Seokgulam Temple (established in 1945). These temples are the facilities established before Jeju Island Biosphere Reserve having been designated, and are protected and managed by Cultural Heritage Protection Act and Traditional Temple Preservation Act.

### 2. Buffer Zone (JSSG, 2012: 51-52)

Except the limited activity to cultivate Shiitake Mushroom having been continued for a long time, no economic activity is done in the national forests which is the terrestrial buffer zone. Based on the distribution of



land-use by altitude, the terrestrial buffer zone is used as pasture, mountains and forests, and miscellaneous area, etc. The Shiitake Mushroom which is an export crop is treated as a special local product, and is sold considerably at high price. Wood-cultivated ginseng is cultivated in the 11 authorized farms located in the national forests. Two farms shipped 100kg (gross income was 59,000~67,000 in US dollar). It is expected that the wood-cultivated ginseng becomes a new income source of forest.

The tourism activity in the buffer zone is done mostly in the public tourism resorts. The public tourism resorts established are two Natural Forest Resorts, Roe Deer Eco-Park, Saryeoni Forest Trail, and Seogwipo Provincial Marine Park. Tourism activities such as fishing, cruise ship, and submarine, all of which are operated by private organizations are mainly active partially in Seogwipo Provincial Marine Park.

Jeju Government promotes a project titled Circumference Path of Mt. Hallasan encircling the whole districts of national forest located at the altitude of 600~800m where the terrestrial buffer zone is. The project finished repairing 9km among the total 80km. Among the total 80km, 60km are repaired as a carriage path of goods such as mushroom, and 20km are repaired as a new forest path by expanding the existing one with 2m in width at maximum. The Circumference Path of Mt. Hallasan is used as a space of eco-experience and forest resort, utilizing natural resources and geographical features at maximum.

Saryeoni Forest Trail is 15km in length, linking Bijarim Road and Saryeoni Oreum with outstanding landscape and suitability of experiencing forest path among those

constructed for the purpose of forest industry. Saryeoni Forest Trail makes better of forest path, and is used as an eco-experience programme for both Jeju citizens and tourists to enjoy green shower through walk in forest path.

### 3. Transition Area (JSSG, 2012: 53-54)

Pasture, forest, and miscellaneous area are the major lands being used, and occupy 88% of the transition area. Arable farm, field, orchard, town, and facility farmland such as vinyl house are 53.2km<sup>2</sup> occupying 9%, while tourism-related facility sites such as golf course and horse racetrack are 10.0km<sup>2</sup> occupying 1.7%. The pastures are distributed mostly at the altitude of up to 400m, and the orchards are distributed mostly at the altitude of lower than 300m. The forests show a pattern of comparatively even distribution, meanwhile the tourism-related facility areas are distributed sporadically up to the altitude of 500m. Agricultural-stockbreeding industry and tourism are the major economic activities. The industry most residents are engaged is agricultural-stockbreeding, and followed by tourism industry. The economic activity in Biosphere Reserve is done mostly in the transition area, showing that there are 21 golf courses, 31 public and private facilities related to tourism, 26 accommodations, and 15 schools, etc.

The fishing village fraternities gain economic income through the collection and sales of marine products. The major marine products they collect are conch, abalone, sea cucumber, and echinoid, etc. They collected 180 tons in 2011, and earned US\$1.09 million.



Jeju BR Logo

In addition, branding BR site is promoted in the name of eco-agriculture. Jeju BR logo implying its designation by UNESCO was created through 2 times of examination in May and September, 2012.

The logo was registrated as a patent in November, 2012. Five products being produced in BR use the logo. They are shiitake mushroom, green tea, Sasa quelpaertensis, wood-cultivated ginseng, and pork.

## IV. The Impacts of Climate Change

### 1. Terrestrial Ecology

There are no comprehensive empirical research on the change in biodiversity except for the extinction and the reduction of population of endemic species (Kim, 2013). However, three existing research publications about climate change impact on plants in Jeju BR are available (JSSPG, 2010: 49; Kim, et al. 2012, Kim, 2013). Two existing research publications about climate change impact on animals are also available (JSSPG, 2009: 103-109. JSSPG, 2010: 49). The former focuses on changes in the vegetation belt, and the latter on insects and birds.

#### 1.1: Flora and Vegetation

Overall, temperate and arctic plants in the vegetation belt moved 200-1,200m northwards. The area of alpine plants was reduced by plants located in the lower part to move upland. Their blooming, fruiting and fertility of seeds changed.

The area of the vegetation belt changed remarkably by forest for 42 years from 1967 to 2009 as below (JSSPG,

2010: 49; Kim, et al. 2012, Kim, 2013).

**Abies koreana E.H.Wilson Forest:** The total distribution area of *Abies koreana* E.H.Wilson forest was reduced by 34%. Particularly, their distribution area which is located higher than 1,000m from sea level was reduced to 19.9% in 2009 from 30.2% in 1967. The vegetation belt is moving northward. In addition, the species composition of *Abies koreana* E.H.Wilson is changing. In accordance with this change, subalpine bush is formed in areas where *Abies koreana* E.H.Wilson forest were formed.

**The Forests of Other Plants:** A field survey was conducted in three sites in 2009 - Sajebi Hill, Gaemidung, and Donnaeko, covering pine tree forest, shrub forest, and other plant forest.

(1) Pine Tree Forest: The total area of pine tree forest is 1,320ha which occupies 8.6% of Jeju Island BR. Its elevation ranges between 630m and 1,500m. More than 80% of pine tree forest distributes between 1,000m and 1,400m from sea level. Pine tree forest in Sajebi Hill increased by 8.3ha, showing 11.57ha in 1967 and 19.87ha in 2009. Pine tree forest in Gaemidung increased by 34.02ha for 42 years from 1967 to 2009. However, pine tree forest in Donnaeko increased by 27.07ha.

(2) Shrub Forest: The area of shrub forest in Sajebi Hill decreased by 4.51ha, showing 26.72ha in 1967 and 22.20ha in 2009. the total area in Gaemidung decreased by 5.74ha. However, the total area in Donnaeko increased by 28.42ha.

(3) Other Forests: In Sajebi Hill, areas of other forest being composed of trees, except *Abies koreana* E.H.Wilson, pine tree and shrub decreased by 2.86ha, showing 107.32ha in 1967 and 104.86ha in 2009. The area in Gaemidung also decreased by 5.74ha, while the area in

Donnaeko increased by 1.35ha. However, the mixed stand forest in the three survey sites being mixed mainly with need leaf tree and evergreen lucidophyll tree increased by 99ha, showing 725.1ha in 1967 and 923.4ha in 2009.

**Pine Wilt Disease:** Wilt disease is any number of diseases that affect the vascular system of plants. Attacks by fungi, bacteria, and nematodes can rapidly kill plants, large tree branches or even entire trees. Wilt diseases in woody plants tend to fall into two major categories, those that start with the branches and those that start with the roots. The occurrence and state of pine wilt disease (hereafter PWD) in Jeju Island including BR sites are summarized as below (JSSGP, 2014; Lee, et al., 2014).

The main cause of PWD is that trees get water stress and result in weakness against the 2nd insect plague. In addition, high temperature cause a rapid diffusion of pine wood nematode. Long-term drought causes moisture deficiency. Weak control activity within an appropriate time (such as not removing the dead pine trees) causes a rapid damage to the tree. Pine trees form a forest with less other trees, and result in the absence of a natural enemy near the village such as wood peckers.

The first occurrence of PWD in Jeju Island was September, 2004. It was lulled since 2006. However, in 2013, 40% of the entire pine forest (16,284ha) was infected with pine wood nematode and the number of dead pine trees were 287,000. In 2013, the average temperature in Jeju Island in July and August was 27.5~29.1°C. This is 1.5~2.1°C higher than the average temperature during the past three years. The average precipitation days were 2.3~4.0 days, which is 0.7~3.5 days fewer than the average during the past three year. Such an abnormal climate provided a fittest environment to the diffusion of

pine wood nematode

In 2014, Jeju Island's climate including temperature, precipitation, precipitation day, and drought was not extreme. However, 324,000 pine trees close to dead trees being infected by PWD were removed.

Others: Some rain forests emerge in coastal areas, valleys, waterfalls, cave terrain, and lava fields. For warm temperate evergreen lucidophyll forests, the number of population decreased at high latitude, but increased at low latitude.

## 1.2: Fauna

**Insect:** It is a general trend that for most insects, their development day decreases and their outbreak gets earlier as temperature rises. A wide range of insect species inhabit in Jeju Island including Jeju Island BR. However, no research has been conducted yet on the change in development day and outbreak of for insects. Significant changes due to climate change in Jeju Island BR has decreased in population of *Aphantopus hyperantus* (Linnaeus) and *Eumenisautonoe* (Esper) which are rare insects inhabiting in subalpine zone, and increase in appearance ratio of subtropical insects (JSSPG,2010:49).

**Bird:** Two remarkable changes in bird ecology caused by climate change occur (JSSPG, 2010: 49). One is the emergence of subtropical birds. The other is that some migrating birds in winter become the resident birds in Jeju Island, while some migrating birds in winter moved their destination to the southernmost region of the Korean peninsula.

**Others:** No empirical data are available on other animals being impacted from climate change. However, it is assumed that bird hatching time, amphibians, reptiles,

and insects becomes earlier. Another assumption is that farm animals (deer, weasel, and rabbit, etc.), ecological changes such as time of child birth and/or hibernation emerge.

## 2. Geology and Geography

Only one empirical research on the geological change in Jeju Island BR is available (Sohn, et. al. 2009). Sohn et al. discovered the naked lands and caved valleys formed by rainwater here and there in the grass area are distributed in the subalpine zone close to the top of Mt. Hallasan. Slope collapse, soil erosion, and sedimentation are progressed rapidly in the vicinity of Baengnokdam which is the crater located on the top of Mt. Hallasan. However, it is not sure that to what extent these are caused by climate change.

An empirical research on the change in Jeju geography is available (JSSPG, 2009: 144-157). This research is based not on Jeju Island BR, but on the entire Jeju Island. The coastal areas are eroded due to sea level rise. The erosion is progressed mainly in pocket beach, tuff cone which is a volcanic sedimentary layer, and tertiary marine sediments. These erosions result in loss of facilities and damage on the villages in coastal areas.

## 3. Agriculture

As explained in previous session on Jeju Island BR, five agricultural products are produced in the BR, using the new BR logo on their products to promote Jeju BR.

However, no existing empirical research is available on the change in their cultivation mode, arable land, production output, and profit which might be caused by climate change.

On the other hand, two comprehensive researches on the impact of climate change on agriculture in the entire Jeju Island are available (JSSPG, 2009: 193-224, JSSPG, 2010: 49-50). They conclude that climate change impacts on the following six agricultural sectors.

Firstly, the arable land of tangerine (*Citrus unshiu* S.Marcov.) and subtropical fruits, all of which are the major agricultural products in Jeju Island, moves northward due to rise in temperature. The sugar content of tangerine is changing.

Secondly, subtropical or tropical crops such as pineapple, and mango, etc. can be cultivated in the naked land.

Thirdly, agricultural products are damaged by the invasion and settlement of exotic diseases and insect pests settled down in Jeju Island.

Fourthly, exotic plants invade new sites where there are no pathogenic fungus and insects in the mechanism of food-chain. This results in a natural selection of original plants due to the lack of their adaptation to the exotic plants which are new neighborhoods.

Fifthly, exotic weeds such as *Solanum viarum* Dunal, L. invaded and settled down in Jeju Island. They have a high possibility to weed out their indigenous species and derive them to extinction.

Sixthly, an earlier seeding period for barleys and leafy vegetables, and their production output is decreasing.



#### 4. Tourist Resort

As explained in the precious session on Jeju Island BR, tourism activities in the buffer zone are conducted mostly in public tourist resorts, such as Natural Forest Resorts, Roe Deer Eco-Park, Saryeoni Forest Trail, and Seogwipo Provincial Marine Park, etc.

The majority of Jeju Island BR's economic activities are located in the transition area. There are 21 golf courses, 31 public and private facilities that are related to tourism, 26 accommodations, and 15 schools, etc. However, no data on the individual tourism sights that are located in Jeju Island BR buffer zone are available.

#### 5. Marine Ecology

As is shown in <Map 2>, three islands and the marine around them are designated as a site of Jeju Island BR. No existing publications are available for the impact of climate change on terrestrial ecosystem of the three islands and their neighboring marine.

However, two publications are available for the impact of climate change on the entire Jeju marine (JSSPG, 2009; 2010). They cover the change in sea algae and marine ecology, as below.

**Sea Algae** (JSSPG, 2009: 126-127): Sea lettuce is reproduced throughout the year and restrains the reproduction of other sea algae. Crustose coralline algae increase rapidly. Especially, crustose coralline algae is known as a major dominant species informing the decrease in the biodiversity of sea algae.

**Marine Ecology** (JSSPG, 2009: 255-257, JSSPG,

2010: 48): Marine ecology consists of physical environment and the species inhabiting in the area. The former includes depth of water, seawater temperature, ocean current, salinity, and sea-floor topography, etc. The latter includes plankton, nekton, and benthic organism, etc. The change in physical environment influences the organisms living in the marine ecosystem in terms of their reproduction, growth, and breath, etc.

In this context, the spreading whitening (efflorescence marine), which is caused by the change in marine ecosystem due to the increase in carbon dioxide in atmosphere and seawater temperature rise, is a major indicator informing a significant change in marine ecology across the coast of Jeju Island.

*Physalia physalis*, which is observed mainly in Philippines and Okinawa, appears in the coastal area during the summer. The sea algae being discovered in subtropical ocean is reproduced. The rapid increase in reproduction of both crustose coralline algae and articulate coralline algae promotes spreading whitening (efflorescence marine). *Martensia denticulate* which is a subtropical sea algae is reproduced rapidly from May to July, and reduces the implantation of beneficial sea algae.

*Enteromorpha prolifera*, which is a green algae that reproduces vigorously in the coast of eutrophication, flowed into the coast of Jeju Island in July and August, 2008, moving along with the ocean current from Qingdao, China, and impacted on sandy beach and fishing ground.

A new fishing ground of cutlassfish was formed. Cold current fish species are disappearing, while tropical species, such as tuna are appearing.

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# Sustainable forest management of Menorca in a context of climate change

Agnès Canals Bassedas

5<sup>th</sup> Meeting of the World Network of Island and Coastal Biosphere Reserves,  
Attard, Malta, 24-26 March 2015

## Sustainable forest management of Menorca in a context of climate change



Agnès Canals Bassedas

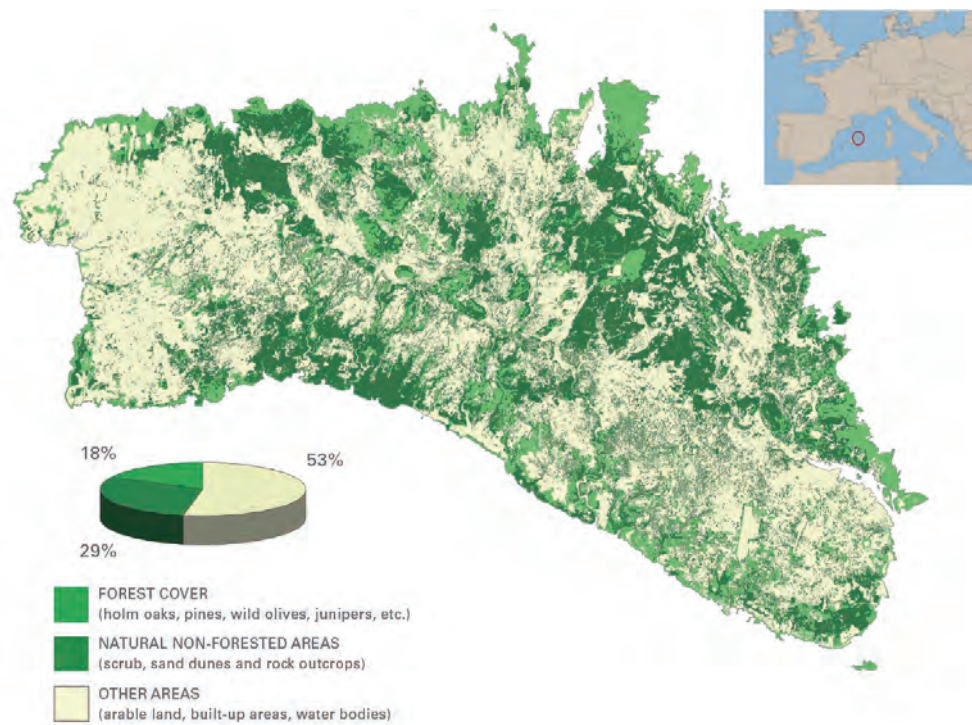
Director of the LIFE+BOSCOS project



### 1.1 The LIFE+BOSCOS project

Menorca's forests occupy a sizeable part of the island and are a key element in its landscape. Today, forests cover almost 50% of the island's surface area, the rest of which chiefly consists of agricultural land. Thus, the dominant landscape on Menorca is an agro-forest mosaic composed of forest patches interspersed with arable land and pastures. This landscape is a throwback to the past, to when the island's forests were exploited more intensely in more diverse ways, and to when estate and farm management necessarily implied integrated agricultural, livestock and forestry practices. Nevertheless, this intense land use ended suddenly in the 1950s, due largely to the advent of the use of fossil fuels and other new materials. Thus, in the twenty-first century we find that the forests on Menorca (and in other Mediterranean regions) – and especially their understoreys – have become very overgrown and are exploited only very sporadically and meagrely, and, worst of all, in most cases without any type of planned management.

Thus, at the beginning of the LIFE+BOSCOS project the forests on the island of Menorca were still spreading and were not managed in any concerted fashion, despite, at the same time, the need to face up to serious changes in climatic (rise in temperatures due to global warming) and local and global socio-economic contexts (oil and economic crises, population increase, increased demand for



Menorca Forest Map

leisure facilities, and so forth). Thus, the LIFE+BOSCOS project represented an opportunity to make use of the principles of governance and sustainability to design a forestry strategy adapted to the socio-economic and scenic requirements of the island of Menorca. The main aim of the project was to help Mediterranean forest systems adapt to the negative changes provoked by climate change via sustainable forest management (understood as a type of management that ensures that a forest's multi-purpose functionality is maintained in the future).

The main objective of the project was fulfilled via forest management at three different scales: (i) forest management on the island in general, (ii) management planning on certain estates and farms and (iii) the execution of management techniques in particular forest plots.

The first phase of the project (2009–2011) consisted of the compiling and generating of information, along with the organization of participatory sessions whose essential aim was the drafting of the directives for adapting Menorcan forests to climate change. These directives, which outline the basic objectives of the management techniques



designed to adapt the island's forests, were tested during the second phase of the project (2011–2014) in 10 collaborating estates.

These 10 farms were chosen from those that applied to join the project and signed a cooperation agreement with the island's government (Consell Insular de Menorca) that will assure the future continuity of the trials, data gathering and the subsequent monitoring processes.

## 1.2 What we have learnt

The LIFE+BOSCOS project set up pilot projects undertaken in collaborating farms and estates whose essential aim was to adapt our forests to climate change. In its initial step, long-term forest management for these properties was planned by drafting and approving adaptive technical management plans based on sustainable criteria to guarantee the multi-purpose functionality of these forests (at all levels, from the production of firewood to the environmental and landscape services they provide). Subsequently, planned actions were implemented in each of the chosen estates to test their effectiveness and efficiency in both economic and environmental terms.

The LIFE+BOSCOS project was co-funded by the European Commission's LIFE environment policy and governance programme and throughout the 'how' of the actions carried out was just as important as the 'what'. Thus, the testing of the way that forests adapt via the contracting of a number of different companies and the carrying out of work in different types of private farms have all helped provide a better understanding of forest governance and, above all, of how the manager-landowner-public administration interaction should work.

All actions were carried out in a thorough, systematic fashion, and all possible data was recorded so that the actions undertaken and the knowledge gained during the LIFE+BOSCOS project could be extrapolated to the whole of Menorca and to other Mediterranean regions.





### 1.3 Knowledge transfer

As mentioned above, the success or otherwise of the project's main aim is dependent on the effective dissemination of the results obtained - indeed, the LIFE+BOSCOS project would have little sense if there was no provision for the transfer of acquired knowledge to the island's forestry sector, that is, to all those concerned either directly or indirectly with the management of our forests.

For this reason, a number of different actions were carried out aimed at publicizing the project and highlighting the ecological importance of the island's forests and the need to actively manage forests to ensure they adapt to future changes. These communication actions targeted schoolchildren, the general public and both islanders and non-Menorcans who work in forest management (landowners, business, forest workers, etc.).

For example, as communications actions addressed to general public:

- More than 40 talks were given in schools and five family excursions were organized, in which almost 1,150 people participated.

- A self-guided itinerary apt for all family members was set up in the public forest of Bosc de S'Arangí. It is equipped with nine information panels that help visitors appreciate more fully the forest ecosystems.

- A general book describing the island's forests, their function, the effects of climate change and adaptive forest management have been published and distributed and it can be also downloaded free-of-charge from the project's website.

And as communication actions for capacity building of land owners and forest managers:

- In April 2015 around 100 people attended a training seminar Forest Management for Adapting to Climate Change: Challenges and Opportunities, organized to present the results of the pilot projects and to encourage information transfer to the forestry sector.

- The results of the project and the conclusions of the seminar have been published in the Good Practice Guide to Forest Management for Adapting to Climate Change, which includes chapters devoted to legal regulations, prices, how to draft management plans, and so forth. The guide is available in both Catalan and Spanish and can be downloaded free-of-charge from the project's website.





Thus, the knowledge gained during the project within the new context of on-going climate change should be seen as an opportunity for modernizing and promoting the forestry sector on Menorca.

Moreover, in order to further publicize the project and fulfil the objective of ensuring that the results of the LIFE+BOSCOS project are relevant to and of demonstrative use in adaptive forest management and environmental policies beyond the shores of the island, the project was presented at 10 national and international congresses and expert meetings.

## 1.4 Challenges and opportunities in the future

Throughout the whole project information on the main risks and impacts of climate change, as well as on the costs and benefits of making forests more resistant or more adaptable to such changes, was gathered and collated. The whole process was backed by local people and, above all, by the forestry sector (i.e. landowners, private companies, farm workers, conservation managers, etc.), which eased the exchange of information and the creation of synergies between the different participants who henceforth will play a key role in any future debate on forest management on the island.

The economic studies carried out as part of the LIFE+BOSCOS project calculate that the island's forests could generate annually direct income of almost €3 million, but that their global value – bearing in mind the environmental services they provide in terms of landscape, biodiversity, carbon fixing, and water and erosion control - is even greater and probably approaches €23.5 million annually.

With the first results of the project in hand, we can now explicitly affirm that these forests are a part of the island's natural and cultural heritage that must be managed actively in an adaptive fashion to ensure their mid- and long-term survival. Nevertheless, new governance mechanisms, still needed to guarantee new opportunities for a forestry sector undergoing profound change, must, necessarily, respect the sustainable values of the Menorca Biosphere Reserve to ensure social and environmental benefits for all Menorcans and for all those who visit the island.



# Príncipe Island Biosphere Reserve (São Tomé & Príncipe) – The Water and Recycle Challenge Project

António Domingos Abreu



5<sup>th</sup> Meeting of the World Network of Island and Coastal Biosphere Reserves,  
Attard, Malta, 24-26 March 2015

# Príncipe Island Biosphere Reserve (São Tomé & Príncipe) – The Water and Recycle Challenge Project



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## Introduction

The island of Príncipe (Democratic Republic of São Tomé & Príncipe), with a land area of 142 Km<sup>2</sup> and a maximum altitude of 948 meters, was nominated in 2012 as UNESCO World Biosphere Reserve.

Since the nomination, Príncipe Island Biosphere Reserve has implemented several initiatives aiming to promote and contribute to the sustainable development of the Island. Projects covering environmental education and awareness, biodiversity conservation, sustainable and responsible tourism, and waste management are among the current priorities of Príncipe Island Biosphere Reserve in full alignment with the environmental programme of the Government of Príncipe Autonomous Region.

