

19 A Case Study of Conservation and Management of Tropical Sand Dune Systems: La Mancha–El Llano

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19.1 Introduction

Coasts are typical environments in which human impacts have led to a whole range of changes with considerable variation in their degree of impact (French 1997). “Of all the coastal ecosystems, dunes have suffered the greatest degree of human pressure. Many dune systems have been irreversibly altered through the activities of man, both by accident and design” (Carter 1988). Most tropical countries have major economic problems and their economies still subsist on just one or two primary commodities. Worldwide tourism has become a very important economic force. Today tropical coasts – mainly beaches and sand dunes – are targeted for tourism of all kinds and are becoming a very important economic income for these countries.

Ecological features and dynamics of the diverse ecosystems, together with a distinctive coastal enterprise, make coastal zones unique. The coast should be recognized as a distinct region with resources that require special attention and environmental impacts that need to be controlled. There are a variety of available methods and necessarily the development of sustainable projects and the management of the coastal zone implies regaining an holistic perspective on coastal problems. Today, integrated coastal zone management schemes are being developed in numerous countries (Viles and Spencer 1995; Clark 1996; French 1997; Cicin-Sain and Knecht 1998).

19.2 Dune Conservation and Management

Sustainable development along the coast has to be based on an integrated management approach, which takes into account the dynamic nature of the littoral. In the following chapter, I would like to develop the idea that work has

to be done at several levels and with a variety of stakeholders, which are complementary and allow realistic planning for coastal activities. The first two approaches will be emphasized and a case study will be used to support the model.

1. A regional system of protected areas with management plans and economic resources that guarantee the preservation of the natural character of the coast and the protection of ecosystem functioning, habitats and species diversity and that includes the regional variation of beaches and dunes.
2. Community-based projects which create sustainable alternatives for development, promote participation of local people in the process and develop adequate structures for the inclusion of local governments in the management propositions and instrumentation. They are the grass root projects that will make environmental policies an everyday reality.
3. A view of the coast as a particular environment, which needs special legislation and an integrated coastal management program. The legal aspects that need to be addressed cannot be covered in this chapter.

Dune management has been visualized as constructing artificial dunes, dune stabilization, recovering dynamics reduced by over-management, beach nourishment (Clark 1996; Bird 1996; French 1997; Nordstrom 2000, among others). In tropical countries, it has to take into account a more integral perspective and learn from developed countries histories of errors and successes. Prevention rather than cure should be the everyday norm. It should include preservation of the natural character of the coast which refers to qualities that derive from natural as opposed to human influences on the coastal system. This means that sand dunes, their formation, dynamic and natural vegetation, are an essential part of the natural character of sandy beaches (Hesp 2000). This view is not perceived in most tropical countries, or indeed in many developing countries. Legislation for coastal areas exists in some tropical countries (Mexico lacks one), although very few have developed rules for dune management. Tourism is the force that is starting to develop management practices. In Quintana Roo, Mexico, a manual has been developed with guidelines for beach and dune protection (Molina et al 1998), although it is not compulsory.

19.3 Beach and Dune Biodiversity and Protected Areas in Mexico

Beaches and dunes occupy a very narrow strip along the coast, although floristically they represent between 5–7% of the flora in the country. The Pacific Mexican coast is on the edge of a tectonic plate, the coastal plain is very narrow or nonexistent except in the south, six climates are present from a

Mediterranean type in the north to a tropical wet climate in the south. Seasonal rivers and coastal lagoons are frequent along the rocky coast, as well as straight beaches and small bays. The Gulf and Caribbean coasts are located in the middle of a tectonic plate, the coastal plain is wide and sedimentary environments predominate. Climate is drier in the north Gulf, but the rest of the coast is warm and humid. There are many rivers along the Gulf and they provide significant sediment supply that littoral currents deliver to the beach and which form extensive sand dune fields. The Yucatan Peninsula is formed by a karstic platform, rivers are subterranean and calcareous sand is mainly of biogenic origin. The northeastern tip is very dry but the rest has a tropical humid climate.

