
Introductory economics textbooks: what do they teach about sustainability?

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Abstract: In response to accelerating ecological deterioration, many universities have made commitments to integrate sustainability across the curriculum and to ensure they graduate ecologically responsible citizens. This study involves a content analysis of the coverage of environment-economy linkages in introductory economics textbooks. In North America, introductory economics courses tend to cover similar content and to rely heavily on textbooks. A small number of standard textbooks dominate this market. Standard introductory economics textbooks in current use in British Columbia, Canada were included in the study as well as three leading US textbooks. These were contrasted against a pair of micro/macro introductory texts explicitly written to address sustainability. The standard textbooks are found to largely ignore or mischaracterise environment-economy linkages and to include little content that would help further student understanding of sustainability. Universities that have made a commitment to integrate sustainability across the curriculum should examine carefully the textbooks used in their introductory economic courses and give preference to textbooks that have integrated sustainability-relevant content throughout the text and have addressed both environment-economy linkages and the challenge of sustainability with sophistication.

Keywords: Talloires Declaration; sustainability; textbooks; environment; curriculum; ecological economics; principles; economics.

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Biographical notes: Tom L. Green recently obtained his PhD degree through the Interdisciplinary Studies Graduate Programme at the University of British Columbia. His ongoing research project focuses on how student attitudes towards the environment are affected by studying mainstream economics. He earned his MA in Ecological Economics from the University of Victoria in 1998. From 2003–2007, he worked as the Director of Socio-economics for a coalition of environmental groups that secured a precedent-setting conservation-oriented land use plan to support both human wellbeing and ecosystem integrity in British Columbia's Great Bear Rainforest. From 1996–2003, he worked as an Ecological Economist analysing forestry and mining projects.

1 Introduction

Many students will not pursue economics beyond the introductory course; for them, the textbook helps shape their attitudes toward economic institutions and policies and helps establish the authority of economists, whose pronouncements they will continue to encounter long after they have left school. [Klamer, (1990), p.158]

Ecosystems are increasingly under stress mainly as a result of the dramatic increase in the scale of economic activity fuelled by population growth, the shift to a consumer economy, technological innovation and the availability of cheap energy (United Nations Environment Program, 2005; Rees, 2003; Fischer et al., 2007; Ayres, 2006). As evidence of accelerating ecological decline mounts, many North American universities have committed to integrating sustainability across the curriculum (Wright, 2002; Haigh, 2005; Lukman and Glavič, 2007). The Thessaloniki Declaration of 1997 stressed that “all subject disciplines must address issues related to the environment and sustainable development and that university curricula must be reoriented towards a holistic approach to education” [cited in Wright, (2002), p.210]. The Talloires Declaration of 1990, which most universities in BC signed, requires that universities “ensure that all university graduates are environmentally literate and have the awareness and understanding to be ecologically responsible citizens.” In 2005, the UN declared a Decade of Education for Sustainable Development; and the UNESCO implementation scheme for this decade stresses “learning for sustainable development embedded in the whole curriculum, not as a separate subject” [cited in Owens and Moore, (2008), p.5].

Universities have a responsibility to ensure their curriculum equips students for informed participation in decisions that have sustainability implications (Moore, 2004). How introductory economics courses address – or fail to address – environment/economy linkages and sustainability are relevant to whether universities meet their commitments to integrate sustainability across the curriculum and to graduate environmentally literate and ecologically responsible citizens. This paper examines how well textbooks address environment/economy linkages and the foundation they give students for understanding the economic dimensions of sustainability.

Each year, over a million students, representing about 40% of first year university students in North America, study economics at the introductory level (hereafter ‘Econ101’). The majority take no further university-level courses in economics. Less than 2.5% of students major in economics and less than 1 in 1,000 students who complete the principles course sequence enrol in a PhD economics programme (Salemi and Siegfried, 1999). Econ101, thus, serves as an important conduit for the transmission of economic theory and values to the population at large (Sleeper, 2007; Marglin, 2008; Benton, 1990). Economic theory and analysis influence the organisation of modern society, shape its institutions and guide the decisions of economic entities (Heilbroner and Milberg, 1995; Ferraro et al., 2005; Fourcade-Gourinchas and Babb, 2002).

Econ101 courses are highly standardised across North American universities and rely heavily on textbooks (Colander, 2000, 2003; Boulding, 1988). A small number of standard textbooks dominate this market, and all are descendents of Samuelson’s classic text published in 1948 (Sleeper, 2007; Stiglitz, 1988; Gottesman et al., 2005). Thus, the mould for current Econ101 textbooks was cast when the global economy was smaller and few ecological constraints, such as concerns over global warming or the depletion of ocean fish stocks, were apparent.

Econ101 textbooks and courses have spawned a considerable literature. Most of this literature has left unexamined the issue of how principles textbooks address environment-economy linkages. Some selected highlights from this literature follow to provide background on North American Econ101 textbooks and to describe the types of questions that various scholars have raised with respect to how Econ101 courses may influence students.

Boulding (1988, p.123) asked whether textbooks are “transmitting real knowledge of the economy ... or are we transmitting a lot of ritual that is useful for passing examinations?”. Even in cases where adverse empirical evidence suggests theory should be discarded, economic textbooks “play a powerfully conservative role in the transmission of doctrine” [Stigler, (1978), p.200]. While Samuelson claimed to represent the state-of-the-art in his textbook, Klamer (1990) examined the first 12 editions and found little substantive change in core content. More recently and in opposition to Klamer’s findings, Sleeper (2007) found that despite a variety of factors that slow the rate at which principles textbooks change, the bestselling US textbook and the Samuelson textbook both generally provide an accurate reflection of the consensus macroeconomic thought within the profession, with a lag of only 5 to 10 years. Colander (2005), however, argues that principles texts once reflected the methodological approaches used by economists, but no longer – the textbooks lag by reflecting the research approaches that economists followed in the 1930s to 1960s. Standard texts have been found in previous reviews to focus on training students in the fundamentals of standard theory with little or no discussion to other schools of economic thought, trans-disciplinary perspectives or the limitations of the economic worldview presented in the text (Underwood, 2004; Knoedler and Underwood, 2003).

Previous research has shown that students who do not continue with economics retain little of the theory covered in an introductory economics course (Allgood et al., 2004; Walstad and Allgood, 1999; Strober et al., 1997). In part, this may be because Econ101 textbooks and courses are encyclopaedic and tend to overwhelm students with details (Becker, 2003, 2007). Nevertheless, it seems probable that many students will be affected by the normative content that is frequently reinforced in the textbooks and that they will be influenced by the text’s worldview and framing of issues. Indeed, there is evidence suggesting that the study of standard economics, with its emphasis on atomistic, selfish, maximising individuals promotes or reinforces values and behaviours that are more selfish and less cooperative (Frank and Schulze, 2000; Frank et al., 1993, 1996; Kirchgassner, 2005) and results in lowered support for measures to protect the environment (Ewert and Baker, 2001), though this evidence has been contested (e.g., Frey and Meier, 2005; Yezer et al., 1996; Cipriani et al., 2009).

Given the above, it seems reasonable to expect that the coverage of, and stance towards, the environment and sustainability adopted within Econ101 textbooks may be an important influence on student knowledge, beliefs, values and behaviours. Since the only formal course in economics for most students will be at the introductory level, integration of sustainability across the curriculum implies that environment-economy linkages and sustainability should be covered at the Econ101 level, rather than setting aside such content until more advanced courses in economics.

There is a limited amount of work assessing introductory economics textbooks from a sustainability perspective. The textbooks have been found to downplay the severity of the sustainability crisis and promote policies and values that make the achievement of

sustainability more unlikely (Northrop, 1996, 2000; Reardon, 2007; Folsom and Brauer, 1998). The present study was undertaken to generate more extensive data on how Econ101 textbooks address environment-economy linkages and other topics relevant to sustainability and to assess their suitability for use in universities that have committed to integrate sustainability across the curriculum. The present review is not intended to assess the clarity, validity or pedagogical quality of economic theory contained in the textbooks that does not intersect with the environment or sustainability.