## The Water & Recycle Challenge Project

One of the most successful projects of the Biosphere Reserve is the Water & Recycle Challenge Project launched in December 2013.

The Project “Water & Recycle” is the result of a joint initiative involving the collaboration of UNESCO’s





Fig 1. The Waste and Recycle Challenge Image



Fig 2. The Biosphere Bottle

Man and Biosphere Programme, through the Division of Ecological and Earth Sciences, the Príncipe Island Biosphere Reserve (São Tomé and Príncipe), the Regional Government of Príncipe Autonomous Region, the Autonomous Organism for the Natural Parks of the Ministry of Agriculture, Food and Environment - Government of Spain; and HBD Tourism (Príncipe Island).

The main aim of the project was to increase awareness on waste management and reduction in the use of plastic by involving local communities in activities promoting the removal of plastic from natural and urban sites as well as by incorporating reutilization and recycling practices.

The main goals of cleaning the existing abandoned plastic waste and promoting the reutilization and recycling of waste in general were pursued by the Water & Recycle project through the introduction of water filtration systems that provide potable water to the public in exchange of its participation and best environmental practices. Awareness campaigns and distribution of stainless-steel reusable bottles (Biosphere Bottles) were also included in the activities of the project.

The project started officially in December 2013, with a phase II starting in June 2014 and ending in February 2015.

## Activities

The project established several activities such as:

- Acquisition of the services for the conception of the logo and overall image and communication strategy of the project

- Printing the bottles with the logo and project information, including sponsorship from UNESCO/MAB and Spanish Ministry of Food, Agriculture and Environment and other partner's logos.

- Training of local technicians on installation and maintenance of the water filtration systems.

- Public launching of the project

- Training and awareness of the local Management Unit of the Biosphere Reserve and preparation of the school campaigns

- Installation of 12 purifiers on the Island of Príncipe and 1 on the Island of São Tomé, including the respective maintenance during at least 3 years

- Purchase and distribution of 5000 steel reusable bottles (Biosphere Bottles) in exchange to the delivery of at least 50 plastic bottles by local population, particularly students,

- Up to 1000 will be sold to tourists visiting the island of São Tomé & Príncipe in order to promote effectively the project worldwide;

- Design and introduction of a awareness campaigns in 14 schools of Príncipe Island, including the production of materials to support the educational activities and explaining the project, in Portuguese and English

- Acquisition of a compactor so that all the collected plastic bottles will be compacted in

order to reduce the volume and transport costs and shipped to a recycle plant.

## Results

The overall results of the Project's activities show a global motivation of Príncipe's Island communities, government and all stakeholders to contribute to a high environmental and sustainability profile of the island. In less than one year, more than 2.000 students, 60 teachers and other sectors of the local communities have shown active interest and participation in the activities promoted by the project.

The Regional Government is also strongly committed and actively contributing to the achievement of the project's goals. The government also provided logistic support and availability of human resources.

The figures of the results obtained are the following:

13 Water purifiers installed

Training and awareness of the local Management Unit of the Biosphere reserve

Training in all 14 schools (over 2000 students and 60 teachers)

4000 Biosphere Bottles delivered

231.000 Plastic waste units received and sent to recycling

Contacts and promotion of the Biosphere Reserve through local and international media

Wide interest in the project show through the Biosphere Reserve's Facebook and other social media

In general this results show a great engagement of communities and stakeholders in contributing to the objective of eliminating the plastic from the island. Domestic waste management best practices are now implemented and awareness of the whole population of the Island was achieved concerning urban and domestic waste and in particular the plastic waste. Plastic waste is a growing world pollution problem, which affects particularly the ocean and the small and vulnerable environments such as small island's coastal zones. Príncipe Island Biosphere Reserve and Príncipe Island's communities have done their part hoping that other Biosphere Reserves might also join in this effort demonstrating that it is possible to live in a plastic waste free world.



Fig 3. Training session for teachers



Fig 4. Awareness campaign for students





Fig 5. Training workshop for the Biosphere Reserve Management Unit



Fig 7. Launching of the Project by the President of the Autonomous Government of Príncipe Island



Fig 6. Installation and training of local technicians on the water purifying machines



Fig 8. Exchange campaign office



Fig 9. Exchange campaign



Fig 10. Waiting to exchange plastic waste for the Biosphere Bottle



Fig 11. Mission accomplished





Fig 12. Using the Biosphere Bottle and the water purifying machine



Fig 13. Compacting collected plastic waste to send to recycling



# The Biosphere Reserve Zembra and Zembretta TUNISIA

António D Abreu

Developed by: Sassi Azaiz.

5<sup>th</sup> Meeting of the World Network of Island and Coastal Biosphere Reserves,  
Attard, Malta, 24-26 March 2015

## The Biosphere Reserve Zembra and Zembretta TUNISIA



Developed by: Sassi Azaiz



Zembra, an island, a story

In 1977:

- Creating the National Park of Zembra and Zembretta Island.
- The National Park Zembra and Zembretta were chosen by UNESCO as a Biosphere Reserve (MAB).

The island is part of Zembra renowned landscape of the Gulf of Tunis and it is often that of Carthage and La Marsa, you can see on the horizon the blue mass, not far from the one that forms the end of Cap Bon .

### Zembra through history

The island was occupied by the man since ancient times. Surveys have shown a continued occupation of the island from the Neolithic times.

Of obsidian flakes (from Puntalaria) and a Neolithic occupation site, show human occupation 3-4000 years BC. The Neolithic man mainly ate fish (50%) of sheep and goats (27%) and birds (22%).

Archaeological surveys in 1992-1993 showed that the island contains important archaeological evidence of a dense occupation and very old (water projects, imposing defense walls, observation tower, Punic necropolis etc ...).



General shape of the island of Zembra

The ecosystem has been overexploited Zembra: almost total disappearance of the original forest, grazing, mammal introduced by man. At the time of independence the island was inhabited by the famous “Khelil” who lived from the exploitation of charcoal.

In the early 60s, a sailing school and diving work and were there to 600 beds occupied. In 1975, STB ended the tourist activities because the school had as many diving instructors that divers tourists.

Then a small protective group e nature led a campaign for the creation of a national park and it ends for to succeed: creating the national park and Zembra Zembretta (Decree of 1 April 1977).

## Objective of the creation of the Biosphere Reserve

- Preservation of ecosystems forest and marine and coastal habitats.
- Species protection vulnerable, rare or threatened mediterranean.
- Valuation of natural species at equipping them with diagrams of planning integrated and durable.

## GENERAL

### CREATION:

- The Zembra National Park and has Zembretta été créée in 1977.
- Decree RESIDENTIAL No. 77-340 of 1-4-1977.
- It is the first park installed in Tunisia - Governorate of Nabeul.
- In 1977, this site is registered by UNESCO among the reserves the Biosphere to protect rare monk seals and the population of sea birds: puffin ashy land and go of audouin.
- The importance of Zembra reside in his situation geographic Particular biogeography of the site that is in the migration couloir linking the western and eastern sectors of Mediterranean.

1 acronym islands Zembra and Zembretta  
 With a general view of the islands,  
 Monk Seal



Cory's Shearwater  
Gull andouin

## GEOGRAPHICAL LOCATION

- This park consists of two islands and Zembra Zembretta separated by a distance of 5 km.
- Situ in the Gulf of Tunis:
  - \* 15 km from the town of Sidi Daoud.
  - \* 55 km from La Goulette.
- Part of the Governorate of Nabeul (Cap Bon)
- Total area = 391 ha.
  - \* Zembra = 389 ha.
  - \* Zembretta = 2 ha.
- Sea depth 120 m.
- Elevation = 435 m.
- Relief the side of your Zembra are formed by steep cliffs.
- On the South side wind hole is a small port and a center of accommodation for the garrison of the Tunisian Navy. This center represents in the years are seventy one unit hotel burlaps destiny for fans to immersed and fischers underwater.
- Anyone want to visit the island must have the permission of the Ministry of National Defense and Ministry of Agriculture.
- The summit is covered with mastic Zembra of mastic oleaster with a saw palmetto group (Dum) and caper.
- The island is home to several other species these vegetation = minor tales rush, garlic rose, colycotum, horehound etc ....
- Near to the Cave of the 'poet' A remarkable carpet samphire (salicornia arabica) covers seepage salted water. Several species of lichens and mosses grows on the rocks, shrubs and trees.



Location of RB Zembra and Zembretta against the Gulf of Tunis and the peninsula of Cap Bon (Governorate of Nabeul).



Current situation of the port Zembra



Shelter in Zembra installed in the 60





Panoramic view Important cover Vegetation



Natural harbor in Hong Ejmal surrounded by the beauty of nature, located on the southwestern part of the island.



Vegetation cover composed of Olea europaea and media phyllaria



Effects of vegetation degradation by strong winds with a dominance Northwest

**PLANT DIVERSITY:** Provision of seeds by Atlantic spanning of water pass through Gibraltar, strong winds and migratory birds.

- What surprises visitors Zembra no trees apart from the juniper of phénicioe isolated trees in Oued Zitoun.
- Due mainly to the effects of several century of digradation and regeneration are followed Zembra.

## Climate

- Climate meinditerrann, winter is marked é little, the minimum is between 8 and 11 °C.
- High Moisture.
- strengths Winds.
- Ocean currents, winds and migratory birds, have largely contributed to enrich the diversity of flora é Zembra (terrestrial and marine).

## Waterborne Wealth

- A Oued which slopes gently through the valley to the sandy beach draining rainwater.
- Existence of sources of fresh water low of e bit.

## Geology

- Standstone ocks and marl of oligocene and the eocene.
- The consecutive contributions of sand and clay sediments from the Quaternary (1.5 million years) have given birth to a valley that ends with variable sandy beach.



- The steep cliffs and bare enable easy observation of geological stratification.

## Biological Wealth

- When one approaches Zembra, it is most striking; it is the greenery that covers the entire island.

Also this flora has been studied since the last century by researchers (and A.Labbe G.Pottier-Alapetite (1954) and A Gammar Nabli 1980) identified to date 4 226 plant species exist only in islands in the western basin of the Mediterranean, it is:

*Sanquisorba spinosa*.

*Iberis semperflorens*.

*Sisymbium polyceratum*.

*Eridium maritimum*.

- Its vegetation is consists of 3 groups together

\* Low vegetation belt and halophile rupicole related to sea spray and rocky cliffs (5 to 8 meters altitude):

- The Antiphyllide beard-de-jupiter.

- Always en Iberis flowers.

\* A second belt develops within the first consisting of a low matorral lentistique of the undergrowth herbaceous nitrophile.

\* The center Zembra is covered by a low, dense matorral mastic, myrtle, cistus and Buyère multipliore. The Phoenician juniper notes the hottest resorts.

- The top part of the island presents a scrub silicicole



Easy observation of the geological stratification



View of the Cathedral: a huge rock separated from the coast, composed of dolomitic rocks dating from the Oligocene and Eocene



The greenery that covers the whole island



Puniprenelle thorny (Sanquisorba spinosa)



Wild carrot



Arbausier (Arbutis unido) Fruit of the arbutus



high = oleaster, strawberry tree, arboresente heather, pistacia lentisqus and mytre.

- Part of Oued Zitoun = oleaster well coming with a bunch of oleaster and pistacia lentisqus 50 to 350m width is considered as a rare fact on the island of the Mediterranean basin.

### Flora Park :

- \* Juniper of Phoenicia.
- \* Myrtle commom.
- \* Calycotum.
- \* The Strawberry tree.
- \* Marine Palmier (Dum).
- \* Myrtle commom.
- \* Calycotum.
- \* Garlic Rose.
- \* Marine Palmier (Dum).
- \* The atriplex.
- \* The oléastre.
- \* Bruyere multiflora.
- \* Lickens.
- \* Foam.
- \* Rush.

### Faunal wealth

- The decision to grant the island Zembra and Zembretta of marine protected area status in 1973 was too late since it has not been able to save the monk seal from extinction.
- Currently this mammal lives on in some islands of Turkey and Greece.
- However, we can have hope of ever seeing the monk seal in the waters of Zembra with severe protection enjoyed this area over 30 years, and w here currently found one of best funds of the Mediterranean.

### The Arthropods:

- Several species of insects:
- \* Seven-spot ladybird.



- \* Fly pungent.
- \* Locust red or blue wings.
- \* Great green grasshopper.
- \* The praying mantis.
- \* The Cabbage turnip.
- \* Two migratory butterflies.
- \* Danais and beautiful lady.

**Mammals:**

Currently attending Zembra mammals have all been introduced by man to more remote times at least. The only original marine mammal was: the monk seal. Unfortunately, the latter disappeared in 1975 when the island began to be protected.

1) In Tunisia, the **rabbit** is found only on the islands' Zembra Kuriate the Galiton “, while on the continent can not meet the hare. This rabbit (*Oryctolagus cuniculus*) is very abundant on the island, living in the maquis (without digging burrows). Some recent studies have shown that the introduction of the rabbit is very old (probably the Punic period).

**2) The Corsican mouflon:**

This mouflon (*Ovis aries*) was introduced in the early 60's couples dropped to Zitoun Wadi, have stationed near the place where they were released. They go through a difficult period e in summer, because they still have not discovered Ain Kabar, the only perennial source of the island, diametrically opposite to the place where they were released.

3) The feral cats: domestic cats introduced by man, are feral, they feed on rabbits, birds. As ls only carnivorous predators, they help to maintain the ecological balance of an isolated ecosystem.



Rabbit (*Oryctolagus cuniculus*)



Herd of Corsican sheep (*Ovis aries*)



Horn sheep (*Ovis aries*)



Female foal (*Ovis aries*)



Group Shearwater



Shearwater which plane in nature



Cory's shearwater nesting



Chick Cory's Shearwater

## The Birds

- \* Pigeon.
- \* Cory's Shearwater.
- \* Goélant of audouin.
- \* Falcons (Pilgrim, Lanier ...).

### ***Birds (have the meters of the island):***

- Cory's Shearwater (*Calonectris Diomedea*): A colony of about 25,000 couples occupied the island from February to October. These are marine birds that during the breeding season. At nightfall and leaving the island at dawn, they push a cry reminiscent features a crying baby.

- Peregrine Falcon (the emblem of the island): A dozen couples houses the island, it is the highest density in Mediterranean and probably in the world. Areas are, since 1975, the fully protected birds.

- The audouin gull (*Larus aidouini*): A few dozen pairs nest in Zembra, competing with a very prolific related species, namely the herring gull (*Larus argentatus*).

Zembra is located on the migratory path Cap-Bon-Sicily, it's so that in autumn and spring, she sees passing thousands of birds belonging to 96 species at least different.

## Reptiles

- \* Snake-iron to -chevel.



## MARINE WEALTH

- marine protected area in 1973.
- National Park in 1977.
- Militarization of the area

Development of a very rich seabed in the Mediterranean

- 149 marine plant species (plant procession that lines the back of the island).
- The algae (red, brown, green ...).
- Posidonia.
- Sea lettuce.

This rich vegetation is causing an animal wealth mainly characterized by:

- The abundance of coral orange.
- The abundance of large gastropods like the giant knife.
- The presence of the giant limpet.
- The abundance of fish (black grouper, sea bream, the tree, the toothed, moray ...).

\* The loggerhead (caret) = sea turtle (endangered throughout the Mediterranean due to pollution and illegal hunting).

## Useful Station

From the residential area of the Tunisian navy, are moving three walking trails:

- The first dates back to the observatory at the top of the island.
- The second leads to Oued Zitoune opposite the rock 'the cathedral'.
- The third leads to the big in Cape via Kabbar Ain.
- These trails are steep and very difficult to borrow, but the tiredness is always compensated by the pleasure of complete the exceptional views.

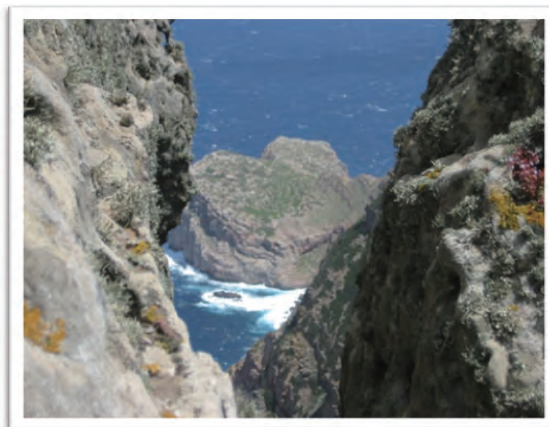


Jeweled walking trail by the administration



Scientific examination for discovery of forest species in the reserve.





Various pictures of the Nature Reserve of beauty representative biosphere

## Development prospects

- The Zembra and Zembretta archipelago; class e National Park and occupies a privileged RB è é e gi and unique in the overall perspective of the development.

Its position at the entrance of the Gulf of Tunis and its location confluence of cold ocean current from the Atlantic; and temperate from East of the Mediterranean basin. Rank its biodiversity among the richest and most diverse.

Geo-morphological characteristics and the absence of occupation and human exploitation makes it one of the last virgin islands in the Mediterranean. The establishment offers RB therefore sufficient assets to be the eco-tourism icon in Tunisia.

- The development must take the obligation to guard saves natural heritage as well as terrestrial marine RB et of this through the gradual integration of the riparian population of the land area: “El Haouaria and Sidi Daoud” and this through:

- The integration of progressive river population of the land area near El Haouaria and Sidi Daoud ‘.

- The identification of the other actors that can manage activities of tourism, leisure and hike (NGOs, associations, national committee of high hike, local communities ...) in collaboration with the DGF and ONTT.

- Foster collaboration with travel agencies in this area green Touristime ‘.

- Research institutions (universities ... ed).

## How to integrate the stakeholders?

- Participatory approach.
- Training (serious, transparency, participation,).
- Having a management plan adapted to the interests previously set.

- The possibility requires the following proposals:

\* Create centers of interest determined by load capacities that cap the number of visitors and prevent any new construction on the island or to trivialize the hiking trails and discovery.

\* Creating and construction of two piers: starting from a place called “Dar Dupuis” in El Haouaria, the other on arrival Zembra and to liaise between the mainland and the island.

### Current Status The jetty ZEMBRA

- Signaling and demarcation of the tracks to hike pedestrian to facilitate covered wildlife and flora as well as landscapes and panoramas. Integrated panels in the natural environment will invite visitors to respect the jitters route of circuits, not to trample or tear the plants, not to disturb nesting birds, not to introduce alien animal and plant species to the island and prevent any form of nuisance.

- hikes will be accompanied and supervised by trained guides mediators to be excellent performers visited the middle.

- markup underwater discovery routes allow you to discover the extraordinary diversity and wealth. Clearly these submarines safaris, where all fishing and gathering is strictly prohibited, will be supervised and secured by professional divers.

- Installation and Zembra on the promontory overlooking the El Haouaria Caves roundabouts observation telescopes to admire the islands of Zembra and Zembretta one side and Haouariens shores each other and to follow Standing bird migration.

- Establish Front and accommodation facilities for visitors and for the restoration of existing infrastructure (bungalows, shelter) and the creation of rural cottages and camping areas .... And also will be used as a research center for diodactiques and scientific activities.

- All these facilities and all these activities will create an ecotourism activity of high-end, and to attract new national and international customers concerned with the preservation of nature.

- Generate direct and indirect jobs that the local youth graduate much needed.

- As for the marketing and management, it will be a tender to specialized tourist operators. A strict specification will be developed and proposed for signature by the candidates before auction.

- It is obvious that the control of these ecotourism activities will remain the exclusive responsibility of the Forestry Directorate.

### Suggestions and Future Prospects

Elaboration of a type adapted management plan é the RB Zembra and Zembretta.

Development of a business plan and identifying







General view showing:  
 1-Zembra sandy beach.  
 Centre of accommodation.  
 3- Bungalows.



Installing spotting scopes

sustainable funding mechanisms.

Implementation of a management unit and the steering committee

Assign curator permanently park.

provide the marine park of a connecting means (small boat, zodiac ...).

Development of an eco-museum .

- Spatial existing building (hosting the conservative, office, shop ...) .

- Facilities of the park =

\* Quoad horse.

\* Computer.

\* GP S.

\* Twin.

\* Telescope ...



Bungalows existing restore





# Noosa Biosphere: a celebration of community and environment

Scott Williams



5<sup>th</sup> Meeting of the World Network of Island and Coastal Biosphere Reserves,  
Attard, Malta, 24-26 March 2015

## Noosa Biosphere: a celebration of community and environment



### Scott Williams

Chair of the Noosa Biosphere Reserve Foundation  
[www.noosabiosphere.org.au](http://www.noosabiosphere.org.au)

The Noosa biosphere is on the east coast of Australia in south-eastern Queensland. We are adjacent to the Great Sandy Biosphere Reserve which includes Fraser Island; the worlds largest sand island.

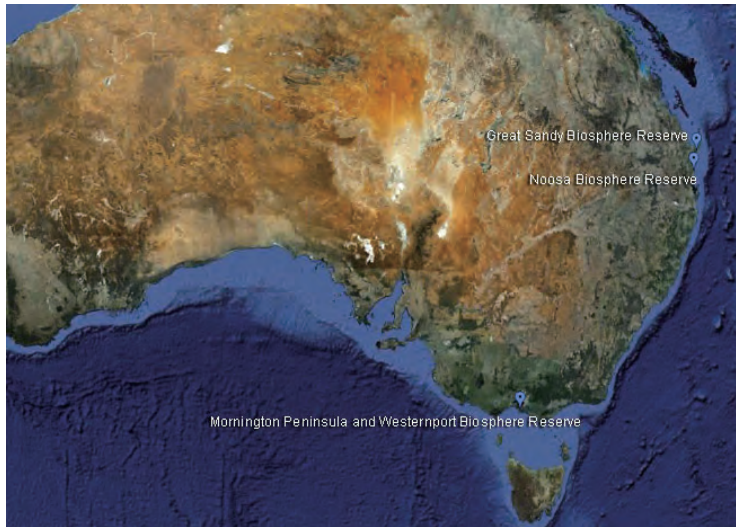
Noosa achieved biosphere status in September 2007 and was incorporated in December 2008. It conveniently and importantly sits over the local government area of the Noosa Shire Council and 3 km of adjacent off shore waters.

The reserve is some 875 square kilometres in area and home to around 55,000 residents.

It is our aspiration to make a difference locally and on a wider national and global level. An early written aspiration sums this up well;

*“With its high profile and unique combination of biodiversity despite high human levels, and extraordinary capacity to appeal to all ages, walks of life, cultural interests and backgrounds, and its already high environmental focus, Noosa Biosphere Reserve has the potential to be an innovative, well publicised and diverse biosphere, which can also reach out to the rest of the global biosphere and truly make a difference.”*

As we are a populated Reserve, we naturally contain a mixture of land uses that reflect this. In addition to protected natural areas, we have residential, commercial and farming land users so our challenge is to meld



these various land uses into a sustainable blend of;

- Environment; protected lands, waterways and vegetated areas
- Lifestyle; where people live and play and
- Livelihood; where people earn their necessary income.

If we can master this, there is greater hope that the lessons we learn in the process can be put into use in other parts of Australia and the world.

## Operational Approach

The Foundation and the many other groups that operate in and on our Biosphere receive very little government support other than from our local Council.

Over many years strong volunteer groups have evolved to progress their special interests related to the overall BR. This strong volunteerism is the lifeblood of the activities preserving and promoting the BR.

One of the main objectives, responsibilities and roles of the Noosa Biosphere Reserve Foundation is to help co-ordinate and develop these volunteer groups to continue to carry out their activities in their areas of interest.

Co-ordinating volunteer groups is a rather more difficult and collaborative task than simply directing paid workers to do certain tasks. Noosa aspires to develop ways for steering the enthusiasm of volunteers so that other regions can adopt the same techniques in their areas.

## Four focus areas

For simplicity, we can distil our operations down to 4 primary focus areas represented in the graphic below.



## Environment

The Noosa Biosphere Reserve is recognised globally for its rich biodiversity.

