

## Economic and Ecological Zoning Proposal for La Roqueta Island, Mexico

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### Abstract

The territory of Mexico is prodigal since it bears exceptional natural landscapes, biological diversity, varied landforms that, we planned from the tourist point of view, are a useful tool for the human in the sustainable regional development. Hence, the central aim is to propose the Economic and Ecological Zoning (EEZ) of La Roqueta Island. The methodology used was founded in office work that included the analytical review of printed and digital materials about Acapulco Bay, EEZ, tourism, local development and heritage; this work was enriched with ten field research. Among the results, we could obtain *i)* some information synthesized the municipal, political, conservation and management issues of the island; *ii)* one map were produced at small scale; *iii)* the physical location of the island, and *iv)* the current local use of the island terrain. The conclusions were *a)* scientific interest in the geomorphologic aspects of the island has facilitated a strong ecological environmental policy, *b)* planning for ecotourism accompanied by only rudimentary environmental management has resulted in minimal preservation of the island and the local economy and *c)* the Island provides the visitors with a place to recuperate physically, mentally and spiritually.

### Environmental Management Unit (EMU), Economical and Ecological Zoning (EEZ), Roqueta, Acapulco, Guerrero

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## Introduction

Sustainable management requires the analysis of ethical, social, economic and ecological factors, and these are now under discussion by various Governments throughout the world including that of Mexico, since the existing economic model of development ignores environmental aspects. An interdisciplinary approach in scientific research can inform the process of zoning in any part of the world (Murillo & Orozco, 2006).

In Mexico, there is a huge diversity of landscape therefore in this essay, we can defend the fact that the territory on Guerrero is prodigal. So, it aims to integrate the debate in the sense that the geofoms are heterogeneous but are useful tool for the human in the sustainable regional development. In the study case, in 1981 the Official Journal of the Federation (Diario Oficial de la Federación, DOF) published a decree that placed La Roqueta Island in Acapulco Bay, Guerrero, Mexico under the management of the Naval Secretariat as of 6 November 1981. The Ministry for Tourism would collaborate in planning tourist activities to be integrated with national plans for tourism on the island.

The purpose of the essay is to increment the interest in the geomorphologic aspects of the island has facilitated a strong ecological environmental policy, whose powers were increased in 1999 by the Environmental Management Unit (Unidad de Manejo Ambiental, UMA). It is important the planning for ecotourism accompanied for better environmental management has resulted in maximal preservation of the island and to get the ecological equilibrium. This act increase the esthetic of the nature reserve and the environmental educational potential, the cultural knowledge and human welfare of La Roqueta Island's recreational area.

The island provides the visitors with a place to recuperate physically, mentally and spiritually.

A question relevant was Which is the zoning model to be engaged to economy and ecology of La Roqueta?

There are six sections that integrate this essay, these sections are: objective, methodology, results, gratitude, conclusions and references.

## Objective

To propose of economic and ecological zoning for the island Roqueta.

## Methodology

Firstly, an office work was carried out through consultation of digital and printed literature of topics as economic and ecological zoning of Sabatini, Verdiell, Rodríguez & Vidal (2003); competitiveness (Sepúlveda, 2008); nature tourism (Chávez de la Peña, 2005); sustentability (López, 2008); ecogeographic method of Melo (1987) y Melo & Niño (2003); ecotourism (Báez, 2003); touristic space planning (Boullón, 2001 y Pérez de las Heras, 2004) and ecological business (Delgadillo & Alburquerque, 2010). Too, printed and digital records of La Roqueta Island were analyzed. These included the digital cartography of the "Instituto Nacional de Estadística, Geografía e Informática" (INEGI) on Acapulco (2013) the orthophotograph of Acapulco Bay (INEGI, 2011) aerial photography (INEGI, 2014) and the topographical Charter of Acapulco (Secretaría de Programación y Presupuesto, SPP, 1981). Others documents as the terrestrial ecology of Otero & Radilla (2001); the marine part of La Roqueta of Palacios (2002); touristic-environmental management of the island Niño (2010a y 2010b).

Was elaborated a base map at 1: 5 000 scale was enriched with field work. A hypsometric map presented the reveals anthropogenic factors (human settlements, land routes, air tracks, etc.) and this was followed by cartographic representation of each of the elements of nature in order to interact with who represent the various economic activities. This would be useful to authorities, entrepreneurs and citizens in decision-making regarding optimum use of the natural resources offered by the terrestrial landscape. Secondly, a work of field was carried out for the achievement of the objective raised in such way that some face-to-face surveys were also carried out in the island, during the period between December 2015 and July 2016 to national tourism (650) and foreigners (350) in larges weekend, Winter, Holy Week and Summer enriched with participant observation, direct observation and study case (Babbie, 1996).

