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Ecological Economics and Sustainable Use of Natural Capital Stocks: A Review

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ABSTRACT:

Conserving species and ecosystem will require a significant shift in current human economic and social thinking. Most environmental degradation occurs as a by-product of human economic activities violating the theory of voluntary transaction. A voluntary transaction is a monetary transaction that takes place only when it is beneficial to both the parties concerned. Here, it is assumed that the cost and benefit of such transaction is borne by both the parties, voluntarily. However, notable exception to this theory occurs frequently dealing with environmental issues giving rise to externalities and market failure. The word externalities, here, refer to the hidden cost borne by the nature like, depletion of clean air, pure drinking water, loss of species, soil quality deterioration due to indiscriminate dumping of industrial waste, conversion of forest land into urban landscape etc. Whenever such externalities exist, the market fails to benefit the society as a whole, giving rise to misallocation of resources, making our society less prosperous by depleting our common property resources. There could be several examples all over the globe in this respect. Side by side, human society traditionally tried to protect Mother Nature from the very dawn of their civilization. This tussle between ecological and economic concern led to development of a new discipline called Ecological Economics and a new philosophy called deep ecology. Hence, a fundamental challenge to the conservation biologists is to ascertain that all the costs and benefits of any economic activity are well addressed and not to affect native biodiversity and ecosystem services.

KEYWORDS: voluntary transaction, externalities, market failure, common property resources, ecological economics, deep ecology.

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1. INTRODUCTION:

Today, we are passing through a period of unprecedented loss of biological diversity. This mass extinction now underway are very much unlike the mass extinctions in the geological past, in which tens of thousands of species died due to catastrophes like asteroid collision, volcanic eruption or sudden dramatic temperature change. This is considered to be the third phase of mass extinction and has a human face caused by human population explosion and associated economic activities. The recently published Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) report, 2019¹ affirms that “Biodiversity and nature’s contributions to people are our common heritage and humanity’s most important life-supporting safety net. But this safety net is stretched almost to breaking point” having grave impact on human civilization. The summary of IPBES¹ report published in May, 2019 highlighted loss of 20% average abundance of native species in terrestrial biome since 1900 with more than 40% of amphibian species, almost 33% of reef forming corals and more than a third of all marine mammals are threatened. At least 680 vertebrate species had been driven to extinction since the 16th century and more than 9% of all domesticated breeds of mammals used for food and agriculture had become extinct by 2016.

The aquatic systems are no exception. The effects of early human activity on aquatic ecosystems, was typically driven by soil erosion, habitat modification or pollution, have been demonstrated in many case studies. Presently, the direct effect (through species introductions, water abstraction) and indirect effect (through altering lake catchments) of human activity on aquatic systems is unquestionable^{2,3}. Introduction of advanced technology and intensive agricultural practices within the last two centuries led to acute impact on ecosystems^{4,5,6,7} in some parts of the globe. Lakes in remote regions have been subjected to anthropogenic nutrient load during the last few decades^{8,9,10,11,12}. The threats to biodiversity are accelerating due to the demands of rapidly increasing human population and its rising consumption of natural resources, such as fire wood, timber, coal, oil, fish and game animals associated with conversion of natural habitats to agricultural fields, cities, housing developments, logging, mining, industrial plants etc.

1.1 *Ecological economics: a trans discipline to ensure sustainable future*

Decisions on protecting species, communities and natural resources very often come down to arguments over money. This has led to development of a new discipline called Ecological Economics. It is a relatively new discipline that studies interaction between economic and ecological systems. It facilitates understanding between economists and ecologists and endeavours to integrate their thinking into a trans discipline aimed at developing a sustainable world. Ecological economics is

concerned with the problem of assuring sustainability in the face of uncertainty and aims to maintain the resilience of ecological and socioeconomic systems by conserving and investing in natural, social and human assets. Conservation biologists and ecological economists today are using the methodology and vocabulary of economics to protect Mother Nature for a sustainable future.