The coast has been divided into different regions and subregions based on geomorphological, climatic, biogeographical, and floristic data (Moreno-Casasola 1999; Moreno-Casasola et al. 1998). I will use the regional classification described by Moreno-Casasola et al. (1998). The country has been divided into five regions (Fig. 19.1), three in the Pacific: the North Pacific (the oceanic coast of the Peninsula of Baja California), the Gulf of California (the states surrounding the Gulf of California or Sea of Cortes), and the South Pacific (south of parallel 21°). Along the Atlantic, there are two regions: the

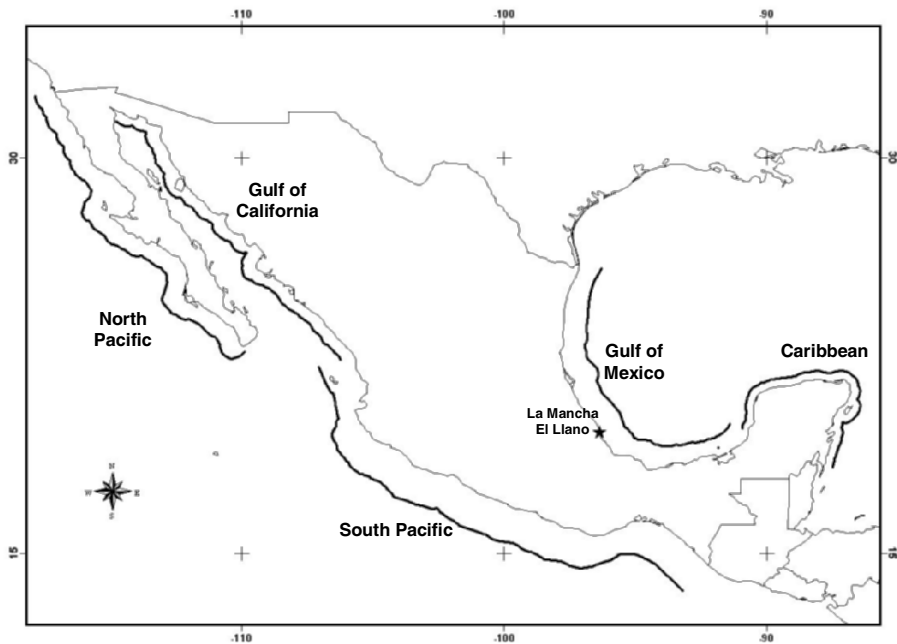


Fig. 19.1. Map of Mexico showing the different regions based on geomorphological, climatic, biogeographical and floristic beach and dune data (taken from Moreno-Casasola et al 1998). The case site of La Mancha-El Llano on the Gulf of Mexico is also indicated

Gulf of Mexico (states of Tamaulipas, Veracruz and Tabasco) and the Yucatan Peninsula (Campeche, Yucatan and Quintana Roo).

For both the Atlantic and Pacific coastlines, 1638 plant species have been registered belonging to 140 families (Moreno-Casasola et al. 1998). There are interesting floristic similarities and differences between regions. All of them share Leguminosae, Asteraceae, Poaceae, and to a lesser degree Euphorbiaceae and Cactaceae as the more abundant families. Other important families are Rubiaceae, Solanaceae, Chenopodiaceae, Cyperaceae, Boraginaceae, and Convolvulaceae.