Finally, involved the processing of socio-economic information from resident population and from the tourists, in order to determine the origin and reason for interest in the following beaches: La Fantasía, Palao, Palmitas and La Marina. This required information such as tourists' favorite areas for then active and intensive recreation and was achieved by questionnaire (Babbie, 2000). The matrix zoning and the corresponding map were developed in order to clarify the distribution of vegetation.

## Results

Ecological and economical zoning: this is defined as the process of dividing a complex geographical space, areas which are relatively homogeneous and characterized according to physical, biological and socio-economic and evaluated factors with regard to their potential for sustainable use and environmental restrictions.

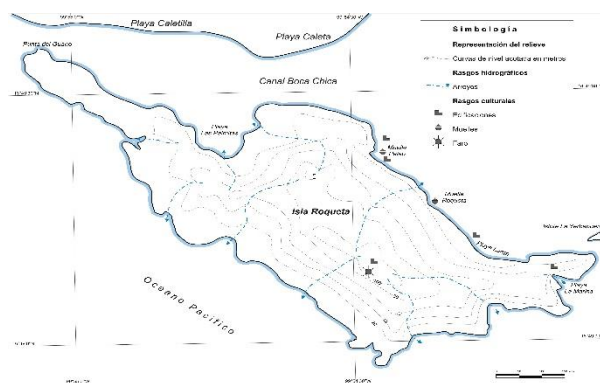
It is a useful tool for planning the rational occupancy, redirecting human activities not compatible with the environmental offer in the field we refer to. Its results are applicable in the territorial planning of natural protected areas; development of sustainable agriculture, determination of the suitability of soils for default uses and ecological and territorial use plants (Sabatini, Verdiell, Rodríguez & Vidal, 2003). The objectives of the EEZ are: Identifying the areas where certain specific uses may be induced through the development of programs, services, financial incentives, etc; identifying the areas with special needs or problems, as well as the ones needing protection or conservation; and providing the basis for the development of infrastructure.

The greatest virtues of the zoning methodology can be applied at all geographical scales and in soils with any type and intensity of uses, but is more widely used to subdivide basins and physiographical regions that hold important concentration of human population. Implementing zoning implies a dynamic process which can be adjusted at any time a socio-economical change appears; this could happen in the studied space or in its area of influence which has to do with national and global trade.

Zoning has the virtue that considers a wide range of land uses that can meet the needs of various users. The objectives of each zone can be compatible or incompatible with certain land uses, but they can also change with the passage of time. The use of multiple objectives and the subsequent optimization allow a periodic reorientation of goals to select the best use of a certain sector.

The island is located southeast of Santa Lucia bay. The geographical coordinates are 16° 49' 30" to 16° 49' 02" North Latitude and 99° 54' 03" to 99° 55' 07" West Longitude. The total area is 190 acres or 75 hectares (INEGI; 2015, Figure 1).

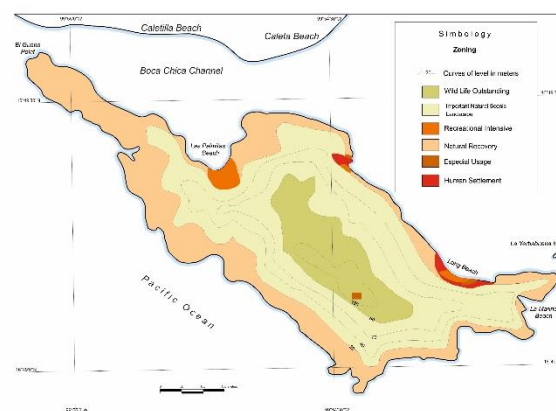
Local management of La Roqueta was initiated by the local concessions in 1958. It outlined the tourist attractions, they are as follows, the island's landscape, the rock cliffs, the beaches of Caleta, Caletilla, Palao, Larga and Palmitas, as well as the restaurant Palao. It included the channels Boca Grande and Boca Chica, Acapulco Bay, the well known buildings and the historical lighthouse were documented in the article Niño (2010b). The La Roqueta Island area is exceptional attractive international market place frequented daily by approximately 600 visitors of which there are 500 are mexicans citizens 60 local people and 40 people from other nations. This number multiplies during the 5 vacations periods of the year (Christmas, easter, long holiday weekends, new years and summer vacations). The visitors relax enjoying the calm crystal clear ocean waters white sands and the colorful tropical fish.



