



Norwegian University  
of Life Sciences

**Master's Thesis 2022 30 ECTS**

Faculty of Landscape and Society (LANDSAM)

# **Ecological Economics in Higher Education – A study on the state of the art of ecological economics education and the challenges and opportunities for its development**

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## Acknowledgements

First of all, I would like to thank Erik for his supervision and feedback during this entire process.

Second, I want to thank Lukas for providing me with good and constructive feedback on my first draft.

I want to thank Wies from the Writing Center at NMBU for the incredibly helpful sessions. You helped me with new ideas, good ways of formulating sentences, and structuring the results and discussion sections.

A big thanks to you, Anja, for the times we worked together on campus in the past semester. Having you there by my side has helped with focusing and quality breaks!

I would also like to thank my dear friends in Ås and Oslo for keeping my spirits up throughout this process.

## Abstract

Ecological economics offers alternatives in response to the perceived failure of mainstream economics to address global environmental challenges. This paper studies the state of the art of ecological economics in education. The assessment outlines the core concepts, theories, and methods taught in the field, discusses elements that are considered relevant for a full degree, and classifies the challenges and opportunities for future development of ecological economics education. A multi-method approach was used, including: i) a systematic search for books on ecological economics, ii) systematic and manual searches for programs, courses, and teaching materials, and iii) semi-structured qualitative interviews with scholars and teachers in the field.

The results show that ecological economics education is centered in Europe and North America and often takes place outside of economics faculties. Ecological economics courses and degrees cover many topics (243), yet some foundational concepts to ecological economics are discussed minimally, for example uncertainty, incommensurability of values, and substitution of capital. There is a large degree of variability in the teaching materials used. Furthermore, there is an inconsistency between the wishes of scholars regarding a curriculum, and the education that currently exists. Main challenges identified can be categorized in institutional, political, and internal challenges. Most important challenges include: struggles within interdisciplinary research and education in ecological economics, the dominance of mainstream economics at universities, and the breadth of, and disagreements within, ecological economics. Steps that can be taken by scholars to progress ecological economics education include: i) increase use of alternative teaching materials and styles of teaching, ii) create a database of teaching materials, iii) provide students with action-based education through engaging with local society and creating partnerships, and iv) engage in academic politics.

It is hoped that this paper can serve as a solid basis for articulating the field further in higher education.

Keywords: University Education, Ecological Economics Curricula, Teaching Materials, Ecological Economics Teaching, Expert Opinions, Economics Education.

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## 1. Introduction

There is a call for deep changes in the way economics is theorized, practiced, and taught, to better serve purposes of social and environmental sustainability in an era of accelerating climate and environmental change (Decker et al. 2019; Dube, 2021; Gowdy & Erickson, 2005; IPBES, 2019). Mainstream economics has been criticized for contributing to and causing environmental problems, and for a failure to address them, due to – amongst others – a focus on unlimited economic growth (GDP growth) and viewing natural resources and pollution as externalities (Gills & Morgan, 2020).

A major opportunity for transforming economics lies within education (Polimeni, 2004; Gills & Morgan, 2020; Salamantov et al., 2020), and there has been a cry for alternative ideas in economic research and education. Ecological economics proposes alternatives to the neoclassical economic theory that heavily dominates the discipline, including in education. Ecological economics emerged in response to the perceived failure of neoclassical economics to deal effectively with environmental problems, and the discipline offers an alternative approach to consider the role of nature and the environment in a more appropriate way (Daly & Farley, 2011).

The importance of reforming economics education towards the concerns of ecological economics has been emphasized, including ideas on the sustainable scale of the economy and issues of equity (Costanza, 1991). Yet there is limited literature specific to ecological economics in higher education, and the practicalities of how such education should look like. Various authors have argued that a concrete curriculum for ecological economics should be developed (Costanza, 1991; Polimeni 2004). Polimeni (2004) further emphasizes that “a formal graduate curriculum for ecological economics is necessary for the successful continuation of the discipline” (p. 292). Many ideas have been posed on how economics should be reformed as a discipline, and how this should be reflected in academics and curricula. However, the literature dealing with the challenge of extending ecological economics in educational curricula is surprisingly scarce, and to the reach of the author’s knowledge, no paper so far is has explicitly taken up the problem. Furthermore, no extensive account has been made to assess the current state of the art of education in ecological economics and the potential for its development.

With the aim of addressing this gap, this research sets up to review the presence of ecological economics in higher education and discusses the potential for its development in educational

curricula. The paper identifies challenges and opportunities for future development of the field in education and gives suggestions for this development. It is hoped that this analysis can serve as a solid basis for articulating ecological economics further in higher education.

The following questions guide this research: Where is ecological economics taught and what are the main trends and geographical patterns? What are the core concepts, theories, and methods taught in ecological economics education? What elements do ecological economists consider most relevant for an ecological economics curriculum? What are the challenges and opportunities for future development of the field in higher education?

The paper is structured as follows. First a brief background of ecological economics theory and literature on ecological economics education is provided. Then, I will elaborate on the methods used in this study. Afterwards the results are presented, followed by a discussion, and at last the conclusions.

## 2. Background and theory

### 2.1 Ecological economics

Ecological economics encompasses a wide variety of ideas, concepts, and methods, and its ontological and epistemological positions are contested outside and within the field. Costanza (1991) states: “...it is not true that ‘ecological economics is simply what ecological economists do’. They do many different things but within a common tradition which is a bit shaky and not clearly delimited because it is at the interface of related fields.” (p. 15).

Core propositions of ecological economics include the notion of biophysical limits to growth and the implications for economic scale; social equity and (re)distribution; coevolution; fundamental uncertainty; interdisciplinarity and transdisciplinary across the social and the natural sciences; limited substitutability of capital; and the valuation of nature (Proops, 1989; Daly, 2008; Martínez-Alier & Muradian, 2015; Costanza, 1991; Costanza, 1996; O’Neill, 1997; Gual & Norgaard, 2010; Daly, 2007; Kallis & Norgaard, 2010). At the core is the idea that the economy is embedded in social and ecological systems, and bound to the laws of thermodynamics (Proops, 1989, Daly, 2008). This implies that the scale of the economic subsystem relative to the physical limits of the hosting ecosystems is key in consideration to sustainability (Daly, 2008). There is a general consensus in the field about the existence of biophysical limits to growth (Martinez-Alier & Muradian, 2015). The proposition that there are limits to growth – including debates on whether growth is feasible or desirable – leads to a focus on (re)distribution of resources and wealth, making considerations of equity another core theme of the field (Costanza, 1996). Ecological economists also emphasize the importance of working in an inter- or transdisciplinary manner that allows understanding the interactions between ecological, social, and economic systems (Costanza, 1991). This is reflected in the emphasis on methodological and value pluralism, for example in the valuation of nature (Martínez-Alier et al., 1998; O’Neill, 1997; Gómez-Baggethun & Martín-López, 2015; Arias-Arévalo et al., 2017). Ecological economists furthermore point out the fundamental complementary nature between natural and built capital, which implies that natural capital cannot be (fully) substituted by human-made capital (Neumayer, 2003; Berkes & Folke, 1992; Daly, 2007). This is contrary to the mainstream economic vision of substitutability between different forms of capital (Solow, 1995). At last, coevolution – “ [the] evolutionary change between interacting social and environmental subsystems” (Kallis, 2007, p.5) – is a

foundational concept in the field, and influences how social and environmental change is perceived.

Since ecological economics emerged as an academic field, there has been debate about its epistemological, normative, and methodological positions (Costanza & Daly, 1987). This debate includes questions on whether the transdisciplinary and pluralist approach is the best way to go for the discipline (Norgaard, 1989; Spash, 2012), and how ecosystem services ought to be valued (Silvertown, 2015). Furthermore, there has been a debate about the ontological framing of biophysical limits (Kallis, 2021; Gomez-Baggethun, 2022), population growth (Martinez-Alier & Muradian, 2015), the use of monetary valuation (Kallis et al., 2013; Christie et al., 2012; Neuteleers & Engelen, 2015), appropriate framings of human-nature relationships (Muradian & Gomez-Baggethun 2021; Kallis 2021), and the extent to which natural capital can be replaced by manufactured capital (Neumayer, 2003; Mayumi et al., 1998; Daly, 1997). These tensions between scholars in the field show the struggle of the discipline to become a coherent whole, and act from a widely shared ontological and ideological basis. Spash (2012, 2020) argues that this has been an obstacle for progress in the field.

## 2.2 Ecological economics in higher education

There is a growing movement in economics that pleads for a change in economics theory, practice, and education, supported by various organizations. Several of these organizations have aims and ideals that resonate with, and emphasize the potential of, ecological economics (Fisher et al., 2017). Rethinking Economics is one of the main platforms for students, scholars, and activists to voice their concerns with, and wishes for, economics education (Rethinking Economics, 2021). Furthermore, Curriculum Open-Access Resources in Economics (CORE) pursues this same goal of radically transforming economics education in order to build a more sustainable, just, and democratic society (Core Economics Education, 2021). These movements include (while they do not specifically focus on) ecological economics, but there is almost no literature specific to ecological economics in higher education. The few exceptions are briefly discussed below.

Røpke (2020) discusses how introductory economics education can be reformed. Her ideas on what an ECON101 course should look like align with ecological economics. With a focus on the understanding of economic systems as systems of provisioning, she outlines how economics education can help change the social and ecological performativity of economics, with a strong focus on sustainability and environmental justice.



Santone (2013) provides an overview of how ecological economics can be taught using a comparative approach with mainstream economics. He focuses on two dimensions: the relationship between the environment and the economy, and the goal of the economy and measurements of success. Using this comparative approach is a way to circumvent the curriculum standards set on the national level, as these are often grounded in mainstream thinking. Focusing on needs and wants, the goals of the economy, and its ways of measuring success, allows teaching ecological economics with reference to areas that are familiar to economic students.

Polimeni (2004) discusses an ecological economics curriculum specifically, as he outlines a full graduate degree. He emphasizes the importance of having a program that is competitive on the labor market, and includes core courses in microeconomics, macroeconomics, econometrics, research methods, and ecological economics.

Eberhardson & Friman (2001) highlight challenges and opportunities in teaching ecological economics. They mention four challenges: i) critical pluralism in education and research, ii) normative point of departure in social science, iii) balancing reform and social change, iv) transforming student notion of dismal science into action and empowerment. They explain that even though difficult, it is important to maintain the critical pluralist approach. They also note that getting students to be “engaged participators rather than detached observers” (p. 4) is needed, which is possible by engaging students in action-based projects. Furthermore, they mention the difficult balance between a critical and radical education, and giving students the education needed to get a job.

Finally, Beer (2018) outlines a possible curriculum for a specific course in ecological economics: ecosystem assessment and valuation (ESAV). This curriculum includes a variety of teaching methods to convey the complexity and normativity involved in ESAV, such as issue-based repeated roleplaying, text-based discussions, teacher presentations, and case study methods.

Besides the literature discussed above, there is little published work on ecological economics education. With this study, I aim to contribute to filling that gap, and provide an entry point for ecological economists to formulate a coherent set of ideas for designing degrees and courses within the field.

### 3. Methods

A multi-method approach was used for data collection, which included: i) a systematic and manual search for programs, courses, and teaching materials, ii) a systematic search for books on ecological economics, and iii) semi-structured qualitative interviews with scholars and teachers in the field.

#### 3.1 Systematic and manual search for programs, courses, and teaching materials

A systematic search, complemented with a manual search, was conducted to map higher education in ecological economics, including programs, courses, and modules. The search was done in English, and was later expanded with a search in German, French, Spanish, Portuguese, and Dutch, due to interviewees mentioning a significant number of programs and courses that were not found with the English search.

The systematic and manual search were conducted through an online search using Google. Each result included at least one of the following keywords: *bachelor (in) ecological economics; master (in) ecological economics; PhD (in) ecological economics; ecological economics summer school; ecological economics course; course in ecological economics; ecological economics education; ecological economics program; ecological economics module; module in ecological economics*. Later complemented with: *curso de economía ecológica; bacharelado em economia ecológica; mestrado em economia ecológica; doutorado em economia ecológica; escola de verão em economia ecológica* (Portuguese); *cours d'économie écologique; licence économie écologique; master économie écologique; programme de doctorat en économie écologique; école d'été en économie écologique* (French); *curso de economía ecologica; licenciatura economía ecológica; maestría en economía ecológica; programa de doctorado economía ecológica; escuela de verano en economia ecológica* (Spanish); *Kurs Ökologische Ökonomie; Bachelor Ökologische Ökonomie; Master Ökologische Ökonomie; PhD-Programm Ökologische Ökonomie; Sommerschule in Ökologischer Ökonomie* (German); *bachelor ecologische economie; master ecologische economie; vak universiteit ecologische economie; zomerschool ecologische economie* (Dutch).

Each finding was coded according to the name in English (author's translation), original name, type (degree, course, module, summer school, other), level (bachelor, master, PhD, other), institution (university, faculty, department). This categorization was used to show the geographical

distribution and the types of education available. The complete table of ecological economics education can be found in Appendix 1.

In order to list the core concepts, theories, and methods taught, the contents (coded as topics) were listed for each course in Appendix 1. Course web-pages and available syllabi were used to uncover the contents and the used teaching materials. The mode of teaching was not included in this search due to limited availability of this information online. Topics were color coded using Excel. For each of the four main categories (economic theory, ecological economics, sustainability sciences and studies, and integrated topics/non classifiable), the subcategories: concepts (foundational/main), toolbox, and policies and governance were included. Ecological economics was distinguished from economic theory to show the presence of both in ecological economics education, and to allow for more subcategories to emerge. Since the majority of the topics fell within ecological economics, more subcategories were created to organize the data, including: ecological economics general concepts, new economies, critiques on mainstream economics, and inequality and justice.

### 3.2 Systematic search for books

A systematic search for books (handbooks, textbooks, and topical books) was conducted to gain overview of the available literature which is/can be used as teaching material. The following search terms for each of the following search engines were used: *handbook ecological economics*, *textbook ecological economics*, *book ecological economics*, in: Google Scholar, Google, Google Books. Since each of these search engines gave a very high number of results, I chose to go through the first 50 pages available for delimitation purposes.

Each finding was coded according to the title, author(s), year published, publisher, reference, and classified according to type (textbook, textbook: specific, book chapter, handbook, other). The complete table can be found in Appendix 4.

The main search was conducted in English. An additional search in German, Spanish, and French gave 39 results. Each finding was coded according to the original title, author(s), year published, publisher, and reference. The full table can be found in Appendix 5.

### 3.3 Semi-structured interviews

Fourteen semi-structured qualitative interviews were conducted with teachers in ecological economics. Participants were selected through purposive and convenience sampling strategies, using networking to establish contacts. To ensure diversity among the participants I approached

scholars from a plurality of genders, countries, and backgrounds. The dominance of European participants can be explained by the use of convenience sampling, as contacts were mainly derived via the European Society for Ecological Economics (ESEE), since the author had access to the contact list for the ESEE. The final sample includes nine men and five women. The majority of them (11 out of 14) lives in, and is from, European countries. One participant is from North America, one from Australia, and one from Latin America.

Through these interviews I collected insights and opinions on: i) experiences in the field of ecological economics as teachers (e.g. the courses they teach/ have taught and their contents, methods of teaching, and teaching materials), ii) reflections on how ecological economics education can improve and develop, and iii) reflections on the challenges and opportunities for ecological economics education.

Interviews were held through Zoom, manually transcribed, and color coded. A combination of inductive and deductive coding was used. The research questions were used as broad categories for codes (deductive approach), including: i) concepts in ecological economics, ii) challenges to ecological economics education, iii) opportunities for ecological economics education, iv) ideas about ecological economics curricula, and v) teaching experience in ecological economics. This was complemented with an inductive approach, structuring results that did not fall within the predefined codes. Codes that emerged were: i) history and development of ecological economics, ii) personal information, iii) debates in ecological economics, and iv) other. All codes were then organized and summarized in order to analyze the data.

### 3.4 Ethics

The project was approved by the Norwegian Research Council (NSD), and all personal data was handled according to the guidelines of the NSD and the Norwegian University of Life Sciences (NMBU).

## 4. Results

### 4.1 Programs and Courses in Ecological Economics

The systematic search resulted in 99 ecological economics teachings, including i) one bachelor program, ii) 11 master programs (two of which do not exist anymore), iii) two PhD programs, iv) 17 bachelor level-, v) 20 master level-, and vi) three PhD level courses, vii) one module within a bachelor's degree, viii) seven summer schools, and ix) six other results (including web-series and courses offered by non-academic institutions). The subsequent manual search resulted in 26 more items: 16 master level-, and nine bachelor level courses, and one research center (where students can write their bachelor, master, or PhD dissertations). At last, five courses were mentioned by interviewees that had not been uncovered by means of the systematic or manual search.

The (active) full degrees are located in the United Kingdom (2), Austria (2), Spain (2), Brazil (1), Ecuador (1), France (1), the United States (1), and Mexico (1). Figure 1 shows the distribution of the courses, modules, and summer schools that were identified. Only active degrees and courses were included in this figure. Table 1 shows the frequencies of the education identified in this study, organized by type, level, continent, country, and institution. The full list of educational programs and courses can be found in Appendix 1.

Type	Level	Continent	Country	Institution	
Degree	Bachelor (1)	South America	Brazil (1)	Universidade Federal do Ceará	
		Master (11)	Europe (7)	Spain (2)	Universitat Autònoma de Barcelona (2)
	UK (1)			University of Leeds	
	Scotland (1)			The University of Edinburgh	
	France (1)			Université Toulouse Jean Jaurès	
	Austria (1)			Wirtschaftsuniversität Wien	
	Norway (1)			Nord University Bodø	
	North America (3)			USA (2)	The University of Vermont; Rensselær
			Mexico (1)	Universidad Veracruzana	
			South America (1)	Ecuador (1)	La Universidad Central del Ecuador
	PhD (2)		Europe (1)	Austria (1)	Wirtschaftsuniversität Wien
North America (1)		USA (1)	Rensselær		
Course	Bachelor (26)	Europe (10)	Austria (2)	Wirtschaftsuniversität Wien; Central European University (campus Vienna)	
			Sweden (2)	Stockholm University; Uppsala University	
			Switzerland (2)	Universität Zürich; Université de Lausanne	
			France (1)	Université Côte d'Azur	
			Belgium (1)	UC Louvain	
			UK (1)	University of York	
			Finland (1)	University of Helsinki	
			North America (6)	USA (3)	University of Oregon; Dartmouth College; Colorado College
				Canada (3)	Queens University; L'université de l'Outaouais et 26des La27urentides; Waterloo University
				South America (5)	Brazil (5)

		Australia (3)	Australia (3)	The University of Queensland (2); Southern Cross University
		Asia (2)	Singapore (1) India (1)	Yale-NUS college Teri School of Advanced Studies
Master	Europe (24)	UK (4)	Spain (3)	University of Oxford; University of Leeds (2); University of Surrey
			France (3)	Universitat Politècnica de Valencia; Universitat Autònoma de Barcelona; Universidad del País Vasco
			Scotland (3)	Université Paris Nanterre; Université Toulouse Jean Jaurès (2)
			Austria (2)	University of Edinburgh (3)
			Sweden (2)	Central European University (campus Vienna); Wirtschaftsuniversität Wien;
			Belgium (2)	University of Uppsala; KTH Royal Institute of Technology
			Italy (1)	Université Libre de Bruxelles; Universiteit Gent
			Iceland (1)	Università di Pisa
			Greece (1)	University of Iceland
			Germany (1)	University of the Aegean
			Turkey (1)	Humboldt University Berlin
	North America (8)	USA (4)	Canada (3)	Boğaziçi University
				Allegheny College; The University of Vermont (3)
				McGill University; Trent University; Simon Fraser University
	South America (5)	Mexico (1)	Brazil (2)	Universidad Veracruzana
				Universidade Federal Fluminense; Universidade Federal do Paraná
		Bolivia (1)	Columbia (1)	Universidad Católica Boliviana
			Ecuador (1)	Universidad Nacional de Colombia
	Australia (3)	Australia (3)		FLASCO-Ecuador
PhD (3)	Europe (2)	Sweden (2)		Australian National University (2)*; Griffith University
	Australia (1)	Australia (1)		Stockholm University; Lund University
				Australian National University*
Not Specified (3)	North America (1)	USA (1)		United States Society for Ecological Economics (USSEE)
	South America (1)	Argentina (1)		Social and Solidarity Economy Resource Site – Buenos Aires, Argentina
	Africa (1)	Central African Republic (1)		EUCLID University, an intergovernmental institution (UN series)
Module	Bachelor (1)	North America (1)	Canada (1)	York University
	Master (1)	North America (1)	USA (1)	Tufts University
	PhD (-)	-	-	-
Summer School	- (7)	Europe (5)	UK (2)	Oxford University; Environment Europe
			Spain (2)	Universitat Autònoma de Barcelona; Universitat de Barcelona
			Italy (1)	Università di Pisa
	North America (1)	Canada & USA (1)		McGill University and the University of Vermont
	South America (1)	Uruguay (1)		Universidad de la República Uruguay

Table 1: Education in ecological economics organized by type, level, continent, country, and institution.. \*One course at the Australian National University is both available for MA and PhD students and is thus listed for both categories.

