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Analysis

Biofuel as social fuel: Introducing socio-environmental services as a means to reduce global inequity?

Sandra Venghaus, Kirsten Selbmann *

Potsdam Institute for Climate Impact Research (PIK), P.O. Box 601203, 14412 Potsdam, Germany

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ABSTRACT

The increasing cultivation of energy crops for biofuel production has significantly altered the focus of the agricultural sector, but the impact of biofuel production and use is not merely an agricultural one. Even more importantly, it is an issue, which likely promotes inequitable conditions and the social conflict of different (basic) needs. Within this context, the dominant argument criticizes the growing demand for biofuels in the north to compromise food security and sovereignty in the south. In order to address these trade-offs and conflicts, the objective of this paper is the introduction of a conceptual framework of socio-environmental services. By expanding the construct of environmental services to explicitly include the social dimension, it shall accommodate for the fact that the provision of environmental services is often embedded in a complex system of global (economic, ecological as well as social) interdependencies. Recently, the concept of payments for environmental services (PES) has received much attention with respect to its potential contribution to both environmental sustainability and the economic alleviation of poverty. By linking the idea of payments for socio-environmental services (PSES) to the three functions of justice, its beneficial impact may be more fully tapped.

1. Introduction

> Farmers depend on and generate a wide range of ecosystem services. Their actions can enhance and degrade ecosystems. Through changes in land-use and production systems, agricultural producers can provide a better mix of ecosystem services, expanding the share of those characterized by positive externalities, to meet society's changing needs.
>
> [– FAO, 2007, p.10]

Agricultural landscapes have long been discussed with respect to their ambivalent role in providing ecosystem services and disservices at the same time (Björklund et al., 1999; Power, 2010). The Food and Agriculture Organization (FAO) of the United Nations for example stresses the fact that 'agriculture' constitutes both a notable source of the three major greenhouse gases (carbon dioxide, methane and nitrous oxide), while – given its carbon sequestration potential – concurrently serving as a carbon sink (FAO, 2007, pp.14 f.). Although meeting food demands remains the primary objective of agriculture, the cultivation of energy crops for biofuel production has added an additional component to the conventional production portfolio of the agricultural sector and thus further intensifies the challenges of widespread land use change and land grabbing. Two of the main driving forces behind the strong political promotion of biofuels are increasing concerns with respect to energy security as well as the objective to reduce greenhouse gas emissions and thus preserve ecosystem services (Brännlund et al., 2008; FAO, 2008, p.15; FAO, OECD, 2007; Fargione et al., 2008; Peters and Thielmann, 2008; WBGU, 2008).

Controversially discussed, past research in this context has focused on separate aspects such as, e.g., energy efficiency, the potential of significant CO_2 reductions as compared to fossil fuels and the effects of extensive monocultures (e.g., Ansel, 2009, p.245 ff.; FAO, 2008, p.5; Gasparatos, 2012; Scharlemann and Laurance, 2008; Schmer et al., 2008; World Bank, 2008).

In the context of conventional agricultural activity, the concept of ecosystem (or environmental) services[1] has often been resumed to provide a comprehensive analytical framework that integrates the emerging conflict between (primarily economic) production objectives and their resulting impact on natural resource depletion and ecosystem sustainability (see e.g., Björklund et al., 1999; Daniel et al., 2012; Gasparatos et al., 2011; Swift et al., 2004; Wunder, 2005).

While the classical understanding of agricultural ecosystem services, e.g., soil fertility, water household, nutrient supply, or biodiversity, has long been expanded to include ecological aspects of sustainability (e.g., contribution to climatic regulation and emission reduction of

* Corresponding author at: P.O. Box 601203, 14412 Potsdam, Germany. Tel.: +49 331 288 2672; fax: +49 331 288 2508.
E-mail addresses: Sandra.Venghaus@pik-potsdam.deKirsten (S. Venghaus), Kirsten.Selbmann@pik-potsdam.de (K. Selbmann).

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[1] For a semantic differentiation of these terms, see pp.4 ff.

greenhouse gases), biofuel production as a potentially ecological fueling alternative moves a further dimension of sustainability into the focus: the social.

Most strikingly reflected in the discussion about the moral justification of using potential food crops for fuel production (i.e., the conflict of "food vs. fuel"), the consideration of different food regimes in order to account for the structural inequality in global agriculture becomes imperative (McMichael, 2009a, 2009b). It has often been argued that the growing demand for biofuels in the north, compromises food security and sovereignty in southern countries while increasing famine in certain regions (Kaphengst et al., 2012; McMichael, 2010). The social argument, however, cannot be limited to rising world market prices for foods and the increasing relocation of biofuel production in developing and emerging countries. In many regions, the expansion of energy crop production has led to the increasing displacement of food production. This trend is especially problematic when it affects subsistence agriculture leaving the local population with the need to purchase expensive, imported foods produced elsewhere (McMichael, 2009a, pp.148 ff.).

If limited agricultural area prohibits the even satisfaction of needs and if the demand for sufficient food in poorer regions confronts the western standard of mobility in such an offensive way, then the production and use of biofuels can hardly meet its promise of *sustainable* progress, but instead aggravates unjust and inequitable conditions.