From the phytogeographical perspective there are interesting differences (Moreno-Casasola et al. 1998). Distribution of tropical, temperate, cosmopolitan, and arid families varies among regions (Table 19.1). For example, the North Pacific coastal flora is influenced by the Sonoran Desert as well as the Mediterranean element it shares with California in the US, making it the more particular flora of all the regions. 171 species are found along both the Atlantic and the Pacific, but only 24 species are shared along the five regions. Growth forms also differ along regions (Fig. 19.2). Herbaceous forms predominate along the drier North Pacific and the Gulf of California. Woody species are the more abundant groups in the Gulf and Caribbean with high numbers in the South Pacific. There is a significant number of endemics: 64 species reported for the North Pacific (16 belonging to the Asteraceae, 7 Leguminosae, 6 Cactaceae, 6 Crassulaceae), 37 for the Gulf of California (9 Asteraceae, 4 Crassulaceae), 5 for the South Pacific, 10 for the Gulf of Mexico, and 34 for the Caribbean (6 Cactaceae, 3 Polygonaceae).

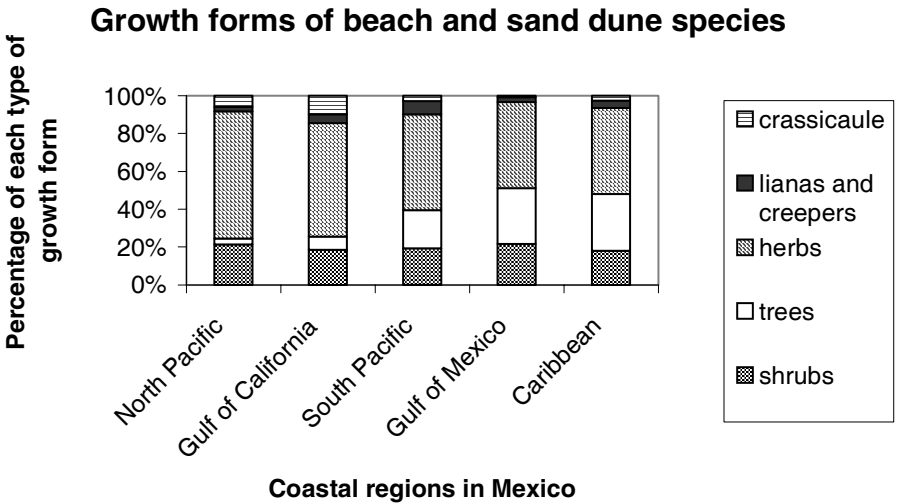


Fig. 19.2. Percentage of growth forms in the beaches and sand dunes of the five coastal regions in Mexico

Table 19.1. Diagnosis and degree of protection of beach and dune ecosystems in Mexico in established reserves. Data are based on (1) Moreno-Casasola et al (1998), (2) INEGI-SEMARNAP (1999), (3) degree of tourist development assigned using data on number of hotels and rooms offered, length of coast developed or under development schemes and number of tourists visiting the year annually