Contained in its area of 875 square kilometres are:

35% protected land such as national parks, conservation parks, state forests, vacant crown land, Noosa River and lakes

- Over 44% of all of Australia's bird species
- 1,365 species of plants
- 711 species of native fauna
- 60 distinct ecosystems.

In particular, the environmental side of the BR has quite a number of special interest groups that volunteer to manage particular aspects of the BR; National Parks, revegetation, catchment area preservation, and even specific areas bordering watercourses.

Perhaps unexpectedly, various commercial interests also make a considerable input to environmental protection. It is in the commercial interests of farmers, for example, to remove introduced vermin like rabbits, foxes and pigs that have limited natural predators and do considerable damage to native animals and vegetation. Since that also impacts on the productivity and viability of farms, the farmers are incentivized to control them and thereby also improve the environment.

One secret to a sustainable BR is no doubt to make it in an individual's best interest to do so!

## Sustainable Development & Livelihood

There is a natural tension between sustaining the environment and making a livelihood and a home in that environment.

Environment

Sustainable  
development

Community  
forums &  
engagement

Learning and  
research



One of the most critical elements to this is undoubtedly the local government and planning authority.

Noosa has been very fortunate to have elected Councils over the years that are pro-conservation and sustainability. In turn this has become a self-reinforcing electoral cycle as new residents move to the area for its natural and sustainable developments and continue to elect Councillors of that mindset.

Noosa planning laws have capped the population growth and kept building to fairly low-rise. The development footprints on the landscape have been carefully managed to minimize the impact of the built environment on the neighbouring habitats.

Many residents make their livelihood directly from tourism and others like the retail sector indirectly from the people servicing the tourism industry and the tourists themselves.

But tourism is a seasonal industry which causes social problems when it is depressed and other pressures in the boom times. The local tourism authorities have done a great job extending the season with out-of-season food, cultural and sporting events that have achieved national status as leaders in their area.

We are fortunate that Queensland's capital is a two hour drive away. Those farmers so inclined can find a ready outlet for organic and exotic produce so that

side of our economy is expanding. Farmers markets also attract weekly tourism loads.

Nevertheless, a small population like Noosa cannot sustain many professions, artisans and entertainers so we must continue to develop our economic plans to "work locally and sell globally" so that these types of service industries can also thrive.

## Community Engagement

As mentioned earlier, we have a supportive local government but little state or federal funding so much of the work protecting and restoring our environment is, and must be, done by community groups.

There is a delicate balance when working with community groups. Too prescriptive on what they can and should do and the interest level drops away. Too little guidance, and they may start to overlap in their interests and even become somewhat competitive.

A top down approach clearly does not work so we have been experimenting with a bottom-up approach to gently guide community groups without causing them to lose interest and passion.

The graphic below shows a form of community governance that has been experimented with. Each sector had its own committee to manage and guide its particular area of interest and they met at a higher level Board to share experiences and direction. At the time of writing, this is being reinvented with a new

community biosphere group so it is too early to say what format the new approach will take.

## Learning and Research

The NBRF is committed to the goal of collecting and passing on our BR experience. The local government provides funding for research and development projects which the Foundation administers. We expect that money will be used as seed money or venture capital to work up the science necessary to support applications for larger sums of money to do worthwhile projects.

Educational institutions from Australia and internationally are encouraged to visit our spectacular natural assets and to learn about the BR in the process.

In order to make this experience and information accessible worldwide, the Foundation is overhauling our digital strategy to make it more contemporary and more of a sharing experience.

## In Conclusion

The Noosa Biosphere Reserve is a living and vibrant entity with many community groups directly and indirectly contributing to its improvement and future.

Nevertheless, the peak bodies still have some considerable way to go educating the local and other peoples about the biosphere reserve concept.

When people clearly understand 'what's in it for them' maintaining and improving our biosphere, we will have achieved true sustainability as a biosphere reserve!



In the logo of both the Council and the Noosa Biosphere Reserve, the stylised flower that appears is the Keys Boronia first catalogued in 1909 and one of our most vulnerable species



# Introduction of Yakushima-Kuchinoerabujima BR plan

Takunori Iwakawa

5<sup>th</sup> Meeting of the World Network of Island and Coastal Biosphere Reserves,  
Attard, Malta, 24-26 March 2015

## Introduction of Yakushima-Kuchinoerabujima BR plan



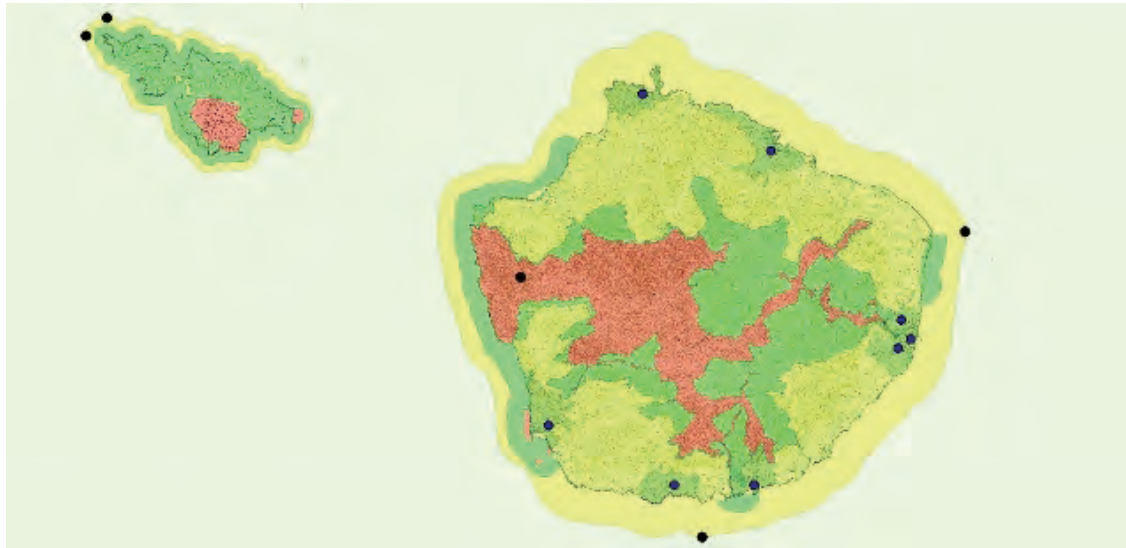
Takunori Iwakawa

Yakushima BR was designated in 1980, but few people who live in Yakushima have known about that. Now, we are going to submit an extension proposal as “Yakushima-Kuchinoerabujima BR” which includes “Kuchinoerabujima” Island located close to Yakushima.

We will utilize the BR as a way to develop the local economy. At the same time, we have to protect the important biodiversity in core area.







- All area 781.60km<sup>2</sup> (See area 241.30km<sup>2</sup>)
  - Yakushima 705.12km<sup>2</sup> (See area 200.77km<sup>2</sup>)
  - Kuchinoerabujima 76.04km<sup>2</sup> (See area 40.53km<sup>2</sup>)
- Core area 124.84km<sup>2</sup> (See area 1.76km<sup>2</sup>)
  - Yakushima 114.77km<sup>2</sup> (See area 1.16km<sup>2</sup>)
  - Kuchinoerabujima 10.07km<sup>2</sup> (See area 0.60km<sup>2</sup>)
- Buffer zone 200.30km<sup>2</sup> (See area 56.29km<sup>2</sup>)
  - Yakushima 153.45km<sup>2</sup> (See area 35.26km<sup>2</sup>)
  - Kuchinoerabujima 46.85km<sup>2</sup> (See area 21.03km<sup>2</sup>)
- Transition area 456.46km<sup>2</sup> (See area 183.25km<sup>2</sup>)
  - Yakushima 436.90km<sup>2</sup> (See area 164.35km<sup>2</sup>)
  - Kuchinoerabujima 19.56km<sup>2</sup> (See area 18.90km<sup>2</sup>)

- means [east end, west side, southern tip, northern tip, center point].
- means big settlements (>500 residents).

### Map provided for the application.

Yakushima Island locates at the northern end of the Ryukyu archipelago and is separated from the southernmost tip of the main Japanese island of Kyushu. The island is also characterized by mountainous landscape, with more than 30 peaks higher than 1000 m, including Miyanouradake (1936 m). Due to the proximity of the warm Kuroshio Current, rainfall is abundant on Yakushima, averaging 4000 mm annually in lowland areas and 8000–10,000 mm in the mountains (Okano and Matsuda 2013 <http://www.sciencedirect.com/science/journal/22126821/2/2>).

Natural Japanese cedar grows at elevations of 600–1800 m in the center of the island. These trees live up to 800 years in other areas in Japan. However, on the island, they can be older than 2000 years due to the abundant rain and high humidity, leading to slow growth. In addition, the trees high resin content makes them resistant to rot. Such trees are called yakusugi, where younger trees are called kosugi. There are more than 1900 plant species including ca. 600 species of moss (Ministry of the Environment et al., 2012).

The fish of Yakushima Island were surveyed comprehensively during 2008–2009, by 10 Japanese agencies, including Kagoshima University Museum and the National Museum of Nature and Science. The survey recorded 951 species of marine (including brackish water) fish in 24 orders, 112 families, and 382 genera.

The human population in Yakushima-Kuchinoerabujima BR is 13,293 in February 2015, and more than 250,000 people visit Yakushima per year. About 100,000 of them are aimed at mountain climbing.

The major industries are tourism and agriculture. In the core area and buffer zone of Yakushima, from the 1600's until the 1970's, amount of forests are caught for living. The huge stumps of trees cut in the past can be seen on the mountain. But now, it is prohibited. In the transition area of Yakushima, people are working at agriculture, coastal fishery, accommodation, and so on. Recently, since the deer increase too much, people are worried about the impact on agricultural products and biodiversity. Kuchinoerabujima has a unique volcanic landscape. In the past people worked at mining. The major industries are farming and agriculture. In addition, some sightseeing tours are held by local people. Many people enjoy hot springs because of the volcano.







# Climate Change Adaptation and Sustainable Development in Gochang Biosphere Reserve, Republic of Korea

Do-Soon Cho



5<sup>th</sup> Meeting of the World Network of Island and Coastal Biosphere Reserves,  
Attard, Malta, 24-26 March 2015

# Climate Change Adaptation and Sustainable Development in Gochang Biosphere Reserve, Republic of Korea



Mr. Do-Soon Cho

Professor, Department of Life Sciences,  
The Catholic University of Korea

## (1) Introduction to Gochang Biosphere Reserve

The whole area of the Gochang County in Jeollabukdo Province, Republic of Korea, was designated as a biosphere reserve in May 28th, 2013. Gochang Biosphere Reserve is located in the south-west coast of the Korean Peninsula (35°18'N – 35°34'N; 126°26' – 126°46'E), covering 67,152 ha (terrestrial area: 60,773 ha, marine area: 6,379 ha). 94.6% of Gochang is composed rural areas, while urban areas occupy only 5.4%. Gochang Biosphere Reserve is composed of diverse ecosystems including agricultural areas, forests, coastal wetlands, and freshwater ecosystems. The tidal flats in the northern part of the Gochang County are major stopover sites for migratory birds of international importance, especially longbill

and plover, and are protected as a Ramsar international wetland site.

Gochang County is composed of fourteen towns and villages. In 2014, the total population of the area was 61,407 people, of which about 40% are engaged in farming activities such as growing rice, vegetables, and fruits, and rearing livestock. Other economic activities include ecotourism and salt production. In fact, Gochang also boasts of many historical and cultural heritages in addition to diverse natural ecosystems. Among them, Gochang Dolmen Site is a cultural world heritage of UNESCO.

The core area of Gochang Biosphere Reserve is relatively small, 9,128 ha, or 13.6% of the total biosphere reserve area (Fig. 1). It is composed of 5 sites; Gochang Tidal Flat Wetland (a Ramsar site), Mt. Seonun Provincial Park (Fig. 2), Ungok Wetland

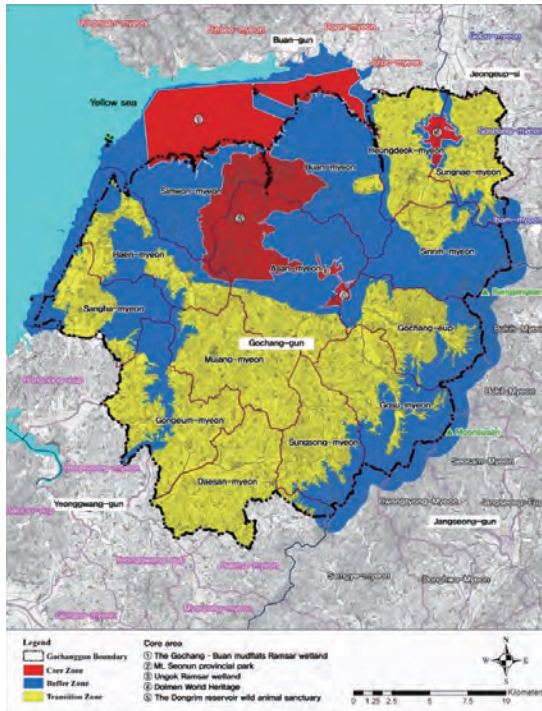


Fig. 1. Zonation map of Gochang Biosphere Reserve.



Fig. 2. Mt. Seonun Provincial Park, covered with deciduous forests dominated by oaks and ironwood, is part of the core area.



Fig. 3. Blackberry (*Rubus coreanus*) farms in transition area in Gochang.

(another Ramsar site), Dolmen UNESCO World Heritage site, and Dongrim Reservoir. Buffer zone is composed of forests, rivers, salt marsh, and sand dunes, with a total area of 26,554 ha or 39.5%. Transition area is mostly agricultural and residential areas, and the total area is 31,470 ha or 46.9%. Since three of the five core areas are wetlands, of which two are Ramsar sites, especially Gochang Biosphere Reserve plays an important role for the conservation of migrating birds of international importance.

Gochang has favorable environmental conditions for production of high-quality agricultural products due to the dominance of loess soil with high mineral contents and the effects of maritime climate. Among the agricultural products, blackberry (*Rubus coreanus*) and watermelon are nationally famous (Fig. 3). Other well-known products from Gochang are rice, pears, peppers, peanuts, radishes, etc. There are around 5,000 blackberry farms in Gochang, and they produce about 6,000 tons of blackberries a year, most of which are used to produce blackberry wines.

Gochang Biosphere Reserve is planning to promote organic farming to increase the income of local farmers. High quality of agricultural products and beautiful agricultural landscapes are used to promote ecotourism, such as blackberry festival and green barley field festival. Abundance of cultural heritages such as dolmen site and fortresses, and diverse ecosystems such as mountains, tidal flats, and inland wetlands in addition agricultural systems are also an aspect of attraction for ecotourism.

## (2) Current and Future Climate Changes in Gochang Biosphere Reserve

To investigate the effects of climate change in Gochang County and to prepare precautionary adaptation measures to climate change, a research project for establishing specific adaptation measures to climate change in Gochang was carried out in 2004.

Recently, climatic events or extremes in Gochang caused various environmental and economic damages. Types of Damages are 1) reduced production of agricultural products such as rice, blackberry, watermelon, melon, ginseng, hot pepper; 2) increased mortality of old people; 3) inundation of roads, houses and agricultural fields, 4) treefalls and biodiversity loss in the forests, and 5) phenological changes, etc. Types of extreme weather events were variable too: big typhoon, heat wave, extreme cold, cold weather during growing season, extreme drought, torrential downpour, heavy snowfall, hailstorm, prolonged monsoon, insect pest outbreak, sea level rise and tidal wave, landslide, etc. These events are believed to be caused by recent climate change in terms of increases in mean annual temperature (Fig. 4), and precipitation (Fig. 5), and increased variation in rainy days (Fig. 6) and drought periods (Fig. 7) for the last 40 years.

Future climate in Gochang County and in Jeonbuk Province is also projected to closely follow the trends of current changes. A computer simulation based on RCP 8.5 scenario shows that mean annual temperature in 2085 will increase by 5°C (Fig. 8), and mean annual precipitation to 1,780mm in 2085, a 400mm increase from now. In addition, growth period for crops in a year will be increase from 210 days now to 260 days in the year 2,100 (Fig. 9), indicating a change from warm temperate climate toward subtropical climate. Days of frost in a year will be decreased from 93 now to 58 in 2085,

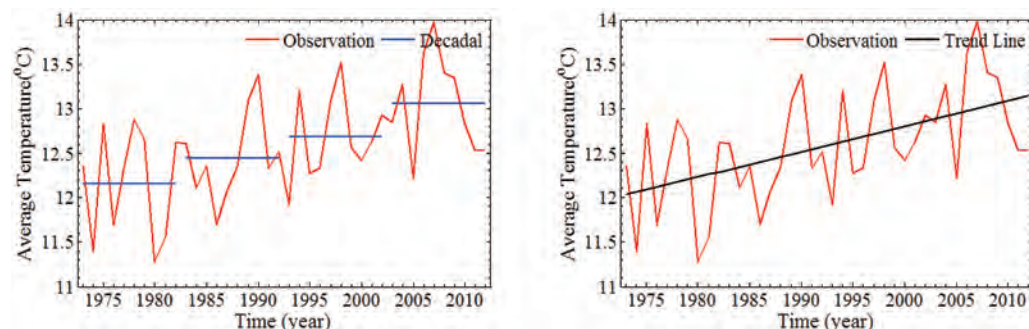


Fig. 4. Changes in mean annual temperature in Gochang for the last 40 years.

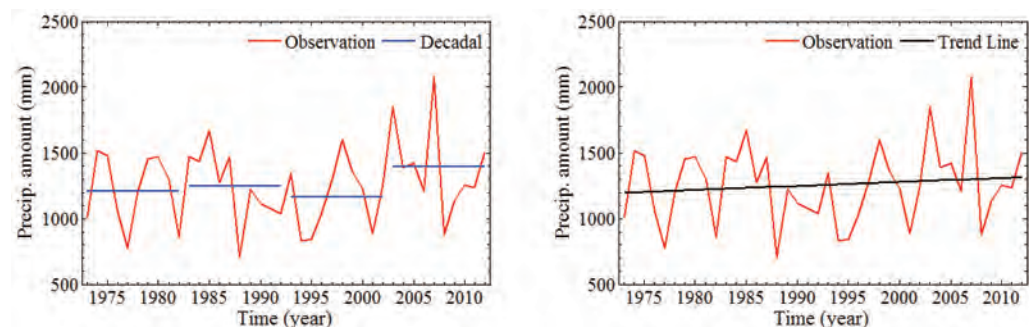


Fig. 5. Changes in mean annual precipitation in Gochang for the last 40 years.

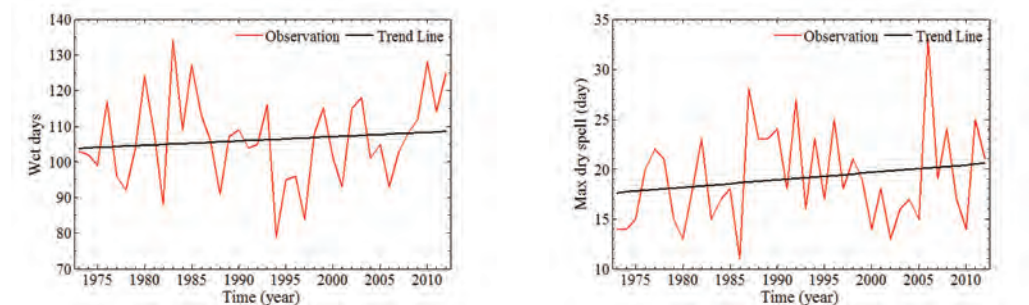


Fig. 6. Changes in days of precipitation in Gochang for the last 40 years.

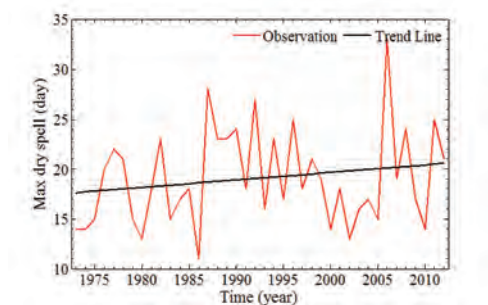


Fig. 7. Changes in maximum continuous days without rain in Gochang for the last 40 years.



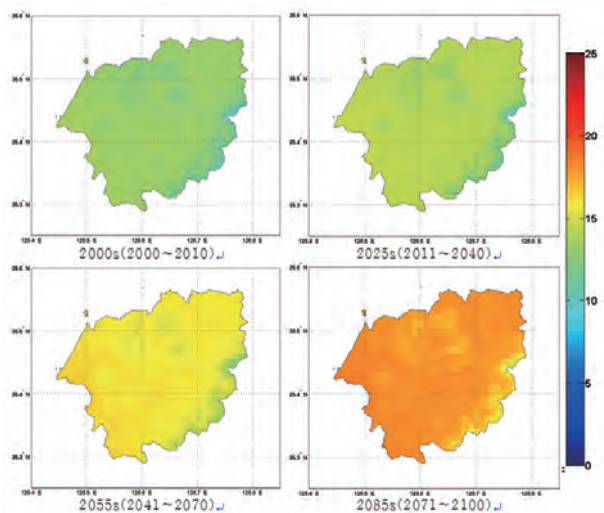


Fig. 8. Projected future changes in annual temperature in Gochang County by location.

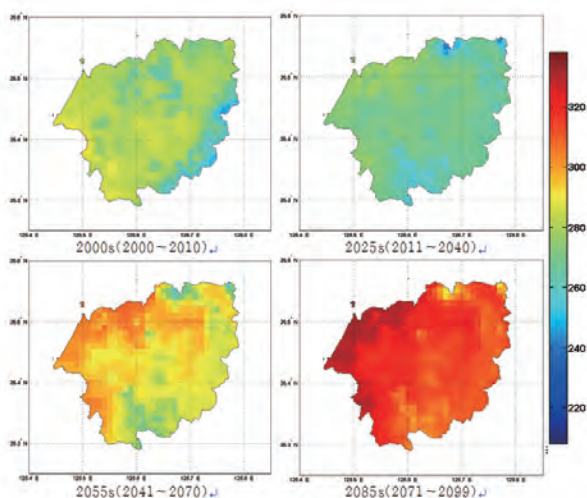


Fig. 9. Projected future changes in annual growth periods for crops in Gochang County by location.

but days in summer will be increased from 114 now to 163 in 2085.

### (3) Vulnerability to natural disasters and adaptation measures to climate change

Due to the current and future climate change in Gochang County, many aspects in terms of economy, health and environment are vulnerable to increased natural disasters. Disasters expected to be increased by climate change are flooding (mega typhoon, local downpour), heavy snowfall (with extreme cold spell), prolonged drought (drinking water shortage), coastal disasters (flooding by sea water, inundation by inland water), and landslide (mountainous area in southeastern Gochang). These disasters will cause damages to health of people, agricultural production, structures such as houses, roads, agricultural facilities. For the last decade, agricultural products have been frequently damaged by flooding, cold spell, hot spell, insect outbreak, and drought. Vulnerability to health of people is also expected to increase in such aspects as circulatory disease, epidemic disease mediated by insects, and water-borne epidemic disease.

Gochang Biosphere Reserve is preparing for adaption measures to climate change. Sandy coastal areas in western Gochang such as Goripo, Gusipo, Dongho areas are vulnerable to flooding by sea water, and even residential areas will be affected. For those areas, drawing of maps showing areas vulnerable to sea water flooding and escape routes, construction of shelters against sea water flooding have been proposed as adaption measures. Provision of shelterbelts (windbreak forests) along the coast lines may reduce the damage by typhoons, sea water inundation and salt water infiltration into inland areas, which can be an example of ecosystem based adaptation to climate change).

Adaptation measures for biodiversity have been proposed too. Examples of such measures are ecosystem monitoring and studies on phenological changes due to climate change, ecosystem restoration, and construction of database for genetic resources and for traditional knowledge on biodiversity.



