Weber Economics & Finance
ISSN:2449-1662
http://www.weberpub.org/wef.htm

International Open Acces Journal
Wesley & Eber Publishing

Research Article **Volume 2-1(2016)**

Economic Valuation of Environmental Services of the Ecological Reserve Mache Chindul, Ecuador Climate Regulation.

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Accepted 24th January, 2016

Abstract

Environmental services are all those benefits that a population obtains from ecosystems. Ecological book, as part of terrestrial ecosystems, offer important environmental services, including the protection of draining basins, biodiversity conservation, and carbon retention in the soil. Other functions are to collect water for the aquiferous systems, which affects its own quality, by filtering, absorbing and retaining some polluting agents, which are prevented from going to the reservoirs. They also contribute to regulating temperature and moisture, which improves air quality, all of which are factors related to quality of life. In this research the importance of the identification and economic valuation of the environmental services of an ecological reserve is highlighted as an instrument for conservation and sustainable use of ecosystems. Throughout this study, the impact of the Mache-Chindul ecological reserve is analyzed in relation to climate regulation, based on the current scenario of climate change. To conduct an economical valuation is only possible if there is an adequate understanding of the role that natural resources and biological biodiversity play from a socio-economical perspective.

Keywords: Environmental services, climate regulation, ecological reserve, Ecuador

1.0 Introduction

This work highlights the importance that has the identification and economic valuation of environmental services in an ecological reserve as a tool for the conservation and sustainable use of ecosystems.

First is a review of the methods of economic valuation of environmental services that are used in economics. Once analyzed this methodological framework is valued the role of an ecological reserve in environmental services related to the regulation of the climate are the production of oxygen and sequestration of carbon, the regulation of the hydrological cycle, the prevention of erosion and protection of soil and the preservation of biodiversity.

In this work, is valued than the Mache-Chindul reserve role, plays in the regulation of climate, taking into account the stage of ongoing climate change. Therefore is presented a summary of the most relevant needs to identify and meet the references to be used and the parameters that must be applied to an analysis of the environmental services of the ecological reserves, in which only through the understanding of the system in its production, regulation and information functions, figures associated with all values can be obtained.

Economic valuation of environmental services

The dilemma between economic growth and environmental protection has not yet been resolved; However, both concepts have begun to integrate. This integration is closely associated with the concept of sustainable development. Sustainable development has as a premise the balance between economic activity, biophysical systems and the quality of life of the society. Maintaining that balance implies knowing and to value the costs and negative effects, as well as the benefits, which are produced by the selection of economic activities and consumption patterns related to biological diversity.

The importance of the economic valuation of the environmental goods and services, including the relating to biological resources and biodiversity, is that they have to recognize a fundamental aspect is the need for indicators to measure the sustainability and economic progress as part of the statistics of the socio-economic development, trade and finance in the regions and countries and to also register the economic value of biological resources and its biodiversity, and the value of its use, depletion or degradation, incorporating them into the costs and benefits, in terms of the future capacity of the economy and society.

Natural capital is formed by air, soil and subsoil, water, oceans and, in general, all biological resources and all interrelations. Part of the natural capital make it clean air, available and uncontaminated water, fertile soils, species and ecosystems healthy, enjoyable landscapes, benign microclimates and everything that helps the well-being and quality of life, including all the religious, cultural, ethical and aesthetic values that represent the existence of natural resources.

Its productive conservation is linked to the well-being of societies for their actual and potential contribution to the wealth of Nations. Mankind benefits from this natural capital

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through the provision of goods such as food, medicine and raw materials; of environmental services, such as the conservation and storage of water, air, water and soil quality; and services of recreation for present and future generations.

However, despite all these benefits, the global figures show another reality: the increasing degradation and depletion of biological resources and biodiversity. This has led to the extinction of a large set of species of plants and animals, and that others are threatened with extinction.

In addition, economic activity does not recognize explicitly the use value of biological resources and of the services provided, often causing the depletion, degradation, and the cancellation of the present and future uses of such resources. The absence of this assessment has allowed for a long time only will make decisions based on strict market signals (when there are formal markets or that they provide elements for follow-up) or in the primary development needs. The distortion of prices on subsidized markets has created incentives for excessive use of resources and led to its increasing scarcity.