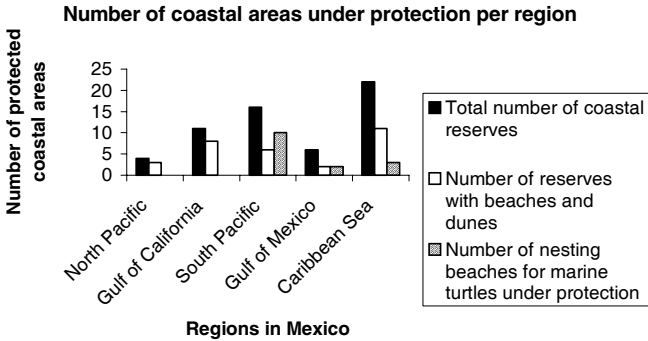
| | North Pacific | Gulf of California | South Pacific | Gulf of Mexico Tamaulipas | Veracruz and Tabasco | Yucatan Sisal | Yucatan and Quintana Roo |
|--|---|---|--|------------------------------|-------------------------------|--|---|
| Plant families (1) | 84 Families | 59 | 92 | | 87 | | 78 |
| Tropical families | 25.8 % | 35.7 | 44.7 | | 47 | | 47.8 |
| Temperate | 10.4 | 4.2 | 2.5 | | 3 | | 4.2 |
| Cosmopolitan | 58.9 | 53.2 | 49.6 | | 49.2 | | 45.6 |
| Arid | 4.7 | 6.8 | 3 | | 0.7 | | 2.4 |
| Plant species (1) | 566 Species | 235 | 555 | | 427 | | 456 |
| Endemics (1) | 64 Endemics | 37 | 5 | 2 | 10 | | 34 |
| Protected surface (ha) (2) | 2,546,790 | 3,996,223 | 820,967 | 0 | 52,327 | 59,130 | 1,077,956 |
| Number of coastal protected areas (2) | 3 | 8 | 6 | 0 | 2 | 1 | 11 |
| Number of biosphere reserves (2) | 2 | 6 | 3 | | 1 | 1 | 5 |
| Percent coastal population (2) ^a | 19.4 | 25.4 | 21.3 | 5.3 | 18.3 | | 10.2 |
| Percent population living in coastal counties (2) ^b | 97.3 | 78.1 | 14 | 28.3 | 30.3 | | 46.3 |
| Length of littoral (km) (1) | | 6107 | 2065 | 457 | 928 | | 1730 |
| Tourist develop- ment (3) | Medium tending to high | Low tend- ing to medium | Low | Very low | Very low tending to low | Low | Very high |
| Diagnosis and recommendation | Strong pres- sure from develop- ments, more protected areas are needed (in the Mediter- ranean cli- matic region and tip of the Penin- sula to ensure endemics habitats) | The nor- thern Gulf coasts are well repre- sented; there is need for protected areas in the south, both along the Penin- sula and the conti- nent | Strongly in need of further protected areas | | | Good, the area is small and the only Bio- sphere Reserve of Ría Celestín repres- ents the coastal com- muni- ties | Pressure from develop- ments and the indicates only more areas are needed i.e. there are plans to develop beach areas of the Sian Ka'an |

^a Percentages were calculated with respect to Mexico's coastal population, 14,591,857 habitants in coastal counties

^b Percentages of people living in coastal counties were calculated with respect to the total population for that region

Beaches and dunes are intensively used by visitors during holidays. Protected areas are a way of assuring that some landforms or areas will be protected from development, trampling, and other types of disturbance. In 1996, Mexico had under different forms of protection 5.8 % of the territory of the country (INEGI-SEMARNAP 1999). Among them the Biosphere Reserves (68.9 % of the protected area) receive funding, have a management plan, and monitor activities to ensure protection of species and habitats. Nineteen of the 59 coastal protected areas belong to this category. The highest numbers are found in the South Pacific region and the Caribbean (Fig. 19.3A). When one examines the area of these reserves in each region (Fig. 19.3B), the northwest of Mexico and the Caribbean have the biggest proportion of coastal land under protection, although only a small part of this area includes beaches and dunes. In these states, population numbers and settlements are not very high, making it possible to set aside larger protected areas (Table 19.1). The Caribbean has a good number of areas but they do not include a reasonable representation of the Caribbean beach and dune vegetation. The region shows the highest increase in tourist activities. Many of the South Pacific protected

A.



B.

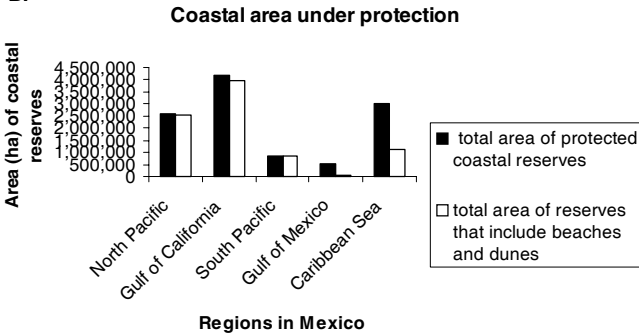


Fig. 19.3. Number A and area B of protected coastal areas in the five regions of Mexico. The area of nesting beaches for marine turtles under protection is always less than 1.5 % in the three regions (South Pacific, Gulf of Mexico and Caribbean)

areas belong to the category of nesting beaches for turtles. In these, only a small fringe of the beach is under protection, so that the total area is very small. The Gulf of Mexico has the lowest value (both in number of areas and the total hectares they cover) of all. It is also the most industrialized region.

