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Commentary

Competition for land: A sociometabolic perspective

Helmut Haberl *

Institute of Social Ecology Vienna, Alpen-Adria Universitaet Klagenfurt, Wien, Graz, 1070 Wien, Schottenfeldgasse 29, Austria
Humboldt-Universität zu Berlin, Integrative Research Institute on Transformations in Human Environment Systems, Quartier Stadtmitte, Friedrichstraße 191, D-10117 Berlin, Germany

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ABSTRACT

Possible negative effects of increased competition for land include pressures on biodiversity, rising food prices and GHG emissions. However, neoclassical economists often highlight positive aspects of competition, e.g. increased efficiency and innovation. Competition for land occurs when several agents demand the same good or service produced from a limited area. It implies that when one agent acquires scarce resources from land, less resource is available for competing agents. The resource competed for is often not land but rather its function for biomass production, which may be supplanted by other inputs that raise yields. Increased competition may stimulate efficiency but negative environmental effects are likely in the absence of appropriate regulations. Competition between affluent countries with poor people in subsistence economies likely results in adverse social and development outcomes if not mitigated through effective policies. The socioecological metabolism approach is a framework to analyze land-related limits and functions in particular with respect to production and consumption of biomass and carbon sequestration. It can generate databases that consistently link land used with biomass flows which are useful in understanding interlinkages between different products and services and thereby help to analyze systemic feedbacks in the global land system.

1. Introduction

Motivated by surging prices of many agricultural products, competition for land has received increased attention (Coelho et al., 2012; Lambin and Meyfroidt, 2011; Haberl et al., 2014; Smith et al., 2010, 2014, in press). Concerns related to competition for land include environmental issues such as increasing pressure on forested areas and ecologically valuable, biologically diverse ecosystems. In addition, food prices, and therefore land rents, may increase as a result of drivers such as the rising food demand of the growing world population together with increased bioenergy demand and regulations to reduce losses of forest or other valuable ecosystems, which may constrain the expansion of farmland for food production (Popp et al., 2011; Wise et al., 2009). While rising prices of land or its products may benefit land owners/users, they negatively affect consumers and may reduce food security. Loss of forests or other carbon-rich ecosystems related to the area demand of additional bioenergy provision may result in increased greenhouse gas (GHG) emissions, thereby counteracting or even negating the stated aim of bioenergy policies to mitigate climate change (e.g., Creutzig et al., in press; Haberl, 2013; Searchinger et al., 2008; Smith et al., in press).

In this literature, competition for land is largely seen as detrimental, resulting in rising prices for agricultural products, reduced food security, loss of valuable ecosystems or GHG emissions (Coelho et al., 2012). Competition for land is a systemic phenomenon resulting from the interplay of the above-mentioned or other drivers (Smith et al., 2010, in press). Motivated by concerns over a "looming land scarcity" (Lambin and Meyfroidt, 2011), classifications for different types of competition for land have been proposed: production vs. production (e.g. food vs. fuel), production vs. conservation (e.g. food vs. nature conservation) or built-up or urban vs. production or conservation (Haberl et al., 2014).

Although scholars from both economics and ecology recognize potentially detrimental effects of competition, they also identify positive aspects, e.g., by exerting pressure to raise efficiency and foster innovation. Interestingly, such effects have so far not featured prominently in the discussion of competition for land, although they were not completely ignored. For example, it was argued that increased competition for land from growing bioenergy supply under the assumption that forest area is protected will stimulate technological progress in raising agricultural yields, albeit at higher monetary (Popp et al., 2012) and ecological (IAASTD, 2009; Smith et al., 2014) costs.

* Institute of Social Ecology Vienna, Alpen-Adria Universitaet Klagenfurt, Wien, Graz, 1070 Wien, Schottenfeldgasse 29, Austria.
E-mail address: helmut.haberl@aau.at.

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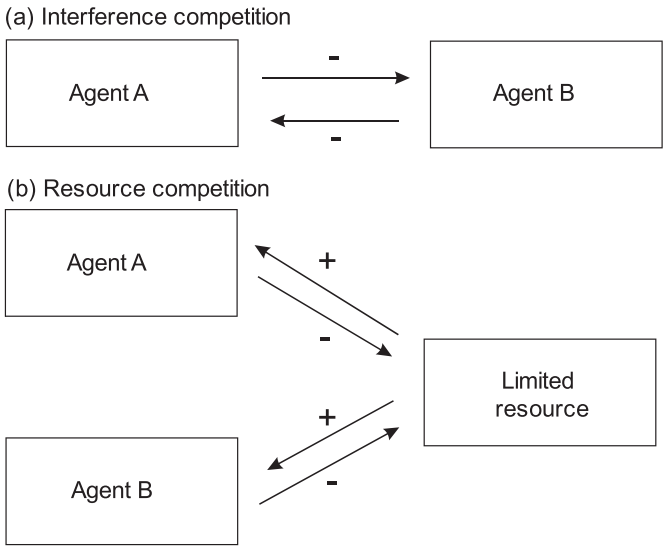

Fig. 1. Two meanings of the notion "competition" as used in the ecological literature, shown here in the simplest case with only two competing agents.
Source: own graph, after Birch, 1957; Passarge and Huisman, 2002.