Despite its strategic to advance towards sustainable development, environmental services of ecosystems and the conservation of biodiversity are generally neglected by policies that favour the opening of land for farming, urban sprawl, excessive industrial concentration and the overexploitation of biological resources. There are other natural common resources, such as water or clean air, which, because they have no associated economic values, are exploited by some to the detriment of others in similar situation. Added to these problems are the pressures of legal and illegal international trade of species at risk and of chemical substances and hazardous waste.

Therefore, economic valuation has been as an instrument that allows to put in evidence the different uses of biological resources and biodiversity. If shown that biodiversity conservation can have one positive economic value greater than the activities that threaten it, information that can be generated on their ecological benefits, cultural, aesthetic and economic support actions to protect and preserve it productively, becoming an important tool to influence Government, collective, individual and social decision-making.

Having adequate assessments creates political instruments for encouraging or discouraging activities according to their environmental costs to society (often called environmental externalities), and can assign those costs to which caused the deterioration (internalization) or promoting incentives for the conservation and sustainable use of natural resources, making it more efficient and a more equitable distribution of the costs and benefits associated.

A fundamental aspect in this task of economic valuation is the social capacity to measure the benefits provided by nature and the present and future costs of degradation or depletion, as well as acquiring a social conscience and a responsible attitude towards the conservation of natural resources. Inadequately low, or null, value promotes the abusive use of the resource and produces social inequities, to the time that is computed as the minimum contribution to the economy. The conservation of biological resources and biodiversity, for present and future generations, is in the Centre of the objective of sustainable development.

Cost effectively preserve natural biological resources means the integrity of ecosystems and all of its components: species of plants, animals and micro-organisms, and their interrelationships. This integrity has impact on the well-being of the society in terms of goods and services that generates. The exercise of the valuation of natural resources and biodiversity is not intended to cover all resource and any possible use. You must however, to cover the most important ecosystems and critical species possessing these, for the conservation of the resource and its sustainable uses.

2.0. Methods for the Valuation of Environmental Services

The value, in the classical economics, is the price that individuals are willing to pay for a good or service. This willingness to pay (DAP), obtained from the supply and demand (Pearce, 1993;) Lipton and Wellman, 1995).

The DAP, is the preference of an individual to a good in particular, therefore, is the man who gives value to things. The majority of material goods has a certain market, set by supply and demand. Also, some environmental goods, have their own market (products of forests, water resources, etc.). On the other hand, environmental services (purification of air, carbon capture, assimilation of waste, etc.), not the case, because there is a market or not have price.

In this sense, for the proper management of natural resources, their assessment, is important since it allows, if it is properly used, provide quantitative criteria to establish the priority of the activities of the society, being applicable essentially to all existing systems, regardless of the development models adopted by the various countries. To facilitate the study and determination of the value of goods and environmental services, with or without market value, establishes a classification in use values and values of non-use (Pearce, 1993;) Freeman, 1993; Pearce and Turner, 1995; Dixon and Pagiola, 1998 and Dosi, 2001).

The values of use (also known as current use values), are those that are derived from the actual use of natural and environmental resources and the benefits derived from them (Hunt, enjoy the landscape, wood, harvesting of fruits, juices, fishing, capturing carbon, etc.). They are composed of the values of direct use, indirect use, and value future value (or option). The values of non-use are those values that have resources regardless of use or usefulness and distinction between existence value and value of legacy.

These values are defined as follows:

- Direct use values: are those that represent the value of production or consumption of the components or functions of ecosystems. Value in use is directly represented by the products generated by the ecosystems, which are placed on the market.

- Indirect use values: correspond to the value of environmental features that support or they protect the

economic activity. This economic value reflects its contribution to the activity of production and consumption.

-Value option: value is not anything other than the willingness to pay for a future use of goods or environmental resource.

-Values of non-use: are the values that have resources regardless of use or usefulness. Distinction between existence value and legacy value.