#### (4) Sustainable Development and Management of Biosphere Reserve

The governance structure for the management of the Gochang Biosphere Reserve was established for the last two years: a management plan for the biosphere reserve with 180 projects was developed in February 2014, a Management Ordinance was approved in April 2014, and a Management Committee composed of 25 members with Mayor of Gochang County as the chair was established in April 2014. In addition, in order to support and coordinate all the activities concerning the biosphere reserve, a new team of eight governmental officials who are entirely dedicated to the management of the biosphere reserve was established in January 2015 under the Gochang County Government. There is a plan to construct a Management Center for Gochang Biosphere Reserve, and it will be comprised of offices, education facilities, conference rooms, exhibition halls, and will be finished by 2017.

For the promotion of sales of local products, Gochang Biosphere Reserve Logo was developed in February 2014 (Fig. 10), and is currently applied for 31 high quality agricultural products such as dairy products, melon, watermelon and sun-dried salts (Fig. 11).

In addition to branding effort, ecotourism is also regarded as a good tool to increase local income in the biosphere. As an initial effort for ecotourism, Yong-Gye Village was selected as one of the model ecotourism sites by the Ministry of Environment of Korea in July 2014. It has a population of 84 people, and the current major income source is agriculture (rice, blackberry, mulberry, etc.). Through the establishment of community cooperation system with local investment, we are expecting a considerable increase in income in the near future.



Fig. 10. The new logo of Gochang Biosphere Reserve developed for promotion of sales of local products.



Fig. 11. Application of Gochang Biosphere Reserve logo to some selected local products such as dairy products (top left), melon (top right), watermelon (bottom left) and sun-dried salts (bottom right).

# High conservation value areas management in Palawan Biosphere Reserve

Ryan Fuentes



5<sup>th</sup> Meeting of the World Network of Island and Coastal Biosphere Reserves,  
Attard, Malta, 24-26 March 2015

# High conservation value areas management in Palawan Biosphere Reserve



**Ryan Fuentes**

Chief Planning Officer  
Palawan Council for Sustainable Development

## Introduction

Palawan is the largest province in the Philippines in terms of land area (Figure 1). It has a total land area of 1.5 million ha, and it is surrounded by municipal waters of some 4.5 million ha. It has one highly urbanized city – Puerto Princesa City – and 23 municipalities. The total coastline is around 2,000 km distributed in 1,700 islands. The main island of Palawan measures 1.2 million ha.

The natural capital of Palawan is significant, and its conservation value is important to national development. The islands harbor a rich biological diversity and contain very high concentration of threatened and endemic plants and animals. The province’s land area is only about 5% of the land area of the Philippines, but it has some 692,000 ha of terrestrial forest cover, including 63,000 ha of mangrove forest (DENR-FMB 2013), corresponding to 10% and 20% respectively of the country’s terrestrial and mangrove forest cover. As of 2010, the Palawan forests make up around 48% of the provincial land area and still hold the majority of the remaining stands of old growth forests in the country.



Figure 1. Location of Palawan Biosphere Reserve, western Philippines.

Palawan forest formation types range from mangrove to beach forest, lowland evergreen dipterocarp forest, lowland semi-deciduous forest, montane forest, and forest over ultramafic and limestone. These forest ecosystems are keystone ecosystems for the balance of the entire island environment (Widmann 1998).

The natural resource-based industries of Palawan are founded on the integrity of Palawan’s environment and its rich biological diversity. The natural resources are the basis for the creation of economic wealth of the province as they support industries of high economic value. These resource-based industries include the live reef fish food industry, the edible birds’ nest industry, the shellfish industry, the South Sea pearls, among others.

The recreation services provided by Palawan islands are also quite significant. As ecological tourism destination, Palawan is cited as “the World’s Best Island” in 2013 by Travel + Leisure magazine. In a survey of readers of the Conde Nast Traveler magazine, Palawan is cited as “Top Island in the World” in 2014.

### Post-frontier Palawan issues

Palawan may be considered the country’s last ecological frontier or the last stronghold of many species. However, emerging post-frontier issues are challenging the development track of the province.

The rich biodiversity of Palawan is under threat from land use change and conversion, notably the expansion of plantations of exotic species, continuing resource extraction, and illegal wildlife trade. Timber poaching continues to threaten the natural forests of the province as rapid development in the city and urban centers require lumber materials and aggregates for construction.

The island character of Palawan allowed for many species to evolve in it. This made it stable and productive. At the same time, the island configuration and geology of Palawan makes it fragile. Palawan is a vulnerable island ecosystem because of its long and narrow geography, steep topography, highly erodible and impermeable soils, and small watersheds and rivers (Hunting Technical Services Limited et al. 1987). These make it vulnerable to both natural disasters, extreme weather events, and unsound man-made activities.

The critical realities for Palawan right now are the impacts of climate change and the increase in population together with urbanization and land use change that may impact the biodiversity. With respect to climate change, Palawan as an archipelagic province is particularly vulnerable to sea level rise, coastal beach erosion, and storm surges.

The population of Palawan increased from 755,412 in 2000 to 994,340 in 2010, with a growth rate of 2.79%. At this rate the current population is estimated at 1.143 million, with a population density



of 73 people/km<sup>2</sup>. This high growth rate is due to high incidence of in-migration.

Other socioeconomic issues include the lack of sustainable energy source, poor solid waste management in municipal centers, low level of people's engagement in conservation, and high poverty incidence. As much as 59.14% of households in Palawan is still below poverty threshold (PPDO 2012). These issues are compounded by other regional concerns such as borderless trade as an offshoot of the ASEAN region economic integration, mass tourism, and national security issues.

## Global management frameworks

In 1990, the province was included in the World Network of Biosphere Reserves under the Man and Biosphere (MAB) Program of UNESCO. In its citation, UNESCO recognized Palawan as “[a sample] of the world's major ecosystem types ... devoted to conservation of nature and scientific research in the service of man” and an area that “provides a standard against which can be measured the effects of man's impact on his environment.” Under Article 3 of the Statutory Framework of the World Network of Biosphere Reserves (1995), a biosphere reserve (BR) should strive to be a site of excellence to explore and demonstrate approaches to sustainable development and conservation on a regional scale.

The other global development framework applicable to Palawan is the 1971 Ramsar Convention on wetlands of international importance. Two sites in Palawan – the Tubbataha Reefs Natural Park (TRNP) and the Puerto Princesa Subterranean River National Park (PPSRNP) – are included in the Ramsar List of Wetlands of International Importance, as well as in the UNESCO list of natural World Heritage Sites. The Ramsar Convention is an intergovernmental treaty which provides the framework for national action and international cooperation for the conservation and wise use of wetlands. There is a broad definition of wetlands under the Convention. They may include mangroves, coastal lagoons, and coral reefs, all of which are prominent in Palawan.

The “wise use” concept is compatible to sustainable management of the aquatic ecosystems of Palawan. The wise use of wetlands in the Ramsar philosophy is defined as “the maintenance of [a wetland's] ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development.” The Convention provides for the application of this principle in sites proximate to declared wetlands.

The SEP as local sustainable development framework of Palawan

One of the great future tasks of mankind is said to be the development of a world-wide accepted strategy leading to sustainability of ecosystems



Figure 2. Underwater of Tubbataha Reefs Natural Park. (Source: <http://tubbatahareef.org/gallery/underwater>)

against human-induced stresses (Crutzen and Stoermer 2000). At the biosphere reserve level, Palawan is fortunate to have the SEP which was intentionally drafted to anticipate social and ecological problems and issues that need a standard of intervention.

A legal framework and local strategy for sustainable development in the province of Palawan is contained in the 1992 landmark legislation called the Strategic Environmental Plan (SEP) for Palawan Act, or Republic Act No. (RA) 7611. The SEP is developed and formulated in the 1980s, a product of a pioneering study and massive consultation in the whole province. The two global frameworks described above have goals similar or complementary to those of the SEP. “Wise use” is, in fact, already integrated into the SEP under its definition of conservation as “the wise use of natural resources that assures regeneration and replenishment for continuous benefit.”

The organizing principle of the SEP is sustainable development. The direction of Palawan’s development is explicitly guided by three features of the SEP philosophy:

- 1. Ecological viability.** Ecological viability means keeping intact the physical and biological cycles that maintain the productivity of ecological systems.
- 2. Social acceptability.** Social acceptability means participatory processes, people’s

commitment, equity in resource access, and equitable distribution of benefits.

**3. Integrated approach.** Integrated approach mean looking at the Palawan region from a wider perspective and taking advantage of the opportunity for coordination and sharing that the region represents.

The legal effect of the SEP is that it will be the guiding framework for government agencies in the formulation of environmental plans, programs, and projects. Hence, all local governments and national government agencies will have to align and coordinate their projects and budgets with the SEP policies and programs.

## A blueprint for green economy

Development activities must support environmental protection. This is primarily because economic development is sustained by the maintenance of the protective value and productivity of various ecosystems. Hence, the ideal course of natural resource conservation in Palawan is where people benefit from the goods and services provided by ecosystems, where factors contributing to poverty are addressed, and where resources are channeled back into conservation (Hunting Technical Services Limited et al. 1987). This green economy framework chooses both paths of environment and development as each of these paths reinforces each other.

To address the continuing challenges to the province as an island ecosystem, there is a need to sustain its ecosystems of high conservation value and natural resource stocks of high economic value. A strategic approach will also require strengthening climate change adaptation and disaster risk management capacities, the promotion of “environmental justice,” and taking advantage of the connectivity of ecological and economic systems.

Ultimately, a green economy is one where economic industries are well regulated and benefits from them trickle down to the needy and poor, where economic industries offer a diversity of sustainable solutions to improve socioeconomic and environmental conditions. The major economic industries of Palawan that will support its green economy are the so-called MOFFAT industries: **M**ining; **O**ffshore energy; **F**isheries; **F**orestry; **A**griculture; and **T**ourism. Related to these five industries, the conditions for the transition to a green Philippine economy as enumerated by the Philippine Council for Sustainable Development (2012) is modified for Palawan as follows:

1. production or technology innovations to improve efficiency in resource-energy use;
2. promotion of material reuse or recycling;
3. reduction of wastes, carbon emissions, effluents, and other pollutants; and
4. conformity and compliance of land and water use to the ECAN standards.

## The primary strategy of Palawan Biosphere Reserve

In order to align local initiatives toward sustainable development, the SEP provides a zoning strategy that is designed to optimize the use of land and waters. This strategy is called the ECAN or the Environmentally Critical Areas Network. The ECAN is an integrated map delineating management zones in both land and sea based on a graduated system of protection and developmental control in accord with the degree of human disruption that the area can tolerate. Criteria and guidelines are instituted to produce an ECAN map using geographic information systems (GIS). The ECAN zones range from the Core Area (areas of maximum protection), to Buffer Zone (areas protecting or shielding the Core Area), to Multiple Use Zone or Transition Area.

One of the goals of The Seville Strategy for Biosphere Reserves is “ensure better harmonization and interaction among the different biosphere reserve zones.” In the geographic context of the Palawan ECAN, this means economic industries co-exist harmoniously with protected areas. To achieve this, the ECAN managers need to institute programs whose goals are the maintenance of Core Areas, the judicious use of Buffer Zones, and sustainable management of Multiple Use Zones. Figure 3 illustrates a possible interaction and harmony among the different biosphere reserve zones. This interrelationship of biosphere zones, operationalized

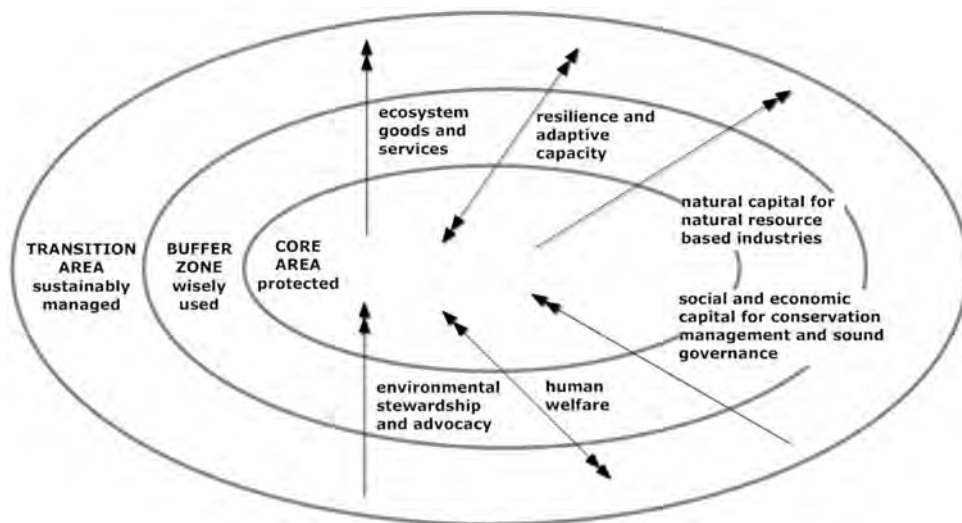


Figure 3. Benefits exchange, interaction, and material flow among the various zones to increase resilience, adaptive capacity, and stability of the biosphere reserve. The direction of arrows represent flow direction. The Transition Area corresponds to the Multiple Use Zone of the Palawan Ecan system.

in Palawan by the Ecan system, ensures the proper management of competing land uses.

## The ecanization process

One of the targets of MDG (Millennium Development Goal) # 7 – “ensure environmental sustainability” – is to “integrate the principles of sustainable development into country policies and programmes to reverse the loss of environmental resources.” Using the SEP as development framework and the Ecan as strategy, “ecanization” is devised as a process to mainstream the principles of sustainable development into local plans, programs, and projects. This process has three steps: (1) delineate and mark the boundaries of the different Ecan zones in both land and sea; (2) identify prescribed activities and resource use to manage and regulate each Ecan zone; and (3) enforce regulatory measures and implement sustainable actions to prevent practices that are destructive of the environment.

Localities that have ecanized their local plans have spatially determined the development and conservation constraints of their areas of jurisdiction. Since the Ecan is a holistic strategy and is aimed at providing an optimal mix of land uses, the financing and implementation of ecanized plans serve to enhance the local conservation values (i.e., ecosystem goods and services).

Among many local development plans, the most strategic plan to mainstream Ecan to is the Comprehensive Land Use Plan (CLUP) since its formulation is mandatory to every municipal, city, and provincial government. The CLUP is the physical framework plan and basis of local development and annual investment plans. It consolidates various thematic plans and integrates the urgent concerns of the locality. If the CLUP conforms or is compliant to the standards set by the Ecan, then it can ensure a balanced mix of environmental protection and economic development activities.

At present, the PCSD is assisting and closely collaborating with local governments in the preparation of ecanized or Ecan-compliant CLUPs. Through ecanized CLUPs,



the biosphere reserve concept is mainstreamed and institutionalized into local development planning process and the local plans and programs are aligned with the framework of sustainable development embodied in the SEP. Ecanization therefore serves to implement the biosphere reserve zoning concept at the local level as well as achieving MDG # 7 target.

## High conservation value areas as strategic areas for ECAN management

Strategic management of biosphere reserves requires a priority setting mechanism to identify special management areas. It is important to identify these areas since sustainable interventions in these places are expected to bring substantial benefits to society. The ECAN system itself identifies Core Areas that require immediate protection to safeguard the quality and volume of ecosystem goods and services in these zones. The high conservation value area (HCVA) framework is another powerful prioritization framework due to its simple and practical application.

HCVAs are areas that are remarkably significant or extremely important from the biological, ecological, social or cultural standpoints. This terminology is adopted from the High Conservation Value Forests (HCVFs) of the Forest Stewardship Council (FSC), HCVFs being forest areas of critical importance to biodiversity on a global, regional or national level. All forest types are unique and important in conservation but HCVFs are forests with outstanding significant values that are of critical importance and which need to be appropriately managed or protected to maintain or enhance the identified forest values (Rayden et al. 2006, cited in Form international website).

HCVAs can be characterized into six major types.

- 1. Biodiversity.** Areas containing globally, regionally, or nationally significant concentrations of biodiversity values (e.g. endemism, endangered species, refugia).
- 2. Landscapes.** Significant large landscape-level areas where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance.



Figure 4. Pied Imperial Pigeon (*Ducula bicolor*) in flight from Ursula Island Game Refuge and Bird Sanctuary, southern Palawan. (Photo: Rommel M. Cruz)



Figure 5. A view of the El Nido-Taytay Managed Resource Protected Area, a landscape-level HCVA. (Photo: Mark Ace V. dela Cruz, 2015)

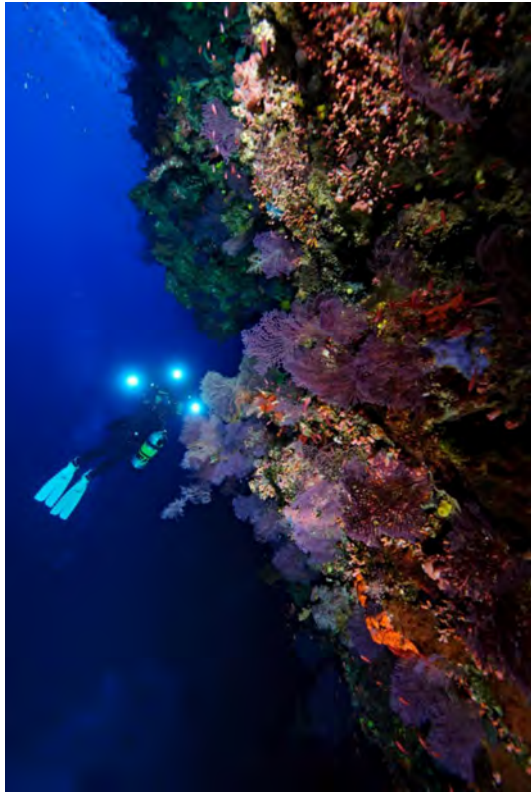


Figure 6. Coral reefs of Tubbataha Reefs Natural Park.  
(Photo: Tet Lara, 2013)

**3. Ecosystems.** Areas that are in or contain rare, threatened, or endangered ecosystems.

**4. Ecosystem services.** Areas that provide basic services of nature in critical situations (e.g. watershed protection, erosion control).

**5. Livelihoods.** Areas fundamental to meeting basic needs of local communities (e.g. subsistence, health).

**6. Cultural identity.** Areas critical to local communities' traditional cultural identity. (Note: These areas of cultural, ecological, economic, or religious significance are identified in cooperation with such local communities.)

The HCVA framework captures all possible outstanding ecological and cultural areas and they are all present in Palawan. HCVAs are usually declared as special management areas through a legal or policy instrument by government, management organizations, or scientific bodies. They are overseen by a management body, which are guided by a management plan and a governing policy.

Palawan's uniqueness and outstanding ecological and cultural character have given rise to HCVAs such as ECAN Core Areas, key biodiversity areas (KBAs), national parks, ancestral domains, World Heritage Sites, critical habitats, wetlands, and watersheds. Managing these areas is important to sustain the tangible and intangible values they provide to the immediate communities.

A clear example of HCVA in Palawan is the Tubbataha Reefs Natural Park (Figure 6). The Park is a source of fish larvae for coastal waters surrounding Palawan mainland and surrounding islands. It supplies the protein needs of the Palawan population and the rest of the country, thus delivering the fish food provisioning service of the reef ecosystem.

A sample of the six HCVA typologies within the Palawan setting is listed in Table 1. It shows the various HCVA management bodies, management plans, and regulatory frameworks.

The flexibility of both the ECAN and HCVA frameworks make it easy to map and align the zones of the HCVA to the ECAN zones. The legal effect of the SEP law in fact makes it mandatory for the ECAN zoning strategy to be applied to the physical zones of HCVAs. The compatibility of ECAN zones to HCVAs does not seem to be a problem since the ECAN Core Areas can be identified based on ecological, biological, or cultural criteria. Based on the guidelines in the delineation of the ECAN, the Core Areas can be the habitats of endangered species; primary growth forests; geohazard areas, or areas above 1,000 m elevation and with steep (>

Table 1. HCVA in Palawan.

HCVA	COVERAGE	GOVERNING POLICY	MANAGEMENT BODY	MANAGEMENT PLAN
1. Core Area and Restricted Use Area of the ECAN	selected areas from 23 municipalities and one city	SEP (RA 7611)	Palawan Council for Sustainable Development	ECAN Resource Management Plan
2. Large-scale protected area or national park	10 landscape-level protected areas	National Integrated Protected Areas System (RA 7586)	Protected Area Management Board (PAMB)	General Management Plan; Protected Area Management Plan
3. KBA	32 KBAs with trigger species	Biodiversity policies	various	Biodiversity Management Plan
4. Cultural HCVA	ancestral lands and waters with Certificate of Ancestral Domain Claims/Titles; indigenous community conserved areas	Indigenous Peoples Rights Act (RA 8371)	traditional/cultural groups, indigenous cultural communities	Ancestral Domain Sustainable Development and Protection Plan
5. Local conservation area (LCA)	LCAs, such as critical habitats, significant caves under RA 9072, and wetlands	various	Local governments and organizations	Ecosystem Management Plan; Local conservation area plan
6. Watershed	Water Quality Management Area (WQMA)	Philippine Clean Water Act of 2004 (RA 9275)	WQMA Governing Board	Catchment Management Plan
7. HCVFs	forests	Revised Forestry Code and other laws	various	Forest Land Use Plan
8. Sanctuary and reserve	local protected areas within administrative boundaries of localities	Local Government Code (RA 7160) and others	Local government	CLUP or other local management plan
9. Wetland of international significance under the Ramsar Convention	PPSRNP and TRNP	various	PAMB	General Management Plan; Protected Area Management Plan
10. Natural area of outstanding universal value	PPSRNP and TRNP World Heritage Sites	various	PAMB	General Management Plan; Protected Area Management Plan
11. National reservation	Tabon Caves Reservation, Tau't Bato Reservation, and Iwahig Penal Farm	various	various	various



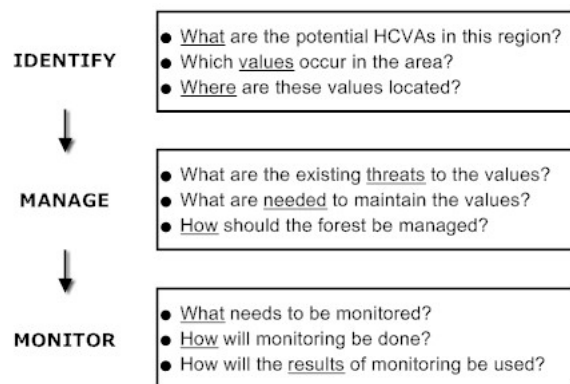


Figure 7. The HCVA process. (Source: HCV Resource Network)

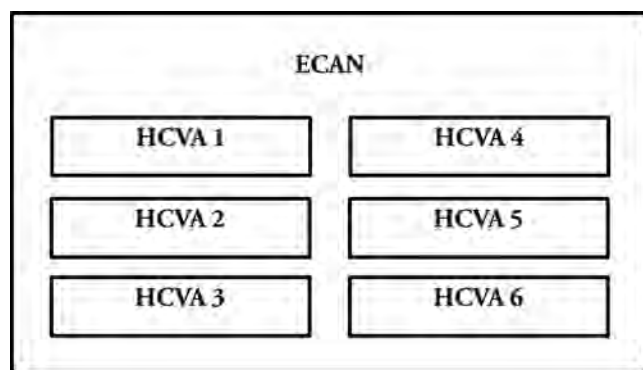


Figure 8. HCVA's network within the ECAN of Palawan BR.

50%) slopes; and sacred sites of indigenous peoples. These Core Areas can easily be within the HCVA's.

## HCVA process

The HCVA process is simple. As shown in Figure 7, it starts with identifying which HCVA's are present using existing data and information. The second step is to identify the appropriate management regime for the HCVA in order to maintain or enhance the values of identified HCVA. Finally the appropriate monitoring system is established to ensure the effectiveness of management practices.