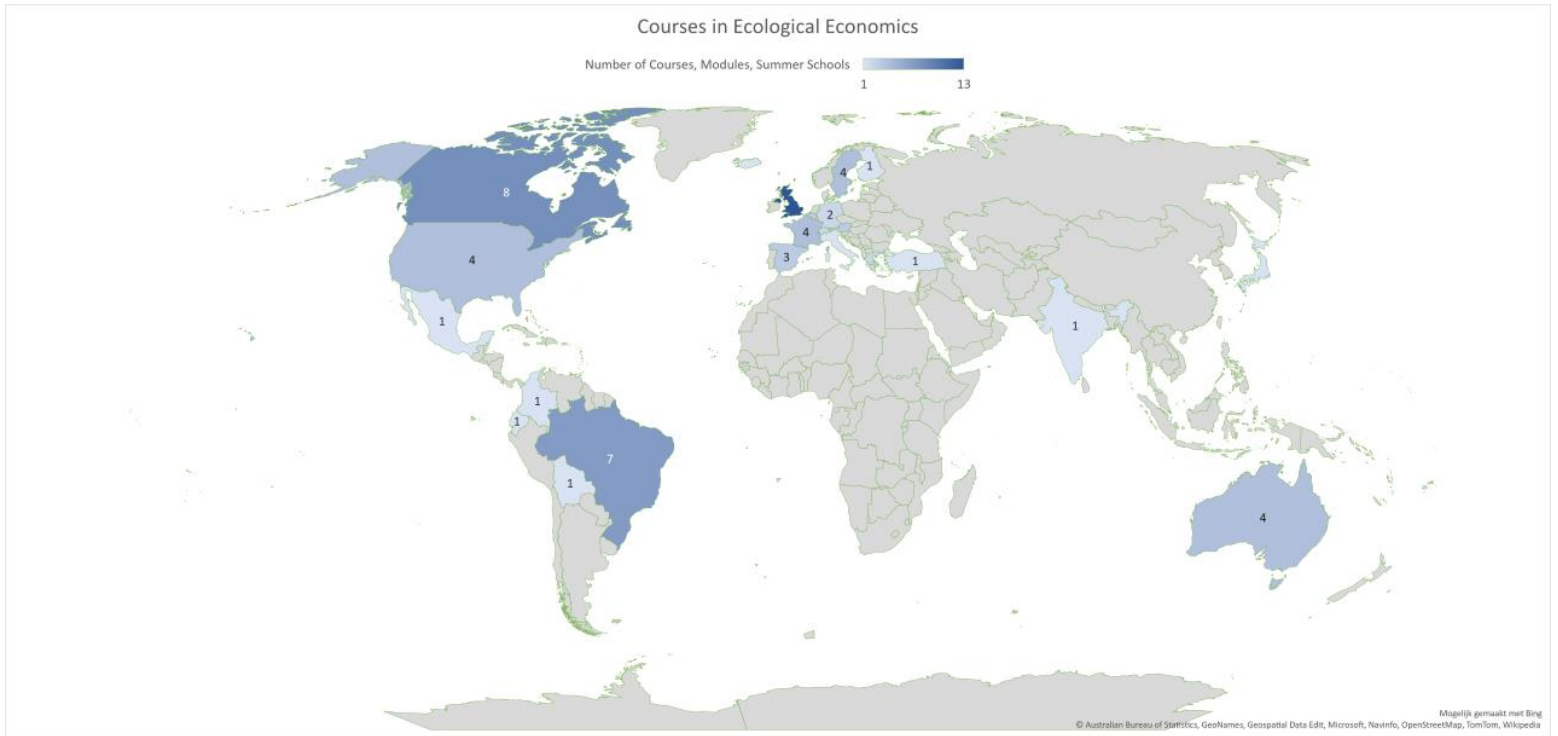


Figure 1: Geographical distribution of courses, modules, and summer schools. Results for Scotland were integrated with the results of the UK, due to limitations in software. Scotland: 4, UK: 9.

## 4.2 Topics and Teaching Materials in Ecological Economics

35 of the 99 items listed in Appendix 1 had teaching material available through their webpages or through syllabi received from interviewees. Of these, 30 had listed books in their teaching materials, 19 scientific articles, and 13 other teaching materials. 72 of the 99 items had a (short or long) course description available, describing the topics covered in the course or degree.

### 4.2.1 Topics in Ecological Economics Education

243 different topics are present in ecological economics education. The topics were coded into four main categories: economic theory, ecological economics, sustainability sciences and studies, and integrated topics/non classifiable. Each main category includes the subcategories: concepts (foundational/main), toolbox, and policies and governance, since these emerged clearly from the topics in each main category. Table 2 shows the topics present in ecological economics education.

Main Category	Subcategory	Topics
Economic Theory (48, 127)	Concepts (26, 79)	Neoclassical Economics (Critique of)/ Conventional Economics (9); Allocation (Resource)/Efficient Allocation/Market Allocation (8); Environmental and Resource Economics (6); Trade (Global/International) (6); Externalities (5); Markets (5); Welfare (Economics) (5); GDP (5); Economic Efficiency (4); Labor/Work/Employment (4); Money/Finance (4); Microeconomics (3); Competition (2).
	Toolbox (9, 19)	Cost Benefit Analysis (7); (Environmentally Extended) Input-Output Analysis (3); Discounting (2); Monetary Valuation (2).
	Policies and Governance (6, 9)	Green Growth (3); Green Economy (2).
	Heterodox Economics (7, 20)	History of Economics/Economic Thinking (6); Institutions/Institutional Economics (5); Heterodox Economics/Pluralist Economics (3); Keynesian Economics (2); Feminist Economics/Feminist Macroeconomics (2).
Ecological Economics (116, 343)	Foundational Concepts (19, 120)	Economic Growth/Criticism of Growth (17); Limits to Growth/Biophysical Limits (14); Systems Approach/Open Systems/Complex Systems (11); (Sustainable) Scale (10); Just and Fair Distribution (9); Embeddedness (9); Transdisciplinarity (9); Interdisciplinarity (8); Complexity (6); Pluralism (Methodological/Value) (6); Entropy (5); Social Metabolism (5); Co-evolution (3); Laws of Thermodynamics (3); Post Normal Science (1); Uncertainty (1); Urgency (1); Incommensurability of Values (1); Substitution of Capital (1).
	Toolbox (30, 61)	(Social) Multi-Criteria Evaluation (10); Valuation of the Environment Methods (8); Case Studies (4); Valuation of Ecosystem Services (4); Agent-Based Modelling (3); IPAT Analysis (3); Critical Thinking (2); Group Work (2); Systems Dynamic Modelling (2); Environmental Accounting (2); Problem Based Learning (2).
	Policies and Governance (14, 25)	Common-Pool Resources Management (6); Pollution Taxes/Green Taxes (6); PES (2).
	Ecological Economics General Topics (22, 50)	Ecological Macroeconomics (12); Ecosystem Services (8); Georgescu-Roegen (4); Holistic Approach (3); Circular Economy (2); Discourses in Ecological Economics (2); Energy and Exergy (2); Normativity (2); Values (2).
	New Economies (9, 22)	Degrowth (9); Post Growth Society (3); Steady-State Economy (3); Prosperity without Growth (2).
	Critiques on Mainstream Economics (10, 40)	Ecological Economics vs. Environmental Economics (17); Decoupling (6); Strong and Weak Sustainability (5); Market Failures (3); Crisis of Capitalism (2); Commodification (2); Environmental Kuznets Curve (2).
Inequality and Justice (12, 25)	Environmental Justice (6); Environmental Ethics (4); Intergenerational Equity (4); Inequality (2); Poverty Alleviation (2).	
Sustainability Sciences and Studies (36, 111)	Main Concepts (22, 60)	Natural Resources (12); Sustainable Development (10); Planetary Boundaries (6); Climate Change (4); Natural Capital (4); Ecology (3); Rebound Effects (2); Socio-Ecological Systems (2); Water Scarcity (2); Sustainable Land Use (2); Urban Sustainability and Development (2).
	Policies and Governance (6, 26)	Biodiversity Conservation (7); Resource Management/Use (5); SDGs (4); GHG Emissions Pricing/Control (3); Eco-Labeling (2); Paris Agreement/COP (2).
	Toolbox (8, 25)	Sustainability Management (11); Sustainability Indicators (5); Population Models (5); Ecological Footprint (3).
Integrated Topics/ Non Classifiable (43, 94)	Main Concepts (33, 61)	Well-being (6); Consumption (5); COVID-19 (5); Political Ecology (4); Transformation (4); Development (3); Engineering/ Technology Development (3); Industrial Ecology (3); Agroecology (2); Waste Production (2).
	Policies and Governance (6, 26)	Policy (Design)/ Climate policy/ Policy Instruments (19); Environmental Governance (3).
	Toolbox (4, 7)	Evaluation Techniques (3); Multi-Disciplinarity (2).

Table 2: Topics covered in ecological economics education. Each category shows the (#topics, times mentioned). Concepts that were mentioned only once are not included in the last column (with exception for foundational concepts to ecological economics).

As can be expected, most topics fall in the category of ecological economics. Many core elements and concepts that are seen as fundamental to ecological economics came forward in the courses descriptions, such as limits (14), complex/open systems (11), (sustainable) scale (10), value



pluralism (6), entropy (5), social metabolism (5), co-evolution (3), and thermodynamics (3). Uncertainty, urgency, incommensurability of values, and substitution of capital were each mentioned only once, even though they can be seen as foundational concepts in the field.

A variety of ecological economics methods and skills (toolbox) are taught in the courses. (Social) multi-criteria evaluation and methods are most prominent in teaching (10). Skills that are taught to students include working with case studies (4), critical thinking (2), working in groups (2), problem solving (2), and reviewing techniques (1).

In eight courses ecological economics was taught side by side with environmental and/or resource economics. Furthermore, in 25 courses the two were compared to point out the differences, and/or critique mainstream economics from an ecological economics point of view. There are also programs and courses that do not include this comparative approach. It did not always become clear from the course descriptions whether or to which degree mainstream economics and environmental/resource economics were mentioned in the courses.

#### 4.2.2 Teaching Materials in Ecological Economics Education

Books that are used most include handbooks and textbooks on ecological economics, as well as textbooks about environmental and resource economics, and a few popular topical books. In total, 80 different books have been used as teaching material (see Appendix 4). The textbook by Daly & Farley (2011), *Ecological Economics: Principles and Applications*, and the textbook by Common & Stagl (2005), *Ecological Economics: an Introduction*, were used the most, eight and seven times respectively. It stands out that *Prosperity without growth* by Tim Jackson (2016) and *Doughnut Economics* by Kate Raworth (2017), are two topical books used more than once. Furthermore, it is noticeable that several environmental and resource economics books are present.

A wide variety of articles is used in education, as 178 different ones have been identified through the systematic search. As a consequence of this, not many articles are used in multiple courses. Only 16 are used more than once (see Appendix 3). Is there a lack of core articles used in ecological economics education? And if yes, is this a problem? I will reflect on these questions in the discussion section of this article.

It became evident that alternative teaching materials (including newspaper articles, online articles, videos, movies, TED talks, podcasts, and policy documents) were used in only a small number of

the courses (13). Courses mainly rely on scientific articles and book(chapters) as teaching material, with 22 courses only using books and scientific articles.

### 4.3 Ideas for Curricula in Ecological Economics

In the interviews participants were asked about their ideas regarding an ecological economics curriculum. The main focus was on full degrees. Since ecological economics is a broad field, the topics that were brought up as relevant are widely varied. This might make it difficult to formulate a coherent set of courses within a degree, as one participant states: “What I think, or hypothesize, is that it is kind of difficult to formulate a curriculum in ecological economics, because it is very broad, and not everything is agreed on”. Before diving into the specific courses that were proposed, it is important to say that an interdisciplinary vantage point was mentioned by all participants as elemental for a degree.

All participants agreed that one or several core courses focused on ecological economic theory should be part of a degree. Furthermore, a core course that should be included according to the majority is philosophy (of science). “This education needs to start from a basic understanding of the reality (...) what is ontology, what is epistemology, what is methodology, what are methods?” emphasizes one of the participants. Critical realism as a basis for ecological economics was considered as a core element of a possible philosophy of science course. This could then be taught together with (environmental) ethics, a topic that was brought forward by several participants.

Another core course is the history of economics and economic thought. History of economic thought, together with the diverse schools of thought in economics, is said to be lacking in mainstream economics education (Dow, 2009; Fisher et al., 2017), and seen by the participants as important for (ecological) economics students to learn about. One participant states: “We need pluralism and pedagogic pluralism like as I said, if I were setting up an education program in ecological economics, you would want to understand different schools of thought in economics. That is very different than saying that they are all valid.”. Ecological economics degrees should thus not only feature ecological economics ideas, but also cover other diverse schools of thought in economics.

Most participants brought up that both qualitative and quantitative methods should be featured in a degree, giving the students multiple tools to analyze relevant problems. Interdisciplinary research

methods should also be taught in a methods course, as inter- and transdisciplinarity is central to ecological economics. Social-multi criteria evaluation (SMCE) was mentioned particularly often by the interviewees, which aligns with the frequency of SMCE being mentioned in course syllabi and webpages.

Lots of topics were brought up that could feature in an elective course, such as: policy (making), institutions, degrowth, finance, trade, inequality, power, transformations, ecological distribution conflicts, coevolution, discourses, biophysical systems, thermodynamics, ecosystems, and so on.

Furthermore, one participant brought up the possibility of having several tracks to choose from in a degree, for example focusing on social ecological economics, on ecological macroeconomics and modelling, or on environmental justice and degrowth. I brought up this idea of having several tracks to choose from to other participants, with positive and mixed reactions. Several participants deemed this way of structuring a degree as more appropriate for the master's level. A more common curricula for the bachelor's level was seen as important to give students the same knowledge and skills to continue later in the field. Providing tracks within degrees does lead to difficulties on the institutional and organizational level. Having the right resources and people available for this way of structuring a degree, is a challenge. However, having multiple tracks within a (master's) degree allows for students to focus on their area of interest and expertise, circumventing problems with the breadth of ecological economics. It would furthermore allow for students with a diversity of backgrounds and interests to enter the field of ecological economics and contribute with their unique point of view, emphasizes a participant.

Interviewees disagreed on the question whether mathematics should be taught to ecological economics students. The following three quotes show this clearly: "My sense is ecological economists have to be very strong in mainstream tools like econometrics, and they have to be very knowledgeable about advanced econometric techniques and data mining (...) quantitative and research methods". Contrary to what another participant states: "I also would not teach econometrics and mathematical modeling, because for me the core of what is important today is how we organize to achieve social change, and superficial empirical relationships correlations.. I see them more as a distraction than that it is helpful to learn". A third interviewee has a stance a bit more in between the previous two: "I definitely wouldn't start providing math courses in an

ecological economics master’s degree, but I would probably teach like micro or macroeconomics in terms of you know making sense of the numbers that the others come up with”. Providing students with the possibility of choosing between several tracks within a degree could solve this problem, by allowing students that are interested in mathematics and modelling to pursue this path, whilst not scaring away students that are not interested in this part of ecological economics, as one participant explains.

Furthermore, multiple interviewees stated that mainstream economics ideas should be part of a degree, yet from a critical perspective. One participant stated that it should not be necessary to include neoclassical economics in order to explain and teach ecological economics, whilst other participants disagree, and think it is important to cover mainstream economics: “It is important when you have knowledge about an alternative [ecological economics], you must know what it is an alternative to.”. Another participant comes up with an interesting solution to this problem, and explains that neoclassical economics can be taught as a historical stream in economics. This way, students can become aware of what ecological economics is an alternative to, without legitimizing neoclassical economics. Another solution that was brought up is to start with ecological economics, and only later on explain mainstream ideas.

#### 4.4 Challenges and Opportunities for Ecological Economics Education

Participants of the interviews were asked what they regard as challenges and opportunities for ecological economics education and its development. The challenges and opportunities were classified in three main categories: institutional, political, and internal, with each two subcategories. Table 3 shows the classification of the challenges and opportunities.

Main Challenges	Subtype of Challenges	Specific Challenges
Institutional	Finance and Funding	<ul style="list-style-type: none"> <li>• Faculty and department structure at universities</li> <li>• Issues with interdisciplinary research and education</li> <li>• Lack of inter- and intra- institutional collaboration</li> </ul>
	Structure and Culture at Universities	<ul style="list-style-type: none"> <li>• Issues with interdisciplinary research and education</li> <li>• Dominance of mainstream economics at universities</li> <li>• Lack of inter- and intra- institutional collaboration</li> <li>• Educational home of ecological economics at universities</li> </ul>
Political	Dominance of Mainstream Economics	<ul style="list-style-type: none"> <li>• Neoclassical economics dominance in business and government (the political climate)</li> </ul>
	Ecological Economics as too revolutionary	<ul style="list-style-type: none"> <li>• Lack of acceptance of ecological economics ideas</li> </ul>

Internal	Scoping of Ecological Economics	<ul style="list-style-type: none"> <li>• Ecological economics as too broad</li> <li>• Ecological economics not well known enough</li> <li>• Lack of a positive vision for the future within ecological economics</li> <li>• The extent to which ecological economics education should accommodate to the job market</li> </ul>
	Educational Challenges	<ul style="list-style-type: none"> <li>• Lack of good quality teaching materials</li> <li>• Structure and contents of degree and courses</li> <li>• Resource intensiveness of education</li> <li>• Experience and expertise of the teacher</li> <li>• Requirements for the programs</li> <li>• Evaluation of students performance</li> <li>• Students expectations</li> <li>• Lack of inter/intra-institutional collaboration</li> </ul>
<b>Main Opportunities</b>	<b>Subtype of Opportunities</b>	<b>Specific Opportunities</b>
Institutional	Finance and Funding	<ul style="list-style-type: none"> <li>• Collaboration with other scholars in different faculties and departments</li> <li>• Engage with academic politics</li> </ul>
	Structure and Culture at Universities	<ul style="list-style-type: none"> <li>• Create a wide spread community of ecological economics in academics</li> <li>• Engage with academic politics</li> </ul>
Political	Dominance of Mainstream Economics	<ul style="list-style-type: none"> <li>• Create a wide spread community of ecological economics in society</li> <li>• Organize ecological economics career events</li> <li>• Collaborate with local societies in educational activities</li> </ul>
	Ecological Economics as too revolutionary	
Internal	Scoping of Ecological Economics	<ul style="list-style-type: none"> <li>• Provide different tracks within degrees</li> </ul>
	Educational	<ul style="list-style-type: none"> <li>• Increase use of alternative teaching materials</li> <li>• Database for teaching styles and materials in ecological economics</li> <li>• Organize longer high quality summer schools</li> <li>• Diversify modes of teaching</li> <li>• Action-based education</li> <li>• Focus on (practical) skills within ecological economics education</li> </ul>

*Table 3: Classification of challenges and opportunities to ecological economics education and its development. Some challenges and opportunities are listed multiple times, as they were mentioned in different contexts and fall into several categories.*

#### 4.4.1 Challenges for establishing ecological economics in higher education

##### ***Institutional Challenges***

Main concerns that were raised were institutional challenges, including finance and funding, and the institutional structure and culture at the university. An important institutional challenge mentioned is the educational home of ecological economics. It seems that ecological economics has a hard time finding its way into economics departments due to the dominance of mainstream economic thinking at universities. Furthermore, because of the fact that ecological economics is an inter- and trans-disciplinary field, fitting in the structure of the university with its separated

faculties and departments, is a challenge. This has as a result that establishing courses and degrees is more difficult, since it often involves collaboration between different departments and institutes. Getting funding for ecological economics research and education is difficult due to this. A participant states: “The typical concern is the issue of interdisciplinarity (...) Labeling [in] universities (...). To get funding, evaluation processes to get certificates and, you are asked over and over to classify yourself within the social science or natural sciences.”. In line with this, one interviewee explained that the type of education that they wish to offer is often highly resource intensive, due to the fact that it includes field courses and interactive teaching. Finding sufficient funding is thus a challenge due to the interdisciplinary nature of ecological economics and the types of courses that are wished for in its education.

