DEFINING ENVIRONMENTAL MANAGEMENT UNITS BASED UPON INTEGRATED SOCIO-ECONOMIC AND BIOPHYSICAL INDICATORS AT THE PACIFIC COAST OF MEXICO

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SUMMARY

Depicting geographic areas encompassing relevant territorial information is essential for proper land-use planning. The literature provides scant examples dealing with integration of socio-economic and biophysical attributes at the territorial level in order to bridge the gap between biophysical data and human society in regional planning. The goal of this study is twofold: first to provide an overview of the main features of the Pacific Coast of Michoacan, Mexico, delineating entities based upon biophysical and socio-economic attributes simultaneously; second, to serve as an integrated baseline to guide decision making processes in land-use planning. The geographic entities obtained represent a reliable approximation to define development and conservation priorities in the context of land-use planning.

For several years now, the pursuit of sustainable development has taken the form of an intense debate about the potential for integrating social, economic and ecological development goals within an overall physical planning context (de Graaf *et al*., 2009). According to Bocco *et al*. (2001), land-use planning results from a reasonable compromise between the environmental potential, measured in terms of the availability of natural resources, and the social demand, measured in terms of the requirements of goods and services by specific human communities. A reliable way to measure the degree of human-induced environmental conversion is through the study of space-time dynamics of land cover (Berry *et al*., 1996). In such context land-use planning based upon land-use change analysis has been recommended as useful to holistically reach sustainable management (Lambin *et al*., 1999; Liverman 2001). So, ecosystem assessment is expressed in land changes and their environmental implication at various temporal and spatial scales (Lambin, 1997) serve to analyze land capabilities to carry on a specific land-use in a sustainable way.

It has been emphasized that territorial information and organized consistent databases are essential in decision making (Bartlett 2000; Sardà *et al*., 2005). Delineation of geographic entities linked to appropriate territorial information becomes indispensable for proper land-use planning. Several approaches have been used for delimitation of geographic entities

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(Marschner 1950; Avery 1968; Anderson 1976; Baja *et al*., 2002; Duque *et al*., 2003), although in general, territorial zoning for land-use planning has been primarily based on biophysical characteristics, and socio-economic characteristics are integrated afterwards. Zoning based upon biophysical attributes has been conducted systematically for land-use purposes because delineation derives into natural entities (Bocco *et al*., 2001; Brenner *et al*., 2006). Regional segmentation based upon socio-economic attributes, on the contrary, is usually dependent of political and in some cases cultural fuzzy entities such as municipalities or provinces. Brenner *et al*. (2006) and Balaguer *et al*. (2008) provide sound examples by dividing the territory into homogeneous environmental units, including geo-environmental, socio-economic and jurisdictional characteristics of the management area, as the base for supporting integrative coastal zone management strategies and activities.

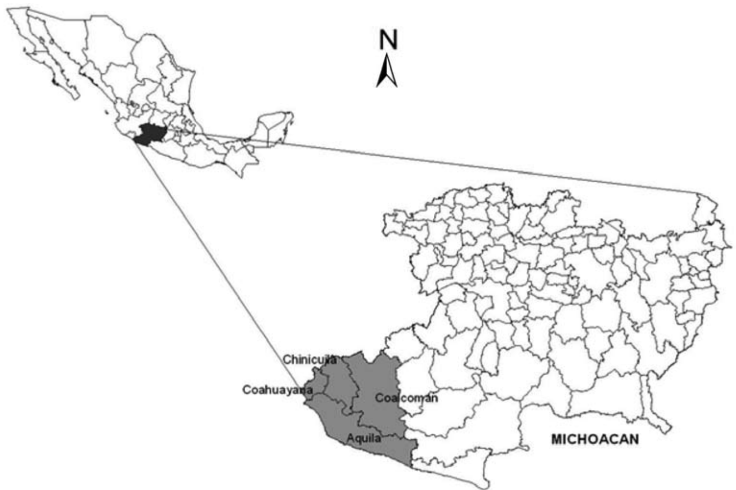

Figure 1. Location of the study area: the sierra-coast region in Michoacan, Mexico.

