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Commentary

# Economists, time to team up with the ecologists!

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ABSTRACT

Bioeconomic modeling is an increasingly relevant meeting arena for economists and ecologists. A majority of the growing literature, however, is written by economists alone and not with ecologists in true interdisciplinary teamwork. Physical distance between research institutions is no longer a reasonable justification, and I argue that, in practice, neither do the more fundamental philosophical oppositions present any real hindrance to teamwork. I summarize these oppositions in order of increasing magnitude as: 1) the axiom, held by many ecologists, of 'irreducible complexity of ecosystem functioning', which is avoided simply because the ecological 'whole' (as opposed to its 'parts') is not an element of most realistic modeling scenarios; 2) the axiom, also held by many ecologists, of 'the precautionary principle', which mainly surfaces at the applied end of natural resource management, and thereby should not prevent economists and ecologists from jointly building the models necessary for the final decision making; and 3) the economists' axiom of 'the tradability principle', which is harder to overcome as it demands value-based practical compromises from both parties. Even this may be solved, however, provided the economists accept non-marketable components in the model (e.g. by using restriction terms based on ecology), and the ecologists accept a final model output measured in terms of monetary value. The easiest candidates for interdisciplinary teamwork in bioeconomics are therefore researchers who acknowledge ethical relativism. As bioeconomics presently functions mainly as an arena for economists, I say the responsibility for initiating interdisciplinary teamwork rests most heavily on their shoulders.



## 1. In Opposition

Traditionally, ecology and economics are bipolar research fields. Practitioners from the two fields often study the same natural resources, but tackle their task from quite opposite ideological and practical perspectives. Still, with today's widespread consensus on the ideal of sustainable management ("*Meeting the needs of the present without compromising the ability of future generations to meet their own needs*", WCED, 1987), it is inevitable that the two groups have to interact. The anticipated "times of energy scarcity" makes the interaction even more pressing (Day et al., 2009). One increasingly relevant meeting arena for economists and ecologists is bioeconomic modeling, a practice from the field of economics that may be principally and epistemologically acceptable to both parties. The literature on the subject is growing: the search string 'bio-economic* OR bioeconomic*' in the ISI Web of Knowledge[SM] database brings up 307 references pre-dating the year 2000 (7.0 per year, starting in 1956) and 572 published in the present millennium (60.2 per year, as of June 2009). Unfortunately, however, only a minority of the publications are the results of true interdisciplinary collaboration. Most seem to be written by economists, not by teams of economists and ecologists. Why the lack of teamwork? Although there likely are far more economists than ecologists in the world, the latter group is not so scarce that this can be a major limiting factor.

One simple proximate cause may be that the two groups seldom are represented within the same research departments. It takes more effort to initiate collaboration with someone working at a physical distance from you. In the few institutions that do interdisciplinary teamwork on a regular basis, economists and ecologists normally work side by side within the same corridors (but see e.g. Sweden's Beijer Institute of Ecological Economics, which collaborates extensively with researchers across several fields and institutions). Nevertheless, in today's information era, physical distance is no longer a reasonable justification for absence of teamwork. Distant communication is both fast and easy, and the flow of information between institutions may be as instant as the flow within the institute corridor.

I believe the ultimate cause of lack of collaboration between ecologists and economists, is the bipolarity in what Joseph Schumpeter [1883–1950] would call their "pre-analytic visions". A pre-requisite for researchers from bipolar fields to collaborate productively is to acknowledge such eventual oppositions. Although there are various levels of potential oppositions between ecologists and economists, arguably the most relevant are those stemming from the following three prevalent field-specific maxims (here summarized in increasing order of magnitude): 1) the axiom, held by many ecologists, of

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'irreducible complexity of ecosystem functioning'; 2) the axiom, also held by many ecologists, of 'the precautionary principle'; and 3) the axiom, held by economists, of 'the tradability principle'. In this paper I argue that in the majority of bioeconomic modeling scenarios none of these oppositions are incommensurable hindrances to interdisciplinary teamwork among ecologists and economists, provided those involved are willing to compromise.