Undertaking a sustainability assessment of textbooks requires an interpretation of sustainability and its minimum requirements, yet the very concept of sustainability is contested (Robinson, 2004). Based on my reading of the literature, I assume that sustainability requires attention to a complex set of issues so as to ensure human demands upon ecosystems are within the biophysical carrying capacity of Earth. These issues include deepening our understanding of ecological systems, process and limits; revisiting society's macroeconomic goals and its understanding of economic development; redesigning modern lifestyles to reduce their ecological impacts; redesigning production processes and products to reduce their resource requirements and waste emissions over their life cycle; implementing institutional arrangements and governance systems to ensure effective management of the commons, resources and landscapes; and redressing inequities in the distribution of wealth (Howarth, 2007; Costanza and Patten, 1995; Robinson, 2004; Huesemann, 2003; Robinson et al., 1990; Sneddon et al., 2006; Daly, 2002). Rather than presuming there is any one correct summation of the requirements of sustainability that should inform Econ101 textbooks, the presumption here is that the texts should at least broach the key aspects of sustainability that are relevant to economics and ensure that the main environment-economy linkages and their probable range of implications for the conduct of and viability of economic activity are addressed.

2 Methodology

2.1 How textbooks were selected

To select the textbooks for this study, I gathered data on textbook adoption from January 2008 to April 2009 for introductory economics courses offered at public universities in British Columbia (BC), Canada. This involved contacting economics departments, inquiring into the course textbooks being sold by university bookstores and viewing course descriptions on university websites. From this analysis, eight standard economics textbooks were identified for inclusion in the study on the basis that they were used at more than one BC university and/or by at least 200 students (six of these eight textbooks were paired micro/macro texts, so when these two volume texts are 'amalgamated' to enable comparisons amongst the textbooks, the BC sample results in the equivalent of five principles textbooks). Based on published data on Econ101 textbook adoption in the USA over the period 2002–2004 (Sleeper, 2007), the leading US textbook, by McConnell and Brue (2008), was added as a point of comparison (the then runner-up and now leading textbook by sales, authored by Mankiw et al. (2007a, 2007b), is represented in this review by its Canadian edition). Because Samuelson's textbook has had such a defining influence on textbooks and economics education (Gottesman et al., 2005; Skousen, 1997) and because it has been deemed the profession's 'textbook of record',

the latest edition, now co-authored by Nordhaus (Samuelson and Nordhaus, 2005), was added to this initial list, even though it no longer figures prominently in North American textbook sales. Finally, because Stiglitz (2006), a recipient of the memorial Nobel prize in economics, has written expressing great concern about the environment, his pair of co-authored textbooks (Stiglitz and Walsh, 2006a, 2006b), was included in the sample since it seemed plausible that he might pay special attention to sustainability. A recent pair of micro and macro economics textbooks (Goodwin et al., 2009a, 2009b), written with the express purpose of addressing ecological sustainability was also included in the study as a point of comparison. The team of authors of these two texts, headed by Neva Goodwin of Tufts University, have credentials in both the economics and the sustainability literature (hereafter I will differentiate between the ‘standard’ textbooks and the ‘sustainability’ or ‘Goodwin’ textbooks). The total sample then is 14 textbooks, or the equivalent of nine principles textbooks once the micro/macro pairs are amalgamated (see Table 2 and list of textbooks in Appendix A).

2.2 How textbooks were analysed

I focus my analysis of Econ101 textbooks on their treatment of environmental aspects of sustainability and downplay the social dimension. The sustainability literature is quite clear that sustainability has environmental, social, cultural and economic dimensions. For instance, improving equity within and between generations is an important aspect of sustainability. Nevertheless, in order to analyse all instances where textbook content had some bearing on equity such as the distribution of income, a large proportion of the textbook would be under the microscope and the analytical task would become overwhelming. Given that ecological sustainability is a prerequisite for the long-term persistence of functional human societies wherein equity is a relevant concern, I reasoned that focusing on the environmental dimension of sustainability would suffice as an initial assessment of the textbooks and would make the analysis more tractable.

By reviewing the sustainability literature I developed a list of markers that would help identify textbook content that could be considered sustainability-relevant as one means of assessing the breadth of sustainability-relevant content included in the various textbooks. These markers are indicated in Table 3.

The main sections of each textbook (excluding preface, glossary, index, web-based chapters and other online materials) were read in their entirety. The proportion of each page devoted to environmental content was recorded. As in any research project involving measurement, there was a need to standardise measurement procedures. For instance, if a sentence includes one environmental term [e.g., from Parkin and Bade’s (2006) text on p.2, “As society we must choose among healthcare, national defence, and the environment.”), does just the one word or the entire sentence count as environmental content? There is also the complication that the textbooks each use their page space differently. There was also a trade-off between defining a precise measurement that would be time consuming and a measurement protocol that still produced sufficiently consistent results and that could be applied efficiently. The greatest precision might be offered by a word count rather than the estimated proportion of page space as was the method used in this paper. However, little is gained with such precision given the essential coarseness of a quantitative measure that fails to capture the quality dimension

(i.e., how sophisticated was the content in question). The methodology and the weighting system are described in more detail in Appendix B.

The data recorded per the above procedures support the quantitative analysis of the textbooks, allowing for a comparison of the extent to which environmental and sustainability-related content was emphasised in the various textbooks. The quantitative measures used in this study and the rationale behind them are reported in Table 1.

Table 1 Description of quantitative measures reported for the textbooks included in the study

<i>Quantitative measure reported</i>	<i>Rationale</i>
Percent of environmental content of total content in main sections of textbook.	Measures emphasis given to including content that addresses environment-economy linkages/ecological sustainability in the textbook.
Percent of environmental content of total content in main sections of textbook subtracting for sections on externalities, public goods and environmental economics.	A measure of the extent to which content that addresses environment-economy linkages/ecological sustainability informs chapters not specifically focused on the environment. This measure is also relevant because instructors typically face time pressure and may omit material that is not felt to be the core of economics (and in some textbooks, the preface suggests that the sections on public goods and externalities can be omitted).
Greatest number of consecutive pages without environmental content.	If environment/sustainability content and issues do not appear in large blocks of the text, students may well assume they are of little relevance for understanding the economy and economics.
Percent of pages with at least some environmental/sustainability content.	If environment/sustainability content is frequently encountered, its importance is likely to be reinforced.
Percent of chapters with at least some content linked to environment/sustainability concepts or issues (cut-off was at least one sentence coverage per chapter, e.g., to qualify a chapter had to score at least 5% of one page or at least five words within entire chapter that addressed environment/sustainability concepts/issues).	A measure of the extent to which environment/sustainability coverage is integrated across the textbook; extent to which authors emphasise environment-economy linkages.

Passages that had not been captured by the environmental screen but were of interest because of the ‘worldview’ they presented were also annotated (but not included in the quantitative measures described above). In particular, I looked for passages that described the end goals of economic activity, technological progress, economic growth, consumption, the linkage between economy activity and human well-being and discussions of equity-efficiency trade-offs. The intent was not to capture all such passages (because the volume would be too large and many passing references to the above issues would be repetitive), but rather to identify representative passages as well as passages that were particularly informative in understanding the implicit assumptions, normative positions and pre-analytic vision of the textbook authors.

Having collated passages from textbooks that were considered relevant to the understanding of environment-economy linkages and sustainability, as well as passages of interest for their worldview, I approached them as ‘artefacts of social communication’ suitable for analysis by qualitative methods [Berg, (1998), p.306]. Rather than using line-by-line coding more typical of grounded theory (Charmaz, 2001), recognising that the textbook passages contain complex information, the codes used related to topics, concepts, rhetorical techniques, knowledge claims, assumptions, normative positions, referencing and the appearance of empirical data. Through this coding process and subsequent analysis, patterns were identified on dimensions of interest.

3 Analysis and results

3.1 Conventions used in this study

In figures and tables, individual textbooks are identified with the first author’s last name. To ensure equivalency in comparisons, I also report results with textbook micro-macro pairs being amalgamated into the equivalent of a principles text (in cases where specific chapters were repeated in a two volume set, the chapters in question were only included once in the amalgamated calculations).