**Figure 1** Study area. Source: Niño, 2012

During the last fifty three years the local concessions preserved and managed by the Pro Defense Association of Roqueta Island A. C. (Asociación Pro Defensa de la Isla La Roqueta A. C.) and the Green Guerreros (Guerreros Verdes) additionally, the citizens of Acapulco have collaborated with the municipal authorities to protect and preserve the island's landscape by not constructing tourist hotels or other building on the island. These structures would permanently modify the island's ecological equilibrium and natural landscape.

The propose of zoning La Roqueta Island should consider the following elements: preservation of the magnificent island landscape, continuation of ecotourism on the island with minimal impact to the areas flora, fauna and landscape, as well as continuing with recreational and sports activities on and around the island (Figure 2).



**Figure 2** Zoning. Source: Own elaboration

The internal zoning of the island presented in the document created by the Environmental Management Unit (UMA) sets future guidelines for preserving the objectives presented by the conservationists and the economic development on the island. It presents guidelines preserving the variety of activities on island and limiting the new construction near and on the island. Additionally, it presents guidelines for the limitation of the tourist population visiting the island daily. The document (Melo & Niño, 2006) proposes a zoning outline for ecotourism, refining the geological landscapes, identifying the possible negative impact to the environment in the future, and the proposed future activities to avoid the negative impact of the activities on the landscapes. It provides for optimistic outlook for the future island usage if these guidelines are enacted (Table 1).

Zone	Flora	Important scenic	Intensi recreational	Natural usage	Special	Human
Char	Nat	Controlled	Attracti	Area of	Area to	Explanation
tics	ources	ress	pe areas.	on of flora	zed for	"Federal
		Preservatio	Ideal	resulting in	ative	Terrestre
			center	Ac-		ne restaurants
						nd "Fantasia"
Man	Con	Preservatio	Implem	Limit	Remode	Correlation
s	of	naturals	reational	ental impact	l touristic	conservational
	and	istic for		nt	cture	with the future
		public				economic
Actio	Lim	Facilities	To	Strict	Restorat	Remodelatio
	of	organized	usage of	ent of	ourist rest	restaurant areas
	ary	tures in order	present	l protection		itchen and
		t the island's		nd		areas)
						To reduce
						gical impact to
Cons		Restoratio	Remod	Study and	Tourist	Sign an
		existing vista	f tourist	proposed	buildings	d and tourist
			reas for	restoration	ration and	nt with public
			film		orm	al universities
Reco	Prot	Environme	Active	Tourist	Module	Established
sage	ra and	ntation	passive	tions	ofessional	reas
	Areas		nal		ents	

**Table 1** Proposal zoning. Source: own elaboration.

The island was divided into six zones to be protected and reserved. They are as follows, wildlife, magnificent scenic landscapes, a recreational area which is well used, natural restoration, a special usage area for agriculture, and physical structures.

A name and additional information has been designated with the headings for each zone, a) name, b) management objectives, c) description, d) construction, e) conservation programs and f) recommended soil usage. All of the fundamentally significant fragile ecological aspects of the islands are categorized as, the fragile flora and fauna, and the scenic vistas. Facilities or limitations on the installation of public services, construction, conservation of natural phenomenon (i.e. waterfalls, etc.) and pathways the analytical studies of La Roqueta island reflect the possibility of the realization of ecotourism and recreational usages on the island. The most important ecotouristics activities are defined as, educational, investigative, conservational and observing the diverse flora and fauna.

Flora and fauna, integrates the natural resources of the island minimizing the socioeconomic impact to the natural heritage and promote activities such as bird watching, and hiking among others. They are fragile geosystems. This zone will help maintain, preserve and conserve the landscape as well as the natural resources and promote the development of scientific activities which will to prevent negative environmental consequences to the island's ecosystems. The suggested usage of the terrain is to preserve the island as a nature preserve with its current landscape highlighting the geofomations of the island and wildlife. The preservation of natural resources with minimal socioecological activities is essential.

Important natural scenic landscape, nature vistas, identifies steep inclines of more than 25°. The specific objective of the island management is to safeguard the islands natural characteristics. The recommended activities for this zone are to open rustic pathways (paved pathways) that will reduce the deterioration of the terrain and facilitate visitors or group access. Registration will be necessary and deployment security agents to guarantee both the safety of visitor and the environment. It is also recommended that environmental educational classes be given by a guide.

