GREEN INFRASTRUCTURE IN-DEPTH CASE ANALYSIS

THEME 3: MULTIFUNCTIONAL USE OF COASTAL AREAS

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1 Introduction

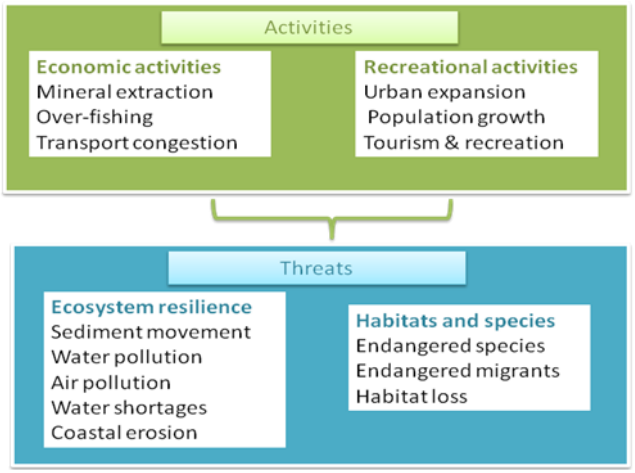
The coast is the area where the land meets the sea and more particularly the "air-sea-land interface zone around continents and islands" (Firn Crichton Roberts Ltd and University of Strathclyde 2000). As such, it has a total length of 89,000 km in the EU. In addition, half the population of the Member States which have a coastline live within 50 km of the sea (European Commission, 2000).

Coasts are defined by their richness in biodiversity elements (see,for example, European Environment Agency, 2002, and the INTERREG IIIC Deduce project). In particular, eight out of the 40 EU-listed priority habitats of wild fauna and flora fall into the coastal habitat. Also, a third of the EU's wetlands are located on the coast as well as more than 30% of the Special Protected Areas designated under the Birds Directive (79/409/EEC). In addition, the reproduction and nursery grounds of most fish and shellfish species of economic value also lie in coastal areas and account for almost half of the jobs in the fisheries sector (European Commission, 1997).

At the same time, coasts play an important role in the development of local and regional economies. A study carried out by the University of the Aegean (2001), showed that the most important sectors in economic terms in the coastal zones were mostly tourism and leisure, agriculture and food, sea fisheries, ports and shipping, and residential housing. Further research in this area was carried out by the INTERREG IIIC Deduce project.

However, as shown in Figure 1.1, the same elements which constitute the richness of the coast pose some threats to its integrity and more particularly its capacity to ensure ecosystem health and resilience and biodiversity conversation.

Figure 1.1 Most threatening activities and related consequences to coastal areas.



Source: Firn Crichton Roberts Ltd & University Of Strathclyde (2000)

There is therefore scope for development of Green Infrastructure in order to ensure the following:

- Conservation of habitats and species: The protection and conservation management of coasts under specific **protection status**. For example, the share of territories near the sea designated under Natura 2000 is higher than 20% (Deduce project).

- Restoration: The **readjustment** of existing or planned infrastructures to mitigate barrier effects and strengthen ecological coherence.

- Planning and management: The promotion of planning of economic activities that **integrate** restoration measures, conservation and connectivity elements.

The three examples presented in this fiche present several approaches taken to ensure the conservation, restoration and sustainable management of coastal habitats and species through the development of ecosystem services of the coast. The first initiative "Protection and management of coastal habitats in Latvia – LIFE02 NTA/LV/008498" is a lead example in the development of a strategy to ensure the provision of cultural and recreational services through managing the inflow of visitors, to prevent the degradation of habitats linked to those actions as well as raising the visitors' awareness. This example shows the details of actions developed in 14 demonstration sites with the support of EU funding through the LIFE programme, from the mapping of habitats of importance to the targeted and integrated management of the sites, closely involving local stakeholders and the general public. This example is moreover interesting in presenting the detailed costs of each of those actions both for the administrative/management side and the costs of the green infrastructure itself, comparing one-off costs to recurrent ones. In addition, the costs are based on actual expenses and can therefore mirror effectively the costs of setting up an infrastructure from the research phase up to the follow-up phase.

The two other initiatives present insights into the development of Green Infrastructure in coastal areas to produce other types of ecosystem serves. The second initiative, the Strategy for Integrated Coastal Zone Management in Spain, presents an initiative to integrate the management of the Spanish coast into cross-sectoral and long-term activities and theplanning of the area. It is particularly interesting for the assessment of the costs associated with land purchase. The third example, BaltCICA, presents an approach to managing the coast in such a way as to improve adaptation and mitigation to climate change.

2 Overview of Initiatives

2.1. Lead Initiative: Protection and Management of Coastal Habitats in Latvia

The LIFE project "Protection and management of coastal habitats in Latvia/Piekrastes biotopu aizsardzība un apsaimniekošana Latvijā – LIFE02 NAT/LV/008498" ran from April 2002 to June 2006 on the Latvian coast. Although historically the coast has been protected and a law was introduced in 1997 for its protection, it started facing increasing human pressure and deterioration. The overall aim of the project was therefore to ensure the conservation, restoration and sustainable management of coastal habitats and species of Community importance. It did so by mapping and evaluating coastal habitats of Community importance, planning the appropriate protection and management measures in protected nature areas where there were no nature conservation plans, restoring and maintaining coastal meadows and dunes in areas where immediate protection actions were required, removing invasive alien plant species, and raising awareness of the general public. One key feature of this project was to develop structures enabling the development of the coast as a recreational activity zone at the same time as protecting its biodiversity and raising the awareness of the users of the areas.

2.2. Secondary Initiative I: Strategy for Integrated Coastal Zone Management in Spain

The Strategy for Integrated Coastal Zone Management in Spain (Estrategia de Gestión Integrada de las Zonas Costeras en España), developed between 2002 and 2010 and addresses the gaps in the existing Spanish legislation, which focused on the management of Maritime-Terrestrial Public Domain but not the wider coastal area. The strategy followed Recommendation 2002/413/EC, which promoted the coordination of policies for the coastal region, planning and management of the coastal resources, protection of natural ecosystems and the increase of social and economic welfare in the coastal regions. In this regard, the Spanish strategy was framed to improve environmental, economic and social aspects of the coastal zone and the use of its resources, using the principles of sustainable development, and to review and adapt the management and decision making by incorporating the principles of Integrated Coastal Zone Management. In order to achieve these objectives the strategy was supported by several instruments: a plan (Master Plan for Coastal Sustainability), a monitoring structure (Sustainability Observatory for the Spanish Coast), agreements with coastal regions, a supervisory structure (National Coast Council), financial instruments (purchase of land for protection and restoration), development of research (support for research and development in coastal areas), and awareness-raising activities (education, continuous education and training activities for coastal managers). While the lead example is primarily concerned with delivering nature conservation, recreational infrastructure, and awareness-raising activities as benefits, this initiative focuses on developing a strategy for managing the coast in a sustainable way while also ensuring support for the tourism sector. In comparison with the lead example, the cost-benefit ratio appears to be more favourable in the long term, although for the moment relatively few effects can be seen and further measures will need to be undertaken.

2.3. Secondary Initiative II: BaltCICA Project

The BaltCICA project was based on the results of two projects , the BSR Interreg IIIB projects ASTRA (Developing Policies & Adaptation Strategies to Climate Change in the Baltic Sea Region), and SEAREG (Sea Level Change Affecting the Spatial Development in the Baltic Sea Region). It is running from February 2009 to January 2012 with a focus on the problems which are likely to be caused by

climate change in the Baltic Sea Region, particularly the rise of sea level and the changing frequency and magnitude of floods, as well as water availability and quality. The project has developed adaptation measures in cooperation with local authorities and administrative bodies and discussed them with other stakeholders. It has tested methods of development and implementation of adaptation measures on pilot projects before transferring them to other projects with similar problems. The fiche presents an overview of two case studies developed in Lithuania, in both the city and the district of Klaipeda. This initiative focuses on creating climate change adaptation measures to be included in city management plans. In comparison with the lead example, the cost-benefit ratio appears to be less favourable, which is mostly due though to the difficulty in quantifying the exact impacts.

3 Protection and Management of Coastal Habitats in Latvia

3.1. General Background Information

The Latvian coast has historically been highly preserved from human negative influence, and this was the case until recently: while Latvia was part of the USSR, access to the seashore was restricted as it also formed the frontier of the Union. The lack of economic and cultural development in this area ensured protection of natural habitats. The coast therefore still possesses an impressive array of habitat types: grey, white[1] and wooded dunes, coastal lagoons, boreal Baltic coastal meadows, and calcareous fens.

However, in parallel, and due to the accessibility of the area to the general public, the coast started facing increasing human pressure: the number of visitors increased substantially in recent decades while at the same time no appropriate management of the sites was introduced. Not only had habitats and species started suffering from deterioration because of their use, but no measure had been undertaken. This relates specificlly to ensuring the conservation and restoration of the habitats and species, the management of the lands and the management of visitor flows, in such a way as to channel them as well as raising their awareness about the opportunities offered by the coastal zone, the threats of biodiversity loss and their responsibilities to them.[2]

Legal background of the project

To counterbalance the biodiversity loss, the Law on Protected Belts was introduced in 1997 to protect the first 300-m strip of land beside the sea. In addition, 45% of the coast is under specific protection status, such as national park or nature reserve (including 14 Natura 2000 sites and in the Baltic Green Belt). Yet the following main threats remain for the coastal habitats:

- Degradation of coastal natural habitats by recreation and activities of tourism;
- Deterioration of coastal ecosystem by motorised vehicles;
- Destruction of indigenous flora and vegetation by invasive alien species;
- Reduction in the area of grey dunes;
- Decrease in the area of semi-natural meadows;
- Decrease of forest biological diversity resulting from inappropriate management;
- Decrease in the area of habitats of Community importance due to building activities and inappropriate coastal management;

[1] White dunes (foredunes) are so called because of their appearance (white sand). Vegetation on them is very sparse, sand is actively blown. Dominating species are **high grasses** which are resistant to being burried by sand. There are no mosses, no lichens, and a low number of species.

Grey dunes (fixed coastal dunes) compose the stage following that of white dunes. The sand movement is slower. Vegetation is low, there are **low grasses, sedges, mosses, lichens**. It is similar to a grassland, however vegetation is sparse, and there is bare sand between the plants. It ecompasses a very high diversity of species. It appears grey because of the low quanitity plants, mosses and lichens.

More information can be found on http://piekraste.daba.lv/EN/apraksti/kaapas.shtml#v7 and http://piekraste.daba.lv/EN/apraksti/kaapas.shtml#v9

[2] More information about the visitors' threats to the environment in Ernsteins R. and Ozola A. (2010).

- Deterioration of endangered habitats in protected nature areas due to the lack of management plans;
- Deterioration of natural habitats due to low public awareness.

Scope of the project

The geographical focus of the project was therefore the entire Baltic Sea coast accounting for 500 km of length and 300 m of width, beginning from the waterline on the terrestrial side. The project also extended to the entire area of the habitats in zones where threatened habitats of Community importance continue outside of this belt (dunes and coastal meadows). The total surface area of the project was 32,000 ha (including approx. 19,000 ha of habitats of Community importance).

The project targeted coastal habitats and species of Community importance (23 habitat types, 7 of them EU priority) and 4 plant species listed in the Habitats Directive, 9 habitat types under the Bern Convention, and 16 species listed in the Birds Directive) and more particularly the following habitats types:

- Western taiga;
- Annual vegetation of drift lines;
- Boreal Baltic coastal meadows;
- Boreal Baltic sandy beaches with perennial vegetation;
- Embryonic shifting dunes;
- Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes);
- Fixed coastal dunes with herbaceous vegetation (grey dunes);
- Decalcified fixed dunes with *Empetrum nigrum*;
- Wooded dunes of the Atlantic, Continental and Boreal region.

