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# How Does Economics Approach Nature?

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**Abstract**

Ecological economics exists in relative isolation among the economics disciplines. This is mainly due to the difficulty which economics has in digesting the thought that the ecosystem as an entity can exist independently of human society, since the mentality of economics is based on individual utility and economic efficiency. However, the ecosystem can be integrated into the mainstream New Keynesian model, as it has been demonstrated in practice. Applying modern models, this study explores why it is difficult to change the usual approach to Nature in economics. It also examines how far the ecosystem and economics can interlock.

**Keywords**

Nature, economic theory, environment, climate change, model, green tax

JEL: A11, B41, C53, C78, D90, E17, O13, O44, Q50, Q54

"*[W]hen should the forest be cut for timber? [...] [W]hen the rate of growth of the forest equals the interest rate.*" (Varian, 2010: 211)

## 1. The puzzle

The need for environmental protection and the negative externalities affecting nature was recognized many decades ago, but nature is still one of the capital assets, while ecological economics is an isolated discipline. Although the long-term challenges and impacts of environmental damage are now included in economic modelling and forecasting, the most widely used, New Keynesian, short and medium-term growth models have not really integrated the constraint that resources are finite. Indeed, mainstream models are even less likely to reckon with the finite load capacity of the climate and the environment, as well as to recognize that environmental damage can lead to irreversible processes on a human time-scale. In the following pages, this objectified understanding of nature will be reviewed to investigate what progress has been made and potentially can be made in the integration of the ecosystem into mainstream economics.

Dasgupta (2008; 2009) demonstrates that in economics, the terms *nature* and *ecosystem* mostly refer to agriculture, mentioned as natural resources or natural capital, and are incorporated as "land" into mainstream models. Thus, in focusing on GDP, a sector like agriculture, comprising just 3-4% of total income production is not in the spotlight at all. As Cavalcanti (2010: 57) notes, even "*(e)nvironmental economics is normally considered as a branch of microeconomics. Its focus is to find correct prices for the optimum allocation of resources*." The mainstream attitudes towards nature in economics are that nature is merely a form of 'natural capital', a property and externality, while environmental protection is understood as part of a cost-benefit analysis.

In the current stage of civilization, mankind regards themselves so independent of the natural environment that it is no wonder that social science models reflecting this way of thinking are unable to treat the economy as part of the natural world. On the contrary, nature is considered to have been conquered by civilized economy. Economics defined itself as a social science, and consequently, neglects every entity that exists independently of human society, such as nature for example. Spash and Smith (2021) clearly deduce that nature in a (post-)modern understanding comprises the non-human, and particularly exists without the mankind. Thus, it can be observed as an entity beyond or besides the economy and human society. In economics, however, the economic activities which cause environmental damage as a negative externality are analyzed only from the perspective of the rest of society.

Economic models do not reflect any responsibility for nature as an independent entity as long as it is treated merely as an asset or a resource. Can nature be raised above the level of a mere production factor, subordinated to human society in a discipline which is, after all, a social science? In mainstream theories and models, nature is just one of several consumable goods and resources. This approach narrows the outlook of economists, for example, when considering the economics of global warming. Fundamentally, social sciences think in terms of costs and benefits to individuals and societies. Can a discipline of social sciences consider the natural environment as more than just a tool, which requires only renewal and sustainability, to channel it properly into production? What questions should a modern macroeconomic model set out to answer? Starting from the widely used Cobb–Douglas

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production function (Cobb and Douglas, 1928) based on the Solow model (Solow, 1956; Swan,1956), the basic assumption of growth models is that economy will have a stable level of growth in the long run. How does the continuously growing global energy demand relate to such a steady state? Does it have a steady state level in reality? And what happens if the energy source turns out to be insufficient?

