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MONETARY VALUATION OF ECOSYSTEM SERVICES AND OPTIONS FOR VALUE REALIZATION IN DEVELOPING COUNTRIES

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Abstract

This paper classifies ecosystem services under 5 groups: at thresholds, provisioning, supporting, regulating and cultural; the first comes under Anthropocene and the last four from MEA. It considers issues raised by ecological economists on sustainable scale, use of marginal analysis, and distributional equity. It stresses the need for monetary valuation for resource allocation decisions and discusses problems in monetary valuation for services in each group. As the principle of "common but differentiated responsibilities" of governments in solving global environmental problems is not accepted by developed countries now, most developing countries face difficulties in implementing SDGs and enhancing provision of ecosystem services. This paper suggests that a decentralized approach involving local communities can enable eco restoration and achieve SDGs at lower cost to governments.

Keywords: *Anthropocene, ecosystems, ecological thresholds, strong sustainability, planetary boundaries, sustainable development*

JEL Codes: Q51; Q56; Q58

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Ulaganathan Sankar

INTRODUCTION

Ecosystems provide multiple services and some of them are vital for human well-being. The Millennium Ecosystem Assessment (2005) found that "over the past 50 years humans have changed ecosystems more rapidly and extensively than in any comparable periods of time in human history" …. and the costs were in "the form of degradation of many ecosystem services, increased risks of nonlinear changes and the exacerbation of poverty for some groups of people". MEA Synthesis Report p1. Many UN agencies and national governments are taking policy measures for halting degradation of ecosystem assets, and for conservation/ restoration of ecosystems assets and enhancing ecosystem services.

Most economists agree on limitations of using conventional methods of national income accounting such as gross domestic product and the need for recognizing the role of natural capital in achieving sustainable development, but economists and ecological economists differ both on the methods of economic valuation and on the means of realization of the values. This paper considers the issues raised by ecological economists and others on monetary valuation of ecosystems assets and services and discusses application of monetary valuation techniques with caution. The following section begins with a brief review of the System of Economic and Environmental Accounting. Then it considers cases where market outcomes are not socially desirable because of 'market failures', or high transaction costs of operating markets or market outcomes unfair due to asymmetric information. Then, it considers criticisms of Farley (2012) questioning use of Pareto welfare criterion, need for consideration of intergenerational equity and use of marginal analysis when an ecosystem is at its threshold. The next section considers problems in realizing the monetary values in the context of increasing resource requirements to achieve SDGs as well as enhancing ecosystem services in developing countries. We suggest that a decentralized approach involving local communities to enhance

ecosystem services will lower government expenditures, and help poverty alleviation. The final section contains concluding remarks.

MONETARY VALUATION OF ECOSYSTEM SERVICES

Costanza et. al. (1997) estimated economic value of ecosystems for 16 biomes in the range of $16 to $54 trillion per year with an average value of $ 33 trillion per year. This paper generated lot of interest and controversies among economists and ecologists. Recognizing the importance of ecosystem services to human well-being, the UN Statistical System developed System of Environmental Economic Accounting (SEEA). It contains physical accounts and monetary accounts. The monetary accounts are based on exchange values. The exchange values are the values at which goods, labour, services, and assets are in fact exchanged or else could be exchanged for cash. For goods which are not traded in markets, SEEA uses prices of similar items (adjusted for quality), cost of production, revealed expenditure for related goods and services, replacement cost approach, or discounted present value of expected receipts.

When all assets and services values are in a common monetary unit, the accounting system can facilitate (a) comparison of values of environmental assets and services with other assets and services; (b) comparison of trade-offs of different ecosystem services; (c) derivation of complementary aggregates such as degradation adjusted measure of national income; (d) evaluation of trends in inclusive wealth; (e)decisions on budgetary allocation on environmental and other expenses. See, Natural Capital Accounting and Valuation of Ecosystem Services, NCAVES (2022).

We may note that aggregation of ecosystem values by different methods raise issues of reliability and comparability. For non-marketed goods, SEEA valuation is based on cost of production or replacement cost or contingency valuation method. Contingency valuation measures often

reflect the preferences of the interviewing population. Hence it is desirable to give a range of estimated aggregate values, reflecting the degree of uncertainty. Ecological economists argue that most economic analysis is based on weak sustainability between natural capital and physical capital, but they claim that physical capital and natural capital satisfy strong sustainability assumption. The strong sustainability assumption is valid when an ecosystem is near its threshold.