The project was based on the following items of EU legislation and policies:

- Recommendation of the European Parliament and of the Council of 30 May 2002 concerning the implementation of Integrated Coastal Zone Management in Europe - 2002/413/EC;
- Conservation of natural habitats and of wild fauna and flora – Directive 92/43/EEC;
- Conclusion of the Convention on Biological Diversity – Council Decision 93/626/EEC;
- Communication on a European Community Biodiversity Strategy – COM (98) 42 final;
- Communication on a Biodiversity Action Plan for the conservation of natural resources COM (2001)162 final.

3.2. Specific Objectives

In order to ensure the conservation, restoration and sustainable management of coastal habitats and species of Community importance in each site, the project, which ran from April 2002 to June 2006 with the support of the LIFE Nature programme, therefore focused on the following broad objectives:

- Ensuring the conservation of 23 habitat types (7 of them EU priority) and 4 plant species listed in the Habitats Directive, 9 habitat types under the Bern Convention and 16 species listed in the Birds Directive;
- Development of the basic framework for sustainable management of the coastal protection belt of the Baltic Sea in Latvia;
- Promotion of a network of protected nature areas and micro-reserves on the Baltic Sea coast;
- Development of sustainable tourism;
- Raising public awareness regarding the need for protection of habitats of Community importance.

The project focused on 14 demonstration sites, including 20 ha of grey dunes and 115 ha of coastal meadows, and developed four management plans in close consultation with local municipalities and communities. The aim was to map and include sites of importance – Natura 2000 sites as well as non-Natura 2000 sites – in the management plans of the municipalities on the Latvian coast. Once these were established, a number of urgent on-site actions were undertaken to restore and protect key areas from further damage or degradation.

The evaluation of the importance of each site and the related restrictions were included in physical plans of municipalities. This was supported through on-going cooperation with the municipalities and ensured an adequate follow-up of the implementation of the measures. This also took the form of micro-reserves, which aim at protecting the habitats and species of Community importance outside Natura 2000 sites or to protect habitats everywhere where their survival is threatened. Each of the reserves is between 0.1 and 0.2 ha according to the "Regulations on the Establishment, protection and Management of Micro-reserves" (2001).

The objectives of the project also entailed an extensive programme of visitor management to channel the increasing stream of tourists away from the most sensitive areas. Through inventory, mapping and planning, the project identified in which exclusive zones it would be reasonable to increase the number of visitors and in which ways and in which zones further protection was necessary. The built infrastructure also aimed at developing tourism in the area in a sustainable manner. The development of the tourist infrastructure was fully integrated in the conservation, restoration and management measures. It consisted of concentrating the tourist flows in focused paths, boardwalks, car parks, resting sites, stairs and barriers with the twofold aim of protecting the environment and improving the infrastructure for tourism to enjoy the area (further details in section 3.3).

In order to support both the objectives for nature conservation and for tourism development, a national awareness-raising campaign aimed at visitors and local communities was carried out.

The working method as adopted by the project was the following:

- Habitat mapping and evaluation: status of protection, threats and management necessity;
- Planning activities: elaboration of functional zoning, management plans for Natura 2000 sites, technical designs for small-scale infrastructure, building permits, monitoring and dissemination of information on habitats;
- Habitat restoration and management: cutting of shrubs and reed in grasslands, removal of invasive species in various types of dunes, maintenance of grasslands (mowing and grazing), construction of small-scale infrastructure for visitors and dissemination of information on habitat management.

The construction of tourist infrastructure was not carried out in independent activities but included in the broader activities for planning and conducting restoration and management. As such it strengthened the linkages between the need for tourist infrastructure for protection and conservation as well as the development of tourism in the area for recreational objectives.

The table below presents a more detailed list of activities which were carried out within the scope of the project.

Table 3.2.1 Relevant actions carried out within the project (presented by category of LIFE programme action).[3]

Relevant Actions Carried Out Within the Project			
Preparatory actions, elaboration of management plans and/or of action plans	**Non-recurring habitat management**	**Recurring habitat management**	**Public awareness and dissemination of results**
These actions covered a detailed analysis of the sites, a mapping of their characteristics. On this basis, planning of further activities was realised and management plans/agreements are defined together with relevant authorities, i.e. municipalities. This also included the design of tourist infrastructure.	**Restoration and management: measures for *ad hoc* management were undertaken. They mostly focused on cutting trees and shrubs, as well as overall cleaning of the sites. Those measures also included the creation of tourist infrastructure.**	**In order to ensure adequate control and protection of the site, their maintenance took the form of mowing and grazing as well as purchase of cattle.**	**Different tools and activities aimed at raising the awareness of stakeholders and visitors to the needs for the project, as well as informing them about the natural elements involved and diffusing the practice as an example for others.**
Preparation of a database of landowners and their interests regarding land use and coastal development. Digital mapping of habitats of Community importance in the coastal protection belt.	Restoration of natural habitats in the area of Kolkas rags. Restoration of grey dunes by cutting trees and shrubs in the coastal protection belt between Ziemupe and Pavilosta. Restoration of Boreal	Maintaining of Boreal Baltic coastal meadows by mowing and grazing. Ensuring adequate control and protection in coastal zone at Piejura Nature Park. Ensuring adequate control and protection in	Establishment and installation of information boards. Preparation and publishing of leaflets. Preparation and publishing of booklets. Seminars for stakeholders.

[3] All those actions are listed back in the table 3.4.2 detailed costs of the project. In table 3.4.2, the actions are listed under GI elements.

Relevant Actions Carried Out Within the Project			
Preparatory actions, elaboration of management plans and/or of action plans	**Non-recurring habitat management**	**Recurring habitat management**	**Public awareness and dissemination of results**
These actions covered a detailed analysis of the sites, a mapping of their characteristics. On this basis, planning of further activities was realised and management plans/agreements are defined together with relevant authorities, i.e. municipalities. This also included the design of tourist infrastructure.	**Restoration and management: measures for *ad hoc* management were undertaken. They mostly focused on cutting trees and shrubs, as well as overall cleaning of the sites. Those measures also included the creation of tourist infrastructure.**	**In order to ensure adequate control and protection of the site, their maintenance took the form of mowing and grazing as well as purchase of cattle.**	**Different tools and activities aimed at raising the awareness of stakeholders and visitors to the needs for the project, as well as informing them about the natural elements involved and diffusing the practice as an example for others.**
Plans of protection measures (functional zoning) for habitats of Community importance in the coastal protection belt. Making agreements and signing contracts with subcontractors and local farmers. Training of habitat experts. The preparation of technical projects for restoration and management of coastal habitats of Community importance. Development of management plan for protected nature area Piejura Nature Park. Development of management plans for the protected nature areas Bernati Nature Reserve and Uzava Nature Reserve. Development of management plan for Vidzemes Akmenaina Jurmala Nature Reserve. Establishment of microreserves for	Baltic coastal meadows in Vakarbulli and Daugavgriva Nature Reserves in Riga city. Management measures for Boreal Baltic coastal meadows and white dunes in the Vakarbulli and Daugavgriva Nature Reserves in Riga. Restoration of grey dunes and white dunes by destruction of expansive plants. Restoration and management of wooded dunes and white dunes in Saulkrasti, in Roja, and in Lapmezciems. Restoration and management of Boreal Baltic coastal meadows, embryonic dunes and white dunes in Ainazi and Salacgriva. Restoration and management of wooded dunes and western taiga in Jurmala. Restoration and management of grey dunes and white dunes in Uzava. Restoration and	coastal zone of North Vidzeme Biosphere Reserve. Purchase of cattle for grazing management in meadows.	Two films about coastal habitats. Creation and updating of a portal about the LIFE project and about coastal habitats. Preparation and publishing of book. Establishment and installation of information signs. Publishing of layman's report. Raising of public awareness regarding Boreal Baltic coastal meadows and white dunes in the Vakarbulli and Daugavgriva Nature Reserves in Riga. Promotion of public awareness regarding conservation of wooded dunes and white dunes in Saulkrasti. Raising of public awareness regarding conservation of Boreal Baltic coastal meadows, embryonic dunes and white dunes in Ainazi and Salacgriva. Public awareness raising

Relevant Actions Carried Out Within the Project			
Preparatory actions, elaboration of management plans and/or of action plans	**Non-recurring habitat management**	**Recurring habitat management**	**Public awareness and dissemination of results**
These actions covered a detailed analysis of the sites, a mapping of their characteristics. On this basis, planning of further activities was realised and management plans/agreements are defined together with relevant authorities, i.e. municipalities. This also included the design of tourist infrastructure.	**Restoration and management: measures for *ad hoc* management were undertaken. They mostly focused on cutting trees and shrubs, as well as overall cleaning of the sites. Those measures also included the creation of tourist infrastructure.**	**In order to ensure adequate control and protection of the site, their maintenance took the form of mowing and grazing as well as purchase of cattle.**	**Different tools and activities aimed at raising the awareness of stakeholders and visitors to the needs for the project, as well as informing them about the natural elements involved and diffusing the practice as an example for others.**
habitats and species of Community importance.	management of wooded dunes, western taiga and white dunes in Carnikava. Restoration and management of white dunes, wooded dunes and western taiga in Nica and Rucava. Restoration and management of grey dunes and white dunes in Pavilosta. Restoration and management of wooded dunes, grey dunes, embryonic and white dunes in Medze.		regarding wooded dunes and white dunes in Roja. Raising of public awareness regarding protection of wooded dunes, western taiga, white dunes and grey dunes in Jurmala. Participation in seminars and conferences.

It must be noted here, that the actions aimed at creating infrastructure for visitors (boardwalks, paths etc.) were included in the "restoration" actions since the structure of LIFE projects did not allow for the creation of a specific action.

3.3. Green Infrastructure Elements

The project is related to two main Green infrastructure elements:

- Protected areas, since the project took place along the entire Latvian coast, 500 km in length and 300 m in width, of which 45% is under formal protection (14 Natura 2000 sites and Baltic Sea Coastal protection belt);

- Sustainable use areas/ecosystem service areas: the whole region covered by the project is of high importance for tourist and recreation activities.

The main aim of the project was fully in line with LIFE nature projects and did not directly intend to be a Green Infrastructure project. However, the innovation of the project was to use the opportunity for the restoration and sustainable management of coastal habitats and species of Community importance to create a process and structure which would enable the provision of ecosystem services, in particular recreational and education activities, through connected areas along the coast that were selected on the basis of inventory, planning and mapping.

Another particularity of the project, in addition to combining nature restoration with ecosystem services, is that the creation of small-scale infrastructure such as boardwalks and benches had existed on the Baltic coasts for a long time. Such recreational support had previously been developed but without having taken into consideration protected habitats and species. The concept of Green Infrastructure strengthens this approach by creating ecosystem services out of the nature restoration activities as well as integrating the notion of nature protection into the recreational activities of visitors. In addition to this approach, the cooperation between nature experts and experts of coastal development and local planner contributed to the success of the project.