3.2 Quantitative results

The proportion of total content that relates to the environment in the standard texts ranges from a low of 0.7% (Stiglitz and Walsh, 2006a) to a high of 5.4% (Krugman et al., 2007b). If one considers the content students would encounter in the combined micro/macro sequence in a standard course, McConnell and Brue’s (2008) text, at 1.8% is at the lowest end of the scale; Stiglitz and Walsh (2006a, 2006b) is next at 2.6%, while the other standard texts range between 3.1% to 4.0%. If chapters on public goods and externalities are subtracted from the total, the standard texts range from a low of 0.4% for McConnell and Brue (2008) to a high of 1.5% [micro editions of both Krugman et al. (2007b) and Frank et al. (2005b)]; as amalgamated textbooks, the upper end of the range is 1.3% for Ragan and Lipsey (2008). The most pages students could read sequentially without encountering any environmental content range from a low of 64 (Krugman et al., 2007b) to a high of 289 pages (Krugman et al., 2007a). From a low of 2% (Stiglitz and Walsh, 2006a) to a high of 15% (Samuelson and Nordhaus, 2005) of textbook pages have at least some environmental content (i.e., at least one word per page); as amalgamated textbooks, Stiglitz and Walsh (2006a, 2006b), Mankiw et al., (2007a, 2007b) and McConnell and Brue (2008) set the low end of the scale at 6%. McConnell and Brue (2008), at 25%, has the lowest number of chapters meeting the environmental content criterion of including at least five environmentally-related words or one sentence per chapter, while the micro edition of Krugman et al. (2007b) at 77% has the highest. In amalgamated form, the high end of the range is 56% for both Samuelson and Nordhaus (2005) and Krugman et al. (2007a, 2007b). Note that this criterion for a chapter to qualify as containing environmental content is quite generous, since students might miss a single sentence and thus not be reminded that there are environmental implications of economic activity.

Table 2 Quantitative results, sustainability-linked content (reported in amalgamated form)

<i>First author</i>	<i>Configuration for reporting results</i>	<i>Year</i>	<i>Edition</i>	<i>Canada/USA edition</i>	<i>Used in BC?</i>	<i># of pages, main sections only</i>	<i>% environmentally-related content</i>	<i>% environmentally related, excluding chapters on public goods and externalities</i>	<i>Greatest number of consecutive pages without environmental content</i>	<i>Pages with at least some environmental content</i>	<i>% of chapters with some environmental content (five words or one sentence minimum cut-off)</i>
Frank	Combined micro/macro	2005	2	Can	Y	816	3.1%	1.2%	117	7%	41%
Krugman	Combined micro/macro	2006	1	Can	Y	952	3.3%	1.0%	289	9%	56%
Mankiw	Combined micro/macro	2008	4	Can	Y	819	3.1%	0.7%	157	6%	36%
McConnell	Principles	2008	17	US	N	703	1.8%	0.4%	220	6%	25%
Parkin	Principles	2006	6	Can	Y	788	4.0%	1.2%	201	9%	44%
Ragan	Principles	2008	12	Can	Y	885	3.4%	1.3%	193	7%	34%
Stiglitz	Combined micro/macro	2006	4	US	N	905	2.6%	0.7%	163	6%	29%
Samuelson	Principles	2005	18	US	N	715	4.0%	1.1%	108	15%	56%
					Average:	823	3.2%	1.0%	181	8%	40%
Goodwin	Combined micro/macro	2008	1&2	US	N	884	6.9%	4.5%	86	25%	85%
					Average:	830	3.6%	1.3%	170	10%	45%

In comparison with the standard texts, the sustainability-oriented texts by Goodwin et al. (2009a, 2009b) have higher scores on almost all measures. Although the Goodwin et al. (2009a) micro volume at 4.4% comes in below the micro editions of Krugman et al. (2007b) at 5.4% and Frank et al. (2005b) at 5.1%, the Goodwin et al. (2009a) micro textbook clearly outcores the others once sections devoted to externalities and public goods are excluded from the standard texts. The Goodwin et al. (2009b) macro text, with 9.6% (6.6% if the aforementioned section is subtracted) far exceeds the other macro volumes. In amalgamated form, the Goodwin et al. (2009a, 2009b) texts come in at 6.9% (4.5% excluding the aforementioned section). Environmental content is more evenly dispersed in the Goodwin et al. (2009a, 2009b) texts, as the number of consecutive pages without environmental content is at the low end of the scale; 23% to 27% of pages have at least some environmental content; and 84% to 87% of the chapters have environmental content using the same criterion of including at least five environmentally-related words or one sentence.

The above data are also represented graphically. The following two graphs illustrate how the standard texts put significantly less emphasis on coverage of environmentally related content.

The results show that the environment is downplayed in all of the macro volumes of two volume texts – despite concerns over the linkage between growth and ecological limits – a finding which echoes Daly’s (1991) observation that the economics discipline lacks an environmental macroeconomics.

Figure 1 Sustainability-relevant text as a proportion of total text in textbook (see online version for colours)

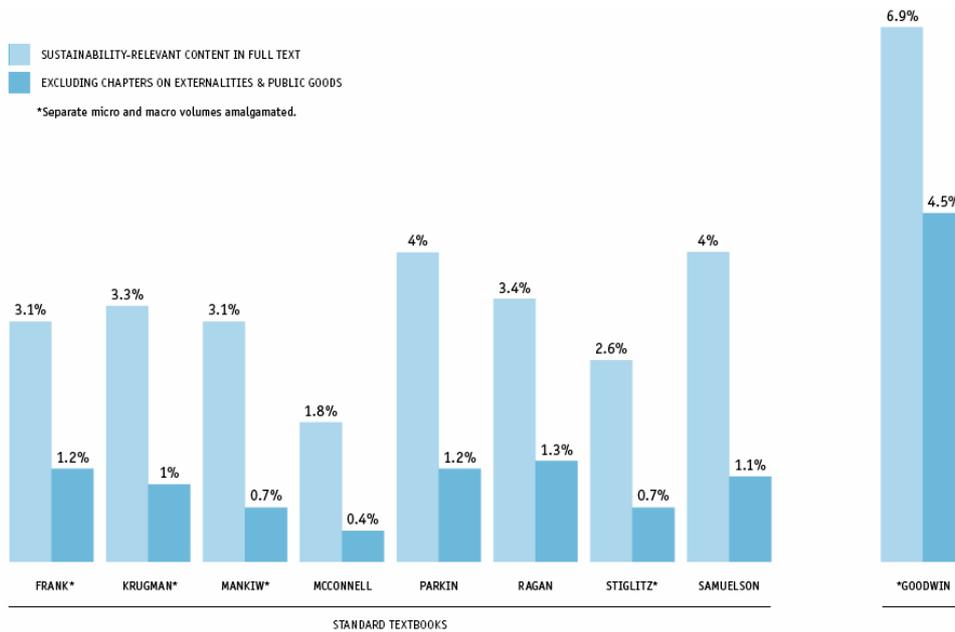
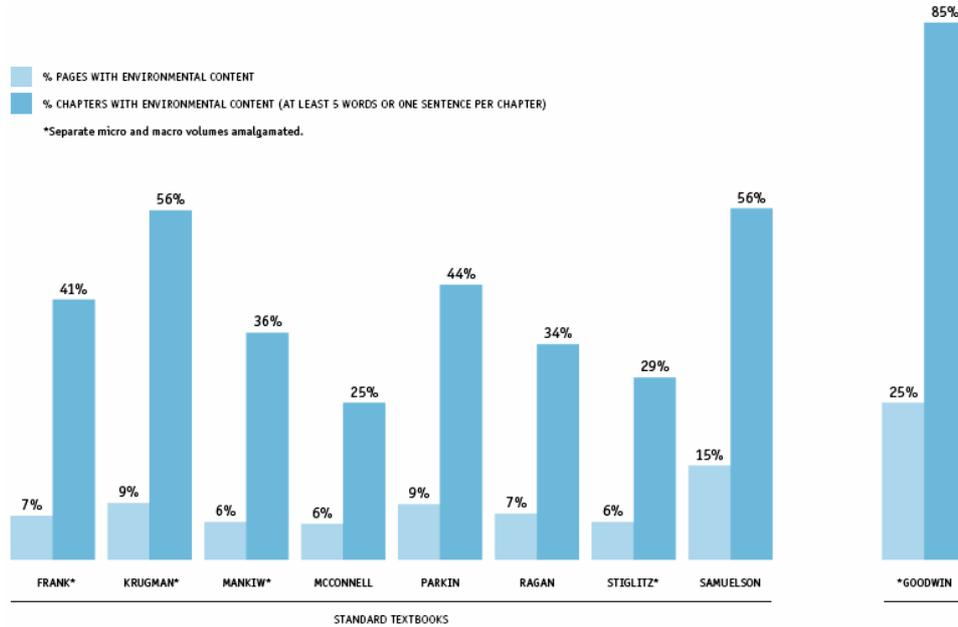


Figure 2 Distribution of environmental content in textbooks (see online version for colours)

While the quantitative assessment reported above gives some indication of the emphasis placed by the various textbook authors on covering environment-economy linkages, it gives little insight on the content. For instance, it does not illuminate the perspective taken in the standard textbooks towards the challenge of sustainability (e.g., whether content takes environmental problems seriously or is dismissive of them), or the sophistication involved in such coverage. This issue is addressed in the following section.