Although the plurality of approaches in HCVA management makes for a diverse learning environment, there is a need to use a shared management framework to consolidate all efforts and to standardize the interventions in these areas. The multiplicity of HCVA management arrangements in Palawan necessitates the use of ECAN as a coherent planning, policy, and management framework. HCVA's management is subsumed within the ECAN management since the HCVA's themselves form a network that is part of the larger ECAN (Figure 8). In addition, the HCVA process (Identify, Manage, and Monitor) is consistent with the ecanization process (Map, Regulate, and Enforce). Thus, the ecanization of HCVA ensures that its management regime is informed by the SEP standard of sustainable development.

The HCVA's network is by no means solely biophysical or geographic in nature. It also supports social networks, learning exchanges, and interactions among environmental managers. HCVA's must not be treated in isolation. Doing so leads to the piecemeal, fragmentary approach to network management. A holistic framework is possible using the SEP as plans integration framework and the ECAN zoning as integrative strategy for network management.

## Challenges to HCVA's management

The challenges to HCVA's network management are manifold. They are related to the social and economic dimensions of sustainable development.

1. recognizing the comprehensive (transdisciplinary) nature of HCVA's network management
2. recognizing the need to "stitch together" the network of HCVA's using SEP ECAN as a shared, holistic management framework and strategy
3. sustaining people participation through "inclusive conservation"
4. refining the institutional arrangements among HCVA's
5. asserting the oversight and monitoring functions of regulatory agencies
6. empowering communities and developing capacities
7. recognizing the interplay of various actors



- in biosphere reserve management and aligning interdependencies of multiple interests
8. pursuing common interests and objectives and finding common platforms to foster multi-stakeholder cooperation
  9. integrating efforts and initiatives of organized groups to have a larger impact
  10. upscaling sustainable approaches from demonstration sites to the wider communities
  11. promoting efficiency and innovation in natural resource-based industries

## Strategic responses

As part of the world network of BRs, Palawan is expected to be a living laboratory and site of excellence to explore and demonstrate approaches to conservation and sustainable development. ECAN and HCVA network management are ways to achieve this goal.

In 2014, two activities have been completed

to contribute toward this effort. The first is the establishment of a functional online information clearinghouse mechanism called the Palawan Knowledge Platform. This platform is an area of cooperation among private and public research and academic institutions in Palawan.

The second is the formulation of the Palawan Sustainable Development Strategy and Action Plan (PSDSAP). The aim of this plan is to create the necessary environmental, socio-cultural, economic, and institutional conditions toward the establishment of an environmentally sensitive economy in the province. The plan contains a menu of actions formulated in the context of poverty reduction and biodiversity conservation. It is a local counterpart of the PBSAP (Philippine Biodiversity Strategy and Action Plan) which is a commitment under the Convention on Biological Diversity. The PSDSAP anticipates the upcoming national development plan and the shift from MDGs to Sustainable Development Goals (SDGs), which is one of the post-2015 development



Figure 9. Header image of the Palawan Knowledge Platform (<http://pkp.pcsd.gov.ph/>) showing the logos of institutions involved in the initiative.

agenda outlined in the Rio+20 Conference.

The PSDSAP (<http://pcsd.gov.ph/psdsap/>) is a guide to optimize the uses of lands and waters in Palawan, maximize the benefits derived from its resources, and minimize or prevent negative impacts from introduced activities. As such, the following strategies are incorporated in the Plan:

1. focus on HCVA's and hotspots areas as priority areas for ECAN management;
2. enhancement of human capacities;
3. enhancement of existing management and regulatory measures;
4. investment in accurate, updated, and scientific information;
5. pursuit of participatory conservation and enforcement through engagement with locals, mobilization of people and resources, looking for champions, and involvement of various sectors;
6. pursuit of operationally sustainable ECAN conservation management and governance; and
7. integration of environmental law enforcement with advocacy campaigns and sustainable livelihood projects.

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# La Campana - Peñuelas Biosphere Reserve Our Commitment to Conservation and Development

Mario GALVEZ

5<sup>th</sup> Meeting of the World Network of Island and Coastal Biosphere Reserves,  
Attard, Malta, 24-26 March 2015

# La Campana - Peñuelas Biosphere Reserve Our Commitment to Conservation and Development



## Mario GALVEZ

Forest Engineer  
Focal Point of the MAB National Committee  
CHILE



## Biosphere Reserves in Chile

Chile currently has ten biosphere reserves, covering about 11.5 million hectares. Of these, approximately, 3.0 million correspond to marine areas and 8.5 million hectares are land areas. Of the latter, 4.5 million hectares (53 %) are the territories that are part of 31 protected wildlife areas of the State of Chile, which are administered by the National Forestry Corporation (CONAF). (Map N° 1).

Of the total area recognized in Chile as Biosphere Reserves, only 40% are territories part of the National System of Protected Areas of the State, while the remaining 60% is privately owned. (Table N°1)

The land area recognized as Biosphere Reserves (8.5 million hectares), represents 11% of the total area of continental Chile, and are a representative sample of the most important ecosystems in the country; from the far north, where the BR Lauca is located on the border with Bolivia and Peru, to the south end, where BR Cape Horn is located the southernmost in the world, and not forgetting the BR Juan Fernandez Archipelago in the Pacific Ocean.





SURFACE AREA BIOSPHERE RESERVES	Total		ASP		No ASP	
	Ha	%	Ha	%	Ha	%
LAND SURFACE AREA	8.471.915	74	4.548.232	55	3.789.281	45
MARINE AREA	2.967.036	26	0	0	2.967.036	100
<b>TOTAL</b>	<b>11.438.951</b>	<b>100</b>	<b>4.548.232</b>	<b>40</b>	<b>6.890.719</b>	<b>60</b>

Table N° 1 Territorial representation of the BR in Chile

## La Campana - Peñuelas Biosphere Reserve

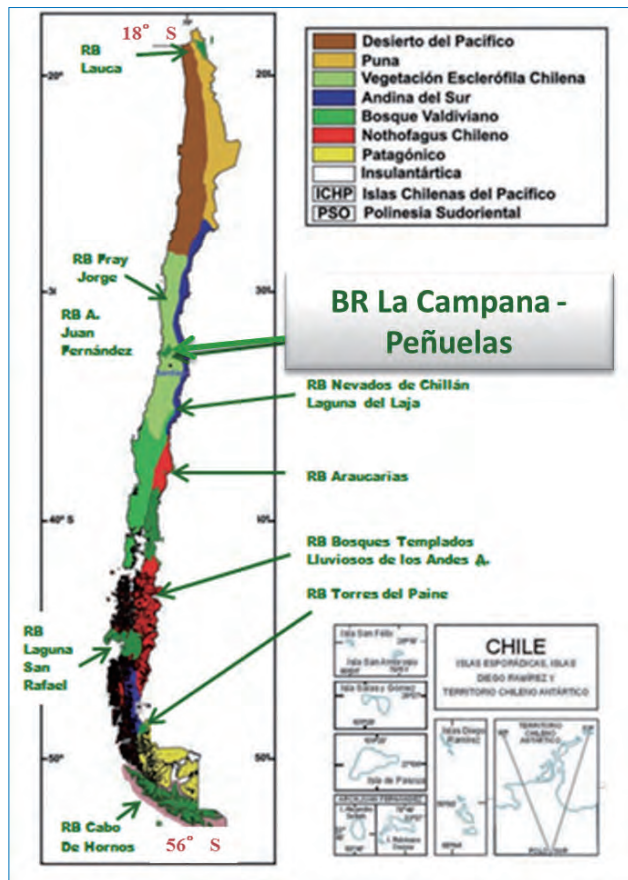
### Physical location and administrative

The Biosphere Reserve La Campana - Peñuelas is located in the central zone of Chile, 60 km from Santiago, adjacent to Valparaiso, the geographical and political center of Chile, between two most populous regions (Valparaiso and Metropolitana). Half of Chile's population is concentrated in these regions. (Statistical Institute of Chile, 2002).

The Reserve protects mainly scrubland of central Chile, one of the twenty five most important ecological regions for biodiversity conservation worldwide (Myres, et al 2000; Dinerstein, et al 1995). About five hundred fifty species of plants are found in the Reserve, including a large number of endemic species. The

main ecosystems in the BR are the formation of Chilean palm (*Jubaea chilensis*) (one of the three most important “palmares” in the country), the “roble” (*Nothofagus macrocarpa*) formation, the most important genus for the subantarctic forest, sclerophyllous woodlands, (the original most extended formation before the human settlement in the central valley) the hidrophyllous forest in the deepest valleys, including important trees like Patagua (*Crinodendron patagua*) and Belloto (*Beilschmiedia miersii*) and the xeric formations.

The BR La Campana - Peñuelas includes Campana National Park, Lake Peñuelas National Reserve and other nature sanctuaries and Priority Sites for Conservation of biodiversity, which are part of the mosaic of Mediterranean ecosystems Chile, recognized worldwide for its high of richness and endemism.



Map 1 Biosphere Reserves in Chile

## Background of the BR La Campana - Peñuelas

### Nomination process

This Biosphere Reserve was recognized by UNESCO in 1984. With nearly 17,000 hectares, it was the only RB in Chile with two separate units, La Campana National Park and the National Reserve Lago Peñuelas. (Map N° 2)

The process of updating the Biosphere Reserve La Campana - Peñuelas, started in 2006, according to the recommendation of the MAB Advisory Committee. The expansion dossier submitted to UNESCO was approved in the N°. 21 session of the International Coordinating Council of MAB, held in Jeju Island, on May 26, 2009.

Currently the BR La Campana - Peñuelas has an area of 238,216 hectares, which corresponds to an area 14 times greater than the original.

The territory currently occupied by the RB -Peñuelas La Campana is divided into eleven municipalities, ten of which belong to Valparaiso Region and one to Metropolitan Region of Santiago. In this area there is an estimated population of 114,000 inhabitants.

This Biosphere Reserve has two core areas, one of which corresponds to La Campana National Park and part of the Nature Sanctuary Cerro El Roble, while the other one area corresponds to the National Reserve Lago Peñuelas. The sum of both core areas reaches 14,603 hectares.

The buffer zone comprises an area of 39,755 hectares and the transition zona has an area of 183,858 hectares, mainly related to agriculture, tourism, forestry, trade and service activities take place. (Map 3)

The same year that the BR was updated, Management Plan BR La Campana -Peñuelas, was approved marking the first Biosphere Reserve in Chile to own a Management Committee and a Management Plan of the territory, which was developed with the active participation of the inhabitants of the territory.

### Ecological Characteristics

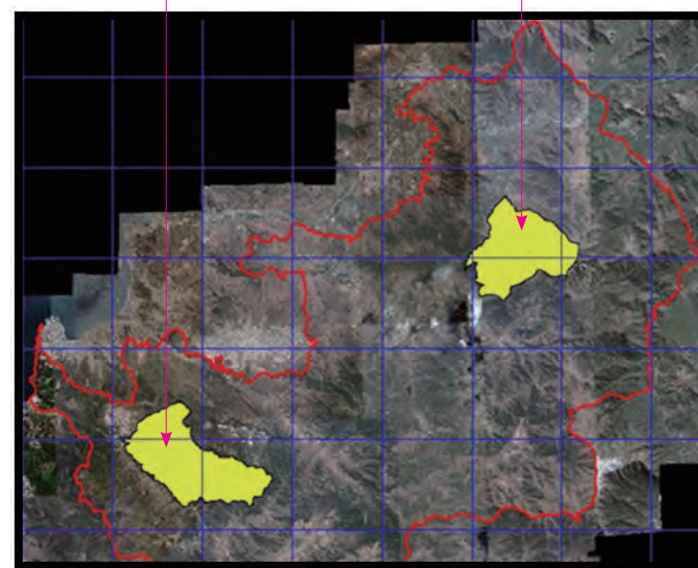
The Biosphere Reserve La Campana - Peñuelas, is located in the quadrant formed at the coordinates 32°44 'S north, 33°23' S south, 71°40' W and 70° 52' W east, in the Region of Valparaiso.

According to the World Wildlife Fund (WWF, 1998), the Biosphere Reserve La Campana - Peñuelas, with its new boundaries, corresponds to the ecoregion of the Chilean Matorral, which represents the transition habitat between the ultra-dry desert of Atacama and the humid temperate forests of the south.

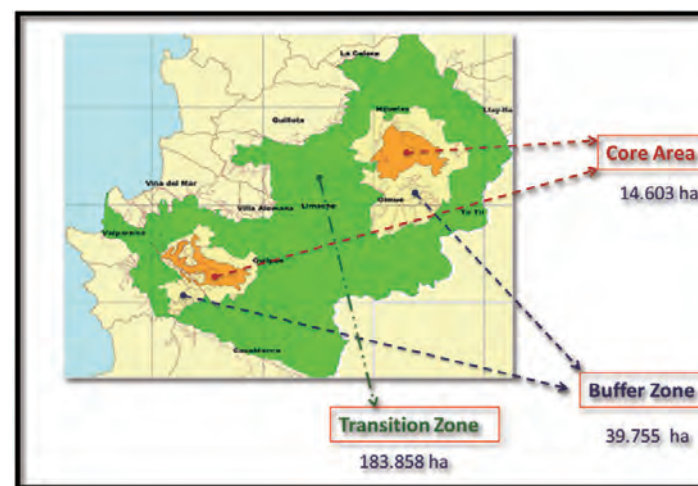
In this ecoregion a very high percentage of plant species, according to various authors, are endemic to Chile (49% and 51%) while many of them are unique species (Montenegro G. et al associations; Mittermeier et al 1999; WWF and IUCN 1997).

Lake Peñuelas National Reserve.

La Campana National Park

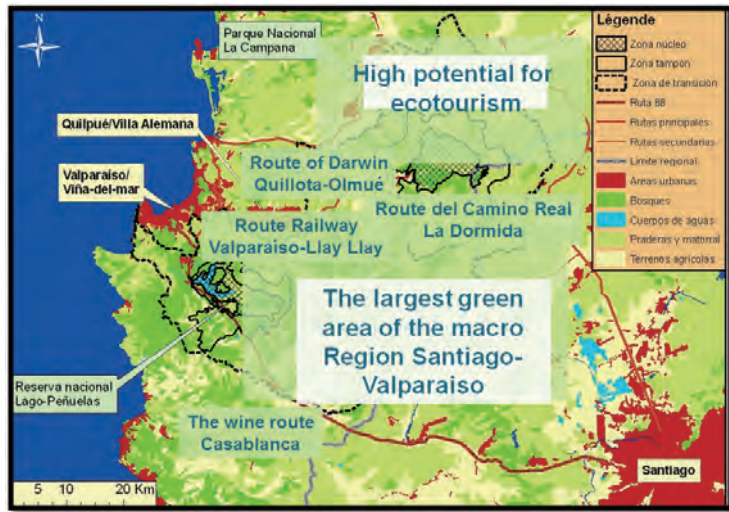


Map 2 BR La Campana - Peñuelas 1984



Map 3 BR La Campana - Peñuelas 2009





Map 4 territory BR La Campana – Peñuelas



Imagen 1

The regions of Valparaiso and Metropolitan Santiago, where is located the Biosphere Reserve La Campana - Peñuelas, are located in the center of the hot-spot “Chilean Winter Rainfall-Valdivian Forests”, one of the 34 biologically richest places yet most threatened on the planet, covering about 39,7142 million hectares in the southern part of Chile and west central edge of Argentina, from the Pacific coast to the peaks of the Andes. (Map 4)

The Biosphere Reserve La Campana - Peñuelas, like the vast majority of Mediterranean ecoregions in the world, are considered the most affected by human impact (Naveh & Dan, 1973).

The territory of the Biosphere Reserve La Campana Peñuelas, updated in 2009, is inserted into two of the eight vegetational regions described for Chile, namely: Region scrub and sclerophyllous forest and Deciduous Forest Region (Gajardo 1993, CONAF 1996), significantly improving the performance of the first, with about 180,000 additional hectares. (Imagen 1)

The area of the Biosphere Reserve is moreover, a very representative sample of the diversity of the landscapes present in the central region of Chile, which is dominated by agricultural areas near to urban areas. The amount of units belonging to the National System of Protected Wilderness Areas by the State, are low, in this area of the Chilean territory.

The presence of native forest into the RB La Campana - Peñuelas increased significantly (over 50,000 hectares) as a result of updating this BR, representing approximately 52% of the current

native forest at all Valparaiso region.

The area in which is situated the updated Biosphere Reserve, is part of the best conserved region within the distribution of native forests in the area.

In the Campana National Park, one of the two core areas of the Biosphere Reserve, is the largest and best preserved “palm grove”. In this park there are 62,900 adult individuals, representing about 52% of individuals of that species (*Jubaea chilensis*), which occupy around 2,764 hectares, representing 33% of the total area of the designated National Park. (Imagen 2)

## Characteristics of territory of the BR La Campana - Peñuelas

**Strong urban influence on the territory:  
Metropolitan Region and Valparaiso Region.**

The Biosphere Reserve La Campana - Peñuelas, is located in an area with strong urban influence. The proximity to the Metropolitan region of Santiago and Valparaiso, the two most densely populated of Chile, with 8.5 million people (half of the national population), generate strong pressure on its territory, for both commercial purposes (mining, agriculture, energy) as well as recreational purposes.

Not always planned growth of urban areas in both the Metropolitan and Valparaiso Region, and the advance of urbanization on rural territory, is seriously affecting valuable natural ecosystems,

which are highly fragmented.

Territory that has a high value and has a high population density

The territory where the Biosphere Reserve La Campana -Peñuelas is located, has the characteristics of climate, accessibility, scenic beauty, among others, which are highly valued attributes for those seeking a new home in areas close to large cities. Moreover the quality of the soil in the area has allowed the incorporation of new crop varieties, which added to the growing range of services for a growing population, plus the proximity and easy of access to ports and airports, make the territory of the BR La Campana - Peñuelas to be located in an area that is a magnet for national and foreign investors.

Metropolitan regions are places where the pressure on the biophysical environment is the strongest and where the issue of sustainability affects more people.

Territory in a major process of desertification.

The territory where is located the Biosphere Reserve La Campana - Peñuelas, is a large area where threats come in the form of drought and poor agricultural or farming practices - clearing, overgrazing, fires, etc. - which results in alarming levels of desertification. In fact, the Norte Chico (regions of Atacama, Coquimbo and Valparaiso) has first priority at national level to activities that

contribute to combating desertification (PANCD-Chile 2003). (Moreira et al, 2014).

### Main economic activities in the territory of the BR La Campana – Peñuelas

Economic activity present in the area of the Biosphere Reserve La Campana - Peñuelas comprises a wide range of companies that are characterized by different magnitudes and a variety of items. Therefore it is possible to find from small craft fairs and farmers, to large companies which carry out different activities, being the major economic activity the service associated to tourism. (Imagen 3)

### Management Biosphere Reserve La Campana – Peñuelas

The Management Committee of the Biosphere Reserve La Campana - Peñuelas, is the highest authority responsible for the administration and management of the territory. (Imagen 4)

This Committee is chaired by the Regional Governor of the Region of Valparaiso, and comprising representatives of the private sector, academic, public and non-governmental organizations, all with a presence in the territory.

The Biosphere Reserve La Campana - Peñuelas has a Management Plan (Plan of Action), which has its origin in a previous diagnosis of the shared reality of the territory, from which lines of action



Imagen 2 (Jubaea chilensis)



Ecotourism Traditional Tourism



Real estate activity Agricultural crops



Imagen 3 (Main economic activities in the territory)





Imagen 4 (The Management Committee of the BR La Campana – Peñuelas)

and activities to the sustainability of the BR and improvement of the quality of life of its inhabitants, thereby complying with the fundamentals of the MAB program.

## Some projects developed in the territory

### New routes for tourism in the BR La Campana - Peñuelas

The Biosphere Reserve La Campana - Peñuelas, since its extension to 2009, has become a new tourist destination thanks to its national recognition. The objective of this project was to identify tourist routes available in the Biosphere Reserve La Campana - Peñuelas and their environment to stimulate the central territory of the region of Valparaiso (Cordillera de la Costa), substantially comprised of communes of rural vocation, through the diversification of destinations linked to nature tourism and special interests. (Imagen 5 and 6)

To achieve the above, the project proposed the creation of a network of public-private cooperation, in order to take actions that allow deepening of tourism, through the design and implementation of new tourism products to develop in The Biosphere Reserve “La Campana-Peñuelas” and emerging destinations.



Imagen 5: Brochures tourism products generated by the project

### Education project on biodiversity in the BR La Campana - Peñuelas.

Pilot project implemented in Biosphere Reserve La Campana-Peñuelas, by the UNESCO office in Chile. This project is developed in two schools located in the buffer zone of the BR, in which the National Forestry Corporation (CONAF) has implemented an environmental education program for several years.

This project, which has two stages, aims to promote the inclusion of education for the protection and valuation of biodiversity as a transversal topic in basic education.

## Project phases

Phase 1. Transversal inclusion of biodiversity related content into teaching in learning processes in 2 selected schools within the La Campana-Peñuelas Biosphere

Reserve.

#### Activities

Mapping of national curriculum to identify entry points for biodiversity related content and learning.

Development of guidelines and exemplary activities on biodiversity learning for teachers (using existing materials as a reference).

Training of teachers on the use of the materials.

Monitoring and support to the implementation of inter-disciplinary activities (inside and outside the classroom) in the selected schools.

Creation of a peer network with teachers of other schools within and close to the Biosphere Reserve.

Phase 2. Educational projects on using the Biosphere Reserve as a hands-on learning site

#### Activities

Identification of potential learning sites within the Biosphere Reserve which allow learning on biodiversity protection and conservation as well as sustainable human and economic development (creation of a map of the “learning landscape”). (Imagen 7)

Development of small educational projects with each school on using the Biosphere Reserve La

Campana - Peñuelas, as a learning site.

Programme diffusion and technology transfer for the marketing of tourism products special interest Olmué territory, under the seal of the Biosphere.

CONAF and the Regional Chamber of Commerce of Valparaiso, promoted the year 2011, an interesting initiative whose aim was to promote sustainable tourism in the territory of the Biosphere Reserve La Campana - Peñuelas.

This initiative was addressed to tourism-related businesses located in the municipality of Olmué, (hotels, restaurants and other service companies) which are located close to La Campana National Park, one of the core of the BR La Campana Peñuelas, in order to improve the supply of tourism products and services related to tourism of special interests, under the seal of the Biosphere awarded by the Institute of Responsible Tourism in Spain. (ITR)

This initiative was aimed at integrate the tourist offer of the territory of the BR, with standards of quality and sustainability, making trade in national and international markets.



Imagen 6: Tourist routes in the territory of the BR

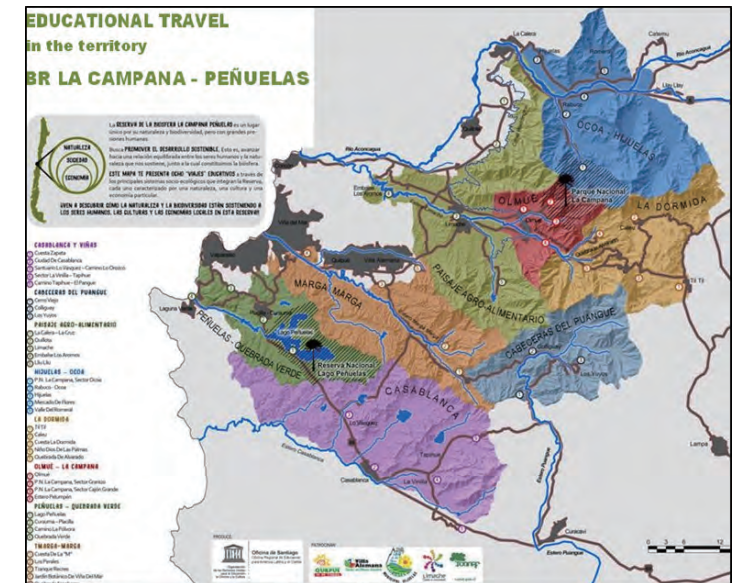
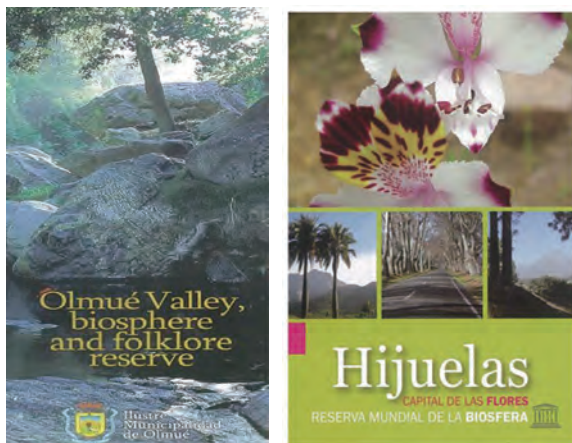
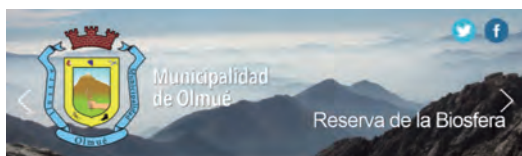


Imagen 7 Educational travel in the territory of the BR La Campana – Peñuelas





Brochures and signage in the territory of the BR



Website of the Municipality of Olmué

## Territorial identity

The update of the Biosphere Reserve La Campana - Peñuelas, generated in the territory a strong identity, particularly in the municipalities, as Olmué and Hijuelas, whose territory is entirely within the boundaries of the BR La Campana – Peñuelas.