3.4. Implementation Costs

The total costs associated with the implementation of the project are as follows:

- **Total budget**: €1,666,151
- **EU LIFE contribution**: €1,192,201
- **Participant contribution**: €182,375
    - Faculty of Biology, University of Latvia: €106,024
    - Liepāja Regional Environmental Board: €37,677
    - North Vidzeme Biosphere Reserve: €38,673
- **Other sources**: €291,574
    - Latvia Environmental Protection Fund: €66,912
    - Municipalities:
        - Rīga: €74,000
        - Rucava municipality: €3,700
        - Medze municipality: €9,000
        - Pāvilosta municipality: €5,400
        - Roja municipality: €9,000
        - Lapmežciems municipality: €10,500
        - Jūrmala municipality: €26,400
        - Carnikava municipality: €9,000
        - Saulkrasti municipality: €10,500

- Salacgrīva municipality: €56,540
- Ainaži municipality: €10,621

The data presented in the tables have been extracted from the financial report of the project and from information provided by the lead partner, the Faculty of Biology of the University of Latvia. It is presented according to each of the individual actions carried out within the project. The data present the actual costs of each of the actions, as reported at the end of the project. They all refer to the direct costs of the actions.

The time scope for the data is the full implementation period of the project, from April 2002 to June 2006, i.e. 50 months.

The data present the actual expenses of the overall project. No detailed information for each individual site was compiled. Also, in most of the cases, the constructions were not built by the project: for every project site, a quote was estimated and construction was subcontracted to external companies responsible for the purchase of material, management and building of the infrastructure. Each of the construction costs varied greatly in each contract (by type, cover, length and width). Prices of materials changed over time.

Table 3.4.1: Overview costs (total & per Green Infrastructure element) / Cost associated with the implementation of the initiative.

	Total (Local Currency)	Core areas	Restoration areas	Sustainable use / ecosystem service zones	Green urban and peri-urban areas	Natural connectivity	Artificial connectivity features	Comments
Total Costs	€1,666,151		€18,965 (one-off restoration) + €14,113 (micro-reserves) = €33,078					– Total budget of the project (including LIFE contribution, partner contribution and other sources)
Time covered by total costs (years)								– April 2002 to June 2006
Annualised costs	€399,876 per year on average		€7,938					– Total costs/Total duration of project (50 months)*12
Area covered [ha]	19,101 ha		Total of restored areas : 200 ha; micro-reserve areas: 712 ha					– The overall area covered by the project is 19,101 ha. – The area is included in 14 Natura 2000 sites and in the Baltic Green Belt
Cost per hectare	€12.5 per year €52 in total		€11 per year €46 in total					– Annual costs/Area covered – Total costs/Area covered
Financial Costs (list any details	€1,666,151							– These cover all the costs detailed per action below

e.g. establishing management bodies)								
Opportunity costs (uncompensated) (list any details e.g. foregone resource use)	€0							– No opportunity costs were assessed within this project

Table 3.4.2: Detailed costs.

FINANCIAL COSTS		
	Cost	**Comments**
One-Off Costs		
Administrative, management and information costs	€416,309	Total
• Establishing management bodies	€2,587 (18 experts €1,391	Action A5. Training of habitat experts. Action A4. Making agreements and signing contracts with subcontractors and local farmers
• Surveys		None carried out within the scope of this project
• Research	€12,232 €87,530 (32,000 ha) €47,366	Action A1. Preparation of a database of landowners and their interests regarding land use and coastal development. Action A2. Digital mapping of habitats of Community importance in the coastal protection belt. Action A3. Plans of protection measures (functional zoning) for habitats of Community importance in the coastal protection belt
• Consultation (and one-off communication costs)	€23,589 (200 boards) €23,054 (20 leaflets) €54,836 (7 booklets) €9,306 (11 seminars) €28,313 (2 films) €15,013 None reported €8,221 (620 signs)	Action E1. Establishment and installation of information boards Action E2. Preparation and publishing of leaflets(20 coloured leaflets, 200,000 copies in total) Action E3. Preparation and publishing of booklets (7 booklets, 113,000 copies in total) Action E4. Seminars for stakeholders. Action E5. Two films about coastal habitats. Action E6. Creation and updating of portal about the LIFE project and about coastal habitats Action E7. Preparation and publishing of book Action E8. Establishment and installation of information signs

	None reported	Action E9. Publishing of layman's report.
• Management plans	€63,813 (8 technical designs, 2 detailed plans and 5 sketch designs)	Action A.6. The preparation of technical projects (technical designs) for restoration and management of coastal habitats of Community importance
	€29,930 (8,808 ha)	Action A7. Development of management plan for protected nature area Piejūra Nature Park
	€10,870 (3,225 + 2,945 ha)	Action A8. Development of management plans for the protected nature areas Bernāti Nature Park and Užava Nature Reserve
	€6,471 (3,849 ha)	Action A.9. Development of management plan for Vidzemes Akmeņainā Jūrmala Nature Reserve
• Land purchase:		No land purchased within the scope of this project
• Restoring GI:		See below
Costs of green infrastructure provision	€33,078	Total
• Land purchase		No land purchased within the scope of this project
• One-off compensation payments		No compensation
• Creation of green infrastructure elements	€14,113 (712 ha covered)	Action A.10. Establishment of micro-reserves for habitats and species of Community importance.
• Restoration of green infrastructure	€1,759 (20 ha)	Action C1. Restoration of grey dunes by cutting trees and shrubs in the coastal protection belt between Ziemupe and Pāvilosta.
	€13,0267 (80 ha)	Action C2. Restoration of Boreal Baltic coastal meadows in Vakarbuļļi and Daugavgrīva Nature Reserves in Rīga city
	€3,539 (100 ha)	Action C4. Restoration of grey dunes and white dunes by destruction of expansive plants.
	€640	Action E11. Restoration of natural habitats in the area of Kolkas rags (cancelled)
Ongoing Costs		
Administrative, management and information costs	€770,003	Total
• Running of administrative bodies	€450,060	Action F1. Administration of the project

	€5,820	Action F3. Establishment of steering group and organisation of steering group meetings.
• Monitoring	€14,255 €13,163 (23 sites)	Action F2. Independent audit of the project Action F4. Monitoring the effect of the management measures on habitats and species
• Ongoing management planning		As part of the overall administration of the project
• Communications	€25,597 €27,327 €124,597 €26,232 €66,784 €16,164	Action E10. Raising of public awareness regarding Boreal Baltic coastal meadows and white dunes in the Vakarbuļļi and Daugavgrīva Nature Reserves in Rīga Action E14. Promotion of public awareness regarding conservation of wooded dunes and white dunes in Saulkrasti. Action E16. Raising of public awareness regarding conservation of Boreal Baltic coastal meadows, embryonic dunes and white dunes in Ainaži and Salacgrīva. Action E17. Public awareness raising regarding wooded dunes and white dunes in Roja Action E21. Raising of public awareness regarding protection of wooded dunes, western taiga, white dunes and grey dunes in Jūrmala. Action E22. Participation in seminars and conferences
• Managing sites:		As part of the overall administration of the project
Costs of green infrastructure provision	€321,909	Total
• Maintenance of green infrastructure	€10,042 (115 ha) €17,043 (8,808 ha) €41,712	Action D1. Maintaining of Boreal Baltic coastal meadows by mowing and grazing: 80 ha in Rīga (45 ha grazing, 35 ha mowing); management of 35 ha in Ainaži and Salacgrīva (20 ha by grazing, 15 ha by mowing. Action D2. Ensuring adequate control and protection in coastal zone of Piejūra Nature Park. Action D3. Ensuring adequate control and protection in coastal zone of North Vidzeme Biosphere Reserve.

	€60,361 (5.5 ha)	Action C3. Management measures for Boreal Baltic coastal meadows and white dunes in the Vakarbuļļi and Daugavgrīva Nature Reserves in Rīga
	€3,596 (0.2 ha)	Action C5. Restoration and management of wooded dunes and white dunes in Saulkrasti
	€31,411 (10 ha)	Action C6. Restoration and management of Boreal Baltic coastal meadows, embryonic dunes in Ainaži and Salacgrīva.
	€2,608 (27 ha)	Action C8. Restoration and management of wooded dunes and western taiga in Jūrmala.
	€34,165	Action E12. Restoration and management of wooded dunes and white dunes in Lapmežciems
	€25,460	Action E13. Restoration and management of wooded dunes, grey dunes, embryonic and white dunes in Medze
	€18,330	Action E15. Restoration and management of grey dunes and white dunes in Pāvilosta
	€19,570	Action E18. Restoration and management of grey dunes and white dunes in Užava
	€26,389	Action E19. Restoration and management of wooded dunes, western taiga and white dunes in Carnikava
	€26,983	Action E20. Restoration and management of white dunes, wooded dunes and western taiga in Rucava.
• Costs of management agreements		No recurring costs for management agreements
• Costs of protective actions	€4,233 (11 beef cattle)	Action D4. Purchase of cattle for grazing management in meadows

OPPORTUNITY COSTS (uncompensated)		
	Cost	**Comments**
Foregone development opportunities		At the outskirt of the project, the Law on protected belts merely restricted but did not prohibit building within the 300 m of coastal habitats. In addition, many settlements, towns and cities stand along the coast, where economic activity was not stopped. In addition, there remain available places for settlement. One of the main aims of the project though was to stop building in protected habitats (done through the set up of microreserves and the "functional zoning" included in physical plans of municipalities). The coverage of the project was to go even beyond the original coastal protected belt. The concept of protection of species had been understood for a long time. However, that of protected habitats was new: many habitats such as grey dunes or wooded dunes were underestimated. The mere concern for the landowners was to be in a nice and pleasant area. The area was divided in small plots. Many landowners had plans to build houses, or guesthouses or other business in sites which suddenly occurred to be a protected habitat. Others were also planning to sell their lands with profits. The change of status of the area therefore affected highly the landowners (estimated to circa 7,000 people concerned): the land value decreased highly. The value of lands and economic losses were not calculated though in the project, nor were estimate from other sources been made available.
Value of potential development foregone		
Foregone resource use		
• Loss of mineral extraction		
• Loss of water abstraction		
Foregone output from land management		
• Foregone agricultural output		
• Foregone forestry output		
Foregone socio-economic opportunities		
• Loss of regeneration opportunities		
• Loss of community uses of land		
Reductions in land values		
Price of land		
Total net economic cost		No estimate of opportunity costs was carried out within the scope of this project

3.5. Observed and/or Projected Impacts

Biodiversity and Socio-Economic Benefits

The tables below summarise the biodiversity and socio-economic benefits provided by the initiative. This information is detailed in turn in the rest of this section.

Table 3.5.1: Overview of biodiversity and socio-economic benefits

Biodiversity Benefits		
Species	**Habitats**	**Genetic Diversity**
Abundance of typical species increased, abundance and vitality of invasive species decreased.	Overall, the representativeness of habitats of Community importance was increased, typical species structure of habitat recovered. Infrastructure for visitors has led to the recovery of vegetation and increase of biodiversity value of habitats. Planning on species and habitats ensures the long-lasting sustainable development in project area.	This was not taken into account in the project.

Source: LIFE Nature project - Protection and management of coastal habitats in Latvia – LIFE 02 NAT/LV/008498 – 2002-2006, Final report

Ecosystem Service/Socio-Economic Benefits	
Provisioning	NA
Regulating	NA
Cultural	Establishment of: • Small-scale tourism infrastructure • Car parks • A bird observation tower • Resting places • Pedestrian routes • Barriers
Supporting	NA
Wider socio-economic benefits (e.g. fuelling economic activity, job creation, health benefits**)**	Involvement of two regional coordinators and 12 local coordinators during the project. New field of work for architects. One person responsible for supervising and maintaining the area over the summer in two municipalities. Wider impact on local economy: increasing number of visitors, use of local shops and local guest houses.

