



## Lecturers' perspectives on how introductory economic courses address sustainability

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## Lecturers' perspectives on how introductory economics addresses sustainability

Tom L. Green  
Postdoctoral Researcher  
Stockholm Resilience Centre  
Stockholm University  
Kräftriket 2B,  
SE-114 19 Stockholm, Sweden  
Email: tom.green@stockholmresilience.su.se

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### Structured Abstract

**Purpose** – Universities have signed the Talloires Declaration, committing themselves to promoting students' environmental literacy and ecological citizenship, thereby creating pressure to integrate sustainability across the curriculum. This article explores sustainability commitments' potential implications for the curriculum of introductory economics courses.

**Design/methodology/approach** – A case study approach involving qualitative research methods and the three largest public universities in British Columbia, Canada was used. As one component of a larger study, 11 of the 19 economists who delivered these courses over the study period were interviewed. The theoretical framework was informed by ecological economics scholarship on how mainstream economic thought represents environment-economy linkages.

**Findings** – Findings suggest that universities' sustainability commitments have not influenced principles of economics curriculum. Sustainability is not salient to lecturers; prospects that

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3 mainstream economics departments will integrate sustainability into curriculum in a timely  
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5 manner without external intervention appear limited.  
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10 Practical implications – While institutions often enthusiastically report on courses that contribute  
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12 to students’ ecological literacy, identifying curriculum that may confound student understanding  
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14 of sustainability receives less emphasis. Introductory economics courses appear to merit scrutiny  
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16 from this perspective.  
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22 Originality/value – About 40% of North American university students take an introductory  
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24 economics course; relatively few take more advanced economics courses. This course thus teaches  
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26 many students economic theory and the economics profession’s approach to evaluating public  
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28 policy, and has potential to contribute to knowledge of sustainability. Few studies examine how  
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30 undergraduate economics curriculum addresses sustainability.  
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36 **Keywords:**

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38 Talloires Declaration / introductory economics / curriculum / lecturers / sustainability / ecological  
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40 economics  
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45 **Article Classification:**

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## 1. Introduction

Many North American universities have committed to addressing sustainability (Haigh, 2005; Lukman and Glavič, 2007; Wright, 2002). The three major publicly-funded universities in British Columbia, Canada, like more than 400 universities worldwide, have signed the Talloires Declaration,<sup>[1]</sup> committing themselves to graduating environmentally literate students capable of becoming ecologically responsible citizens.

What do universities' sustainability commitments imply for introductory economics courses (hereafter 'Econ101')<sup>[2]</sup> taught by mainstream economics departments? Is Econ101 helping the academy meet its sustainability commitments and adding to students' environmental literacy, or should Econ101 curriculum be revised to reflect these commitments? This research project sheds light on these matters through interviews with Econ101 lecturers. Econ101 was selected for study given the fact that much environmental change is the result of economic drivers (Dietz et al., 2007) and because a growing body of literature suggests that improved prospects for sustainability require new economic goals and models (Hueting, 2009; Speth, 2008, 2009).

A review of sustainability declarations and commitments made by universities found that these institutions aim to graduate students who are environmentally literate, are guided by environmental ethics and take moral responsibility for promoting sustainability (Wright, 2002). When campus sustainability assessment tools (Shriberg, 2004), sustainability declarations, university commitments to sustainability (Haigh, 2005; McMillin and Dyball, 2009; Wright, 2002) and literature on sustainability in higher education (Martin and Jucker, 2005; Moore, 2005) are considered, it appears a consensus is emerging that sustainability is best addressed through integration across the curriculum rather than by merely being tacked onto existing degree requirements. One reason for this view is that add-ons tend to be confined to the introductory level

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<sup>[1]</sup> The declaration and the signatories can be viewed at the website of the secretariat for the declaration, the Association of University Leaders for a Sustainable Future (ULSF): [www.ulsf.org](http://www.ulsf.org) (accessed May 17, 2008).

<sup>[2]</sup> In this paper, the short form 'Econ101' will be understood to include all mainstream permutations of first-year economics, whether it is taught as an overarching principles course, as two separate courses, one each in microeconomics and macroeconomics, or as an economic policy course.