3.3 Breadth of coverage

Table 3 provides an overview of the breadth of sustainability-relevant issues, concepts and terms covered by the different texts. It indicates that even if a student were to read all the standard texts included in this study, they would be exposed to a narrower range of issues, concepts and terms than they would by reading the pair of Goodwin et al. (2009a, 2009b) texts. Some caution is needed in interpreting this table. The fact that one of the markers shows up in a given textbook and is reported in this table does not imply that the text provides information that will help students better understand a particular aspect of humanity's sustainability predicament. For instance, note that all of the standard textbooks (in amalgamated form) address the limits to growth debate. However, as will be shown below, the debate is generally presented in a manner that implies that those who have learned to 'think like an economist' should see how concerns about limits are overstated.

3.4 Encounters with content

In the process of coding the texts it became apparent that from a sustainability perspective, the mainstream and the sustainability-oriented variants were substantially

different. It should be noted that the standard texts do vary in the degree to which they express confidence in the market mechanism, their enthusiasm for government involvement in the economy and their emphasis on distributional issues. As was shown above, the emphasis given to environment-economy linkages and other sustainability-relevant content also varies amongst the standard textbooks. However, there is relatively little variance when it comes to promoting economic growth or presuming that higher levels of consumption are desired. Of the standard textbooks, no major differences were found between Canadian and US editions on dimensions of interest for this study. Accordingly, in the following discussion, the standard texts are considered jointly.

Table 3 Occurrence of selected concepts relevant to sustainability (see online version for colours)

ISSUES/CONCEPTS/TERMS	STANDARD TEXTBOOKS								GOODWIN
	FRANK	KRUGMAN	MANKIW	MCCONNELL	PARKIN	RAGIN	STIGLITZ	SAMUELSON	
Acid rain	✓	✓		✓	✓	✓	✓	✓	✓
Bioaccumulation									
Biodiversity		✓			✓				✓
Complexity									✓
Cumulative effects									
Deforestation	✓				✓		✓	✓	✓
Desertification									
Discontinuity									✓
Ecological limits	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ecological footprint									✓
Ecology / ecosystems	✓		✓		✓	✓		✓	✓
Ecosystem services									✓
Endangered species / extinction		✓			✓	✓	✓	✓	✓
Eutrophication									
Exotic species									
Fisheries collapse	✓	✓	✓	✓	✓	✓	✓	✓	✓
Global warming / greenhouse gases	✓	✓	✓	✓	✓	✓	✓	✓	✓
Green GDP	✓		✓				✓	✓	✓
Groundwater depletion							✓		✓
Habitat / habitat loss		✓		✓	✓		✓	✓	✓
Health effects of env. degradation		✓	✓	✓		✓	✓	✓	✓
Irreversibility					✓			✓	✓
Limits to growth	✓	✓	✓	✓	✓	✓	✓	✓	✓
Malthusian predicament		✓	✓		✓	✓	✓	✓	✓
Natural capital	✓							✓	✓
Natural areas and "wilderness"		✓		✓	✓		✓	✓	✓
Nitrogen cycle									
Nutrient									
Ozone layer / depletion		✓		✓	✓		✓	✓	✓
Pesticides		✓		✓	✓	✓	✓	✓	✓
Population (stabilization of)								✓	✓
Precautionary principle									✓
Salinization									✓
Soil erosion	✓			✓		✓		✓	✓
Sustainability / sustainable development				✓		✓	✓		✓
Thermodynamics (laws of) / throughput					✓				✓
Toxics	✓	✓	✓	✓	✓	✓	✓	✓	✓
References from natural or environmental sciences, or sustainability literatures								✓	✓
Empirical data on state of the environment			✓						✓
Total occurrences	11	14	10	13	17	13	17	21	32

Selected passages from the standard textbooks are quoted and discussed below to give the reader a richer understanding of how the standard textbooks treat a number of environment-economy linkages (space limitations do not permit presenting equivalent passages from the Goodwin text). We begin by looking at how the standard textbooks describe the subject matter of economics and the perspective they take on markets, since this sets the overarching context in which environment-economy linkages and sustainability-relevant issues emerge.

The textbooks tend to limit the scope of economics to the science of choice under scarcity, “Economics is the study of how people make choices under conditions of scarcity and of the results of those choices for society” [Frank et al., (2005a), p.3].

This focus on choice as the realm of economics is well accepted within standard economics. However, before Robbins’ (1935) seminal essay, the subject matter of economics was not so narrowly restricted. Under the influence of a positivist philosophy of science, Robbins and subsequent scholars (e.g., Samuelson, 1938) believed that grounding economics in individual choice would improve the scientific credentials of the discipline; this positivist effort, however, has failed, according to scholars versed in philosophy of science (Davis, 2005; Tacconi, 1996).

From a sustainability perspective, restricting the domain of economics as the science of choice under scarcity while using a framework of methodological individualism, is problematic. The lens of choice results in the textbook’s content and the students’ attention being heavily weighted towards issues of market exchange, price formation and to exploring the implications of marginal changes. It limits attention to environment-economy linkages, the sources of natural resources, how resources are utilised and where waste products go. Since the consumer’s preferences, which are assumed to guide choice, are taken as given it avoids examination of whether consumption is in fact contributing to well-being (Costanza et al., 2007; Konow and Earley, 2008; Lutz and Lux, 1979). It focuses on the individual (since individuals choose) and neglects the community (Marglin, 2008). It also downplays the fact that the poor, with their limited income, are largely unable to make meaningful choices in market settings. It also tends to push out of view issues such as why market economies can result in the superfluous wants of the rich being attended to while the pressing needs of the poor remain unmet (Lourdes, 2003; Nelson, 1993), an issue whose importance escalates as demands on the biosphere expand (Daly, 1992). Since the existing distribution of wealth and income is assumed as given, the focus on choice reduces the relevance or importance of scrutinising the distribution of wealth and how wealth was accumulated (e.g., wealth due to actual wealth creation, such as value-added through production vs. wealth derived from the liquidation of natural resource stocks or is merely reallocated through such processes as the seizure of lands from indigenous peoples). Because choice is largely understood within economics as choice within markets, there is a tendency to downplay provisioning activities within the household (England, 2003; Nelson, 1993; Ferber and Nelson, 1993) and other informal economic activity. The standard textbooks also tend to take as given or to leave unexamined institutional aspects of markets. This despite the key role that institutions play in shaping market society and hence the context in which choice takes place (O’Neill, 2007; Ostrom, 2008; Polanyi, 1944; Bromley, 2006).

From a sustainability perspective then there are a number of reasons for returning to a more expansive definition of the scope of economics, to going beyond that which can be understood as fitting under the rubric of choice. Feminist economists, and many others,

advocate for economics to be recast as provisioning to meet society's needs, the approach used in the Goodwin textbooks.