Source: LIFE Nature project – Protection and management of coastal habitats in Latvia – LIFE 02 NAT/LV/008498 – 2002-2006, Final report

Biodiversity Benefits

The project had the following direct and indirect effects on conversation of species and habitats:

- Direct effect from habitat management: mowing and grazing of grasslands, cutting of shrubs, removal of invasive species;
- Indirect effect from habitat management by building small-scale infrastructure for visitors: construction of boardwalks, stairs, barriers, resting sites etc.;
- Indirect effect in level of planning by securing a favourable protection regime for habitats and species of Community importance at a broader scale (functional zoning, microreserves, management plans for Natura 2000 sites);
- Indirect effect by raising of public awareness.

The following table presents the benefits to biodiversity achieved by the project:

Table 3.5.2: Benefits to biodiversity.

Benefits to Biodiversity Achieved During the Project[4]			
Direct habitat management	**Habitat management by building small-scale infrastructure for visitors**	**Planning (functional zoning, microreserves, management plans for Natura 2000)**	**Raising of public awareness**
Summary: Overall, the representativeness of habitats of Community importance was increased, typical species structure of habitat recovered, abundance of typical species increased, abundance and vitality of invasive species decreased. (The method used to assess the change is presented below.)	Summary: Infrastructure for visitors has led to the recovery of vegetation and increase of biodiversity value of habitats.	Summary: Planning on species and habitats ensures the long-lasting sustainable development in project area.	Summary: The project self-assessed an overall increase in awareness of the landowners and the municipalities of the coastal development.
Boreal Baltic **coastal meadows** were managed by mowing, grazing and cutting of shrubs. This led to an increase in abundance of indicator species of seminatural grasslands as well the abundance of rare and protected species (including *Angelica palustris*, species of Community importance). In parallel, abundance and vitality of reeds and shrubs has decreased. Embryonic **shifting dunes** and white shifting dunes along the shoreline with *Ammophila arenaria* were managed by dune strengthening restoration of embryonic dunes, and establishment of small-scale infrastructure for visitors. This led to the recovery of structure, dynamics and vegetation of embryonic dunes. In sites, where boardwalks were established, area of bare sand decreased and vegetation (typical species) recovered up to the sides of	Boardwalks, resting site, benches and other infrastructures were built in 16 sites (12 municipalities), on sites where habitats of Community importance (grey dunes, white dunes, wooded dunes, boreal forest, coastal grasslands) are threatened because of visitor activities. Thanks to this infrastructure, vegetation has recovered, and the area of bare soil is decreasing. Species typical for natural habitats are colonising bare sands and overall the biodiversity value of habitats is increasing.	Mapping of **habitat and functional zoning maps** covered an area of approximately 32,000 hectares out of which 19,000 hectares are covered with habitats of Community importance. This served as the basis for the protection of habitats of Community importance in the whole site. 198 microreserves were proposed to ensure to ensure the favourable protection status for habitats of Community importance outside of Natura 2000 sites, 65 were approved during the project. Habitat maps are being integrated into the physical plans of coastal municipalities, which ensure the protection of other habitats of Community importance. Management plans of 4 Natura 2000 sites were elaborated for the adequate protection of habitats in protected nature	Information products: 200 information boards, 2 educational nature path in the dune zone, 11 seminars held, 7 booklets, 20 leaflets, 1 book, 2 films. Municipalities and landowners learnt the necessity of nature protection with means of habitat management including the management of visitor behaviour and establishment of small-scale infrastructure for visitors. Residents and employees of the local administrations gained understanding that balanced development of agriculture and tourism is one of the protection mechanisms of the Habitats of Community importance. Information was diffuses by means of booklets, leaflets, and services for visitors. Visits to coastal habitats increased awareness of coastal nature: it is important in a context where visitors look for calm and rest at the same time as

[4] LIFE Nature project - Protection and management of coastal habitats in Latvia - LIFE02 NAT/LV/008498 – 2002-2006, Final report

Benefits to Biodiversity Achieved During the Project[4]			
Direct habitat management	**Habitat management by building small-scale infrastructure for visitors**	**Planning (functional zoning, microreserves, management plans for Natura 2000)**	**Raising of public awareness**
boardwalks. The cutting of invasive shrubs and building of small-scale infrastructure in **grey dunes** led to a decrease in the abundance, density and vitality of *Rosa rugosa*. In sites where small-scale infrastructure was established, vegetation is recovering, bare sand became occupied by species typical for grey dunes. Dune strengthening, cutting of invasive shrub species , establishment of small-scale infrastructure for visitors were all operated in **wooded dunes** of the Atlantic, Continental and Boreal region and **boreal forests**. These measures decreased the Vitality, density and height of invasive shrubs. In addition, visitors, who have increased in number, use intensively boardwalks. Typical pine forest vegetation is recovering up to the sides of boardwalks.		areas. In addition, the area of two Natura 2000 sites (Užava Nature Reserve and Bernāti Nature Park) was enlarged to include additional habitats of Community importance.	information to learn and discover about nature. The dissemination of booklets, organisation seminars, press publications, habitat maps and proposed functional zoning, enabled to influence the system of physical planning in Latvia towards the protection of coastal Habitats of Community importance. The involvement of land owners, architects, local farmers and specialists of different profession in the activities of the project provided them with experience on the management of habitats of Community interests.

The Method Used to Assess the Change Due to Direct Habitat Management

The method used for this assessment was that of Brown-Blanquet. Sample plots (squares of 1x1 m or 2x2 m) were set up and in each plot all the species were identified followed by their percentage of cover. The figures obtained were then compared along the duration of the project. The number of plots was large enough for statistical analysis and special programmes for processing these data were used.

The "plant communities" (plants growing in groups) were used to define the habitat in order to check which species were typical for each plant community and which ones were not. Other parameters such as bare sand were also recorded in the sample. This method enabled the following to be measured:[5]

- Increase of representativeness of habitats of Community importance: Some "good" species increased their cover and some increased their abundance. This was assessed through the growing number of "good" species per plot. Species composition became more typical of this habitat. In parallel, species and structures which indicated habitat degradation (invasive species, shrubs in grasslands, some particular species typical for abandoned grasslands etc.) decreased.

- Recovery of typical species structure: Vegetation recovered up to the sides of boardwalks. For example, in Daugavgriva the total cover of vegetation increased by 30% in the year following the action.

- Increased abundance of typical species: cover increased from 1% to 5%. In other words, at the beginning they were present in 2 of the 30 sample plots and at the end of the project in 10 of the 30 sample plots.

In addition, habitat management by building small-scale infrastructure for visitors led to the following benefits to biodiversity:[6]

- Embryonic shifting dunes and white dunes (shifting dunes along the shoreline with *ammophila arenaria*): The success of management consisted in visitors using the boardwalks and the vegetation recovering up to the sides of boardwalks. Typical foredune species, such as *Ammophila arenaria, Leymus arenarius, Festuca arenaria,* starting growing again. In parallel, the area of bare, trampled sand decreased;.

- Grey dunes (fixed coastal dunes with herbaceous vegetation): The success of management is also linked to the number of visitors using boardwalks as well as recovery of typical vegetation. Few trampled and slightly eroded sites remained at the end of the project, in order to ensure necessary sandblow. Bare sand was first colonised by *Carex arenaria* and *Festuca sabulosa*. Grey dune vegetation was recovering up to the sides of boardwalks where mosses and herbs appeared. For example, in Daugavgrīva the total cover of vegetation had been increased by 30% in the year following the action.

- Wooded dunes of the Atlantic, Continental and Boreal region: The success of management is also linked to the number of visitors using boardwalks as well as recovery of typical vegetation. Previously degraded sites started being populated by typical forest species such as moss *Pleurosium schreberi, Hylocomium splendens, Brachithecium albicans* and herbs *Lerchenfeldia flexuosa*, *Melampyrum pratense*. With the establishment of boardwalks, the

[5] The exact figure cannot be tracked back: 5 years after the project was finished, not all the information was kept.

[6] Annex 4 to the Final report of the project.

habitats of rare species further from the boardwalks, such as *Pulsatilla pratensis*, *Peucedanum oerselinum*, *Dianthus arenarius* and *Geranium sanguineum* were preserved. Close to the boardwalks, *Linnaea borealis* and *Geranium sanguineum* indicated healthy forest. The recovery of vegetation was slower in the driest and sunny sites (such as the old dune forest in Saulkrasti) than in more shaded sites. However, similar a positive trend has been observed in all sites.

Socio-Economic Benefits

The project was successful in developing cultural and social integration, creating jobs and developing recreational infrastructure:

- Integration was tackled by cooperation with the Russian community of Latvia (30% of Latvia's population). The Film *The Green City* was translated into Russian and a competition for pupils was organised, for both Russian and Latvian children. In addition, accessibility was ensured for handicapped people: the observation tower in Daugavgrīva and boardwalks in Medze were adapted for wheelchairs.

- In terms of job creation, two regional coordinators and 12 local coordinators were involved in the projects. Regional coordinators managed most of the practical works in municipalities. Local coordinators were local people familiar with local problems, local paths and local municipality authorities. In addition, the project developed the work of architects (who were not working in this field before), who are continuing the work in designing the infrastructure of habitat management.

- Also, in all municipalities additional work is needed to maintain and occasionally repair the constructions and areas. In two municipalities there is a person which is supervising and maintaining the area during the summer period.

In terms of recreation infrastructures, after the building of the boardwalk the flow of visitors was more concentrated, as they started using the paths strictly. Visitors have started using the resting sites and reading the information signs. This has made them aware of the value of this area and taught them about habitats and species.

When several paths were possible to the sea, the project chose which paths should be used for the concentration of visitor flow and which should be minimised. It also entailed building several barriers on illegal roads to stop driving into dunes and beach. In some municipalities (such as Jurmala), the infrastructure was developed at a site which was not the most popular but was very rich in terms of biodiversity, with a remarkable landscape and also quite resistant to recreational pressure. A system of paths, stairs, viewing platforms and information boards was established and became very popular. As it was situated in a strategic location, near the museum and near the car park, it attracted visitors who were interested in nature. As such, Jurmala which was famous for its beaches, has now become well-known for its dune forest.

Overall, the following infrastructure resulted from the project actions:

- Small-scale tourism infrastructure in 12 municipalities, with the elaboration of two detailed plans, 12 technical designs, and five sketch designs;

- Car parks in Pavilosta and Lapmezciems were built, car parks in Roja and Lapmezciems were improved;

- In Riga, a bird observation tower was built;

- 29 resting places were established (from simple benches and tables to more elaborate facilities, with fireplaces, wide benches and children's playground);
- Pedestrian routes were built:
  - 1,925 m^2 covered with gravel;
  - 900 m^2 covered with chippings;
  - 7,900 m wooden boardwalks (0.75–3.0 m wide);
- 76 barriers were constructed (simple fencings along roads, barriers on illegal roads, along paths and around car parks).

The development of the infrastructure has led to an increase in the number of visitors, positively impacting the local economy. Local shops and local guest house are increasingly visited. However, no statistical data have been compiled on this.

3.6. Observed and/or Projected Economic Impacts

The project did not calculate the economic impact on the 12 municipalities.

The number of visitors, both local and international, is increasing every year, and even more due to the promotion of the initiative by tourism information centres, travel guides and websites.

Municipalities maintain and renovate all the built outputs of the project. This had led in turn to the employment of one person maintaining the area in summer for at least three municipalities.

