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Exploring the effect of land use on ecosystem services: The distributive issues

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ABSTRACT

The current debate of ecosystem services has focused more on monetary valuation methods and payments for environmental services (PES) then on the classic economic analysis (i.e. assumptions regarding: sustainability, justice and efficiency). This paper examines, taking into consideration ecosystem services, income distribution from different land uses to stakeholders. We study the Portuguese common land ecosystem, which is characterized as having a wide range of ecosystem services. Allowing that all the benefits can be translated into economic value, we estimated the total economic value (TEV) associated with these territories on 5 different land use situations: forest, shrubland, water bodies, mountain agriculture and other uses, and analyzed the current institutional arrangements around these territories. We found that the distribution of the benefits of different land uses is relatively inequality. The results showed that the contemporary institutional arrangements of wealth distribution ensure a relatively fair distribution insider of system; however this institutional arrangement is unable to ensure equitable distribution of wealth by external stakeholders. We can conclude that different types of land use provide a very asymmetric distribution of income by different groups of humans: land owners; citizens of a country, and residents of Earth.

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Introduction

Distribution refers to the division on the flow of resources, as embodied in final goods and services between people's alternatives. A good distribution is fair or that is "reasonable", or at least the one who allowed the degree of inequality is limited within an acceptable range (Daly, 1992). There is a long history in economics of a consequentialist approach to distributive justice. From the classical economics' point of view, distributive justice is determined by whatever generates the best outcome for society (Mill, 1848). While in wealth production, humanity is restricted by natural laws, its distribution, is a matter of human institution solely. The distribution of wealth, therefore, depends on the laws and customs of society. The rules, by which it is determined, reflect the opinions and feelings of the ruling portion of the community (Mill, 1848). On this concern private property, institution is supposed to guarantee the fruits of the individuals' own labor and abstinence.

The main tool for analyzing economic inequality is the Lorenz curve (see Fig. 3), this concept was introduced by Lorenz (1905) who investigated the problem of measuring wealth concentration. This curve is an intuitive method for representing income distribution. Created by plotting cumulative income shares against cumulative population shares, the Lorenz curve forms the backbone of several inequality measures, including the popular Gini coefficient. The Lorenz curve has played a basic role, for example, in the analysis of income and earnings inequality (Sen, 1973; Slottje, 1989; Doiron and Barrett, 1996). The Gini coefficient (Gini, 1912), a measure of distribution inequality, is defined, geometrically, as the ratio of the area between the line of equal distribution and the observed Lorenz Curve to the area under the uniform distribution:

$$Gini = \frac{A}{(A+B)} \quad (1)$$

where A is the area between the line of perfect equality and the Lorenz curve, and the area under the Lorenz curve is B.

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There are ways of decomposing the Gini coefficient but the component terms of total inequality are not always intuitively or mathematically appealing (Litchfield, 1999). The classical, mathematical, definition of Gini coefficient appears in the notation of the theory of relative mean difference:

$$Gini = \frac{1}{2n^2\bar{y}}\sum_{i=1}^{n}\sum_{j=1}^{n}[y_i - y_j] \quad (2)$$

where n is the number of individuals in the sample, y_i is the income of individual i, $i \in (1,2,\ldots,n)$, and $\bar{y} = (1/n)\ \Sigma yi$, the arithmetic mean income.

This coefficient has values within the range 0 (perfectly uniform distribution) to 1 (complete inequality).

Economists frequently take property rights approach to distributive justice, arguing that whatever distribution emerges from voluntary transactions (e.g. market transactions) is just (Farley, 2012). For ecosystem services there are two ways to put this approach into practice: the monetary valuation of ecosystem services based on estimates of willingness to pay (e.g. through contingent valuation, hedonic pricing, travel cost, etc.) and/or the use of market based instruments for allocation decisions concerning ecosystem services. In contemporary times Martinez-Alier and O'Connor (1999) discussed how valuations of today's externalities and also valuations of future externalities (and of environmental resources and services) will depend on the distribution, not only of property rights, but also of income and of power in social-institutional terms. In the case of ecosystems services, justice concerns entitlements to both the structural building blocks of ecosystems and the services they generate. The two of course are frequently in conflict (Farley, 2012).