## Cooperation Agreements

In 2009 a cooperation agreement was signed between Biosphere Reserves La Campana - Peñuelas (Chile) and Fontainebleau et du Gâtinais (France). This agreement was signed because of the marked similarities between the two Biosphere Reserves, which are located in a complex and extensive metropolitan context.

In the case of BR Fontainebleau, of 150,544 hectares and a population of 267,665 inhabitants, is at 60 kilometers from Paris, France, while the RB La Campana - Peñuelas, of 238,216 hectares, which has a population of 124,083 inhabitants, is located 60 kilometers from Santiago, adjacent to Valparaiso.

The most important points of this cooperation agreement are:

- A work plan co-developed
- Priorities and activities to develop
- Exchange mechanisms such as video conferencing, technical visits, etc
- Exchange of experiences and skills
- Mutual learning to improve the management

of the biosphere reserves in the urban context

## Pending issue

### Governance

The enlargement of the Biosphere Reserve Campana-Peñuelas raises a problem of governance of the territory.

The National Forestry Corporation (CONAF), is the administrator of the protected wildlife areas, which in the case of this Biosphere Reserve corresponds to the core areas (Campana National Park and the National Reserve Lago Peñuelas). However, responsibility for the management of the Biosphere Reserve La Campana - Peñuelas, in the whole territory, is a matter still unresolved.

Despite having been formally created a Management Committee, chaired by the Regional Governor, the highest authority in the region, which is composed of representatives from the public and private sectors, the BR still lacks appropriate governance.

The issue is not minor, because the participation of all stakeholders, especially the Municipalities and civil society is a prerequisite without which there is not effective management, an issue that is relevant to the success of the Biosphere Reserve and one of the requirements of the MAB program.

Considering the special characteristics of the territory of the BR La Campana - Peñuelas, the governance of this becomes a very important issue.

Is currently under working on the creation of a new Management Committee for the BR, with the purpose of define the best possible government for the territory of the RB La Campana - Peñuelas.

- Brand: Biosphere Reserve La Campana – Peñuelas

Valuation of products of the territory

Promotion of the services provided by the population

Enhancing internal and external market

Improve the diversification and complementarity of products and services offered.



Avocado Crop



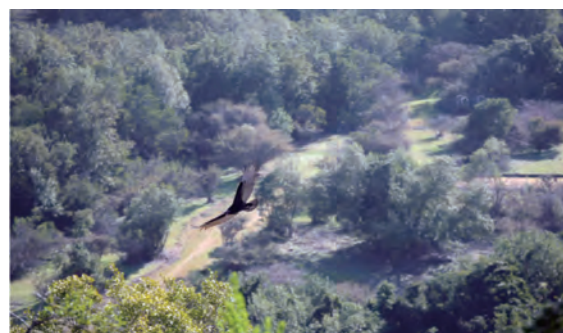
Cheese production



Horseback riding



Hiking



Birdwatching



# Climate change projects and Amazing Places of the Fundy Biosphere Reserve

Megan de Graaf

5<sup>th</sup> Meeting of the World Network of Island and Coastal Biosphere Reserves,  
Attard, Malta, 24-26 March 2015

## Climate change projects and Amazing Places of the Fundy Biosphere Reserve



### Megan de Graaf

Executive Director  
Fundy Biosphere Reserve

The Fundy Biosphere Reserve (FBR) was designated as a World Biosphere Reserve by UNESCO in 2007. It joined a network of 16 Biosphere Reserves across Canada and over 600 worldwide, with an area of over 430,000 hectares of the Upper Bay of Fundy coast in the province of New Brunswick, stretching from St. Martins to the Tantramar Marsh, near Sackville, and inland to Moncton.

For the past few years, the FBR has been leading important work on climate change, gathering and analyzing data on how the climate has evolved and how it will impact our region as it continues to change. The FBR knew that the climate of the region, and the people who worked outside all of their lives, had a story to tell.

From thought-provoking videos on the realities of climate change in our regions and how citizens can play a role in shaping our future, to forests conservation research, our work aims to produce public education materials and important capacity-building resources for our communities, so that they are better equipped to plan for and face climate change.

### Climate Change in Atlantic Canada Videos

Across Atlantic Canada, coastlines and communities are being adversely affected by climate change, and as temperature, sea level and storm surge increase, adaptation initiatives are being planned and implemented to navigate the impending storm.

In 2011, with funding from the New Brunswick Environmental Trust Fund, FBR Conservation Scientist



Ben Phillips began to interview local climate knowledge-holders, such as beekeepers, farmers, snowplow drivers, fishers, gardeners, and First Nations elders. The project also included some climate data (such as temperature highs and lows, snow fall and melt dates, number of drought days, and rain event amounts and duration) analysis to explain these local trends in our weather.

The project rapidly evolved into an exciting collaboration between the FBR and Dr. Ian Mauro, Canada Research Chair in Human Dimensions of Environmental Change at Mount Allison University.

Ben's interviews were documented by Dr. Ian Mauro's multi-media research team, along with other weather and climate related content from Atlantic Canada. Working with Mauro's team, a year's worth of video footage has been carefully assembled into short documentary films, which aim to increase awareness about the real world experiences of coastal communities, and how they are on the front lines of climate change and responding to it.

You can view all the films, and related content, here: [www.climatechangeatlantic.com](http://www.climatechangeatlantic.com).

### The Whitney Journals Documentary Video

All over the Fundy Biosphere, people can become "citizen scientists" by regularly recording nature observations, like the Sussex-based

Whitney family did for nearly 40 years on their farm. The FBR analyzes this data in order to chronicling the effects of climate change on the local environment.

Since 2011, the Fundy Biosphere has been collecting and analyzing citizen-sourced climate data such as family weather diaries, crop records, lighthouse logbooks, and wildlife recordings.

Made possible thanks to funding from the New Brunswick Environmental Trust Fund, the *Climate Change Proxy Materials* project encourages people to become "citizen scientists" by regularly recording nature observations and sharing them with the FBR for analysis, thereby providing communities with knowledge of the effects of climate change at a local level. The project thus approached the topic of climate change from a bottom-up perspective, relying heavily on our most informed elders.

The FBR wanted incorporate the most interesting and relevant results from these data sources into short videos. A first video, *The Whitney Journals* (<https://www.youtube.com/watch?v=hG5DDNmUIXQ>), was launched in June 2013. The video explores nature observations collected by the Whitney family for nearly 40 years and the analysis of these observations as chronicling the effects of climate change on their local environment.

For example, according to the Whitney's'

records, since the early 1970s, the frost-free growing season is now 25 days longer, the breeding season for spring peepers has expanded an extra 29 days, robins are appearing a full one month earlier in the spring, and lilacs are showing a seven day advance in their growing season.

Receiving much praise, The Whitney Journals was on display at the Royal Ontario Museum and secured peer validation through the Phoenix Award by the New Brunswick Environmental Network.

The Fundy Biosphere Reserve hopes to continue building this project in the future with more such citizen-sourced materials. Bottom of Form

Forests of the Future in the Fundy Biosphere Reserve

Since 2013, the Fundy Biosphere Reserve has shifted its climate change work in order to focus on conservation and ensuring forest health in our region. Through our Climate Change Resilient Forest Corridors Project, we have identified climate change-resilient tree species and mapped out where those species are currently located within the Biosphere Reserve.

In the summer of 2014, we planted 2,500 climate resilient trees in key areas in the reserve in order to create forest corridors between the Reserve's protected areas. These corridors will allow wildlife to pass through more easily and also ensure that the forests continue to thrive as

the climate changes.

We also hosted free outdoor workshops, where we presented our research and connected with the public, encouraging communities and local landowners to plant climate resilient tree species on their lands.

We continue to work closely with communities within the FBR. We've hosted open houses and other events to share climate change adaptation expertise and materials and we continue to disseminate our research findings. Many communities in the FBR are developing Green Plans or Integrated Community Sustainability Plans (ICSPs), and can benefit from more information about climate change adaptation planning.

By planning ahead for climate change and planting tree species that have a better chance to thrive, we can help ensure that there will be healthy and beautiful trees in our neighborhoods and parks as well as in the forest, to be enjoyed by generations to come. The FBR issued a pamphlet and technical report containing maps and species' recommendations, which are available at <http://www.fundy-biosphere.ca/en/home/forests-of-the-future.html>.

### Sustainable Development

The FBR has also been working for several years to support sustainable development in the







region, in particular to promote sustainable tourism. To do so, the FBR created the Amazing Places (APs) project in 2010-11. The project was created to encourage sustainable tourism linked to trails, active outdoor exploration, and community capacity building. To do this, FBR staff mapped hiking trails throughout the FBR into one resource (an online and paper brochure) for tourists and for residents. Next, the FBR selected 50 Amazing Places along the trails – lookoffs, remarkable geological features, waterfalls, etc. Next, the FBR created interpretive web pages for each Amazing Place, then produced a Google Earth application to guide visitors, and smartphone-accessible signs were installed at each Amazing Place linking back to the website’s interpretive content.

In April 2014, the FBR enhanced the project with spectacular Planet Earth-style videos to enhance the hiking experience, photos, interpretive material, and hike-planning support ([www.FBRAmazingPlaces.ca](http://www.FBRAmazingPlaces.ca)). The videos profile eight Amazing Places: the majesty of Lavery Falls, the water-sculpted rocks of Moosehorn, the salmon habitat of Black Hole, the Upper Salmon River estuary, the ancient bog of Caribou Plain, the intricate microclimate of Dickson Falls, the backwoods camping at Goose River, and the shorebirds of Mary’s Point.

# The islands of the Iroise Sea biosphere reserve and the French Network of Island and Coastal Biosphere Reserves

Cécile LEFEUVRE



5<sup>th</sup> Meeting of the World Network of Island and Coastal Biosphere Reserves,  
Attard, Malta, 24-26 March 2015

# The islands of the Iroise Sea biosphere reserve and the French Network of Island and Coastal Biosphere Reserves



Cécile LEFEUVRE

Project manager, French marine protected areas agency,  
Iroise Marine Nature Park

## The islands of the Iroise Sea biosphere reserve

The islands of the Iroise Sea biosphere reserve was created in eighty-eight and the review process has been done four years ago. There are three inhabited islands within the biosphere reserve boundaries. Almost one thousand and three hundred people are living on those three islands.

The administrative authorities for the management and the action in the reserve are the Armorique Regional Natural Park and the Iroise Marine Nature Park.

- The core areas are focused on and around the islands of Ouessant, Molène and Sein, and the archipelago of Molène;
- Those core areas are surrounded by contiguous buffer zones;
- Then an outer transition area makes the connection between the islands and links together the insular waters.







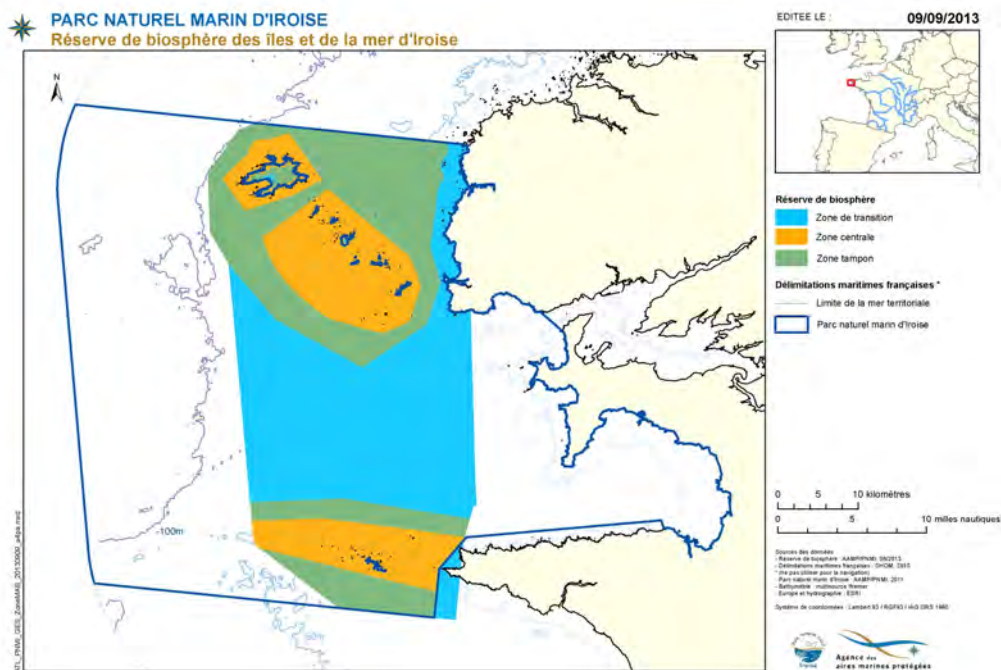
Ouessant



Sein



Molène





In Iroise, we find a mosaic of ecological systems representative of the atlantic biogeographic region and a spectacular species and ecosystem associated diversity, like kelp forests, sea grass beds, seabirds colonies, bottlenose dolphins groups, grey seals, Ouessant Sheep and black honeybee. These species find there all the trophic resources needed in their home range.

The Biosphere reserve is also very important in terms of cultural values and heritage, past and current material or intangible. For instance in Iroise you can find the greatest density of offshore lighthouses in the world. The long story of traditional fishing activities in the area is also an unexhausting source of heritage, etc.

Regarding the first function of the biosphere reserve, our action plan last year focused on the consequences of the winter storms: the shore has been secured and the beaches cleaned up by volunteers and managers of natural areas.

In Iroise, there are several kinds or levels of protection regimes (nature reserve, marine park, terrestrial natural park etc..) that is one of the reason why we have been implemented in that particular area a management policy such as a biosphere reserve. The management plans of the reserve have been fed by the different tools of protection and management and thus became much more consistent.

If you now considering the second major function of the biosphere reserve, we studied last year the feasibility to draw up a project which might possibly interest farmers in coming and taking over farms on the islands for sustainable development purposes. There is no more farming on the islands in Iroise anymore and we are searching solutions to encourage new settlement of insular farmers.

We have protected species, particularly sensitive to human pressure and disturbance. Tourism has negative impacts on seabirds and cetaceans, like terns and bottlenose dolphins. These impacts are mitigated by awareness campaigns and “no go” areas, designed with the involvement of all the stakeholders.

The third function of the biosphere reserve can be shown with the example of Valmer. This research program funded by Europe expected to define the ecosystem services valuation and assessment of the kelp forest in the archipelago of Molène (which is the biggest kelp forest in French waters and the most diverse in Europe).

We also have educational programs for sustainable development and public awareness, about invasive species to inform the inhabitants of the negative impacts of planting exotic vegetation in their home gardens.



Some of the very rich biological diversity



Some of the cultural heritage



## The Biosphere reserve conference

The governance of our reserve is a little bit original and specific. Indeed, there are a lot of different forms of management and coordination structures in Iroise; therefore we have this experience on alternative management methods.

Each year, we gather all the islands of the Iroise Sea biosphere reserve stakeholders: local councils, inhabitants, local environmental associations, scientists, public servants and managers of natural areas for a meeting conference.

The aim is to exchange views about the reserve and what has been done during the year. The meetings are also profitable to build specific projects through workshops, field visits and excellent lunches.

## The French Network of Island and Coastal Biosphere Reserves

The four French Island and Coastal Biosphere Reserves cover two different oceans and the Mediterranean Sea:

- the Guadeloupe Archipelago Biosphere Reserve is localized in the heart of the Caribbean French Antilles;
- Fakarava Biosphere reserve is in the south Pacific and belong to French Polynesia;
- the Fango Valley Biosphere is a Mediterranean Reserve in Corsica;
- and then Iroise is in the north east Atlantic and face the celtic temperate sea.

They are all together under a various range of climatic and ecological conditions and give a good taste of the french coastal marine and overseas biodiversity.

This French network was created last year. The aim is to go further in the exchange of experience and experiment between Island and Coastal Biosphere Reserves and implementing joint projects dealing with islands or insularity



interests. Our first work session is scheduled to take place in Corsica in April 2015.

In this network, there are a lot of mutual concerns with the islands' specificities, and probably realities of your own reserves too, like:

- Adaptation frameworks for climate change and sea-level rise impacts on coastal zone;
- The land-sea interface: coastal activities, water quality, etc.;
- Threats to the island biodiversity: evaluation of increasing pressure on natural environments, invasive species, disturbance and overfishing and the best ways to mitigate them;
- The sustainable economic development of small insular communities: geographical remoteness, housing, demography, employment, etc.;
- The issues of air and water pollution, waste and energy use;
- Conserving all forms of cultural heritage, including the intangible one: language, music, dance and recipes;
- Pupils Education.

## Contacts list

- The islands of the Iroise Sea biosphere reserve: biosphere-iroise@mab-france.org
- Fango Valley Biosphere Reserve in Corsica: innocenzi.julien@gmail.com
- The Commune of Fakarava Biosphere in French Polynesia: miri.tatarata@environnement.gov.pf
- Guadeloupe Archipelago Biosphere Reserve In the heart of the Antilles: daniel.silvestre@guadeloupe-parcnational.fr

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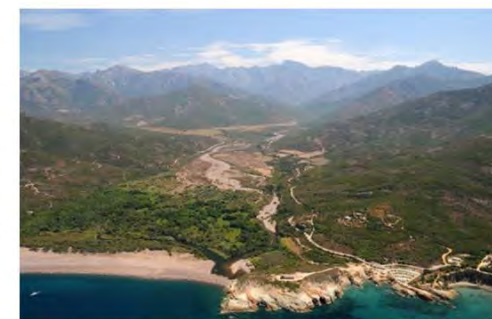
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Guadeloupe Archipelago Biosphere Reserve  
In the heart of the Antilles



The Commune of Fakarava Biosphere in  
French Polynesia



Fango Valley Biosphere Reserve in Corsica

+ Iroise

# THE FUTURE UNESCO BIOSPHERE RESERVE OF FAJÃS DE SÃO JORGE, AZORES, PORTUGAL

Hernâni Jorge  
Emanuel Veríssimo  
António D Abreu



5<sup>th</sup> Meeting of the World Network of Island and Coastal Biosphere Reserves,  
Attard, Malta, 24-26 March 2015

# THE FUTURE UNESCO BIOSPHERE RESERVE OF FAJÃS DE SÃO JORGE, AZORES, PORTUGAL



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## Introduction

The Archipelago of the Azores lies in the mid Atlantic, comprising nine volcanic islands, located roughly between 37° and 40° north latitude and 25° and 31° west longitude.

The Azores is Portuguese autonomous region with a population of 244,780 people (2008 data).

The islands of the archipelago are divided in three geographical groups: the Eastern Group, comprising Santa Maria and São Miguel, the Central Group, including Terceira, Graciosa, São Jorge, Pico and Faial, and the Western Group, composed by Corvo and Flores. The Azores, along with the archipelagos of Madeira, Canary Islands and Cape Verde, constitute the biogeographic region of Macaronesia.

Positioning systems find the nine islands of the Azores in the North

Three of the islands are already UNESCO Biosphere Reserves – Corvo, Graciosa and Flores and São Jorge is preparing the application to become also a UNESCO Biosphere Reserve. This application will be submitted during 2015.

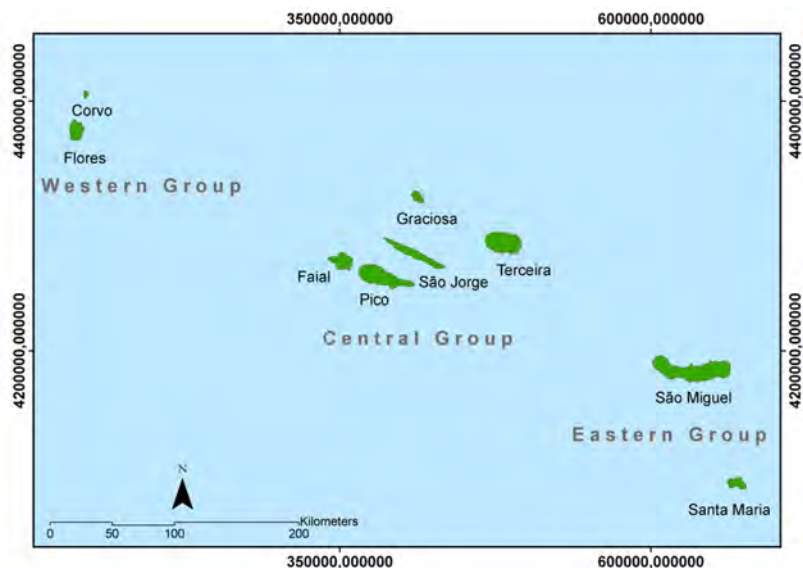


Fig. 1 – Map of The Azores Archipelago



Fig. 2 – logo of the future Fajãs de S. Jorge UNESCO Biosphere Reserve

## The future UNESCO Biosphere Reserve of Fajãs de São Jorge

São Jorge is one of the central Islands of the Azores archipelago. It has a length of 54 km and a maximum width of 6.9 km, featuring a long volcanic ridge stretching from northwest to southeast. The area of the island reaches 243.9 km<sup>2</sup>, and it is the home to 9.171 inhabitants (2011 data). The highest altitude is 1,053 m at Pico da Esperança.

One of the main topographic characteristics of S. Jorge are the Fajãs. The Fajãs, are flattened surfaces formed near the sea and framed by more or less imposing cliffs, resulting either from lava flows that entered the sea (such as Fajã dos Bodes e de São João) or from the detachment of land and rocks from the cliffs (as is the case of Fajã dos Vimes) due to earthquakes, heavy rain or some other instability that affected the cliffs.

### Natural features and protected areas

The Island of S. Jorge shows a high level of endemic and indigenous Biodiversity, encompassing 1 mammal, 9 birds and 25 terrestrial molluscs endemic species. 10 sea bird species are known to breed in São Jorge that, together with a high number of migratory species turns S. Jorge an hot spot for bird watching, including European and American species

together with the indigenous and endemic ones.

S. Jorge has two RAMSAR sites: Planalto Central (Pico da Esperança) and the Fajãs das Lagoas de Santo Cristo e dos Cubres, 3 Natura 2000: 1 - Ponta dos Rosais; 2 - the NE coast and Ponta do Topo and, 3 - Ilhéu do Topo e Costa Adjacente.

S. Jorge has also an Island Natural Park, covering a significant area of the island and comprising 13 sub types of protected terrestrial and marine reaching a total of 75,93 Km<sup>2</sup>. 23,29 % of the terrestrial surface of the island is under the Island Natural park while the marine protected areas reach 14, 42 Km<sup>2</sup>. Since 2013, S. Jorge has 5 geo--sites integrating the European and Global Geo-park networks.

### Socio - economy

The main economic activities are farming, livestock, fisheries and tourism. The Cheese from S. Jorge is a well-known international brand as well as the tuna fish industry provides gourmet products internationally recognized by the quality and sustainable use of traditional techniques and knowledge.