Intensive recreational usage, provides for the integration of the island's lower levels. The natural characteristics of this zone are the gentle slope of the hill, to the almost virgin beaches, and a warm climate. The minimum slope of the terrain allows for intensive recreational usage. Recreational usage of the shoreline as a whole is a tourist attraction. These areas are heavily populated by tourist. The objective of area management is to provide the tourist with a spiritually peaceful place to adventure, relax, observe the natural surroundings and harmonize with magnificent scenery of the island (Figure 2).

(Niño, 2010), presents the consequences to the island's landscape if the administrative philosophies presented are enacted to preserve the natural resources and recreational activities appointed to each zone.

The idea is to allow the admission of groups of visitors in controlled numbers with the goal of educating the groups along the lines of active and passive ecotourism. It will be important to specify areas to be reserved for camping, "palapa", area and local commercial tourist businesses which sell film, souvenirs, etcétera.

The map displays the spatial distribution of the Mexican Environmental Management and Protective Policy for the island. The protected area is dark green the conservation area is Light green, the restoration area is purple and the area designated for improvement is red. These policies also include five areas to be improved.

The natural recovery usage, include the vegetation areas that have reversible and regenerative potentials. The eco-destruction continues annually. Also, it includes the wildlife zones to be managed with the objective of zonal preservation, and improvement.

Special usage, this area is indispensable for the administration of the island. The principle objective is to maintain and safeguard the administrative areas as well as the existing structures of the island. These are to include all administrative services (security, protection, restoration and optimal land conservation) which are of importance to local employees and visitors. The specific proposal is the remodeling of existing structures insuring protection of the island's natural landscape. The actions to be undertaken are to maintain the functions of the areas that are for tourist usage and limiting the access to the administrative areas. The buildings to be included are the tourist registration building, reception center, which will be a visitors courtesy area, (i.e. bathrooms, auditorium, rest area, exhibits, movie that replay automatically, and a panoramic vista area which will include a five arts section. These administrative structures are to centralize the administration of the island and promote ecotourism (Niño, 2009).

Human settlement, is for strategic security of the island's light house as well as the restaurant area, Palao and La Fantasía. These strategic areas currently dedicated to the island's and restaurant's security, are impossible to relocate.

The objective is to inspire and awaken the interest of the population's awareness to the preservation of the island's natural resources.

The principal ideas are, to have more qualified personal, remodel the administrative buildings and construction of a visitor's center, environmental awareness information will be to promote preservation of the island as a nature preserve.

The costal zone known as "Zona Federal Marítimo Terrestre" (Zofemat) is from sea level to 20 meters above sea level on the island in Law number 137 which is concerned with tourism in the state of Guerrero. The regulations describe the touristic development of the island, its natural ecological and beauty, located near the main land of Acapulco. The idea is to increase the touristic development of La Roqueta island in the future.

This planning should be participatory, "beyond the implementation of Rationalist Court planning models", whose contents are usually defined in the political centers to apply, but without assessing the role of local actors, or their expectations and needs (Molina, 2007).

Planning is first and foremost an inter and multidisciplinary process considering that the problems of the use of resources may not be raised or resolved by a single discipline and to achieve their complete understanding is desirable to optimize communication between scientists capable of addressing the study of natural and social areas; planning the environment implies the holistic view of resources within the area in question, to be recourse to the technical aptitude and knowledge of the geographer, ecologist, forest or biologist, architects, engineers, environmentalists, sociologists, etc.

Each will contribute in this process so that the global environment and the relationship between their parties are recognized and considered within a Natural Protected Area's management plan.

Where the indicators of sustainability are interrelated in its various aspects such as the physical component which includes the slope of the ground, plant development, agrological capacity (depth, fertility, development and stoniness), gathered from coverage and water erosion; biotic component, presence or absence of vegetation (deforestation) and anthropic component, such as the total population, economically active population, economically inactive population, wages, occupation, production, consumption, index of marginalization (housing, services, access roads, transportation, food supply center).

The strategy is an adjustable process whose aim lies in "meeting the set of rules to ensure a better decision in every moment". The challenge here is to make the right decisions at the right time since carrying out a developmental option rarely relies on clearly distinguishable and instantaneous events (Oñate, Pereira, Suárez, Rodríguez & Cachón, 2002).