Several participants mentioned that universities have more and more adopted a type of business model, trying to make profits and accommodate to the needs of markets and governments. One participant in particular phrased it as follows: “[it is] very much about where universities were meant to make societies better and give humankind a better future and not just (...) get revenue, and spit out mass numbers.”. Several participants expressed their dislike of this way of running a university, and felt that this would enforce the state quo in a capitalist society. In itself, this seems not to match with the underpinnings of ecological economics, often having a focus on post-normal science and radical alternatives for the economic system we currently live in. As the same participant follows up: “I understand why they might try to make it more practical and more relevant, socially relevant, as that was the idea; but it has gone too far that way. It is big business.”. It can thus be challenging for ecological economics to be part of universities with this climate and culture, as it does not align with the underpinnings of ecological economics itself.

Multiple participants raised the concern of accommodating to the job market, aligning with adopting a type of business model as described above. One participant was clear in their opinion on this matter and explained that using the ‘tools approach’ is incredibly reductionist, and stated: “Learning how to use a chisel or something doesn’t make you a carpenter (...) So it is not like there is a magic toolbox, and you say all these are the tools and now I am going to go out and use them regardless of what it is I need to do. The old metaphor of you don’t use a hammer when you need a screwdriver...”. It is necessary to teach the students to reflect on these tools, whether they are useful and valid, and when and how they are appropriate to use. However, another participant

disagreed with this way of thinking and said that skills that the market demands should from the start be included in the program. There is thus a need to reflect on the balance between keeping true to the core of ecological economics, and preparing students for the job market.

### ***Political Challenges***

Political challenges identified are twofold: the dominance of mainstream economics in societies and ecological economics as too revolutionary. With mainstream economics being the status quo in societies and politics, it is difficult for ecological economics to establish itself and gain influence. A participant formulates: “At least in the kind of political systems which I am living in, that ecological economics is just too revolutionary and we do not want anything like a degree on this”. Ecological economics ideas are thus seen as too radical, leading to difficulties in spreading its ideas in education, amongst businesses, and in politics.

### ***Internal Challenges***

Internal challenges to ecological economics education include: the availability of good quality teaching materials, students expectations, the structure and contents of degrees, the lack of a positive vision for the future, resource intensiveness of teaching, evaluation of students performance, requirements for the programs, ecological economics not being well-known enough, the expertise of the teacher, and a lack of inter-institutional collaboration. I will briefly touch on two of these challenges.

Two participants mentioned the lack of a positive and constructive vision for the future within ecological economics. At the heart of ecological economics education should be a hopeful and positive vision about the future: “Instead of describing all things that are bad on problematic and the crisis, we have to come up with good solutions what can we do? So instead of asking what we cannot, should we not try to up with examples: what can we do?”. Formulating a curriculum around this hopeful vision can work empowering for the students and instructors, and motivate them to materialize positive change. Eberhardson & Friman (2001) also emphasize this importance of moving from ‘dismal science’ to action and empowerment. It is perceived to be a challenge for ecological economics to move away from focusing on the negative, towards a more positive and constructive vision for the future.

At last, the evaluation of students in the type of courses that ecological economists want to offer, is challenging. Participation is seen as a key element for evaluation, yet is difficult to grade. As

one participant explained, if everyone has met the objectives of the course and has participated and developed their critical thinking, and grades A are given to all, the accreditation will knock on the door, and tell them to do things differently. Not only is the institutional setting at universities hindering the type of courses that fit ecological economics, the way of evaluating students is also a challenge.

#### 4.4.2 Opportunities for Ecological Economics Education

The challenges identified above are important to address and solve. The opportunities for solving these challenges were categorized using the same typology as for the challenges, namely institutional, political, and internal, and are discussed below respectively. Many of the opportunities align with ideas of interviewees on what a degree should entail, and are thus discussed only briefly here.

##### *Institutional Opportunities*

Participants mentioned several opportunities with regard to the issue of integration at universities and economics departments. First, ecological economics should continue to create a bigger community in academics and society. Cortese (2003) states that: “In many cases, we think of teaching, research, operations, and relations with local communities as separate activities; they are not.”. (p.17). Integrating education with local societies can widen the reach of ecological economics, possibly leading to more interest for ecological economics research and education. A participant explains that when there is a growing interest in ecological economics ideas from the (local) society, universities might be more likely to follow, and allow for research, courses, and degrees. This can work hand in hand with the more hands-on practical courses wished for by interviewees, where students work on case studies in collaboration with local actors. Second, ecological economists should continue to pursue collaborations between departments, however difficult this may be, in order to establish more and better interdisciplinary research and education. One interviewee emphasizes that academic politics, and being vocal and outspoken, play an important role in this.

##### *Political Opportunities*

An opportunity for ecological economics is to get more widespread and well-known, and better convince of its relevance for the current socio-environmental issues, to gain influence in politics and decision-making. This is in line with the opportunity described above. Spreading ecological



economics ideas can not only happen through educational activities and research, but also through efforts from the local and international societies for ecological economics.

Furthermore, organizing career events specifically for ecological economics (students) can be a way to link business, local administration, and organizations, with students. It is important for students to have the prospect of finding a (relevant) job. Organizing a career event can show students the opportunities that they have in the field, and show possible employers what ecological economists have to offer, possibly broadening the acceptance of ecological economics ideas and practices.

### ***Internal Opportunities***

Many of the opportunities mentioned by participants fall in the category of internal opportunities, including: focusing on skills, action-based education, alternative ways of teaching, a database for teaching materials, and summer schools.

Several of the interviewees would like to see ecological economics education focus more on practical skills, that could be useful in the job market. A focus on skills rather than content, as one interviewee describes it. However, not all participants agree on this, and one participant in particular emphasizes the need for a strong theoretical and philosophical focus within an ecological economics curriculum.

Providing ‘action-based education’ is perceived to be a major opportunity for ecological economics. This could be achieved by having actionable thesis projects and assignments, where students conduct a project with real world outcomes. As discussed above, this can also have positive implications for overcoming political and institutional challenges.

Ecological economics courses can be a space for experimenting with new and alternative ways of teaching. The mode and style of teaching was brought up several times by participants as an opportunity. These modes and styles of teaching can then be shared with the community, and best practices can be recommended. One participant emphasized the importance of how we teach, and explains that “...this is my understanding of teaching. I trust the methodology. I do not trust knowledge transfer. I think me transferring my knowledge is useless.”. Alternative ways of teaching (with one-way lectures being the default), seem to be one of ecological economics biggest opportunities. By diversifying the way we teach, we can transfer skills such as teamwork, problem solving, and forecasting, better to the students. Gáspár et al. (2021) dive into participatory methods

in economics education, and give examples of methods, such as horizon scanning, decision techniques, and future studies. These ways of teaching seem to be successful in achieving skills such as foresight, critical thinking, and problem solving, and are more engaging for the students. Ecological economics education can make use of such modes of teaching, and learn from the experiences of Gáspár et al. (2021), and Kiss et al. (2021).

Two participants mentioned that a database of teaching materials would help instructors to formulate good courses, and would facilitate (international) cooperation in the ecological economics community. At last, organizing longer, good quality summer schools is an opportunity for creating a strong community in ecological economics, and introducing new students to the field.

As can be deduced from the opportunities mentioned above, there are many possibilities for improving ecological economics education. What stands out is that all these ideas and ideals require some sort of collaboration (between ecological economists, the academic institutions, and civil society), often challenge the status quo, and thus require institutional change and flexibility. In the discussion section of this paper I will reflect more on how ecological economics can advance and develop its education, and give recommendations.

## 5. Discussion

### 5.1 State of the Art of Ecological Economics Education

Ecological economics education seems to be centered in Europe and North America. It stands out that very little education was found in Asia and Africa. Even though this could be due to language constraints in the conducted searches, it is interesting to note its consequences. Students from Asia and Africa do not seem to have much opportunity to follow a course or degree on the subject. Consequently there is little representation of ecological economics on these continents. The international and local societies for ecological economics can focus on how ecological economics can become more widespread in research and education worldwide, not only in Europe and the Americas.

There is much room for further development of undergraduate programs and ecological economics courses accessible in mainstream economics degrees. Only one undergraduate degree in ecological economics currently exists, and it stands out that only a handful of degrees (3) are based at economics departments or faculties. The same goes for the courses: of only 12 of the 78 it can be said with certainty that they are taught at economics faculties/departments. Most often, ecological economics courses and degrees are taught elsewhere (environmental, science, engineering, agricultural faculties/departments e.g.). This illustrates the limited acceptance of ecological economics in mainstream economics departments as of now. It is important that ecological economics finds its way into economics departments, as many economic students are not familiar with ecological economics, and its critiques to neoclassical economics. Establishing more (undergraduate) degrees, and having ecological economics education within economics departments are both important for increasing the reach of ecological economics ideas.

There is not much consistency between the courses with regard to teaching materials used. Courses in ecological economics rely mostly on book(chapter)s and scientific articles, and little one alternative teaching materials. The core textbooks and handbooks in ecological economics are not used often in education. Though critiques on the textbooks have been outed (e.g. Røpke, 2020), these books are still a main resource for ecological economics education, and could be utilized more. Furthermore, there does not seem to be a set of core articles in ecological economics education. In order to provide students with essential knowledge of the field, a set of core articles is useful. The large variety of teaching materials used in ecological economics teaching is not

necessarily only negative. It can provide a plural conception of what is researched in the field to the students, and give an overview of contested topics within ecological economics.

Through this study it has not become evident what core teaching materials should be at the center of ecological economics education. Many different opinions on what should or should not be included were brought up by interviewees, without a clear common consensus. A conversation between scholars and students in the field about what core teaching materials should be, is thus needed.

Ecological economics education is not always consistent with what is seen as the core of the field. As discussed in section 2, there is a core set of ideas and concepts that stand central, such as issues of scale, equity, (biophysical) limits, (re)distribution, fundamental uncertainty, interdisciplinarity and transdisciplinarity, valuation of nature, embeddedness, thermodynamics and entropy, methodological and value pluralism, coevolution, and complementarity of capital. The results of the systematic and manual searches indicate that a part of these core topics are covered in education yet to a limited extent. Inter- and transdisciplinarity, limits, scale, (re)distribution, embeddedness, and valuation of nature were included most often. The following concepts that can be seen as core to ecological economics were covered minimally: pluralism, equity, coevolution, thermodynamics, fundamental uncertainty, and complementarity of capital. This has as a consequence that students might not get the full scope of what ecological economics entails and what the main predispositions are. Considering that 72 course syllabi and/or descriptions were analyzed, it can be concluded that core ideas and concepts in ecological economics are not covered substantially. Some courses analyzed in this study were focused on a specific topic within ecological economics however, and it is thus not strange that these did not focus on the full scope of the field and its basic theory.

The lack of core concepts in ecological economics education indicates that there might be no clear understanding of what ecological economics entails. The many different topics and teaching materials covered can be interpreted to reflect the tensions and inconsistencies in the field, and the issues with the breadth of ecological economics. Having an open and pluralistic approach in ecological economics (including in its education) is important, but I am of the opinion that a more coherent set of ideas and conceptual foundations is needed to advance its education and research.

Spash (2012 & 2020) also argues that the lack of a common ontological and ideological standpoint in the field results in the field not being able to progress substantially.

It is interesting to note that the ideas of the participants on ecological economics curricula do not necessarily align with current available ecological economics education. There is thus an inconsistency between the wishes of ecological economists and existing education. In the section below I elaborate on the fundamentals for ecological economics education, based on the insights from scholars in the field, as a start for a more substantial conversation about what ecological economics education should look like.

## 5.2 Fundamentals for Ecological Economics Education

A main question central to this article is how ecological economics education can progress into the future. What are the fundamental contents that any curriculum in ecological economics should feature? Through the interviews it became clear that a curriculum for a course or degree is hard to formulate, as opinions on what to include diverged significantly from participant to participant. Even though ideas on fundamentals for ecological economics curricula diverged between participants, a common set of ideas for a full degree could be identified. The elements for degrees that participants overall agreed on are summarized below.

Designing a degree in ecological economics entails looking at the content (what topics, concepts, and methods do we want to teach the students?), the teaching materials (what teaching materials can we use to convey these contents best?), and the type and style of teaching (what teaching methods can we use to engage the students best and give them the highest possibility for flourishing?). Below, I have summarized findings from this research for each of these three aspects, supplemented with my own insights. This is not a prescriptive list, but rather a source of inspiration for ecological economists aspiring to set up a degree.

First and foremost, I want to emphasize the core values that should stand central in ecological economics education. Cortese (2003) emphasizes the importance of values (and ethics) in education (for sustainability), and argues that ecocentric values should stand central in a student's education. The most important values for ecological economics in my opinion are: diversity, critical thinking, creativity, and collaboration. These values should be engrained in all activities, teachings, and interactions.

For degrees it is important to highlight which core courses should feature as a basis. The elective courses that are relevant are widely varied, and I will only mention possibilities for these briefly and not go into depth here. Core courses for every degree in ecological economics should be: history of economic thought; heterodox economics; philosophy of science and ethics; ecological economics introduction and general course(s); research methods, and a thesis project. The research methods course should feature both quantitative, qualitative, and interdisciplinary research methods. It is also important to include a natural sciences course, focusing on ecology and global sustainability sciences. This will give students the necessary knowledge on the natural environment and systems thinking.

Within general/introductory ecological economics courses students should be familiarized with core concepts and ideas in the field – such as the core concepts outlined in section 2 – and the diversity of research topics in ecological economics. Elective courses should focus on a specific idea or topic and dive more in depth. There are many topics to cover in specialized elective courses, such as: ecological macroeconomics (modelling), degrowth and postgrowth, limits, sustainability sciences, environmental governance, climate and politics, political ecology, policy making, social-multi criteria evaluation, ecosystem services, doughnut economics, theories of well-being, indicators of sustainable prosperity, systems thinking, and coevolution (this is not an exhaustive list). Electives can be grouped together to form different tracks within a degree, an idea discussed in section 4.3.

For each of these courses styles of teaching can be used that motivate the students to think critically. Inspiration can be taken from Gáspár et al. (2021), and Kiss et al. (2021), though many more alternative styles of teaching are available.

### 5.3 Strategies and Recommendations for Moving Forward

The sections above discussed the state of the art of ecological economics education and ideas on what curricula should entail. In order to achieve these ideas for future education in the field, the challenges and opportunities should be addressed. Three types of challenges and opportunities were identified through this study: institutional challenges, political challenges, and internal challenges. I believe that it is necessary to address these simultaneously, in order to create the biggest leverage points for change.

Many of the challenges that were brought up in the interviews come back to the rigid institutional structure at universities. A lack of resources in terms of finance, time, modes of student evaluation, available teachers, and challenges with organizing interdisciplinary studies and research, are all linked to the academic climate that is currently present at universities. In that regard, many of the challenges that ecological economics faces are also present for other fields, especially those that are multi-, inter-, or transdisciplinary. Boden & Borrego (2011) outline a set of institutional barriers to interdisciplinary research, of which most can be seen as barriers to education as well. They clearly show that the current departmental and faculty system works against interdisciplinary efforts. Even though more effort is put into advancing interdisciplinary research and education (Sánchez et al., 2021 & Askehave, 2015), the current academic climate does not yet allow for sufficient interdisciplinary work. These problems are not easy to solve, and finding and implementing solutions will be a long term process. Ecological economists should engage more with academic politics, and actively work to create the institutional and cultural setting in which ecological economics (education) can flourish. Working together with other interdisciplinary fields, and engaging actively with organizations such as Rethinking Economics is crucial.

Ecological economics needs to become more hands-on and practical, and engage with civil society, in order to spread its ideas and gain influence. Ecological economics can be a pioneer in *action-based education*. This is one of the most important opportunities to emphasize. Mainstream economic thinking is the status quo in societies nowadays, which has as a consequence that alternative ways of thinking are pushed to the sidelines, if not completely of the edge. It is a major challenge for ecological economics to confront the mainstream way of thinking, and eventually push it out. Engaging more with (local) societies was mentioned as an possible step to take in order to spread the ideas of ecological economics and create more interest for it. Cortese (2003) mentions that “partnerships with local and regional communities” are crucial to creating successful higher education (p.19). By creating practical projects together with local societies, students do not only make a tangible contribution to their local environment, but it also helps spread the ideas of ecological economics. What follows from this, is that lecture style teaching based solely on books and scientific articles, with little active discussion and participation of the students, is not suitable for ecological economics education. More diverse and creative modes of teaching, and teaching materials, should be used in order to give the students the necessary tools and skills to think critically, envision *and* realize a sustainable and equitable society.

Facilitating debates in class should be part of these more diverse and creative modes of teaching, as this can help students to develop critical thinking on controversial topics within ecological economics. Teaching students different perspectives from a critical point of view, and allowing them to decide for themselves what they agree with, helps to form their values and normative stance, as Eberhardson & Friman (2001) argue.

If ecological economics education becomes more hands-on and practical, it is important to be careful about the extent that curricula are adapted to the wishes of the market. Eberhardson & Friman (2001) also mention this as a challenge for ecological economics education. If ecological economics wants to become more influential in society, I argue that caution is in place when adapting its education to the wishes of the market. This will enforce status quo of dominant mainstream economics and neoliberal thinking (Holbrook, 2004). The skills that are demanded by the market, don't always align with the values of ecological economics. It is not inherently wrong to train students in skills and methods that can be used in the job market, yet it is important to make a distinction between those that are in line with ecological economics thinking, and those that are part of a flawed mainstream economic way of thinking. We should teach the students the skills, methods, and ways of (critical) thinking that align with the values and the core of ecological economics, before introducing the mainstream. Mainstream methods should be discussed through a critical lens based on ecological economics principles, to familiarize the students with how many things are done today. Courses and degrees should however start with explaining ecological economics, before introducing the mainstream. Even though ecological economics emerged as a critique to the mainstream, it is about time that the field stands strong by itself, without relying on being a critique to neoclassical economics.

To advance ecological economics in higher education, the international and regional societies for ecological economics should put education higher on their agendas. The international and regional societies are a community where advancements within the field are shaped, and it is thus important for these organizations to put more weight on ecological economics education. As mentioned above, a database with educational materials is one important step. This database can be managed by the International Society for Ecological Economics (ISEE) together with the regional societies. Inputs from members of the community should be easy and low key. This way, we can create a knowledge commons in ecological economics, with good, diverse, and alternative teaching materials on a variety of topics. This should include books, scientific articles, videos, policy



documents, podcasts (such as the ESEE podcast), and more. Different ways of organizing and teaching courses can also be included in this database.

This database of teaching materials is thus a concrete step to be taken by the ecological economics societies. Røpke et al. (2022) have created a similar type of database for ecological economics education, aimed at high schools. The website is available both in Danish and English, and can be used as inspiration by scholars on university level education in ecological economics. It can function as an example for a database set up by the ISEE. At last, more attention for ecological economics education at the organized conferences is needed for advancing ecological economics education.

I have outlined the main challenges and opportunities for ecological economics in higher education, and have provided an overview of important core elements for a curriculum. This can be used by teachers to reflect on their curricula and take inspiration. It is important to emphasize that ecological economics should not only be present at the university level, but also make its way into high school curricula. Advancing ecological economics outside of academia is equally important, and it is hopeful to see that this is already happening, for example in Bødo, Norway (Nilsen, 2021). I encourage scholars in the field to advance ecological economics education, both at their universities and in their local societies.

Future research on ecological economics in education can focus on the experiences of students that partake in courses and degrees. Furthermore, a survey can be held amongst more scholars about their ideas of what a degree or course should feature and look like. This will give a more comprehensive overview of the challenges and opportunities for ecological economics education, taking into account the students perspective.