From the cultural and heritage point of view S. Jorge has a vast historical heritage linking religious, gastronomy and building peculiar aspects unique to the Island.

The Festas do Divino Espírito Santo in the Azores are a main event since the early years of





Fig.5 – The topography of S. Jorge Island

promoter of the future Biosphere Reserve in cooperation with the local municipalities, non governmental organizations, research institutions, academia and public in general. The application process is being developed under a participative approach engaging and motivating the participation of all local and regional relevant stakeholders as well as in cooperation with other Biosphere reserves, from the Azores and other countries. S. Jorge promoted already a meeting of the REDBIOS network and the participation in the Malta meeting of the Global Network of Island and Coastal Biosphere in Malta is also part of the commitment of S. Jorge to be an active partner of the MAB world network.

The main development objectives of the future UNESCO Biosphere reserve f fajãs de S Jorge are the following:

- Contribution to the sustainable development
- International promotion of Biosfera Açores brand
- Capacity building – schools, administration, NGO's, companies, people
- Networking with other BR's (WNICBR, REDBIOS, IBEROMAB; EUROMAB);
- Investment attraction;
- Promotion of research and development;
- Added value to life and economy of people and communities of S. Jorge Island



# Urdaibai Biosphere Reserve (Basque Country)

Paula Caviedes  
Manu Monge-Ganuzas

5<sup>th</sup> Meeting of the World Network of Island and Coastal Biosphere Reserves,  
Attard, Malta, 24-26 March 2015

## Urdaibai Biosphere Reserve (Basque Country)



Paula Caviedes  
Manu Monge-Ganuzas

Photographs: Technical Service of the  
Urdaibai Biosphere Reserve and Jon  
Maguregi.

### 1. General Characteristics

Urdaibai was designated as a Biosphere Reserve on December 16, 1984, and its estuary was added to the list of Ramsar Wetlands in 1992 by the Ramsar Convention. Under the EU Protected Areas and Ecological Networks, several places within Urdaibai were designated bird sanctuaries (ZEPA ES0000144) in 1994, including its river network (ZEC ES 2130006) in 2013, the estuary and coastal areas (ZEC ES 2130007) and the Cantabrian Oak forest (ES 2130008).

It is located at the southeast of the Bay of Biscay in Bizkaia province, consisting of 22 municipalities that occupy an area of 220km<sup>2</sup>, 10% of which belongs to the Basque Autonomous Community. Its geographical area is bounded by the Oka River and its tributaries, Artigas and Laga Rivers, which flow into the Cantabrian Sea (Figure 1).

The Oka River, bordered by a gallery forest, is the landscape designer. Human activity is developed along the hillside and valley bottoms. This territory design is a mosaic of diverse landscapes with oak and indigenous forests, grasslands, agricultural crops and especially tree crops (Figure 2). On the valley floor is an interesting estuary of which the dynamics is determined by waves, tides, and wind and river currents



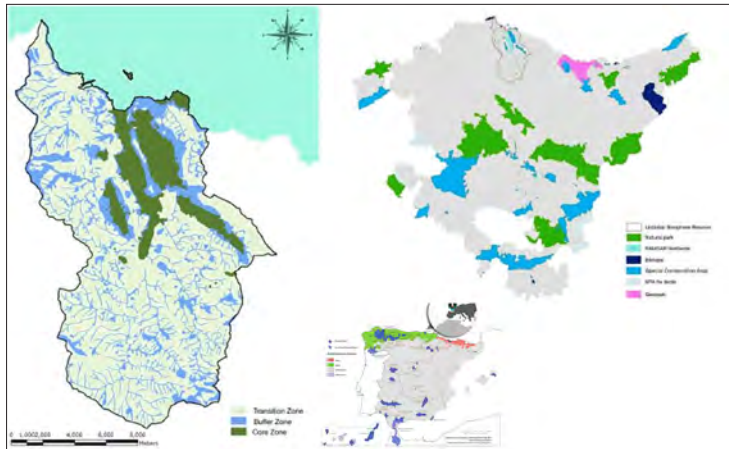


Figure 1



Figure 2



Figure 3



Figure 4

(Figure 3). The Artigas and Laga rivers also located in the Biosphere Reserve flow directly into the open sea, separated from the estuary along cliffs that line the bay. Spectacular limestone karst forms on which well-preserved Cantabrian holm oak (Figure 4) is situated are very important assets in the area.

Urdaibai has a population of 45,000, of whom about 80% are concentrated in the towns of Bermeo and Gernika-Lumo. The two constitute an axis along which the main roads and commercial networks intersect. They have separate socioeconomic characteristics relating to their different geographic locations and the historical trajectory. Bermeo keeps its fishing and canning tradition (Figure 5) while major economic activities in Gernika-Lumo are industry and services. The population in the rest of the municipalities of Urdaibai is less than 2,000, some of whom work in the agricultural and livestock sector (Figure 6) while others in the coastal areas mostly rely on the summer tourism.

## 2. Natural Heritage

The Urdaibai Biosphere Reserve contains a great diversity of natural habitats: mountains, deep valley, meadows, marshes, beach sands, cliffs and beaches. Also,



its estuary, the karst and the coastline are other key natural heritages. Alongside these ecosystems, an agricultural system has developed around traditional farming villages (Figure 8), towns and cities.

In Urdaibai natural communities can be distinguished as hardwood forests, thickets, meadows, rocky land, plus aquatic and shoreline vegetation. There are also plantations growing in the forest and grasslands. Only within the group of vascular plants, 615 species have been recorded and described.

The Cantabrian holm oak forest features its special values in terms of rich diversity of botanical species (Figure 9). In addition the uniqueness of the estuarine vegetation has gained international recognition as an important natural and scientific resource.

The diversity of habitats of Urdaibai determines the existence of a variety of wildlife: birds, mammals, amphibians, reptiles, insects, fish, mollusks and crustaceans. The estuary is a valuable place for migratory birds (Figure 10) as well as for breeding, sedentary wintering birds. In addition to the birds, there is a balanced presence of other vertebrates including the European mink (*Mustela Lutreola*). The vertebrate fauna total 318 species.

Urdaibai has an interesting geo-diversity illustrating a part of the history book of the earth written in rocks from the Triassic (251 million years ago) until the Quaternary (2.6 million – current) periods. There are some 43 important geo-sites including fossil reefs, estuaries, turbidity currents, relics of ancient volcanic stages, and other interesting outcrops from the Cretaceous-Tertiary, etc. (Figure 11).



Figure 5



Figure 6



Figure 7





Figure 8



Figure 9



Figure 10



Figure 11

### 3. Cultural Heritage

Urdaibai was inhabited from about 15,000 years ago. This ancient relationship between human beings and Urdaibai is evident in archaeological sites such as Santimamine (Kortezubi) (Figure 12) in the defensive forts of Illuntzar, Arrola, and Kosnoaga mountains, the ancient Roman town of Forua (Figure 13), tower-houses in Madariaga, Montalban and Urdaibai, and medieval castles like Erenozar. These medieval buildings are witness to the importance of Gernika-Lumo as headquarters of the Assemblies of Bizkaia and the “passage of vow” and the Camino de Santiago or the wine and fish route.

From the sixteenth century to the mid-twentieth, the Urdaibai economy was based on agriculture and livestock, which helped shape the typical landscape of Basque villages. Industrial activity in mills and foundries in this period partially changed river channels (Figure 14) and the coast. Meanwhile, fishing in the ports of Bermeo, Mundaka and Elantxobe generated wealth. It also began to develop a major forestry activity that continues to this day. Interestingly, traditional silvopastoral practices in Urdaibai have endured over the centuries.

Also, there are noteworthy rural sports

customs and rituals such as Marijesiak in Gernika-Lumo and Muxika, Atorrak in Mundaka, the Feast of the Magdalene in Bermeo and Ibarrangelua, or the burial of Saragi in Muxika.

There are also agricultural fairs such as the last Monday party in Gernika-Lumo (Figure 16), and fishing fairs like Arrain Azoka in Bermeo.

Urdaibai is also one of the areas of Bizkaia that has transmitted the ancient Basque language, Euskera, one of the oldest languages in Europe, from generation to generation.

#### 4. Socio-economy

In recent years (2006-2015), the population of rural areas in Urdaibai has increased about 8% although there is a high rate of aging (21%). From 2008 to 2010, there has been a slight decrease in the socio-economy activity rate (-5%).

In the tertiary sector is 67% of the population working, and 29% works in industry and construction and 3% in the primary sector. Although the primary sector is relatively important, it has seen a gradual reduction in the number of livestock farms and arable hectares. However, the area devoted to organic farming is on the rise.

About 1,000 residents have jobs in fishing (80% of the primary sector), but the industry is shifting

to lower economic value species (mackerel and bonito). The catches of bonito only accounts for 62% of the total income and mackerel 34%.

Regarding the distribution of establishments by sector: industrial establishments account for 8%, construction 15%, and hotels and restaurants 9.9%. Urdaibai is characterized by small establishments, in which about 13,000 residents are employed.

### 5. Contribution of Biosphere Reserves to Sustainable Development

Like other Biosphere Reserves, Urdaibai is divided into three zones: 1. a core area which covers the coast, the estuary, the Cantabrian holm oak, and archaeological sites, whose basic objective is to preserve places of natural value; 2. a buffer zone which contains areas of coastal protection and the oak and river network and develops activities compatible with conservation purposes; and 3. a transition zone where ways are promoted and put into practice to utilize resources sustainably. That consists of forest areas, rural villages and scattered hamlets.

Like other Biosphere Reserves, Urdaibai management develops around three functions: conservation, sustainable development and logistical support (research, interpretation, education and capacity building). These three



Figure 12



Figure 13





Figure 14



Figure 15

functions are implemented through action plans that are currently being reviewed and updated.

Urdaibai has legislation that stipulates and regulates the protection and sustainability criteria of land use. On the other hand, it has planning documents for each of the three functions assigned to the Biosphere Reserves.

Regarding the role of conservation, it should be mentioned that the important work has been carried out over the last years, both in its preventive aspect by applying the rules provided in the legislation and the Key Urdaibai Development Plan, and through the implementation of environmental restoration projects in the areas of greatest natural value.

An important milestone for sustainable development was the adoption of Regional Agenda 21 (PADAS) in 1998. This Plan was a major effort of participation, coordination and consensus between public and private sectors in Urdaibai to undertake the function of sustainable development under the Agenda. It also should underline the progress made with regard to promoting the use of renewable energy and ecotourism through the creation of nature observation centers: Torre Madariaga, (Figure 17), wildlife observatories in San Kristobal and Matxixako, Urdaibai Bird Center (Figure 18) and road cleanups (Figure 19).

Urdaibai also wants to be a place of learning for

achieving sustainable development. To do this, it has been conducting research in collaboration with the UNESCO Chair on Sustainable Development and Environmental Education of the University of the Basque Country (UPV/EHU). In this sense, there are countless conferences, training courses, exhibitions and publications carried out at the headquarters of the World Network of Biosphere Reserves with the aim of spreading knowledge and contributing to the flow of trade and communication with the public.

## 6. Outstanding Activities in relation to management in the Urdaibai Biosphere Reserve over the past 15 years.

### 6.1. Introduction

All the projects implemented by the technical service of the Urdaibai Biosphere Reserve are based on three pillars: 1. the implementation of the actions in the projects aimed at conservation and/or restoration of nature, sustainable economic development, and research, interpretation and sustainability education; 2. monitoring, study and scientific evaluation of the degree of compliance and success of such activities; 3. conducting promotion of the objectives, methodologies and results of the projects to different communication levels, from the scientific and education communities to the general public.

This approach is considered particularly interesting because it corresponds fully with the principles of action of the World Network of Biosphere Reserves: conservation, development and logistical support.

These projects are aimed at the conservation of ecosystems in some cases, and environmental restoration in other cases. They also purport to add value to these ecosystems by promoting the compatibility of public use and the good health of ecosystems by setting out the limits of their capacity. It starts from the conviction that the natural environment provides a range of services to humans that can serve as an engine for economic and social development of the territory. Finally, it is considered essential to the understanding of environmental and human factors that influence the system because what is not known is not valued and therefore hardly managed properly. The understanding can be obtained through scientific approach from several perspectives including environmental, social, economic, etc. This monitoring and evaluation of project management is the basis for planning, implementation and further development, and becomes evaluation criteria. It also establishes corrective management projects based on the criteria that had previously been ignored. The knowledge generated must be transmitted to society at the scientific, educational and civic levels. To do this, each project from its initial stage incorporates a series of communication

techniques, from the publication of scientific articles in international, national or regional magazines to the creation of educational materials focused on formal or informal education or recording radio segments, appearances on TV programs, writing articles in newspapers, designing and publishing applications for mobile phones, etc.

## 6.2. Restoration projects of the dune systems of the beaches of Laida and Laga (2000-2007).

Urdaibai estuary is the largest (1,015 ha) and best-preserved along the Basque coast, with an excellent variety of habitats and phytocoenoses some of which are very exceptional. The estuarine habitat and specific communities have made a phenomenal development in terms of diversity and extension, covering a comprehensive spectrum from seawater to freshwater. The estuary area where the Laida sand dunes and adjacent Laga beach are situated includes the Urdaibai ZEC coastal marsh (ES 2130007) and ZEPA Urdaibai rias coast (ES 0000144). The representation of the dunes in Urdaibai (13.3 ha) accounts for the most extensive Basque coast set. According to the Protected Areas and Ecological Network in EU, the Basque County has wetland sand dunes of 32.2 ha, among which Urdaibai dunes represent 41.3%. The sand dune ecosystems along the Basque coast are extremely scarce, and have been shrinking.

The restoration of the dunes of Laida and Laga



Figure 16



Figure 17





Figure 18



Figure 19

(Ibarrangelua) contributed to about 7 hectares added to the extent indicated above, therefore having a significant impact on the recovery of these ecosystems. Laida Beach is located on the right margin of the mouth of the ria, and Laga beach, east of the Laida, is surrounded by two capes. Among the habitat recovered, 50% is mobile coastal dunes with *Ammophila arenaria* (code 2120), which is an invasive species, and the rest is shifting dunes (code 2110) with indigenous vegetation and fossil dunes (code 2130).

The biggest threat on existing dune habitats - reduced but potentially recoverable - is the intrusion of beachgoers, destroying the morphology of the dunes and vegetation and preventing natural regeneration. On the other hand, they are influenced by both natural and anthropogenic factors that prevent the configuration of mature dune ecosystems. Besides factors linked to human use there can be huge impacts from wind (in the absence of obstacles that capture transported sand), catastrophic sweeping away of sand by heavy rain storm, or tidal waves. Thus, unstructured dune areas develop and accumulations in formation can be lost, which reduces a sand's dune ability to remain and affects the hydrodynamic balance of the rias coast.

These factors and the existence of an extensive dune area in Laida in the first half of the twentieth century led to the execution of a pilot test in 2000, subsequently expanded in 2001-2003, placing

sand collectors and planting dune crop species. The results, recognized by rigorous scientific study, were encouraged to extend the project to a much larger surface area (2004-2007), which was undertaken with the support from LIFE-Naturaleza, a financial enterprise of the European Union.

The overall project objectives were: 1. restore coastal habitats on the beaches of Laida and Laga; 2. put recreational use and management of the beach in order without jeopardizing the habitat; 3. raise awareness of the beachgoers on the importance of dune ecosystems which should be maintained and respected; and 4. set a precedent for future interventions in similar situations.

As for the socio-economic context of the project area, it is important to point out the intensity of the massive presence of visitors at Laida and Laga beaches in summer (up to 30,000 in a single day). The large population influx to the area could contribute to the economic activity in a positive way, but in order to maintain tourism sustainability a well-structured regulation should be enforced to maintain order and put a limitation on the use of space.

Thus, following the criteria established by the monitoring and scientific assessment carried out, we created dune environments in places where they had existed previously, and enriched the dune ecosystem rather than losing it (Figure 20).

Nearly 15 years after the project began, staying for about 8 years in perfect condition after the restoration, unfortunately, the dunes of Laida beach were eroded by an extended spate of intense bad weather from 2009 to 2015, mainly in 2013, which led to the disappearance of the entire upper area of the beach. Nevertheless, activities for information distribution and public awareness have been successful because citizens and visitors in the Biosphere Reserves have learned much about the importance of these ecosystems with the restoration project for dune ecosystems, after projects at many beaches of the Basque and Cantabrian coast. In addition, it is quite encouraging that it has generated valuable scientific information about the functioning of these ecosystems and changed the social perception to them throughout the project.

On the other hand, dune systems are in good health on the beach of Laga, although it is still necessary to perform various actions related to the withdrawal of settlements and the management of public use in certain sensitive areas of the dune system.

### 6.3. Environmental restoration of the upper estuary of the Oka (2009-2016).

The project area, which covers the upper Oka estuary in the municipalities of Gernika-Lumo, Arratzu, Kortezubi, Forua and Murueta, has since the sixteenth century undergone various human

activities including marsh drainage schemes for agriculture and the artificial channeling of the river channel passing through the upper estuary. It contributed to the degradation of natural ecosystems in the upper estuary and isolated this tidal area. In addition, around 1970 they abandoned cultivation in the area, causing the expansion in recent decades of an invasive exotic plant, *Baccharis halimifoli*, to the neighboring areas and total loss of function of this important natural heritage in the upper estuary of the Oka river.

The comprehensive restoration and enhancement of the natural and cultural heritage of the upper estuary of the Oka river has such objectives as the partial recovery of its water functionality and the restoration of its fluvial-estuarine habitats so that they can support the important biodiversity of the area, encourage and promote knowledge, enjoyment and accessibility to this area of special environmental value, and organize regulated visits to this area.

With the primary goal of restoring natural ecosystems and as an adaptation measure to climate change that is occurring around the planet and contributing to a rise in sea level of 2 mm a year in this coastal area, the project includes, among other actions, eliminating several artificial banks that prevent flooding of these ancient marshes and wetlands, creating brackish marsh that will ensure the inflow of sea water, curbing the spread



Figure 20



Figure 21

of invasive exotic plants, restoring functionality as an estuary and ultimately their fluvial-estuarine habitats and supporting the important biodiversity of the area.

The project will also reorganize existing paths in the area and interconnect them so that visitors can learn, enjoy and easily access this area of special environmental value, carrying out environmental education and green tourism as a means to develop the Biosphere Reserve while regulating traffic and promoting the need for that. (Figure 21).

The environmental values include the interesting biodiversity they harbor in different environments of the estuary, highlighting some animal species such as European mink, the spoonbill, the stickleback and the osprey. As for the vegetation, the upper estuary is an interesting example of species adaptation to the conditions of flooding and salinity, as well as an example of coexistence with human uses of the territory. A variety of configuration of land is shown from reeds, bulrushes, and halophytes linked to the marsh and the estuary, to forestry and agro-forestry landscapes which highlight the Cantabrian oak, meadows and pastures.

Additionally, the project provides scientific observation and evaluation in continuous monitoring, obtaining the information necessary for evaluation and even the implementation in

other environmentally degraded areas as well as the Urdaibai Biosphere Reserve.

The project has restored the Barrutibaso environment and functionality of the old bed of the Oka river as it passes through Forua by removing existing power lines on the right bank of the ria waterway, improving a 14-km network of paths and connecting the two sides with a pedestrian trail and cycle path.

In addition, with the aim of promoting the important heritage of this area, various resources for interpretation and outreach have been created together with the promotion of ecotourism. They include not only videos, panels, interpretive brochures and educational materials, but also applications for mobile phones that provide information on habitats, species and culture, allowing a self-guided type of travel for users to walk along small paths through the upper estuary.

A network of paths has been set up, receiving a large public influx, and informative tools are available to the visitors along the paths as well as in the schools and on web pages and in app downloads.

Now, a pending issue is requisite authorizations to replace artificial banks with sea water wetlands.

**6.4. The project to reintroduce the osprey (2013-2017).**



Osprey (*Pandion haliaetus*) is a raptor that arouses much interest due to its presence in Europe and North America and conditions suffered by their populations as a result of the intensive use of pesticides. On the Iberian Peninsula it became extinct in the early 1980s, but thanks to reintroduction programs several pairs did successfully breed in Cadiz and Huelva. Globally, osprey is included in the category “of least concern”, while at European level, the species is evaluated as “rare” in a status of “unfavorable” conservation.

The Urdaibai Biosphere Reserve is one of the places in the north of the Iberian peninsula where every year a large number of this species are observed, especially during migratory periods. The observation of many ospreys that arrive for several days is an indication of the adequacy of its estuary and adjacent forests. The suitability of this area is supported by the fact that they inhabit there and are observed to be actively catching fish during the migration period. Osprey reproduction is a part of the objectives set in the conservation measures of the EU Protected Areas and Ecological Network for the Urdaibai Biosphere Reserve.

The osprey is one of the most spectacular birds to be seen in the Urdaibai Biosphere Reserve since it is a kind of “flag” bird and a popular, charismatic species. As a nesting species, its recovery helps raise environmental awareness and enhance the

choice of the Urdaibai Biosphere Reserve as an ecotourism destination (Figure 22).

The system employed is the translocation of offspring from another region and maintenance to the point of release. The translocated ospreys are taken to artificial nests where they are fed; they remain in the artificial nests until they can fly and are then released. During the stay and the pre-migration period the ospreys become used to the area. As a result they will consider the release site as their home area and orient their homing instinct back to Urdaibai, due to intense philopatric nature that characterizes the species.

Given the extent of the estuary of the Oka river, extensive forest cover and the wide availability of prey, it is estimated that Urdaibai could provide a capacity for 8-10 breeding pairs. The current lack of suitable places for nest building could be a factor limiting this potential, but it will be corrected by extending the program of installing artificial nests.

The reintroduction project is carried out together with an outreach and environmental education program equipped with the following objectives:

1. convert osprey as a dynamic element, by which schools create environmental education processes in line with the recovery projects in Urdaibai, to deepen knowledge about bird migration, especially to support the knowledge of the most



Figure 22

common migratory birds and our environment; 2. involve schools in the process of this experience, not only with environment centers nearby but with other human communities in Europe and Africa, promoting language immersion schools through exchanges of experience between countries regarding recovery programs or osprey conservation; 3. become familiar in the use of new technologies by performing jobs and interacting with students from other countries; 4. create teaching tools about osprey with updated versions that will be distributed to each educational institution, encouraging more participation into the project in different ways; 5. promote awareness regarding the conservation of water birds in Urdaibai while making environmental education a strategic project to support the osprey recovery initiative of Urdaibai Biosphere Reserve.

To do this, the following activities will be carried out: 1. hold forums for informative talks among schools within the Urdaibai Biosphere Reserve; 2. distribute promotional books with similar contents consisting of three chapters to schools, community centers and city halls; 3. establish a website containing all relevant information about the osprey and the Urdaibai project; 4. collaborate with schools in other countries with regard to the Linking Schools and Communities project led by the Osprey Migration Foundation; 4. publicize the different phases of the project through local and state media (arrival of the specimens, release, monitoring, return,

nesting, etc.).

#### 6.5. Collaboration with environmental volunteer associations and land stewardship (2002-).

To do this, sustainable management of private land is carried out through the implementation of administrative processes such as donation, cession, renting or buying, as well as sustainable management of the public land through grants or consortia. Thus, efforts are under way for the recovery of threatened species through the implementation of recovery plans, and comprehensive research and outreach activities are under way intended to promote awareness for nature conservation.

Currently, part of the resources managed by the administrations is directed to meet those purposes, but the actual preservation of our environment requires the participation of different social entities, public or private. This new sensibility is reflected through personal commitment that many people have made, including members or volunteers of NGOs and other associations working for the conservation of nature and the environment.

Especially important is the role the private sector has begun to play in achieving these goals, making more efforts at the points where government administration fails. It is true that various non-profit associations and foundations

have raised funds and utilized private means toward actions to protect the natural environment.

The Urdaibai Biosphere Reserve is encouraging these activities through the support of voluntary activities and land stewardship, which have served as an example across the Basque region.