Sustainability could be defined as the amount of consumption that can be continued indefinitely without degrading capital stocks—including "natural capital" stocks¹³. In a business, capital stock includes long-term assets such as buildings and machinery that serve as the means of production. Natural capital is the soil and atmospheric structure, plant and animal biomass, forests, fish populations and petroleum deposits etc., that forms the basis of all ecosystems. This natural capital stock uses primary inputs (sunlight) to produce the range of ecosystem services and physical natural resource flows. The natural resource flows yielded by these natural capital stocks are, respectively, cut timber, caught fish, and pumped crude oil. We have now entered a new era in which the limiting factor in development is no longer manmade capital but remaining natural capital. Timber is limited by remaining forests, not sawmill capacity; fish catch is limited by fish populations, not by fishing boats; crude oil is limited by the accessibility of remaining petroleum deposits, not by pumping and drilling capacity¹³. Ecological economists see manmade and natural capital as fundamentally complementary and therefore emphasize the importance of limiting factors and changes in the pattern of scarcity. This is a fundamental difference that needs to be reconciled through debate and research.

1.2 To achieve economic efficiency

Ecological economics also seeks true economic efficiency. Economic efficiency and good economic decision making are not possible if all of the costs and benefits are not considered or included in prices. Cost benefit analysis of the development projects are done to compare the values gained against the cost of the project or resource use¹⁴. Often current market prices do not capture the full costs of an economic activity that depletes resources or damages natural systems (natural capital); or inflicts costs to human health and well-being (social and human capitals) caused by pollution or other side effects of the activity. These excluded costs are called externalities, defined as costs that are not included in the price of the product but are shouldered by a third party, outside the producer/seller and buyer/consumer. Capture of these costs in the market would provide a powerful incentive to move towards sustainability.

One of the most universally accepted theories of economic transaction are voluntary transaction. This is a monetary transaction with an assumption that the cost and benefits of the transaction are borne by both the parties involved with an expectation to improve their own situation

in the society that ultimately leads to a more prosperous society. However, serious exception to this principle directly applies to environmental issues.

2. THE MAGNITUDE OF PROBLEM

Nature provides food, energy, medicines and genetic resources and a variety of other materials fundamental for people's physical well-being and for maintaining culture. According to recently published IPBES, 2019¹, more than 2 billion people rely on fuel wood for their primary energy needs, an estimated 4 billion people rely primarily on natural medicines for their health care and 70 per cent of drugs used for cancer are natural or are synthetic products inspired by nature. Nature, through its ecological and evolutionary processes, sustains the quality of the air, fresh water and soils on which humanity depends, distributes fresh water, regulates the climate, provides pollination and pest control and reduces the impact of natural hazards. In the past 50 years, the human population has doubled, the global economy has grown nearly 4-fold and global trade has grown 10-fold, leading to enormous increase in demands for energy and resources¹. Economic exchange is often negotiated between parties and institutions of unequal power, which influences the distribution of benefits and long-term impacts. Let it be explained with some hypothetical example as follows.

2.1 Thermal power plant: Is it a light house to civilization?

Let us consider the case of a hypothetical thermal power plant. The plant burns coal, emits toxic fumes and supplies low cost electricity to the consumers. However, the hidden cost of transaction like decreased air quality, increased respiratory diseases to animals and people, damage to plant life ultimately leading to a polluted environment is borne by the society as a whole. The parties involved in this voluntary transaction are the consumers and the company who owns this power plant although the detrimental effects of this transaction are borne by a third party, the society leading to negative externalities¹⁵. When negative externalities exist, the market may fail to maximize net benefits to the society leading to market failure. This situation leads to misallocation of resources meaning accumulation of resources to a few business houses or a few individuals at the expense of larger society. So, the society becomes less prosperous from some economic activities instead of more prosperous in contradiction with the basic principles of voluntary transaction.

However, this situation could well be resolved by installing appropriate filters and electrostatic precipitators which would actually add to the production cost of electricity generation. Hence, both the parties in this involved in this voluntary transaction may or may not be interested in this issue and ultimately, the third party, society as a whole suffers from this business transaction deteriorating quality of our common property resources.

2.2 Common property resources: Do we value our air, water, soil?

The most important and frequently overlooked externality is the damage to open access resources, like air, water and soil as a consequence of human economic activity. These resources are owned by the society and should be available to everyone for use. In absence of well-defined property rights and regulations, the people, industries damage these resources without paying a minimal cost or no cost at all. In such a situation, the value of open access resources are gradually lost, known as the tragedy of the commons¹⁶. Hence, the fundamental challenge to the conservation biologists and environmental activists is to ascertain actual costs and benefits of economic activity affecting common property resources and biological diversity. For this purpose, new development projects are evaluated in order to assess present and future effect of the economic activity on the environment and economy.