### 5.3 Limitations

First of all, the limited time available for the project has restricted the scope of the study. A bibliographic analysis of teaching materials was first considered in addition to the other methods, to assess the quality of teaching materials. This would be a possibility for a follow up study. Secondly, the language constraint of me as the researcher made it difficult to find all relevant education and teaching materials. Thirdly, due to limited experience with interviews, there is a possibility for bias in the interview data interpretation. I have tried to minimize the impact of this

by including as many views of the participants as possible in the results section of this article, and often using direct quotes.

## 6. Conclusions

This study aimed to assess the state of the art of ecological economics in higher education, and the challenges and opportunities for its development. Ecological economics education seems to be mainly centered in Europe and North America, with a few exceptions, and is often present outside of economics departments. 11 full degrees in ecological economics are currently available, of which only one on the bachelor-, and two on the PhD level. There is thus room for ecological economics to establish more degrees (and courses) worldwide.

The inconsistencies within the field seem to be reflected in its education, with concepts, theories, and methods taught being very diverse. It seems that core concepts of ecological economics are not always reflected in its education. Furthermore, the used teaching materials are widely varied and little consistent, leaving much room for ecological economics education to improve and become more coherent.

Main challenges for future development of ecological economics in education were categorized into three main types: institutional, political, and internal challenges. Finding sufficient funding, the dominance of mainstream economics at universities and in society, struggles with interdisciplinary efforts, and issues with accommodating ecological economics education to the job market, all have an influence on the extent that ecological economics can be developed in education.

There are several opportunities for the development of ecological economics education that became evident through this study, with the most important ones being: i) increase the use of alternative teaching materials and styles of teaching, ii) create a database of good educational materials, iii) provide different tracks within a (masters) degree, iv) provide students with action-based education through engaging with local society and creating partnerships, and v) engage in academic politics. The international and regional societies for ecological economics can take a leading role in achieving these opportunities. They should focus more on education in their aims and at the organized conferences.

I have provided an overview of what can be seen as core elements of a degree in ecological economics, and hope that this functions as a source of inspiration for teachers in the field. By outlining challenges and opportunities for ecological economics education to advance, I hope to

have given specific examples of the steps that can be taken to achieve further development of ecological economics courses and degrees.

Education plays a crucial role in transforming the current economic system, and solve the social-an environmental crises we are facing in society today (Polimeni, 2004; Gills & Morgan, 2020, Salamantov et al., 2020). Ecological economics, with a strong focus on sustainability and justice, challenges the status quo and poses solutions to these challenges. Therefore, developing ecological economics in higher education is important. I hope that this study can serve as a source of inspiration for ecological economists to advance ecological economics education.

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## 8. Appendices

### Appendix 1: Programs and courses in Ecological Economics

	English Name	Original Name	Type (Degree, Course, Module, Summer school, Other)	Level (Bachelor, Master, PhD, Other)	Institution (University, Faculty, Department)	Active
1.	Ecological Economics	<a href="#">Economia Ecológica</a>	Degree	BA	Universidade Federal do Ceará, Centro de Ciências Agrárias	Yes
2.	Master in Ecological Economics	<a href="#">Maestría en Economía Ecológica</a>	Degree	MA (Professional Masters)	La Universidad Central del Ecuador, Facultad Ciencias Económicas	Yes
3.	Ecological Economics	<a href="#">Ecological Economics</a>	Degree	MA	University of Leeds, School of Earth & Environment	Yes
4.	MSc Ecological Economics	<a href="#">MSc Ecological Economics</a>	Degree	MA	The University of Edinburgh (College of Science and Engineering) /Scotland Rural College	Yes
5.	Master in Social Sciences: Ecological Economics and Sustainable Development Course	<a href="#">MASTER Sciences sociales   parcours Économie Écologique et Développement Durable (2E2D)</a>	Degree	MA	Université Toulouse Jean Jaurès	Yes
6.	Socio-Ecological Economics and Policy	<a href="#">Socio-Ecological Economics and Policy</a>	Degree	MA	Wirtschaftsuniversität Vienna	Yes
7.	Ecological Economics Graduate Certificate	<a href="#">Ecological Economics Graduate Certificate</a>	Degree - Graduate certificate	MA	The University of Vermont, Gund Institute for Environment & Rubenstein School of Environment and Natural Resources	Yes
8.	Master in Environmental and Ecological Economics	<a href="#">Maestría en Economía Ambiental y Ecológica</a>	Degree	MA	Universidad Veracruzana	Yes
9.	Ecological Economics, Values, and Policy	<a href="#">Ecological Economics, Values, and Policy</a>	Degree	MA (Professional Master's)	Rensselaer, The Departments of Science and Technology Studies and Economics	No
10.	Interdisciplinary Studies in Environmental, Economic, and Social Sustainability	<a href="#">Interdisciplinary Studies in Environmental, Economic, and Social Sustainability</a>	Degree	MA	Universitat Autònoma de Barcelona, Faculty of Science	Yes
11.	MBA in Ecological Economics	<a href="#">MBA in Ecological Economics</a>	Degree	MA	Nord University, Bodø Graduate School of Business	No

12.	Online Master's on Degrowth, Ecology, Economics, and Policy	<a href="#">Online master's on Degrowth: Ecology, Economics and Policy</a>	Degree	MA	Universitat Autònoma de Barcelona, Institute for Environmental Studies and Technology and R&D (Research and Degrowth)	Yes
13.	Ecological Economics	<a href="#">Ecological Economics</a>	Degree	PhD	Wirtschaftsuniversität Wien, Institute for Ecological Economics	Yes
14.	Ecological Economics Ph.D.	<a href="#">Ecological Economics Ph.D.</a>	Degree	PhD	Rensselær, Department of Economics	No
15.	Module: Applied Ecological Economics	<a href="#">Module: Applied Ecological Economics</a>	Module in degree	BA (Hons)	York University, Department of Environment and Geography, Bachelor in Environment, Economics and Ecology	Yes
16.	Bachelor Thesis in Ecological Economics	<a href="#">Bachelor Thesis In Ecological Economics</a>	Course (Bachelor thesis)	BA	Wirtschaftsuniversität Wien, Institute for Ecological Economics	Yes
17.	Introduction to Ecological Economics	<a href="#">Introdução à economia ecológica</a>	Course	BA	Universidade Federal de Ceará, Centro de ciencias agrarias	Yes
18.	Mathematics for Ecological Economics	<a href="#">Matemática para a economia ecológica</a>	Course	BA	Universidade Federal de Ceará, Centro de ciencias agrarias	Yes
19.	Statistics for Ecological Economics	<a href="#">Estatística para economia ecológica</a>	Course	BA	Universidade Federal de Ceará, Centro de ciencias agrarias	Yes
20.	Contemporary Ecological Economic Thought	<a href="#">Pensamento economico ecológico contemporaneo</a>	Course	BA	Universidade Federal de Ceará, Centro de ciencias agrarias	Yes
21.	Indicator Systems for the Ecological Economy	<a href="#">Sistemas de indicadores para a economia ecológica</a>	Course	BA	Universidade Federal de Ceará, Centro de ciencias agrarias	Yes
22.	Ecology and the Economy	<a href="#">Ecology and the Economy</a>	Course	BA	University of Oregon	No
23.	Ecological Economics Short Course Syllabus	<a href="#">Ecological Economics Short Course Syllabus</a>	Course	-	USSEE, United States Society for Ecological Economics	Unsure
24.	Ecological Economics	<a href="#">Ecological Economics</a>	Course	BA	Yale-NUS college	Yes
25.	Ecological Economics	<a href="#">Ecological Economics</a>	Course	BA	Teri School of Advanced Studies, Department of Policy Studies	Unsure
26.	Syllabus for Environmental Economics and	<a href="#">Syllabus for Environmental</a>	Course	BA	Uppsala University, Department of Earth Sciences	Yes

	Ecological Economics	<a href="#">Economics and Ecological Economics</a>				
27.	Ecological Economics	<a href="#">Ecological Economics</a>	Course	BA	Stockholm University, Institutionen för naturgeografi	Yes
28.	Introduction to Ecological Economics	<a href="#">Introduction to Ecological Economics</a>	Course	BA	Waterloo University, Faculty of Environment, School of Environment, Enterprise and Development	Yes
29.	Ecological Economics	<a href="#">Ecological Economics</a>	Course	BA	Dartmouth College, Environmental Studies Program	Yes
30.	Ecological & Environmental Economics	<a href="#">Ecological &amp; Environmental Economics</a>	Course	BA	The University of Queensland, Faculty of Business, Economics & Law, School of Economics	Yes
31.	Ecological Economics	<a href="#">Ecological Economics</a>	Course	BA	The University of Queensland, Faculty of Science, School of Agriculture Food Sciences	Yes
32.	Introduction to Ecological Economics	<a href="#">Introduction To Ecological Economics</a>	Course	BA	Queens University, School of Environmental Studies	Yes
33.	Ecological Economics	<a href="#">Économie écologique</a>	Course	BA	L'université de l'Outaouais et 26des La27urentides, Département des sciences naturelles	Yes
34.	Ecological Economics and Analysis of Economic Growth	<a href="#">Ecological Economics and Analysis of Economic Growth</a>	Course	BA	Universität Zürich, Fakultät Mathematik-Naturwissenschaft	Yes
35.	Ecological Economics	<a href="#">Ecological economics</a>	Course	BA	University of Helsinki, Master's Program in Food Economy and Consumption	Yes
36.	Introduction to Ecological & Environmental Economics	<a href="#">Introduction to Ecological &amp; Environmental Economics</a>	Course	BA	University of York, Department of Environment and Geography	Yes
37.	Ecological Economics	<a href="#">Ecological Economics</a>	Course	BA	Southern Cross University, Faculty of Science and Engineering	Yes
38.	Ecological Economics	<a href="#">Ecological Economics</a>	Course	BA	Colorado College	Yes
39.	Ecological Economics	<a href="#">Ecological Economics</a>	Course	BA	Central European University – Campus Vienna	No

40.	Elements of Ecological Economics – Introduction to Ecological Economics	<a href="#">Eléments d'économie écologique - Introduction to Ecological Economics</a>	Course	BA	Université de Lausanne, Faculté des géosciences et de l'environnement	Yes
41.	Ecological Economics	<a href="#">Economie écologique</a>	Course	BA	UC Louvain, Ecole des Sciences économiques/Economics School of Louvain	Yes
42.	Economics and Ecology	<a href="#">Économie et écologie</a>	Course	BA	Université Côte d'Azur	Yes
43.	Ecological Economics	<a href="#">Ecological Economics</a>	Course	MA	McGill University, Department of Economics	Yes
44.	Ecological Economics	<a href="#">Economía ecológica</a>	Course	MA	FLASCO-Ecuador, Department of Development, Environment and Territory	Yes
45.	Ecological Economics	<a href="#">Ecological Economics</a>	Course	MA	University of Surrey	Yes
46.	Ecological Economics	<a href="#">Economía Ecológica</a>	Course	MA	Universidad Nacional de Colombia, Instituto de Estudios Ambientales	Yes
47.	Ecological Economics Online Course	<a href="#">Ecological Economics Online Course</a>	Course	MA	Trent University, International Institute for Environmental Studies	2019
48.	Social Ecological Economics	<a href="#">Social Ecological Economics</a>	Course	MA	Wirtschaftsuniversität Wien	Yes
49.	Ecological Economics Course 2018	<a href="#">V Curso de Economía Ecológica 2018</a>	Course	MA	Universidad del País Vasco, Departamento de Economía Aplicada III de la UPV/EHU	2018
50.	Introduction to Ecological Economics	<a href="#">Introduction to Ecological Economics</a>	Course	MA	University of Leeds, School of Earth & Environment, Leeds University Business School	Yes
51.	Tools and Techniques in Ecological Economics	<a href="#">Tools and Techniques in Ecological Economics</a>	Course	MA	University of Leeds, School of Earth & Environment, Leeds University Business School	Yes
52.	Environmental Economics and Ecological Economics	<a href="#">Environmental Economics and Ecological Economics</a>	Course	MA	University of Uppsala, Department of Earth Sciences	Yes
53.	Ecological Economics	<a href="#">Ecological Economics</a>	Course	MA	Universiteit Gent, Department of Economics	Yes
54.	Environmental and Ecological Economics	<a href="#">Environmental and Ecological Economics</a>	Course	MA	Boğaziçi University, Department of Economics	Yes

55.	Ecological Economics: Foundations and Principles	<a href="#">Economie écologique: fondements et principes</a>	Course	MA	Université Toulouse Jean Jaurès, Département Sciences économiques et gestion Sur Internet	Yes
56.	Ecological Economics and In-Depth Development Studies	<a href="#">Economie écologique et études du développement approfondies</a>	Course	MA	Université Toulouse Jean Jaurès, Département Sciences économiques et gestion Sur Internet	Yes
57.	Fundamentals of Ecological Economics	<a href="#">Fundamentos de la Economía Ecológica</a>	Course	MA	Universidad Veracruzana, Facultad de Economía	Yes
58.	Ecological Economics	<a href="#">Economie écologique</a>	Course	MA	Université Paris Nanterre, Department of Economics, Management, Mathematics and Computer Science	Yes
59.	Ecological Economic Theory	<a href="#">Ecological Economic Theory</a>	Course	MA	The University of Vermont, Gund Institute for Environment & Rubenstein School of Environment and Natural Resources	Yes
60.	Ecological Economic Methods	<a href="#">Ecological Economic Methods</a>	Course	MA	The University of Vermont, Gund Institute for Environment & Rubenstein School of Environment and Natural Resources	Yes
61.	Ecological Economic Practice	<a href="#">Ecological Economic Practice</a>	Course	MA	The University of Vermont, Gund Institute for Environment & Rubenstein School of Environment and Natural Resources	Yes
62.	Environmental and Ecological Economics	Environmental and Ecological Economics	Course	MA	Humboldt University Berlin	Unsure
63.	Ecological Economics (ECEC)	<a href="#">Ecological Economics (ECEC)</a>	Course	MA (& Advanced Certificate)	Central European University, Department of Environmental Sciences and Policy, Campus Vienna	Yes
64.	Environmental/Ecological Economics	<a href="#">Environmental/Ecological Economics</a>	Course	MA	University of the Aegean – Department of the Environment	Yes
65.	Foundations of Ecological Economics	<a href="#">Foundations of Ecological Economics</a>	Course	MA	Universitat Autònoma de Barcelona, Faculty of Science	Yes
66.	Ecological Economics and Policy	<a href="#">Ecological Economics and Policy</a>	Course	MA	Australian National University, Crawford School of Public Policy	Yes

67.	Environmental Economics and Policy	<a href="#">Environmental Economics and Policy</a>	Module	MA	Tufts University, Global Development and Environment Institute	Yes
68.	Foundations in Ecological Economics	<a href="#">Foundations in Ecological Economics</a>	Course	MA	University of Edinburgh, School of Geosciences, College of Science and Engineering	Yes
69.	Ecological Economics Field Methods in Research and Practice	<a href="#">Ecological Economics Field Methods in Research and Practice</a>	Course	MA	University of Edinburgh, School of Geosciences, College of Science and Engineering	Yes
70.	Applications in Ecological Economics	<a href="#">Applications in Ecological Economics</a>	Course	MA	University of Edinburgh, School of Geosciences, College of Science and Engineering	Yes
71.	Ecological Economics	<a href="#">Ecological Economics</a>	Course	MA	KHT Royal Institute of Technology, Skolan för arkitektur och samhällsbyggnad	Yes
72.	Ecological Economics	<a href="#">Ecological Economics</a>	Course	MA	University of Iceland, School of Engineering and Natural Sciences, Faculty of Life and Environmental Sciences	Yes
73.	Ecological Economics	<a href="#">Ecological Economics</a>	Course	MA	Simon Fraser University	Yes
74.	Ecological Economics	<a href="#">Economia Ecologica</a>	Course	MA	Universita di Pisa, Dipartimento di Economia E management	Yes
75.	Ecological Economics	<a href="#">Ecological Economics</a>	Course	MA	Allegheny College	No
76.	Ecological Economics	Ecological Economics	Course	MA	Universidade Federal Fluminense	Yes
77.	Ecological Economics	Ecological Economics	Course	MA	Griffith University	No
78.	Principles of Ecological Economics, Globalization, and Intercultural Equity	<a href="#">Principios de Economía ecológica, globalización y equidad intercultural</a>	Course	MA	Universitat Politecnica de Valencia	Yes
79.	Ecological Economics and Degrowth: Transformative Pathways to Sustainability	Ecological Economics and Degrowth: Transformative pathways to sustainability	Course	MA	University of Oxford	Yes

80.	Special Topics IV – Ecological Macroeconomics	<a href="#">Tópicos Especiais IV – Macroeconomia Ecológica</a>	Course	MA	Universidade Federal do Paraná, Setor de Ciências Sociais Aplicadas	Yes
81.	Ecological Economics and Political Ecology Course	<a href="#">Curso economía ecológica y ecología Política</a>	Course	MA	Universidad Católica Boliviana	Yes
82.	Ecological Economics	<a href="#">Economie écologique</a>	Course	MA	Université Libre de Bruxelles, Center for Sustainable Development Studies Institute for Environmental Management and Spatial Planning	Yes
83.	Sustainability and Ecological Economics	<a href="#">Sustainability and Ecological Economics</a>	Course	MA/PhD	Australian National University, Crawford School of Public Policy	No
84.	Ecological Economics and Sustainable Development Laboratory	<a href="#">Ecological Economics and Sustainable Development Laboratory – (Eco.Su.D)</a>	<i>Research - Mainly conducting research in ecological economics by MSc Students – PhD candidates</i>	MA & PhD	University of Crete, Department of Economics	Yes
85.	Ecosystem Services and Economic Analysis: An Introduction from an Ecological Economics Perspective	<a href="#">Ecosystem services and economic analysis: an introduction from an ecological economics perspective</a>	Course	PhD	Stockholm University, resilience center	No
86.	Ecological-Economic Modelling: and Introduction	<a href="#">Ecological-Economic modeling – an introduction</a>	Course	PhD	Lund University, Faculty of Science, Centre for Environmental and Climate Research	2011
87.	Global Ecological Economics	<a href="#">Global Ecological Economics</a>	Program/Research Group	PhD	Kyoto University, Graduate School of Global Environmental Studies	Yes
88.	Online Course in Ecological Economics	<a href="#">Curso online de Economía Ecológica</a>	Course (online)	Other: level not specified	Social and Solidarity Economy Resource Site – Buenos Aires, Argentina	2013
89.	Ecological and Feminist Macroeconomics	<a href="#">Ecological and feminist macroeconomics</a>	Course	Other: Summer school	Universitat de Barcelona, School of Economics	2021
90.	Circular Economy and Degrowth Principles	<a href="#">Circular Economy and Degrowth Principles</a>	Course	Other: Summer school	Universitat Autònoma de Barcelona	Yes



91.	Oxford Summer School in Ecological Economics	<a href="#">Oxford Summer School in Ecological Economics</a>	Course	Other: Summer school	Environment Europe	2019
92.	Ecological Economics	<a href="#">Ecological Economics</a>	Course (online)	Other: no level specified	EUCLID University, an intergovernmental institution (UN series)	Unsure
93.	EE4ALL Summer Crash Course Program	<a href="#">EE4ALL Summer Crash Course Program</a>	Course	Other: Summer School	McGill University and the University of Vermont	2022
94.	Back to the Roots of Ecological Economics	<a href="#">Back to the roots of Ecological Economics</a>	Course	Other: Summer School	Universita di Pisa	2022
95.	Ecological Economics, Governance and Environmental Sustainability: Business Transformation, ESG Investment and New Sustainable Business Models	<a href="#">Ecological Economics, Governance and Environmental Sustainability: Business Transformation, ESG Investment and New Sustainable Business Models.</a>	Course	Other: Summer School	Oxford University	2022
96.	VII International Course on Ecological Economics	<a href="#">VII International Course on Ecological Economics</a>	Course	Other: Summer School/Conference	Universidad de la República Uruguay	2021
97.	Ecological Economics	<a href="#">Ecological Economics</a>	-	Other: Institute and Research	Carl of Ossietyky Universität Oldenburg	Yes
98.	Ecological Economics Workshop	<a href="#">Ecological Economics Workshop</a>	-	Other: Workshop	Sociedade Brasileira de Economia Ecológica	2022
99.	Ecological Economics	<a href="#">13. Ecological Economics</a>	-	Other: Online educational series	<a href="#">Journey of the Universe (www.journeyoftheuniverse.org)</a>	Yes