The standard texts argue that scarcity emerges because humans have insatiable desires:

For better or worse, most people have virtually unlimited wants. We desire various goods and services that provide utility. Our wants extend over a wide range of products, from necessities (for example, food, shelter, and clothing) to luxuries (for example, perfumes, yachts, and sports cars). [McConnell and Brue, (2008), p.7]

Northrop (2000, p.54) argued that by starting with scarcity in the context of unlimited material desires, textbook authors are engaged in an ad hoc formulation of society's core economic problem and implicitly adopt a problematic normative position, lumping as equivalent a poor person's desire for food with a well-off person's desire for jewellery. There is thus no differentiation made in this framework between ensuring basic needs are met and supporting conspicuous consumption. The desirability of expanding the amount of private goods that a given individual can consume is taken as given. The environmental impacts of consumerism are not subjected to critical examination. As discussed below, the texts' emphasis that scarcity is inherent in the human condition is inconsistent with their argument that natural resources themselves are not scarce in terms of acting as binding constraints on economic activity and on prospects for advancing human well-being.

Textbooks leave the impression that economists have given the market a scientific seal of approval. Mankiw's et al. (2007b, p.158) text contains one of the more enthusiastic endorsements of the market:

We can now better appreciate Adam Smith's invisible hand of the marketplace... The benevolent social planner doesn't need to alter the market outcome because the invisible hand has already guided buyers and sellers to an allocation of the economy's resources that maximizes total surplus. This conclusion explains why economists often advocate free markets as the best way to organize economic activity.

However, the endorsement of the market is elsewhere qualified, since externalities or other distortions may impede economic efficiency:

But the invisible hand isn't always our friend. It's also important to understand when and why the individual pursuit of self-interest can lead to counterproductive behaviour. [Krugman et al., (2007a), p.3]

The default presumption of the desirability of market outcomes in many of the standard texts contrasts with the views of market outcomes that prevail in the sustainability literature. Of particular relevance to sustainability, is the tendency of markets to oversupply private goods (e.g., stereos and jewellery) and undersupply public goods, e.g., a clean atmosphere, conservation areas, (Galbraith, 1998), as well as their inability to account for the needs of future generations. Such issues would ideally receive more attention.

The textbooks strongly support economic growth, which is presented as enabling a reduction in pollution and investments in improved environmental quality:

Growth has allowed economies to reduce pollution, be more sensitive to environmental considerations, set aside wilderness, create national parks and monuments, and clean up hazardous waste, while still enabling rising household incomes. [McConnell and Brue, (2008), p.315]

Note how in the above passage, that which is sacrificed or lost as a result of growth is omitted. As a result of growth, natural areas that children once explored and played in are paved over. With ever more cars on the streets, neighbourhoods that were once tranquil become noisy. Also, 'wilderness' existed before growth and without growth there would be less need to protect wilderness areas.

While texts allocate a small amount of space to discussing the limits of relying on GDP as an indicator of social welfare and its relevance for public policy decisions, the textbooks' enthusiasm for a growing GDP is not supported in the sustainability literature, particularly in the case of rich industrialised countries.

Under current conditions, despite some progress in dematerialising and reducing the energy intensity of industrial economies, increased GDP generally implies increased throughput of matter and energy. Rather than seeing increasing throughput as a sign of economic health, ecological economists argue that a healthy economy achieves high levels of wellbeing with a minimum of throughput (Boulding, 1966; Daly, 1992; Hall et al., 2001). Except for a small number of local pollutants, empirical data does not support the notion that nations create less of an environmental burden and better protect the environment as their income increases (Dinda, 2004). This becomes especially evident when one factors in the environmental impacts that are associated with imported products, since so much manufacturing has been outsourced to developing nations. A comparison across nations found limited variance in ecological footprint per unit of GDP. Although affluent nations have a somewhat higher level of eco-efficiency, or lower impact per unit of GDP, the improvement is insufficient to offset the footprint entailed by increased levels of consumption associated with higher levels of income and far below that which would be necessary to achieve sustainability (York et al., 2004). Given that continued economic growth does little to advance human well-being in rich countries while at the same time growth poses fundamental challenges to achieving sustainability, the relevance of re-examining society's commitment to growth in GDP becomes apparent (Victor, 2008; Ayres, 2006; Jackson, 2009; Bergh, 2009).

The standard textbooks downplay the importance of energy and natural resources to industrial economies and fail to explore the implications of such high rates of resource throughput for sustainability and the viability of ongoing economic growth. The environment is generally dealt with by the texts in a stylised manner that is not drawn from actual environmental problems, and is frequently abstracted away from entirely:

Suppose that two factories – a paper mill and a steel mill – are each dumping 500 tonnes of glop into a river each year. [Mankiw et al. (2007b), p.217]

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Traditionally, economists also have highlighted the importance of a third input, land, but in modern industrial economies land is of secondary importance. For most purposes, it suffices to focus attention on the three major markets – product, labor, and capital – and this text will follow that pattern. [Stiglitz and Walsh, (2006b), p.15]

Mankiw's use of 'glop', rather than an actual pollutant, makes his case easier to explore but reduces the value of the lesson offered by the text in teaching students about actual pollution problems. In abstracting away from land (which includes resources), textbooks set up the analysis in a manner that often violates the first law of thermodynamics – the conservation of matter and energy – since they include production functions where output in the form of material goods that have energy embodied within them are produced without requiring any inputs or generating any wastes. Such conceptualisation is unlikely to contribute to enhancing a student's understanding of environment-economy linkages.

Many passages recognise the aesthetic value of the environment but downplay the essential role it plays in supporting human well-being. In discussions of clean vs. dirty environments they recall the simplified portrayal of environmental issues of the 1960s and 1970s; such passages might lead students to an overly simplistic notion that should environmental problems occur, the environment can generally be 'cleaned up' to a pre-existing state,

Put another way, in a very dirty environment, a little cleanliness will be much prized, but in a very clean environment, a little more cleanliness will be of only small additional value. [Ragan and Lipsey, (2008), p.410]

The textbook characterisation of the environment is difficult to reconcile with contemporary understanding of ecosystems as complex, interrelated and hierarchical systems whose behaviour is uncertain and fails to recognise how human pressure on the environment can lead to discontinuous change and irreversibilities (Holling, 2001; Ludwig et al., 1993; Limburg et al., 2002).

Sometimes language and examples trivialise the extent of our ecological predicament. For instance, in a discussion on limits to growth, Samuelson acknowledges that growth can imply the loss of natural habitat using the wording, "displace trees, wolves and marsh reeds..." (p.363). Students are unlikely to read into this mention of the displacement of marsh reeds, how the loss of wetland ecosystems can have a significant effect on other natural systems as well as on human well-being or sustainability. As a result of the stylised description of the environment and the trivialisation of environmental issues, the standard texts are unlikely to add to student knowledge about environment-economy linkages or to result in students appreciating the severity of our environmental predicament and the challenges it entails for how society organises economic activity.

The textbooks generally downplay how environmental deterioration affects human health. Indeed, it often appears as though there are no linkages between health and the environment or even that one must be traded-off for the other:

As a society we must choose among healthcare, national defense, and the environment. [Parkin and Bade, (2006), p.2]

Where the linkage between health and the environment is discussed, it is described in an abstract and euphemistic manner that may leave students with little sense of the potential consequences for human well-being:

Air pollution continues to cloud major U.S. cities, imposing large costs in terms of reduced property values and increased health care expense. [McConnell and Brue, (2008), p.592]

Some of the passages suggest that the authors desire to reassure students that, aside from the difficulty of resolving problems like global warming, environmental trends are improving:

Today, Lake Erie supports a fishing industry, just as it did in the 1930s. No longer treated as a garbage dump for chemicals, the lake is regenerating its ecosystem. [Parkin and Bade, (2006), p.383]

While it would be undesirable to write textbooks that make students feel despondent about future prospects and while it is relevant to show that effective environmental policies can be devised and implemented, an overemphasis on reassuring students may result in them misapprehending the extent of the sustainability challenge, concluding that environmental problems can easily be solved and that the economic growth can continue for the indefinite future without serious implications for the environment. The fact is that globally, despite three decades of discussions and policies intended to improve sustainability, most environmental indicators continue to worsen (United Nations Environment Program, 2005; Fischer et al., 2007).