3.EFFORTS TO ANSWER THE ENVIRONMENTAL QUESTION

Environmental Impact Assessment (EIA) is a process of evaluating the likely environmental impacts of a proposed project or development, taking into account inter-related socio-economic, cultural and human-health impacts, both beneficial and adverse. UNEP defines Environmental Impact Assessment (EIA) as a tool used to identify the environmental, social and economic impacts of a project prior to decision-making¹⁷. It aims to predict environmental impacts at an early stage in project planning and design, find ways and means to reduce adverse impacts, shape projects to suit the local environment and present the predictions and options to decision-makers. On the other hand, Cost-benefit analysis (CBA) is an analytical way for society to make decisions about complicated issues such as education, health care, transportation, or the environment. Like most personal decisions, it involves a comparison of the costs of an action compared with considerations of the benefits of that action.

3.1 The cost benefit analysis: A case study from Bacuit Bay, Palawan, Phillipines¹⁸

With more than 800 species of fish, 120 species of coral and 1700 of crustacean and nudibranch, amidst lush green timber forest the islands are a fascinating place for tourists all over the world. The competing use of terrestrial and marine environmental resources were modelled for three development options:

3. **Option 1:** Intensive logging, tourism and fishing would occur together.

Implications: logging will generate more revenue but will have a strong negative impact on the fishing industry and tourism due to increased siltation leading to destruction of corals and other associated animals.

4. **Option 2:** Protect forest with a ban on logging, the fishing and tourism would provide more revenue.

Implications: forest will be protected and it turn the corals and associated animals will also survive.

5. **Option 3:** logging in a responsible and limited way to minimize environmental damage.

Implications: fishing, tourism and sustainable logging would coexist without compromising the economic benefits of other two sectors.

Table 1: Cost benefit analysis for three development options in Bacuit Bay, Philippines^{18,21}.

Development option	Amount of revenue generated by (in million \$ over 10 yr period)			
	Tourism	Fisheries	Logging	Total
1. Intensive logging until timber depleted	6	9	10	25
2. Logging banned, protected area established	25	17	0	42
3. Sustainable logging	24	16	4	44

Comments: Although this cost benefit analysis showed sustainable logging at option 3 as the best alternative, the authorities decided to vote for option 2 and a marine sanctuary was created in the Bacuit Bay and is now a major tourist resort¹⁹. Although, theoretically, these cost benefit analyses are easy to deal with, practically these studies are actually very difficult to calculate since the benefits and costs change over time.

3.2 Importance of traditional knowledge

Various reports across the globe observed that nature declines less rapidly when managed by indigenous people with their traditional knowledge in comparison with other areas. At least a quarter of the global land area is traditionally owned, managed, used or occupied by indigenous peoples¹. In addition, a diverse array of local communities, including farmers, fishers, herders, hunters, ranchers and forest-users, manage significant areas under various property and access regimes.

3.2.1 Poor man's energy crisis: Is there any answer?

Ecological services of forests, an important carbon sink, not only account for 7.3 per cent of India's overall GDP, but also account for 57 per cent of the GDP of the poor or the effective household income of those living below the poverty line and relying on activities like subsistence farming and the gathering of non-timber forest produce²⁰. About 2.6 billion people all over the globe depend on fuelwood as the primary energy source for heating and cooking¹⁶ known as "Poor Man's Energy Crisis". Poor people being unable to buy kerosene or other fuels from local market due to shortage of fund, exhaust all local fuel sources. This would force the poor to walk ever greater distance to obtain fuel leading to ever widening circles of deforestation. People sometimes are forced to burn crop remains and dung for fuel leading to a loss of mineral nutrients needed to maintain agricultural productivity. The answer to this crisis was found in the traditional Sherpa villages in Nepal with the custom of "Shingo Nava". Here, men were elected to be forest guards and these men would determine i) what trees to be cut and ii) how much fuelwood people could collect and hence protect the common resources at least to certain extent. People violating the village rules had to pay fines which were used to fund village activities²¹. In this way, people used to develop and follow ways and means of extracting common property resources in a sustainable manner so that the renewable ones would not be destroyed completely.