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3 and are seen by students as token courses whose content can quickly be forgotten (Haigh, 2005).  
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5 Further, what students learn in ecoliteracy modules is often contradicted by core curriculum that  
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7 countenances unsustainability (Sterling, 2004); students are left on their own to deal with such  
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9 incoherence. The above suggests that in order to support university sustainability commitments it  
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11 is important to evaluate how sustainability is or might be addressed in Econ101.  
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14 It appears that some disciplines are already deliberating how to address sustainability through  
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16 curriculum. For instance, the observation that engineers' work influences society's demands on the  
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18 environment seems to have motivated a number of studies on incorporating sustainability into  
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20 engineering curriculum (Lundholm, 2004; Mulder et al., 2012). As of this writing, there have  
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22 already been five international conferences on Engineering Education for Sustainable  
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24 Development. However, despite the fact that economic decisions can have decisive environmental  
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26 impacts, there seems to be little interest in investigating sustainability's place in undergraduate  
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28 economics curriculum. One recent study that addresses this topic found that undergraduate  
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30 economics education in the UK does not engage with sustainability (Plumridge, 2010). Thus, more  
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32 research in this area is needed. This study contributes to that aim.  
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35 The research reported here involves one component of a larger research project based on a case  
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37 study of Econ101 as taught at British Columbia, Canada's three major publicly-funded universities  
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39 (Canadian Econ101 courses are modelled on their US counterparts).[<sup>3</sup>] The overarching project  
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41 involved content analysis of leading Econ101 textbooks (Green, 2012a) and analysis of data  
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43 generated from three interview sets. The first population interviewed consisted of mainstream  
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45 economists who teach Econ101; those results are the subject of the present paper. The second  
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47 comprised professors who work in sustainability-oriented programs—such as natural resource  
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49 management—that encourage students to take Econ101. The third involved students who had  
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51 recently completed an Econ101 course (Green, 2013).  
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## 2. Mainstream economics and sustainability education

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[<sup>3</sup>] The University of British Columbia, Simon Fraser University and the University of Victoria.

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3 While there is no widely agreed upon definition of mainstream (neoclassical) economics  
4 (Colander, 2000a; Dequech, 2012; Lee, 2004), it is the school of economic thought predominant in  
5 university economics programs, government finance departments and institutions like the World  
6 Bank. Broad consensus indicates that Econ101 courses are highly standardized across North  
7 American universities, in part because the course textbook is typically selected from a handful of  
8 leading contenders (Boulding, 1988; Colander, 2000b, 2003).

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16 Synthesizing from Colander (2000a), Marglin (2008) and Hill and Myatt (2010), mainstream  
17 economics as represented in Econ101 classrooms builds up from a workhorse model of perfectly  
18 competitive markets where firms seek to maximize their profits and self-interested, rational  
19 individuals with insatiable demands consume goods and services and seek to optimize their utility.  
20 Econ101 courses thus tend to be suffused with an implicit assumption that consumption is good—  
21 and the more of it the better (Northrop, 2000; Reardon, 2007). More technically, this model  
22 centres on identifying economically efficient ways to allocate resources by considering marginal  
23 trade-offs in a setting where externalities (unintended consequences of an economic transaction  
24 that are experienced by third parties) are considered exceptional and are generally omitted from  
25 analysis. The existing distribution of wealth is generally taken as given.

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35 Even within the mainstream economics education literature, Econ101 curriculum and pedagogy  
36 have faced considerable criticism (Becker, 2000, 2004, 2007; Colander and McGoldrick, 2009;  
37 Colander, 2000b, 2003, 2005; Laurenceson, 2005; Round and Shanahan, 2010), though this  
38 critique has not examined the treatment of sustainability or how the environment-economy nexus  
39 is conceptualized. Few undergraduate students encounter heterodox theory (e.g., Marxist,  
40 institutionalist, feminist or ecological approaches to economics) in mainstream economics  
41 programs (Knoedler and Underwood, 2003; Lee, 2004).

