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Abstract Environmental benefits and costs are very recurrent terms when they come to sustainable development. Keys for the north coastal area of Camagüey province, is a major tourist development plan in the medium term in Cuba. But is nonetheless a concern how to maintain environmental quality when important natural values are identified. It is a very fragile ecosystem that exists in the ten protected areas, of these one with international importance (Wildlife Refuge “High River” from Camagüey). Preliminary works’ hypothesis is that if you identify yourself to about the coat was five in the area Camagüey northern coastal ecosystem as increased interconnection planned tourism development in their keys, money are in your products and natural features and environmental costs are estimated to be able to evaluate the economic feasibility of environmental area through the benefit ratio cost. Correspondingly two objectives are identified: 1. Estimate the environmental benefits and costs in the northern coastal area of Camagüey and 2. Calculate the cost benefit relation methodological procedure designed and validated in the Territorial Project “Analysis of the production and services environmental in the north coastal area of the province of Camagüey, Cuba” executed by CIMAC in 2010. The environmental and economic benefits for the ecosystem to date represent 39 pesos for every peso of environmental cost updated.

Keywords Coastal management; Environmental benefits and costs; Sustainable development; Camagüey; Cuba

Introduction

In social life every man works for certain purposes, interests and aspirations and the results of human action correspond to some extent with his claims, which facilitate obtaining your own satisfaction. “An issue of great social importance is the urgency of considering environmental vulnerability as a key variable in planning for sustainable development of the region to be incorporated in all regional, national and local actions to be taken in the future” (1).

“The absence of rules and regulations (or the ability to enforce them) to order the establishment of human activities in high risk areas, combined with the progressive deterioration of the environment by human action leads to situations that contribute to an increase the impact of natural disasters” (op.cit.).

Tourism is one of the largest investment recovery. In Cuba is one of the areas of greatest extension, which has undoubtedly been an important source of income for the country and has contributed to increasing the standard of living of the population in the interaction zone, but has also affected the environmental quality ecosystem pollution and changing land use.

The study area is considered to contour 5m which has a 4 062.0 km² and supplemented by four municipalities. It is comprised of land areas, offshore cays and marine areas. The first they has an area of 952.75 km² the second 1955 km² and the rest to the last. The land uses by municipalities are:

Esmeralda: pastures, forests and idle lands;
Sierra Cubitas: reed, various crops, citrus forest and vacant land;

Minas: forest, reed, grass, citrus and various crops;

Nuevitas: forest, pasture, several crops, mining and industries The fundamental tenants agencies are: MINAGRI (livestock enterprises, cooperatives, farms you estarles, forestry bureau, citrus and Enterprise for the Protection of Flora and Fauna) and MININT (sugarcane farms).

In the Keys, the main uses are forest and undergrowth. They have exceptional beaches and natural landscapes.

Ten communities are located: La Gloria, Puerto Piloto, Palma City, Gurugú, Mola, Nuevitas, San Agustín, Punta de Ganado, San Agustín and La Boca. Population over 44 thousand habitants and are interesting the fact is that except San Austin and Mola, the rest have type of spontaneous settlement.

These coastal area rich ecosystems compose natural assets such as protected areas. These count with one of the six Ramsar sites in Cuba: Wildlife Refuge "Río Máximo". Another also distinguish by Maternillo-Tortuguilla, La Alegría-Laguna Larga, Alturas de Guajaba, Punta del Este, Correa, Alto del Puerto, Silla de cayo Romano y Alto de Juan Sáez (2).

The preliminary working hypothesis is that if you identify yourself to about the coat was five in the north coastal area of Camagüey ecosystem as increased interconnection planned tourism development in their keys, money are in your products and natural functions and estimate the environmental costs can be assessed environmental economic feasibility for the area through the cost benefit ratio.

Objectives of work:

To estimate the benefits and environmental costs in the north coastal area of Camagüey and

Calculate the cost benefit ratio.

1 Materials and Methods

The abundant and valuable international and national literature used to confirm the relevance of the topic being addressed, the multidisciplinary nature and importance to Cuba. Different criteria and methodologies are reviewed and techniques contextualized in the world. Particularly effective information of several authors, mainly Cubans and go to similar case studies. Using INTERNET also favors updating the above issues then works and most significant results are reported.

The research entitled "Economic and methodological tool for environmental management of natural wetlands Cuban international importance" (Zequeira, 2007) is a theoretical and methodological base and source of information for the estimates made in this paper.

The ordering planes in the northern cays: Sabinal, Romano, Cruz and Mégano developed by the Provincial Directorate of Physical Planning in the province, create information sources for the projection of tourism development.

They also represent valuable sources of information plans of handling and operating of Ballenatos Bahía de Nuevitas, Maternillo Tortuguilla y Wildlife Refuge Río Máximo precisely because they provide the natural values of these protected areas, which require management and how be used sustainably.

"Economic analysis of mangrove ecosystem Sabana Camagüey" (Gómez, 2002) is a thesis paper which is very important for the transfer of economic benefits is belonging to the study area vegetation type, and contain interesting assessment tools.

The project "Environmental Management of the coastal zone as a contribution to sustainable tourism development in Santa Lucia, Camaguey" (2007-2110), which has as the main executor Research Centre of Environment of Camagüey (Centro de Investigaciones de Medio Ambiente de Camagüey CIMAC) shows results of the current status and impacts caused by tourism in that area.

Represents a valuable source of information the results of a territorial project "Analysis of the production of environmental goods and services in the north coastal area of the province of Camagüey, Cuba" (Group of authors, 2010), which has as main executor to pointed in the same entity before and coordinated by the lead author of this study paragraph. Such aid with theoretical, methodological and practical results.

The environmental impact is contributing key criteria when it comes to environmental costs. In the case of "Project Barceló Hotel Santa Lucia Beach Resort". (Group of authors, 2010) sample results pertaining to
the subject of this study ecosystem which is developed with the participation of CIMAC. Among other elements of the environmental cost and important information for natural and socioeconomic subsystem.

