

COMMENTARY

Rediscovering place and accounting space: how to re-embed the human economy

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Abstract

This article proposes to move beyond monetary assessments of ecosystem services in order to counteract an important mechanism behind their current undervaluation: the process of disembedding. Disembedding describes the influence of modernity on social relationships. It also clarifies how Human-Nature relationships have been affected. Modern societies have become disembedded from the context of local ecosystems, resulting in diminishing knowledge of, and attention to, ecosystem services. The emergence of general purpose money is presented as a key factor in the disembedding process because it has brought with it the message of substitutability and the possibility of an increasing appropriation of distant ecosystems. The paper argues that, in order to re-embed societies instead of pursuing current trends, the limits to human expansion in the biosphere have to be made visible. Therefore, a strategy of re-embedding the human economy into the life-support context is put forward, where bioregional thought and its intention of rediscovering, mapping, and 're-inhabiting' local places is combined with the ecological footprint tool. In contrast to monetary assessments of ecosystem services, the ecological footprint assessment presents the limits of the services' availability, and thus clarifies the fact that increased appropriation of bio-productive space normally involves increasing pressure on remaining ecosystems. © 1999 Elsevier Science B.V. All rights reserved.

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1. Introduction

In recent years, much research has focused on the value of ecosystem services. Considerable discussion has been generated by an estimate that

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the monetary value of the Earth's ecosystem services may be more than one third larger than the global gross domestic product (Costanza et al., 1997). Obviously, current economic decision-making severely neglects the value of ecosystem services to human welfare. However, we doubt that monetary assessment of nature's functions will actually be able to bring us any closer to sustainability. As most of our colleagues acknowledge, it is "eminently clear that the total value of ecosystem services is infinite—we could not possibly live without them" (Daily, 1997, p. 366). Nobody would thus claim that concerned researchers are seriously looking for the true monetary value of ecosystem services. Rather, the aim of their work is to inform people about something that they should already know: that we are inexorably dependent on earth's life-support system. If the objective is to cure this modern ignorance, research about its cause—to our minds the real problem—should be decisive. In this article we present the problem from this perspective and also discuss how to move beyond monetary measures of ecosystem services in order to provide more accurate feedback to economic systems.

2. What is the problem?

"I am suggesting that the notion of global environment, far from marking humanity's reintegration into the world, signals the culmination of a process of separation." (Ingold, 1993, p. 31)

If we were asked to define a prime reason for the widespread ignorance of ecosystem services, our answer would be disembeddedness of society from nature. The concept of disembedding or decontextualization is well known in the disciplines of sociology and anthropology and usually refers to a process whereby social relationships are lifted out of local contexts of interaction and restructured "across indefinite spans of time-space" (Giddens, 1991, p. 21). The shift from *Gemeinschaft* (community) to *Gesellschaft* (society), which is fundamental to the whole phenomenon of modernity, is a typical example of

this development (Polanyi, 1957; Tönnies, 1887). *Gemeinschaft* is defined as a natural and unplanned social union of people, who depend on each other like the organs of an organism and perceive themselves as united for good and for bad. In *Gemeinschaft*, human exchange is characterized by reciprocity and is dependent on the context (place and people involved). This economy of sharing contrasts with *Gesellschaft*, where people perceive themselves as separated and human exchange is not determined by local context or community goals. In *Gesellschaft*, economic rationality, i.e. the impetus to maximize economic profit, has taken precedence over social bonds (Sahlins, 1972).

Ecology is as much the study of relationships as sociology. A plausible conclusion is that modernization has also had a considerable influence on the Human-Nature relationships and that the process of disembedding is a key to understanding this development as well. It can be said that our relationships with ecosystem services have equally been 'lifted out' of the local context and remodeled across unfixed spans of time-space. We now appropriate distant ecosystem services in time (i.e. since we draw on natural capital which will result in decreasing interest in the future) and space (i.e. through long-distance trade). Hence, through modernization, previously important relationships between populations and local ecosystems are losing their significance and local lifestyles are becoming less adapted to the existing context, e.g. the specific soil, climate, and culture.