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50 Mainstream economic theory can undoubtedly provide insights into the causes of environmental  
51 problems and inform the design of effective environmental policies (Pearce and Turner, 1990).  
52 Mainstream economists, especially those in the subdisciplines of environmental and natural  
53 resource economics, emphasize that markets sometimes fail to deliver socially optimal outcomes.  
54 For instance, to reduce excessive pollution, externalities should be internalized such that economic  
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3 actors face the full social cost of their market decisions (e.g., in the case of oil, a carbon tax should  
4 be applied such that the market price includes both oil's cost of production and the damage that  
5 burning oil imposes on society). These economists also note that markets readily supply private  
6 goods like t-shirts and cars because ownership can easily be established over them and their  
7 purchase price gives firms a monetary incentive to produce them. In contrast, public goods such as  
8 clean air have two key characteristics: diverse people benefit from them and it is impractical to  
9 establish ownership over them. As a result markets may fail to deliver a sufficient supply since  
10 users benefit from a given public good even if they do not pay for its provision. Nevertheless, a  
11 previous study found that leading Econ101 textbooks devote a mere 3.2% of their total printed  
12 area to externalities, public goods and other environmentally-related topics (Green, 2012a).  
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23 Despite the insights offered by mainstream environmental and resource economics, ecological  
24 economists (who do not belong to the mainstream school) critique mainstream economic theory  
25 for building upon a naïve conceptualization of environment-economy linkages and failing to  
26 acknowledge economic drivers of environmental degradation. For instance, mainstream models  
27 intended to capture how a firm, or the economy as a whole, produces output are usually simplified  
28 to include only two inputs, capital (machinery) and labour. Such models ignore the fact that  
29 material and energy inputs are required for production—bakeries require flour and natural gas if  
30 they are to bake bread. Thus, ecological economists promote specifying the economy's material  
31 and energy stocks and flows in economic theorizing and modelling (Ayres, 2007; Daly, 1992;  
32 Georgescu-Roegen, 1971, 1986). Once one adjusts economic theory to account for the role of  
33 these inputs, the fact that wastes will be generated as an inevitable by-product of production and  
34 will need to be disposed of is brought to the fore; environmental degradation is not merely a  
35 problem of buyers and sellers who ignore the effects of their production and consumption on third  
36 parties, as the externality model suggests. Furthermore, ecological economists stress that natural  
37 capital and ecosystem services help enable economic activity and support human wellbeing  
38 (Vemuri and Costanza, 2006; Victor, 1991). As noted earlier, mainstream economists generally  
39 presume that a healthy economy depends upon growing levels of economic output, consumption  
40 and per capita income. In contrast, ecological economists contend such growth erodes natural  
41 capital, entails increasing throughput of materials and energy and rising risk of ecosystems will  
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3 flip into regimes that deliver diminished flows of ecosystem services (Daly, 1992; Georgescu-  
4 Roegen, 1971; Røpke, 2005).  
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9 Drawing from this ecological economics perspective, it follows that to comprehensively consider  
10 how the economic theory presented in Econ101 addresses sustainability, one must also evaluate  
11 how it represents linkages between the economy and the environment. These linkages include the  
12 economy's dependence upon resources extracted from the environment and returned as waste  
13 products and how ecosystem services support the economic process. As such, this study considers  
14 how both environment-economy linkages and sustainability (henceforth, EELS) are treated in  
15 Econ101.  
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### 23 **2.1 Significance of the study**

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25 Economists argue that students from across the academy should take Econ101 because it provides  
26 a basic understanding of how modern economies function (Boulding, 1988). Indeed, each year,  
27 over a million students representing about 40% of first-year university students in North America  
28 take Econ101. Of these students, the majority take no further university-level courses in  
29 economics and less than 2.5% major in economics (Salemi and Siegfried, 1999). Econ101  
30 provides a rare chance for economists to present economic theory to students from diverse  
31 disciplines. It is thus an important conduit for transmitting economic theory sanctioned by the  
32 economics profession to the broader population (Fourcade, 2006; Marglin, 2008).  
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## 42 **3. Methodology**

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45 As there was limited research to build on, the authors reasoned that a qualitative approach, which  
46 is appropriate when researchers want to generate data about perspectives, experiences and  
47 opinions (Creswell, 2003; Marshall and Rossman, 2006), was suitable. The three universities  
48 selected for the case study were chosen because each has an economics department, has made  
49 sustainability commitments and is a major, publicly-funded university. For the lecturers, a semi-  
50 structured interview format was used since they help uncover unanticipated data and themes and  
51 help generate dense, detailed descriptions of issues and motivations (Becker, 2001). The interview  
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3 guide was structured so as to explore how Econ101 lecturers view the course's handling of  
4 sustainability; whether contemporary concerns regarding the state of the environment (e.g., global  
5 warming) and universities' sustainability commitments have affected what they teach; and the  
6 extent to which they favour revising Econ101 curriculum to more explicitly address sustainability.  
7 Further details regarding the methodology, including the interview guide, are provided in Green  
8 (2012b).  
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### 14 15 16 **3.1 Recruitment of economics lecturers**