First, we consider objections to the use of market prices for the purpose of ecosystem asset valuation. Economists are aware that the justification for use of market prices for valuation based on Pareto criterion is valid only in case of competitive markets. There is a vast literature on "market failures", due to economies of scale in production, externalities and public goods. Economies of scale lead to natural monopolies and hence the resulting market prices are above the marginal costs. Most countries prefer public ownership or private ownership of such monopolies subject to price regulation. Externalities cause divergence between marginal private costs and marginal social costs. One commonly adopted solution is levy of an output tax equal to the difference between marginal social cost and marginal private cost[1]. Another solution is a system of "cap and trade regulation" to deal with pollution problem. In the case of public goods having properties of non - rivalry and non-excludability public ownership is recommended.

Coase stresses the importance of well-defined and enforced property rights and absence of transaction costs for the efficient functioning of markets. Coase (1960; 2001) says, "In order to carry out a market transaction it is necessary to discover who it is that one wishes to deal with, to inform people that one wishes to deal and on what terms, to conduct negotiations leading up to a bargain, to draw up the contract, to undertake the inspection needed to make sure that the terms of the contract are being observed, and so on. These operations are often extremely costly, sufficiently costly at any rate to prevent many

transactions that would be carried out in a world in which the pricing system worked without cost.

Asymmetric information between buyers and sellers in a market may result in unfair outcomes. See Akerlof (1961). The cultivation of medicinal plants under common property regime in many developing countries resulted in bio privacy. The Convention on Biological Diversity assigned sovereign rights over biological resources to governments and enabled creation of an access and benefit sharing regime for transfer of biological resources from the sellers to the users.

Access to market is also an important issue especially in rural areas. Ribot and Peluse (2009) define access as "the ability to derive benefit from things …including material objects, persons and to titles, and symbols". They mention the following access mechanisms: rights, structural and relational, technology, markets, knowledge, and social capital. Economists concentrate on markets. Sociologists stress the role of social capital in rural areas. Access to technology is important in case of bioprospecting.

Distributive justice

Second, it is true that many neoclassical economists use the utilitarian framework, and make policy prescriptions using the Pareto criterion of welfare. There are a few exceptions. Musgrave (1957) introduced the concept of merit goods in economics. Markets may not provide goods such as elementary education, basic medical care and safe drinking water at affordable prices to all people. Paternalistic attitude of a government may result in provision of such goods to the poor either free or at subsidized prices. The degradation of ecosystem services has affected the poor very much because of their dependence on lakes, public wells and canals for drinking water and for firewood.

Rawls (1971) developed a theory of justice as fairness based on the principles: (a) Each person has a basic and equal right to the basic

liberty compatible with similar liberties for others; (b) Social and economic inequalities are managed so that are both reasonably expected to be everyone's advantage, and attached to positions and offices open to all.In contrast to the Pareto criterion of increase in welfare of at least one person without a change in welfare of others, Rawls criterion is to maximize the welfare of the least advantaged in society. Many would accept ensuring basic minimum needs of all people a desirable criterion. The problem is that a market economy cannot ensure fair distribution of goods and services.

The Burtland Commission (1987) defined sustainable development as "development that meets the needs of the present without compromising the ability of future geneations to meet their own needs". It is based on intergenerational equity. It also highlights the issue of sustainable scale of an economic activity. It has three pillars: economic, social and environmental. Acceptance of Millenium Development Goals and Sustainable development Goals by the world community make certain goods and services global public goods.

Ecological thresholds

Rockstrom, J., et. al. (2009) note that "a new era has arisen, the Anthropocene, in which human activities push the Earth system outside the stiff environmental state of Holocene, with consequences that are detrimental or even catastrophic for large parts of the world (p 472). They identified 9 planetary boundaries of the Earth system and reported that in three cases (rate of biodiversity loss, climate change, and human interference with the nitrogen cycle) the systems have already exceeded the boundaries[2].

Transgression of planetary boundaries is a global environmental problem and requires collective action by all countries. United Nations Framework Convention on Climate Change (UNFCCC) accepted the principle of "common but differentiated responsibilities" of governments in tackling global environmental problems like climate change. The

problems are common because climate change is a global public bad. The responsibilities are higher for developed countries because they are historically responsible for the accumulation of greenhouse gases and possess the technology and resources for solving the problem. In the Kyoto Protocol developing countries were exempted from greenhouse gas reduction commitment. In the Rio Conference on Environment and Development 2012, developed countries refused to honour this commitment. Under the Paris Agreement on climate change in 2015 every country was asked to report its "nationally determined commitments". Most countries, including developing countries, have also agreed to implement the Sustainable Development Goals (SDGs). Some SDGs require provision of merit goods. Now, developing countries must find resources for solving both global environmental problems and achieving SDGs.