Consequently, the consideration of socio-environmental services as an adaptation to the concept of environmental services becomes inevitably necessary. The objective of this paper is thus the introduction of a theoretic framework of socio-environmental services, which is based on the classical theory of ecosystem services, but accommodates for the fact that many environmental services today are strongly embedded in a complex system of global (economic, ecological as well as social) interdependencies; its importance is further signified by the inequity of cost–benefit distribution between North and South (McMichael, 2009b). The global effects of biofuel production and use – as one example of an agricultural activity with a significant impact on environmental service provision – can thus hardly be reasonably analyzed without the clear and – above all – systematic consideration of social effects within their complex context.

The introduced concept of socio-environmental services contributes to the field of sustainability research by suggesting a framework, which formalizes the direct interdependence of social, ecological as well as economic sustainability, thus allowing an integrative analysis of the key factors, which currently impact the efficient and equitable allocation of global (natural as well as financial) resources. Aspects of consideration include, e.g., the protection of ecosystems, climate change mitigation, energy security, social justice, and poverty alleviation.

2. Background and Literature Review

2.1. Ecosystem and Environmental Services

> The changes that have been made to ecosystems have contributed to substantial net gains in human well-being and economic development, but these gains have been achieved at growing costs in the form of the degradation of many ecosystem services, increased risks of nonlinear changes, and the exacerbation of poverty for some groups of people.
>
> [– Millennium Ecosystem Assessment (MEA), 2005, p.1]

The provision and preservation of ecosystem services have long been subject to extensive scientific research (e.g., Bingham et al., 1995; Daily et al., 1997; Davidson, 2012; de Groot et al., 2002; Helliwell, 1969; King, 1966; Odum and Odum, 1972; Pearce, 1993; Swift et al., 2004; Turner, 1993). Defined as "the benefits people obtain from ecosystems" (Dempsey and Robertson, 2012; MEA, 2005, p.vii; Rapport et al., 1998, p.397;) or the "biological underpinnings essential to economic prosperity and other aspects of our well-being"(Daily et al., 1997, p.2), ecosystem services are generally classified into the four broad categories — (a) provisioning services, (b) regulating services, (c) cultural services and (d) supporting services (see e.g., FAO, 2007, p.43; Fisher et al., 2009, p.644; MEA, 2005, pp.28 ff.).

Most significantly shaped by the Millennium Ecosystem Assessment (MEA) in, 2005, research on ecosystem services has intensified since (Fisher et al., 2009, p.643) and resulted in the establishment of a tremendous number of policies and regulations for their preservation (e.g., Ottaviani, 2011, pp.15 ff.). During the past years, the original understanding of ecosystem services has increasingly been challenged as too narrow (e.g., Dempsey and Robertson, 2012; Fisher et al., 2009). Hence, several studies suggest various adaptations to the concept (e.g., Muradian et al., 2010; Pascual et al., 2010; Tacconi, 2012). Given the topic of our research, special focus in this paper will be set on its expansion to 'environmental services'. Although in the literature the terms ecosystem and environmental services have often been used interchangeably (e.g., Wunder, 2005, p.4), the delineation as assumed here considers environmental services as those services, which refer "specifically to the subset of ecosystem services characterized by externalities", i.e., 'off-site' effects (Swallow et al., 2007; acc. to FAO, 2007, p.6; Wunder, 2005, p.1). Environmental services thus allow the consideration of a much broader set of additional effects related to the classical bio-ecological properties, such as the inclusion of indirect (environmental as well as socio-economic) effects.

2.2. Agricultural Landscape as an Ecosystem

With a total land area of roughly 13 bn. hectares or "38% of Earth's terrestrial surface" (Foley et al., 2011, p.337), agricultural ecosystems are considered as the world's largest managed ecosystems (FAO, 2011, p.3; IUCN, 2008, pp.4 ff.; Power, 2010, p.2959). At the same time, by converting large regions into agricultural lands, the long tradition of human intervention has significantly imperiled the amounts of ecosystem services provided by these areas (Björklund et al., 1999, p.270; Daily et al., 1997; Foley et al., 2011, p.337). Given their role as both providers and consumers of ecosystem services (Björklund et al., 2012; Power, 2010), agricultural landscapes are especially sensitive to depletion effects such as, e.g., the deprivation of soil fertility or genetic diversity (Foley et al., 2011; Power, 2010). It can thus be argued that "farmers constitute the largest group of natural resource managers on earth. They both depend on and generate a wide array of ecosystem services. Their actions can enhance and degrade ecosystems" (FAO, 2007, p.5). Consequently, decisions with respect to agricultural intensification are made in consideration of food needs, market opportunities, as well as expected improvements in management efficiency associated with specialization (Swift et al., 2004, p.128). It is also this aspect that provides the reason for the past emphasis on provisioning services,[2] which generally constitute 'private goods', whereas regulating, supporting and cultural ecosystem (or environmental) services are often 'public goods' (characterized by non-rivalry in consumption and non-excludability), whose benefit cannot be confined to particular consumer groups (see e.g., European Communities, 2008, p.27; FAO, 2007, p.13; Power, 2010, pp.2967 f.; Swallow et al., 2009, p.1,). With different foci, e.g., on smallholders (Björklund et al., 2012, p.828) or support for neighboring natural ecosystems to maintain and improve environmental services (Power, 2010, p.2961), one of the remaining key challenges is the identification of effective incentives or policies that help minimize negative side-effects while contributing positively to meeting the increasing demand for agricultural produce (Björklund et al., 2012; Swallow et al., 2009, p.6).

[2] Provisioning services generally include ecosystem products (goods and services), which are of direct, tangible use to humans. Common examples include food, crops, water, energy (biomass fuels), biochemicals or pharmaceuticals (see e.g., MEA, 2005, pp.155 ff.).