Provincial environmental strategy and the records of municipalities under regimen integrated coastal zone are also consulted interview and municipal environmental specialists.

Are sources of information to estimate the environmental cost, the costs of investment concepts and operation oxidation ponds, worker training and direct and indirect costs associated with conservation use and environmental management Registered in statistical systems and financial information of the Research Center of Environment of Camagüey, Ministry of Tourism, Provincial Wildlife Company, National Forest Company in Camagüey, Ciego de Ávila - Camagüey GEOCUBA Company Provincial Delegation of the Ministry of Science, Technology and Environment. Suitable material environmental strategy of the province for environmental issues.

The number of deaths by type of extracted model won the 0436-01 national statistical system of the ONE-Camagüey "Selected Indicators cattle and sheep." Provides data based on the unit cost of materials production commercial farming in the coastal municipalities of reference tables for the finance section on statistical yearbook 2011 version of the institution itself. Promotes information also for the conversion of heads livestock biomass types, the model "end of the cattle inventory" executed by the Company and Assurance Services of the Ministry of Agriculture in the province.

The methodology used is "economic-methodological procedure for the" Analysis of the production of environmental goods and services in Cuban north coastal zone, province of Camagüey" the lead author of this study (unpublished) deposited in the respective scientific advice Research Centre of Environment Camagüey, Cuba and the National Association of Economists and Accountants of Cuba in Camagüey, Cuba.

1.1 General Research Methods
(1) Historical-Logical: For the development of the problem and the treatment of the subject in the Cuban context and the particular province.

(2) Analysis and synthesis: Used to check the background and the existing literature on the subject in general.

(3) Social research (quantitative and qualitative): For data collection, descriptive statistical analysis, obtaining information related mainly to perceptions, attitudes and opinions, among others, used complementary and integrated manner.

1.2 Empirical Research Methods
Documentary and bibliographical study: They will be summarized and theories related to the research topic, based on the analysis of articles, technical reports, operating plans and management (specifically the protected area) among other trends.

Observation: For important clarifications, referring to biodiversity, conservation workers and people in general of the communities in the study area, where the open and non-participant observation with external observers and is used both outside the group (university students and researchers of the project).

Statistics: For the sample design and making estimates for the data analysis.

Workshops of ideas: Criteria for partial and final results (as opponents involved specialists from other institutions and decision-making).

1.3 Research techniques:
Geographic Information System: Program commonly used for the description and analysis of geographic information.

Avoided cost (replacement and alternative / substitute): Save that for society, if it comes to science and technology, to approach the hypothetical involvement of environmental services.

Restoration cost: Cost to rehabilitate damage hypothetical approach to the involvement of environmental services.

Transferring economic / ha benefits: Extrapolation of economic benefits from ecosystems with similar characteristics.

Opportunity Cost: Value of the good or service forgone.

Cost Benefit Analysis: To propose viable solutions from the economic, social and environmental terms.
The abundant bibliography confirms the relevance and importance of the subject and allows access and use of information by various authors, to examine studies of similar cases in other countries as well as to test the scientific novelty of the work. Using INTERNET favors updating and deepening of those points.

2 Results
The results are displayed in two sections. Expose respectively economic benefits and environmental costs as well as benefits related environmental costs.

2.1 Economic and environmental benefits and costs
Economic Benefits
To estimate the economic benefits of environmental working with the respective values of direct, indirect and option use. It takes into account the economic value of biodiversity "from the position of the Marxist labor theory of value have no value can be estimated from the economic effect would their absence and / or conservation, and that provide directly or indirectly to man and which may be measurable utility, which is a prerequisite for calculating the price of these "(Zequeira, 2007).

Direct use value: The direct use value represents the sum of the indicators (product of quantity times price) associated with each element of biodiversity, in correspondence to their use and management. Includes traded goods and consumptive use [1], rated to their corresponding local market prices [2].

Indirect use value: Four environmental features for the coastal area north of Camagüey are selected. They are grouped into three variables: capture of CO₂, water supply, and erosion control and soil formation.

Option value: There are two variants: use (sell or consume) and retain with sustainable use. Vegetation, wildlife and water are considered.

Below are estimates for the ecosystem in question benefits are summarized below (Table 1):

<table>
<thead>
<tr>
<th>Category</th>
<th>Environmental Economic Benefits (MP)</th>
<th>Percentage Structure (%)</th>
<th>Economic and Environmental Performance (MP / km²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total direct use value</td>
<td>181 020</td>
<td>20.2</td>
<td>44.6</td>
</tr>
<tr>
<td>Total indirect use value</td>
<td>308 663</td>
<td>34.4</td>
<td>76.0</td>
</tr>
<tr>
<td>Total option value</td>
<td>408 462</td>
<td>45.5</td>
<td>100.6</td>
</tr>
<tr>
<td>Total</td>
<td>898 145</td>
<td>100.0</td>
<td>221.1</td>
</tr>
</tbody>
</table>

Note: Source: Prepared by the authors

Environmental Costs
This paper focuses on the environmental cost as estimated by the concept of fixed and variable costs to manage, investigate or manage in order to maneuver or potential harm caused by the economic-social subsystem amount. Represents the amount of financial, material and human resources that the state and / or state and non-state entities should plan your budget for the purpose to prevent, mitigate or restore a negative externality [4]. Further includes the total or partial loss of material goods produced in the ecosystem as a result of the realization of the social labor expended without economic use estimates are shown below (Table 2):