Table 19.1 summarizes these results and shows that beach and dune communities still are in strong need of protection. There are floristically very rich regions with a high number of endemics, under strong pressure for tourism development. Beach protection should increase in these regions. Others are in strong need of protected areas such as the Gulf of Mexico. In this region, as well as in the South Pacific, federal and state authorities have to make a bigger effort for establishing natural reserves, but there should also be a strong community involvement and creation of local reserves.

19.4 Community Management for the Conservation of Coastal Resources: La Mancha-El Llano Case Study

Coasts are used by many different sectors of society. This has led to a proliferation of controlling and interest groups when it comes to coastal management. In the construction of a management plan, experts should incorporate as many views as possible from as many users as there exist. The plan should be based on the needs of the people where it is going to be applied (French 1997). Stakeholder participation is a relevant issue. Integrated Coastal Zone Management experiences in tropical countries are just beginning. Several authors have described various case studies (Clark 1996; French 1997; Cicin-Sain and Knecht 1998). Mexico's coastal areas, as well as those in many other tropical countries, give us a great opportunity to develop strategies within the framework of sustainable development. In most of these regions, local people see their world changing at a speed they cannot cope with. Government authorities in these rural counties are farmers and ranchers, elementary or high school teachers without access to many of today's information systems or environmental concerns. For them, ecology is a synonym of pollution and garbage; there is no comprehension of the need for an integrated and holistic view of the coastal zone; dunes are perceived as wastelands that should be put to use, for example, for cattle ranching.

Mangroves and estuaries are very much appreciated by local people and by governments. Many stakeholders will participate in activities related with these habitats. Other ecosystems such as freshwater wetlands are recently being recognized as providing important services and having ecological values. In tropical regions they are still associated with unhealthy conditions and government based programs to drain them, still exist. Beaches and dunes are poorly understood. Rural people see them as areas with nutrient-poor soils where low-intensity cattle ranching can take place. It is still very difficult to

involve them in conservation schemes for these environments. As stakeholders, their interest is focused on transforming these environments to suit their productive activities.

A sustainable project would need to: (1) involve the local people and the local authorities, (2) create the space for interaction with other levels of government, (3) incorporate women as active members of society, (4) give children and youngsters information and education on the environment that surrounds them, and from which their parents are making an income, and (5) incorporate the concept of nature protection in their everyday lives. A case study is described to show how we are trying to create a sustainable way of living on a tropical coast. In the following, I will give a general overview of the project and develop with more detail the activities around the beach and sand dune system.

The study area of La Mancha-El Llano, located along the central coast of Veracruz (Fig. 19.1), is characterized by an extraordinary array of coastal ecosystems in an area of 22,484 ha. The beach and dune systems can be described and classified according to natural characteristics and actual use (Table 19.2). A detailed description of the beaches and dunes in the area appears in Moreno-Casasola (1997). Dunes reach 25 m in height and show different degrees of stabilization, with areas of erosion and sand accretion. In general, dunes are considered very fragile systems (French 1997; van der Maarel, 1997; Carter 1988), with degrees of transformation that range from low to very high. All (except the reserve at La Mancha) are cattle grazed. Both dune lakes (Cansa Burros and La Mancha) are highly modified by human activities and are considered to have a high fragility. They are invaded by introduced tilapia fish; *Pistia stratiotes* and *Eichhornea crassipes* have become plagues. Tectonic hills are part of the coastal landforms in the area and have been modified by cattle ranching. There are numerous stakeholders in the area: local people who have lived on the local resources for many years, others are just arriving and see the potential the area has for tourist development. Along the border of La Mancha Lagoon is the field station and protected area of the Institute of Ecology, a research institution.