People living in cities illustrate very well the effects of the disembedding process. Many urban inhabitants live removed from "any sense of the limits of the land", and are "completely unaware of how their food and other commodities were produced" (Worster, 1988, p. 14). In addition, through exchanges between the urban population and the dwellers in what remains of the land, the process of decontextualization continues its pace. Neo-classical economic theories can be seen as both a result of, and a further contribution to, this process. One can easily imagine that these economic theories have been formulated by city dwellers, in full conformity with their everyday experience of commodities flowing into town.

These theories depict the economic process as never-ending cycles of capital, producing commodities (resulting in more capital), without taking into account the increasing demand on limited ecosystem services. Simultaneously, rural dwellers who live in closer contact with threatened ecosystem services (farmers, fishermen, etc.), have less incentive to protect them as the returns from the distant market allow for the replacing of both local practices and natural assets with expert knowledge and industrial inputs (chemical fertilizers, pesticides, oil-fueled trawlers to go farther offshore etc.).

Disembedding leads to diminishing attention to feedback signals from local ecosystems. This contrasts sharply against certain anthropologists' examples of indigenous peoples living in reciprocal relationships, both with each other and their surroundings (Ingold, 1996). Reciprocal relationships depend on the idea that whatever is given will return to you, your kin or descendants, some day, in one way or another. Such an idea can be reinforced by everyday experience as long as you live in a local context where you depend on healthy relationships with all life surrounding you. In modern societies, through the process of disembedding, these relationships have become less important and the reciprocal attitude has gradually given way to modern perceptions of a one-way causality where nature is regarded as a passive object. With this modern attitude, it is "no wonder that we 'give' pollutants to nature" (Norgaard, 1994, p. 171).

2.1. *New approaches needed*

If the value of ecosystem services has been obscured and ignored through the modernization process, how is it then to be rediscovered? In fact, although delayed and diffused by the distance between consumers and ecosystem services, the effects on ecosystems of applying the basic theoretical assumptions of neo-classical economics are gradually being perceived. Researchers are now inventing new economic terms to inform the public about the importance of our life-support system. For example, ecological economists insist that 'natural capital' must not be diminished if we

are to be able to live off its 'interest'. The very notion of 'ecosystem services', which has found its way also into the discourse of this article, is used to transmit this crucial change of attitude. Despite the apparent colonization of ecology by an economic vocabulary, these efforts to emphasize nature's functions are commendable. Still, in order to disrupt the ongoing process, our change has to be more fundamental than that. Let us explain: When considering what the ingredients are of the disembedding process, some of the consequences¹ of which we now wish to abate, we will discover that the emergence of money² as a dominant medium for human exchange has played a crucial role. This is because the inherent message of money is a message of substitutability, and what is substitutable is also out of context. Money has made possible the substitution of impersonal market exchanges for social bonds and of industrial inputs for local natural services. Of course, we realize today what fooled us all: money is not a substitute for nature's services—what it did was to displace our demands on these services in time and space, particularly through the increasing appropriation of distant places, which were subject to "the shift from local ecosystem to regional hinterland and global economy" (Cronon, 1992, p. 267; Catton, 1980).

Hence, realizing the impossibility of substituting human-made capital for our life support system, we have to act accordingly. Otherwise, we will find ourselves doing what Einstein warned us not to do: trying to solve the problem with the thinking that created it (Watzlawick et al., 1974).

¹ It is important to stress the fact that all possible effects of the disembedding process are not necessarily to be regarded as negative. Among examples of, to our minds, indisputable progress are equality, freedom and universal rights (although they should be combined with equally 'universal' responsibilities). As will be shown also, the making of modern maps, which requires the power of abstraction of a disembedded mind, may be an decisive tool in the struggle for a sustainable future.