<table>
<thead>
<tr>
<th>Classification of environmental cost</th>
<th>Estimated total (MP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>On the concept of sustainability</td>
<td>13 190.9</td>
</tr>
<tr>
<td>Management</td>
<td>6 367.5</td>
</tr>
<tr>
<td>Research</td>
<td>384.3</td>
</tr>
<tr>
<td>Management</td>
<td>3 415.0</td>
</tr>
<tr>
<td>Mitigation Measures</td>
<td>3 024.1</td>
</tr>
<tr>
<td>For loss of economic benefit</td>
<td>9 605.8</td>
</tr>
<tr>
<td>TOTAL</td>
<td>22 796.7</td>
</tr>
</tbody>
</table>

Note: Source: Prepared by the authors
Table 3 Cash flow for environmental benefits and costs. Camagüey North Coastal Zone. UM: P

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Profits. Amb (Yt)</td>
<td>898145400</td>
<td>898145400</td>
<td>898145400</td>
<td>898145400</td>
<td>898145400</td>
<td>898145400</td>
<td>898145400</td>
</tr>
<tr>
<td>Cost amb. Partial (Et)</td>
<td>19772600</td>
<td>19772600</td>
<td>19772600</td>
<td>19772600</td>
<td>19772600</td>
<td>19772600</td>
<td>19772600</td>
</tr>
<tr>
<td>Et mitigation measures</td>
<td>3024100</td>
<td>3024100</td>
<td>3024100</td>
<td>3024100</td>
<td>3024100</td>
<td>3024100</td>
<td>3024100</td>
</tr>
<tr>
<td>Total Et</td>
<td>22796700</td>
<td>22796700</td>
<td>22796700</td>
<td>22796700</td>
<td>22796700</td>
<td>22796700</td>
<td>22796700</td>
</tr>
<tr>
<td>Yt - Et</td>
<td>875348700</td>
<td>875348700</td>
<td>875348700</td>
<td>875348700</td>
<td>875348700</td>
<td>875348700</td>
<td>875348700</td>
</tr>
<tr>
<td>(-) 35% tax</td>
<td>306372045</td>
<td>306372045</td>
<td>306372045</td>
<td>306372045</td>
<td>306372045</td>
<td>306372045</td>
<td>306372045</td>
</tr>
<tr>
<td>FCPPF</td>
<td>568976655</td>
<td>568976655</td>
<td>568976655</td>
<td>568976655</td>
<td>568976655</td>
<td>568976655</td>
<td>568976655</td>
</tr>
<tr>
<td>FCPCV</td>
<td>875348700</td>
<td>875348700</td>
<td>875348700</td>
<td>875348700</td>
<td>875348700</td>
<td>875348700</td>
<td>875348700</td>
</tr>
<tr>
<td>I = 15%</td>
<td>0.86956522</td>
<td>0.75614367</td>
<td>0.65751623</td>
<td>0.57175325</td>
<td>0.49717674</td>
<td>0.4323276</td>
<td>0.37593704</td>
</tr>
<tr>
<td>Yt updated</td>
<td>780996000</td>
<td>679126957</td>
<td>590545180</td>
<td>513517547</td>
<td>446536998</td>
<td>388293045</td>
<td>337646123</td>
</tr>
<tr>
<td>Et updated</td>
<td>19823217</td>
<td>17237580</td>
<td>14989200</td>
<td>13034087</td>
<td>11333989</td>
<td>9855643</td>
<td>8570124</td>
</tr>
<tr>
<td>FC updated</td>
<td>761172783</td>
<td>661889376</td>
<td>575555979</td>
<td>500483460</td>
<td>435203009</td>
<td>378437399</td>
<td>329075999</td>
</tr>
<tr>
<td>FC current and Trailing.</td>
<td>761172783</td>
<td>1423062159</td>
<td>1998618138</td>
<td>2499101598</td>
<td>2934304607</td>
<td>3312742006</td>
<td>3641818005</td>
</tr>
<tr>
<td>Current Value</td>
<td>3641818005</td>
<td>3641818005</td>
<td>3641818005</td>
<td>3641818005</td>
<td>3641818005</td>
<td>3641818005</td>
<td>3641818005</td>
</tr>
<tr>
<td>B / C ratio</td>
<td>39.4</td>
<td>39.4</td>
<td>39.4</td>
<td>39.4</td>
<td>39.4</td>
<td>39.4</td>
<td>39.4</td>
</tr>
</tbody>
</table>

Note: Source: Prepared by the authors

The criteria of the experts are critical.

The discount rate is 8%.

Depreciation is the straight line method works to 4% of tangible fixed assets.

For project evaluation are reported as income to environmental goods and services (value uses actual direct, indirect and option and potential).

Expenditures are considered in the environmental costs charged by the management, research, administration and implementation of mitigation measures.

It works with all currency.

The estimated date for the ecosystem and environmental economic benefits which represent 39 pesos for every peso of updated environmental cost.

3 Discussion

Direct use value

The direct use value represents the sum of the indicators (product of quantity times price) associated with each element of biodiversity, in correspondence to their use and management. Includes traded goods and consumptive use [5], rated to their corresponding local market prices [6].

To estimate the economic assets of the state sector, the commercial production of the entity is used [7] while for the non-state sector income indicator, which matches sale, due to the peculiarities of this activity is accepted.

Estimates for the state sector in the study area, corresponding to the average of six years (2004-2009) [8] sorted by economic sectors of the productive system. The land area of the project makes important contributions to the economy. The total amount of the economic benefit, the town has significantly Nuevitas (with strong industrial activity: production of eclectic energy, fertilizer, paint, cement, barbed wire, dairy, and tourism).

The area corresponding to the Emerald township project is second in the production of goods. Mainly affects the sugar industry (AZCUBA) and agricultural activities with emphasis on livestock.

Private fishing is of particular interest for environmental protection [9], as in the days of workshops and field expeditions, it was observed that this activity is significant [10]. The calculation of this economic activity is carried out in all the communities located in the coastal area to a height of 5 meters, with the participation of external agents and the collaboration of some fishermen and family. Search data is enriched, from information provided by employees for conservation located in the Keys (ENPFF), fishermen engaged in fishing activity and workers fly exerting activity on the platform of the territory corresponding to boats other territories. The estimated total calculated
based on the local price per pound [11], showing a more than 48 million pesos (48,566.0). Includes scales, lobster, shrimp, and sponges [12] as well as the annual household consumption, which means an avoided expense and therefore is accepted as income. These figures are not recorded in the statistical system of the province.