17 From January to February 2011, an invitation was sent out to the 19 individuals identified as  
18 teaching at least one Econ101 course at the three universities from January 2010 to April 2011; 11  
19 participants were recruited. Interviews were conducted from February to April 2011. The authors  
20 conducted all interviews, recording them digitally. Data was coded and analyzed per guidance  
21 from the qualitative research methods literature (Miles and Huberman, 1994; Saldaña, 2009;  
22 Wellington and Szczerbiński, 2007).  
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30 Measures were taken to respect informants' confidentiality; in the following sections, the letters J  
31 through T denote different participants. To facilitate reader interpretation and reduce the  
32 likelihood of participants being identified, in quoting informants edits have been made that do not  
33 affect the speakers' intended meaning. Where a quote has been edited in the interest of brevity,  
34 '...' indicates omitted text. Quotes are followed by an alphanumeric tag in curly brackets that  
35 denotes the relevant paragraph in the transcript. Both women and men were represented at each  
36 study site; however, if gender were indicated, some interviewees might be identified. Given that  
37 eight of 11 interviewees were male, all results are reported using the male pronoun.  
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46 Table 1 details the characteristics of the 11 economists who participated in the study.  
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**Table 1: Breakdown of the sample of economists participating in the study**

Participant type	# of participants
Tenured faculty	6
Tenure-track faculty	1
Contract (sessional) faculty	4
Males	8
Females	3
University of British Columbia	3
Simon Fraser University	4
University of Victoria	4
Microeconomics only	6
Macroeconomics only	1
Principles	3
Economic Policy	1
Total participants	11

## 4. Results

### 4.1 *Relevance of sustainability to Econ101 curriculum*

Four participants volunteered information that suggested personal concern about current environmental trends, while two participants were dismissive of environmental concern. A self-identified climate change sceptic, lecturer M spoke of “general hysteria with global warming” {M-421}, attacked concerns about limits to growth as unfounded and referred to environmentalists as jackasses advocating for “living in caves” {M-401}.

Participants saw the market mechanism as solving problems of resource scarcity, the idea being that higher prices caused by scarcity would spur greater efforts to find and extract resources and use them efficiently. Economic growth, rising consumption and a healthy environment were described as outcomes that could be achieved concurrently. Lecturers J and M described devoting course time to explaining why the Club of Rome report<sup>[4]</sup> was wrong and why contemporary concerns about ecological limits to growth are misplaced.

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[4] *Limits to Growth* describes the results of a computer model intended to explore the behaviour of the economy and environment considered as a system; it suggests that under business-as-usual policies, continued economic growth leads to population collapse within a century (Meadows et al., 1972).

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3 Sustainability was not a salient concept for these lecturers; none explicitly addressed sustainability  
4 in Econ101 and little or no time was spent on environment-economy linkages. J, M and Q  
5 commented unfavourably on the sustainability commitments made by their university. The first  
6 two did so because they rejected the commitments' underlying premise that environmental trends  
7 are worrisome.  
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14 For Q and K, sustainability is problematic for economics because it is not well defined; Q labelled  
15 it a “fluffy catch-all phrase” {Q-29}. J saw sustainability as a loaded word associated with a  
16 “religion of sustainability” {J-127}. In his view, the fact that we have survived thus far  
17 demonstrates that human self-interest ensures sustainability:  
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21 *I mean we sustain ourselves, we survived, so it [sustainability] has got be more*  
22 *than that. Out of pure self-interest. Well here we are, and I'm an economist, so*  
23 *Adam Smith kind of articulated this, pure self-interest is enough to sustain us*  
24 *because out of our own self-interest we have an interest to sustain ourselves. {J-*  
25 *15}*  
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29 Three participants volunteered that until the interview, they had never considered the relevance of  
30 sustainability and environment-economy linkages to Econ101 curriculum. When asked what  
31 environmental content students encounter in first-year economics, T pulled out the course  
32 textbook and spent two or three minutes examining the table of contents before explaining that the  
33 question had reminded him that there is a chapter on the environment.  
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39 Four participants, P, Q, R and S, discussed how EELS is treated unsatisfactorily in Econ101. The  
40 interview prompted P to consider incorporating environmental content in the future. Most  
41 participants referred to time pressures, noting that they need to prioritize teaching ‘core’ economic  
42 theory—or as J explained, “we are to talk about cost, value, equilibrium, maximization” {J-225}.  
43 Likewise, S explained that notwithstanding his personal preference for placing more emphasis on  
44 environmental topics, the course description implies the focus should be on, “how we use concepts  
45 and theory to analyze economic issues” {S-75}.  
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54 Two of the participants, Q and R, were highly critical of typical Econ101 courses—including  
55 those taught by their colleagues—describing students as leaving standard Econ101 courses  
56 without having learned much. In their assessment, there is too much emphasis on covering  
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3 technical material that is overly abstracted from reality and does not promote student  
4 understanding. They both teach upper-year economics courses and see students who have taken  
5 their colleagues' Econ101 courses as inadequately prepared because they have been taught little or  
6 nothing about externalities and market failures. Q explained how lecturers' tendency to skip  
7 market failures leads to students concluding that economists always love markets:  
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12 *...we teach students badly. Like we give them a very bad sense of what economics*  
13 *is and we sort of drive away good students in droves, 'cause they walk away*  
14 *thinking we're on crack. {Q-41}*  
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17 Although Econ101 courses do not directly address sustainability, six of the lecturers suggested  
18 that the course offers tools and insights relevant to addressing sustainability, including market  
19 failures, the concept of opportunity costs, GDP's limitations as a measure of welfare and the need  
20 to carefully weigh costs and benefits when making public policy decisions. One lecturer offered  
21 that Econ101 can "open up" the minds of students from programs that explicitly focus on  
22 sustainability{T-105}.  
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#### 28 29 30 **4.2 Should Econ101 curriculum be revised to address sustainability?**