Natural resources include the "geology and lithologic substrate", the morphology of the land and soil; the fluvial network; vegetable formations and its floristic wealth; Wildlife; "weather conditions and specific ecological traits" which should be basis of constant consultation for the development projects making and promotion of some natural appeal in particular (Boullón, 2001).

The public use of the resource, “refers to protected natural areas in operation”, it seeks to know the interrelation between visitors, facilities and services, as well as the impact that public use exerts on the environment in order to detect the type of most frequent activities, the number of participating users and favorites sites for their performance (Melo & López, 1994).

The determination of the limits will be congruent to the management objectives so that the location for employees, visitors and owners of adjacent land are easy to set. Then, we have to settle the optional uses for management based on the value of the resource, use and current property, ability and limitation of the land to the environmental impact of physical development and socio-economical and political aspects of the region.

Once limits are settled, we have to assess and classify lands by separating the entire protected natural areas of management, indicating where they can or cannot locate physical works. This zoning map occurs on the preliminary sketch of the plan.

Latin America uses the following system of the land classification which considers nine independent management zones: Wild Life Outstanding, Natural Recovery, Natural Scenic Landscape Recreational, Special Use, Recreational and Intensive Use and finally Human Settlement (Niño, 2008).

Once the management zones and formulated appropriate uses are established, the different programs have to be made.

The zonal proposal for La Roqueta island show potentials benefits of being implemented, among them we can mention:

- a) To avoid the capricious use of the island which can lead to social conflicts and irreversible damage to the quality of natural resources as it happened with the “ExAca-Extremo” project.
- b) To accurately understand the objectives, priorities and requirements of licensees of the island, the municipal authorities, owners of the seven restaurants, national and foreign tourists. In order to reconcile interests in the implementation of land-use plans.
- c) Technical advice and planning territorial on behalf of human resources’ planners of natural protected areas and sustainable tourism specialists attached to State institutions.
- d) The proposal for the island zoning includes a range of time between two and five years to be set up in the insular territory where the beneficiaries are multiple as well as monitoring the elements of nature: water, soil and vegetation in order to avoid environmental impacts with a vision of intergenerational social equity through a participatory approach and combination of multiple State and municipal public policies.

As “La Roqueta” has its well-defined limits, we propose the zoning where they can or cannot locate physical works. Latin America uses the following system of classification of lands which consider seven independent management areas: intangible, primitive, extensive and intensive use, historical and cultural, natural recovery and special use (Linberg & Hawkins, 1993).



On the island, the territorial strategy emphasizes the local resources in order to make sustainable tourism that is currently carried out on the island itself and the providers' competences in established restaurants to offer a quality product as it is the walk from the Continent's harbor to the island.

The comprehensive goals of the tourist phenomenon consist of reconciling the protection of the environment with economic and social interests of the local population, the tourists' acceptance and the satisfaction of their needs. "Protection and valuation of natural spaces by local, public and private economic actors, and by other contributors to the tourist community, as hoteliers, restaurateurs, etc., are directed to maintain the quality of the environment and to provide them with special attention" (Ramírez, 2006).

The territory seen as a holistic entity where its components "involved, rather than independent and isolated from others, but integrated through a dense and complex network of strong and close relationship ties, including a situation of mutual dependence, where participation and alteration of each of the components have an impact on the content", the structure and the functioning of the others and, of course, of the whole territory. This is shown as a real, complex, complete and inseparable entity defined by content, dynamics and states that result from processes subordinated to the functioning of all and each of the fundamental elements.

The recreational activity which is highly recommended is the field visit, due to the proximity to the area of the city and the port of Acapulco, tourists have excellent routes of shipping communication in motorized boats.

It is recommended carrying out formal and informal talks on the outdoor stage and they should be about topics that guide and promote sustainable tourism as a strategy of sustainable development, the conservation of the landscape, sound management of natural resources, importance of the local natural area; existing publications and by edit, will focus on the various items of "La Roqueta".

The recommended administrative actions revolve around the organization of protection, rehabilitation (cleaning), educational programs and cultural diffusion, agreement signing, tourism promotion and research, and training of community cooperation in the work committees to undertake.

### **Gratitude**

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### **Conclusions**

The enactment of environmental policies for conservation, restructuring tourism and land use of La Roqueta Island will promote as well as preserve the island's future as a natural protected area as defined in the UMA.

Zoning is useful to ensure the success of activities connected with the resulting exploitation of the natural resources of the island landscape. Within the framework of the sustainability of the landscape, we must avoid any recreational activity that adversely affects our natural resources.

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