The standard textbooks downplay the importance of energy and natural resources to industrial economies and fail to explore the implications of such high rates of resource throughput for sustainability and the viability of ongoing economic growth. The standard texts also provide an unreliable, out-of-date and skewed introduction to the limits to growth debate that favours dismissing the notion of limits. They begin with Malthus and find that his prediction that unless population growth was halted, population would outstrip food production has been shown to be wrong:

Where did Malthus go wrong? As we discussed in a case study earlier in this chapter, growth in mankind's ingenuity has offset the effects of a larger population. Pesticides, fertilizers, mechanized farm equipment, new crop varieties, and other technological advances that Malthus never imagined have allowed each farmer to feed ever-greater numbers of people. Even with more mouths to feed, fewer farmers are necessary because each farmer is so productive. [Mankiw et al., (2007a), p.157]

In contrast with the standard texts, the consensus amongst economists that Malthus was wrong may be eroding. An article recently published in the *Canadian Journal of Economics* reviews Malthus' theories and suggests that his concerns that population could overshoot the resource base remain valid and that a demographic transition is essential to achieving sustainability, "which is very much a modern translation of what Malthus wrote in 1798" [Brander, (2007), p.36]. The assertion common to the standard texts that Malthus was wrong may not resonate well with the 1/3 of the population that suffers from chronic food insecurity, especially as another 2 or more billion humans are expected to join the planet this century in a context where 1/5 of the world's topsoil has been lost in the last half century (Raven, 2002).

The Club of Rome study, which initiated the modern limits debate, is incorrectly described by Ragan:

Extrapolating from the oil shortages caused by the OPEC cartel, the Club of Rome concluded that industrialized countries faced an imminent absolute limit to growth. [Ragan and Lipsey, (2008), p.634]

As the foreword to *Limits to Growth* makes clear, the computer modelling exercise was initiated following a meeting of the Club of Rome in April 1968. The results were published in 1972. The OPEC oil embargo did not begin until the fall of 1973. Clearly, the authors of *Limits* could not have based their analysis on the oil shortages caused by OPEC.

One strategy that is used to defeat the limits to growth arguments is to attack a strawman:

Most economists, however, agree that absolute limits to growth, based on the assumptions of constant technology and fixed resources, are not relevant. [Ragan and Lipsey, (2008), p.634]

This argument fails because neither Malthus, the original *Limits to Growth* report, nor many exemplars of more recent analysis are based on the assumption that technology remains constant. For instance, Malthus assumed that food production would keep expanding in part via improvements in tillage, while the Club of Rome study included a scenario exploring the implications of unlimited availability of nuclear energy, resources and pollution control [see Chapter IV of Meadows et al. (1972)].

The essential role of energy in supporting economic activity and in explaining past growth (Warr et al., 2008; Ayres and van den Bergh, 2005; Cleveland et al., 1984; Hall et al., 2003; Ayres, 2008) is neglected in the standard textbooks. Instead, the textbooks explain economic growth by reference to population growth, technological progress and capital investment:

In fact, the huge changes in living standards that modern economies have experienced over the past two hundred years and the truly amazing differences between the economy in 1900 and the economy in 2000 are in large part due to technological change. We are not manufacturing more of the same goods as the economy in 1900. We are making goods that the people of 1900 never dreamed of... Key to the whole process of economic growth, then, is technological progress – thinking up new ways to do not just old things but also entirely new things. And for this reason, ideas are central to explaining economic growth. [Stiglitz and Walsh, (2006b), p.453]

There is of course nothing wrong with helping students appreciate the extent to which knowledge has improved, technology has advanced and societies have invested in manufactured capital and how these factors have played an important role in enabling economic growth. From a sustainability perspective, however, it would be advantageous for students to be aware of the extent to which technological progress has both enabled and depended upon a dramatic increase in the level of energy and material use and in consequent environmental impacts.

The textbooks present an optimistic perspective on the future supply of non-renewable natural resources. With little theoretical justification or empirical evidence, Samuelson and Nordhaus (2005, p.379) claims that the market does an adequate job of allocating resources over time:

Important examples of appropriable, non-renewable natural resources are fossil fuels such as oil, gas, and coal. Economists argue that because private markets can efficiently price and allocate their services, such natural resources should be treated the same as any other capital asset.

Since prices of natural resources have not risen over the long-term, it is evidence that scarcity is not increasing and that concerns about natural resource scarcity are unfounded:

If we were depleting natural resources faster than their discovery, we would see the prices of those resources rise. That has not been the case for most natural resources; in fact, the prices of most of them have declined. And if one natural

resource becomes too expensive, another resource will be substituted for it.
[McConnell and Brue, (2008), p.315]

There are problems with arguments that suggest that markets can be relied upon to allocate natural resources over time and that falling resource prices indicate that concerns about natural resource scarcity and limits to growth are unfounded. First, it should be noted that such arguments sidestep key contemporary concerns with respect to sustainability because they approach the issue of limits by focusing on the potential of resource exhaustion but downplay the impact on ecosystems of resource extraction (e.g., habitat loss) and the impact of waste disposal generated by high levels of natural resource consumption. Current thinking suggests that pertaining to how non-renewable resources constrain growth, the more pressing problem is not depletion but rather how high levels of natural resource extraction and consumption threaten to overwhelm the environment's assimilative capacity (Simpson et al., 2005). For instance, there is enough coal remaining to supply demand for several more centuries, but were it all to be combusted without sequestering the resulting CO₂, the resulting global warming would be catastrophic (Haberl et al., 2009; Jaccard, 2005). With respect to renewable natural resources, most of the economically important stocks are already fully utilised or indeed are being overharvested (United Nations Environment Program, 2005).

Even were one to accept the textbooks' focus on assessing the potential constraints to growth by focusing on whether non-renewable resources scarcity is emerging, there are a number of reasons why market prices cannot be relied upon as an indicator of natural resource scarcity (Victor, 1991, 2008; Norgaard, 1990). Resource owners may face economic incentives to liquidate natural resource stocks if they feel they may lose the rights to extract the resource in the future. Victor (1991, p.201) argues that prices cannot be taken to provide a signal of natural resource scarcity in the instance where markets are not working in accordance with the neoclassical model, since the assumptions required for prices to carry normative significance will fail. Norgaard (1990) points out that there is a logical fallacy involved in relying on cost or price paths to detect scarcity, when one of the required (but typically unstated) premises for prices to carry the required information is that resource users themselves must be informed about the existence of scarcity. In this instance, Norgaard asks, why not ask resource allocators directly? Conversely, if resource allocators are not informed about scarcity, then prices will be affected by their ignorance. Finally, current markets are incapable of dealing with most future contingencies (Marglin, 2008), while future generations are not able to bid in current markets and thus do not participate in intertemporal allocation decisions (Padilla, 2002). Yet, the incomes of future generations and therefore the amount willing to pay for resources are affected by decisions about resource use today (Victor, 2008). This implies that one cannot rely on markets to allocate resources over time in a manner that incorporates the needs of future generations – a key prerequisite for sustainability.

A number of textbooks suggest that since some countries like Japan are rich despite being resource-poor, natural resources are no longer important to rich countries:

The second classic factor of production is natural resources... the possession of natural resources is not necessary for economic success in the modern world... Many countries, such as Japan, had virtually no natural resources but thrived by concentrating on sectors that depend more on labor and capital than on indigenous resources. [Samuelson and Nordhaus, (2005), p.558]

The above statement would be less likely to mislead students into believing that rich economies have dematerialised were it made clear that the economies of Japan and other industrialised nations actually consume prodigious amounts of natural resources and can thrive despite having limited domestic resources only if other nations have the required natural resources and are willing to trade them at affordable prices (Wada, 1999; Muradian et al., 2002). Furthermore, much of the South to North trade in resources results in the displacement of environmental burdens to poorer countries (Giljum and Eisenmenger, 2004; Muradian et al., 2002).

Parkin and McConnell both contain, but do not substantiate, the claim commonly made by Cornucopians in the early limits to growth debate that human imagination can transcend resource limits:

Moreover, say economists, economic growth has to do with the expansion and application of human knowledge and information, not of extractable natural resources. In this view, economic growth is limited only by human imagination, [McConnell and Brue, (2008), p.317].