## Appendix 2: Articles used in ecological economics teaching

Title	Author & Year	Reference	Frequency
Beyond GDP: Measuring and achieving global genuine progress.	Kubiszewski, Costanza, Franco, Lawn, Talberth, Jackson, Aylmer, 2013	Kubiszewski, I., Costanza, R., Franco, C., Lawn, P., Talberth, J., Jackson, T., & Aylmer, C. (2013). Beyond GDP: Measuring and achieving global genuine progress. <i>Ecological Economics</i> , 93: 57–68. doi: 10.1016/j.ecolecon.2013.04.019.	4
Ecological economics: themes, approaches, and differences with environmental economics.	Van den Bergh, 2000	Van den Bergh, J. C. (2000). Ecological economics: themes, approaches, and differences with environmental economics. <i>Regional Environmental Change</i> , 2 (1): 13-23. doi: 10.1007/s101130000020.	4
Weak comparability of values as a foundation for ecological economics.	Martínez-Alier, Munda, O'Neill, 1998	Martínez-Alier, J., G. Munda & J. O'Neill. (1998). Weak comparability of values as a foundation for ecological economics. <i>Ecological Economics</i> , 26 (3): 277–286. doi: 10.1016/S0921-8009(97)00120-1.	4
In defence of degrowth.	Kallis, 2011	Kallis, G. (2011). In defence of degrowth. <i>Ecological Economics</i> , 70 (5): 873–880. doi: 10.1016/j.ecolecon.2010.12.007.	3
The history of ecosystem services in economic theory and practice: from early notions to markets and payment schemes.	Gómez-Baggethun, De Groot, Lomas, Montes, 2010	Gómez-Baggethun, E., De Groot, R., Lomas, P. L., & Montes, C. (2010). The history of ecosystem services in economic theory and practice: from early notions to markets and payment schemes. <i>Ecological economics</i> , 69 (6): 1209-1218. doi: 10.1016/j.ecolecon.2009.11.007.	3
A safe operating space for humanity.	Rockström, Steffen, Noone, Persson, Chapin, Lambin, Foley, 2009	Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F. S., Lambin, E. F., ... & Foley, J. A. (2009). A safe operating space for humanity. <i>Nature</i> , 461 (7263): 472-475. doi: 10.1038/461472a.	2
Ecological macroeconomic models: assessing current developments.	Hardt & O'Neill, 2017	Hardt, L., & O'Neill, D. W. (2017). Ecological macroeconomic models: assessing current developments. <i>Ecological economics</i> , 134: 198-211. doi: 10.1016/j.ecolecon.2016.12.027.	2
Economics in a full world.	Daly, 2005	Daly, H. E. (2005). Economics in a full world. <i>Scientific american</i> , 293 (3): 100-107. <a href="http://www.jstor.org/stable/26061149">http://www.jstor.org/stable/26061149</a> .	2
Is less more... or is more less? Scaling the political ecologies of the future.	Robbins, 2020	Robbins, P. (2020). Is less more... or is more less? Scaling the political ecologies of the future. <i>Political Geography</i> , 76: 102018. doi: 10.1016/j.polgeo.2019.04.010.	2
Social Multi-Criteria Evaluation: Foundations and Operational Consequences.	Munda, 2004	Munda G. (2004). Social Multi-Criteria Evaluation: Methodological Foundations and Operational Consequences. <i>European Journal of Operational Research</i> , 158 (3): 662-677. doi: 10.1016/S0377-2217(03)00369-2.	2

The economics of degrowth.	Kallis, Kerschner, Martínez-Alier, 2012	Kallis, G., Kerschner, C., & Martínez-Alier, J. (2012). The economics of degrowth. <i>Ecological Economics</i> , 84: 172–180. doi: 10.1016/j.ecolecon.2012.08.017	2
The value of the world's ecosystem services and natural capital.	Costanza, de Groot, Farber, Grasso, Hannon, Limburg, Van Den Belt, 1998	Costanza, R., de Groot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., ... & Van Den Belt, M. (1998). The value of the world's ecosystem services and natural capital. <i>Ecological economics</i> , 25 (1): 3-15. doi: 10.1038/387253a0.	2
The worth of a songbird: Ecological economics as a post-normal science.	Funtowicz & Ravetz, 1994	Funtowicz, S. & J. Ravetz. (1994). The worth of a songbird: Ecological economics as a post-normal science. <i>Ecological Economics</i> , 10 (3): 197-207. doi: 10.1016/0921-8009(94)90108-2.	2
To value or not to value? That is not the question.	Kallis, Gómez-Baggethun, Zografos, 2013	Kallis, G., Gómez-Baggethun, E., & Zografos, C. (2013). To value or not to value? That is not the question. <i>Ecological economics</i> , 94: 97-105. doi: 10.1016/j.ecolecon.2013.07.002.	2
Trends in the development of ecological economics from the late 1980s to the early 2000s.	Röpke, 2005	Röpke, I. (2005). Trends in the development of ecological economics from the late 1980s to the early 2000s. <i>Ecological economics</i> , 55 (2): 262-290. doi: 10.1016/j.ecolecon.2004.10.010.	2
What is degrowth? From an activist slogan to a social movement.	Demaria, Schneider, Sekulova, Martínez-Alier, 2013	Demaria, F., Schneider, F., Sekulova, F., & Martínez-Alier, J. (2013). What is degrowth? From an activist slogan to a social movement. <i>Environmental Values</i> , 22 (2): 191–215. doi: 10.3197/096327113X13581561725194	2
A behavioral approach to the rational choice theory of collective action.	Ostrom, 1998	Ostrom, E. (1998). A behavioral approach to the rational choice theory of collective action: Presidential address, American Political Science Association, 1997. <i>American political science review</i> , 92 (1): 1-22. doi: 10.2307/2585925.	1
A green new deal without growth?	Mastini, Kallis, Hickel, 2021	Mastini, R., Kallis, G., & Hickel, J. (2021). A green new deal without growth?. <i>Ecological Economics</i> , 179: 106832. doi: 10.1016/j.ecolecon.2020.106832.	1
A greener revolution in making? Environmental governance in the 21 <sup>st</sup> century.	Agrawal & Lemos, 2007	Agrawal, A. & M. Lemos. (2007). A greener revolution in making? Environmental governance in the 21st century. <i>Environment</i> , 49 (5): 36-45. doi: 10.3200/ENVT.49.5.36-45.	1
A new valuation school: Integrating diverse values of nature in resource and land use decisions.	Jacobs, Dendoncker, Martín-López, Gómez-Baggethun, Boeraeve, Washbourne, 2016	Jacobs, S., Dendoncker, N., Martín-López, B., Barton, D. N., Gomez-Baggethun, E., Boeraeve, F., ... & Washbourne, C. L. (2016). A new valuation school: Integrating diverse values of nature in resource and land use decisions. <i>Ecosystem services</i> , 22 (B): 213-220. doi: 10.1016/j.ecoser.2016.11.007.	1
A proposal for the greening of textbook macro: 'IS-LM-EE'.	Heyes, 2000	Heyes, A. (2000). <i>A proposal for the greening of textbook macro: 'IS-LM-EE'</i> (No. 99/7). Department of Economics, Royal Holloway University of London.	1

A Review of the Stern Review on the Economics of Climate Change.	Nordhaus, 2007	Nordhaus, W. D. (2007). A Review of the Stern Review on the Economics of Climate Change. <i>Journal of Economic Literature</i> , 45 (3): 686-702. doi: 10.1257/jel.45.3.686.	1
A social-multicriteria evaluation approach to assess extractive and non-extractive scenarios in Ecuador: Intag case study.	Walter, Latorre, Tomás, Munda, Larrea, 2016	Walter, M., Latorre Tomás, S., Munda, G., Larrea, C. (2016). A social-multicriteria evaluation approach to assess extractive and non-extractive scenarios in Ecuador: Intag case study. <i>Land Use Policy</i> , 57: 444-458. doi: 10.1016/j.landusepol.2016.05.030.	1
A socio-metabolic transition towards sustainability? Challenges for another Great Transformation.	Haberl, Fischer-Kowalski, Krausmann, Martínez-Alier, Winiwarter, 2011	Haberl, H., M. Fischer-Kowalski, F. Krausmann, J. Martínez-Alier & V. Winiwarter. (2011). A socio-metabolic transition towards sustainability? Challenges for another Great Transformation. <i>Sustainable Development</i> , 19 (1): 1-14. doi: 10.1002/sd.410.	1
A stock-flow-fund ecological macroeconomic model.	Dafermos, Nikolaidi, Galanis, 2017	Dafermos, Y., Nikolaidi, M., & Galanis, G. (2017). A stock-flow-fund ecological macroeconomic model. <i>Ecological Economics</i> , 131: 191-207. doi: 10.1016/j.ecolecon.2016.08.013.	1
Abandoning the concept of cultural ecosystem services, or against natural-scientific imperialism.	Kirchhoff, 2019	Kirchhoff, T. (2019). Abandoning the concept of cultural ecosystem services, or against natural-scientific imperialism. <i>BioScience</i> , 69 (3): 220-227. doi: 10.1093/biosci/biz007.	1
An ecological macroeconomics model: The energy transition in the EU.	Nieto, Carpintero, Lpbejón, Miguel, 2020	Nieto, J., Carpintero, O., Lpbejón, L.F., Miguel, L.J. (2020). An ecological macroeconomics model: The energy transition in the EU. <i>Energy Policy</i> , 145: 111726. doi: 10.1016/j.enpol.2020.111726.	1
An evaluation of monetary and non-monetary techniques for assessing the importance of biodiversity and ecosystem services to people in countries with developing economies.	Christie, Fazey, Cooper, Hyde, Kenter, 2012	Christie, M., Fazey, I., Cooper, R., Hyde, T., & Kenter, J. O. (2012). An evaluation of monetary and non-monetary techniques for assessing the importance of biodiversity and ecosystem services to people in countries with developing economies. <i>Ecological economics</i> , 83: 67-78. doi: 10.1016/j.ecolecon.2012.08.012.	1
An institutional analysis of payments for environmental services.	Vatn, 2010	Vatn, A. (2010), An institutional analysis of payments for environmental services, <i>Ecological Economics</i> , 69 (6): 1245-1252. doi: 10.1016/j.ecolecon.2009.11.018.	1
Analysis of Academic Literature on Environmental Valuation.	Guijarro & Tsinaslanidis, 2020	Guijarro, F. and P. Tsinaslanidis. 2020. Analysis of Academic Literature on Environmental Valuation. <i>International Journal of Environmental Research and Public Health</i> , 17 (7): 2386. doi:10.3390/ijerph17072386	1
Auctions for conservation contracts: an empirical examination of Victoria's BushTender trial.	Stoneham et. al. 2003	Stoneham et. al. (2003). Auctions for conservation contracts: an empirical examination of Victoria's BushTender trial. <i>The Australian Journal of Agricultural and Resource Economics</i> , 47 (4): 477-500. doi: 10.1111/j.1467-8489.2003.t01-1-00224.x.	1

Australia's genuine progress indicator revisited (1962-2013).	Kenny, Costanza, Dowsley, Jackson, Josol, Kubiszewski, Thompson, 2019	Kenny, D. C., Costanza, R., Dowsley, T., Jackson, N., Josol, J., Kubiszewski, I., ... & Thompson, J. (2019). Australia's genuine progress indicator revisited (1962–2013). <i>Ecological Economics</i> , 158: 1-10. doi: 10.1016/j.ecolecon.2018.11.025.	1
Automobile fuel economy standards: Impacts, efficiency, and alternatives.	Anderson, Parry, Sallee, Fischer, 2011	Anderson, S. T., Parry, I. W. H., Sallee, J. M., & Fischer, C. (2011). Automobile fuel economy standards: Impacts, efficiency, and alternatives. <i>Review of Environmental Economics and Policy</i> , 5 (1): 89–108. doi: 10.1093/reep/req021.	1
Beyond monetary measurement: How to evaluate projects and policies using the ecosystem services framework.	Sijtsma, Van der Heide, Van Hinsberg, 2013	Sijtsma, F. J., Van der Heide, C. M., & Van Hinsberg, A. (2013). Beyond monetary measurement: How to evaluate projects and policies using the ecosystem services framework. <i>Environmental Science &amp; Policy</i> , 32: 14-25. doi: 10.1016/j.envsci.2012.06.016.	1
Biodiversity policy beyond economic growth.	Otero et al., 2020	Otero, I., Farrell, K. N., Pueyo, S., Kallis, G., Kehoe, L., Haberl, H., ... & Pe'Er, G. (2020). Biodiversity policy beyond economic growth. <i>Conservation letters</i> , 13 (4): e12713. doi: 10.1111/conl.12713.	1
Catalonia's energy metabolism: Using the MuSIASEM approach at different scales.	Ramos-Martín, Canellas-Bolta, Giampietro, Gamboa, 2009	Ramos-Martín, J., Canellas-Bolta, S., Giampietro, M., & Gamboa, G. (2009). Catalonia's energy metabolism: Using the MuSIASEM approach at different scales. <i>Energy Policy</i> , 37 (11): 4658-4671. doi: 10.1016/j.enpol.2009.06.028.	1
Changes in the global value of ecosystem services.	Costanza, De Groot, Sutton, Van der Ploeg, Anderson, Kubiszewski, Turner, 2014	Costanza, R., De Groot, R., Sutton, P., Van der Ploeg, S., Anderson, S. J., Kubiszewski, I., ... & Turner, R. K. (2014). Changes in the global value of ecosystem services. <i>Global environmental change</i> , 26: 152-158. doi: 10.1016/j.gloenvcha.2014.04.002.	1
Characterizing the metabolic pattern of urban systems using MuSIASEM: The case of Barcelona.	Perez-Sánchez, Giampietro, Velasco-Fernández, Ripa, 2019	Pérez-Sánchez, L., Giampietro, M., Velasco-Fernández, R., & Ripa, M. (2019). Characterizing the metabolic pattern of urban systems using MuSIASEM: The case of Barcelona. <i>Energy policy</i> , 124:13-22. doi: 10.1016/j.enpol.2018.09.028.	1
Circular economy as an essentially contested concept.	Korhonen, Nuur, Feldmann, Birkie, 2018	Korhonen, J., Nuur, C., Feldmann, A., & Birkie, S. E. (2018). Circular economy as an essentially contested concept. <i>Journal of cleaner production</i> , 175: 544-552. doi: 10.1016/j.jclepro.2017.12.111.	1
Combining participative and institutional approaches with multicriteria evaluation. An empirical study for water issues in Troina, Sicily.	De Marchi, Funtowicz, Cascio, Munda, 2000	De Marchi, B., Funtowicz, S. O., Cascio, S. L., & Munda, G. (2000). Combining participative and institutional approaches with multicriteria evaluation. An empirical study for water issues in Troina, Sicily. <i>Ecological Economics</i> , 34 (2): 267-282. doi: 10.1016/S0921-8009(00)00162-2.	1

Commercial and biophysical deficits in South America, 1990-2013.	Samaniego, Vallejo, Martínez-Alier, 2017	Samaniego, P., Vallejo, M.C., Martínez-Alier, J. (2017). Commercial and biophysical deficits in South America, 1990-2013. <i>Ecological Economics</i> , 133: 62-73. doi: 10.1016/j.ecolecon.2016.11.012.	1
Contemporary guidance for stated preference studies.	Johnston, Boyle, Adamowicz, Bennett, Brouwer, Cameron, Vossler, 2017	Johnston, R. J., Boyle, K. J., Adamowicz, W., Bennett, J., Brouwer, R., Cameron, T. A., ... & Vossler, C. A. (2017). Contemporary guidance for stated preference studies. <i>Journal of the Association of Environmental and Resource Economists</i> , 4(2), 319-405. doi: 10.1086/691697.	1
Creating an earth atmospheric trust.	Barnes, Costanza, Hawken, Orr, Ostrom, Umana, Young, 2008	Barnes, P., Costanza, R., Hawken, P., Orr, D., Ostrom, E., Umana, A., & Young, O. (2008). Creating an earth atmospheric trust. <i>Science</i> , 319 (5864): 724. doi: ???	1
Decoupling Debunked – Evidence and argumenta against green growth as a sole strategy for sustainability.	Parrique, Barth, Briens, Kerschner, Kraus-Polk, Kuokkanen, Spangenberg, 2019	Parrique, T., Barth, J., Briens, F., Kerschner, C., Kraus-Polk, A., Kuokkanen, A., & Spangenberg, J. H. (2019). Decoupling debunked – Evidence and arguments against green growth as a sole strategy for sustainability. <i>European Environmental Bureau</i> .	1
Decroissance: A project for radical transformation of society.	Muraca, 2013	Muraca, B. (2013). Decroissance: A project for a radical transformation of society. <i>Environmental Values</i> , 22 (2): 147–169. doi: 10.3197/096327113X13581561725112.	1
Der Rebound-Effekt: ein blinder Fleck der sozial-ökologischen Gesellschaftstransformation.	Santarius, 2014	Santarius, T. (2014). Der Rebound-Effekt: ein blinder Fleck der sozial-ökologischen Gesellschaftstransformation. <i>GAIA - Ecological Perspectives for Science and Society</i> , 23 (2): 109–117. doi: 10.14512/gaia.23.2.8.	1
Development: Time to leave GDP behind.	Costanza, Kubiszewski, Giovannini, Lovins, McGlade, Pickett, Wilkinson, 2014	Costanza, R., Kubiszewski, I., Giovannini, E., Lovins, H., McGlade, J., Pickett, K. E., ... & Wilkinson, R. (2014). Development: Time to leave GDP behind. <i>Nature</i> , 505 (7483): 283-285. doi: 10.1038/505283a.	1
Digging deeper into Hardin’s pasture: the complex institutional structure of the tragedy of the commons’.	Cole, Epstein, McGinnis, 2014	Cole, D. H., G. Epstein, and M. D. McGinnis. (2014). Digging deeper into Hardin's pasture: the complex institutional structure of the tragedy of the commons', <i>Journal of Institutional Economics</i> , 10 (3): 353-369. doi: 10.1017/S1744137414000101.	1
Disaggregated economic impact analysis incorporating ecological and social trade-offs and techno-institutional context: A case from the Western Ghats of India.	Lélé & Srinivasan, 2013	Lélé, S. & Srinivasan, V. (2013). Disaggregated economic impact analysis incorporating ecological and social trade-offs and techno-institutional context: A case from the Western Ghats of India. <i>Ecological Economics</i> , 91: 98-112. doi: 10.1016/j.ecolecon.2013.03.023.	1
Discounting the discount rate: Ecocentrism and environmental economics.	Barkin, 2006	Barkin, J. S. (2006). Discounting the discount rate: Ecocentrism and environmental economics. <i>Global Environmental Politics</i> , 6 (4): 56-72. doi: 10.1162/glep.2006.6.4.56.	1