Finally the value of total direct use of the project area and yield estimates [13], by forms of ownership. The result kept fixed relationship, ecosystem [14] object of study, to emphasize the shared responsibility of people, producers and decision makers as a "whole". This result is similar to sustainable yield [15], because it is accepted that the yield achieved does not, necessarily, good environmental management to respect the regeneration of renewable natural resources for long periods.'s form of government ownership is predominant with more than 29 thousand pesos per hectare yield. In order of importance remains private, with more than 12 thousand ha.

Indirect use value
Four environmental features for the coastal area north of Camagüey are selected. They are grouped into three variables: capture of CO₂, water supply, and erosion control and soil formation.

CO₂ Capture
For the valuation of the environmental service [16] capture capability is used for tropical forest [17] and mangrove [18]. The results are achieved using the Geographic Information System (GIS).

The appraisal of the environmental function is one of the services provided by forests, the ecosystem under consideration, the economy and society in general. Here are the details:

Tropical forest
The Cross Keys Mégano have this vegetation because of their geomorphological attributes [19]. The remaining keys have a total of 62,823.1 ha of tropical forests, at greater length in Romano (72.2%). On land they have a presence of 40,477.1 ha for all throughout the coastal area of 62,823.1 ha.

Interestingly, the economic benefit provided. Cays in the amount totals more than 18 million pesos, on land are close to 33 million pesos and there is generally more than 69 million annual contribution.

Mangrove Forest
It has presence in all the Keys and mainland ecosystem. It covers an area of 25,873 has in the first (also in this case is Romano MSB) and 390.7 has in the second for a grand total of 48,263.7 ha. The economic benefit is provided about 5 million pesos with emphasis in the area of the Keys with a figure approaching 3 million pesos (more Romano contribution).

The indirect use value for the concept of capturing CO₂ in the study area is more than 74 million pesos annually, of which 93% are tropical forests.

Water supply
The northern side of the province has been rated an area of 5243 km² in 10 watersheds of different sizes and rainfall among them the most important are Caonao, Jiguéy, Máximo, Minas, Saramaguacáin, Cascorro and Las Cabreras. Average drain volume 1461 m³ / year, average annual rainfall of 1315 mm and in June it produces about 30% of runoff and 20% in the month of October, which summarizes that in the 50% is produced in these two months [20].

The largest groundwater reservoirs that surround this area, are located in the town of Sierra de Cubitas (karst rocks) and areas between the Máximo river and Lugareño in cracked rocks (serpentinites). Between the towns of Lombillo and Jaronú to the limit of the Sierra de Cubitas, there are also significant reserves of water are affected by its vicinity to marine intrusion, caused mainly due to the high exploitation of the aquifer prior to 1965, aggravated by the alteration the dynamic equilibrium of the aquifer and geologic conditions favorable [21].

The estimated environmental service is performed under the hypothetical approach to natural service interruption by the immediate loss of ecosystem functions [22], due to deterioration in environmental quality or change of use. If this is accepted, the salt wedge advance inland [23]. Therefore, the effect of the concentration will increase and therefore the migration of the ion motion due to the difference of the concentration gradient.

In this simulation, the settlements, as well as agricultural tenants of the study area will be affected by a decrease in crop yields or forced to dismiss traditional land uses. In this case, the company would be required
to replace the service with engineering investment. The economic valuation of the environmental function is performed, considering the storage and retention of water (water supply through watershed, reservoirs and aquifers) [24]. Here are some very important results for the bases of the valuation are discussed.

To simulate the impact from the above, the ecosystem service of water supply is valued from the expenditure avoided by hydraulic investment concept. Used in the calculation:

Distances substitute project: in this case, the distance of alternative reservoir (new source of supply given by the INRH Province) and the respective communities of settlers handles [25]. GIS was used.

Unit Pricing substitute project estimated average cost of investment hydraulic km proposed by the Company of Hydraulic Research Projects Camagüey (23,440 pesos / km per year.)

Erosion control and soil formation [26]
It continues with the previous scenario, referred to in this case, the environmental impact [27] for soil quality [28] which is associated to saline [29]. To improve the quality of a salinized soil, recurring process in practice is the use of fertilizer, preferably natural, such as compost [30], which provides both productive and ecological benefits.

In the valuation of environmental services costs avoided by fertilizing the soil allowed to maintain their natural conditions, where the cost of covering the land area occupied by the Keys and mainland is recognized. In economic valuation in respect of the maintenance of soil quality, it is argued that to improve the conditions of salinized soil, compost 45 ton required for 1 ha [31].

Restoration of 1 ha of salinized soil is estimated between 9000 and 27 000 pesos [32]. To give a monetary expression to protective, the minimum cost is accepted. In both cases, we proceed to assess GIS through the occupied area. The results of the environmental service proposed in this work are briefly discussed below:

Maintenance of soil quality
In the valuation of environmental services costs avoided by fertilizing the soil, where the cost of covering the land area occupied both the Keys and mainland recognized accepted.

Total Keys
The total area of the Keys amounts to 7722.0 ha. Have greater surface Romano (5190 ha) and Sabinal (1153 ha). The concept of avoided cost for maintaining soil quality (replacement project) amounts to more than 131 million pesos.

Mainland
It has an area of 15610.9 ha in the four coastal municipalities. In this case the area is selected to evaluate the ecosystem service in question to the area used by compact weed [33] with and without spine. The environmental service, amounts to more than 396.7 thousand pesos [34].