## 2. Recent Roots, Early Divergence

Both ecology and economics are relatively new research fields, even though ecological and economic principles were already being discussed by early philosophers, e.g. Aristotle [384–322 BCE] on economy in his work *Politics* (Jowett, 2000), and Aristotle's student Theophrastus [370–c.285 BCE] on ecology in his various works on botany (Ramalay, 1940). Ecology as a scientific term was founded by the German biologist Ernst Haeckel [1834–1919] and the Danish botanist Eugenius Warming [1841–1924] in the 1860s (Goodland, 1975). Adam Smith [1723–1790] is broadly referred to as the originator of economics (Pressman, 1999), specifically his 1776 series *The Wealth of Nations*, which has been labeled "the effective birth of economics as a separate discipline" (Blaug, 2007). Ecology and economics both evolved at the time when science parted from philosophy and the 'scientific method' emerged with fairly broad consensus (Butterfield, 1965). Accordingly, neither can claim superiority over the other on the grounds of historical maturity.

From their literal identities alone, it seems at first that ecologists and economists have more in common than not. The indiscriminate *eco* forms the terminological basis of both terms. *Eco* stems from Greek and is typically translated as *household* in the English language. Thus, ecologists and economists both include in their name a metaphor that implies they are involved with systems (as opposed to isolated elements)[1]. With the suffixes of 'ecology' and 'economics', however, the common metaphor diverges into different actions: *-logy* and *-nomy* are typically translated by ecologists and economists themselves to *knowledge* and *manage*, respectively. Although the rational interrelationship between knowledge and management (one who wishes to manage must also have knowledge) is acknowledged by both ecologists and economists, an opposition emerges through the syllables' value associations. These represent the core of the contrasting ethical beliefs of the majority of the two fields' practitioners. Ecologists and economists tend to be positioned relatively far apart on the anthropocentric–biocentric ethical axis.

## 3. Viewing the World from Different Centers

Arguably, in Western cultures anthropocentric ethical views are, both historically and currently, more widely distributed than biocentric views. 'Arguably' because centrisms do change over time. Today there is a wide range of anthropocentric ethics, from traditional utilitarianism to newer environmentalism bordering biocentrism (like the *Deep Economy*, McKibben, 2007). Within anthropocentrism, an illustrating example of starkly contrasting views on man's role in relation to other species, is Peter Singer [1946–] versus the Kantian ethics, i.e. the divergence between assigning intrinsic value to animals other than humans versus assigning values to these animals only on the grounds of their worth to us.

Biocentrism, on the other hand, is relatively recently defined in the western cultures, originating as late as the Victorian era 1837–1901 (Worster, 1994). Although not yet as diverse, biocentrism still has branched off from several sources, e.g. the 'deep ecology' of Arne Næss [1912–2009] and the 'Ehrfrucht vor dem Leben' of Albert Schweitzer [1875–1965]. In its purest form, biocentrism equals the value of all life[2]. Most branches of biocentrism also consider abiotic factors integral to the ethics on living organisms, but there are variations in emphasis on individual life versus holistic ecosystem functioning (the latter exemplified by 'Gaia', Lovelock, 1979). What all branches of biocentrism have in common, and which differentiates them from anthropocentrism, is the fact that they do not consider benefit to humans or humanity to be the ultimate criterion for ethical decisions.

The personal ideological views of ecologists and economists influence both their selection of research topic in the first place, and their choice of factors to include or emphasize in their actual research. Consequently, two models for the same basic natural resource problem built by the two individual parties may turn out to have nothing more common than having the same subject under study. That practically sums up why the society needs practitioners to work interdisciplinarily.

## 4. Bridging the Gap with Bioeconomics?

Bioeconomics is an interdisciplinary methodology that draws on both the natural and social sciences by combining economic and ecological theories in the study of biological resource dynamics. Although Malthus [1766–1834] may be the one who (unconsciously) initiated bioeconomics in the first place (Tullock, 1999), the methodology was not formally established until the 1950s by fishery economists (Gordon, 1954, Scott, 1955, Schaefer, 1957). The first approaches involved mostly mathematics and not much economics, and typically were single-species models with no higher-order ecological relations. Over the last three to four decades, however, bioeconomic modeling has advanced to relatively comprehensive approaches that include complex techniques from both economics and ecology (Landa and Ghiselin, 1999).