Ecological macroeconomics: An application to climate change.	Rezai, Taylor, Mechler, 2013	Rezai, A., Taylor, L., & Mechler, R. (2013). Ecological macroeconomics: An application to climate change. <i>Ecological Economics</i> , 85: 69-76. doi: 10.1016/j.ecolecon.2012.10.008.	1
Ecological Macroeconomics: Introduction and Review.	Rezai & Stagl, 2016	Rezai, A., & Stagl, S. (2016). Ecological Macroeconomics: Introduction and Review. <i>Ecological Economics</i> , 121: 181-185. doi: ???	1
Ecological modernization and the global economy.	Mol, 2002	Mol, A. P. (2002). Ecological modernization and the global economy. <i>Global environmental politics</i> , 2 (2): 92-115. doi: 10.1162/15263800260047844.	1
Ecological-economic modeling for biodiversity management: potential, pitfalls, and prospects.	Wätzold et al., 2006	Wätzold, F., Drechsler, M., Armstrong, C. W., Baumgärtner, S., Grimm, V., Huth, A., ... & Wissel, C. (2006). Ecological-economic modeling for biodiversity management: potential, pitfalls, and prospects. <i>Conservation Biology</i> , 20 (4): 1034-1041. doi: 10.1111/j.1523-1739.2006.00353.x.	1
Econ 101 – In need of a sustainability transition.	Røpke, 2020	Røpke, I. (2020). Econ 101—In need of a sustainability transition. <i>Ecological Economics</i> , 169: 106515. doi: 10.1016/j.ecolecon.2019.106515.	1
Economic experiments and environmental policy.	Noussair & van Soest, 2014	Noussair, Charles N. & van Soest, Daan P. (2014). Economic experiments and environmental policy. <i>Annual Review of Resource Economics</i> , 6: 319–337.	1
Economic growth and the environment: Whose growth? Whose environment?.	Beckerman, 1992	Beckerman, W. (1992). Economic growth and the environment: Whose growth? Whose environment?. <i>World development</i> , 20 (4): 481-496. doi: 10.1016/0305-750X(92)90038-W.	1
Economic growth, carrying capacity, and the environment.	Arrow, Bolin, Costanza, Dasgupta, Folke, Holling, Pimentel. 1995	Arrow, K., Bolin, B., Costanza, R., Dasgupta, P., Folke, C., Holling, C. S., ... & Pimentel, D. (1995). Economic growth, carrying capacity, and the environment. <i>Ecological economics</i> , 15 (2): 91-95. doi: 10.1017/S1355770X00000413.	1
Economic valuation of ecosystem goods and services: a review for decision makers.	Tinch et al., 2019	Tinch, R., Beaumont, N., Sunderland, T., Ozdemiroglu, E., Barton, D., Bowe, C., Börger, T., Burgess, P., Cooper, C., Faccioli, M., Failler, P., Gkolemi, I., Kumar, R., Longo, A., McVittie, A., Morris, J., Park, J., Ravenscroft, N., Schaafsma, M., Vause, J. and G. Ziv. (2019). Economic valuation of ecosystem goods and services: a review for decision makers. <i>Journal of Environmental Economics and Policy</i> , 8 (4): 359-378. doi: 10.1080/21606544.2019.1623083.	1
Ecosystem services and beyond: Using multiple metaphors to understand human-environment relationships.	Raymond et al., 2013	Raymond, C. M., Singh, G. G., Benessaiah, K., Bernhardt, J. R., Levine, J., Nelson, H., ... & Chan, K. M. (2013). Ecosystem services and beyond: Using multiple metaphors to understand human–environment relationships. <i>BioScience</i> , 63 (7): 536-546. doi: 10.1525/bio.2013.63.7.	1

Ecosystem services in decision making: time to deliver.	Daily et al., 2009	Daily, G. C., Polasky, S., Goldstein, J., Kareiva, P. M., Mooney, H. A., Pejchar, L., ... & Shallenberger, R. (2009). Ecosystem services in decision making: time to deliver. <i>Frontiers in Ecology and the Environment</i> , 7 (1): 21-28. doi: 10.1890/080025.	1
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The economic effects of climate change.	Tol, 2009	Tol, R. S. (2009). The economic effects of climate change. <i>Journal of economic perspectives</i> , 23 (2): 29-51. doi: 10.1257/jep.23.2.29.	1
The economic legacy of the Holocene.	Krall, 2018	Krall, L., 2018. The economic legacy of the Holocene. <i>The Ecological Citizen</i> , 2 (1): 67-76.	1

The economics of water quality trading.	Olmstead, 2010	Olmstead, S. M. (2010) The economics of water quality trading. <i>Review of Environmental Economics and Policy</i> , 4 (1): 44–62. doi: 10.1093/reep/rep016.	1
The ecosystem services agenda: Bridging the worlds of natural science and economics, conservation and development, and public and private policy.	Braat & de Groot, 2012	Braat, L. C., & de Groot, R. (2012). The ecosystem services agenda: Bridging the worlds of natural science and economics, conservation and development, and public and private policy. <i>Ecosystem Services</i> , 1 (1): 4-15. doi: 10.1016/j.ecoser.2012.07.011.	1
The extermination and conservation of the American bison.	Lueck, 2002	Lueck, D. (2002). The extermination and conservation of the American bison. <i>The Journal of Legal Studies</i> , 31 (S2): S609-S652. doi: 10.1086/340410.	1
The GDP paradox.	Van den Bergh, 2009	Van den Bergh, J. C. (2009). The GDP paradox. <i>Journal of economic psychology</i> , 30 (2): 117-135. doi: 10.1016/j.joep.2008.12.001.	1
The genuine progress indicator 2006.	Talberth, Cobb, Slattery, 2007	Talberth, J., Cobb, C., & Slattery, N. (2007). The genuine progress indicator 2006. <i>Oakland, CA: Redefining Progress</i> , 26.	1
The Green New Deal and Green Transitions.	Bryner, 2019	Bryner, N. S. (2019). The Green New Deal and Green Transitions. <i>Vt. L. Rev.</i> , 44: 723. doi: ???	1
The identity of ecological economics: retrospects and prospects.	Özkaynak, Adaman, Devine, 2012	Özkaynak, B., Adaman, F. and P. Devine. (2012). The identity of ecological economics: retrospects and prospects. <i>Cambridge Journal of Economics</i> . 36: 1123–1142. doi:10.1093/cje/bes021.	1
The knowledge that counts: institutional identities, policy science, and the conflict over fire management in the Gran Sabana, Venezuela.	Sletto, 2008	Sletto, B. (2008). The knowledge that counts: institutional identities, policy science, and the conflict over fire management in the Gran Sabana, Venezuela. <i>World Development</i> , 36 (10): 1938-1955. doi: 10.1016/j.worlddev.2008.02.008.	1
The metabolism of oil extraction: A bottom-up approach applied to the case of Ecuador.	Parra, Di Felice, Giampietro, Ramos-Martin, 2018	Parra, R., Di Felice, L.J., Giampietro, M., Ramos-Martin, J. (2018). The metabolism of oil extraction: A bottom-up approach applied to the case of Ecuador. <i>Energy Policy</i> , 122: 63-74. doi: 10.1016/j.enpol.2018.07.017.	1
The net benefit of saving the Asian elephant: a policy and contingent valuation study.	Bandara & Tisdell, 2004	Bandara, R. and Tisdell, C. (2004). The Net Benefit of Saving the Asian Elephant: A Policy and Contingent Valuation Study. <i>Ecological Economics</i> , 48 (1): 93-107. doi: 10.1016/j.ecolecon.2003.01.001.	1
The post-growth challenge: secular stagnation, inequality and the limits to growth.	Jackson, 2019	Jackson, T. (2019). The post-growth challenge: secular stagnation, inequality and the limits to growth. <i>Ecological economics</i> , 156: 236-246. doi: 10.1016/j.ecolecon.2018.10.010.	1
The prerequisites for a degrowth paradigm shift: Insights from critical political economy.	Buch-Hansen, 2018	Buch-Hansen, H. (2018). The prerequisites for a degrowth paradigm shift: Insights from critical political economy. <i>Ecological Economics</i> , 146: 157-163. doi: 10.1016/j.ecolecon.2017.10.021.	1



The prosperous way down.	Odum & Odum, 2006	Odum, H. T., & Odum, E. C. (2006). The prosperous way down. <i>Energy</i> , 31 (1): 21-32. doi: 10.1016/j.energy.2004.05.012.	1
The rebound effect: an assessment of the evidence for economy-wide energy savings from improved energy efficiency.	Sorrell, 2007	Sorrell, S. (2007). The Rebound Effect: an assessment of the evidence for economy-wide energy savings from improved energy efficiency. <i>UK Energy Research Centre London</i> .	1
The role of economics in climate change policy.	McKibbin & Wilcoxon, 2002	McKibbin, W. J., & Wilcoxon, P. J. (2002). The role of economics in climate change policy. <i>Journal of economic perspectives</i> , 16 (2): 107-129. doi: 10.1257/0895330027283.	1
The SO2 Allowance Trading System: The Ironic History of a Grand Policy Experiment.	Schmalensee & Stavins, 2013	Schmalensee & Stavins. (2013). The SO2 Allowance Trading System: The Ironic History of a Grand Policy Experiment. <i>Journal of Economic Perspectives</i> , 27 (1): 103-122. doi: 10.1257/jep.27.1.103.	1
The sustainability debate: Idealism versus conformism – the controversy over economic growth.	Verstegen & Hanekamp, 2005	Verstegen, S. W., & Hanekamp, J. C. (2005). The sustainability debate: Idealism versus conformism—the controversy over economic growth. <i>Globalizations</i> , 2 (3): 349-362. doi: 10.1080/14747730500367843.	1
The transition to a sustainable prosperity-a stock-flow-consistent ecological macroeconomic model for Canada.	Jackson & Victor, 2020	Jackson, T., & Victor, P. A. (2020). The transition to a sustainable prosperity-a stock-flow-consistent ecological macroeconomic model for Canada. <i>Ecological Economics</i> , 177: 106787. doi: 10.1016/j.ecolecon.2020.106787.	1
The ultrasocial origin of the Anthropocene.	Gowdy & Krall, 2013	Gowdy, J., & Krall, L. (2013). The ultrasocial origin of the Anthropocene. <i>Ecological Economics</i> , 95: 137-147. doi: 10.1016/j.ecolecon.2013.08.006.	1
To Tax or Not to Tax: Alternative Approaches to Slowing Global Warming.	Nordhaus, 2007	Nordhaus, W. D. (2007). To Tax or Not to Tax: Alternative Approaches to Slowing Global Warming. <i>Review of Environmental Economics and Policy</i> , 1 (1): 26–44. doi: 10.1093/reep/rem008.	1
Toward some operational principles of sustainable development.	Daly, 1990	Daly, Herman E. (1990). Toward some operational principles of sustainable development. <i>Ecological Economics</i> , 2 (1): 1–6. doi: 10.1016/0921-8009(90)90010-R.	1
Towards a post-Keynesian ecological macroeconomics.	Fontana & Sawyer, 2016	Fontana, G., & Sawyer, M. (2016). Towards post-Keynesian ecological macroeconomics. <i>Ecological Economics</i> , 121, 186-195. doi: 10.1016/j.ecolecon.2015.03.017.	1
Towards an environmental macroeconomics.	Daly, 1991	Daly, H. E. (1991). Towards an environmental macroeconomics. <i>Land economics</i> , 67 (2): 255-259. doi: 10.2307/3146415.	1
Trade and the environment: from a ‘Southern’ perspective.	Muradian, Martinez-Alier, 2001	Muradian, R., & Martinez-Alier, J. (2001). Trade and the environment: from a ‘Southern’ perspective. <i>Ecological Economics</i> , 36 (2): 281-297. doi: 10.1016/S0921-8009(00)00229-9.	1

Trade, growth, and the environment.	Copeland & Taylor, 2004	Copeland, B. R., & Taylor, M. S. (2004). Trade, growth, and the environment. <i>Journal of Economic Literature</i> , 42 (1): 7–71. doi: 10.1257/002205104773558047.	1
Understanding the complexity of economic, ecological, and social systems.	Holling	Holling, C.S. (2001). Understanding the complexity of economic, ecological, and social systems. <i>Ecosystems</i> , 4 (5): 390-405. doi: 10.1007/s10021-001-0101-5.	1
Unraveling the claims for (and against) green growth.	Jackson & Victor, 2019	Jackson, T., & Victor, P. A. (2019). Unraveling the claims for (and against) green growth. <i>Science</i> , 366 (6468): 950-951. doi: 10.1126/science.aay0749.	1
Urban ecosystems: the human dimension.	Rees, 1997	Rees, W. E. (1997). Urban ecosystems: the human dimension. <i>Urban ecosystems</i> , 1 (1): 63-75. doi: 10.1023/A:1014380105620.	1
Use of ecosystem services economic valuation for decision making: questioning a literature blindspot.	Laurans, Rankovic, Billé, Pirard, Mermet, 2013	Laurans, Y., Rankovic, A., Billé, R., Pirard, R., & Mermet, L. (2013). Use of ecosystem services economic valuation for decision making: questioning a literature blindspot. <i>Journal of environmental management</i> , 119: 208-219. doi: 10.1016/j.jenvman.2013.01.008.	1
Valuing nature's contributions to people: the IPBES approach.	Pascual, Balvanera, Díaz, Stenseke, Yagi, 2017	Pascual, U., Balvanera, P., Díaz, S., Pataki, G., Roth, E., Stenseke, M., ... & Yagi, N. (2017). Valuing nature's contributions to people: the IPBES approach. <i>Current opinion in environmental sustainability</i> , 26: 7-16.	1
What is ecological economics?	Costanza, 1989	Costanza, R. (1989). What is ecological economics? <i>Ecological Economics</i> , 1 (1): 1-7. doi: 10.1016/0921-8009(89)90020-7.	1
Where are cultural and social in ecosystem services? A framework for constructive engagement.	Chan et al, 2012	Chan, K. M., Guerry, A. D., Balvanera, P., Klain, S., Satterfield, T., Basurto, X., ... & Woodside, U. (2012). Where are cultural and social in ecosystem services? A framework for constructive engagement. <i>BioScience</i> , 62 (8): 744-756. doi: 10.1525/bio.2012.62.8.7.	1
Why ecological economics needs to return to its roots: The biophysical foundation of socio-economic systems.	Melgar-Melgar & Hall, 2020	Melgar-Melgar, R. E., & Hall, C. A. (2020). Why ecological economics needs to return to its roots: The biophysical foundation of socio-economic systems. <i>Ecological Economics</i> , 169: 106567. doi: 10.1016/j.ecolecon.2019.106567.	1
Will raising the incomes of all increase the happiness of all?	Easterlin, 1995	Easterlin, R. A. (1995). Will raising the incomes of all increase the happiness of all?. <i>Journal of Economic Behavior &amp; Organization</i> , 27 (1): 35-47. doi: 10.1016/0167-2681(95)00003-B.	1

### Appendix 3: Books used in ecological economics teaching

Title	Author(s)	Year	Book reference	Frequency
Ecological economics: principles and applications.	Daly & Farley	2011	Daly, H. E., & Farley, J. (2011). <i>Ecological economics: principles and applications</i> . Island press.	8
Ecological economics: and introduction.	Common & Stagl	2005	Common, M., & Stagl, S. (2005). <i>Ecological economics: an introduction</i> . Cambridge University Press.	7
Prosperity without growth: Foundations for the economy of tomorrow.	Jackson	2016	Jackson, T. (2016). <i>Prosperity without growth: Foundations for the economy of tomorrow</i> . Routledge.	4
An introduction to ecological economics.	Costanza, Cumberland, Daly, Goodland, Norgaard	1997	Costanza, R., Cumberland, J. H., Daly, H., Goodland, R., & Norgaard, R. B. (1997). <i>An introduction to ecological economics</i> . CRC Press.	4
Routledge handbook of ecological economics	Spash	2017	Spash, C. L. (2017). <i>Routledge handbook of ecological economics</i> . Routledge.	3
Small is beautiful: A study of economics as if people mattered.	Schumacher	2011	Schumacher, E. F. (2011). <i>Small is beautiful: A study of economics as if people mattered</i> . Random House.	3
Doughnut economics: seven ways to think like a 21st-century economist.	Raworth	2017	Raworth, K. (2017). <i>Doughnut economics: seven ways to think like a 21st-century economist</i> . Chelsea Green Publishing.	3
Environmental and natural resource economics: A contemporary approach.	Harris & Roach	2017	Harris, J. M., & Roach, B. (2017). <i>Environmental and natural resource economics: A contemporary approach</i> . Routledge.	3
For the common good, redirecting the economy toward community, the environment and a sustainable future.	Cobb & Daly	1989	Cobb, J., & Daly, H. (1989). <i>For the common good, redirecting the economy toward community, the environment and a sustainable future</i> .	3
Governing the commons: The evolution of institutions for collective action.	Ostrom	1990	Ostrom, E. (1990). <i>Governing the commons: The evolution of institutions for collective action</i> . Cambridge university press.	3
Environment and natural resource economics.	Tietenberg & Lewis	2018	Tietenberg, T., & Lewis, L. (2018). <i>Environmental and natural resource economics</i> . Routledge.	2
Natural resource and environmental economics.	Perman, McGilvray, Common	2003	Perman, R., Ma, Y., McGilvray, J., & Common, M. (2003). <i>Natural resource and environmental economics</i> . Pearson Education.	2
Ecological economics: a workbook for problem-based learning.	Farley, Erickson, Daly	2005	Farley, J., Erickson, J. D., & Daly, H. E. (2005). <i>Ecological economics: a workbook for problem-based learning</i> . Island Press.	2
Valuing the earth: economics, ecology, ethics.	Daly & Townsend	1992	Daly, H. E., & Townsend, K. N. (1992). <i>Valuing the earth: economics, ecology, ethics</i> . MIT press.	2

Degrowth: a vocabulary for a new era.	D'Alisa, Demaria, Kallis	2014	D'Alisa, G., Demaria, F., & Kallis, G. (2014). <i>Degrowth: a vocabulary for a new era</i> . Routledge.	2
Ecological economics: the science and management of sustainability.	Costanza	1992	Costanza, R. (1992). <i>Ecological economics: the science and management of sustainability</i> . Columbia University Press.	2
Sustainable development.	Vivien	2007	Vivien FD. (2007). <i>Sustainable development</i> . Editions la Découverte.	1
Institutions and the environment.	Vatn	2007	Vatn, A. (2007). <i>Institutions and the Environment</i> . Edward Elgar Publishing.	1
Intermediate microeconomics: a modern approach: ninth international student edition.	Varian	2014	Varian, H. R. (2014). <i>Intermediate microeconomics: a modern approach: ninth international student edition</i> . WW Norton & Company.	1
Handbook of environmental and resource economics.	Van den Bergh	2002	Van den Bergh, J. C. (2002). <i>Handbook of environmental and resource economics</i> . Edward Elgar Publishing.	1
Debating Nature's Value: The Concept of 'Natural Capital'.	Anderson	2018	Anderson, V. (2018). <i>Debating Nature's Value: The Concept of 'Natural Capital'</i> . Springer.	1
Policy instruments for environmental and natural resource management.	Sterner & Coria	2013	Sterner, T., & Coria, J. (2013). <i>Policy instruments for environmental and natural resource management</i> . Routledge.	1
Ecological economics: sustainability in practice.	Shmelev	2011	Shmelev, S. E. (2011). <i>Ecological economics: sustainability in practice</i> . Springer Science & Business Media.	1
The future is degrowth: A guide to a world beyond capitalism.	Schmelzer, Vetter, Vansintjan	2022	Schmelzer, M., Vetter, A., & Vansintjan, A. (2022). <i>The future is degrowth: A guide to a world beyond capitalism</i> . Verso Books.	1
Développement durable, ou le gouvernement du changement total.	Rumpala	2010	Rumpala, Y. (2010). <i>Développement durable, ou le gouvernement du changement total</i> . Lectures le livre.	1
Amulya Reddy: Citizen scientist.	Rajan	2009	Rajan, R. (2009). <i>Amulya Reddy: Citizen scientist</i> . New Delhi: Orient Blackswan.	1
Industrial ecology and spaces of innovation.	Green & Randles	2006	Green, K. & Randles, S. (2006). <i>Industrial ecology and spaces of innovation</i> . Cheltenham: Edward Elgar.	1
The economics of ecosystems and biodiversity.	Kumar	2012	Kumar, P. (2012). <i>The Economics of Ecosystems and Biodiversity</i> . Routledge.	1
Rules, Games, & Common-Pool Resources.	Ostrom, Roy, Walker	1994	Ostrom E., Roy G. & Walker J. (1994). <i>Rules, Games, &amp; Common-Pool Resources</i> . The University of Michigan Press.	1
Gut leben: eine Gesellschaft jenseits des Wachstums.	Muraca	2014	Muraca, B. (2014). <i>Gut leben: eine Gesellschaft jenseits des Wachstums</i> . Verlag Klaus Wagenbach.	1
Environmental and natural resource economics.	Moore & Hackett	2011	Moore, M.C. & Hackett, S.C. (2011). <i>Environmental and Natural Resources Economics</i> . Routledge.	1