The basic framework for the sustainable management of the coastal protection belt of the Baltic Sea in Latvia has been created. Information gathered by the project on habitat mapping and functional zoning is being widely used for the planning of nature conservation measures and the drawing up and evaluation of the territorial plans of the costal municipalities. The building of a small-scale demonstration site consisting of pedestrian trails, stairs, resting sites and car parks is serving to raise awareness among local stakeholders. Costal municipalities and landowners have been able to learn about sustainable coastal management. The local stakeholders are equipped to continue conservation initiatives at the end of the LIFE project. The project also drew up comprehensive digital maps of habitats of Community importance and functional zoning for the protection measures in the coastal zone of Latvia. All maps are available to interested stakeholders via the project website and on request. These maps have been used by local government bodies as a way of integrating conservation into the management planning of 24 municipalities.

The maps are also a very useful tool for the elaboration of the Natura 2000 network in Latvia. The implementation of management plans is ongoing in a proposed area of 987 ha. In addition, 65 micro-reserves have been approved.

3.7. Recent Developments and Outlook

The project has concluded that the infrastructure was kept in excellent condition in all the municipalities, which maintain, renovate, promote and expand all the measures. A key success factor was that the measures were built in some of the most popular nature sites. Also, promotion is done through travel guides, tourism information centres and websites.

The network was planned in such a way that visitor flows are shifted from the most vulnerable sites to more resilient areas. Visitors now use the roads which were created and are kept away from vulnerable areas. The improvement of habitats can clearly be seen.

In addition, sustainability of the project is ensured through the following:

- Integration of functional zoning and habitat maps in physical plans of municipalities;
- Implementation of partly implemented technical designs by municipalities, both with their own and external funding;
- Maintenance of small-scale tourism infrastructure by local municipalities: responsibility for all constructions (including information boards) was legally transferred to the municipalities or to the Joint Stock Company “Latvian State Forests”;
- Management plans were integrated into physical plans of municipalities and also implemented in the scope of other projects.

In particular the following was observed in each individual municipality:

- Pape: The network of boardwalks was expanded by another LIFE project.
- Medze: Some information boards were renovated.
- Pavilosta: The sites became very popular. The municipality is expanding the network of routes. After the LIFE project, a nature reserve was established. A nature protection plan was elaborated and habitat management is being continued.
- Uzava: Latvian State Forests (the landowner of the site which was managed by LIFE project) is maintaining and expanding the network.
- Roja: The municipality built more routes in scope of other projects. This has become a popular tourist site.
- Lapmežciems: Popular site.
- Jurmala: The municipality is maintaining and repairing the infrastructure.
- Rīga: More infrastructures are still necessary.
- Carnikava: The municipality is continuing the cooperation with the project team.
- Saulkrasti: The municipality is planning a specific project to expand the network of routes etc.
- Salacgriva, Ainazi: The infrastructure is well-maintained.

More habitat management works are being planned by several municipalities, and the project experts are invited to participate in planning. Also, the project launched the wave for initiatives in the area of protection and management of coastal habitats in Latvia. The Environmental Protection Club of Latvia and also Delna (the Latvian branch of Transparency International) developed projects on issues such as illegal building, driving in coastal habitats and conflicts of interests of municipalities, civil servants and politicians.

Although threats identified at the outskirt of the project were highly reduced with the implementation of the actions, two major concerns remain:

- Through the privatisation of properties, it will be more difficult to ensure habitat protection in newly-privatised lands;
- There is still a lack of involvement in and understanding of municipalities on nature protection issues.

Therefore, the project prepared an "After-LIFE Conservation Plan" aiming at ensuring its further sustainability and addressing the remaining threats, according to the following actions:

- Habitat maps and functional zoning continued in the spatial planning of the municipalities;
- Continuing the implementation of technical designs;
- Maintenance of the built infrastructure;
- Management plans for four Natura 2000 sites;
- Management of coastal grasslands by mowing;
- Management of grasslands by grazing.

3.8. Summary

GREEN INFRASTRUCTURE BENEFITS	
Ecosystem resilience	✓
Climate change adaptation	
Disaster prevention	
Ecosystem service provision	✓
Main indicators for measuring ecosystem service provision	
1. Number of visitors	
2. Number and variety of species	
3. Number of physical plans including Green Infrastructure elements	

3.9. Contact Details

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4 Comparable Initiatives

1. Policy Initiative

Strategy for Integrated Coastal Zone in Spain (*Estrategia de Gestión Integrada de las Zonas Costeras en España*).

2. General Background Information

The Spanish Strategy for Integrated Coastal Zone in Spain (ICZM) was developed on the basis of several existing pieces of legislation, addressing the gap for a comprehensive strategy for the management of coasts in Spain.

The "public domain" is at the heart of the administrative law regarding coasts of Spain.[7] The importance of this concept is reflected in the 1978 Constitution which is the main source of Spanish law: Article 132.1 states that such areas cannot be subject to embargo, divestment or prescription. The following relevant instrument was Coastal Law 22/1988 which identified, gave status and managed the Maritime Terrestrial Public Domain, and more particularly:

- The shores of seas and rias;
- Territorial seas and inland waters;
- The natural resources of the economic zone and continental shelf.

This Law sought to ensure greater protection of the Maritime-Terrestrial Public Domain and also had two major objectives: to guarantee the domain's public status and to conserve its natural characteristics. However, the law was designed to manage the Maritime-Terrestrial Public Domain and not for the wider coastal area.

Regional initiatives at the level of Autonomous Communities were also launched for the management of coastal regions. However, these were only regional- and sector-based initiatives. These initiatives involved the Ministry of Rural and Marine Environment through the Sustainable Management of the Coast Department, and only act in the public space of coastal area. In addition, and with regard to non-public spaces, the Ministry of Rural and Marine Environment established agreements with each Autonomous Community. As such, a national strategy was needed, and the Spanish Strategy for Integrated Coastal Zone in Spain sought to address the following objectives:

- To coordinate the various policies which affect the coastal regions;

[7] Public domain are sea-land status under the provisions of article 132.2 of the Constitution and is further defined in Title I, Chapter I, article 3 of the Spanish Coastal Law as being part of the Maritime-Terrestrial Public Domain:
1. The sea shore and estuaries, including:
a) The sea-land area or space between the low water mark, and the extent to which the waves reach the greatest known temporary or where it exceeds that of the high tide line live equator. This includes marshes, ponds, marshes, estuaries and, in general, the lowlands that are flooded due to the ebb and flow of tides, waves or water seepage from the sea.
b) Beaches or storage areas.
2. Territorial sea and inland waters, with their bed and subsoil, defined and regulated by specific legislation.
3. The natural resources of the economic zone and continental shelf, defined and regulated by specific legislation.

- To plan and manage resources and coastal areas;
- To protect natural ecosystems, increase social and economic welfare of coastal regions and develop their potential.

The ICZM Strategy was developed in line with the following EU directives and recommendations with which it shares objectives and strategies:

- Directive 79/409/EEC on wild birds;
- Directive 92/43/EEC on natural habitats, fauna and flora;
- Directive 2000/60/EC establishing a framework for Community action in the field of water policy;
- Directive 2001/42/EC on the effects of certain plans and programs on the environment;
- Recommendation 2002/413/EC implementing integrated coastal zone management in Europe;
- COM (2004) 516 Proposal for a Directive on Spatial Data Infrastructure, INSPIRE.

More particularly, Recommendation 2002/413/EC is the direct legal basis for the ICZM. Although it is not binding, there is a formal commitment by Member States of the EU to follow the priorities laid out by adopting a strategic approach to ICZM. The approval of this recommendation in 2002 was the clear starting point of the work and efforts that led to the development of this strategy. The strategy was developed over eight years in three stages: preparation (2002–2005), planning and organisation (2006–2007), and implementation and review (2008–2010). The strategy is being implemented with the support of the following instruments:

- Master Plan for Coastal Sustainability;
- Sustainability Observatory for the Spanish Coast;
- Agreements with coastal regions;
- National Coast Council;
- Purchase of land for protection and restoration;
- Support for R&D in coastal areas;
- Education, continuous education and training activities for coastal managers.

3. Specific Objectives

There are two strategic objectives of the strategy:

- To improve environmental, economic and social aspects of coastal zone and the use of its resources under the principles of sustainable development;
- To review and adapt the management and decision making by incorporating the principles of Integrated Coastal Zone Management.

The strategy defines the following 10 specific objectives, of which six are related to the first strategic objective, and four with the second strategic objective:

Table 3.1 Specific objectives.

Sustainable development of coastal areas	Integrated management
1. Sustainable management of the interaction between natural physical processes and the occupation of the coastal strip, including the implementation of town planning. 2. Protecting and restoring coastal ecosystems. 3. Optimising the use of natural resources, including living resources, mineral resources and renewable energy sources respecting the carrying capacity of the system. 4. Security against the risk of environmental accidents and natural disasters on the coast. 5. Enhanced allocations for public use and accessibility to the coast under the criteria of sustainability. 6. Recovery and promotion of cultural heritage linked to the coast.	7. Effective and systematic integration of information and knowledge about the environment in decision-making process. 8. Coordination between different administrative levels to facilitate territorial coherence and cohesion in defending the collective interest. 9. Transparency in the management process and effective participation in the planning of actions. 10. Financial consolidation to ensure the availability of necessary technical and financial resources.

4. Green Infrastructure Elements

Protected areas: Related to the actions to improve protected areas in the public domain of coastal area.

Restoration zones: Related to restoration and protection of coastal systems (dunes, beaches and cliffs), and the reintroduction of extinct species.

Sustainable use areas/Ecosystem service areas: Recovery and expansion of the landscape quality of coastal wetlands; recreational activities, reduction of risks of natural hazards.

Elements of natural connectivity: Through the elimination of artificial settlement in the public domain of coastal area, rehabilitation of coastal stretches of urban influence or affected by singular impacts.

All the elements mentioned above form the core of the objectives and actions of the ICZM: by integrating the management of the coast with the protection of ecosystems, the initiative seeks not only to optimise the use of resources, but also reduce the risk of natural hazard and to increase recreational activities on the coast.

5. Implementation Costs

The budget for the Master Plan for the Sustainability of the Coast cost €6,422,366 to develop in two years. At the present time, pending final settlement, total cost have amounted to approximately €6,000,000.

The 2006 budget of the Directorate General of Coasts to finance measures is €200,989,530.

One of the primary objectives of the strategy is to extend the maritime-terrestrial public domain *naturally*. To this end, a series of acquisition activities in coastal areas, as well as demolition, have been carried out since 2004. Acquisitions enabled the State to become the owner of the territory, whereas demolitions were a core element of the strategy in order to recover the coast from buildings.

The total amount of areas acquired in 2007 was 11,227,308 m² for a total of €29,390,794, giving an average of €2.6 per m². The details about the acquisitions are presented in the table below:

Table 6.1 Size recovered between the years 2005–2007 and associated costs.

Period	Surface (m²)	Cost (€)
2005–2006	4,408,629	15,346,141
1 January–24 October 2007	6,818,679	14,044,653
Total acquired on 24 October 2007	***11,227,308***	***29,390,794***
Cases pending (24 October 2007)	960,000	60,000,000
Records with a declaration of public utility or processing	15,000,000	130,000,000

Source: Ministry of Environment, and Rural and Marine Affairs (2007)

With regard to the overall size of demolitions, it accounted for 273,027 m². No information about the costs of demolition was available. The increase in the number of demolitions from 2004 to 2007 is presented in the table below.

Table 6.2 Demolitions carried out in 2004-2007.