It has been argued that socio-economic attributes need to be incorporated in the land-use planning processes since the beginning (Sardà *et al*., 2005; Brenner *et al*., 2006). Then, each geographic area, previously defined, should help identify needs in a hierarchical structure (Juárez 2000; Yáñez-Arancibia and Day, 2004) and facilitate a better understanding of the regional socio-spatial complexity. Integration of the socio-economic complexity from the first step, and at the same level as biophysical complexity, can improve the definition of integral socio-ecological units, where different environmental and socio-economic indicators are developed side by side. These units, in turn, can be used as the platform for further land assessment and environmentally sound land-use planning.

In developing countries, most of them in inter-tropical regions, contemporary territorial occupation has followed an unlimited growing model. These countries have difficulty in reducing the high costs of land transformation, due to the weak integration of planning with major conservation works and rational land-use strategies. Land-use planning and the necessary supporting data are crucial to developing countries that are usually under severe environmental and demographic strains (Bocco *et al*., 2001). At coastal regions, where large urbanization prevails and most areas are substantially more fragile, land-use planning is urgent (Brenner *et al*., 2006). This is the case of the Pacific coast in the Michoacan State, Mexico, where, in addition, poverty and land abandonment have increased current cultural and natural depletion. These are challenges for environmental managers, territorial planners, policy makers and academics, who must look for new approaches to deal with the multidimensionality of socio-ecological problems. Given this costal condition, land-use planning is seen as a shortcut to guide the small public investment in more durable management practices.

The goal of this study is twofold: first, to provide an overview of the main features of the Pacific Coast of Michoacan delineating entities, based upon biophysical and socio-economic attributes simultaneously; and second, to provide a method ideally suited for land-use planning that may serve as an integrated baseline for a shortcut, easily updated method, to allow cost-savings, and as a basis for integrated management. Although dealt in the context of a Mexican coastal zone, the methodology presented may be applied to any region with available territorial information. The results are discussed in the light of their implications in future land planning issues, where strategies and activities can be implemented according to the environment and socio-economic context of the territory.

Study area

Within the Mexican context, Michoacan State (about the size of Costa Rica) is amongst those with the most important bio-cultural heritage (GEM, 2003). Yet, it faces strong driving forces that threaten its natural and cultural heritage. Currently, over 50% of the territory and 70% of the superficial water bodies have some degree of disturbance (UMSNH-GEM, 2002). Within Michoacán, the coastal Pacific region is the most outstanding area, because it has experienced drastic land-use changes with multiple social, economical and ecological implications in the last years.

The biophysical dimension

The South-west region of Michoacan (covering 6474km^2) is characterized by a particularly abrupt and complex relief, whose highest points reach ~2700m. From the geologic point of view this is one of the oldest regions of the state (Vargas *et al*., 2000). The high topographic elevations have been shaped by geologic processes and weathering (Garduño, 2005). Such elevations control the pass of Pacific ocean effects that strongly influence temperature and humidity; the geographical setting of the sierra-coast region determines much of the variation in the physical environment. Both the hydrologic and temperature regimes can be attributed to the location of the system in the transitional region between the tropics and temperate areas (Neartic and Neotropical biogeographic zones). But such geographic setting has also determined the biological richness of the region (Rzedowski, 1991). From the floristic point of view, the sierra-coast region has been identified as one of the top priority conservation areas without official protection regime (Velázquez *et al*., 2005). Wildlife diversity also is outstanding, especially if species richness per unit area and endemic criteria are taken into account (Villaseñor 2005).

The socio-economic dimension

The sierra-coast region includes eight municipalities, but the portion included in this study consists of only four municipalities which comprise 10.8% of the surface of the Michoacan State (Figure 1). This territory harbors 1.4% of the total population of the state; with an average density of <13 inhabitants per km^2. Historically, it has been an isolated area with a very important cultural heritage strongly linked to its environment management. These regions experienced the lowest growth rate (5.5%) in the last five decades; whereas the rest of the state growth rate average is >35%. During the last 25 years the region has presented conditions of marginalization, denoted by lack in economic opportunities and deficient provision of services related to education and health. The municipality with the most alarming situation is Aquila, which has shown very high marginalization since 1980. These precarious conditions reflect the lack of articulated environmental and development plans for the whole region.