Within the bioeconomic tradition, ecological economics emerged as a distinct field with an emphasis specifically on sustainable development through interdisciplinary practice (Söderbaum, 2007). The International Society of Ecological Economics (ISEE) was founded in 1989, and its peer-review journal *Ecological Economics*, has in its twenty years of existence contributed significantly to interdisciplinary exchanges between economy and ecology. Originally, ecological economics was not intended to lean more heavily on either field (Constanza, 1989). However, as Constanza said in his founding editorial, "Ecological economics will, in the end, be what ecological economists do". Bioeconomics (hitherto ecological economics) is still largely represented by economists collaborating with each other, not economists collaborating with ecologists. While the economists may no longer so clearly be labeled 'pure economists' in that they, to a lesser degree, represent traditional neoclassical economics, few would likely disagree that involving more of the 'pure ecologists' nevertheless would be beneficial in order to make progress (leaving it for the reader to define what constitutes progress).

What, then, are the hindrances? It is often said of bioeconomics that it is an attempt to bridge the empirical culture of biology and the theoretical culture of economics. That clearly describes a pertinent practical challenge to ecologists and economists meeting interdisciplinarily in bioeconomic modeling. The former comes from a predominantly empirical school, while the latter comes from a largely theoretical school. The debatable question is: how much empirical data are needed to obtain adequate knowledge? When allocating scarce research funds for theoretical model building and empirical fieldwork, respectively, a disagreement is likely to arise between two

[1] By this I do not imply that all ecologists and economists are holistic. A few may pledge reductionism, while many do both (they have a complementary view on holism and reductionism).

[2] The majority of these are likely to acknowledge that the cognitive abilities of *Homo sapiens* are unsurpassed by any other species, and that our culture sets us morally apart (under the notion that moral duties and deficiencies are solely for humankind).

such methodologically different practitioners. In the long history of science, ecologists and economists who team up are still pioneers in their fields. Since the theory-empirics dilemma is practical, not ideological, I optimistically choose to believe it will be solved within a reasonable period of time of interdisciplinary practice. I will therefore turn to the three, more fundamental philosophical oppositions between economists and ecologists which may explain their reluctance to team up.

### 4.1. Irreducible Complexity

Building system models, be they biological or economic, means finding the right balance between simplicity and complexity. When a bioeconomic model is built in interdisciplinary collaboration, the trade-off discussions as to which parameters to include will be more pressing than if the same model is built by one of the parties alone. An element that particularly complicates these discussions is the axiom, held by many ecologists, of 'irreducible complexity of ecosystem functioning'. Although many ecologists have a complementary view on reductionism versus holism, i.e. they see it as necessary and rational to reduce ecosystems in order to obtain knowledge about them, some also believe that "the whole is more than the sum of its parts" (Tancred-Lawson, 1998). These ecologists may deem it difficult, though possible, to describe 'the parts' with economic language, but they may find it practically and philosophically impossible to do so for 'the whole'. Fortunately, in practice this potential opposition is seldom a non-solvable challenge in bioeconomic model building. As all modeling is simplification of reality, for most natural resources the 'whole' will not be part of a realistic modeling scenario. One exception may be models that directly addresses ecosystem functioning per se, but so far their relation to economics remains largely unexplored (Hooper et al., 2005).

### 4.2. 'Precautionary Principle'

The ethical element over which 'pure ecologists' and 'pure economists' most often have collided in the past is the axiom broadly accepted by ecologists of 'the precautionary principle'. It basically says that if we do not know the consequences of our actions, we shall refrain from them. More specifically it applies to actions that may do 'harm' (including actions that is not considered harmful today, but possibly considered so in the future). An essential application of this principle is that in the absence of scientific consensus on the effects of actions, the burden of proof falls on those who advocate taking the actions. It is much-quoted in politics, as exemplified by this communication from the European Commission as of February 2, 2000: "The precautionary principle applies where scientific evidence is insufficient, inconclusive or uncertain and preliminary scientific evaluation indicates that there are reasonable grounds for concern that the potentially dangerous effects on the environment, human, animal or plant health may be inconsistent with the high level of protection chosen by the EU".