Year	Total no. of demolitions	Total surface demolished (m²)
2004	40	11,180
2005	194	83,470
2006	345	93,814
2007	665	84,563
Total	*1,244*	*273,027*

Source: Ministry of Environment, and Rural and Marine Affairs (2007)

6. Observed and/or Projected Impacts

Threats Associated with the Change in the Coastal Management Model

The implementation of the new management model required the strengthening of the principle of sustainability to ensure that short-term economic and social imbalances are overcome. The most important threats were identified at the outskirts of the implementation of the measure, as follows:

- **Tourism** sector, which could be affected by the switch to a more sustainable model of tourism which respects coastal ecosystems, promotes the sustainable use of resources and also promotes alternatives to mass sun-and-sand tourism (it contributes 12% of GDP and many jobs throughout the country)

- **Construction** sector (18% of Spain's GDP and many new homes are concentrated in coastal areas), a major source of employment.

- **Fisheries** sector: Threats were associated with the possible introduction of measures to protect endangered stocks, which might have led to job losses in a sector already experiencing many problems due to the depletion of fisheries resources.

- **Ports and maritime transport**: Key activities for the economy which might have been affected in their models and activities.

- **Industry**: Many industries located on the coast are in areas of high environmental value or zones which might have been subject to natural risks in future. Relocating to other sites could have been opposed due to the economic and social costs.

- **Disagreements among administrations** of measure to improve the management model without changing national administration. Agreements with the regions (the other measure being the creation of a National Coast Council) were quite binding since they amounted to a commitment by the region to cooperate at all levels (administrative, technical and financial).

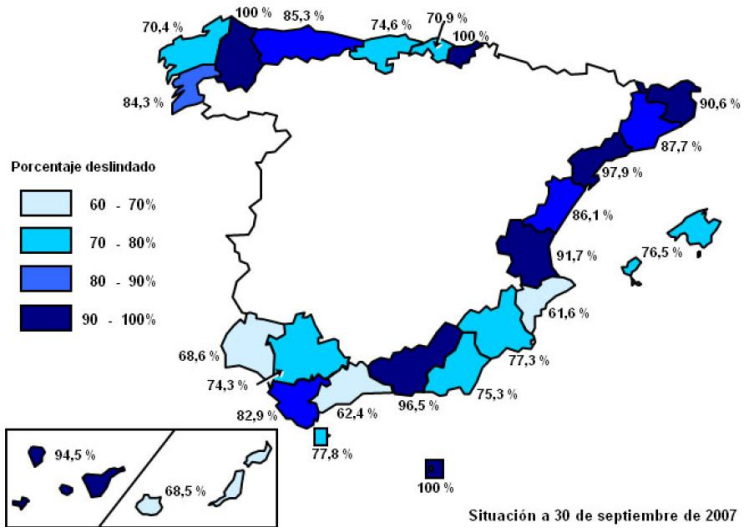
- **Disagreemenst with stakeholders**, which might have been associated with the outcome of a diagnosis in which they were asked to express an opinion and participate. The potential exclusion of some stakeholders to fit with the objective criteria of the master plan might have triggered their opposition, potentially amplified through the media.

Expected Positive Impacts

The benefits of the strategy in the long-term will be measured by analysing the evolution of the state indicators and management that will be used as a reference for the planning of actions (in the Master Plan for Sustainability) and the monitoring and observation of the coast (through the Sustainable Coast Observatory).

Since 2004, there has been a positive development for the approval of boundaries for the areas to be included as public domain. It has exceeded 60% of the territories under this status in all cases in 2007, reaching 100% in the case of Guipúzcoa.

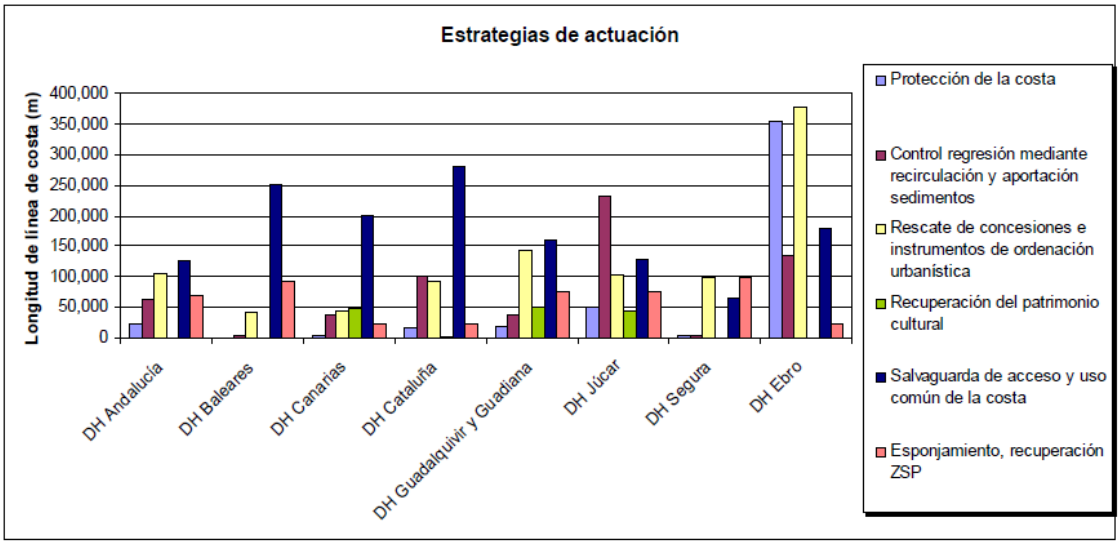
Figure 6.4.1 Percentage demarcated by province.



Source: Ministry of Environment, and Rural and Marine Affairs (2007).

Figure 6.4.2 shows the action strategies in the coast in each Autonomous Community. In general, actions to safeguard access and common use of the coast are the most important. This can be understood by the fact that the Law enforced access to the beach every 200 m. This in addition required little time and investment and therefore was more easily implemented than other measures. Not only does this measure ensure access to the sea, but also in a way that both enables protection of the coasts access and use by visitors for recreational purpose. In contrast, in the river Ebro coastal district, measures on coastal protection have been the most important.

Figure 6.4.3 Some of the action strategies in the littoral.[8]

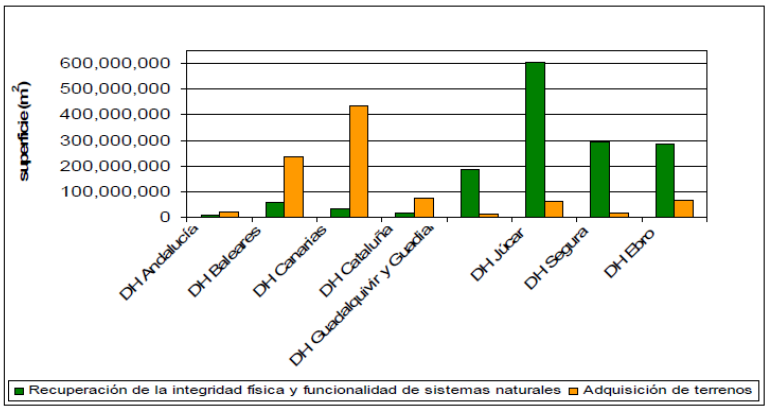


Source: Ministry of Environment, and Rural and Marine Affairs (2007)

[8] In order of listing: coastal protection; control and regression by sediment supply; rescue grants and urban planning instruments; recovery of cultural heritage; safeguarding access and common use of the coast.

Figure 6.4.4 presents the recovery of physical and functional integrity of natural systems (green in the map) and land purchase (orange) in each coastal district. This graph shows that in cases where restoration actions were most needed, it did not require land purchase. On the contrary, where land was purchased, the respective ecosystems were already in good health.

Figure 6.4.4 Environmental recovery strategies and acquisition of land on the coast.



Source: Ministry of Environment, and Rural and Marine Affairs (2007).

In addition, the following positive impacts were expected:

- Comprehensive knowledge of the coast: Data collection and reporting on the coast and its incorporation into databases and information systems provide a comprehensive view of all parts of this complex system, constituting a scientific basis for further studies, a source of public information and strong support for decision-making processes.

- Optimal use of coastal resources: Coastal resources, be they biological, geological or energy, will be exploited in a sustainable way. This will ensure a balance between the human needs and maintaining optimal levels of natural systems. This is to be ensured through, for example, the creation of structured access to the beach and structuring the common use of the coast (measures will be developed to ensure sustainable tourism).

- Protection and restoration of coastal ecosystems and landscape: The measures will protect much of the valuable space from the point of view of its biodiversity, landscape and natural systems or restore degraded areas. Economic instruments such as the purchase of land for protection and restoration will contribute strongly to achieving the objectives.

Expected Negative Impacts

The following negative impacts are expected:

- Slowdown in decision-making processes and administrative: The decision-making processes will be subject to a slowdown due on the one hand to the time needed to reach the necessary agreements between the different administrative levels and between environmental and sectoral authorities, and on the other hand because the slow mechanisms of participation and contribution of stakeholders interested in the decision process.

- Slowing economic growth in the short term: Changes and adjustments to the model of growth and development that currently characterise the coastal zone will involve short-term negative impacts on productivity and employment systems, which will reduce productivity and employment.

7. Observed and/or Projected Economic Impacts

Table 6.1 showed the monetary value attached to the purchase of coastal areas. The total amount from 2005 to October 2007 is €29,390,794. Taking into account the pending cases, those with a declaration of public utility or processed the same, the figure could rise to about €190 million.

Economic benefits are supposed to be high in tourism. However, no data have been compiled on this issue so far.

8. Recent Developments and Outlook

Part of the integrated management was not finished due to a lack of agreement reached between the different authorities. The overall implementation of the strategy was therefore not totally completed. However, in 2008, a sustainability strategy of the coast in the area "River Basin District of Andalusia" (from Carnero the provincial boundary Almeria-Murcia) was developed. This strategy is focused on a very delimited region and takes account of the ICZM for further action.

9. Summary

GREEN INFRASTRUCTURE BENEFITS	
Ecosystem resilience	
Climate change adaptation	
Disaster prevention	✓
Ecosystem service provision	✓
Main indicators for measuring ecosystem service provision	
1. Area of land recovered	
2. Number of tourism infrastructure created	
3. Number of visitors	

10. Contact Details

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1. Policy Initiative

BaltCICA Project

2. General Background Information

The BaltCICA project draws on the results of the BSR Interreg IIIB projects ASTRA (Developing Policies & Adaptation Strategies to Climate Change in the Baltic Sea Region), and SEAREG (Sea Level Change Affecting the Spatial Development in the Baltic Sea Region) and its Decision Support Frame.

Focusing on the Baltic Sea Region (BSR), the ASTRA project, which operated from 2005 to 2007, assessed regional impacts of the ongoing global change in climate. It developed adequate climate change adaptation strategies and policies, together with relevant stakeholders, such as planners and decision makers. The project website is http://www.astra-project.org/ and that of the Lithuanian case study (City of Klaipeda and the Curonian Spit): http://www.astra-project.org/02_lithunia.html (Project report: Hilpert et al. 2007).

The ASTRA project was a follow up of the SEAREG INTERREG IIIB project, which operated from 2002 to 2005. While the SEAREG project focused only on sea-level changes and related flooding problems, ASTRA had a wider scope. The Decision Support Frame on sea-level change and related hazards was initiated by the SEAREG project and further developed in the ASTRA project.

3. Specific Objectives

The duration of the BaltCICA project is from February 2009 to January 2012.