While the theory of economics identifies welfare as its ultimate goal, at the same time, the practice of economic policy constitutes a contest for survival between nations and national economies racing each other in growth and performance. The Cold War entailed a military rat race to finance armament from the fruits of economic growth. In such a paradigm, China aims to defeat the US in trade and production to build her global power supremacy. Despite all the criticisms that have been levelled at it, GDP growth remains the most important economic policy indicator. Obviously, the attitude of the de-growth school (Georgescu-Roegen, 1986) – which rejects economic growth – will never be a mainstream approach in the current global order. Is it possible in the New Keynesian model that the development of technology and the improvement of productivity are sufficient to reach income growth without expanding any kind of need for natural resources? The reason for this need is to avoid overburdening ecological carrying capacity. Less extensive use of land as a capital asset could contribute to the slowing of the processes of desertification and rainforest eradication. Meanwhile, reducing the demand for non-renewable energy sources could, hopefully, reduce the greenhouse effect. Nevertheless, the increase of production could also improve the quality of life without unsustainable environmental side effects if it was based on quality innovation instead of quantitative extension of machinery made from raw materials. Papers similar to Georgescu-Roegen's (1986) approach have also been published in recent years, which recommend turning the focus of economics from boosting the GDP toward production for sharing or not for sale, where welfare is sustainable without the classic consumer society characterized by frequently repetitive consumption and planned obsolescence (Bliss and Egler 2020).

## 2. Ecological economics in mainstream modelling

Costanza (1996) reviews how the natural world, the ecosystem and the discipline of ecology sought to be incorporated into economics during the history of economic thinking. He claims that "ecological economics views the socioeconomic system as a part of the overall ecosphere" (ibid. 980) and focuses on the activities and welfare of the human population in a fair system of allocation of resources. Cavalcanti (2010) asserts that ecological economics has targeted the feedback between social and natural systems, and the influence of the services received from the ecosystem. This is the reason why ecological economics is not very compatible with current mainstream economics, which is based on marginal utility, individual and social optimum, and efficiency seeking, where the ecosystem is part of the socioeconomic system and not opposed to it, as in the ecological approach. Although Costanza believes that the general equilibrium model could be a methodological entry into mainstream economics for the ecological discipline if 'generality' were extended to the ecosystem including human society, the wide range of General Ecosystem Models does not currently include the classic structure of General Equilibrium Model with households, firms and government. (Figure 1 and 2)

The methodological pluralism of economics means that the mathematical methodology of the New Keynesian model, which represents the mainstream in the 21st century economics, would be supplemented by methods drawn from ecological economics. In such an approach, the evolution of economic theory could be a further development of the neoclassical model. (According to Thomas Kuhn (1962)'s philosophy of science, until a fundamentally new paradigm arrives, science builds on existing theories)

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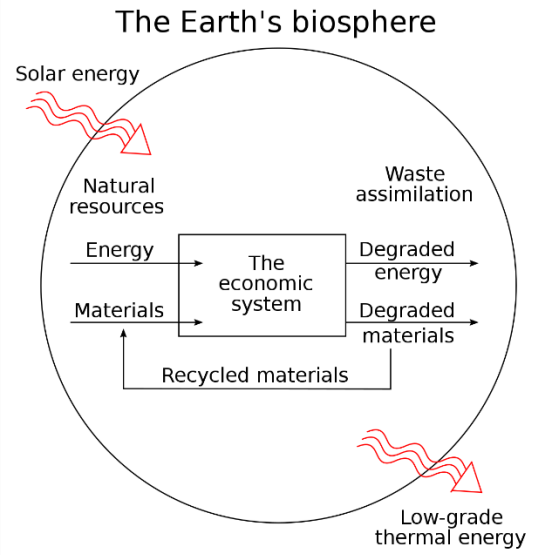


Figure 1. Ecosystem model

Source: Hammond and Winnett (2009:1216)

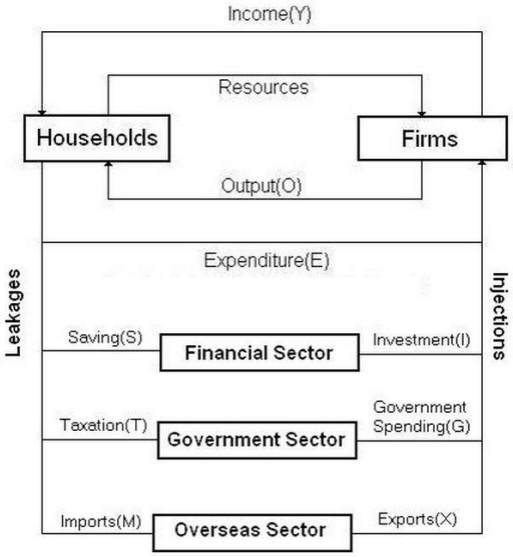


Figure 2. Five-sector model of general equilibrium

Source: Buultjens (2000:10)