Table 1 contains 5 groups of ecosystem services and lists of selected goods and services under each group. The goods and services include private good, private good with negative externality, merit good, public good, global public bad, intermediate good and option value. For each good we mention valuation problem. In case of private good, its market value can be taken as a measure of value. For a private good with negative value its social cost (private marginal cost+ marginal damage cost) can be taken as a value. For a public good, its marginal cost of provision can be taken as a value. For a global public bad, like greenhouse gas (GHG) emission, we need an estimate of global social cost of carbon. Climate change analysis also poses a challenge to conventional economic analysis. Using climate mitigation, as an example, Weitzman (2009) demonstrates the inappropriateness of using cost-benefit analysis for a catastrophe[3]. As the social cost of carbon is not available, each country has its cost estimate based on policies such as carbon tax or carbon cap and trade or regulatory policy. Since the Paris Agreement, countries have their compliance costs of nationally determined commitments. The implied cost of GHG emission reduction

can also be derived from alternative means such as improvement in energy efficiency, green energy or carbon capture and storage program.

In the case of biodiversity loss also we have transgressed the planetary boundary. Heal (2000) stresses higher productivity, insurance and genetic benefits of biodiversity. Dasgupta (2021) notes that high biodiversity implies not only higher productivity but also greater resilience. He says "biodiversity is the diversity of life. The economics of biodiversity is the economics of the entire biosphere .....we are embedded in nature" (page 4). Biodiversity benefits sometime arise as co- benefits of policies such as carbon sequestration, afforestation and restrictions on land use. Countries adopt methods such as creation of protected areas, diversified cropping pattern, incentives for increase in forest cover and forest density. The Convention on Biodiversity assigns rights over biological resources to governments and enables creation of an access and benefit sharing regime for transfer of biological resources from the suppliers to the users. This is expected to reduce bio piracy. But there are no reporting requirements on increase in biodiversity or expenses on biodiversity. In case of nitrogen boundary problem there is no global convention. High nitrogen use is a negative externality. Countries use policies such as reduction of perverse subsidy on nitrogen fertilizer, incentive for organic farming and nitrogen recovery.

Two groups of ecosystems services-supporting and regulating – are considered intermediate goods and hence their values are included in final goods. Some attempts are being made to estimate their values from willingness to pay methods. Payment for ecosystems services (PES) are being attempted for services such as pollination, waste reduction and biomass production. One feature of PES is that it is voluntary and contractual. For cultural services, estimation by willingness to pay method like travel cost method is available.

Table 1: Type of Service, Valuation and Options for Value Realization

	Type of service	Valuation problems	Value realization options
At thresholds			
Climate change	Global public bad	Unsustainable, marginal analysis inappropriate; Cost of compliance with the Paris Agreement	Market -based measures like carbon tax or cap and trade system (with auctioning permits), regulations and incentives legislations regulations and incentives, community support
Biodiversity loss	"	Some services not marketed; cost of compliance with CBD	Regulations and incentive
Nitrogen boundary	Private good	cost of negative externality	Regulations and incentive
Provisioning services			
Food	Private good	externality	Market value +cost of merit good provision
Lumber	Private good	SDGs 1& 2 make it merit	Market value Market value + cost of MSP
NTFPs	Private good	good for poor	Merit goods for the poor
clean water	Private good	Market value Merit good for poor	Market value + Cleaning cost
Clean air	Public good	"	
Genetic value	Merit good	Public provision	cost of provision
Regulating services*			
Pollination	Intermediate good	Market value in case of contracts between the suppliers and the users	PES,community support
Waste regulation	"	Limited market	Community support Public expenditure
Flood regulation	"	Limited market	Public expenditure and community

	Type of service	Valuation problems	Value realization options
Supporting services*			
Soil formation	intermediate good	Government management	Public expenditure and community support
Nutrient cycling Biomass	"	Limited market	Local -community support,tourist revenue support
production			,,
Cultural services			
Ecotourism	Private good	Guided tour	Public expenditure, local community support
Aesthetic values	Private good, option value	Willingness to pay	

- Haines-Young, R., and M.B Postchin (2017) combine regulating and supporting services under one category. MEA uses four categories: provisioning, supporting, regulating and cultural. We added "At thresholds" a separate category because at this stage the system is unsustainable and marginal analysis is inappropriate.