Among these actions carried out by these entities is the work of Urdaibai BP by the Lurguia Foundation, which since 2002 has restored a total of 79 forest plots (1,000 km<sup>2</sup>) through land stewardship, of which 34 are included in EU Protected Areas and Ecological Network (Figure 23). They have also participated in other restoration projects and environmental protection projects.

## 6.6. Geo-diversity Strategy and Geological Heritage (2010-2018).

In order to value the geological heritage of the Urdaibai Biosphere Reserve and promote strategic planning on geo-diversity of the Basque Country, it was decided to develop a Strategy for Geo-diversity in Urdaibai to address the preparation of the Geo-diversity Strategy of the Basque Autonomous Community.

The Basque Government commissioned the development of a strategy to the University of the Basque Country through the Urdaibai Biosphere Reserve Technical Office. The objectives were:

1. conduct an inventory of geo-sites (LIG);
2. plan and implement an institutional policy and a model of integrated management of geo-diversity;
3. ensure the conservation and protection of geological heritage and geo-diversity;
4. promote education and training for the conservation and sustainable use of geo-diversity;
5. promote the sustainable utilization of geo-diversity and promotion of geo-tourism; and
6. evaluate the actions proposed in the strategy and implement follow-up measures.

To accomplish the first objective, a methodology was applied for selection and assessment of geo-sites, developed by a working group at the University of the Basque Country, and then it created an inventory of 43 geo-sites in the area of the Urdaibai Biosphere Reserve.

The general inventory attempted to differentiate the actual value of each geo-site regardless of the purpose of usage. The aspects of their fundamental values were their intrinsic (scientific) values and their potential usage: instructive-informative and tourist-recreational purposes.

Information on fragility, vulnerability and risk of degradation was necessary for the Biosphere Reserve to assess the need for protection regarding the value deemed for each site.

What should be considered in setting up the



Figure 23





Figure 24



Figure 25

geo-sites inventory is, it should be useful, practical and easy to implement yet provide all essential information. From such an inventory one can extract the information of interest to develop further specific inventories depending upon the goals outlined in later phases including protection, geo-tourism, rural development, etc.

The vast majority of geo-site materials in the Urdaibai Biosphere Reserve are related to Cretaceous and Quaternary age. It is an area with a well-developed plant cover, and the best outcrops, consequently, the highest concentration of geo-sites, are located in the coastal strip along either side of the central axis which is the estuary. Most notable in this area are flysch type deposits; facies of marine carbonate platform, rich in fossils and with various sedimentary structures, and especially coastal dynamics modeling the area. Noteworthy are the estuary, beaches and the sandbar of Mundaka, a well-known destination for surfers from around the world, possessing great beauty (Figure 24), and a clear geomorphologic value and wealth and stratigraphic/paleontological variety (Figure 25). Cape Matxitxako, a geographical emblem in the Basque Country, shows not only its huge scenic and cultural value, but also the Cretaceous flysch.

Other geo-sites further away from these areas are related to materials from the Quaternary and the Cretaceous. These are elements of great geological and educational value, and even have

tourism appeal with highly added cultural values, as there are many things to see such as pinnacles and sink-cavities. It is also important to mention such wonderful items as red limestone of Ereno, ornamental rock used in many landmark buildings in Bilbao and other cities in Spain and European countries, which, apart from its aesthetic value, has significant geological values (stratigraphic/paleontological and tectonic and mineralogical) as well as historical/cultural values.

Among the actions described in the Strategy for Geo-diversity in Urdaibai are the maintenance of the 13 geo-tourism walk routes and two vehicle roads and the establishment of 28 interpretive signposts. Also, recently, the Geo-site Guide in Urdaibai Biosphere Reserve has been published, which mentions the signposts installed within the site and has become the reference publication to learn the 250 million geological history of this area. Another major task is to incorporate information on the geo-sites in the Master Plan for Use and Management of the Urdaibai Biosphere Reserve, which is currently under development.

6.7. The UNESCO Chair Program on Sustainable Development and Environmental Education of the University of the Basque County of the Biosphere Reserve of Urdaibai.

Ten years ago, in collaboration with the Department of Environment and Land Management of the Basque Government, the

University of the Basque Country (UPV/EHU) created the “Class for Sustainable Development and Environmental Education in the Urdaibai Biosphere Reserve.” This class took its first steps, responding to the objectives of the Man and Biosphere Program (MAB) of UNESCO and helped Urdaibai become a place for experiences and learning and as a laboratory, developing with the local community. The collaboration between Biosphere Preserve and UNESCO Chair program became a model case as a way of working, known among other Biosphere Reserves.

In the 2010s, the UNESCO Chair program strengthened its status as a specialized program in promoting applied research and teaching on issues of sustainable development and environmental education from an interdisciplinary perspective and also from the management perspective. In this regard, it should be emphasized that the Chair program functions as a place for consultation and dialogue among scientists, policy makers and local management agents for the union of science and environmental management towards sustainable human development.

The Chair on sustainable development and environmental education at the University of the Basque Country has established the challenges of further research and specialized studies on sustainability and environmental education from an interdisciplinary perspective, encompassing natural

and social science. The methodology is designed to foster collaboration among academia, social partners and politicians and society at large, since all activities within it are focused on helping solve real problems.

The research projects mentioned above are aimed at understanding and solving problems related to sustainable development in the Basque Country, and especially in the Urdaibai Biosphere Reserve whose territory they want to be used for testing and demonstration of experiences. It is expected that scientific cooperation and the transfer of results and experiences of sustainable development through the Network of Chairs and the World Network of Biosphere Reserves as well as other academic and scientific networks will be strengthened.

The most important research projects under the auspices of UNESCO Chair program are related to ecosystem services, climate change, geo-diversity and the environment in general.

Thus, during the period 2003-2009, research projects were called for and more than 80 research projects were implemented and disseminated to society. This generation of knowledge has been the basis for the proper management of the Biosphere Reserve.

The UNESCO Chair, with the support of the Basque Government, has developed the research

project “Millennium Ecosystem Assessment in the Basque Country and in Bizkaia.” This is part of the scientific program called Millennium Ecosystem Assessment (EEM), which aims to gather information on the state of conservation of the planet’s ecosystems and their services, with Urdaibai being one of the main areas of study. The ultimate purpose of this project is to generate scientific knowledge on the conservation status of ecosystems in the Basque Country and the services they provide to humans, as well as the factors affecting the provision of such services. With this, we intend to offer those responsible, both public and private, tools and information necessary to know the value of ecosystems, the services they provide to society, and the effects of the decisions they make on ecosystems in order to help them make decisions for ecosystems and human welfare.

Finally, we have worked with public administrations, citizens and stakeholders to gather input, amendments, opinions and suggestions.



Islands as model biosphere reserves. Presentation in  
the meeting of Island and Coastal Biosphere Reserves,  
Malta, March 2015.

Dr Toomas Kokovkin



5<sup>th</sup> Meeting of the World Network of Island and Coastal Biosphere Reserves,  
Attard, Malta, 24-26 March 2015

## Islands as model biosphere reserves. Presentation in the meeting of Island and Coastal Biosphere Reserves, Malta, March 2015.



Dr Toomas Kokovkin

UNESCO MAB focal point, Estonia

MAB programme has declared since decades that biosphere reserves should be considered as models of sustainable development. In the new MAB strategy 2015-2025, the mission of the programme is described as achieving sustainable development goals through learning from the network of model regions, where policies and actions are explored and demonstrated, and lessons learned. We, the members of the global network of biosphere reserves enjoy being called “sites of excellence” and being best examples for sustainable use of highest natural and cultural values. It appears that biosphere reserves have accepted the status of being model areas, and serve this purpose as much as their capacity allows. However, in the MAB community there is still a discussion about insufficient visibility of biosphere reserves, and about the need to expand the knowledge beyond the limits of our own network. It is not always clear, how such models of sustainable development can be used in “real life”, where regional planning, development policy, nature conservation and cultural diversity issues meet.

In this short presentation I will discuss the suitability of island biosphere reserves to contribute to the above discussion and to serve as models of sustainable development.



Firstly, what characteristics do we expect from a model area? In my opinion, the following properties of a model area are important. A model is a simplified representation of the real world. A model should have clear boundaries, so that the inputs and outputs could be measurable. The internal structure, components and functions of the model should be identifiable. And the model should be replicable in various conditions in other locations.

For biosphere reserves, the outer borders and internal spatial structure are defined by a “sacred cow” of the concept, namely by zoning into core, buffer and transition areas. Well known is the basic scheme of biosphere reserves zoning, which consists of concentric circles of the above-mentioned zones. In reality, very few biosphere reserves follow this classical spatial model, because the geographical conditions in real world are much more diverse. It is quite a challenge for a biosphere reserve designer, as well as for the advisory committee who evaluates biosphere reserve applications, to find the connection between the classical model and the real-life zoning. There are few biosphere reserves which quite accurately follow the concentric circle system, and among those are some islands. For instance, the zonation of Jeju island in Korea and Ometepe island in Nicaragua.

Interestingly, some islands represent the inverted model of zonation, where the transition (development) zone is in the middle of the island, surrounded by coastal buffer, whereas marine environment constitutes core area. Although not ideally concentric, such examples can be seen on Menorca or the Azores islands.

Speaking about biosphere reserves as models for regional sustainable development, the notion of ‘self-sufficiency’ comes into play. True balance between socioeconomic and natural components is achievable in clearly delimited systems, without any matter and energy

supply from outer systems (we do not mean solar energy, of course). Actually, this is the reason why the concept of urban biosphere reserves is questionable. Urban systems can hardly be models of sustainable development, since energy and matter (including fuel, food, water etc) is normally acquired from outside of urban areas. Whereas islands are closest, in their nature, to self-sufficient socioeconomic and natural systems. Due to isolation and remoteness, many island biosphere reserves demonstrate patterns of sustainable nature use, for instance the Island of Principe or Great Nicobar.

What is the conclusion of my short presentation? MAB programme is positioned as the one which consists of the global network of biosphere reserves, or models for sustainable development. Among the vast diversity of biosphere reserves in the world, best suited to serve as models for sustainable development are insular biosphere reserves, as they bear several characteristics which correspond to the needs of modeling.







# Biosphere reserves in the German Wadden Sea: Status and challenges

Jürgen Rahmel

5<sup>th</sup> Meeting of the World Network of Island and Coastal Biosphere Reserves,  
Attard, Malta, 24-26 March 2015

## Biosphere reserves in the German Wadden Sea: Status and challenges



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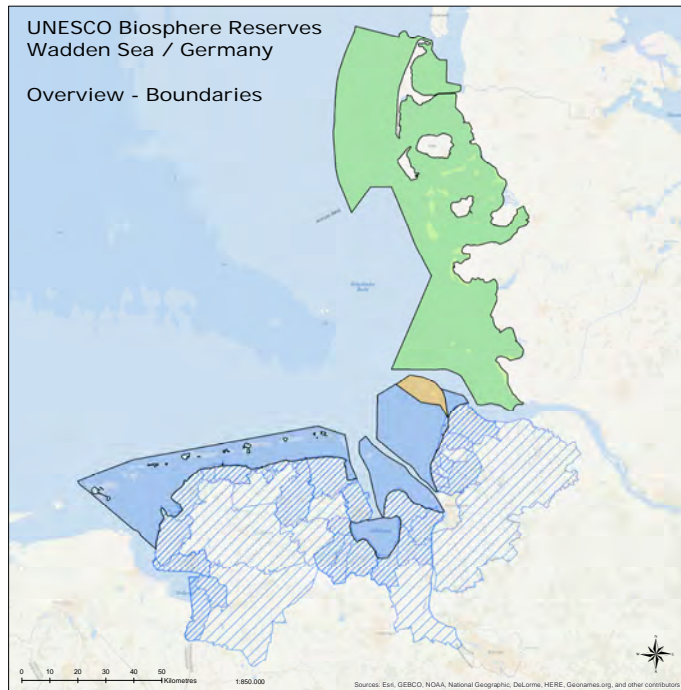
### Abstract

Topics of this article are the UNESCO-MAB-biosphere reserves in the German Wadden Sea. A special focus is set on the one in the federal state Niedersachsen (Lower Saxony). Characteristics of the region, conservation status and future challenges are described.

### Characteristics of the region

The Wadden Sea stretches along the North Sea coast of the three countries The Netherlands, Germany and Denmark. It covers an area of 10.000 km<sup>2</sup> and is therefore the largest tidal area behind barrier islands in the world. Designated as a World Heritage Site by UNESCO it is a natural system of outstanding universal value which complies with three inscription criteria.

Regarding the criterion “Natural forces and dynamics prevail” the Wadden Sea contains some outstanding examples representing major stages of earth’s history, ongoing geological processes in the development of landforms and significant geomorphic or physiographic features



**Legend**

- biosphere reserves
- Waddensea Biosphere Reserve of Hamburg
- Waddensea Biosphere Reserve of Lower Saxony
- potential partner municipality for formal transition area (Lower Saxony)
- functional transition area (Lower Saxony)
- Biosphere Reserve Wadden Sea and Hallig Islands of Schleswig-Holstein

Fig. 1: German Wadden Sea areas

The criterion "Ecological and biological processes" is met by this young and dynamic mesotidal system by the examples of significant ongoing ecological and biological processes, evolution and development of ecosystems and important communities of plants and animals. In this habitat at second glance one square meter of the tidal flat can contain 12 kg blue mussels, 100 lugworms, 50.000 mudsnails or 100.000 mudshrimps. The Wadden Sea has the function of the most important nursery of North Sea fish. 80 % of all plaices, 50 % of all common soles and 40 % of all sprats and herrings in the North Sea grow up here. Furthermore, it serves as a turntable for migrating birds. More than 10 - 12 Millionen migrating birds stop two times a year in the Wadden Sea. And it is a breeding place for more than 50 bird species.

Concerning the criterion "Unique in its variety and diversity" it can be stated that the Wadden Sea actually contains important and significant natural habitats for in-situ conservation of biological diversity including threatened species of outstanding universal value from the point of view of science or conservation.

MAB Biosphere Reserve	Area (km <sup>2</sup> )	Zonation Core / Buffer / Trans.	Designation National Park	Designation Biosphere Reserve	Designation World Nature Heritage Site
Schleswig-Holstein	4.431	35,4 / 64,1 / 0,5	1985	1990	2009
Hamburg	138	91,5 / 8,5 / 0	1990	1992	2011
Niedersachsen	2400	68,5 / 31,0 / 0,5	1986	1993	2009

Tab. 1: Comparison of the German Wadden Sea areas

### Conservation status

The conservation of the Wadden Sea is organized on a national and international level. The German federal states Schleswig-Holstein, Hamburg and Niedersachsen have established national parks in their respective parts of the Wadden Sea in the 1990s (Tab. 1). In order to warrant an international conservation the three neighbouring states The Netherlands, Germany and Denmark have developed a trilateral management plan



which also includes a common monitoring approach.

Furthermore, the area received international designations. In the 1990s the Dutch and the three German parts of the Wadden Sea became MAB-biosphere reserves (Tab. 1). From 2009 to 2014 the entire area of the Wadden Sea was successively designated as a UNESCO World Nature Heritage site.

The actual positions of the MAB-biosphere reserves can be seen in fig. 1.

This situation as a multi-designated area seems to be somehow confusing. However, the designations do not lead to contradictory approaches to the system. In fact, they even give support to each other.

## Challenges

Although appreciable progress has been achieved during the last three decades the coastal zone of Niedersachsen still faces a variety of influences with have to be reduced in order to maintain the ecological integrity of the area. Fig. 2 presents some of these influences and the related problems or tasks, respectively.

Among these influences tourism can cause problems or on the other hand give reason for stronger efforts in nature conservation. The reason for the latter is the importance of intact nature for decisions upon holiday destinations. This has strong implications for the value added in tourism business. When JOB et al. (2009) conducted their research in the national park area of Niedersachsen 3 Millionen guests visited the region for 20 Mill. overnight stays. 11% where co called “national park tourists” whose main reason for their visit was the conservation area. Furthermore, 81% of all tourists want recreation activities in or with the nature (swimming, walking, bird watching e.g.).

The economical turnover per year which was created only by the national park tourists was calculated to be 114 million € This amount can give a basis for 3.000 jobs.

Tourism has a long history on the coast of Niedersachsen. In 1797 the first resort on the German North Sea coast was founded on the island Norderney. The 25 km<sup>2</sup> large island was in the beginning just visited by a small number of visitors. However, around 1900 the numbers already rose up to 25.000 visitors per year. After World War II an almost exponential growth was observed. Todays annual numbers reach 520.000 overnighth

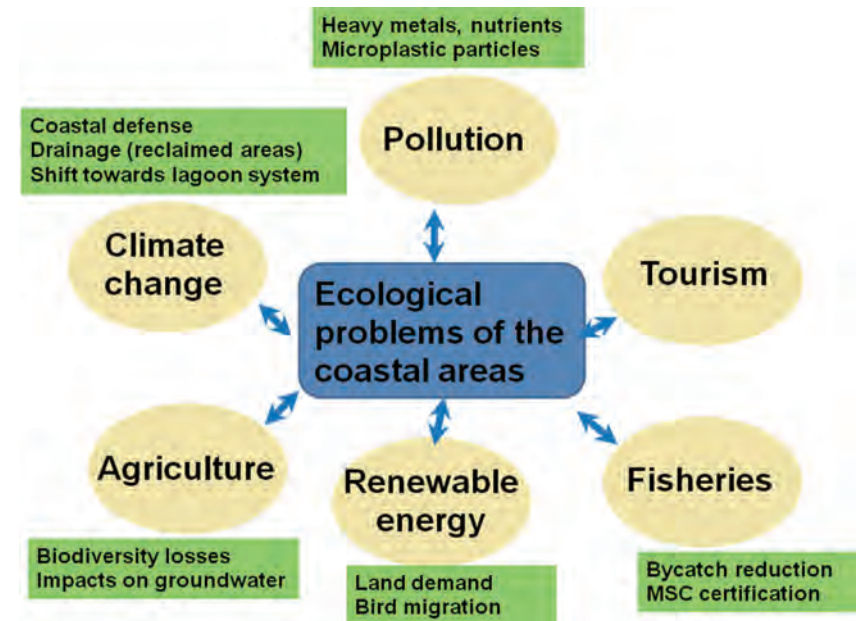


Fig. 2 : Challenges for a sustainable development in the Wadden Sea region of Niedersachsen, Germany

visitors in addition to 250.000 guests who just stay for the day. During this period the former fishermen village has developed towards a city with 6.000 inhabitants. This caused significant changes to the social and cultural life. The nature of the island, however, still shows all of the properties which characterize the world nature heritage site Wadden Sea. To prevent future damages of the natural treasures of the Wadden Sea the UNESCO committed the neighbouring status to implement a sustainable tourism strategy. It was accepted on the Trilateral Minister Conference in 2014. Important topics of the strategy are climate neutral mobility, promotion of hiking and cycling, partner networks, promotion of regional food products, concepts for guidance of tourists and environmental education.

During the first evaluation of the German Wadden Sea biosphere reserves they were criticised for the almost complete lack of a transition zone (Tab. 1). The federal states followed different approaches to solve the problem. In Schleswig-Holstein the “Halligen” (some small islands) decided to become the new transition zone. Hamburg could not undertake own actions, as the total property of the city state in the Wadden Sea had already been designated as a national park.

In the case of the Niedersachsen biosphere reserve counties along the coast were then regarded as a functional transition zone and projects were carried out there in order to promote a sustainable development. Up to now efforts were made in the following fields: sustainable tourism (migratory bird days, partner initiative), sustainable land-use (promotion of regional

and sustainable products), climate protection and adaptation and education for sustainable development.

In spite of all these activities the UNESCO still demands a spatially well-defined transition zone for the Wadden Sea MAB-biosphere reserve in Niedersachsen. Therefore, the federal state of Niedersachsen and his biosphere reserve administration developed a plan which aims at the voluntary integration of coastal municipalities into the transition zone. Based on this idea of voluntary cooperation a development process with the coastal municipalities was started in 2014. The aim is an official application for an acceptance of the biosphere reserve within newly defined borders at UNESCO in 2017.

The advantages the coastal municipalities can expect for their participation are improvement of image for tourism marketing and against demographic change, better access to fundings and precaution for future generations.

## References

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# The 5<sup>th</sup> Meeting of the World Network of Island and Coastal Biosphere Reserves

Date: 24 - 26 March, 2015

Venue: Attard, Malta

Participants: 18 Biosphere Reserves and 15 countries

Subject: The Impact of Climate Change and Sustainable Development of  
Island and Coastal Biosphere Reserves

5<sup>th</sup> Meeting of the World Network of Island and Coastal Biosphere Reserves,  
Attard, Malta, 24-26 March 2015

## The 5<sup>th</sup> Meeting of the World Network of Island and Coastal Biosphere Reserves



### STATEMENT

The World Network of Island and Coastal Biosphere Reserve was established in 2012, in order to fulfill some recommendations of the Madrid Action Plan for Biosphere Reserve 2008-2013, and to find some solutions for common issues to deal with Climate Change and Sustainable Development in island and coastal regions.

The 5<sup>th</sup> Meeting was held in Attard, Malta, on 24-26 March 2015 and 18 BRs from 13 countries joined the meeting. Participants came from Republic of Korea (Jeju Island and Gochang BRs), Spain (Menorca, La Palma and Urdaibai BRs), Estonia (West Estonian Archipelago BR), Australia (Noosa BR), Sao Tome & Principe (Principe BR), Tunisia (Zembra and Zembretta BR), Japan (Yakushima BR), the Philippines (Palawan BR), Chile (Campana Peñuelas BR), Canada (Fundy BR), France (Iles et Mer d'Iroise BR), Portugal (possible future Sao Jorge BR in the Azores), Germany (three German Wattenmeer BRs), and the MAB National Committees of the Republic of Korea and Spain, the UNESCO National Commissions of Malta, Iceland and the Republic of Korea, and the UNESCO/MAB Secretariat.

The main subject of the meeting was 'The impact of Climate Change and Sustainable Development on the Biosphere Reserves.' The participants introduced their related Biosphere Reserve and examined future action plans and made a few decisions as follows.



Conclusions:

**1. Establishing management regulations of the members of the World Network of Island and Coastal Biosphere Reserves**

As the number of Biosphere Reserve members increased and as the management criteria is vague, it is necessary to establish management regulations for systematically managing and inducing continuous network activities. Therefore, the status will be set up by application and approval for the BR membership.

**2. Dates and venue of the next meeting**

The 6th meeting will be held in Lima, Peru, during the 4th World Congress of Biosphere Reserves, 14-19 March, 2016.

**3. The Network's Newsletter**

Jeju and Menorca Secretariat continue preparing the Network's newsletter every six months. It will be notified on the Jeju / Menorca and UNESCO web sites. BR members are invited to share useful information on their BR sites through this newsletter.

**4. Publication of a casebook study**

A wide range of information and experiences presented in this meeting will be presented in a book to be published by the Jeju Secretariat with Menorca's support, and presenters are invited to provide appropriate content and submit it as soon as possible.

**5. Sharing information on BR activities**

BR members should share their various activities with others such as utilizing the BR Brand, for profit creation and contribution to conservation and sustainable development. BR members could present their successful activities at the upcoming network meeting, and share them on the newsletter. Moreover, under the mutual consultation, the BR members could benchmark each other by field study.

#### **6. Suggestions on research projects and training workshop**

Joint research projects on climate change are implemented by Jeju Island Biosphere Reserve, and a project on sustainable development is implemented by Menorca Biosphere Reserve. Suggestions from all the participants for these research projects would be appreciated to draw effective results. Also a training course for biosphere reserve managers has been implemented in Jeju Island since 2013, and the next program is scheduled for October, 2015. Participation and support would be appreciated for the successful achievement of this training course.

#### **7. Participants strongly support the application of the new Fajas de S. Jorge, Azores, Portugal, Biosphere Reserve.**

#### **8. Special thanks go to the Maltese National Commission for UNESCO for organizing in an excellent way this important event.**

















5<sup>th</sup> Meeting of the World Network of Island and Coastal  
Biosphere Reserves,  
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