31 The next priority motivating the interviews was to better understand whether economists  
32 delivering Econ101 believe addressing sustainability requires curriculum revisions.  
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37 Seven of the 11 lecturers expressed the view, at least initially, that Econ101 curriculum should not  
38 be revised to address sustainability. M explained how the majority of Econ101 students "are really  
39 struggling with the basic concepts. So for me to make it more complex would be really hard" {M-  
40 151}. He estimated he could afford devoting one hour of lecture time per semester to EELS. J  
41 argued that just as calculus courses should focus on math and not integrate sustainability, so  
42 Econ101 should not be altered.  
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49 For J, N and T, addressing EELS would require watering down the economic theory they teach.  
50 For T, adding sustainability would result in Econ101 being "dumbed down till it's the equivalent  
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3 of a sociology course” {T-117}<sup>5</sup>. For J, the result would be a “Mickey Mouse” course with  
4 sustainability content taught by those who know little about the topic {J-103}. J allowed that  
5 students from programs that emphasize the environment might struggle with the perspective  
6 offered in Econ101, but suggested that such programs might need to rethink their teaching, “as  
7 opposed to why should we have to rethink economics, and introduce all the sustainability ideas  
8 when they don't make all that much sense to us” {J-111}.  
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16 Incorporating EELS into Econ101 was seen as involving teaching material that is too complicated  
17 for a first-year course. N explained that focusing introductory courses on helping students acquire  
18 basic concepts and tools better equips them to address the environment in upper-level economics  
19 courses. A common theme was that upper-division courses are the place to learn about the  
20 economics of the environment. However, lecturers also acknowledged that since many students do  
21 not take upper-level economics courses many students might never encounter such economic  
22 theory.  
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30 Two lecturers ruled out changing curriculum to address EELS, while three expressed willingness  
31 to implement modest changes. L explained that because of the interview he will be more sensitive  
32 to how Econ101 addresses the environment. In contrast, T’s willingness to alter Econ101  
33 curriculum was contingent on that of leading economics departments. Q and R said they would  
34 like their department to fundamentally rethink Econ101 curriculum to address the fact that too  
35 much of it is not useful to students; changes they advocated for included greater attention to  
36 externalities and public goods. However, Q explained that resistance from fellow faculty have  
37 stymied his efforts to go beyond incremental changes.  
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## 46 **5. Discussion of the findings**