TABLE I
INDICATORS USED FOR ENVIRONMENTAL MANAGEMENT UNIT'S DEFINITION

Dimension	Indicator	Descriptor	Data scale	Source
Socio-economic	Population density (PD)	Relationship between the number of people inhabiting a determined surface of the territory	Data by locality	a
	Urbanization degree (UD)	Proportion of the population that lives in urban areas	Data by locality	a
	Spatial agriculture concentration (AC)	Percentage of arable land that covers the territory	1:25 000	b
	Spatial industry concentration (IC)	Municipal concentration of industry *	Municipal data	c, d
	Road density (RD)	Length of roads in km	1:25 000	e
Biophysical	Land cover conversion (LCC)	Alteration and deforestation were regarded as the change from natural vegetation to man made cover	1:250000	f
	Permanence of man made covers (PMC)	Permanence of crops, improved grasslands for livestock production, and human settlement	1:250000	f
	Permanence of natural vegetation (PNV)	Permanence of natural vegetation that includes temperate forest, tropical forest, tropical scrublands, native grasslands and coastal vegetation types	1:250000	f
	Potential for recuperation and re-vegetation (PR-R)	Changes from man-made land cover into any type of natural vegetation land cover	1:250000	f

* Total production: mining, manufacturing, electricity and water sector, construction industry; municipality values of agricultural production, livestock and forestry, and the total production total for fishing, mining.
a: INEGI (2005), b: Priego-Santander *et al.*, (2008), c: INEGI (2004), d: SAGARPA-SEDAGRO- SIAP-INEGI (2003), e: INEGI (2000), f: Set I (INEGI 1976) and Landsat ETM+7 (2003).

Methodology

Socio-economic and biophysical indicators were used to delineate homogeneous management land units, using available spatial information. Because of the heterogeneity of this area and the need to incorporate effectively the environmental structure and function, a regional cartographic scale 1:250000 was chosen for the study.

Grid cells as the unit of analysis

Data used in the present study were aggregated on a grid cell system to increase the level of detail. This approach is commonly used for spatial analysis and has been applied for analysis of landscape patterns (Haines-Young, 1992; Poudevigne and Alard 1997; Abdullaha and Nakagoshia 2006; Van Eetvelde and Antrop 2009) and spatial socio-economic assimilation (Propín and Sánchez 1998; Cardona 2004). The study area was divided into ~300 cells; each of them of 5×5km. These grid cells of 25km^2 were used as spatial units for the analyses and each one was expressed as a independent polygon in the GIS, which facilitates integration of the data. The indicators selected were integrated to the grid cells by GIS aggregation of the data sets. Some cells along borders are smaller because they were cut by municipal boundaries. The geographic grid was developed using the GIS application of ArcView 3.2 (ESRI 1999) and Arc GIS 8 (ESRI 2004).

Selection of data sources and definition of indicators from both dimensions

For a better understanding of the socio-economic dynamics in the sierra-coast region socio-economic territorial units were first defined through methodologies used in economic geography (Propín and Sánchez 1998; Sánchez *et al.*, 1999; Juárez 2000; Cardona 2004). Five indicators that represent spatial basic contents of social and economic issues were selected: 1) population density (PD), 2) urbanization degree (UD), 3) spatial agriculture concentration (AC), 4) spatial industry concentration (IC), and 5) road density (RD). Values of socio-economic indicators were collected from official statistics.

Afterwards, and with the purpose of developing an integrated and general vision of the sierra-coast system, the biophysical dimension was incorporated by means of land-use cover change analysis. The spatial identification and quantification of land-use changes contributes to the characterization of the territory and helps locating areas that need priority attention, as well as establishing policies and formulating corrective action plans for better resource management in such zones (Palacio-Prieto *et al.*, 2004). Related to the biophysical dimension, the land-use change analysis was generated from two land cover maps, one from 1976 and the other from 2003, on a scale of 1:250000. Six major land-use processes were identified on the basis of conversion among land cover clusters (*sensu* Velázquez *et al.*, 2003), but they were reclassified into four single categories. Alteration and deforestation were regarded as the change from natural vegetation to man-made cover (crops, improved grasslands for livestock production, and human settlement). The permanence of man-made covers was considered separately as a single category. The permanence of secondary and primary forest represents a third category, as the continuity of natural vegetation that includes temperate forest, tropical forest, tropical scrublands, native grasslands and coastal vegetation types (e.g., dunes). The fourth category includes those loci where re-vegetation and recuperation took place, and comprises changes from man-made land cover into any type of natural vegetation land cover. Thus, the resulting map was reclassified into the four categories described. These four regrouping categories, were the four indicators chosen to describe the processes in the biophysical dimension: 1) land cover conversion (LCC), 2) permanence of man-made covers (PMC), 3) permanence of natural vegetation (PNV), and