If we want to understand the role of ecology in economics, Boyed (2007: 721) is worth quoting here, who considers that ecology should be used to "assess welfare losses arising from over-consumption", which originates in borrowing from future resources just for consuming in the present. Such an approach can be observed in recent economic modelling. The claim that the mainstream is not concerned at all with the destruction of the natural environment is an exaggeration. Global warming has been incorporated into both general growth models and analyses focusing on economic sub-sectors. The DICE model of Nordhaus (1992) and its modified version, Nordhaus and Yang (1996), are capable of scenario analysis about the long-term effect of climate change. These models incorporate the long-term growth impact of carbon consumption, of course in a strictly cost-benefit analysis approach. So far, however, there is a sharp distinction between the short-term forecasting model and the long-term scenario analysis model.

Modelling practices based on the CGE (Computable General Equilibrium) model have been advanced, too, regarding the global warming effects of trade policy decisions, as exemplified by Balistreri and Rutherford (2011). More information on environmental impacts and methodological options can be found in the studies by Holzer and Cottier (2015), Ecorys (2014), the House of Commons Environmental Audit Committee (2015), Frankel and Rose (2005), Holladay (2008) and the UNEP-IISD (2005). However, since ecological economics also analyzes welfare, usually treating it just like economics though in an ecosystem context, the discipline still thinks in terms of the cost-benefit understanding of use of nature and of value theories of economics (Dasgupta 2009; Pirgmaier 2021) This phenomenon strengthens the long-term focus on sustainability, but does not go beyond the mainstream view of nature as a capital asset.

Paavola and Adger (2005) and Dzeraviaha (2018) approach the integration of ecology into economics from the perspective of institutionalism to attempt to integrate ecology into the mainstream of economics. This perspective analyses environmental topics from a governance perspective, for example carbon tax or regulation. In tax matters, starting from the Pigou tax, several advanced models are ready to examine the relationship between tax impact and climate change: Kim et al. (2011), Cooper (1998), Pizer (1997), Nordhaus (2007). Meanwhile, Buchanan (1969) and Nye (2008) analyzed the tax impact on the fuel market, while Edlin and Karaca-Mandic (2006) adjust it to heterogeneous markets. Sinn (2008) outlines the green paradox, i.e. when an efficient green tax eliminates its own tax base, which is obviously unfavourable from a budgetary point of view. Edenhofer and Kalkuhl (2011) also investigate the realization of this paradox. Bossier and Bréchet (1995) examine the limited possibilities of green taxes in the context of the tax system as a whole.

Based on the Coase Theorem (Coase, 1960), some optimization models derived from microeconomics for pollution pricing take into account welfare optimization, intertemporal resource allocation, and variable discount rates (Kuik et al., 2008; Azar, 1999) Moreover, the issue of limited natural resources has already been incorporated

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into the labour market model (Lintz 1992) and the modified version of Porter's Competitiveness Diamond (Berg and Holtbrügge 1997).

**3. Policy analysis and environmental factors**

Institutional ecological economics has also penetrated into policy analysis and valuation models. Heller (2003), who confronts fiscal policy with various long-term public finance challenges, integrates the issue of climate change into fiscal policy. Jones and Keen (2009) contemplated the so-called green recovery path at the beginning of the global financial crisis in 2009, an idea that had already appeared in Bossier and Bréchet's (1995) study on how to mitigate the European employment crisis by replacing labour taxes with increasing green taxes to make labour costs more competitive. Barker (1998) developed the E3ME (energy-environment-economy model of EU) model, which specifically tests the combined effects of green taxes on energy efficiency, employment and competitiveness.