-Existence value : represents the extent that society is willing to pay to preserve resources for themselves, i.e., so that they continue to exist.

-Legacy values : represent the available pay so that future generations can make use or not of these resources.

Finally, Pearce (1993), introduced at the beginning of the Decade of the 90s, the concept of Total economic value (VET), which is composed of the sum of the "use values" and "non-use values". A classification for the economic valuation of biological resources and their diversity in accordance with the benefit to society is generally accepted.

A biological resource often has several economic values simultaneously. The case of the forest system is representative. It can be measured by its timber production (direct use value); by their protection of aquifers and soil, for his contribution to the quality of air, by the services of self-sustainability for the biotic wealth that contains (indirect use values). Species that are located in the system may have future potential uses in food, pharmaceutical products, or new raw materials (option value), and conservation can be a good in itself for individuals (existence value) or to be able to bequeath to their descendants (heritage value).

When there is a market, it is very frequent for values of non-use and environmental services, using a simulated or built market. A survey whereby a situation similar to a market is built is designed. The techniques used are the contingent valuation and the degree of contingency.

For example, in the contingent valuation asked respondents how much they are willing to pay to preserve a species or a natural area, Alternatively, how much they are willing to receive by the destruction or disappearance of a species or a natural area. This payment can be in the form of voluntary contributions, as fiscal charge or a higher price for the products and associated services. The interviewee will provide the background information on the quantity, quality and changes that may occur on the good, choose the payment instrument and, finally, asked to make a selection from among several options to give your answer. From the responses, is derived the availability of individuals to pay and, through this, it is estimated the net present value of the resource.

The problem of economic valuation is not easy. Besides adequate physical and biological knowledge of the resource or service involved, it is necessary to have specialists and training in this field, which has led to consider target countries themselves and through international organizations, the development and promotion of the application of methods for the valuation of environmental goods and services.

3.0 Assessment of the Environmental Service of Climate Regulation

This section describes the environmental services that ecosystems provide and which have to be used in the territorial and socio-economic management approaches. For the analysis described the services related to the regulation of climate, which are reflected in a number of aspects that have an undoubted economic translation, it must be taken into account for the protection of these services.

It is particularly important to identify these services do not have a clear projection of market relations, and therefore lack compensation and incentives. Throughout this section refers to the contributions and the reserve Mache-Chindul in the services provided in relation to the regulation of the climate. This function is indirectly derived from the functions fulfilled the forest by his mere existence regarding the ability of resilience, diversity and balance of the global ecosystem and the protection of other elements such as:

1. Production of oxygen and sequestration of carbon
2. Regulation of the hydrological cycle
3. Erosion prevention and soil protection
4. Preservation of biodiversity

The reserve Mache-Chindul is located to the southwest of Esmeraldas and Manabí northward on the Western mountain range with an area of 70,000 hectares. The reserve is one of the best representations of tropical very wet forest of the Ecuadorian coast carazterizado for its high biodiversity and surprising levels of endenismo.

Mache-Chindul is the source that feeds Atacames, Muisne, Teaone and Dogola rivers in Cheve in Manabí and Esmeraldas Coaque, Cojimies. It has significant water resources, flora and fauna. They have inventoried 1434 species distributed in 624 genera and 149 families. In terms of fauna have been 136 species of mammals, 491 birds 54 amphibian and 38 reptiles.

The territory of this reserve has traditionally been home to ethnic Chachi as San Salvador and black as the rooster, Tigrillo, Agua Clara and Tigua.

Below we describe each of these services and providing the ecosystem and that should induce socio-economic and territorial management approaches:

Production of Oxygen and Carbon Sequestration

Biosphere plays an important role in the regulation of the climate at the local level. An environmental service of great relevance in the global order which gives the vegetation of the forest consists of producing oxygen through the process of photosynthesis, by means of which carbon dioxide (CO2) absorbing green plants is fixed as organic biomass. So, the excessive concentration of carbon dioxide is reduced and therefore decreases the greenhouse whose economic

consequences are devastating. The forest fixes carbon in their biomass and soil, evacuating large percentages of carbon which is inside and on the surface of the soil.