TABLE II
INDICATOR CLASSIFICATION OF THE SOCIO-ECONOMIC DIMENSION

Indicator	Population density (inhab/km²)	Urbanization degree (%)	Spatial agriculture concentration (%)	Spatial concentration of industry (USD/km²)	Road density (km/km²)
Range	PD	UD	AC	IC	RD
1: Very low	0-6	0	0	0-93.5	0
2: Low	>6-20	>0-10	>0-20	>93.5-934.9	>0-0.00001
3: Medium	>20-50	>10-30	>20-40	>934.9-1869.7	>0.00001-0.00002
4: High	>50-250	>30-45	>40-60	>1869.7-2 804.5	>0.00002-0.00003
5: Very high	>250	>45	>60	>2804.5	>0.00003

TABLE III
INDICATOR CLASSIFICATION OF THE BIOPHYSICAL DIMENSION

Indicator	Land cover conversion %	Permanence of man made covers %	Permanence of natural vegetation %	Potential of recuperation and re-vegetation %
Range	LCC	PMC	PNV	PR-R
1: Very low	0-5	0-5	0-5	0-5
2: Low	>6-20	>6-20	>6-20	>6-20
3: Medium	>21-50	>21-50	>21-50	>21-50
4: High	>51-75	>51-75	>51-75	>51-75
5: Very high	>75-100	>75-100	>75-100	>75-100

4) potential for recuperation and re-vegetation (PR-R).

Together, biophysical and socio-economic indicators represent the nine layers used for geospatial analysis. These geospatial themes were selected according to their conceptual and specific contributions as quantifiable phenomena of the dynamic sierra-coast system and the quality of the available data. Table I shows the themes used and their descriptors, the spatial scale and the year when the data were gathered.

Data aggregation method and integration of dimensions

Through simple spatial aggregation operations in GIS, the socio-economic and biophysical information was integrated in a common spatial framework (the four municipalities). Spatial data aggregation is widely used in environmental analyses (Haining, 1990; Bian and Butler, 1999; Ceddia *et al.*, 2009), and during an aggregation process the original spatial data are reduced to a smaller number of data units (points, lines, polygons, or pixels) for the same spatial extent (Bian and Butler, 1999). As already mentioned, data was aggregated on a grid system and spatially combined to produce a pseudo-indicator code from each cell. Therefore, each cell was codified according to the value range of each indicator, socio-economic (Table II) or biophysical (Table III).

Cells were classified according to the set of socio-economic values of the five indicators, which formed the code of each cell (e.g., 23152, 41322…), and then they were grouped in an order to include those with similar code. The code is not a mathematical, but a typological expression (Propín and Sánchez 1998; Juárez 2000). The codes with the higher frequency were considered the centre of the typological groups. In this process, all the possible similar combinations that could be subordinated to one typological group were assigned to it. Results were aggregated, based on the final composition of the code. The same procedure was followed for the biophysical indicators. Resulting codes of both dimensions were finally grouped; these typological groups constituted the sum of socio-economic and biophysical indicators, and represent their territorial expression.

The final typological map was converted to a pseudo-line grid using the spline interpolation method with GIS applications of Arc GIS 8 (ESRI 2004). This method interpolates a surface from points using a minimum curvature spline technique. Spline is an algorithm applied to alter data so as to smooth their cartographic representation; it serves to produce contours or imaginary lines in which the variable takes a constant value (Díaz-Padilla *et al.*, 2008). To do this, the cell-shape was converted to a point-shape, in which each point, with its correspondent value, was located at the centre of the cell.

Statistical analysis

Once the indicators were calculated, a correlation analysis was carried out to explore the association between biophysical (LCC, PMC, PNV and PR-R) and socio-economic (PD, UD, AC, IC and RD) indicators. The Pearson correlation coefficient (r) was applied. It determines the extent to which values of two variables are proportional to each other. The model assumes that variables have linear distributions; thus, the ordinal values from biophysical and socioeconomic indicators were transformed to natural logarithm (ln), since they did not comply with a normal distribution. Finally, variables correlated at $p<0.05$ significance were selected. Processing was performed in Statistica 9 (StatSoft, 2009).

