Ecological Economics 70 (2011) 778–787

Contents lists available at ScienceDirect

Ecological Economics

journal homepage: www.elsevier.com/locate/ecolecon

Analysis

Shared wealth or nobody's land? The worth of natural capital and ecosystem services

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ARTICLE INFO

Article history:
Received 30 April 2010
Received in revised form 30 August 2010
Accepted 17 November 2010
Available online 28 December 2010

Keywords:
Emergy
Commons
Natural capital
Ecosystem services
Environmental policy

ABSTRACT

The prerequisite for a sustainable and equitable use of common resources (the so-called Commons) must be the proper evaluation of their role within the complex network of relationships that ensure ecosystems functioning, resilience, and evolutionary dynamics. It is crucial to ascertain to what extent the common wealth is used for the common benefit. Money-based schemes for valuing the Commons, such as the so-called "willingness-to-pay", provide a user-side evaluation perspective based on the idea that value only stems from utilization by humans. As a complement to such a point of view, we present and discuss in this paper a donor-side evaluation method (Emergy Synthesis) based on the idea that a proper measure of value can be achieved by also accounting for the work done by the biosphere in generating services and resources. It should not be disregarded that such resources and services also provide support to other species in the web of life. Emergy, a scientific measure of such environmental support, is suggested as a tool capable to assess quantity and quality of shared resources, thus providing a basis for their environmentally sound management.

1. Introduction

Governments use money-based accounting systems of national economies to calculate macroeconomic indicators such as gross domestic product, gross national product, and per capita income, among others. In the last years, also in response to a perceived lack of comprehensiveness of such accounting systems, more attention was placed on the economic use and evaluation of the ecosystems. A recent example in this direction is the international project "The Economics of Ecosystems and Biodiversity TEEB (http://www.teebweb.org/) aimed at evaluating in money terms the contribution of ecosystems and biodiversity within the framework of productive economic systems. The term "Environmental Accounting" is most often referred to as the practice of including the indirect costs and benefits of an economic activity, for example its environmental load on health and society, along with its direct costs, when making business decisions.

Considering the almost complete decoupling of the economy and the environment that characterized the so-called mainstream (or neoclassical) economics by far, the recent recognition that human economies rely on natural resource storages and ecosystem services must be considered an important step ahead, very likely one of the most important achievement of Ecological Economics, a modern branch of the Economic theory (Georgescu-Roegen, 1975; Costanza, 1989; Martinez-Alier, 1990; Patterson, 1998; Daly and Farley, 2004; Faber, 2008).

Point is now: What is the value of natural capital and ecosystem services? How can such a value be measured? Value for whom? No doubt that within the framework of Neoclassical Economics the value of an environmental resource is very small when the resource is abundant and starts to increase when it approaches scarcity. Several resources were not assigned any value in the past due to their relative abundance (land, pasture, fresh water) compared to demand by a smaller population. They remained as no-value "Commons" until growing population and increased use made their economic value to grow. Some "Commons", such as clean air and rain water, are not (yet) marketed and therefore they are considered worthless: as a consequence, they are considered nobody's resources and degraded by improper use (e.g. polluted by chemical emissions). Other resources such as land, forests and fresh water storages can more easily be limited and marketed, so that they are being assigned monetary values. Worth mentioning as a typical case of misused commons, the trend towards privatization of water and improper use has been clearly indicated as unacceptable practice by the United Nations in its 64th General Assembly on 28 July 2010, declaring access to clean drinking water and sanitation as a human right (UNO, 2010).

A large number of studies have already warned about the turndown ahead, suggesting models, policy tools, limits to growth, and alternative lifestyles (Hubbert, 1949; Meadows et al., 1972; Capra, 1982; Tainter, 1988; Odum and Odum, 2001; Heinberg, 2009). Moreover, while the present resource exploitation mostly supports the welfare of a minority of wealthy people in developed countries, the environmental degradation related to such welfare affects the majority of world population, left without the primary resources and services necessary to secure their present and future well being. Hardin (1968) referred to the degradation of common resources as to

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doi:10.1016/j.ecolecon.2010.11.015

an inexorable "tragedy of Commons". Barnes (2006) claims that there is no reason for which the "Commons are inexorably "*fated to self-destruct*" and suggests Commons – the inheritance received by nature and by previous generations – to be maintained over time by revising the dynamics of global markets. He suggests new actors (independent Trusts) to operate in favor of the other species, the global environment and future generations. Barnes identifies "three forks" of the Commons river, i.e. the main pathways for the formation of Commons: Nature, Community and Culture (Fig. 1). According to such an identification, Barnes listed a large number of products, services and infrastructures that are generated by Nature or by the common effort of entire societies and that in turn become a source of additional value and wealth. Internet and the stock market are two examples of infrastructures that generate value (the existence of which allows actions that support economic and cultural processes and generate income). Creation of wealth by using the Commons is, in Barnes' opinion, something that involves property rights of all species and the unborn as well. All individuals are entitled to ownership rights by birth and should receive dividends of the wealth created.