² Here, we focus on general purpose money, which means a universally accepted medium of exchange, in opposition to special purpose money, for which only some goods and services can be bought (Seymour-Smith, 1986: p. 198–199; Hornborg, 1998).

In order to avoid this error of solving problems with more of the same, alternate approaches are needed: in the following pages we present two approaches which may complement each other very well.

3. Rediscovering place: the bioregional framework

Today, there is an awakened interest in indigenous cultures, particularly because of their often sustainable interaction with the ecosystems they depend (or depended) upon (Vecsey, 1980). Many quotations of indigenous elders underscore strong spiritual attachment to their land. According to a woman of the Okanagan native group in British Columbia, the word for language in Okanagan also means ‘our place on the land’ and body means ‘the land-dreaming capacity’ (Armstrong 1996, p. 465).³

There are many reasons to believe that ecosystem services would be better acknowledged and protected had people only regained some sense of place. The importance of reinhabiting local places is also a recurrent argument in the discussion of alternatives to the actual course of development (globalization, urbanization, centralization). Romanticism, back-to-the-land movements and many other reactions against disconnection and uprootedness preceded the bioregional movement, and today the necessity to reconnect with the land is gaining support both for scientific and psychological reasons (Roszak et al., 1995).

3.1. The concept of bioregionalism

“The aim of bioregionalism is to help our human cultural, political and social structures harmonize with natural systems.” (Plant, 1990, p. 13)

³ However, caution is appropriate when referring to such translated quotations. The way they are interpreted may often tell more about the modernized observer’s own alienation than they can inform about the way the person quoted perceives the world.

The word bioregionalism was coined in 1974 by Allen van Newkirk in Canada and spread rapidly throughout North America. Its advocates define the meaning of bioregionalism as follows: bio means life, regional means within a defined area, and ism is the human part of it; how we study, live in and act as a part of a bioregion. “A bioregion can be determined initially through the use of climatology, physiography, animal and plant geography, natural history and other descriptive natural sciences. The final boundaries of a bioregion are best described by the people who have lived within it, through human recognition of the realities of living-in-place” (Berg and Dasmann, 1990, p. 35). Inspired by native practices, bioregionalists argue that community, human and natural, is the scale at which living should be done.⁴ On this scale, the necessary knowledge for sustainable living-in-place will develop, building both on local traditions and new discoveries of assets at hand. Moreover, people who live-in-place are also those who should make the decisions affecting their region, as they will have the best sense of what is right for that region. They not only have the most intimate knowledge about it, but are also the ones who have the highest stakes in the outcome of their decisions. In order for bioregional decision making to be possible, both political and economic power needs to be devolved to the community level, a process which should be driven from the bottom up. Economic power is gained through increased self-sufficiency of the bioregion and mutual aid among its inhabitants, and political power is achieved as people gradually take responsibility for their place and local relationships. In North America, there are more than one hundred bioregional groups, the activities of which extend to both the restoration of wetlands and the development of local exchange and trading systems (LETS).

⁴ Community from an ecological perspective is “any naturally-occurring group of organisms which occupy a common environment” (Allaby, 1994, p. 83). When talking about community from an exclusively human perspective, we both refer to “people living in one locality” and “the locality in which they live” (Makins, 1994, p. 327).

According to bioregional geographer David McTaggart, bioregionalism should neither be interpreted as an ideology nor as a neutral scientific tool. Rather, it can be explained as certain values that arise as one decides to assume responsibility for one's place. McTaggart (1993, p. 308) proposes to:

1. "Recognize that 'society' and 'environment' are integrated elements in a single complex."
2. "Recognize that complex entities (regions or ecosystems, for example) are 'active systems' in their own right, and are not the equivalent of the sum of their parts."
3. "Recognize that the network of relationships (internal and external) which integrate complex systems are multi-faceted and reciprocal, and that as a consequence a 'cause-effect' analytical framework is inadequate."
4. "Understand that transition in the global or local 'web of life' is a normal condition for which the human species now carries a large measure of responsibility."
5. "Be aware that community responsibility for place operates through the mechanism of a collective social or cultural consciousness in which are embedded a set of normative values; and that constructive bioregional activity is designed to respond to and condition these values in such a manner that actions planned or carried out will promote certain specific and desired qualities, such as community welfare, ecosystem soundness, restoration and conservation."
6. "Recognize that the complex we refer to as a 'bioregion' (often thought of simply as 'place') is not an 'object' or 'thing' (if by this we mean that it has no capacity for self-development); but that it is a self-modifying entity which uses and processes information and is therefore a virtual 'terrain of consciousness'."

These lines offer a variety of approaches for bioregional thought and practice, many of which are reactions against the historical process of disembedding and its consequences.

3.2. Learning approaches for bioregional development

"Bioregionalism is about bringing that which has been separated back together." (Aberley, 1993, p. 3)

For bioregionalists, documenting one's place on a personal map is a necessary step between talking about it and, more specifically, becoming engaged in it. The art of bioregional mapping is taught in several books, but an all-pervading theme is that everybody has the right and can achieve the ability to map his or her own place. Personal (i.e. non-scientific), bioregional mapping is a way to rediscover home and to "fill the world again with personal and communal descriptions of time and space" (Aberley, 1993, p. 6). However, as mapping skills evolve, bioregionalists use them also to document destruction of land and culture, to discover important features in local development issues, and to communicate visions of alternative land use in the bioregion at hand. Many bioregionalists use computer based geographic information systems (GIS) to facilitate the combination of different types of information carrying a geographic component. The aim of many of the bioregional projects that make use of GIS is to locate areas which are crucial for various ecosystem services, and to find out which of these are currently protected or actually threatened by human activities.⁵ Effective investigations can also be made regarding linkages between land ownership, land use, threatened ecosystem services, infrastructure, price of land, wealth distribution, etc. (Aberley, 1993).

When dealing with the intermingling of anthropogenic and biocentric factors of change, the notion of co-evolution is useful. Initially confined to co-evolutionary biology, this term has been introduced as a way of explaining how complex systems interact with each other, without excluding either cultural or biophysical factors. The new use of the concept was introduced by Norgaard

⁵ This geographic approach called GAP, is also used in many state conservation programs (for more information see Noss, 1987).

(1994) as a means of describing the evolution of cultural phenomena. Other scholars acknowledge the necessity of developing a co-evolutionary approach when studying human relationships to ecosystem services (Berkes and Folke, 1998). Regarding current global developments, it is argued that “we need to find out about the relations between the components of change” (Vitousek, 1994, p. 1871). Indeed, this is what bioregionalists have been trying to do for quite a long time now. The fact that one of the early bioregional reviews was called ‘Co-evolution Quarterly’ suggests how intimately the bioregional social movement is linked to a more comprehensive scientific paradigm which is now emerging.

4. Bioregionalism in a disembedded world

An interesting phenomenon to be discovered while investigating bioregions is that quite a few of the factors that have an influence on a studied region cannot be put on a local map. Some of them cannot even be put on the map of the entire Earth. David McTaggart calls these factors ‘non-localized’ and refers to phenomena such as ideology, economic influence, and politics (McTaggart, 1993, p. 116). The existence of these factors reminds us of the larger context of bioregions, which makes the project of re-embedding in local ecosystems quite overwhelming. Of course, to carry out research within a bioregional framework may help protect local ecosystem services while counteracting the processes which made their current underestimation possible. However, it would be naive to think that people all around the world would suddenly choose to reinhabit their bioregion and rediscover local ecosystem services. Prevailing societal forces constitute much too powerful apparatus which entice communities and individuals to develop in the opposite direction.