Using surveys to value public goods: the contingent valuation methods.	Mitchell & Carson	1989	Mitchell, R. C. & Carson, R.T. (1989). <i>Using Surveys to Value Public Goods: The Contingent Valuation Method</i> . Washington, D.C.: Resources for the Future.	1
Thinking in systems: A primer.	Meadows	2008	Meadows, D. H. (2008). <i>Thinking in systems: A primer</i> . Chelsea green publishing.	1
Paradise for sale: a parable of nature.	McDaniel & Gowdy	2000	McDaniel, C. N., & Gowdy, J. M. (2000). <i>Paradise for sale: a parable of nature</i> . Univ of California Press.	1
Recent developments in ecological economics.	Martínez-Alier & Røpke	2008	Martinez-Alier, J., Ropke, I. (2008). <i>Recent Developments in Ecological Economics</i> . E. Elgar, Cheltenham.	1
Handbook of ecological economics.	Martínez-Alier & Muradian	2015	Martinez-Alier, J., & Muradian, R. (2015). <i>Handbook of ecological economics</i> . Edward Elgar Publishing.	1
International encyclopedia of the social and behavioral sciences.	Smelser & Baltes	2014	Smelser, N. & Baltes, P. (2014). <i>International encyclopedia of the social and behavioral sciences</i> . London: Pergamon.	1
The environmentalism of the poor: a study of ecological conflicts and valuation.	Martínez-Alier	2003	Martinez-Alier, J. (2003). <i>The Environmentalism of the poor: a study of ecological conflicts and valuation</i> . Edward Elgar Publishing.	1
Ecological economics. Energy, Environment and Society.	Martínez-Alier	1987	Martínez-Alier, J. (1987). <i>Ecological Economics. Energy, Environment and Society</i> . Basil Blackwell.	1
Creating an ecological society: toward a revolutionary transformation.	Magdoff & Williams	2017	Magdoff, F., & Williams, C. (2017). <i>Creating an ecological society: toward a revolutionary transformation</i> . NYU Press.	1
Economics in the future.	Dopfer	2019	Dopfer, K. (2019). <i>Economics in the future</i> . London: Macmillan.	1
The economics approach to environmental and natural resources.	Kahn	1995	Kahn, J. R. (1995). <i>The Economic Approach to Environmental and Natural Resources</i> . Drypen Pr.	1
Collapse: how societies choose to fail or succeed.	Diamond	2004	Diamond, J. (2004). <i>Collapse: How Societies Choose to Fail or Succeed</i> . Penguin Books.	1
The ecological economics of consumption.	Reisch & Røpke	2004	Reisch, L. & Røpke, I. (2004). <i>The ecological economics of consumption</i> . Cheltenham: Edward Elgar.	1
Material concerns: Pollution, profit and quality of life.	Jackson	2013	Jackson, T. (2013). <i>Material concerns: Pollution, profit and quality of life</i> . Routledge.	1
Principles of environmental economics and sustainability: an integrated economic and ecological approach.	Hussen	2012	Hussen, A. (2012). <i>Principles of environmental economics and sustainability: an integrated economic and ecological approach</i> . Routledge.	1
Ecological economics from the ground up.	Healy, Martínez-Alier, Temper,	2013	Healy, H., Martínez-Alier, J., Temper, L., Walter, M., & Gerber, J. F. (2013). <i>Ecological economics from the ground up</i> . Routledge.	1



	Walter, Gerber			
The economics of global climate change.	Harris & Roach	2007	Harris, J. M., Roach, B., & Environmental, J. M. H. (2007). <i>The economics of global climate change</i> . Global Development And Environment Institute Tufts University.	1
Introduction to environmental economics.	Hanley, Shogren, White	2019	Hanley, N., Shogren, J., & White, B. (2019). <i>Introduction to environmental economics</i> . Oxford University Press.	1
Environmental economics in theory and practice.	Hanley, Shogren, White	1997	Hanley, N., Shogren, J. F., & White, B. (1997). <i>Environmental economics in theory and practice</i> . London: Macmillan.	1
Cost-Benefit Analysis and the Environment.	Hanley & Spash	1994	Hanley, N. & Spash, C.L. (1994). <i>Cost-Benefit Analysis and the Environment</i> . Edward Elgar Publishing.	1
Energy and the wealth of nations: An introduction to biophysical economics.	Hall & Klitgaard	2018	Hall, C. A., & Klitgaard, K. (2018). <i>Energy and the wealth of nations: An introduction to biophysical economics</i> . Springer International Publishing.	1
Planetary economics: energy, climate change and the three domains of sustainable development.	Grubb	2014	Grubb, M. (2014). <i>Planetary economics: energy, climate change and the three domains of sustainable development</i> . Routledge.	1
A primer of ecology.	Gotelli	2008	Gotelli, N. J. (2008). <i>A primer of ecology</i> . Sunderland, MA: Sinauer Associates.	1
Economix: How and Why Our Economy Works (and Doesn't Work), in Words and Pictures.	Goodwin	2012	Goodwin, M. (2012). <i>Economix: How and Why Our Economy Works (and Doesn't Work), in Words and Pictures</i> . Abrams.	1
Economics and the Environment.	Goodstein & Polasky	2017	Goodstein, E. S., & Polasky, S. (2017). <i>Economics and the Environment</i> . John Wiley & Sons.	1
Environnement et développement durable: une approche méta-économique.	Godard	2015	Godard, O. (2015). <i>Environnement et développement durable: une approche méta-économique</i> . De Boeck Supérieur.	1
Consumer society in American history: a reader.	Glickman	1999	Glickman, L. B. (1999). <i>Consumer society in American history: a reader</i> . Cornell University Press.	1
Towards an integrated paradigm in heterodox economics.	Gerber & Steppacher	2012	Gerber, J.F. & Steppacher, R. (2012). <i>Towards an integrated paradigm in heterodox economics</i> . Basingstoke: PalgraveMacmillan.	1
The entropy law and the economic process.	Georgescu-Roegen	1971	Georgescu-Roegen, N. (1971). <i>The Entropy Law and the Economic Process</i> . Harvard University Press.	1
Environmental economics: an introduction.	Field	1994	Field, B. C. (1994). <i>Environmental economics: an introduction</i> . McGraw-Hill Book Company (UK) Ltd.	1
The foundations for an ecological economy: an overview.	Farley	2016	Farley, J., 2016. <i>The foundations for an ecological economy: an overview</i> . Beyond Uneconomic Growth.	1
Pluriverse: a post-development dictionary.	Escobar, Demaria, Kothari,	2019	Escobar, Demaria, Kothari, Salleh, Acosta. (2019). <i>Pluriverse: A Post-development Dictionary</i> . Tulika Books.	1

	Salleh, Acosta				
The progress illusion: reclaiming our future from the fairytale of economics.	Erickson	2022	Erickson, J. D. (2022). <i>The Progress Illusion: Reclaiming Our Future from the Fairytale of Economics</i> . Island Press.	1	
Economic growth and environmental sustainability: the prospects for green growth.	Ekins	2002	Ekins, P. (2002). <i>Economic growth and environmental sustainability: the prospects for green growth</i> . Routledge.	1	
How much is enough: the consumer society and the future of the earth.	Durning	1992	Durning, A. (1992). <i>How much is enough: The Consumer Society and the Future of the Earth</i> . W.W. Norton & Company.	1	
L'économie écologique.	Douai & Plumecocq	2017	Douai, A., & Plumecocq, G. (2017). <i>L'économie écologique</i> . La Découverte.	1	
Enough is enough: building a sustainable economy in a world of finite resources.	Dietz & O'Neill	2013	Dietz, R., & O'Neill, D. (2013). <i>Enough is enough: Building a sustainable economy in a world of finite resources</i> . Routledge.	1	
Beyond growth: the economics of sustainable development.	Daly	2014	Daly, H. E. (2014). <i>Beyond growth: the economics of sustainable development</i> . Beacon Press.	1	
Steady-state economics: with new essays.	Daly	1991	Daly, H. E. (1991). <i>Steady-state economics: with new essays</i> . Island press.	1	
Ecological economics for the anthropocene: and emerging paradigm.	Brown & Timmerman	2015	Brown, P. G., & Timmerman, P. (2015). <i>Ecological economics for the anthropocene: An emerging paradigm</i> . Columbia University Press.	1	
Microeconomics: Behavior, Institutions, and Evolution.	Bowles	2003	Bowles, S. (2003). <i>Microeconomics: Behavior, Institutions, and Evolution</i> . Princeton University Press.	1	
The economics of the environment.	Berck & Helfand	2010	Berck, P. & Helfand, G. (2010). <i>The Economics of the Environment</i> . Pearson.	1	
Ecology: from individuals to ecosystems.	Begon & Townsend	2020	Begon, M., & Townsend, C. R. (2020). <i>Ecology: from individuals to ecosystems</i> . John Wiley & Sons.	1	
The economic growth engine: how energy and work drive material prosperity.	Ayres & Warr	2010	Ayres, R. U., & Warr, B. (2010). <i>The economic growth engine: how energy and work drive material prosperity</i> . Edward Elgar Publishing.	1	
Useful work and information as drivers of growth.	Ayres & Warr	2002	Ayres, R. U., & Warr, B. (2002). <i>Useful work and information as drivers of growth</i> . INSEAD.	1	
The economics of happiness: Building genuine wealth.	Anielski	2007	Anielski, M. (2007). <i>The economics of happiness: Building genuine wealth</i> . New Society Publishers.	1	
The new systems reader: alternatives to a failed economy.	Speth & Courier	2020	Speth, J. G., & Courier, K. (2020). <i>The new systems reader: alternatives to a failed economy</i> . Routledge.	3	
Economics of the environment: selected readings.	Stavins	2019	Stavins, R. N. (2019). <i>Economics of the environment: selected readings</i> . Edward Elgar Publishing.	2	
The International Yearbook of Environmental and Resource Economics 1998-1999.	Tietenberg & Folmer	1998	Tietenberg, T. & Folmer, H. (1998). <i>The International Yearbook of Environmental</i>	2	

*and Resource Economics 1998–1999.*  
Edward Elgar.



## Appendix 4: Table systematic search for books in Ecological Economics – English

Title	Author(s)	Year	Publisher	Reference	Type
Ecological Economics: a Practical Programme for Global Reform	Dziobek	1992	Zed Books	Dziobek, C. (Ed.). (1992). <i>Ecological economics: a practical programme for global reform</i> . Zed Books.	Textbook
Ecological Economics: The Science and Management of Sustainability	Costanza	1992	Columbia University Press	Costanza, R. (1992). <i>Ecological economics: the science and management of sustainability</i> . Columbia University Press.	Textbook
Energy and the Ecological Economics of Sustainability	Peet	1992	Island Press	Peet, J. (1992). <i>Energy and the ecological economics of sustainability</i> . Island Press.	Textbook
Investing in Natural Capital: the Ecological Economics Approach to Sustainability	Johansson, Hammer, Folke, Costanza	1994	Island Press	Johansson, O. (1994). <i>Investing in natural capital: the ecological economics approach to sustainability</i> . Island Press.	Textbook
Ecological Economics and Sustainable Development: Theory, Methods and Applications	Van den Bergh	1996	Edward Elgar Publishing Ltd.	Van den Bergh, J. C. (1996). <i>Ecological economics and sustainable development. Theory, methods and applications</i> . Edward Elgar Publishing Ltd.	Textbook
Ecological Economics: Concepts and Methods	Faber, Manstetten, Proops	1996	Edward Elgar Publishing Ltd.	Faber, M., Manstetten, R., & Proops, J. (1996). <i>Ecological economics: concepts and methods</i> . Edward Elgar Publishing Ltd.	Textbook
Getting Down to Earth: Practical Applications of Ecological Economics	Costanza, Segura, Bonilla	1996	Island Press	Costanza, Segura, Bonilla. (1996). <i>Getting down to earth: practical applications of ecological economics</i> . Island Press.	Textbook
Frontiers in Ecological Economics: Transdisciplinary Essays by Robert Costanza	Costanza	1997	Edward Elgar Publishing Ltd.	Costanza, R. (1997). <i>Frontiers in ecological economics: transdisciplinary essays by Robert Costanza</i> . Edward Elgar Publishing Ltd.	Other
An introduction to Ecological Economics	Costanza, Cumberland, Daly, Goodland, Norgaard	1997	CRC Press	Costanza, R., Cumberland, J. H., Daly, H., Goodland, R., & Norgaard, R. B. (1997). <i>An introduction to ecological economics</i> . CRC Press.	Textbook

Ecological Economics and the Ecology of Economics: Essays in Criticism	Daly	1999	Edward Elgar Publishing	Daly, H.E. (1999). <i>Ecological economics and the ecology of economics: essays in criticism</i> . Edward Elgar Publishing.	Other
Economics and Environment: Essays on Ecological Economics and Sustainable Development	Pearce	1999	Edward Elgar Publishing Ltd.	Pearce, D. (1999). <i>Economics and environment: essays on ecological economics and sustainable development</i> . Edward Elgar Publishing Ltd.	Other
Global Food Markets and Their Local Alternatives: A Socio-Ecological Economics Analysis	Stagl	1999	Rensselaer Polytechnic Institute	Stagl, S. (1999). <i>Global food markets and their local alternatives: A socio-ecological economic analysis</i> . Rensselaer Polytechnic Institute.	Textbook: specific
Ecological Economics: A Political Economics Approach to Environment and Development	Söderbaum	2000	Earthscan	Söderbaum, P. (2000). <i>Ecological economics: a political economics approach to environment and development</i> . Earthscan.	Textbook
Toward Sustainable Development: An Ecological Economics Approach	Lawn	2000	CRC Press	Lawn, P. A. (2000). <i>Toward sustainable development: an ecological economics approach</i> . CRC Press.	Textbook
Biodiversity and Ecological Economics: Participation, Values and Resource Management	Tacconi	2000	Earthscan	Tacconi, L. (2000). <i>Biodiversity and ecological economics: participation, values, and resource management</i> . Earthscan.	Textbook: specific
The Economics of Nature and the Nature of Economics	Cleveland, Stern, Costanza	2001	Edward Elgar	Cleveland, C.J., Stern, D.I., Costanza, R. (2001). <i>The Economics of Nature and the Nature of Economics</i> . Edward Elgar.	Textbook
The Origins of Ecological Economics: The Bioeconomics of Georgescu-Roegen	Mayumi	2001	Routledge	Mayumi, K. (2001). <i>The origins of ecological economics: the bioeconomics of Georgescu-Roegen</i> . Routledge.	Textbook: specific
New Dimensions in Ecological Economics: Integrated Approaches to People and Nature	Dovers, Stern, Young	2003	Edward Elgar Publishing Limited	Dovers, S., Stern, D., & Young, M. (2003). <i>New dimensions in ecological economics: Integrated approaches to people and nature</i> . Edward Elgar Publishing Limited.	Textbook

Managing Wetlands: An Ecological Economics Approach	Turner, Van den Bergh, Brouwer	2003	Edward Elgar Publishing	Turner, R. K., van den Bergh, J. C., & Brouwer, R. (2003). <i>Managing wetlands: an ecological economics approach</i> . Edward Elgar Publishing.	Textbook: specific
The Ecological Economics of Biodiversity: Methods and Policy Applications	Nunes, Van den Bergh, Nijkamp	2003	Edward Elgar Publishing Ltd.	Nunes, P. A., Van Den Bergh, J. C., & Nijkamp, P. (2003). <i>The ecological economics of biodiversity: methods and policy applications</i> . Edward Elgar Publishing Ltd	Textbook: specific
The Environmentalism of the Poor: A Study of Ecological Conflicts and Valuation	Martínez-Alier	2003	Edward Elgar Publishing	Martinez-Alier, J. (2003). <i>The Environmentalism of the poor: a study of ecological conflicts and valuation</i> . Edward Elgar Publishing.	Textbook: specific
Modelling in Ecological Economics	Proops & Safonov	2004	Edward Elgar Publishing	Proops, J. L., & Safonov, P. (Eds.). (2004). <i>Modelling in ecological economics</i> . Edward Elgar Publishing.	Textbook: specific
Spatial Ecological-Economic Analysis for Wetland Management: Modelling and Scenario Evaluation of Land-use	Van den Bergh, Barendregt, Gilbert	2004	Cambridge University Press	Van den Bergh, J.C.M., Barendregt, A., Gilbert, A. (2004). <i>Spatial Ecological-Economic Analysis for Wetland Mangement</i> . Cambridge University Press.	Textbook: specific
The Ecological Economics of Consumption	Røpke & Reisch	2004	Edward Elgar Publishing	Røpke, I., & Reisch, L. A. (2004). <i>The ecological economics of consumption</i> . Edward Elgar Publishing.	Textbook: specific
Dimensions of Environmental and Ecological Economics	Sahu & Choudhury	2005	Universities Press	Sahu, N. C., & Choudhury, A. K. (Eds.). (2005). <i>Dimensions of environmental and ecological economics</i> . Universities Press.	Textbook
Ecological Economics: A Workbook for Problem-Based Learning	Farley, Erickson, Daly	2005	Island Press	Farley, J., Erickson, J. D., & Daly, H. E. (2005). <i>Ecological economics: a workbook for problem-based learning</i> . Island Press.	Textbook
Ecological Economics: An Introduction	Common & Stagl	2005	Cambridge University Press	Common, M., & Stagl, S. (2005). <i>Ecological economics: an introduction</i> . Cambridge University Press.	Textbook
Joint Production and Responsibility in Ecological Economics	Baumgärtner, Faber, Schiller	2006	Edward Elgar	Baumgärtner, S., Faber, M., & Schiller, J. (2006). <i>Joint production and responsibility in ecological economics</i> . Edward Elgar.	Textbook: specific

Marxism and Ecological Economics: Toward a Red and Green Political Economy	Burkett	2006	Brill	Burkett, P. (2006). <i>Marxism and ecological economics: Toward a red and green political economy</i> . Brill.	Textbook: specific
Sustainable Development Indicators in Ecological Economics	Lawn	2006	Edward Elgar Publishing	Lawn, P. A. (Ed.). (2006). <i>Sustainable development indicators in ecological economics</i> . Edward Elgar Publishing.	Textbook: specific
Ecological Economics and Sustainable Development	Daly	2007	Edward Elgar Publishing	Daly, H. E. (2007). <i>Ecological economics and sustainable development</i> . Edward Elgar Publishing.	Textbook
Frontier Issues in Ecological Economics	Lawn	2007	Edward Elgar	Lawn, P. (2007). <i>Frontier issues in ecological economics</i> . Edward Elgar.	Textbook
Ecological Economics and Industrial Ecology: A Case Study of the Integrated Product Policy of the European Union	Kronenberg	2007	Routledge	Kronenberg, J. (2007). <i>Ecological economics and industrial ecology: a case study of the Integrated Product Policy of the European Union</i> . Routledge.	Textbook: specific
Ecological Economics of Sustainable Watershed Management	Erickson, Messner, Ring	2007	Emerald Group Publishing Limited	Erickson, J.D., Messner, F., Ring, I. (2007). <i>Ecological Economics of Sustainable Watershed Management</i> . Emerald Group Publishing Limited.	Textbook: specific
Ecological Economics Research Trends	Pertsova	2007	Nova Publishers	Pertsova, C. C. (2007). <i>Ecological economics research trends</i> . Nova Publishers.	Textbook: specific
Institutions and the Environment	Vatn	2007	Edward Elgar Publishing	Vatn, A. (2007). <i>Institutions and the Environment</i> . Edward Elgar Publishing.	Textbook: specific
Socioecological Transitions and Global Change: Trajectories of Social Metabolism and Land Use	Fischer-Kowalski & Haberl	2007	Edward Elgar Publishing	Fischer-Kowalski, M., & Haberl, H. (Eds.). (2007). <i>Socioecological transitions and global change: Trajectories of social metabolism and land use</i> . Edward Elgar Publishing.	Textbook: specific
Ecological Economics and Sustainable Development: Selected Essays	Daly	2008	Edward Elgar	Daly, H. (2008). <i>Ecological economics and sustainable development: Selected essays</i> . New York, NY, USA: Edward Elgar.	Other