Soil Protection
The existence of this vegetation represents another cost avoided, this time, for soil protection. Estimating the environmental service provided is the total cost would mean for society, rehabilitate damage hypothetical approach to the outage of the ecosystem in question (fertilization and restoration), which exceeds the 210 billion pesos. The major contribution in land area is covered with weeds [35].

Environmental economic expression of selected coastal area north of the province services means more than 308 million pesos. The soil provides the greatest service is the one with the greatest relevance in the percentage structure (68%) with an environmental performance of 76 thousands of pesos per ha.

Option Value
There are two variants: use (sell or consume) and retain with sustainable use. The results are organized by the variables vegetation, wildlife and water:

Vegetation
Includes forest and mangrove, located in the mainland and cays ecosystem under study. To estimate the opportunity cost used the area by wooded formation, the estimated biomass and the producer price for timber, firewood and charcoal bag [36]. Below is detailed vegetation type:

Forest: Forest Conocarpus erectus, Evergreen Forest microphyll, mesophyll semideciduous forest, evergreen gallery forest, evergreen swamp forest and semideciduous microphyll forest.
It has a total area of 173,550.4 ha of these, 50% correspond respectively to the mainland and cays. The following alternatives are identified: Opportunity cost of wood [37] and the opportunity cost of firewood [38].

To estimate the number of cubic meters of wood, the total is calculated wooden foot (126.1 million cubic meters) and the acres of forests in the country (2434.98 thousand ha) [39]. A good alternative is the opportunity cost of firewood for fuel. The biomass was calculated based on 65% of the cubic meters of timber [40]. Biomass was calculated rate [41] to 6.01 pesos per m³. These data are extrapolated to the study area using GIS to obtain the corresponding biomass and pricing runs.

The potential forest income, expressed through the opportunity cost are approaches 23 million pesos, of these, over 64% are concentrated on land, the rest on the keys. The greatest potential corresponds to Romano, economic benefit produced in an area of 161.34 km². The wood exceeds 22 million pesos (97%) while the difference is identified by way of fuelwood. It is necessary to clarify that this forest ecosystem has greater potential for use, among other beekeeping is [42] and medicinal plants for drug development [43].

Mangle: Mixed Evergreen Forest Mangrove of Rhyzophora Mangrove A.germinans, Mangrove Forest Evergreen Rhyzophora Mangrove A.germinans Lr, Conc. Mangrove of Rhyzophora Mangrove.

Data are available on the production of mangrove wood, so its could specify the estimate for this forest formation as a potential producer. However, in this work, the possibility that the mangrove is exploited for timber harvesting is not discarded, but neither stimulates it should be handled on a sustainable basis [44].

To keep the dimension presented above, resource exploitation must consider the average annual increase (AAI: 4.2 m³/ha/year), which means that not should be removed a quantity exceeding the annual average natural forest recovery. The authors share and highlight respect for this principle, so it corresponds to the estimated annual production potential.

A good alternative would be the opportunity cost the production of coal [45]. With an availability of 20 m³ string charcoal produced 30 sacks [46]. These data are extrapolated to the study area using GIS to obtain the corresponding biomass and pricing runs.

It works with the following: Wooden Opportunity cost and opportunity cost of bags of charcoal The economic benefits for the mangrove forest formation and exhibits a potentiality of total revenues approaching 27 million and more one in convertible currency (over 28 million in both currencies). This forest type predominates in the area of the keys so it has the largest share of revenues to 54% of the amount.

In general, the opportunity cost for vegetation exceeds 51 million in both currencies. The estimated equivalent amount of revenue that the company resignation conservation concept with sustainable use of forests in the area under study.

Wildlife

Contemplate the number of individuals in wildlife conservation, inventory held for Máximo River owner. Also included, equal treatment with other resources, such as eggs (flamingo, crocodile, etc.) among others. It also contains the spawning stock of cattle, horses, sheep, goats, pigs, poultry and buffalo [47].

Biomass player cattle rate by type with the corresponding producer price [48]. When exist, for other species, the inventory is used under the same scheme [49].

Species conservation owner by Enterprise for the Protection of Flora and Fauna in Camagüey (Empresa Nacional de Flora y Fauna en Camagüey)

According to the list of species, there are numerous individuals, many of them exotic and charismatic. At the time of this survey, the entity mentioned above, did not have all the inventory so it is not possible to assess the universe. The shelter "Río Máximo", site of international interest, wildlife has important natural values.

Are identified 20,000 individuals of seabirds [50]. Several bird species would be limited by the type of food and adaptation in captivity. For example the pelican eating fish which would cause feeding in captivity outside very expensive. In the case of the dolphin is a species that has demand in the international market for non-hotel activities. These criteria, among others, provide a benchmark for estimating the minimum manning the opportunity cost.

The estimate is considered following: potential opportunity cost of flamingos, the opportunity cost of
water birds, crocodile opportunity cost, opportunity cost of dolphins, deer opportunity cost and opportunity cost of jutía. The estimated total income exceeds 76 million pesos, of these, the most representative is the pink flamingo (92%).

Conservation species of the production system in all forms of property.

In areas used for livestock (cattle, horses, sheep, goats, pigs and poultry) exist a part of the total mass intended for reproduction. The alternatives considered are: opportunity cost of cattle, equine opportunity cost, opportunity cost of sheep, goat opportunity cost, opportunity cost of pigs, poultry opportunity cost and opportunity cost of buffalo.

The potential income for conservation species in the productive system in this project area. It is observed that potential income exceeds 66 million pesos. The municipalities with the highest share in the amount are: Esmeralda (51.4%) and Minas (30.8%). These results affect two situations: 1. The project area defined by the height of 5 meters (selected for this project) and 2. These are areas with high internal specialization in the livestock sector.