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50 Given humanity’s worsening ecological predicament (United Nations Environment Program,  
51 2005), it seems reasonable to expect that in the 21st century attaining a basic understanding of the  
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56 <sup>5</sup> Many economists see sociologists as engaged in soft, descriptive science and their own profession as relying  
57 on rigorous methods that parallel those in the natural sciences. See explanation in Nelson(2010). The authors  
58 thank one of the reviewers for drawing this paper to their attention.  
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3 economy would include gaining knowledge of how economies interact with their broader  
4 ecological contexts. While Econ101 lecturers are providing students with some knowledge useful  
5 for addressing sustainability, such as an understanding of the problem of externalities, their  
6 contribution appears to be much below its potential and in some cases even counterproductive.  
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12 Lecturers described how addressing EELS would necessitate dropping some core content, which  
13 suggests that for these participants, economic theory directly related to the environment and  
14 sustainability is not core theory. Furthermore, it suggests that they have not considered whether  
15 attending to EELS might require updating or replacing some core economic theory and implies  
16 that they conceptualize the economy and the environment as independent realms, though they  
17 acknowledge problems involving externalities and the provision of public goods. This outlook  
18 contrasts with the ecological economics perspective wherein the two realms are tightly coupled  
19 (Liu et al., 2007), biophysical constraints are considered (Daly, 1992; Georgescu-Roegen, 1971)  
20 and growing economic activity is seen to imply an increasing risk of exceeding planetary  
21 boundaries (Dietz et al., 2007; Rockstrom et al., 2009).  
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32 As sustainability was not salient to Econ101 lecturers and most lecturers saw little need to revise  
33 curriculum to address EELS, it seems that if curriculum changes were debated in economics  
34 departments, the most change likely to be agreed upon would be to ensure that Econ101 places  
35 more emphasis on addressing sources of market failures like externalities. More substantive  
36 changes would likely be resisted; indeed, some lecturers might offer hostile theoretical  
37 perspectives on sustainability.  
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45 In cases where faculty in economics departments are disinterested in or hostile towards  
46 sustainability, faculty in other departments should consider establishing courses that allow  
47 students to learn economic theory that explicitly incorporates environment-economy linkages,  
48 tackles the issue of sustainability and includes heterodox perspectives. Indeed, this phenomenon is  
49 already occurring. Simon Fraser University's Faculty Environment now offers its own course in  
50 ecological economics; students are no longer required to take an Econ101 course.  
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3 Based on these results, the authors suggest university administrators consider setting up  
4 interdisciplinary teams of scholars, including some with expertise in the environmental sciences  
5 and sustainability literatures, to review curriculum from a sustainability perspective. Such a  
6 process would ensure that curriculum is scrutinized by external reviewers who lack investment in  
7 the discipline's methodology, starting assumptions and underlying values.  
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### 13 14 **5.1 Limitations**

15 While over half of the Econ101 lecturers identified as teaching an Econ101 course at any of the  
16 three case study universities during the study period were interviewed, the data generated is not  
17 representative of lecturers who teach Econ101 at other North American universities. Although  
18 Econ101 courses are highly standardized across North America, there is likely to be variability in  
19 content at different universities and even within universities. This study may have limited bearing  
20 in instances where a department or individual lecturer follows a syllabus that substantially departs  
21 from the norm.  
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## 30 **6. Conclusion**

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33 Well over a decade has passed since the universities in this study made public sustainability  
34 commitments. Furthermore, as this research project concluded, the decade of education on  
35 sustainable development (2005-2014) promulgated by the UN was more than half over.  
36 Nevertheless, the Econ101 lecturers tended to be unaware of their university's sustainability  
37 commitments and did not find sustainability salient. None of the lecturers reported explicitly  
38 addressing sustainability in Econ101. There was little sign that curriculum would be reviewed to  
39 assess how well the course attends to sustainability or environment-economy linkages. However,  
40 it should be noted that two lecturers were dissatisfied by the fact that their colleagues tended to  
41 skip over market failures with environmental consequences when teaching Econ101. The present  
42 study documents an instance of a discipline that remains engaged in teaching theory that would  
43 benefit from critical re-examination to account for the fact that human demands now push against  
44 planetary boundaries (Daly, 2005; Rockstrom et al., 2009).  
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Econ101 courses in their present incarnation at the case study sites perform poorly at supporting—and perhaps impede—university efforts to meet sustainability commitments. Rather than contributing to students’ environmental literacy, these courses perpetuate the view that the economy exists in isolation from the environment. They present consumerism as an unproblematic aspect of modern economies and economic growth as desirable despite accumulating evidence that growth is accelerating environmental deterioration. Econ101 courses have an as yet untapped potential to enhance students’ ability to engage meaningfully with these issues.

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### About the author

Tom Green is an ecological economist who is currently working as a postdoctoral researcher at the Stockholm Resilience Centre, Stockholm University. He is a founding member of the Canadian Society for Ecological Economics and formerly worked as Director of Socio-economics for a coalition of environmental groups promoting conservation solutions in British Columbia’s Great Bear Rainforest. His research interests include how the environment-economy nexus is addressed in university-level economics education, the resilience of social-ecological systems and the implications of abandoning growth of GDP as a public policy priority. He has an MA from the University of Victoria and a PhD from the University of British Columbia. Tom Green can be contacted at: [tom.green@stockholmresilience.su.se](mailto:tom.green@stockholmresilience.su.se)