The increase of atmospheric temperature due to anthropogenic causes, its adverse consequences on the essential ecological processes and therefore the negative conditions on the circumstances that enable our way of life, gives place to the framework Convention of the United Nations in the fight against climate change, and its development, the famous Kyoto Protocol (1997) basically oriented to the reduction and control of emissions of the so-called of Greenhouse Gases (GHG).

Abiotic natural resources (water, air, soil) and biodiversity (microbial, plant and animal) are integrated functional elements biogeochemical cycles, and therefore have a double role in the greenhouse effect and climate change. On the one hand they contribute to its increase if they increase their emissions of greenhouse gases and other function as sinks to be able to store carbon in their structures.

Regarding carbon sinks, as it considered the Kyoto Protocol, they are all processes or mechanisms which make disappear a greenhouse gas from the atmosphere. In the field of international agreements are considered sinks activities subsequent to 1990, among which is the management of forests, afforestation and reforestation and management of crops. In crop management, the main uptake in these systems is the accumulation of organic carbon in the soil.

Not yet, in addition to the limit number set by the Kyoto Protocol for sinks, and which is estimated at 2%, the truth is that all the stored carbon not can post but only the annual increase of carbon absorbed, provided it meets certain requirements (activities directly induced by man, verifiable and quantifiable, among others, may be considered certain agricultural land management actions).

Fixation of carbon by vegetation

The carbon storage capacity is, among other features, depending on the species and plant and ecosystem formation. Consequently, the reforestation of farmland may serve to increase the stock of carbon in the soil, but also improving the conditions of existing forests, forests can evolve into more mature state. Similarly if the forest surface reforesting marginal agricultural area be increased and reforesting grassland and scrub CO_2 fixation in proportion would increase. Certain farming practices also help reduce soil carbon losses and storage, but accounting is not sufficiently known.

For the reasons stated above, particularly ecological and Mache-Chindul reserves is to enable developing this environmental service regulatory climate and this is due mainly enhance sustainable forest management that promotes carbon sequestration, halt erosion , favors the maintenance of biodiversity, and rational use of resources by local people and landscape. In Table 1, some actions to consider this and related environmental services.

Table 1. Activities linked to the production of oxygen and sequestration of carbon

Enhancing sustainable forest management that promote carbon fixation, halt erosion, favors the maintenance of biodiversity, and the rational use of resources by local populations and landscape
Participation in research programmes national forest and international on the development of crop varieties better adapted to climate change.
Improved knowledge and information on the State of health of our forests.
Institutional support and agri-environmental measures on adaptation and mitigation to climate change.
Implementation of silvicultural treatments on forests that promote its function as sinks of CO2 (carbon forestry)
Support to the agricultural practices that improve the functions of the soil as a sink of CO2.
Promotion of the production and consumption of local agricultural products, environmentally-friendly production with the environment, organic farming and the autochthonous varieties.

Regulation of the Hydrological Cycle

Water is a very important factor that becomes the engine that allows all the relationships in the ecosystem. This resource may be affected both its quality and its quantity. Anyway, a deterioration of this resource brings serious consequences reflected in problems of erosion, sedimentation, runoff, floods or droughts that are reflected in the alteration of the local climate.

Forecasts of changes in the flow of the rivers as a result of the impacts of climate change indicate a reduction of 2.5 to 9% according to IPCC scenarios.

Water scarcity will also affect other sectors such as health and tourism, among others. Also could be affected ecosystems from wetlands and river banks, due to the decrease in flow rates, the quality of circulating water and the effects of greater regulation to store more volumes in rainy periods. Soils would lose moisture with effects on vegetation, and therefore an increased vulnerability of forests and crops to pests and diseases, and changes in the spatial distribution. Also would be more likely prone to fire.

To all this must be added that the increase in temperature tends to increase evapotranspiration from crops, but the increase of CO2 in the atmosphere counteracts this increase, so the effect combined increase of temperature and concentration of CO2 will be a slight increase of the crop evapotranspiration.