The BaltCICA Project is designed to focus on the most imminent problems that climate change is likely to cause in the Baltic Sea Region. The aim of the BaltCICA project is to achieve a better capability to deal with the impacts of climate change at those levels where concrete adaptation measures have to be implemented and are visible/tangible for the population. Special emphasis is on adaptation to sea-level rise and the changing frequency and magnitude of floods for the cities and regions located on the Baltic coast. The concentration of large parts of the population and many larger cities in coastal areas make the region especially sensitive to climate change. The project focuses on the most imminent problems that climate change will cause in the Baltic Sea Region: changes in water availability and quality as well as in sea level and flood risk seem to be most relevant. The BaltCICA project, with the involvement of local and regional partners, prepares regions and municipalities to cope with a changing climate. Adaptation measurements are developed in cooperation with local authorities and administrative bodies and are discussed with other stakeholders. The innovative features of the project are not only in developing the measures, jointly with local authorities and administrative bodies, but also in implementing them through case studies.

The project aims at transferring successful methods of development and implementation of adaptation measures from pilot studies to other case studies facing similar problems. The BaltCICA project focus on climate change impacts, adaptation measures, costs and benefits of adaptation as well as communication and dissemination activities (http://www.baltcica.org).

The Lithuanian case study consists of the **Klaipeda city** case study area (http://www.baltcica.org/casestudies/klaipedacity.html), and **Klaipeda district** case study area (http://www.baltcica.org/casestudies/klaipedadisctrict.html).

The main focus of the two case studies were:

Table 3.1 main focus of the case study areas.

Klaipeda city case study	Klaipeda district case study
1. To assess climate change impact on Smelte river hydrological regime. 2. To review possible Smelte river flooding mitigation and adaptation measures.	1. Climate change impacts on groundwater levels and hydrochemical composition. 2. Development of the detailed plan of Karkle beach infrastructure (spatial planning) taking into consideration possible climate change impacts.

The two case studies have taken the following four steps:

1. Scenario-Building (January 2009–May 2010): Assessment of consequences of climate change and visual presentation of assessment results.

2. Development of adaptation options (May 2010–June 2010): Based on the assessment of climate change impacts several adaptation options are identified and discussed with local stakeholders during scenario workshops, that led to the short list of adaptation options selected for the appraisal procedure.

3. Appraisal of adaptation options (July 2010–April 2011): Feasibility study on selected adaptation options was prepared and discussed during the second seminar with local stakeholders, action plan for the implementation of most efficient adaptation measures was developed.

4. Implementation of adaptation measures (May 2011–December 2011): Based on the appraisal procedure and discussion with local stakeholders, political decisions concerning implementation of concrete adaptation measures are taken.

The following targets were foreseen for the project:

Table 3.2 Expected targets - Communication and publicity indicators

Communication and publicity indicators	Measurement Method	Target
No. of addresses e-mailed to	Number of email addresses in the project mailing lists. This number should include ONLY regularly used emails to inform about main project activities e.g. invitations to main project events; newsletters; press releases etc.	120
No. of participants at the regional, national and transnational events	Number of participants counted according to the participant list. Only events organised or co-organised by the project. Dedicated to project activities/results and addressing project target groups. Meetings of the project steering groups or working meetings are not counted.	80
No. of printed publications distributed	All printed project publications distributed to the relevant target groups. No of printed copies.	300

No. of articles in international press (newsletters, magazines etc.)	Articles covering project activities, partnership, results etc. Clear reference to the project, EU & Programme made. No paid advertisements.	4
No. of articles in national newspapers	Articles covering project activities, partnership, results etc. Clear reference to the project, EU & Programme made. No paid advertisements.	2
No. of articles in regional newspapers	Articles covering project activities, partnership, results etc. Clear reference to the project, EU & Programme made. No paid advertisements.	2
No. of articles in local newspapers	Articles covering project activities, partnership, results etc. Clear reference to the project, EU & Programme made. Not paid advertisements.	3
No. of brochures produced	Brochures about project activities, results Please count only issues.	1
Number of flyers produced	Flyers about project activities, results. Please count only issues.	1
No. of public events advertising the project organised by the project	Events organised by project to external target groups to promote the project activities/results. E.g. Stakeholder events; regional info days; press conferences etc.	4
No. of public events advertising the project attended by project representatives	During the event project representative should have an active role in promoting the project e.g. presentation about project; run project exhibition stand etc.	1
No. of TV broadcasts	Appearances in the TV (national, regional, local, commercial or public) covering project activities, partnership, results etc. Clear reference to the project, EU & Programme made.	0
No. of radio broadcasts	Radio broadcast (national, regional, local, commercial or public) covering project activities, partnership, results etc. Clear reference to the project, EU & Programme made.	2
Average monthly visits on the project website		15
No. of officials of ministries, responsible for climate change adaptation participating in project events		2

Source: Vaiva Ramanauskiene.

Table 3.3 Expected targets – Output indicators for common results.

Output indicators for common results	Measurement Method	Target
Number of politicians directly involved in project activities	Involvement of politicians is ensured in the project's decision making bodies as for example project's Steering Committee, Management Board, Advisory group or Board as etc.	4
Number of open public events with politicians participation	Events (conferences, press conferences, seminars etc) organised for wider public (not limited to the project partnership) where politician(s) take(s) an active role, for example give a speech, moderate an event, a session or panel discussion etc. This may include international, national and regional/level events. Please do not count the internal working meetings, workshops, and seminars etc that are organised only for the project partners.	2
Number of political statements to be endorsed, resulting from project activities and signed within the project lifetie	Statements signed/endorsed by the politicians either at local, regional, national or European level during the project lifetime. As for example Memorandum of Understanding, Agreement, Transnational Action Plan, Territorial Development Plan, regional plan/strategy, local land use plan etc. Please keep in mind that these documents should be signed/ endorsed by the respective politicians. One statement signed by several politicians is counted as one statement.	2
Amount (EUR) of investments realised with Programme's funding within the project lifetime	Investments that are described in the section 6.4.2. of the Project Data Form.	50,000
Amount (EUR) of investments realised with other than Programme's funding within the project lifetime	Investments planned to be realised during the project lifetime by other funding than the funds committed to the project by the Baltic Sea Region Programme 2007-2013. These investments should contribute to the achievement of the project's expected results and planned objectives. For example, implementation of certain activities agreed among the project partners in action plan designed during the project lifetime (building a road, installing equipment to prevent the pollution from the Baltic Sea or reconstruction of the building by using the feasibility study developed by the project etc.).	0

Source: Vaiva Ramanauskiene

4. Green Infrastructure Elements

Sustainable use areas/Ecosystem service areas: The primary aim of the project is not Green Infrastructure since it main focuses on climate change adaptation. However, the indirect water-balance measures foreseen as possible adaptation measures, i.e. controlling urbanisation of rural part by legal acts, preservation and cultivation of agro-natural landscapes, matches the 'sustainable use' of GI elements typology. Therefore, one of the outcomes of the project is a Green Infrastructure initiative. The knowledge being extracted from the project supports the communities and cities in developing further Green Infrastructure initiatives, based on this outcome.

5. Implementation Costs

The total BaltCICA project budget is €5,271,150. The project is partly funded by the EU Baltic Sea

Region Programme 2007–2013 (ERDF co-financing: €3,877, 940) and the Norwegian national contribution: €112,550.[9] The lead partner of the project is the Geological Survey of Finland (GTK) and the partnership comprises 24 partners including municipalities, regional authorities and research institutes.

The Lithuanian contributions to the project were:

Table 5.1 Lithuanian contributions to the project.[10]

Source	Total partner budget (€)	ERDF co-financing (€)
Municipality of Klaipeda	150,000	127,500
Environmental Centre for Administration and Technology	88,620	75,327
University of Vilnius	82,000	69,700

In comparison, the ASTRA project was co-financed by the Baltic Sea Region's INTERREG III B Program of the European Union, with a project budget of €2.2 million. (It was not possible to get information on the part of financing provided by the Lithuanian Government and the project contractors).

Other costs include:

- Feasibility study and investment project on surplus water reduction in Klaipeda (€50,000);
- Detailed Spatial Plan of Karkle beach Infrastructure (€87,000).

6. Observed and/or Projected Impacts

The project is still on-going and no such assessment has been carried out. The final conference of the BaltCICA project will be held in January 2012. Further results of the project will then be discussed.

An approach to assess the benefits of Green Infrastructure to tackle climate change together with geoscience elements was developed through the BaltCICA project (Bottle & Rubski, 2011). It has not been used yet to our knowledge.

7. Observed and/or Projected Economic Impacts

The project is still on-going and no such assessment has been carried out. The final conference of the BaltCICA project will be held in January 2012. Further results of the project will then be discussed.

A methodology was set up within the broader project to assess the cost-benefit assessment of adaptation to sea-level rise on the basis of the case study of Kalundborg in Denmark (Schimtd-Thome et al., 2010). As far as is known, the methodology has not yet been applied.

[9] http://eu.baltic.net/Project_Database.5308.html?&&contentid=6&contentaction=single

[10] http://eu.baltic.net/Project_Database.5308.html?&&contentid=6&contentaction=single

8. Recent Developments and Outlook

So far the BaltCICA project in the Klaipeda city case study area contributed to a study on adaptation measures and possible adaptation costs (Stonevicius et al., 2010). The conclusion of the study was to propose the following possible adaptation measures for raised water level caused by heavy precipitation:

- Technical measures to enlarge the diameter of the channel or to change river channel configuration, e.g. to build dykes;
- Indirect water-balance measures (controlling urbanisation of the rural part by legal acts, preservation and cultivation of agro-natural landscapes).

In addition, the core of the project was not only to develop a measure, but also to implement it. The implementation process is still on-going. In parallel, the BaltCICA objectives interact with other activities of Klaipeda city: a detailed territorial planning process of the city is under development and solutions of flooding problems developed within the project are to be included in this plan.

9. Summary

GREEN INFRASTRUCTURE BENEFITS	
Ecosystem resilience	
Climate change adaptation - indirectly	✓
Disaster prevention	
Ecosystem service provision	
Main indicators for measuring ecosystem service provision	
1. Transfer into policy-making	
2. Soil water storage capacity	
3. Floodplain water storage capacity	

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5 Conclusions

5.1 Overview of the Initiatives

This report has shown that the development of Green Infrastructures can deliver important benefits for the protection and management of the coast. The examples covered ecosystem services such as recreation and cultural activities, integrated management and planning as well as approaches to adapt to climate change.

Other specific tools, such as those developed for the implementation of the Strategy for Integrated Coastal Zone in Spain (e.g. the Master Plan for Coastal Sustainability, the Sustainability Observatory for the Spanish Coast, the National Coast Council, etc.), show that a wide array of measures are available for each setting and environment, adapted to the aim of each Green Infrastructure.

Other initiatives have been taken in the EU to develop Green Infrastructure protection and management of coasts. For example, the French Loi Littoral (Coastal Zone Law)[11] is a long-standing attempt to organise land-use planning in coastal areas in view of preserving natural heritage. In relation to this law, the establishment of the Conservatoire du Littoral (Conservatory of the Coastal Areas)[12] is an example of the use of an institution for the preservation and management of Green Infrastructure in coastal areas.

Several other initiatives focused on coastal protection and maritime spatial planning with a particular aim of ecotourism and recreation, landscape and amenity and erosion control, for example Coastal Area Management Programme (CAMP) in Cyprus and the National Policy and Plan for Prevention and Response to Pollution of the Sea and of Coasts in Greece. These measures concern core and restoration areas, sustainable use/ecosystem service zones and green urban and peri-urban areas). They are both implemented at national level by governments and mostly use as tools strategies and plans as well as information gathering and mapping.