The issue of climate change has also been integrated into mainstream monetary and financial policy models. A study by the Bank of England (2015) concludes that global warming and the wrong economic policy reactions to it undermine financial stability. Companies that have suffered directly from climate damage and thus become insolvent, as well as oil companies that may have suffered from a fall in stock prices, could be among the first causes of growing instability. A working paper by Dafermos et al. (2017) examines a central bank initiative called the green QE (Quantitative Easing) program using an ecology-based macromodel. The focus of their study is on how climate change affects financial stability and price stability, and how central banks should adapt to them. Their thesis is that global warming will destroy companies' capital stock, which will spill over to a deterioration of both their profitability and liquidity. This could increase insolvency, which would ultimately erode both financial stability generally and the banking sector. Participants in the capital market might reallocate their investment portfolios in such a case if they want to manage the risk from climate change. The reaction to this will result in a decline in the value of corporate bonds and stocks. In addition, growing financial instability restricts credit growth, which would have a negative impact on green investment. In this way, efforts to mitigate climate change are weakened. For this reason, the green QE can anticipate global financial instability and support climate change mitigation. Based on the results presented by Dafermos et al. (2017), the effectiveness of a green monetary program is determined fundamentally by the elasticity of green investments in response to changes in the yields on the bonds which finance them. Murphy and Hines (2010) and Campiglio (2016) also addressed Green Quantitative Easing, concluding that monetary and financial policy should shift funding sources towards low-carbon economic activities.

**4. Further interlocking of ecosystem and economics**

All of the models above continue to be conceived within the framework of a cost-benefit analysis by rational decision-makers and the self-interested (selfish) individuals. However, individual selfishness may also entail that the interest of individuals is to preserve nature, either to save their own living environment or for the benefit of their descendants. Economics is a social science, thus, by definition, it is constructed from the perspective of human society. The assumption of rational thinking as a cornerstone of the *homo oeconomicus* model cannot allow human individuals' interests to override nature.

The boldest approach is imported from behavioural science into ecological economics, as exemplified by Gowdy (2007). This study places individual decisions on the foundations of neuroscience, and claims that they are driven not only by reason (rationality) but also by emotion. A human individual participates in social decisions in a given institutional and cultural environment, and does not merely take their own narrow interests into consideration. The decision theory (and game theory) model developed by Güth et al. (1982), known as the ultimatum game, argues that an explanation for human behaviour can be found in motivations which exceed the *homo oeconomicus* approach. On this basis, it is clear that the impact of financial incentives is limited when it comes to solving environmental and social problems.

Gowdy (2017: 642) concludes that a minimum proportion of people (a threshold) is needed to address certain problems such as climate change, who are willing to work together to take any action to manage the problem at all. However, the masses are only willing to cooperate if non-cooperating rule breakers (free-riders) can clearly be punished. Furthermore, it is very important for human individuals to be willing to work primarily with those who are considered to be "hive minded". This is the behavioural challenge in global warming: the whole human race needs to feel that every other person on the Earth belongs to the same group as them from an environmental perspective to be able to begin a strong and effective cooperation within the global society and community.

Further interlocking of the ecosystem model and the New Keynesian model is hindered by a crucial difference in their fundamental approaches to the relationship between economy and nature. The ecosystem model of ecological economics regards economy as a subset of the ecosystem, which participates in the flow of resources, energy and waste. In contrast, the mainstream economics model considers the economy to be an overall set which

includes nature as one of the subsets in the circulation of factors and income. This fundamental conflict is not irresoluble, however. The model of a circular economy opened up the possibility for economists to extend the current general equilibrium open economy models towards new perspectives of optimization. The *homo oeconomicus* approach has been undergoing a gradual revision in economics since microfunded macroeconomics and behavioural economics started to spread in applied economics. In parallel, environmental constraints and necessities have forced human society to reform its way of thinking about individualism, interest, optimum and environment. Just as a social science adjusts its models to be able to understand society as completely as possible, this slow change in social behaviour must be reflected in mainstream models as well. The circular economy model, behavioural economics and the evolving social attitude together can provide an opportunity for a possible future outcome, where the overall set is the ecosystem and the economy is a subset in a mainstream general equilibrium model of economics.

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