Human knowledge and information can help improve the efficiency with which resources are used and can help expand the pool of resources where exploitation is technically feasible (though such expansion typically involves ecological consequences). However, human knowledge and technology does not allow for doing without resources entirely. People tend to eat food, not ideas; and prefer to live in houses made of wood, cement and steel, rather than those constructed out of mere information. Aside from the cultural realm (e.g., reading a poem), knowledge and information are mostly useful in contexts where they are applied to resources in order to produce capital or consumer goods (e.g., better knowledge and information allows for less wood to be used to construct a house, or steel instead of wood, but knowledge is only useful if there are raw materials to work with and it does not allow for a house to be built out of thin air) (Daly, 1992).

More broadly, improvements in knowledge and technological progress are often portrayed as reducing the economy's resource requirements and its environmental impacts and hence reducing the likelihood that there might be limits to growth:

The technological advances that bring economic growth help us to economize on natural resources and to clean up the environment. For example, more efficient auto engines cut gasoline use and tailpipe emissions. [Parkin and Bade, (2006), p.452]

Most economists are less concerned about such limits to growth than one might guess. They argue that technological progress often yields ways to avoid these limits. If we compare the economy today to the economy of the past, we see various ways in which the use of natural resources has improved. Modern cars have better gas consumption. New houses have better insulation and require less energy to heat and cool them. Technological advances have also allowed us to access resources previously thought to be too difficult to extract. Such advances have, for example, made it possible to extract much more oil from the oil sands in Alberta than once was thought possible. Other technological advances have resulted in recycling, causing some nonrenewable resources to be reused. Finally, the development of alternative fuels, such as ethanol instead of gasoline, allows us to substitute renewable for nonrenewable resources. [Mankiw et al., (2007a), p.146]

There are many valid points in the above passages. What is lacking though is consideration of factors that tend in the other direction (Huesemann, 2004), including

Jevons's paradox wherein improvements in the efficiency of resource use can expand the number of industries or processes wherein a given resource can be economically used, such that resource consumption accelerates with efficiency improvements (Sorrell, 2009). Our cars get better mileage and so we drive further. We insulate houses better, but we build bigger houses, have fewer people in each house and expect them to be warmer (or cooler). We develop the technology to exploit Alberta's oil sands but then are left with the ecological consequences of mining the landscape, extracting the oil and burning the resulting fuel. With improved knowledge, we realise that making ethanol has a low energy return on investment and that it has little potential to displace current fuel consumption levels (Haberl et al., 2009). Finally, in the context of a limits to growth argument, it is important to understand that a positive growth rate implies that GDP will increase exponentially, while eco-efficiency improvements made possible by improvements to human knowledge will eventually involve diminishing marginal returns. Since net resource and energy throughput and environmental impact involves multiplying the first exponentially increasing number by the second number, which decreases ever more imperceptibly over time, eventually, if unchecked, growth will cancel out the improvements in eco-efficiency and the aggregate effect will be unsustainable (Huesemann, 2004; Luten, 1980).

In large part, the inadequate treatment of the role of resources and energy in enabling economic activity in the standard texts can be expected since the standard economic model has been found to have "no role for physical materials, energy or the laws of thermodynamics. Energy and materials exist in the theory as outputs – products and services – but not as inputs or drivers" [Ayres, (2008), p.294].

The perspectives of environmentalists are caricatured and they are often portrayed as being ignorant of rudimentary economic theory:

Many environmentalists are sceptical about the efficiency and desirability of markets. Some do not understand economists' reasoning as to why markets can be, and often are, efficient mechanisms for allocating scarce resources. Others understand the economists' case but reject it, although few complete their argument by trying to demonstrate that direct government controls will be more effective. [Ragan and Lipsey, (2008), p.420]

It is unclear who the authors intend to include under the environmentalist label: does it include professionals working in the environmental sector, scientists with advanced training working on environmental issues, or merely volunteer activists and campaigners paid by NGOs? The diversity of perspectives held by the environmental community is largely lost in the standard textbooks and it seems as though many textbook authors have drawn on the least sophisticated exemplars of environmental thought. Consistent with the neglect of referencing and attribution that other researchers have found in principles texts (Paxton, 2007), rarely do the texts quote specific environmentalists or provide sources to allow readers to verify the accuracy of the text's description of the positions and claims purportedly put forward by environmentalists:

Despite the stated goals of some environmentalists, it would be impossible to prohibit all polluting activity. For example, virtually all forms of transportation – even the horse – produce some undesirable polluting byproducts. But it would not be sensible for the government to ban all transportation. [Mankiw et al., (2007b), p.217]

The textbooks reproduce the unfortunate confusion introduced by Hardin's (1968) classic but poorly named 'tragedy of the commons' article (see Dietz et al., 2003; Hardin, 1998), wherein common pool resources are overharvested or degraded due to a misalignment between individual incentives and collective interests. As a result, the standard texts often misdiagnose natural resource management problems and provide a pessimistic assessment of the viability of collective responses to resource management and environmental challenges.

The term 'tragedy of the commons' comes from fourteenth century England where areas of rough grassland surrounded villages. The commons were open to all and used for grazing cows and sheep owned by the villagers. Because the commons were open to all, no one had an incentive to ensure that the land was not over grazed. The result was a severe overgrazing situation. During the sixteenth century, the price of wool increased and England became a wool exporter to the world. Sheep farming became profitable, and sheep owners wanted to gain more effective control of the land they used. So the commons were gradually enclosed and privatized. Overgrazing ended, and land use became more efficient. [Parkin and Bade, (2006), p.370]

The problem occurs because like Hardin, the textbooks conflate open access (where no property rights are defined and there are no management rules, enforcement mechanisms or sanctions) with common property regimes (where the members of a group have defined property rights to exploit a common pool resource under a set of collectively derived rules and use enforcement mechanisms and apply sanctions to ensure compliance). The textbooks explain the enclosures that took place in England in terms of a necessary step to improve the productivity of agricultural land, ignoring the empirical data which shows that in the open field system predominant in England, rights to use were carefully defined, enforcement mechanisms were in use, sanctions for non-compliance were applied, management was effective and innovative and enclosure often resulted in a reduction in yields (Allen, 1982, 2001; Marglin, 2008). They fail to mention that enclosures took place in part because members of a dominant class forced a change in property right entitlements to better suit their personal interests and that a large portion of the population lost its means of subsistence and suffered gravely as a result (Neeson, 1993).

The textbooks devote considerable space and give significant importance to the Coase theorem:

Ronald Coase...was the first to see clearly that if people can negotiate with one another at no cost over the right to perform activities that cause externalities, they have the incentive to arrive at an efficient solution. This insight, which is often called the Coase theorem, is a profoundly important idea, one for which Coase (rhymes with 'dose') was awarded the 1991 Nobel Prize in Economics. [Frank et al., (2005b), p.284]

The attention given to the Coase theorem bears examination given that the theorem is inapplicable except in circumstances that are generally trivial from an environmental perspective since it only applies in those improbable instances where bargaining is possible and efficient. Coase was wrong to ignore wealth effects (Bromley, 1991) and failed to consider how more clearly defined private property rights may undermine other mechanisms for addressing environmental problems [Bowles, (2004), p.227]. The enthusiasm for the theorem may partly be due to a misreading of its implications as suggesting the desirability of limiting government's intervention in the economy since it

initially appears to indicate that well-assigned property rights will do a better job than government [Bowles, (2004), p.230]. Alternatively, textbook authors may feel pressure to include the Coase theorem because it is part of the economics profession's pathway navigating worsening environmental conditions. However, it seems unlikely to add much to student capacity to understand the economic dimensions of sustainability and it may abet an incorrect conclusion that extending property rights is a sure path to more sustainable outcomes.

Moving beyond the textbook discussion of Coase, there is much content that seems to be oriented towards having students accept that by creating property rights, the management of natural resources can be improved and the production of pollution can be abated:

In each of these instances, private property rights and market outcomes would have supplied solutions that almost everyone in society would regard as better than what happened. [Stiglitz and Walsh, (2006b), p.418]

In recent years, economists have proposed extending property rights to environmental commodities by selling or auctioning permits to pollute and allowing them to be traded on markets. Preliminary evidence suggests that this extension of property rights has given much more powerful incentives to reduce pollution efficiently. [Samuelson and Nordhaus, (2005), p.35]

While private property rights can sometimes lead to improved environmental outcomes, the textbook story is too simplistic. In many instances both empirical data and economic theory show that private property regimes are likely to lead to resource overexploitation or environmental degradation. For certain common pool resources, reinstituting and reinvigorating common property regimes or state management is more likely to be successful (Freyfogle, 2003; O'Neill, 2007; Bromley, 1991, 1992; Dietz et al., 2003; Clark, 1973). Furthermore, for the extension of property rights to work effectively at reducing externalities, it would have to be possible to define property rights over all environmental attributes. Yet, most environmental attributes cannot be bounded and demarcated in a manner that would make property rights meaningful (Vatn and Bromley, 1994).