Also, there are reasons to believe that local environmental movements do not always create sustainable solutions to locally perceived problems. Often they seem to concentrate on local land use issues, e.g., the protection of local wildlife reserves and wetlands against all kinds of exploitation, while the effects of local activities on other

areas are less attended. For instance, there are cases where communities have refused planting forests for bioenergy in order to protect the biological diversity of the local region. From a truly bioregional perspective this behavior can be completely justifiable only if the opponents of the energy forest, in return, are prepared to keep their energy consumption within the local capacity without an energy forest. If they do not, their opposition may result in yet another transfer of environmental problems and resource extraction from the richer to the poorer parts of the world.

Moreover, the existence of large cities complicates the bioregional vision considerably. In some regions, living within the means of nature seems impossible, as there simply is not enough space for inhabitants to grow their own food and fibers. How are they to rediscover the biophysical context of their activities and understand the importance of safeguarding those distant ecosystem services from which their daily supplies are delivered?

Among ecologists, there is a recurrent discussion about the difficulties of finding an appropriate scale for the study of ecosystems. Simon Levin develops this topic and states in point of fact that there is no such thing as an appropriate scale on which to describe populations or ecosystems. Everything depends on the eye of the observer since “each species observes the environment on its own unique suite of scales of space and time” (Levin, 1992; p. 1945). A natural question then follows: is there also a unique scale of space and time on which the human species best observes its environment? According to numerous investigations, indigenous people have co-evolved with ecosystems on a local scale which often corresponds to what can be called bioregions (Dasmann, 1988). However, such a world is quite distant, and many of us can be said to belong to the biosphere people rather than ecosystem people (*ibid.*). Does the shift from ecosystem people to biosphere people indicate that we have developed the capacity of co-evolving sustainably with ecosystems on a global scale? In other words, are biosphere people able to observe and adapt to feedback signals from the whole biosphere?

Evidence in support of this assumption is conspicuously absent. On the contrary, continuous

reports of the state of the world seem to indicate that biosphere people are driving us all to ruin—apparently because of people’s inability both to perceive and react properly to the signals from the global life-support system. Perhaps, as Ingold (1993) felt regarding the term global environment, the disembedding process has even managed to convey the human mind from the bioregion right out into empty space. This would mean that humans have not only stopped perceiving themselves as parts of local places, they have also mentally disconnected themselves from the context of the biosphere. Even evolutionary optimists would probably agree with the fact that the human mind—and economy—need to be re-embedded, if not in a bioregional, then at least in a biospheric context.

5. Accounting space: the ecological footprint tool

In order to choose re-embedding instead of continuing current trends, ways of making limits to human expansion visible are needed. Preferably, our approaches should be relevant for both bioregional and biosphere perspectives. The concept of appropriated carrying capacity, or ecological footprint, offers such an approach.

5.1. Making the limits to human expansion visible

The ecological footprint concept was conceived by Wackernagel and Rees (1996) to estimate how much biologically productive space people use to sustain themselves. Ecological footprint calculations are based on two assumptions: first, it is possible to keep track of most of the resources we consume and many of the wastes we generate; secondly, most of these resource and waste flows can be converted to a corresponding biologically productive area. Thus, the ecological footprint of any defined population (from a single individual to a whole city or country) is the total area of biologically productive land and water occupied exclusively to produce all the resources consumed and to assimilate all the wastes generated by that population, using prevailing technology. Some of the appropriated spaces may be found within the

local region, while others will be in other countries or even on other continents.

As early as 1971, modern economists started to point out that all economic activity inexorably brings about consumption of exergy⁶, i.e. a conversion of high grade matter and energy into waste products and heat (Georgescu-Roegen, 1971). This is an uncontradicted fact, based on the second law of thermodynamics. Still, although it is a matter of vital importance, the concept of exergy has never entered the public discourse on limits to growth. The reasons for this can be found in its obscurity for the lay public and in the lack of an absolute to compare it with. What the ecological footprint does is to focus attention on the limited surface of Planet Earth, where the transformation of solar energy into essential, high-grade matter and energy is performed. The biosphere’s potential to transform solar energy into living matter is considered to be the most limiting factor for the human economy. It is scarcer than the solar radiation (which powers these biological processes), non-renewable resources (which can be concentrated by use of energy), and money (which represents human preferences and some of the services people get out of the biosphere’s productivity). In footprint calculations, the results can be related to this limiting factor, expressed in bioproductive world average land.