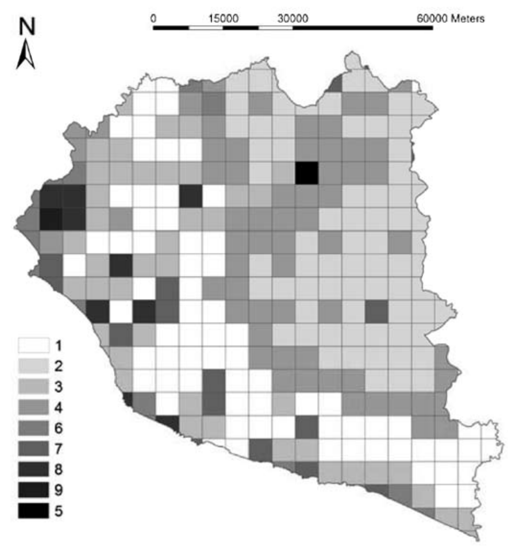

Figure 2. Spatial socio-economic assimilation levels in the sierra-coast region, Michoacan, Mexico.

Results

The municipality level analysis tends to a homogenized real socio-economic status in the territory. The gradient differential between the different socioeconomic assimilation units allows to have a clear idea about

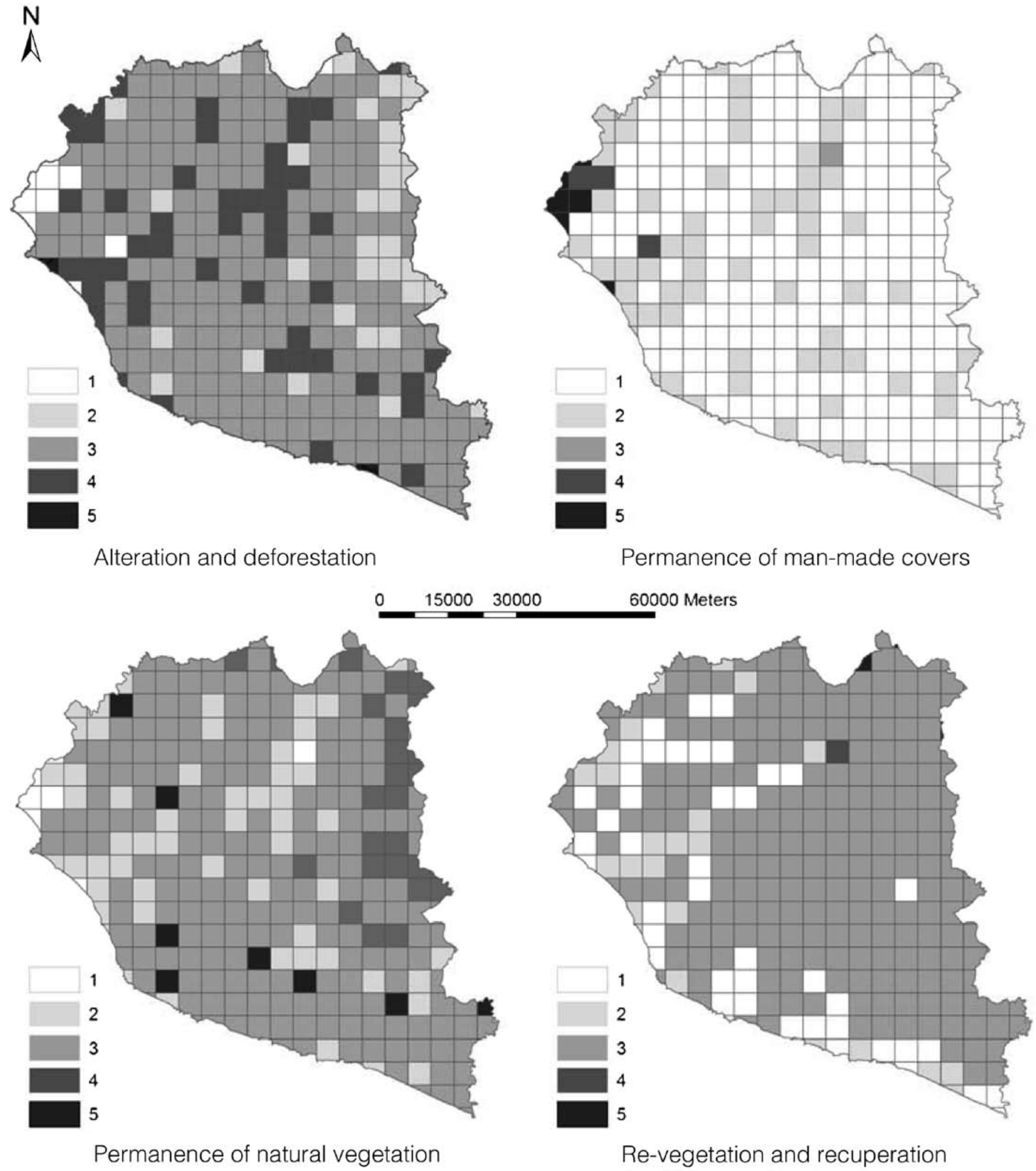

Figure 3. Principal processes identified in the land use change analysis (1976-2003).

the demographic, economic and agricultural synergies of the study area, more in line with its reality and complexity. The method used identifies clusters and patterns inherent in the data. The socio-economic assimilation levels obtained represent the territories with the lowest values (1, 2…) and those with the better regional socio-economic assimilation (… 8, 9; Figure 2). Population density and spatial concentration of agriculture were the main indicators in the regional differentiation due of the low regional urban and industrial development. By contrast, road density was expressed irregularly. Most of the territory presents very low to low levels of economic assimilation, and the highest levels are concentrated in the municipality capitals and coastal villages with small-scale tourism development.

On the other hand, according to ranges of table III, Figure 3 shows values (from 1 to 5) of territorial expression from each bio-physical indicator. These indicators were aggregated to the socio-economic assimilation level. Once the different indicators were measured, new typological groups, which included the nine indicators, were created to define the integrated indicators valuation for each environmental management unit (Table IV). It was necessary to characterize a new resulting code for each cell through the combination of codes.