Deliberative Ecological Economics	Zografos & Howarth	2008	Oxford University Press	Zografos, C., & Howarth, R. (2008). <i>Deliberative ecological economics</i> . Oxford University Press.	Textbook
Ecological Economics of the Oceans and Coasts	Patterson & Glavovic	2008	Edward Elgar Publishing	Patterson, M. G., & Glavovic, B. C. (Eds.). (2008). <i>Ecological economics of the oceans and coasts</i> . Edward Elgar Publishing.	Textbook: specific
Ecological Economics: An Introduction	Edwards-Jones, Davies, Hussain	2009	John Wiley & Sons	Edwards-Jones, G., Davies, B., & Hussain, S. S. (2009). <i>Ecological economics: an introduction</i> . John Wiley & Sons.	Textbook
Post Keynesian and Ecological Economics: Confronting Environmental Issues	Holt, Pressman, Spash	2009	Edward Elgar Publishing	Holt, R. P., Pressman, S., & Spash, C. L. (Eds.). (2009). <i>Post Keynesian and Ecological Economics: Confronting Environmental Issues</i> . Edward Elgar Publishing.	Textbook: specific
Resilience, Reciprocity and Ecological Economics: Northwest Coast Sustainability	Trosper	2009	Routledge	Trosper, R. (2009). <i>Resilience, reciprocity and ecological economics: Northwest Coast sustainability</i> . Routledge.	Textbook: specific
Ecological Economics Reviews	Limburg, Costanza, Kubiszewski	2010	Blackwell Publishing	Limburg, Costanza, Kubiszewski. (2010). <i>Ecological Economics Reviews</i> . Blackwell Publishing.	Other
Elements of Ecological Economics	Andersson & Eriksson	2010	Routledge	Andersson, J. O., & Eriksson, R. (2010). <i>Elements of ecological economics</i> . Routledge.	Textbook
System Science and Modeling for Ecological Economics	Voinov	2010	Academic Press	Voinov, A. A. (2010). <i>Systems science and modeling for ecological economics</i> . Academic Press.	Textbook: specific
Ecological Economics: Principles and Applications	Daly & Farley	2011	Island Press	Daly, H. E., & Farley, J. (2011). <i>Ecological economics: principles and applications</i> . Island press.	Textbook
Ecological Economics: Sustainability in Practice	Shmelev	2011	Springer Science & Business Media	Shmelev, S. E. (2011). <i>Ecological economics: sustainability in practice</i> . Springer Science & Business Media.	Textbook

Multicriteria Evaluation in a Fuzzy Environment: Theory and Applications in Ecological Economics	Munda	2012	Springer Science & Business Media	Munda, G. (2012). <i>Multicriteria evaluation in a fuzzy environment: theory and applications in ecological economics</i> . Springer Science & Business Media.	Textbook: specific
Regional Sustainability: Applied Ecological Economics Bridging the Gap Between Natural and Social Sciences	Ring, Klauer, Wätzold, Mansson	2012	Springer Science & Business Media	Ring, I., Klauer, B., Wätzold, F., & Mansson, B. A. (Eds.). (2012). <i>Regional Sustainability: Applied Ecological Economics Bridging the Gap Between Natural and Social Sciences</i> . Springer Science & Business Media.	Textbook: specific
How Ecofeminists Use Complexity in Ecological Economics	Salleh, Mellor, Farrell	2013	Routledge	Salleh, A., Mellor, M., & Farrell, K. N. (2013). How ecofeminists use complexity in ecological economics. In <i>Beyond Reductionism</i> (pp. 180-204). Routledge.	Bookchapter
What Lies Beyond Reductionism? Taking Stock of Interdisciplinary Research in Ecological Economics	Farrell & Luzzati	2013	Routledge	Farrell, K. N., & Luzzati, T. (2013). What lies beyond reductionism? Taking stock of interdisciplinary research in ecological economics. In <i>Beyond Reductionism</i> (pp. 62-101). Routledge.	Bookchapter
A Survey of Ecological Economics	Krishnan, Harris, Goodwin	2013	Island Press	Krishnan, R., Harris, J., & Goodwin, N. R. (Eds.). (2013). <i>A survey of ecological economics</i> (Vol. 1). Island Press.	Other
Study Guide for Ecological Economics	Daly	2013	Cram101 Incorporated	Daly, H.E. (2013). <i>Study guide for ecological economics by Daly, Herman. E.</i> Cram101 Incorporated, 2013.	Other
Ecological Economics from the Ground Up	Healy, Martínez-Alier, Temper, Watler, Gerber	2013	Routledge	Healy, H., Martínez-Alier, J., Temper, L., Walter, M., & Gerber, J. F. (Eds.). (2013). <i>Ecological economics from the ground up</i> . Routledge.	Textbook
Ecological Economics: Political Economics for Social and Environmental Development	Söderbaum	2013	Routledge	Söderbaum, P. (2013). <i>Ecological economics: Political economics for social and environmental development</i> . Routledge.	Textbook

Building a Green Economy: Perspectives from Ecological Economics	Richardson	2013	Michigan State University Press	Richardson, R. B. (2013). <i>Building a green economy: perspectives from ecological economics</i> . Michigan State University Press.	Textbook: specific
Ecological Economics and Sustainable Development	Costanza, Alperovitz, Daly, Farley, Franco, Jackson, Victor	2015	Routledge	Costanza, R., Alperovitz, G., Daly, H. E., Farley, J., Franco, C., Jackson, T., ... & Victor, P. (2015). 18 ECOLOGICAL ECONOMICS AND SUSTAINABLE DEVELOPMENT. In: <i>Routledge International Handbook of Sustainable Development</i> . Routledge.	Bookchapter
Ecological Economics: A New Paradigm Ahead	Jakobsen	2015	Edward Elgar Publishing	Jakobsen, O. (2015). Ecological economics: a new paradigm ahead. In <i>Business and the Greater Good</i> . Edward Elgar Publishing.	Bookchapter
Handbook of Ecological Economics	Martínez-Alier & Muradian	2015	Edward Elgar Publishing	Martinez-Alier, J., & Muradian, R. (Eds.). (2015). <i>Handbook of ecological economics</i> . Edward Elgar Publishing.	Handbook
Ecological Economics for the Anthropocene: An Emerging Paradigm	Brown & Timmerman	2015	Columbia University Press	Brown, P. G., & Timmerman, P. (Eds.). (2015). <i>Ecological economics for the anthropocene: An emerging paradigm</i> . Columbia University Press.	Textbook
Alternatives to Money-As-Usual in Ecological Economics: A Study of Local Currencies and 100 Percent Reserve Banking	Dittmer	2015	Universitat Autònoma de Barcelona	Dittmer, K. (2015). <i>Alternatives to money-as-usual in ecological economics: a study of local currencies and 100 percent reserve banking</i> . Universitat Autònoma de Barcelona.	Textbook: specific
Green Economy Reader: Lectures in Ecological Economics and Sustainability	Shmelev	2016	Springer	Shmelev, S. (Ed.). (2016). <i>Green economy reader: Lectures in ecological economics and sustainability</i> (Vol. 6). Springer.	Other
Ecological Economics	Sarkar	2016	Gyan Books	Sarkar, S. (2016). <i>Ecological Economics</i> . Gyan Books.	Textbook
Beyond Uneconomic Growth: Economics, Equity and the Ecological Predicament	Farley & Malghan	2016	Edward Elgar Publishing	Farley, J.C., Malghan, D. (2016). <i>Beyond uneconomic growth: economics, equity and the ecological predicament</i> . Edward Elgar Publishing.	Textbook: specific



Ecological Economics and Harmonious Society	Qu, Sun, Guo, Yu	2016	Springer	Qu, F., Sun, R., Guo, Z., & Yu, F. (Eds.). (2016). <i>Ecological economics and harmonious society</i> . Berlin/Heidelberg, Germany: Springer.	Textbook: specific
Resolving the Climate Crisis: The Ecological Economics of Climate Change	Lawn	2016	Springer	Lawn, P. (2016). <i>Resolving the Climate Change Crisis: The Ecological Economics of Climate Change</i> . Springer, Dordrecht.	Textbook: specific
Routledge Handbook of Ecological Economics	Spash	2017	Routledge	Spash, C. L. (2017). <i>Routledge handbook of ecological economics</i> . New York; London: Routledge.	Handbook
Doughnut Economics: Seven Ways to Think Like a 21st-Century Economist	Raworth	2017	Chelsea Green Publishing	Raworth, K. (2017). <i>Doughnut economics: seven ways to think like a 21st-century economist</i> . Chelsea Green Publishing.	Other
Transformative Ecological Economics: Process Philosophy, Ideology and Utopia	Jakobsen	2017	Routledge	Jakobsen, O. (2017). <i>Transformative ecological economics: process philosophy, ideology and Utopia</i> . Routledge.	Textbook
Rethinking Economics	Fischer, Hasell, Proctor, Uwakwe, Ward-Perkins, Watson	2017	Taylor & Francis	Fischer, L., Hasell, J., Proctor, J. C., Uwakwe, D., Ward-Perkins, Z., & Watson, C. (2017). <i>Rethinking economics</i> . Taylor & Francis.	Textbook: specific
Ecological Economics	Van der Heide, Heijman, Heijman, Schaminée, Schaminée	2018	Wageningen Academic Publishers	Van der Heide, M., Heijman, W.J.M., Heijman, W., Schaminée, J.H.J., Schaminée, J. (2018). <i>Ecological Economics</i> . Wageningen Academic Publishers.	Textbook
Anarchism and Ecological Economics: A Transformative Approach to a Sustainable Future	Jakobsen	2018	Routledge	Jakobsen, O. D. (2018). <i>Anarchism and ecological economics: A transformative approach to a sustainable future</i> . Routledge.	Textbook: specific
Ecological Economics and Policy	Daniels	2018	Routledge	Daniels, P. (2018). <i>Ecological economics and policy</i> . Routledge.	Textbook: specific



Ecological Economics: Redefining Economics for Democracy and Sustainability	Söderbaum	2019	Routledge	Söderbaum, P. (2019). Ecological economics: Redefining economics for democracy and sustainability. In <i>Alternative Approaches to Economic Theory</i> (pp. 207-221). Routledge.	Bookchapter
Eco Eco: Ecological Economics	Robertson & Robertson	2019	Action Publishing Technology Limited	Robertson, J., Robertson, J. (2019). <i>Eco Eco: Ecological Economics</i> . Action Publishing Technology Limited.	Textbook
Paradise Lost?: The Ecological Economics of Biodiversity	Barbier, Barbier, Folke	2019	Routledge	Barbier, E. B., Barbier, J. C. B., & Folke, C. (Eds.). (2019). <i>Paradise Lost?: the ecological economics of biodiversity</i> (Vol. 2). Routledge.	Textbook: specific
Introduction: What is Ecological Economics and Why Do We Need It Now More Than Ever	Costanza, Erickson, Farley, Kubiszewski	2020	Edward Elgar Publishing	Costanza, R., Erickson, J. D., Farley, J., & Kubiszewski, I. (2020). Introduction: what is ecological economics and why do we need it now more than ever. In <i>Sustainable Wellbeing Futures</i> (pp. 1-15). Edward Elgar Publishing.	Bookchapter
Ecological-Economic Modelling for Biodiversity Conservation	Drechsler	2020	Cambridge University Press	Drechsler, M. (2020). <i>Ecological-Economic Modelling for Biodiversity Conservation</i> . Cambridge University Press.	Textbook: specific
Sustainable Wellbeing Futures: A Research and Action Agenda for Ecological Economics	Costanza, Erickson, Farly, Kubiszewski	2020	Edward Elgar Publishing	Costanza, R., Erickson, J. D., Farley, J., & Kubiszewski, I. (Eds.). (2020). <i>Sustainable wellbeing futures: A research and action agenda for ecological economics</i> . Edward Elgar Publishing.	Textbook: specific
Ecological Economics and Socio Ecological Strategies for Forest Conservation: A Transdisciplinary Approach Focused on Chile	Fuders & Donoso	2021	Springer	Fuders, F. & Donoso, P.J. (2021). <i>Ecological Economics and Socio Ecological Strategies for Forest Conservation</i> . Springer.	Textbook: specific
Humanitarian Ecological Economics and Accounting	Richard & Rambaud	2021	Routledge Focus	Richard, J., Rambaud, A. (2021). <i>Humanitarian Ecological Economics and Accounting. Capitalism, Ecology and Democracy</i> . Routledge Focus.	Textbook: specific

Sustainability and the New Economics: Synthesising Ecological Economics and Modern Monetary Theory	Williams & Taylor	2021	Springer Nature	Williams, S. J., & Taylor, R. (Eds.). (2021). <i>Sustainability and the New Economics: Synthesising Ecological Economics and Modern Monetary Theory</i> . Springer Nature.	Textbook: specific
A History of Ecological Economics Thought	Franco & Missemmer	2022	Taylor & Francis	Franco, M. P. V., & Missemmer, A. (2022). <i>A History of Ecological Economic Thought</i> . Taylor & Francis.	Textbook: specific
Global Ecological Governance and Ecological Economy	Zhang & Yu	2022	Springer	Zhang, W. & Yu, F. (2022). <i>Global Ecological Governance and Ecological Economy</i> . Springer.	Textbook: specific
Radical Ecological Economics and Accounting to Save the Planet: The Failure of Mainstream Economists	Richard	2022	Taylor & Francis	Richard, J. (2022). <i>Radical Ecological Economics and Accounting to Save the Planet: The Failure of Mainstream Economists</i> . Taylor & Francis.	Textbook: specific

## Appendix 5: Table systematic search for books in Ecological Economics – non-English

English Title	Original Title	Author(s)	Year	Publisher	Reference
Ecological Economics. A European Perspective	Économie écologique. Une perspective européenne.	Petit, Froger, Bauler	2022	Springer	Petit, Froger, Bauler (2022). <i>Économie écologique. Une perspective européenne. 1st ed.</i> Springer.
Ecological Economics: Introduction to Environmental and Natural Resource Economics	Economie écologique: introduction à l'économie de l'environnement et des ressources naturelles	Pillet	1993	Georg	Pillet, G. (1993). <i>Economie écologique: introduction à l'économie de l'environnement et des ressources naturelles.</i> Georg.
Environmental Economics and Ecological Economics: New Paths to Prosperity	Économie de l'environnement et économie écologique: les nouveaux chemins de la prospérité	Laurent & La Cacheux	2015	A. Collin	Laurent, É. & La Cacheux, J. (2015). <i>Économie de l'environnement et économie écologique: les nouveaux chemins de la prospérité.</i> Ed. 2nd. A. Collin.
The Ecological Economy	L'économie écologique.	Douai & Plumecocq	2017	La Découverte	Douai, A. & Plumecocq, G. (2017). <i>L'économie écologique.</i> La Découverte.
Ecological Economics, an Alternative Political Economy?	L'économie écologique, une économie politique alternative?	Petit	1997	-	Petit, R. (1997). <i>L'économie écologique, une économie politique alternative?</i>
Rethinking the Biodiversity Challenge: Ecological Economics	Repenser le défi de la biodiversité: l'économie écologique	Mouysset	2015	Rue d'Ulm	Mouysset, L. (2015). <i>Repenser le défi de la biodiversité: l'économie écologique.</i> Rue d'Ulm.
A Leap Towards an Ecological Economy	Un bond vers une économie écologique	Paul	2021	Éditions Saint Honoré	Paul, D. (2021). <i>Un bond vers une économie écologique.</i> Éditions Saint Honoré.
Ecological Economics and Environmental Policy	Economía Ecológica y Política Ambiental	Martínez-Alier & Jusmet	2013	Fondo de Cultura Economía	Martínez-Alier, J. & Jusmet, J.R. (2013). <i>Economía ecológica y política ambiental.</i> Ed. 3. Fondo de Cultura Economía.
Fundamentals for an Ecological and Social Economy	Fundamentos para una economía ecológica y social	Spash	2020	Los libros de la catarata	Spash, C.L. (2020). <i>Fundamentos para una economía ecológica y social.</i> Los Libros de la Catarata.
Ecological Economics: Reflections and Perspectives	Economía ecológica: reflexiones y perspectivas	Álvarz Cantalapiedra, Carpintero, Aguilera, Bermejo, Jusmet, Riechmann	2009	Consorcio del Círculo de bellas artes	Cantalapiedra, Carpintero, Aguilera, Bermejo, Jusmet, Riechmann. (2009). <i>Economía ecológica: Reflexiones y perspectivas.</i> Consorcio del círculo de bellas artes.
Fundamentals of Ecological Economics: Theoretical Bases and Instruments for the Resolution of Society-Nature Conflicts	Fundamentos de economía ecológica: bases teóricas e instrumentos para la resolución de los conflictos sociedad naturaleza	Pengue	2009	Ediciones Kaicron	Pengue, W. A. (2009). <i>Fundamentos de economía ecológica: bases teóricas e instrumentos para la resolución de los conflictos sociedad naturaleza.</i> Ediciones Kaicron.
Introduction to Ecological Economics	Introducción a la Economía Ecológica.	Common & Stagl	2017	Editorial Reverté, S. A.	Common, M & Stagl, S. (2017). <i>Introducción a la economía</i>

ecológica. Ed. 3. Editorial Reverté, S.A.

Sustainable Development and Ecological Economy: Integration Environment-Development and Ecological Economics	Desarrollo sostenible y economía ecológica: integración medio ambiente-desarrollo y economía-ecología	Jiménez Herrero	1996	Síntesis	Jiménez Herrero, L.M. (1996). <i>Desarrollo sostenible y economía ecológica: integración medio ambiente-esarrollo y economía-ecología</i> . Síntesis.
Ecological Economics: A Methodology for Sustainability	Economía ecológica: una metodología para la sustentabilidad	Rentería	2000	Universidad Nacional Autónoma de México.	Rentería, A. C. (2000). <i>Economía ecológica: una metodología para la sustentabilidad</i> . Universidad Nacional Autónoma de México.
From Ecological Economics to Popular Environmentalism	De la Economía Ecológica al ecologismo popular	Martínez-Alier	1992	ICARIA Editorial, S.A.	Martínez-Alier, J. (1992). <i>De la economía ecológica al ecologismo popular</i> . Ed. 1. ICARIA Editorial, S.A.
Ecological Economics, Fundamental Bases	Economía ecológica. Bases fundamentales.	Gómez Giraldo	2007	Universidad Nacional, Instituto de Estudios Ambientales, Programa de Maestrías en Medio Ambiente y Desarrollo.	Gómez Giraldo, L.J. (2007). <i>Economía ecológica. Bases fundamentales</i> . Universidad Nacional, Instituto de Estudios Ambientales, Programa de Maestrías en Medio Ambiente y Desarrollo.
Introduction to Ecological Economics	Introducción a la economía ecológica.	Costanza	1999	AENOR	Costanza, R. (1999). <i>Introducción a la economía ecológica</i> . AENOR.
Economía ecológica, demografía ambiental y Desarrollo	Economía ecológica, demografía ambiental y Desarrollo	Cabrera Trimiño	1997	Editorial de Ciencias Sociales	Cabrera Trimiño, G.J. (1997). <i>Economía ecológica, demografía ambiental y Desarrollo</i> . Editorial de Ciencias Sociales.
Manual for an Ecological Economy	Manual para una economía ecológica	Bermejo	1994	Bakeaz	Bermejo, R. (1994). <i>Manual para una economía ecológica</i> . Ed. 2. Bakeaz.
For an Ecological and Solidary Economy: Conversations with Antonio Estevan and José Manuel Naredo	Por una economía ecológica y solidaria: conversaciones con Antonio Estevan y José Manuel Naredo.	Estevan, Torregrosa, Naredo	2009	Icaria editorial	Estevan, A., Torregrosa, D., Naredo, J.M. (2009). <i>Por una economía ecológica y solidaria: conversaciones con Antonio Estevan y José Manuel Naredo</i> . Icaria editorial.
New Environmental Economy - Ecological Economics - Economic and Ethical Basis of Sustainability, Instruments for its Implementation	Neue Umweltökonomie - Ökologische Ökonomie - Ökonomische und ethische Grundlage der Nachhaltigkeit, Instrumente zu ihrer Durchsetzung.	Rogall	2002	Leske + Budrich, Opladen	Rogall, H. <i>Neue Umweltökonomie - Ökologische Ökonomie - Ökonomische und ethische Grundlage der Nachhaltigkeit, Instrumente zu ihrer Durchsetzung</i> . Leske + Budrich, Opladen.

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Evolutionary Ecological Economics	Evolutorische ökologische Ökonomie.	Geisendorf	2001	Metropolis-Verlag	Geisendorf, S. (2001). <i>Evolutorische ökologische Ökonomie</i> . Metropolis-Verlag.
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