The problem with the sustainable use of the Commons is that it is not easy to establish an agreed upon measure of value as the basis of economic, normative and conservation actions. Energy taxes, carbon taxes, and even the Kyoto protocol share the difficulty of identifying a measure of value that can be used as the basis of a "policy for the Commons".

In spite of the efforts done by several Governments and the scientific community, the anthropocentric framework that still characterizes most of the economic approaches mainly focuses on and assigns value to those services that are of interest and benefit to humans, in so disregarding the fact that nature provides services to countless species different than human beings. Odum (1988, 1996) identified the work of biosphere driven by solar, gravitational and geothermal energies as the source of environmental goods and services. He provided a common measure for such sources, namely the solar equivalent energy (emergy), pointing out that it can be used as the basis for sustainability assessments and natural capital evaluations (Odum, 1994a). Other authors developed emergy-based studies on sustainable economic development (Ulgiati and Brown, 1998), ecosystem value (Brown and Bardi, 2001), carrying capacity (Brown and Ulgiati, 2001), taxation and incentive schemes (Bimonte and Ulgiati, 2002), landscape development intensity (Brown and Vivas, 2005), environmental debt (Campbell, 2005), among others, all relying on the idea that the emergy content of a flow or storage is a measure of (not only economic) value, quality and wealth. The focus of the emergy accounting method is placed on the overall functioning of the geobiosphere with all its components and processes, within which human societies are embedded. Since shared resources belong to all species on Earth and to the future generations as well, processes and systems which receive the largest benefits from their appropriation of the Commons (storages of minerals, fuels, standing biomass, fresh water, clean air, culture, information, biodiversity) should provide a proportional feedback to reinforce the resource basis. This is needed in order to prevent natural capital degradation and to ensure the resource throughput (empower) being maximized through all levels of world ecosystems and societies.

2. The Emergy Synthesis Method. Concepts and Definitions

Pointing out that human societies feed on natural capital withdrawal and use different kinds of ecosystem services, Odum (1988, 1996) identified natural capital and ecosystem services as the real source of wealth, in spite of the common belief that only labor and economic capital were such a source. Emergy, the total amount of solar equivalent energy that is invested by the environment in support of a given process, is suggested as a scientific measure of the direct and indirect work performed by the biosphere. Within such a "donor-side" perspective, the value of a resource relies on the effort that is needed for its production and delivery over a "trial and error" process that ensures optimization of resource use.

The emergy synthesis method (Odum, 1996) is a technique of quantitative evaluation that determines the environmental value of non-marketed and marketed resources, services, commodities and storages in common units of solar equivalent energy required to make a given product or service. The method is based on principles of energetics (Lotka, 1922), systems theory (von Bertalanffy, 1968) and systems ecology (Odum, 1994b). It allows to quantify the amount of environmental work supporting each flow or storage, thus valuing each resource based on a supply-side effort, not just on human preferences and market contingency. In short, emergy is defined as the total available energy of one kind (usually of the solar type) directly and indirectly required to support a process and generate an output product or service. All renewable and nonrenewable, local and imported input flows to a process (matter, energy, labor, money and information) are listed in an inventory and converted to emergy units by means of emergy intensity coefficients named Unit Emergy Values (UEV; also named transformities when the flow is measured in energy units). All the emergy input flows resulting from the procedure are added into a total and several performance indicators are then calculated. Flows that are not directly of solar origin are converted to solar equivalents by means of suitable conversion coefficients. As a consequence, emergy is measured in unit of solar equivalent joule (seJ).

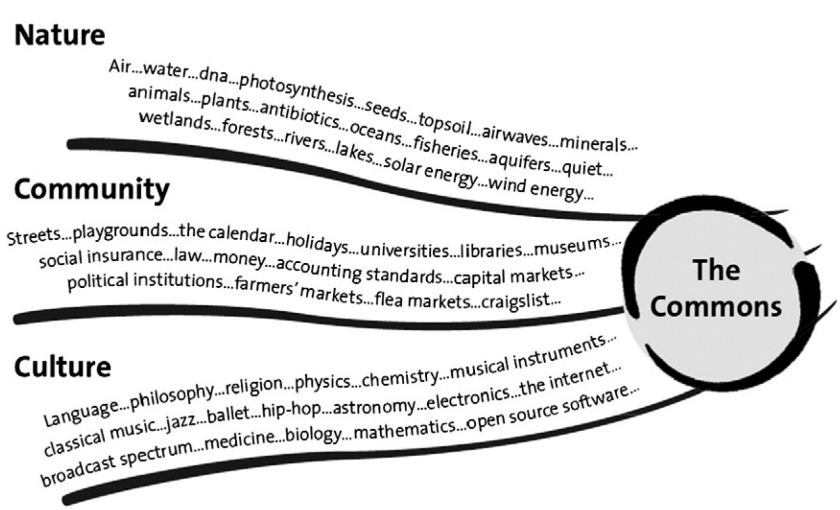

Fig. 1. The three forks of the Commons river (Barnes, 2006).