Without prejudice to the need for further studies of estimation on the availability of water on the horizon 2100, the two variables that appear to be key are the increase of evapotranspiration of plants and reduction of rainfall.

The impacts of climate change will have partners among others, changes in the amount of available water resources.

These changes imply necessarily the remodeling and redefinition of new policies such as the technological, energy, environmental, management of the territory and also the agrarian and hydraulics, so that ecosystems are in better environmental and therefore better prepared against the changes.

With this scenario of climate change, it is essential to know the role of the ecological reserve in the regulation of the hydrological cycle and flows that are maintained thanks to the conservation of the vegetation cover that guarantees the booking. In table 2, some of these actions are to take account of and related to the environmental service.

Table 2. Actions related to the regulation of the hydrological cycle

Reduce the impact of the decrease in rainfall and its seasonality, as well as more frequent change and intensity of extreme events of droughts and avenues, enhancing natural techniques and recovery of ecosystems.
Streamlined water applications anticipating scenarios of shortages and ensuring the quality of returns.
Keep the good ecological status of rivers and wetlands.
Protect and enhance aquatic ecosystems to ensure better adaptation to the adverse effects of climate change, ensuring the quality of the waters.
Comply with commitments regulation of water resources, improve their management scenarios for seasonal and torrential rainfall.
Promoting studies and economic analyses that reflect the real value of water and the public policies that contribute to the fulfilment of the principle of cost recovery.

Preservation of Biodiversity

Biodiversity, or "biological diversity" meets a wide variety of functions in the ecosystem and can, at the same time, produce countless benefits for its wealth as a source of raw materials and ingredients for the chemical, industrial production and drugs. Although presented major complications in time to calculate their benefits in economic terms, attract investments by pharmaceutical companies, among other initiatives.

The measurement of biodiversity is very complex. Like most of the natural resources, the extent and value of biodiversity depend on site that is. Although biodiversity is a source of resources for the benefit of society and the economy, there is a precise identification of the flow of goods and services that come from the ecosystem. If we consider also a scenario of climate change, the RBOV provides adaptive mechanisms against future changes that reduce and mitigate losses in quantity and quality of natural resources and biodiversity, caused directly by human activities and indirectly by the impacts of climate change.

4.0 Conclusions

In this work highlighted the importance which the identification and economic valuation of environmental services in an ecological reserve as a tool for the conservation and sustainable use of ecosystems. It has valued the role as the of Mache-Chindul ecological reserves, plays in the regulation of climate, taking into account the stage of ongoing climate change.

As discussed in labour, goods and services provided by ecosystems are very diverse and can be measured economically each separately, but the provision of such services implies the good state of health of the ecosystem as a whole. Thus, protection of the soil and biodiversity services are closely linked with the hydrologic cycle, and vice versa.

In what refers to strategies for prevention and management of hydrological risks arising from the needs of adaptation to climate change in course, must be set as a priority the need to strengthen the resilience of the continental hydrological cycle, through improving t**he ecological ecosystem**. In this sense the economic role of the ecosystems of the reserve may be key in reducing costs for damage caused by extreme weather events.

Economic valuation of environmental services in climate regulation is a fundamental element to ensure that the decision-making process is well focused and informed. One is this the climatic regulating function that presents a higher difficulty rating in economic terms.

The potential of both the soil and forests carbon sequestration is of great economic importance. In the case of soil carbon capture this service associated with the prevention of erosion and soil protection. For its part, the kidnapping of carbon of the masses and their economic value, they might be increased with a sustainable forest management promoting the use of biomass as fuel in power generation plants. The sustainable management of forests which, at the same time, play a key role in the prevention of forest fires

The role of preservation of biodiversity is one of the protective functions of great importance which have forests. The existence of a wide biological diversity increases resilience of ecosystems against adverse conditions resulting from climate change underway.

Finally, economic valuation is a useful tool to bring out the different uses of biological resources and biodiversity. If it is possible to show that the conservation of biodiversity can have one positive economic value greater than the activities which endanger it, information about their ecological, cultural, aesthetic and economic benefits will encourage actions to protect and preserve it productively.

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