Thematic maps of each dimension represent an independent view of the territory, and together they constitute the main input for the integrated process. Natural and socio-economic dimensions were combined to shape the final map. This is the crucial step to make different dimensions consistent with each other. The combination process obeyed a logic data aggregation procedure which summarized the typological groups for every level.

Once these two independent rationalizations were performed, they were combined to obtain the Pearson

TABLE IV
INTEGRATED INDICATORS VALUATION FOR EACH ENVIRONMENTAL MANAGEMENT UNIT

	PD	UD	AC	IC	RD	LCC	PMC	PNV	PR-R
I	1	1	1	2	1	3	1	4.5	2.5
II	1	1	1	4	1	2	1	4	2.5
II	1	1	2	2.5	2.5	3.5	1.5	3	1
IV	2	1	2.5	2	2	4.5	2.5	3.5	2.5
V	3	1	3.5	3	2.5	5	3.5	2	1.5
VI	3	1.5	3	3	3	2	3.5	2	2
VII	4.5	5	5	5	2	2	3.5	1	4

1: very low, 2: low, 3: medium, 4: high, 5: very high.

TABLE V
PEARSON CORRELATION COEFFICIENT (R) AMONG INDICATORS OF BOTH DIMENSIONS

	PD	UD	AC	IC	RD	LCC	PMC	PNV	PR-R
PD	1.00	*0.60*	*0.63*	-0.18	0.34	-0.15	*0.57*	*-0.51*	-0.05
UD		1.00	0.39	0.20	-0.01	-0.23	*0.52*	*-0.60*	-0.01
AC			1.00	-0.35	*0.49*	-0.34	*0.86*	*-0.71*	-0.23
IC				1.00	-0.03	-0.22	-0.37	0.08	0.26
RD					1.00	-0.14	0.33	*-0.51*	-0.05
LCC						1.00	*-0.48*	0.36	-0.27
PMC							1.00	*-0.81*	-0.17
PNV								1.00	0.06
PR-R									1.00

Values with statistical significance $p<0.05$ are indicated by italics.