In natural resource management it is traditionally the economy that drives potentially 'harmful' actions (i.e. development of land, rural employment and economic subsistence). Although few economists rhetorically dismiss 'the precautionary principle' (e.g. in their risk analyses), their approach to it is almost exclusively anthropocentric and thereby fundamentally different from that of the ecologists. This also holds for most of the economists involved in ecological economics, the subfield of economics that for the last two decades has specifically addressed sustainability. For ecologists the concept typically may include, in addition to anthropocentric precautions, the ethical responsibility towards intrinsic values of all life and the maintenance the aforementioned 'whole' of ecosystems. To use everyday language, ecologists have more reasons to be precautious, and where economists see possibilities for human exploitation, ecologists see limitations to it.

At first thought, therefore, one would think that the 'precautionary principle' opposition creates considerable difficulties for ecologists and economists who try to collaborate. While this may occasionally be so (e.g. when particularly strong-headed researchers are involved), in my experience the opposition mainly surfaces at the applied end of natural resource management, not in the actual model building process. In this context, building the model is actually the 'easy' part; while it is harder for the managers/politicians later to implement the model findings. In the actual process of building the model, 'the precautionary principle' may create the same allocation dilemma as already discussed for model parameters in general. However, typically it is mainly the precautions that draw the two groups into collaboration in the first place, and consequently, the researchers involved more or less have *a priori* agreement on which broad-scale elements to include. The real challenge lies in how to measure them, which is an opposition that is more difficult to overcome.

### 4.3. 'All Things Tradable'

A central axiom in economics is that most resources can be sold in a market, and therefore assigned a monetary value (hereafter referred to as 'the principle of tradability'). Within the majority of schools of thought in economics, prices are principally set on the convergence of supply and demand. Most economists acknowledge that it is difficult to put a price on non-material goods such as mental values (hitherto personal, cultural and religious), while they also see it as a rational necessity in order to make decisions. While economists may have several approaches to the problem of pricing non-material goods, they basically all use people's or societies' willingness to pay either by revealed or stated preferences (Whitehead et al., 2008), with the preferences being subject to supply and demand.

For some ecologists the tradability axiom may be an 'incommensurable' opposition, to phrase it with the liberally used term and concept of Thomas Kuhn [1922–1966]. Kuhn said of incommensurability that it "…causes fundamental problems in communication between proponents of different paradigms…This problem cannot be resolved by using a neutral language for communication…" (Kuhn, 1970). The challenge of linguistic incommensurability between ecologists and economists should be negligible. It only demands a willingness to be each others' 'translators' (Kuhn, 1970), which I personally see as my moral duty rather than as my choice when involved in research funded by the society.

Kuhn (1969) clearly stated that scientists with incommensurable theories should in no way shun communicating with each other. According to Kuhn, it is this particular communication that may lead to scientific progress. While Kuhn basically treated paradigms within disciplines in his work on scientific revolutions, his theories of incommensurability may also apply interdisciplinarily. This is not to imply that interdisciplinary bioeconomic modeling necessarily leads to scientific progress, although it may lead to applied progress such as a more comprehensive land use management.

What distinguishes a bioeconomic model from purely ecological or purely economic models is the combination of biological entities and monetary values. Every input parameter must be assigned a value, either a cost or a benefit which negatively or positively influences the output measurement. Indirectly, the prices do not have to be monetary values. Forage for wildlife for example can be valued as the number of animals sustained per entity. Likewise, the value of a reduction of biodiversity in a national park can be impacted by a decrease in the number of visiting people. Ultimately, however, these entities are valued in terms of money in the model's output statement (another numéraire may be used, e.g. energy (Gilbert and Braat, 1991, p. 41), though see Månsson, 2007).

For ecologists particularly the pricing of non-material goods may be ideologically challenging (Rappaport, 1993). Economists have tried to acknowledge intrinsic value e.g. through the concept of 'existence value' (Aldred, 1994), which may broadly be defined as value of an object apart from human use of it. While some mental values, such as to know that a species will exist in the future, are probably acknowledged by many ecologists to fall within the concept of existence values, the majority of ecologists will principally object to the pricing of intrinsic values per se (see e.g. Attfield, 1998 versus Aldred, 1994). This is a vast debate not necessary to reiterate here, suffice it to say that the objection centers on the paradox of evaluating non-human value with human measures.