5.2. Visualizing the links between local lifestyle and global change

According to Vitousek et al. (1997)—p. 494, “most aspects of the structure and functioning of Earth’s ecosystems cannot be understood without accounting for the strong, often dominant influence of humanity”. Human impact on the global scale is the corollary of three processes: increasing carbon dioxide in the atmosphere because of fossil fuel consumption, increased fixation of nitrogen through the production of industrial fertilizer, and

⁶ The first complete definition of the term, exergy, was given by H.D. Baehr (1965); although it is clear that it is a central concept in the work of Georgescu-Roegen, he did not use the word.

Table 1

Comparison of the average ecological footprint in Malmöhus county to the biocapacity in the county and the world (1994 data)^a

Categories (numbers in hectares per capita)	Ecological footprint	Existing bio-capacity	
		In Malmöhus county	On the planet
Land for CO ₂ absorption	2.7	0.00	0.00
Arable land	1.2	1.64	0.74
Pasture	0.8	0.53	0.33
Forest	1.6	0.56	1.00
Built-up area	0.4	0.51	0.18
Sea	0.3	0.13	0.12
Total	7.1	3.4	2.4

^a Per capita areas are expressed in hectares of bioproductive world average land. Modified from Wackernagel et al., 1998.

significant land use and land cover changes. The latter may be “the single most important of the many interacting components of global change affecting ecological systems” (Vitousek, 1994, p. 1867).

The ecological footprint makes it possible to link all three processes to a primary cause, i.e. human consumption. The aspect of human-induced increase in carbon dioxide in the atmosphere is included in footprint assessments by calculating the area of newly planted forest that is required for the sequestration of the CO₂ released by combustion of fossil fuel. In the latest studies, attempts were made to include ecological capacities necessary for absorbing nitrogen and phosphorous leaching from human sources such as agriculture and cities (Folke et al., 1997; Wackernagel et al., 1998). Connections between resource use and current global land use changes are made explicit by accounting for the corresponding appropriation of three major categories: arable land, pasture, and forest. Appropriation of sea space through consumption of fish and fish dependent food production has also been considered in footprint studies (Folke and Kautsky, 1989; Wackernagel et al., 1998). Further, as cities grow on arable land, loss of biological productivity is represented by the concurrent expansion of built-up land.

For example, we have estimated ecological appropriations and the available biological capacity in Sweden at the national, county and watershed level by use of published government statistics (Wackernagel et al., 1998). Table 1 shows, in

different categories, the amount of biological productive capacity used by the average person in Malmöhus county in southern Sweden. This is compared to the biological capacity both at the county and the global level. As becomes obvious, this county could not even provide half of the ecological services appropriated by its inhabitants. Moreover, this estimate shows that the average inhabitant of Malmöhus county appropriates more than three times as much biocapacity than what exists per capita in the world. Please note that these figures underestimate the true footprint of the population, since some ecological impacts are not included. Also, biocapacities are overestimates, since they build on the assumption that industrial yields are sustainable. Moreover, a substantial amount of the existing biocapacity should be left unused for biodiversity preservation.

The ecological footprint does not identify where in the world system the consequences of our appropriation of space will be visible. However, increased appropriation of space logically involves increasing pressure on the remaining productive space, and thereby diminishing productive areas for economically weaker groups and other species. Consequently, the results of ecological footprint analyses of most westernized societies serve to point out that unless personal footprints are reduced, one should not be surprised by, or condemn, the escalating conflicts over land rights, overfishing, overharvesting of natural resources, or the accelerating loss of topsoil because of unsustainable farming practices on ever more marginal lands.