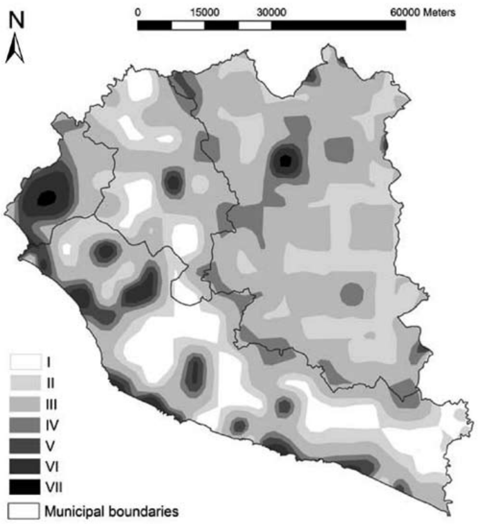

Figure 4. Resulting environmental management units defined by biophysical and socio-economic indicators.

correlation coefficient (r), and then see the degree of relationship between indicators of both dimensions (Table V). Correlations with statistical significance ($p<0.05$) are the positive significant correlation between PD with UD (0.60), PMC (0.57) and with AC (0.63), AC with RD (0.49), and PMC with UD (0.52); and the negative correlations, which indicate an inverse relationship of PNV with four of the socio-economic indicators, PD (-0.51), UD (-0.60), AC (-0.71) and RD (-0.51). But the most remarkable negative correlation was between PNV and PMC (-0.81; Table V). Therefore, correlation analysis validates the significant relationship between the different socioeconomic and biophysical indicators.

Finally, the resulting map of the summarized values was transformed into a pseudoisolines map through an interpolation process. Pseudoisolines allow to understand the spatial definition of the variables and their territorial diffusion. Therefore, each typological level represented a single socio-ecological unit. Figure 4 shows the resulting cartographic representation, with the correspondent typological group number (corresponding values for each unit are shown in Table IV), which represent the results of the socio-economic and the biophysical thematic rationalizations.

Based on the spatial information and data aggregation it was possible to produce a good representation of the functional dynamics of the sierra-coast region in both dimensions. In general, higher values for the socio-economic components are accompanied by lower values for the biophysical components, showing a clear inverse relationship. This pattern clearly reflects that zones with the lowest levels of economic assimilation present the highest levels of permanence of natural vegetation while, at the same time, have intensified processes of land-use change in a significant way. These units in turn, despite being currently managed as homogeneous units, are composed of territories with dissimilar socio-economic and biophysical values; thus, two units could not be managed in the same way. The resulting units allow to make inferences about the inter-municipal and inter-regional differences in the whole territory, which shows specific characteristics by its proximity or remoteness to development poles. These findings could be incorporated into ongoing land-use planning to define specific responses and strategies to each zone.

Discussion and Conclusions

This paper was able to show complex relationships between biophysical and societal datasets by means of defining sound indicators depicting each cell (Table I). Although cells are geographical artifacts, meaningless from biophysical and societal point of views, they served as an entrance to provide weighted values to all indicators. In a second instance, these cells were transformed into natural entities by means of the spline method so that natural entities prevailed, as shown in Figure 4. The integration problem was solved using a geographic grid (Haines-Young, 1992; Poudevigne and Alard, 1997; Abdullaha and Nakagoshia, 2006; Van Eetvelde and Antrop, 2009) that allows standardizing geographical discontinuous expression of biophysical features, and thus, comparisons with socio-economic features were on equal conditions. In this sense, integration of disparate biophysical and socio-economic dimension difficulties in terms of scale mismatch, lack of overlap for specific locations, and a mismatch in the temporal scale of the data sets, were solved. Hence, a main input was the information from both dimensions translated into nine indicators, which could be mapped digitally and hence could contribute to the delimitation of boundaries for environmental management units. This is crucial for interdisciplinary research by creating conceptual, albeit practical, frameworks for sustainable integration of natural resource use with economic systems and society (Holling 2001; Ludwig *et al.*, 1997).