Problems such as multi-users generating social conflicts, low quality education, rural economy where jobs are scarce and wages are very low, silted and polluted lagoons, extensive cattle ranching that increases deforestation and soil erosion, and the variety of stakeholders, indicate that action has to be taken before the area deteriorates still more. A management plan for the coastal area of La Mancha needs to take into account the environmental conditions of its ecosystems. There is a need for a strategic approach to coastline access management, a need to develop a tourist program and the strategies to change a rural county into an ecotourist resort, and all have to be integrated into an overall coastal zone management policy. In the neighboring Institute of Ecology a research project on conservation and management of coastal ecosystems has been in progress since 1998. The researchers and students working there

believe that local people have to be involved in decisions of what is taking place in the area where they live. The project was designed trying to use a total catchment management approach as the means to develop conservation and good management practices in the area. To promote the restoration, conservation, and sustainable use of natural resources along the Gulf coast of Mexico, we are working in La Mancha–El Llano as a case study (Moreno-Casasola 2000; Moreno-Casasola et al. 2000). The reserve of the Institute of Ecology A.C., is the radiating point for many of the actions taking place.

We are using four instruments to develop the management plan, which will help us reach our objectives of sustainable use, conservation, and restoration in different ways:

1. The Watershed Management Committee is formed by the different stakeholders in the area: productive and social sectors, governmental authorities, and institutions for research and education. It is conceived as a forum promoting interaction between the different social sectors in the area and promoting environmental solutions to the watershed and coastal problems.
2. The productive projects allow local people to obtain a better income through the use of natural resources. It gives us the opportunity to link a particular group of people with the conservation and/or restoration of habitats. Table 19.3 shows the productive projects, their objectives, who is involved and what they do for the beaches and dunes.
3. Conservation and restoration projects are based on community action and environmental education. They are coupled with the productive projects to help people understand the ecosystems they live in and the importance that a healthy environment has on their everyday life. It allows us to incorporate children, youngsters, and women into activities and increase their awareness on the importance of sustainability for their future.
4. Land-use planning is a legal instrument in the Mexican legislation (Ordenamiento Territorial). It can be used as a planning exercise that allows local people, technical groups, and government to discuss and decide on ecological principles for land use. Table 19.2 is such an exercise that is being discussed at the community level. The process allows the discussion of areas that should be declared as reserves, with a strong community participation and involvement.

Other activities are also taking place, which promote the conservation of the beach and dunes: weekly beach clean-up, making compost with organic garbage, promoting the use of dry latrines, annual Beach Bird Festival, environmental education (talks, conferences, games, videos, visits to ecosystems, among others), citizen committees for protection and vigilance of resources, training courses for local people and county authorities.

We would like to exemplify how La Mancha project and the Institute of Ecology developed a series of agreements with the “palaperos” (restaurant

Table 19.2. Coastal description for the area of La Mancha and El Llano, Veracruz. Activity proposed: *C* conservation, *T* tourism development of low density, ecotourism, *R* recreation, infrastructure, *A* agriculture and cattle ranching