6. Bioregions and biosphere: working on multiple scales

As stated earlier, bioregionalism is about re-embedding human living in local places. It is argued that people who live-in-place, in the long run, are those who are most capable of making wise decisions about their region. However, the re-embedding of human communities in local ecosystems is not a guarantee for healthier ecosystems and increased biodiversity. The health of local life-support systems may even decrease in certain places because of increased pressure on the land for local sustenance. Even in a more bioregional world, local solutions may be erroneous, but as regional economies would be more independent of each other, the effects of human mistakes would be much smaller, felt more quickly, and therefore should be more reversible. This is why we consider bioregionalism a better precautionary alternative than current development, which by tightly linking all human activities, puts at risk all of them at once. Together with continuous local capacity assessment, the ecological footprint calculations may assist in defining a sustainable size for the economy within chosen boundaries and document potentially destructive overshoot. In this way, the ecological footprint tool may make the transition to a more self-sustaining region both easier and safer to achieve. For this purpose, on the contrary, current monetary assessments of ecosystem services may not be sufficiently accurate.

Nevertheless, while having living-in-place as a goal, one still has to face a reality which has a global scope. In order to promote re-embedding, the struggle has to be pursued on the biospheric level as well as on the bioregional one, and for this to be possible, a common vocabulary is needed. Consequently, we agree with researchers who, in their attempt to make information about the value of ecosystem services heard above the noise of ‘buyers and sellers’ on the global market, affirm that “a common currency helps to inform the decision-making process” (Daily, 1997, p. 10). Indeed, to re-embed decision-making in the context of a limited biosphere, we will need a common currency; but this common currency needs to

be related to an absolute. Human economy, irrespective of scale, depends on the provision of ecosystem services, provided by biological processes that require space. In the assessment of the appropriation of productive space, the ecological footprint stresses the limits of those services’ availability as opposed to monetary measures which will only inform about the relative value for its users. The accounting for demand as compared to supply of bio-productive land may become as necessary at the global as at the local level. Consequently, the footprint tool can be useful both for ‘global managers’ and for those who embrace uncertainty and opt for the ‘safe-fail’⁷ solution of bioregionalism.

7. Conclusion

In this paper we have discussed the role of disembedding as a driving force in the ongoing destruction of Earth’s life-support system. We argue that monetary assessments of ecosystem services may well challenge prevailing economic theories, but do not present a cure for disembeddedness. Such assessments neither inform about limits to human expansion, nor contradict the idea of substitutability, a crucial component in the disembedding process. As has been shown, disembeddedness of society from nature threatens nature’s services (and thus human survival) in many ways. For instance, under the influence of expert systems and market exchanges, rural people are losing the knowledge of, and attentiveness to, local ecosystem services. Moreover, growing numbers of people who are geographically distanced from the production of ecosystem services have no incentives to reduce the impact of their consumption, shielded as they are from the negative consequences of human expansion. The concept of bioregionalism may assist in rediscovering and reestablishing relationships with nature on a local

⁷ is used in opposition to the term fail-safe, which means that something is unlikely to go wrong, foolproof. Rather than trying to reach optimal control, a safe-fail solution allows for failures to happen, but organises in ways that reduce the impact of these unforeseen failures, in time and space.

scale. However, we also need a common vocabulary for safeguarding ecosystem services on a global scale. Because rapid changes in land use present one of the most pervasive factors threatening global ecosystem services, the concept of appropriated space may offer such a common vocabulary. With its assessments of appropriated space, the ecological footprint is useful, not only for fathoming the competing uses of the surface of the Earth, but also for understanding its implications for nature's functions. The ecological footprint tool and the bioregional concept may thus be complementary in the re-embedding endeavor; the ecological footprint tool by making us realize and monitor our dependence and influence on ecosystem services at all scales up to and including a global perspective, and bioregionalism by promoting societies where people are re-embedded in local ecosystems and attentive to their feedback.

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