Results show that there is spatial correlation of biophysical and socioeconomic indicators. The permanence of natural vegetation shows a statistically significant negative correlation with four of the five socio-economic indicators. As Sánchez *et al.* (1999) suggest, places with the highest levels of socio-economic assimilation tend to be associated with important environmental problems. In this sense one of the principal findings of the present approach was that units have dissimilar socio-economic and biophysical values (Table V). However, it is important not to simplify this relationship, as evidence supports the conclusion that the simple answers found in population growth, urbanization, and infrastructure rarely provide an adequate understanding of land change (Lambin *et al.*, 2001).

As shown in Figure 4, there were loci with contrasting biophysical and socio-economic values. It has been argued that these contrasting places can be more vulnerable to externalities due to the economic dependency of local people upon natural resources, because as Rudel *et al.* (2005) pointed out, the restricted options created by poverty drive inappropriate land-use and degradation. In the sierra-coast region, externalities can include changes in the distribution of economic welfare between different segments of society and increased environmental impacts. Consequently, impoverished zones with associated social problems urgently need larger investments and improvement of their socio-economic development. In this sense, next step after definition of environmental management units could be the definition of priorities for management in land-use planning and associated policy development. It has been recommended, however, that proper management-oriented scenarios should be built on real policy objectives as part of a more systemic view (Van der Weide, 1993). Environmental management instruments may, in the long term, facilitate the decision making process and the projection of actions on the territory, promoting the conservation of the natural and cultural heritage simultaneously.

To conclude, the area comprises mixed urban and rural landscapes distributed throughout the territory, where socioeconomic and biophysical phenomena rarely present themselves continuously through the territory, which makes it difficult to differentiate into homogenous units. Therefore, the spatial combination of the two dimensions represents a significant contribution as part of an integrative approach, including the aggregation of indicators and regional information in the analysis of sierra-coast system. The method also allows different analyses because it uses diverse sources of information. Cartographic representation of pseudoisolines was carried out to reduce cartographic abstraction and to facilitate the spatial understanding of the results. The approach could also be adapted and applied to other regions with available territorial information. Given the difficulties and constraints inherent to land-use planning, the method proposed, which includes socio-economic and biophysical dimensions, can be an integrative contribution in order to provide an analytical framework for the development of regional strategies related to land-use planning. It is also expected to be an important tool for the future implementation of the land-use planning program of the sierra-coast region of the Pacific coast of Mexico.

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DEFINICIÓN DE UNIDADES DE GESTIÓN AMBIENTAL BASADA EN INDICADORES SOCIO-ECONÓMICOS Y BIOFÍSICOS INTEGRADOS DEL PAISAJE EN LA COSTA DEL PACÍFICO EN MÉXICO

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RESUMEN

El reconocimiento de áreas geográficas que comprenden información territorial relevante es esencial para una planificación del uso del suelo apropiada. La literatura provee escasos ejemplos donde la integración de atributos socio-económicos y biofísicos son conjuntados en aras de conformar un puente entre datos biofísicos y las sociedades humanas para la planificación regional. Este estudio cubre dos objetivos: en primer lugar, ofrecer una visión general de las principales características de la costa del Pacífico de Michoacán, México, delimitando entidades en base a los atributos socio-económicos y biofísicos; y en segundo lugar, servir como un sistema integrado de referencia para orientar procesos de toma de decisiones en la planificación del uso del suelo. Las entidades geográficas obtenidas representan una aproximación confiable para definir las prioridades para el desarrollo y la conservación dentro del marco de la ordenación del territorio.

DEFINIÇÃO DE UNIDADES DE GESTÃO AMBIENTAL BASEADA EM INDICADORES SOCIOECONÔMICOS E BIOFÍSICOS NA COSTA DO PACÍFICO NO MÉXICO

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RESUMO

A descrição de áreas geográficas que incluem informação territorial relevante é essencial para um apropriado planejamento do uso do solo. A integração de atributos socioeconômicos e biofísicos a nível territorial pode ser a ponte entre a natureza e a sociedade no planejamento regional. O objetivo deste estudo é duplo: em primeiro lugar, oferecer uma visão geral das principais características da costa do Pacífico de Michoacán delimitando áreas com base nos atributos socioeconômicos e biofísicos; e em segundo lugar, servir como um sistema integrado de referência para orientar processos na tomada de decisões para o planejamento do uso do solo. As entidades geográficas obtidas representam uma aproximação confiável para definir as prioridades para o desenvolvimento e a conservação, no contexto do ordenamento do território.