Additional examples, related to the multi-functional use and enhancement in the wider environment and permeability of the coast are:

- The Strategy of an integrated coastal zone management) in Denmark;
- The Shoreline management plans in Great Britain;
- The Draft Plan for the West Part of the Gulf of Gdańsk – First Maritime Spatial Plan in Poland;
- The Portuguese Strategy for Integrated Coastal Zone Management.

These initiatives mainly aim for the moderation of extreme weather events and the provision of cultural and social services. They are implemented at the national level (except for the Plan for the Gulf of Gdansk) by central governments. As implementation tools they use regulation and planning, strategies and plans as well as public funding and investment.

Finally, the initiative of the Baltic Green Belt – the section of the European Green Belt operated on the Baltic coast – has as the direct objective of biodiversity conservation in developing examples of sustainable development of the coast. The initiative is led by the University of Kiel, which cooperates

[11] http://www.outils2amenagement.certu.fr/rubrique.php3?id_rubrique=12

[12] http://www.conservatoire-du-littoral.fr/front/process/Home.asp

with NGOs and public authorities. It seeks to improve the ecological status of the marine and terrestrial Baltic Sea area while supporting the implementation of the HELCOM Baltic Sea Action Plan for the protection of the Baltic Sea and evaluating the implementation of international agreements for coastal protection along the Baltic Green Belt. This initiative also aims to identify barriers and success factors/indicators of sustainable coastal development.

5.2 Achievements and Successful Measures

The measures presented in this case analysis seem to be particularly useful in contributing to:

- Overall preservation, restoration and management of protected species and habitats (mostly through direct habitat management of areas, such as through mowing and grazing, cutting of shrubs and removing invasive species, as well as mapping areas of importance and integration of newly protected sites);
- Expansion of sustainable tourism, through the management of visitor/user flows (e.g. network of small-scale visitor infrastructure like pedestrian trails, stairs, resting sites, car parks etc.);
- Economic development (tourism and integrated management and planning);
- Cooperation with local stakeholders and the general public as well as awareness raising campaigns.

The costs involved vary greatly among the examples. In the LIFE project, the total costs were €1,666,152 out of which only 2% were clearly reported for restoration activities, accounting for a cost of €46 per ha restored in total. However, these costs also included the costs for tourist infrastructure (no particular axis for action existed in the structure of LIFE projects), which cannot be estimated as separate elements. In addition, 20% of the total costs relate to maintenance of the areas, which also included restoration and management measures. The total cost of the entire project per ha covered is an average of €12.5 per ha. As averages, these costs are higher than that for acquisition of the land in the Spanish example, which accounted for €2.6 per m². However, the implementation of ICZM in Spain requires further measures to be implemented in order to be fully operational and effective: only when those are developed and the costs assessed can a full cost-benefit analysis be undertaken.

Assessing the impacts of the measures, especially compared to the costs, is made more complicated by the fact that few effects have been quantified and economic returns have usually not been estimated. Concerning climate change adaptation and mitigation, the impacts (notably by the BaltCICA project) still need to be assessed over time. Although it is difficult to conduct a cost-benefit analysis of the Lithuanian case studies of the BaltCICA project, it is worth noting that a methodology was developed for the cost-benefit assessment of adaptation to sea-level rise on the basis of the case study of Kalundborg in Denmark (Schimtd-Thome et al., 2010). The methodology has not yet been applied. Another approach developed by the BaltCICA project to assess the benefits of Green Infrastructure to tackle climate change might also be assessed together with geoscience elements (Bottle & Rubski, 2011).

5.3 Weaknesses of the Initiatives

In terms of implementing the initiatives, the challenges related to the set up of Green Infrastructure can be linked to their innovation. In the case of the LIFE project for example, emphasising and protecting biodiversity through the building of small-scale infrastructure for visitors (boardwalk, bird

watch towers etc.), was new and had to be tested before it could be improved. At the same time, raising awareness was crucial to ensure change in attitude and improved management. This challenge was overcome:

- For the general public: Most visitors were, prior to the project, unfamiliar with the value of embryonic, white, grey and wooded dunes. It was perceived for many as being a waste area or obstacle between the car and the beach. The project showed that these areas were very valuable and required attention. Visitors learned habitat names and species from information boards and to appreciate landscapes other than beach and sea. Their attitude changed as they stopped damaging the dunes and started using the boardwalks conscientiously in order to protect the plants and animals.

- For the municipalities: Before the project, municipalities were reluctant to fully embrace the notion of protected habitats, since this could potentially lead to the prohibition of activities. Half of all the coastal municipalities participated in the project and the other half played the role of observer. After the end of the project, the municipalities continued to build other Green Infrastructure objects in cooperation with the project team. The project can be seen as having raised the standard of Green Infrastructure in coastal municipalities as they now build better infrastructure which takes nature protection into account.

- For the state: The project led to improvements in planning quality at the state level. Through habitat mapping in the entire coastal protection belt and the "functional zoning" for every area, the project informed the municipalities and the Ministry of Environment, the Ministry of Regional Development and the Environmental Protection Boards about the values and necessary actions. Ministries and Environmental Protection Boards all raised their standards for territorial and other types of planning. They became familiar with habitats and species of Community importance.

The Spanish ICZM example showed that its implementation threatened the following sectors: tourism, construction, fisheries, ports and maritime transport and industry. In addition, the initiatives highlighted the difficulties that can arise between administration and stakeholders in ensuring that all interests are taken into account and the measures implemented timely.

The assessment of the biodiversity impacts of the initiatives has proven to be well documented in the case of the LIFE project, together with the Brown-Blanquet method. However, although highly enriching, this approach had its limits with regard to the wider implications of the structures created for visitors. Indeed, the assessment is based on plots which represent the trend: it cannot, however, take into account the variety of structures (here paths) created, which are all defined by different parameters (such as the plant communities traversed, the number and types of visitors etc.). This situation makes quantitative assessment difficult.

5.4 Potential to Contribute to Green Infrastructure

The examples presented in the case analysis show that coastal areas can have an array of multifunctional uses: by ensuring ecosystem conservation management, initiatives can also provide various ecosystem services. These mostly focus on recreational and cultural activities (tourism) and climate change adaptation through the protection of biodiversity. Although for the moment very few benefits derived from those services have been estimated quantitatively, the first outcomes and outputs of the projects have shown that there is a high potential for the development of green infrastructures along European coasts.

In this regard, it is worth mentioning that several studies have already presented the potential of an ecosystem-based approach, and thereby can let us extrapolate on the potential of Green Insfrastructure, to contribute to the protection and management of coastal habitats. For example, the Working Group on Biodiversity and Climate Change (2009) reported that the characteristics of the coast (use of soft coastal defences, maintenance and restoration of mangroves and other coastal forest, protection of coral reefs) would have potential benefits to ecosystems: climate change adaptation and mitigation, nature conservation, coastal protection and fishing nurseries leading to revitalised fish stocks and thus improving livelihoods. Also, Zeitlin et al. (2009, p.7) recommended that ecosystem-based adaptation should be taken into account in the decisions of the Parties to the UNFCCC at COP15 in accordance with the outline provided in the Bali Action Plan, and an "emphasis [should be] placed on marine and coastal ecosystems, especially in the least developed countries and small island developing states, where economies are highly dependent on the resilience and productivity of natural ecosystems" and that coastal and marine ecosystem-based adaptation would become:

- A focus of new technology development and transfer;
- Supported by increase financial resources and investments.

Another example of the awareness of the importance of the issue was the publication by UNEP (2011) of a guide to an Ecosystem-Based Management (EBM) approach, designed to ensure sustainable development for marine and coastal environments and the livelihoods that depend on them. By providing practical guidelines to planners and policy-makers in local, national and regional governments, it presents the marine and coastal ecosystems as units with many ecological and social links. The guide also stressed the role of this approach in particular in mitigating and adapting to climate change.

The cost-effectiveness of the ecosystem-based approach was also pointed out by the guide to the EBM approach by UNEP. New costs can be incurred at the planning stage (gathering information, synthesizing and analysing it, and presenting it to the public and decision-makers) and implementation stage (better understanding of ecosystem by scientific research, evaluating the efficacy of management, coordinating and communicating between the different agencies and authorities), the costs being proportional to the size of the initiative. At the same time, continuing a traditional sectoral management approach is also quite costly. The guide foresees the following savings in developing and EBM approach:

- Economies of scale: In grouping the work of management agencies in undertaking training, research and monitoring and surveillance (as opposed to scattered and isolated ones);
- EBM management can prove to be more efficient than conventional management: Although costs might be higher, benefits would be higher as well and benefit the whole society;
- Broad-based scientific understanding of the ecosystem and the factors impacting it lowers the risks of unexpected losses faced by changing environments;
- It serves as the basis for ecosystem-based adaptation, which is concerned with "the management of biodiversity and natural resources in ways that help vulnerable communities cope with the impacts of climate change" (UNEP, 2011, p.17).

In terms of implementation, the guide points to financing challenges. It calls for the use of private funding when possible, e.g. through direct ownership of the area, or with private-public partnerships (e.g. municipal governments with chambers of commerce, or private financing of public sector

resource management). The guide also suggests other sources of funding such as lottery revenues, tourist related fees, fees for eco-labelling and certification and fishing licences or fishing access agreement revenues. It also promotes the use of Payment for Ecosystem Services (PES) systems and associated market offsets (UNEP, 2011, pp. 60–61).

5.5 Lessons for a Potential EU Green Infrastructure Strategy

Initiatives at the EU level have already been undertaken, notably through the development of Recommendation 2002/413/EC on the implementation of Integrated Coastal Zone Management in Europe, which stressed the importance of an ecosystem-based approach and the benefits of proper integrated management on areas with a high competition for land and sea resources, and a multitude of administrative legislation and authorities. In addition, in September 2010 the EU also ratified the Protocol on ICZM to the Barcelona Convention. The Spanish example in this fiche showed the positive effect of this recommendation at national level. The OURCOAST initiative of the European Commission, aimed at disseminating information about ICZM implementation, presents other examples available through a publically accessible database, brochures and guidance materials (http://ec.europa.eu/ourcoast/index.cfm?menuID=3). The EU has taken further steps in the development of ICZM: a review of the ICZM is currently being carried out, out of which a proposal will be prepared by the end of 2011, supported by an on-line consultation and a public hearing.

However, these examples also showed that the fact that the Recommendation is non-binding prevents the assurance that all Member States will develop this approach or to the same extent. In particular, some issues faced by the Member States in implementing ICZM are detailed in Dauvin et al. (2004). In addition, this Recommendation points to the main challenges faced by the coast but does not emphasise the development of specific Green Infrastructure initiatives to tackle them. Finally, the main focus of the Recommendation is land use and does not target directly ecosystem health and resilience, biodiversity conservation or direct benefits to human populations in the form of enhancement of maintenance of ecosystem services.

EU intervention is also particularly needed since issues related to coast management are often cross-border, as shown in the example of the BaltCICA: some initiatives have been launched to harmonise the approaches but these remain isolated, and although they increase the awareness of policy-makers on those issues, policies remain national if not regional or local, which prevents a unified approach.

In conclusion, this report presents examples which are valuable for the development of Green Infrastructure in the protection and management of coasts in the EU. The data indicated the efficiency and effectiveness of those approaches, which could serve as best practices in the development of other initiatives. The brief mention of other initiatives in the final section showed other examples which either target other ecosystem services or have other approaches for achieving the same objectives. Finally, these measures also stress the first success of the ICZM and the need to expand it and to develop further EU initiatives to ensure the development of Green Infrastructure for the protection and management of the coast in the EU.

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