Likewise, 'non-tradable' ecological processes and principles cannot be straightforwardly quantified. When faced with this problem in bioeconomic modeling, I find that the solution is to include the elements as restrictions terms. For example when modeling production of moose versus timber (Wam and Hofstad, 2007), we were challenged by the biological fact that sex ratios of moose must not exceed a certain skewness in order for cows to find adequate mates (Solberg et al., 2002). We put no direct monetary value on the sex-ratio principle, but rather included it simply as a model restriction term. Although it would be philosophically more demanding to do the same for intrinsic values per se, in practice it can be done quite easily (e.g. by applying the principles of minimum viable populations as model restriction terms). Such non-priced restriction terms mean the economists have to compromise regarding their 'tradability principle'. Such philosophical compromises demand relativism, i.e. an open mind and a willingness to view one's own knowledge[3], beliefs and values not as absolute truths.

## 5. Inevitable Relativisms

Relativism versus absolutism has probably been the object for more philosophical thought than any other issue throughout man's existence. It has caused much debate, from Platon's [c. 424–348 BC] innate knowledge versus the Sophists (like Protagoras [490– 420 BC]) to the 20th century "Science war" with participants such as Paul Feyerabend [1924–1994] and Alan Sokal [1955–]. The more recent controversies center much on scientific method, where relativism by some has even been aligned with anarchism: "The displacement of the idea that facts and evidence matter by the idea that everything boils down to subjective interests and perspectives is – second only to American political campaigns – the most prominent and pernicious manifestation of anti-intellectualism in our time" (Laudan, 1990). However, even the perception of being a relativist is relative. For a relativist it is not illogical to be an ethical relativist, and simultaneously have a (more) absolute view on scientific knowledge.

"Wilderness is the raw material out of which man has hammered the artefact called civilization... To the labourer in the sweat of his labour, the raw stuff on his anvil is an adversary to be conquered. So was wilderness and adversary to the pioneer. But to the labourer in repose, able for a moment to cast a philosophical eye on his world, that same raw stuff is something to be loved and cherished, because it gives definition and meaning to his life" (Leopold, 1949). As the American naturalist Aldo Leopold [1887–1948] wrote of wilderness in his Sand County Almanac: "How we perceive and value something is individual". This particular quote illustrates relativism in all its philosophical senses; cognitive, ethical and aesthetical. When it comes to management of natural resources (and hence, bioeconomic modeling), cognitive, ethical and aesthetical relativism all matter. In this particular context the cognitive and aesthetical becomes part of the ethical. The ethics concerned involves taking into consideration anthropocentric values such as human happiness and experiences of mastering and identity, of which in all the aesthetical is an integral part (Hågvar, 1999). With the cognitive here becoming part of the ethical relativism, I address the (to me) fact that what individuals see as objects in this context (i.e. natural 'resources'), is so influenced by our values that we may see differently. Physically a tree is a tree, but for reasons reflected in the oppositions discussed throughout this text, our translation of a tree into a 'resource' is relative. A collaborative bioeconomic model is therefore ethical relativism in practice, an exercise in making ideological compromises and finding the "least common denominator". Compromise, however, is not automatically negative. Under the moral norms of ethical relativism, compromise might in fact be the right thing to do!

## 6. Conclusions

I have argued that the three potentially incommensurable oppositions between the traditionally bipolar research fields ecology and economics, may all be overcome (in the context of bioeconomic modeling): 1) the axiom, held by many ecologists, of 'irreducible complexity of ecosystem functioning' is of no real hindrance as the ecological 'whole' (as opposed to its 'parts') is seldom an element of most realistic modeling scenarios. 2) The axiom, also held by many ecologists, of 'the precautionary principle' mainly surfaces at the applied end of natural resource management, and should not prevent researchers from building the underlying, interdisciplinary models. 3) The economists' prevalent axiom of 'the tradability principle' is an opposition of fundamental character, but can be solved with a willingness to compromise by both parties: the economist must accept non-marketable components (e.g. use of restrictions terms based on ecology) in the model, and the ecologist must accept a final model output measured in terms of monetary value. The easiest candidates for interdisciplinary teamwork in bioeconomics are therefore researchers who acknowledge ethical relativism. As bioeconomics currently functions mainly as the economists' arena, I say the responsibility for initiating interdisciplinary teamwork rests most heavily on their shoulders.

[3] Knowledge as what we personally perceive to know, not concerning undisputable scientific facts, see section 5.

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