| | | San Isidro beach dunes | Los Amarillos beach and dunes | Cansa Burros beach – dunes | Dune lake – Cansa Burros | Tectonic hill |
|--------------|--|------------------------|-------------------------------|----------------------------|--------------------------|---------------|
| Beach | <u>Long or Curved</u> , <u>Narrow/Wide</u> | L, W | L, W | L, N | | |
| | <u>Barrier island/ adjacent Dune fields</u> | D | D | D | | |
| | <u>Subject to high flooding. No/Yes</u> | Y | N | N | | |
| | <u>Abundant embryodunes/Scarce</u> | A | S | S | | |
| | <u>Erosion/Accretion</u> | A/E | A/E | A/E | | E |
| Dunes | <u>Highly mobile/Mix/Stabilized</u> | HM | HM | M | | S |
| | Pioneers, sand binding plants | x | x | x | | |
| | Grassland/thickets | | | x | | x |
| | Dry, low tropical forest | | x | | | x |
| | Tropical semideciduous forest | | | | | |
| | Presence of endemics | x | x | x | | |
| | Abundant beach birds, crabs | | | | x | |
| | Invasive species | x | | x | | x |
| | Dunes slacks/dune lakes | x | | | x | |
| Activities | Recreation | x | | | | |
| | Fishing | | | | x | |
| | Cattle grazing | | x | x | | x |
| | Coconut cultivation | | | | | |
| | Sugar cane cultivation | | | x | | |
| | Water extraction | | | | | |
| | Garbage dumps | | | | | |
| | Land partitioning for tourism | | | | | |
| | Public services provided | | | | | |
| | Nature Reserve | | | | | |
| | Buildings or structures | | | | | |
| Stakeholders | Only local stakeholders | x | x | x | x | |
| | External stakeholders present | | | | | |
| | Tourism developers | | | | | x |
| | Degree transformation (<u>Low</u> , <u>Medium</u> , <u>High</u> , <u>Very High</u>) | L | L | M | H | VH |
| | Fragility (<u>L</u> , <u>M</u> , <u>H</u>) | H | H | H | H | L |
| | Activity proposed | R | C | T, A | C | T |

| La Mancha beach and dunes | La Mancha dune lake | Fossil dune hill Jicacos | Old dunes | Farallón beach and dunes | Barrier island/beach | Villa Rica beach | V. Rica tectonic hill | V. Rica dunes | Limón beach |
|---------------------------|---------------------|--------------------------|-----------|--------------------------|----------------------|------------------|-----------------------|---------------|-------------|
| C, N | | | | L, N | L, W | C, N | | L, N | L, W |
| D | | | | D | | BI | | D | River plain |
| Y | | | | N | Y | N | | N | Y |
| S | | | | A | S | S | | | A |
| A/E | | E | | A/E | E | E | E | A/E | A |
| S | | S | S | M | S | | S | HM, M | M |
| x | | | | x | | | | x | x |
| x | | x | x | x | x | | x | x | |
| x | | x | | | | | x | | |
| x | | | | x | | | | x | x |
| x | x | x | | x | | | | | |
| x | | x | x | x | x | x | x | | x |
| x | x | | | | x | | | | |
| x | | | | x | | x | | | |
| | | x | x | x | x | | | | x |
| | | | x | | | | | x | |
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| x | | | | x | x | | | | |
| x | x | | | | | x | | | |
| x | | x | x | | | x | | x | |
| x | x | | | x | x | x | x | x | |
| L | H | M | M | M | H | VH | H | VH | L |
| H | M | L | H | H | H | M | M | H | H |
| C | C | T | C | R | T | R | C | T | C, A |

Table 19.3. Description of community productive projects linked with beaches and dunes in La Mancha and El Llano, Veracruz

| Productive project: what is it? | Who works in it? | How does it help beaches and dunes? | Function within the community management plan |
|--|--|--|---|
| Services in beach restaurants and information center for the program | Peasants and fishermen who sold food on the beach in rustic establishments | <ul style="list-style-type: none"> - Keeping the beach clean - Keeping crab poachers away - Giving information to visitors - Providing touristic services in the beach - Not allowing vehicles on the beach | <ul style="list-style-type: none"> - Demonstrating that conservation is an economic alternative - Managing and preserving the coast, specially the beaches |
| Ecotourism guides and services | Peasants and fishermen | <ul style="list-style-type: none"> - increasing people's awareness of the importance of beaches and dunes - Promote organization for the conservation of habitats and resources | <ul style="list-style-type: none"> - Developing ecotourism activities for visitors and for local people - Demonstrating that conservation is an economic alternative |
| Propagation of native species in a nursery | Women from the town of Palmas de Abajo | <ul style="list-style-type: none"> - Developing the first nursery with native sand dune fixing plants - Providing alternatives to the use of <i>Casuarina equisetifolia</i>, an exotic used for sand dune fixing | <ul style="list-style-type: none"> - starting a productive and sustainable activity for women - Developing the first nursery with native local plants and trees |
| Conservation and management of the blue crab (<i>Cardisoma guanhumi</i>) | Fishermen from two cooperatives | <ul style="list-style-type: none"> - Increase awareness of the importance of crab populations - Promote organization for the conservation of habitats and resources | <ul style="list-style-type: none"> - Recovering crab populations - Transforming them into an economic benefit for the fishermen - Demonstrate that an adequate management preserves the resource and the habitat |