Water

For the socio-economic and environmental importance of water, elements necessary for its economic assessment are highlighted. On the north side of the province has been rated an area of 5243 km² with 10 river basins of different sizes and rainfall. Among these, the most important are Caonao, Jigüey, Máximo, Minas, Saramaguacán, Cascorro and Las Cabreras. Average drain volume 1461 m³/year, average rainfall of 1315 mm/year and in June it produces about 30% of runoff and 20% in October so in the year, 50% is produced in these two months [51]. In the Máximo river basin is a diverter work and in Saramaguacán is a diverter to allow a better distribution and utilization of water resources. On the north side of the province, dams supplying the population are Máximo, Amistad Cubano Bulgarian, Mañana de la Santa Ana, La Atalaya and Santa Teresa I. To perform the economic analysis is required to identify a water balance variables for the supply availability and customer demand.

The first is subject to the amount of annual rainfall in the catchment, the average river flow and health spending by Hydrological Camagüey Company (Empresa Hidrológica de Camagüey) must ensure, that aspect is very important for maintaining ecosystem health (protect the quality environment for the development of biodiversity). In addition, the average annual evaporation and the degree of water runoff is integrated. The demand has contracted into account the main economic activities.

The opportunity cost of water at the site of study considers the river basin water balance [52] which allows knowing the approximate amount of water. Availability of water has to ensure the ecological costs to provide goods and services which, it is essential to respect this request. Opportunity cost for the required identifying alternative uses of water, for which the classification used by the World Bank proposal [53]. Rice farming is one of the biggest productions liquid demands in agriculture. This production line cycle consumes 3.072 million cubic meters of water in the holding [54].

As best alternative is selected agricultural use [55] corresponding to America. Subsequently, for the opportunity cost of water, the balance is multiplied by 70% of the water availability in the study area [56], the amount of water use for the best variant indicated at the beginning of paragraph (74%) and the price of liquid [57]. The estimated amounts to 214 615.2 thousands of pesos is the potential income from this concept. Interestingly enough in these results that water constitutes the most important concept for potential income in the study area and therefore the highest environmental performance.

From the categories before stated, a first approximation of environmental goods and services and therefore the amount is composed of the estimated value of direct and indirect use and the option contained in the respective items of own compendium is obtained results. Here are the most outstanding in each category are discussed aspects:

Direct use value: The value of direct use has the lowest structural involvement with more than 44 thousand pesos per km² environmental performance. The state sector accounts for 66.4% of economic benefit with increased expression in Nuevitas, followed by Esmeralda. The industry sector is the predominant (86.7%) followed by agriculture (9.3%). Tourism contributes moderately, but has significant potential
exploitation for the country and particularly in the province.

Indirect use value: The economic benefit provided by the concept of indirect use value in the coastal area north of Camagüey, means savings for Cuban society. This results in the highest value corresponds to the natural resource land with 68% in the structure, something that is very revealing for sustainable land management.

Option Value: The estimated value option, through the opportunity cost shows that the water poses the greatest potential income and environmental performance so that, from an environmental economic perspective, the result becomes the aspect of interest for the integrated management of the coastal zone.

Biological resources [58] in the north coastal area provide economic benefits. However, these may decrease over time if the producers of the coastal municipalities of reference do not increase their environmental economic culture. It is necessary to direct the mission of their economic organizations towards cleaner production [59], to the extent that the development budget permits it (economic recovery) on the platform of an appropriate environmental management system [60].

Environmental costs
This paper focuses on the environmental cost as estimated by the concept of fixed and variable costs to manage investigate or manage in order to maneuver damage caused by the economic-social subsystem amount. Represents the amount of financial, material and human resources that the state and / or state and non-state entities should plan your budget for the purpose to prevent, mitigate or restore a negative externality [61]. It also includes the total or partial loss of goods results in the realization of abstract labor [62] as well as no economic use of or damaged products and environmental functions.

In the literature reviewed several classifications or types of environmental costs are handled [63]. This interesting in this work is respected rankings but, in this work requires a new approach which is based and follows.

Where there is wealth creation in the local production system or the economy in general and it is not consumed or marketed according to the destination for which it is planned, then you can produce a total or partial loss for the producer but also for the environment and society. Even though the product may have an economic use (recycling), the fact is that there is also the expense of social work, a specific consumption of energy and natural resource. In this case, there is an income or economic social and environmental benefits lost and should be considered as an environmental cost.

According to the authors of this paper, the classification of environmental costs must always be, among others, depending on the objectives of the research project, the status and availability of the information of the statistical system and the size and scope of the results (outputs). Therefore, to promote the objectives and structure planning, programs plans maneuvers and operational plans in protected areas and integrated management of the coastal zone and the general policy of Cuba referred to the management and control of the environment, in this work the following categories are used:

On the concept of sustainability: management [64] (investment prevention, mitigation or damage restoration, monitoring [65], environmental education [66], monitoring [67] and environmental management [68], research [69] and administration [70].

For loss of economic benefit (income or economic, social and environmental benefits not taken advantage of the production of material goods).

By funding concept of mitigation measures, preventive or corrective by polluters.

Economic activity generates negative impacts on the environment through pollution. Entities must have management systems and waste management, management systems or at least basic preventive, corrective or mitigating actions. The implementation of these means a cost to the producer which must be properly planned in the budget of any form of ownership.

To fulfill its responsibilities and missions, Camagüey province has an institutional and organizational structure that allows the assistant to management, research capacity of the ecosystem and other interests in the northern coastal area.
The provincial delegation of the Ministry of Science, Technology and Environment (CITMA, Spanish terms) has a group of directors, management and environmental inspection respectively. In this instance center specializing in research, which identifies its mission project execution with outputs for the management and sustainable use of biodiversity, environmental education, pollution and damage restoration, among other subordinates.

Articulated manner and cooperated, there are territorial state agencies whose missions contain the implementation of research and / or directed to environmental management (Provincial Forestry Enterprise, Camagüey Forestry Station, Enterprise for Protection of Flora And Fauna in Camagüey, Territorial Enterprise GEOCUBA actions Institute for Soil, Pasture and Forage Institute and Institute for Water Resources.