Ecosystem services: concept, valuation and distribution issues

Ecosystem services (ES) research has become an important area of environmental science investigation over the last decades. The Millennium Ecosystem Assessment (MEA, 2005) and The Economic of Ecosystem and Biodiversity report (TEEB, 2010) represent two important milestones, aiming at mainstreaming ES in decision-making. Despite this, the use of ES is still limited both in plan and program-making (Geneletti, 2011) and environmental performance assessment of policy tools (Rega and Spaziante, 2013). In addition, the concept of ecosystem services does not, to our days, gather consensus amongst ecologists and economists (Boyd and Banzhaf, 2007; Wallace, 2007; Fisher and Turner, 2008) since linked ecological-economic systems are complex. In both fields, economics and ecology, which are often seen to have conflicting goals, ecosystem services are an extension of both economic externalities and ecological functioning, providing a nexus between the two fields (Fisher et al., 2009). Two commonly cited ES definitions are the one by Costanza et al. (1997) in that ecosystem services represent "*the goods and services derived from the functions and utilized by humanity*" and The Millennium Ecosystem Assessment (MEA, 2005) definition, in which ES are defined as "*the benefits people obtain from ecosystems*". Boyd and Banzhaf (2007) offer an alternative definition, i.e., ecosystem services are not the benefits humans obtain from ecosystems, but rather the ecological components directly consumed or enjoyed to produce human well-being. Fisher et al. (2009) define ecosystem services as the aspects of ecosystems utilized (actively or passively) to produce human well-being. Regardless of the author, ecosystem services are a function of complex interactions among species and their abiotic environment; complex use and utilization patterns; and various perceptions by beneficiaries (Fisher et al., 2009). From this meaning, any step in the system can be considered an ecosystem service regardless of where it occurs along the chain of events as long as humans use it to produce welfare.

There is an on-going debate on how to assign value to ecosystems services. The monetization (monetary valuation) of ecosystem services has been advocated by many as an optimal strategy to make nature visible to decision makers and financial markets, with the hope that this would eventually lead to the sustainable use of natural resources and their preservation. For other authors (see, among others, de Groot, 1992; Hanley, 1992; Diamond and Hausman, 1994; Vatn and Bromley, 1994), it is advisable to look at alternatives to ES for integration of nature into economic decisions (Baveye et al., 2013). The total economic value (TEV) is a concept made popular by Pearce and Turner (1990), and represents the several ways by which a natural resource, such as a forest, is valuable to people. Therefore TEV of a natural resource is the sum of its direct, indirect, option, and existence values (Pearce, 1991; Groombridge, 1992). TEV can be decomposed in to economic value for use in connection with utility value, economic value of non-use, related to the intrinsic value, where all issues of intrinsic value (ethical, religious and cultural) of natural resources are discussed. In the "*total value of nature*" Costanza et al. (1997) published the results of a comprehensive study estimating the value of annual global ecosystem services.

Ecosystem services are supplied to the economic system at a range of spatial and temporal scales. Hein et al. (2006) argued that ecosystem services can be generated at a range of ecological scales, and can be supplied to stakeholders at a different range of institutional scales. In light of distribution issues, one possibly important classification scheme considers the decision context of how ecosystem services relate to equity in the provision of human welfare (Fisher et al., 2009). This is important as it is now well accepted that failing environmental quality disproportionately affects people that are marginalized by the market economy (Dasgupta, 2002). This can be complex by the fact that stakeholders at different spatial scales have different interests in ecosystem services (Hein et al., 2006). The scale at which benefits and costs are captured is also a very important issue in terms of practicality and equity.

In this paper we will discuss the distributive issues associated with ecosystems services to different land uses. Today's understanding of the effects of land use on ecosystem services benefits distribution is far from complete. This paper is structured as follows: In the next section we will present details the methodological and data collection use in this case study: Portuguese common land ecosystem. Key findings emerging from the case study Section will analyze and discuss the result, followed by some brief conclusions.

Research approach and methodology

Case study methodology is well developed within social sciences. The process of designing a case study must be carried out in a methodical manner if the results are to be accurate and meaningful (Stake, 1995). Although findings originating from case studies cannot be generalized to populations, by following a rigorous methodological framework that includes maintaining the 'chain of evidence' and protecting against validity problems, case study research can strongly contribute to knowledge about social phenomena (Yin, 2009).

Data collection

Information on the monetary value of ecosystem services were sourced, mainly, from the "Ecosystem Service Valuation Database" (ESVD) developed by Van der Ploeg and de Groot (2010). This database includes more than 300 valuation studies and 1350 valuation estimates worldwide for different ecosystems, ecosystem