owners) and the County authorities, both for the benefit of their own businesses, and for the beach and dune protection.

First set of agreements: the Institute of Ecology, a neighboring research institution, has to give its agreement for the establishment of beach restaurants. The conditions set were that the palaperos accepted a set of commitments for beach management. Agreements included that only five people would receive the authorization to make sure that they could make a good income out of this productive activity, authorizations are non-transferable (only their direct family can take over the business as a guarantee that the same agreements will be kept); they built restaurants according to a model designed with traditional local designs and materials. They bought materials and paid for the construction and the Institute provided the wood and technical advice. The palaperos got organized to keep the one kilometer strip of beach clean. In addition, they function as an information center for the management plan and the ecotourism project. Through these schemes a productive project generating an income is strongly linked to a conservation program. Their everyday work depends on the adequate management of the beach.

Second set of agreements. Training courses and workshops were designed to help the palapero group advance within the project (have a self-sustainable organization, good management practices, conflict-solving mechanisms). Through the workshops they became organized: named a president, secretary, and treasurer, defined their functions and established a control notebook (for keeping track of agreements, meetings, etc.). They agreed to share equally work, expenses, and maintenance of installations (either by working directly themselves or paying somebody else to do their share). The Institute built ecological toilets (dry latrines) for beach visitors. The palaperos charge a small fee for using the toilets which is used for buying cleaning materials and keeping the baths clean. The County will reduce the monthly tax until the business gets going and the Institute meanwhile will help with water and electricity until the palaperos can provide their own. The County will help with materials and equipment to fix the road and have good access for tourism.

Third set of agreements currently taking place: training on restaurant services and developing an environmental education program with them, to increase their knowledge of the beach, dunes, beach birds, lagoon ecosystems, and conservation and restoration needs. Two other local groups working within the area have developed an ecotouristic alternative which includes trails and guided tours on the beach and both the mobile and stabilized dunes. After the visit the tourists end their day having dinner with the palaperos. In this way, three groups of stakeholders in the area are linked together.

Other productive projects on ecotourism have been developed. Two local peasant groups have been trained as ecoguides and one of them now has a series of cabins for lodging groups. They both give guided tours along the beach, mobile dunes and stabilized dunes. They have learnt about the value of preserving the natural character of the coast and during the tours, talk about sand deposition and erosion, sand-loving plants, how slacks and dunelakes are formed. They decided that their names were Duneadventures in San Isidro and Ecoguides in Movement. One of the groups has started to give guided tours to school children from their village.

These projects and agreements will help these groups receive an income by providing services to local tourists, increase their awareness that this income is in direct relation with beach quality and service as well as ecosystem conservation, increase their training and that of their families and develop organizational capacities as well as protecting the beach and dunes, its flora and fauna. A model of beach management is being demonstrated and is being extrapolated to other beaches in the watershed. Work on productive and conservation projects coupled with development of organized groups is turning them into organized producers with strong environmental responsibility. The joint work between academic groups, government authorities and local inhabitants has shown to be very productive. Results are slow to come, but they are grass root achievements. Only through involvement and responsible participation of all stakeholders will we be able to manage and protect very fragile ecosystems such as beaches and dunes.

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