Moreover, entities, state and non-state, are required to use technology and techniques harmonious with the environment, to restore damages and mitigate negative impacts through investments (in line with economic development). All this is accompanied by the planning and execution of a portion of its budget for costs associated with environmental education programs (promote better health and environmental and workplace culture to their workers) and acquisition of means of protection (prevent diseases and industrial accidents).

Without exception, all institutions and regional economic organizations intertwined with the coastal area north of Camagüey running direct and indirect costs for project implementation and / or deployment of actions and tasks for the environment. Consistent with the definition and classification of previously defended environmental costs, the loss for the financial benefit to the livestock in the study area in respect of deaths is added.

The estimated environmental cost in terms of sustainability in the north coastal area corresponds to the total sum of the direct and indirect costs captured [71] as defined above and classification. The concept of sustainability cost is slightly more significant. Its estimated totals more than 10 million pesos a year. In the category of current management costs are included for maintenance of oxidation ponds served by the municipal budget (4) and expenses incurred by the Enterprise for Protection of Flora And Fauna in Camagüey of Camagüey and by CITMA territorial offices in the four coastal municipalities.

Environmental cost for research, expression of budget spent on research projects of national, branch and territorial (5) and service concept (1) is identified. Then shows the environmental management costs which includes direct and indirect costs of the four regional offices CITMA and Enterprise for Protection of Flora And Fauna in Camagüey. Finally, the environmental cost for loss of economic benefit with a total of more than 9 million throughout the study area is added.

Of the total calculation, the Enterprise for Protection of Flora And Fauna in Camagüey runs over four million pesos in spending for conservation in all protected areas located in the study area. Management programs for the conservation and protection and surveillance, constitute 56% of the total executed.

The implementation of mitigation measures, resulting from environmental pressure created by economic activity, brings a cost to polluters. His estimate is an important indicator which should be considered in the cash flow realized in the last stage of the methodological framework of the research.

The total mitigation measures (37) to reduce the environmental problems identified in the coastal area valued at over three million estimated, of these 54.9% were Nuevitas. This area puts pressure on her bay, although improved, can compromise the quality of tourism mega project planned on the cays. Therefore, a contribution would mean that polluters should bear in their respective budgets in compliance with environmental and social responsibility.

The total estimated costs amount to total 22 796.7 of which 42% is for loss of profit, by 44.6% and 13.3% sustainability by mitigation measures to polluters in coastal area north of Camagüey.

In assessing the cost benefit traditional assessment techniques are identified as projects where the environmental benefits income and expenses as the environmental costs are used. The results allow highlighting the environmental economic importance of this coastal area.
No records are identified in this work. The results provide a first approximation to the topic covered. The results are interesting also for economic and environmental education of residents, managers and decision makers in order to realize sustainable development projects. Economic profit lost in the productive base is undervalued by not including all the production lines of the local system.

The production of environmental goods and services is a result of considerable interest, not only to express the economic importance of biodiversity in the ecosystem, and therefore for management but is a necessity for comprehensive evaluation of the use of ecosystem.

Goods in storage have a key role because it reaches the highest estimate. Constitute environmental goods that have multiple future potential. Of these, many are located in protected areas. The water and soil, and limited resources in handling demanding, provide interesting economic values, which claimed the interest of decision makers.

In particular, the pollution in the Bay of Nuevitas, where multiple important human settlements develop industrial production, is a major threat to the coastal zone. In the medium term it could change the landscape of the ecosystem where tourism development is planned on the cays. In this sense, accompanied with measures identified environmental investments to mitigate the negative impact which means a cost.

The paper evidence moreover, the importance of the mechanism of collection and payment for environmental services for the use of an ecosystem, in this case the north cays of Camagüey province.

4 Conclusions
The environmental economic benefit exceeds 898 million pesos. Greater percentage has the goods in storage with 45.5%.

The environmental cost exceeds 22 million with higher incidence in funding for the sustainability of the north coastal area of Camagüey to about 5 contour followed by loss of economic benefit of the productive system.

The cost benefit ratio exhibits an interesting result with 39 pesos for each of the environmental cost and a current value of 3 641 million pesos.

References


Notes and comments
[1] According Windevoxhel is assigned to products of nature that are consumed directly, without passing through a market. The value of consumptive use can be assigned a price through mechanisms such as estimating the cost at market if the product is sold in the market rather than being consumed.

[2] In the case of Cuba, the essence of economics is scheduled with market elements, as a feature of socialism. Commodity prices are subsidized, bumped and deregulated in terms of social interest, particularly for the economic mechanism.

[3] means the expression of the value of direct, indirect and option per km2 use of the ecosystem in general (4 062.0 km2 of land area firm, landmass and sea), because it functions as a whole from the interaction of the components of biodiversity.

[4] Dangerous effects of the economic process generated by not taking it all the costs of production. Social costs are the sum of the costs of these externalities and natural resources that have been assigned a price.

[5] According Windevoxhel is assigned to products of nature that are consumed directly, without passing through a market. The value of consumptive use can be assigned a price through mechanisms such as estimating the cost at market if the product is sold in the market rather than being consumed.

[6] In the case of Cuba, the essence of economics is scheduled with market elements, as a feature of socialism. Commodity prices are subsidized, bumped and deregulated in terms of social interest, particularly for the economic mechanism.

[7] is a statistical indicator. Mean expression value priced companies, property, labor and certain services and / or produced in the period, which are reported and are for sale.

[8] On the date of completion of the work had not yet the end of 2010. The authors believe that the calculation obtained is representative of the current situation, in that it covers the average six years.

[9] Any personal or communal, public or private action, tending to defend, improve or enhance the quality of natural resources, the terms of any direct or indirect beneficial uses for current and prospective community justice.