3.2.2 Endeavour to protect Common Property Resources through Sacred Groves: The traditional answer

Sacred groves are the tracts of virgin forest that were left untouched by the local inhabitants, harbour rich biodiversity, and are protected by the local people due to their cultural and religious beliefs and taboos that the deities reside in them²². The historical link of the sacred groves have been traced back to the pre-agricultural, hunting and gathering stage of human societies²³. Sacred groves provide the unique link between present society to the past in terms of biodiversity, culture, religious and ethnic heritage. All forms of vegetation in the groves are supposed to be under the protection of reigning deity of that grove, and the removal of even a small twig is a taboo²⁴. There are thousands of sacred groves all over India and floral wealth and conservation potential of these tiny forest patches are impressive enough to acknowledge them as "mini biosphere reserves"²⁵. The Ecosystem services available from sacred groves^{26,27,28,29,30,31} are noted below:

1. Maintaining the desirable health of ecosystem
2. Conserve the indigenous flora and fauna
3. Reduce habitat destruction
4. Reduction in erosive force of water and conservation of soil

5. Maintenance of hydrological cycle
6. Conserve the viable population of pollinators and predators
7. Natural dispersal of seeds of useful species
8. Availability of water of desired quality
9. Serve as the potential source of propagules that are required for colonization of wastelands and fallows
10. Preserve the cultural and ethical practices developed through indigenous knowledge for generations

3.3 To follow or not to follow traditional conservation practices?

However, it has been seen that religious beliefs and taboos that were central to the protection of sacred groves are being eroded over the years due to various reasons and thus the present status of sacred groves is rather precarious. Many of these traditional conservation systems have been broken due to population growth, cash economies as well as centralized or “top-down” conservation decisions that take control of natural resources. Various anthropogenic pressures due to developmental activities, urbanization, exploitation of resources and increase in human population have threatened many social customs and taboos, today. People now frequently sell natural resources to town markets for money leading to destructive and non-sustainable extraction of local resource at village level as a result of progressive erosion of social controls. This is leading to faster depletion of local resources and forcing poor villagers to pay high prices in town markets for same commodity which was earlier available to them either free of cost or at a minimal cost from native area. But, it is also true that, access to town markets sometimes provides advantage to villagers, like, they get better price for their products. With that extra amount of cash, people could start their own business, educate their children and have access to modern medical care²¹ etc.

Some climate change mitigation programmes as well as environment related legislations have had negative impacts on indigenous peoples and local communities in different parts of the globe. The negative impacts of all these pressures include continued loss of subsistence and traditional livelihoods from ongoing deforestation, loss of wetlands, mining, the spread of unsustainable agriculture, forestry and fishing practices and impacts on health and well-being from pollution and water insecurity. These impacts also challenge traditional management, the transmission of indigenous and local knowledge. These also weaken the potential for sharing of benefits arising from the sustainable management of environmental resources by the indigenous peoples and local communities which is also relevant to the broader society.

4. FUTURE OF THE PROBLEM:

Biological diversity preserves our basic life support systems of food production, water supply, oxygen replenishment, waste disposal, soil conservation etc. People will be healthier and happier in a clean and green environment. However, human economic activity very often destroys species and degrades ecosystem hampering human wellbeing in the long run. All over the world, environmental organizations are making conscious effort to use their knowledge to protect species and ecosystem and leads to the concept of deep ecology. The most central and ethical argument to this concept is that species and biological communities have a right to exist on this planet based on an intrinsic value, that is independent of human needs and people have a responsibility to protect biodiversity. Deep ecology is a philosophy that not only speaks in terms of conservation biology but also includes an obligation to implement the needed changes through political activism and a commitment to personal life style changes²¹. The present-day concept of sustainable development and green economy recommends poverty eradication and social justice as the main purposes of an ecologically sound economic system.

There is a lack of awareness and education about sustainability, the environment, and causes of environmental degradation. In addition, much environmental knowledge held by indigenous peoples is being lost, as is knowledge of species, particularly in the tropics. We should promote at all levels education that weaves together fundamental understanding of the environment with human economic activities and social institutions, and promotes research that facilitates this interweaving process. The concept of a Green Economy is a shift in paradigms and sets aside the common misconception of trade-off between economic development and environmental stewardship, because all human activity depends on the existence of a responsible framework for using environmental assets and that is more true about the poorest section of populations as they depend disproportionately on the ecological commons both for livelihoods and for consumption.

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