VALUE REALIZATION OPTIONS

Monetary valuation of ecosystem services is needed for resource allocation. Even when their estimates are uncertain, they give some idea about the relative importance of each of the service for resource allocation. The question is how to realize the values. Even in case of catastrophic problem like climate change, government responsibility does not mean that government has to do everything; it only means that government has to create conditions which regulate/ incentivize people to undertake mitigation programs. For example, in cases of climate change and pollution control, many countries choose carbon tax or cap and trade system[4]. These methods can also generate revenues for governments. Other options such as improvements in energy efficiency and green energy are also beneficial to consumers in the long run.

In case of biodiversity loss there are many opportunities for associating local and forest communities in the task of biodiversity enhancement. Assignment of rights over certain forest resources e.g., non-timber forest products (NTFPs) and reducing transaction costs via operation of minimum support prices for NTFPs can incentivize forest dwellers to invest money and their own labour in enhancing production of NTFPs. There is also scope for value addition. This will also generate employment. There are plenty of opportunities for involving local communities/and indigenous forest communities, with the scientific research institutes/ pharmacy companies for commercialization of medicinal products. Gadgil, Berkes and Folke (1993) observe that 'indigenous peoples with a historic continuity of resource-use practices often possess a broad knowledge base of the behaviour of complex ecosystems in their own localities. This knowledge has accumulated through a long series of observations transmitted from generation to generation. Such "diachronic" observations can be of great value and complement the "synchronic" observations on which western science is based…It is vital, however, that the value of the knowledge practice-belief complex of indigenous people relating to conservation of biodiversity is fully recognized if ecosystem and knowledge would be most appropriately accomplished through promoting the community-based resource management system of indigenous people'(p.1). Costa Rica has successful examples of REDD+ programs, payment for ecosystem services and fruitful partnership between National Biodiversity Institute (INBio) and Merck pharmaceutical company for patenting and commercialization of medicinal plants produced by indigenous community. In India, the Tropical Botanical Garden Research Institute in Kerala helped Kani tribes to covert a local medicinal plant, 'arogyapacha', to a commercial product, 'jeevani', an anti-fatigue.

In case of common property regimes, Ostrom (1990) has shown how an organization for allocating responsibilities and sharing benefits among members can be created and managed by its members. The government's job is to create enabling conditions such as guarantee of

individual/community rights, recognition of the institutions involved, and honouring mutually agreed contracts by the concerned parties. Existing programs relating to ecosystem restoration in India such as Mahatma Gandhi National Rural Employment Guarantee and Compensation Afforestation funds can be transferred to these community groups because of their knowledge about local ecosystem degeneration and ease in monitoring. These activities can generate additional employment and enhance ecosystem services.

In many countries, including India, a few programs have been designed to convert indigenous tribes and other locals in forests, who were treated as poachers, as guardians of forests by associating them in activities like ecotourism and wild life protection. Conflicts between wild animals and forest dwellers often arise when wild animals enter in human inhabited areas in search of food and water. Some forest dwellers engage in poaching for food, and possibly sale of wild animal products. This situation can be avoided if the protected areas are well maintained to meet the requirements of wild animals and the forest dwellers get opportunity for employment and earnings.

PES programs can be designed to incentivise suppliers of ecosystem services to enter into agreements with users of ecosystem services such as municipalities, Panchayats and consumer groups on mutually beneficial contractual basis. PES programs exist for watershed protection, pollination, waste reduction and a few other services. These programs enhance ecosystem services and augment incomes of the suppliers and thereby contribute to poverty alleviation. Consumers are willing to pay for preservation of option values, such as existence of wild animals, scenic spots, and preservation of 'keystone species', but it is difficult to realize such values via markets alone. As this is an intergenerational equity issue, governments are responsible for preservation of option values.

CONCLUDING REMARKS

The recent finding of the Stockholm Resilience Centre that the Earth has transgressed six of the planetary boundaries is a warning to countries to take urgent measures to keep the Earth back on a safe operating zone. As a precautionary measure, it is necessary for governments to strengthen policies for restoration of degraded ecosystems. As developing countries face difficulties in finding resources to achieve both SDGs and restoration of ecosystems, the governments must create conditions which would enable individuals or communities to undertake these tasks.

End notes

1. This is known as Pigouvian tax, named after A.C.Pigou, a British economist.
2. In September 2023 a team of scientists at the Stockholm Resilience Center found that six of the nine planetary boundaries have been transgressed. Hence the Earth appears to be outside the safe operating zone of humanity.
3. According to Weitzman (2009) this problem arises because the high impact, low probability catastrophe has a built-in tendency to be fat-tailed.
4. In case of carbon tax, tax revenue accrues to government. In case of cap and trade, government can generate revenue from auctioning permits.

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