[10] Obviously, this requires special attention in the integrated management, as well as in the environmental education program in order to promote sustainable harvest, driving a harmonious art of fishing with the ecosystem. To that end runs rigorously sampled participatory and anonymously, to approximate the reality of the economic benefit provided by biodiversity in question for this item.

[11] Following the approach of fishermen, the volume of mass in pounds (70% of the catch) is calculated.

[12] The figure contains the state fisheries for other provinces, which is combined with the form of private property by the above reasons. Could not estimate the extraction of coral, but the inhabitants of the tourist area of St. Lucia, which is made manifest to trade with artisans from various parts of the country. Nor calculating capture carey, which is sold in private restaurants and for local consumption achieved.

set of living and nonliving, complex and closely related components, which act as a whole and which are the specific natural and disturbed environments.

At the heart of environmental conservation that seeks, on the basis of a rational use of nature, continued productivity of their renewable natural resources and continuous savings and utilization (recycling) of non-renewable.

With the adoption of the Kyoto Protocol (1997), exchangeable forest resources as carbon sinks become the benefit of industrialized countries. There are various estimates of CO₂ capture in the world for tropical forests. This paper uses 81.25 ton / ha obtained by Benitez in "Estimation of total biomass equiperitiota Forti casuarina plantations in the province of Camagüey." University of Alicante. 2006.

The economic benefit of capturing CO₂ is used (103.5 t / ha) for this type of forest in the Sabana Camagüey ecosystem. Gomez (op.cit.), because it belongs to the same study area of this author.

More information on "natural characterization of the northern coastal area, Camagüey Province, Cuba" at baseline.

IRHH Report issued by the province for this research project.

Dams supplying the population on the north side of the province are Maximum, Amista Cubano Bulgarian, Morning Santa Ana, La Atalaya and Santa Teresa I. In the Maximum basin and there is a diverter work in one hidroregulador Saramaguacuá and a diverter to allow a better distribution and utilization of water resources.

Immediate ecosystem functions: Include all relationships between the system and the largest wooded basin, where the positive or negative impacts are significant.

This shift is also depending on other combined factors such as relief, human economic activity and the delivery of fresh water (land-sea), among others, but in this analysis it is assumed that they are constant.

Salinity is an important element for the quality of water intended for human consumption because a variation in chemical composition causes different diseases such as cardiovascular, kidney and blood pressure (HBP), among others. International Standard 93-02, 1985, states that drinking water must meet the established physical, chemical and microbiological requirements. For more information on Zequeira, 2007, op.cit.

The report itself contains the distances measured in a straight line to the area of the most convenient source, usually all wells with these communities today are out of standard bacteriology (fetal and total Colis) that chlorination is resolved. The increase of areas with low fertility is the result of several factors, among them are the erosive processes that have removed the topsoil, and the misuse of technologies of crops, causing its degradation chemical, physical and biological.

Desertification, meanwhile, is the result of development and the combination of the afored mentioned degradative processes. Fundamentally, erosion, salinity and vegetation removal, factors inducing changes towards a decrease of rainfall regions and soil biological potential. There are other degradative actions not addressed as limiting, such as open-pit mining and borrow areas, although operating in smaller area, they are not negligible factor for the country, for its devastating effect.

Any net positive or negative change, causing on the environment as an indirect consequence of human actions likely to produce changes that affect the health, productive capacity of natural resources and essential ecological processes.

The soil has unique characteristics such as fertility, i.e., the power to meet the needs of the plants with nutrients and water, ensuring their root systems and provides a number of air and heat for normal development thus ensures greatly agricultural production, this constitutes a fundamental reason for their protection.

Soil quality is also depending on the type of it: brown, carbonate, salt or other. To assess a soil productivity is essential to know the limiting factors (are those which cause reduction in the possibilities of agricultural use) and their interactions.

Fertilizer applied to soil improvement from natural components. There are other types such as crop residues and dung, which are processed fertilizers as well as organic matter fertilizer is not processed.

Data from the Institute of Soil Camagüey. 2004.
They are those components of biodiversity that support a direct, indirect or potential use.

The application continues of an integrated preventive environmental processes and products, in order to reduce risks to humans and the environment strategy.

Those aspects of the general systems of an enterprise, including organizations, practices and resources, conduct and provide support for the role of environmental management.

Dangerous effects of the economic process generated by not taking it all the costs of production. Social costs are the sum of the costs of these externalities and natural resources that have been assigned a price.

Barzev (2008) for example, considers that to ensure the supply of environmental goods and services in the future, the major environmental costs of an ecosystem can be grouped as follows:

Costs of conservation: From ecosystem functions in the relevant areas.

Cost Recovery: From degradable critical areas (although it is preferable that the recovery and restoration costs are financed by other projects, not about maintaining a flow of ecosystem benefits, but to recover, given its excessive degradation).

Handling costs: Within the institution in charge of the management of natural resources.

Action planned to evolve a system in such a way that you can derive the most from this in the short term and to preserve it for use argo term. A shape or type of operation may be desirable for certain uses, but inconvenient to others. For proper operation, it is necessary to evaluate the advantages and disadvantages of the alternatives but without forgetting conservation. Contains the amount of investment and operation for prevention, mitigation or restoration.

Process of repetitive observation, with related one or more elements of the environment, according to a well defined temporal plan objectives.

Educational process whereby the learner acquires, both natural and social, of the interdependence comprehensive and detailed collection of all components of the environment and the functioning of ecosystems, the need for its preservation and its compatibility with the development.

Technical System organized periodic data for existing pollution in a given area.

A set of procedures through which an entity may intervene to modify, influence or guide the uses of the environment and the impacts of human activities on it.

Joint R & D territorial, and national branches to contribute to sustainable development.

Force contracted work to control financial resources and material power to regulate, control and optimize their use. Includes expenses for logistics and materials for completing actions and tasks of environmental management and overheads caused by the environmental inspection.

Estimates are undervalued, with emphasis on management and administration. Could not get the information universe in all institutions and facilities involved.
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