This article aims to discuss the potential merits of the socioeconomic metabolism approach in analyzing competition for land. It starts by summarizing the meaning of competition in various disciplines, in particular ecology and economics, and relates it to land (Section 2). The potential contribution of a sociometabolic perspective to understanding competition for land is discussed in Section 3. Section 4 provides outlook and conclusions.

2. What is Competition for Land?

2.1. Competition in Ecology and Economics

The notion of competition is used in many scientific disciplines with widely varying meanings depending on the context. In this article, I focus on two concepts from the ecological literature, (a) interference competition and (b) resource competition (Fig. 1). In both concepts, competition includes a negative effect of one agent on another. Interference competition means that agents harm each other directly when trying to acquire a scarce resource. In resource competition, the negative effect results from reduced availability of the resource for the inferior competitor.

In ecology, "agents" may be individual organisms of the same species ("intraspecific competition") or different species ("interspecific competition"). Intraspecific competition is a density-dependent process that limits population growth, whereas interspecific competition is one of the main biotic interactions structuring biotic communities and playing an important role in evolutionary processes (Cain et al., 2008). Some detrimental direct interactions between organisms such as predation or parasitism are usually[1] excluded from the definition of competition (Birch, 1957), mainly because predator–prey and parasite–host relations mostly result in the coexistence of both species. In contrast, an important aim of ecologists is to understand the role of competition in structuring biological communities through what is called the "competitive exclusion principle," i.e. the assumption that among two species using the same resource in the same way, one species will outcompete the other – in other words, two species using the same resource in the same way cannot coexist (Gause, 1934; Hardin, 1960).[2] An important distinction is that between resources and factors: While factors (e.g. temperature) may affect organisms, they are not depleted — in contrast to resources such as water, nutrients, food, sunlight or space: if a resource is used or occupied by one organism, the availability of that resource for another organism is reduced by that amount.[3] While detrimental effects of competition on inferior competitors are recognized, the ecological literature also highlights some of its positive aspects, e.g. as part of evolutionary processes or in the regulation of populations in ecosystems (Cain et al., 2008).

In neoclassical economics, competition is cherished as the force guaranteeing that interactions of profit-maximizing, self-interested individuals on markets result in both productive and allocative efficiency. Competition is seen as Adam Smith's famous invisible hand in action, securing optimal use of scarce resources in meeting society's unlimited wants (Rohlf, 2008). Neoclassical economists usually distinguish situations of competition in "perfect markets" (numerous buyers and sellers with complete information on supply and demand prices trade homogenous goods) from "imperfect markets" where these assumptions are to some extent violated. The complementary notion of Schumpeterian "entrepreneurial competition" is focused on the role of "creative destruction" and innovation: successful introduction of new products by entrepreneurs allows them to escape competition for some period in which they can enjoy the benefits of being "temporary monopolists." This phase is, however, soon followed by imitation by other producers resulting in renewed competition that reduces monopoly rents. Entrepreneurial competition hence allows for (at least temporary) coexistence of cooperation and coordination (which are both involved in innovation) with competition (Breton, 1996).[4]

Because competition is seen as a key element of technological progress and economic efficiency, it is widely accepted that it should be promoted by the state through appropriate policies, e.g. by antitrust laws preventing monopolies hence enabling competition and by regulations ensuring market fairness and avoiding collusion (Molitor, 1992). One might say that, while they regard resource competition as benign, neoclassical economists tend to call for rules to exclude most forms of "interference competition" according to Fig. 1. Only for few markets would many neoclassical economists agree that they should be excluded from competition, e.g. in the case of products or services where economies of scale are large enough to justify natural monopolies (Sharkey, 1983), e.g. electricity grids, or for public goods that cannot be procured profitably by private companies (Rohlf, 2008).

However, not all economists agree that competition is overwhelmingly benign. Even neoclassical economists usually accept that markets fail to result in socially optimal outcomes when external costs are not properly reflected in prices (Rohlf, 2008). Ecological economists have suggested that international competition may result in a "race to the bottom" of social and environmental standards leading to inequality,

[1] Sometimes the notion of competition is used so broadly that it becomes more or less synonymous with "selection"; i.e. any process contributing to the "struggle for existence" would fall within that concept – a use of the notion that is, however, mostly seen to be too inclusive to be useful (Birch, 1957).

[2] This notion has been extended to the hypothesis that n species can co-exist on n resources in well-mixed habitats (Levin, 1970). Species may coexist, however, if they use the same resource differently as a result of "resource partitioning" (Cain et al., 2008). Later work has suggested that the frequency and severity of disturbances may alleviate such restrictions and allow more species to coexist, i.e. the "intermediate disturbance" hypothesis (Connell, 1978). Current work suggests that species interaction may produce unstable or chaotic dynamics and equilibrium may be the exception rather than the rule in ecosystems; hence competitive exclusion in equilibrium systems may be a lot less ubiquitous than previously thought (Passarge and Huisman, 2002; Sommer and Worm, 2002).

[3] A substance may be a resource or a factor, depending on the circumstances. For example, although animals use oxygen it usually does not become scarce (and hence is not a limited resource) under free air conditions — but in the soil it is a limited resource for which competition may be intensive (Cain et al., 2008).

[4] The economic competition framework has been extended to the political sphere in a concept claiming that governments compete in several ways: between its own components, among each other, as well as with private actors (companies) in supplying goods and services (Breton, 1996).