The textbooks place heavy emphasis on the use of economic instruments to achieve the economically efficient level of production:

When people cannot solve the problem of externalities privately, the government often steps in. Yet, even now, society should not abandon market forces entirely. Rather, the government can address the problem by requiring decision makers to bear the full costs of their actions. Pigovian taxes on emissions and pollution permits, for instance, are designed to internalize the externality of pollution. More and more, they are the policy of choice for those interested in protecting the environment. Market forces, properly redirected, are often the best remedy for market failure. [Mankiw et al., (2007b), p.223]

The texts acknowledge that estimating the marginal external costs of pollution so as to determine the efficient level of pollution can be difficult:

It may not be easy to calculate the social costs and benefits of pollution... Calculating the marginal social costs of pollution requires that we put a dollar value on the environment. But what is the cost of the extinction of a species like the spotted owl? What is the cost of the acidification of lakes that kills the fish – and with them any possibility of freshwater fishing? Calculations are

possible, but there will always be a range of uncertainty. [Krugman et al., (2007b), p.488]

Despite such hedging, the considerable space devoted to the exposition of pollution charges and tradable emission schemes in the standard texts and the stress on demonstrating how such tools are more efficient than regulation may leave students with the impression that the estimation of marginal external costs can generally be undertaken and that pollution charges and tradable emission schemes can be applied to almost all problems (and that regulation is generally inefficient and best avoided). There is little doubt that getting prices to better reflect environmental impacts through the application of market mechanisms will be an essential component of moving towards sustainability, and in this sense the texts make a useful contribution to enhancing student knowledge. However, the texts generally do not do justice to the many instances where pollution charges and tradable emission schemes are impractical, unlikely to succeed or have been found to be of limited effectiveness. In part, this is because such instruments are largely geared toward dealing with 'end-of-pipe' environmental impacts, which offer limited possibilities for environmental improvement (Ayres, 2008). As well, modern production processes involve a diversity of inputs and outputs and entail a level of complexity that complicate the textbook story to the point where they are unlikely to be able to address a broad range of environmental impacts. How and where environmental burdens are distributed must be considered for ethical and geographical reasons (given variations in population density, socio-economic status and geographic factors that affect the assimilation and health effects of pollutants) yet economic instruments are not always able to address these dimensions of the problem effectively (Bailey, 2002; Beder, 1996). In practise, economic instruments in the USA do not reflect those that would obtain optimal results according to the economic models as they have been shaped by ethical considerations (Tietenberg, 1998).

While the textbooks largely confine their coverage of environment/economy linkages in sections on externalities and public goods, they are unsatisfactory and are disconnected from the remainder of the text, leaving students with economic theory that is incoherent. In part, this is because the metaphor of market failures and the externalities approach are themselves limiting and incoherent (Berger, 2008; Kapp, 1970; Marglin, 2008; Bromley, 2007). While an externality approach encourages the identification of public policies that help 'get the prices right', and while such an adjusted price system could be an important corrective to avoid many unsustainable actions, there are myriad practical and theoretical challenges involved in seeking to correct market failures. Similar challenges arise in seeking to address environmental problems through extended and more clearly defined property rights.

Given that ecosystems are complex, interconnected systems subject to discontinuities of which humans will always have incomplete knowledge (Limburg et al., 2002), we will never be able to understand how nature supports human well-being and how human activity can compromise nature's ability to support human well-being in the future. Efforts to estimate marginal external costs are quickly overwhelmed by interdependencies and complex causal chains that cannot be completely specified (Kapp, 1970). In order to correct market failures through a property rights approach, it is necessary to define property rights over all environmental attributes, yet most cannot be bounded and demarcated in a manner to make property rights meaningful (Bakker, 2005) while compressing all the information on an environmental attribute to a single metric

involves a loss of information that is important to the choices being made (Vatn and Bromley, 1994). The cost of either developing pollution charges/tradable permit schemes/markets to reflect external costs or of precisely defining property right for all environmental attributes would be prohibitive in many instances [Marglin, (2008), p.283].

Herman Daly (1992, p.88) suggested that approaching the environment through the externality lens involves tacking on the environment as an afterthought and the commonly used wording of 'internalising externalities' is 'revealingly contradictory'. Other scholars argued that the externality lens limits the conceptualisation of the environmental predicament and thereby fails to identify potential policy solutions (Berger, 2008; Norgaard, 1985). It does not deal with the scale of the overall economic system relative to the encompassing natural systems upon which it depends. This is because while the externality approach can point to prices to correct relative scarcity, it cannot deal with absolute scarcity – that the scale of the economy is becoming too large for the biosphere that must accommodate it – since “it is impossible to raise the relative prices of all resources in general” [Daly, (1992), p.42]. Nor does it adequately address environmental degradation that is not directly associated with human economic interests (since there will be no external social cost to add as a corrective to prices); give sufficient weight to impacts on the poor (whose income is insufficient to demonstrate willingness to pay for environmental quality); or the myriad instances when environmental impacts of economic activity cannot be predicted or are distant in time (since future generations cannot intervene in current markets). It suffers from theoretical incoherence and it conflates rights and efficiency (Vatn and Bromley, 1997). Finally, because it seeks to motivate changes in the behaviour of individual agents, it is ill-suited for dealing with issues that must be addressed collectively such as land use planning and investing in suitable infrastructure. For instance, even if the price of gasoline was increased to reflect environmental impacts, it would be hard for individuals to opt for low emission transportation in a sprawling city where public transit is infrequent and stretched to capacity.

The theoretical coherence of internalising externalities is also questioned because of the incommensurability involved in equating the state of the environment to market goods. The externality approach assumes that making choices between a stereo and a computer is equivalent to making a choice between, say, a stereo and critical habitat needed for sustenance. Yet, there is no universal unit which can adequately represent all values. Since individuals and communities have certain ethical value commitments and abide by certain principles that exclude certain objects and activities being exchanged in market transactions (e.g., selling one's child is not acceptable, National Parks are not for sale, no matter the price offered) in many instances there is no defensible means of estimating marginal social costs (O'Neill, 2007). Finally, it is important to recognise that if prices are not actually changed through the application of pollution charges and the like, then the values calculated to capture externalities are merely “rhetorical devices in arguments with governments” [O'Neill, (2007), p.43].

There are a number of responses from within environmental economics to the above arguments. Societies make choices, such choices involve trade-offs and prices can be estimated from such choices. Decisions can be made, not everything be saved, so some sort of a ranking procedure is needed [e.g., see Pearce et al., (1994), p.18]. Although estimating marginal social costs is fraught with difficulties, it is better to bring this

information to decision-makers than to proceed blindly. Yet, these arguments are not convincing, because it involves a distorted view of rational choice in which decisions can only be made where all choice options are expressed in a single metric, and where choice is merely the application of a mathematical algorithm [O'Neill, (2007), p.42]. Clearly, humans have long made choices without a singular metric, and we shall continue to do so (Bromley, 2004; Vatn and Bromley, 1994).

Were the texts to move beyond the externality framework, there is the potential for them to provide students greater insight into the nature of our environmental predicament. For instance, by providing a brief overview of the implications of the 1st and 2nd Laws of Thermodynamics, students could come to understand that though the economic process conserves matter and energy, the end result of production and consumption is the drawing down of natural resource stocks, the loss of usable energy and the generation of wastes (Ayres, 2008; Georgescu-Roegen, 1971). Grounding the economy in biophysical reality brings to the fore issues that have both economic and environmental dimensions that deserve the students' attention: what resources are being used, at what rate are they being extracted, what wastes are being generated, what ecosystem services are being degraded as a result – and what can be done to improve the sustainability of the economy.

4 Conclusions and recommendations

Introductory economics textbooks in current use in BC, as well as three leading US textbooks, one of which includes a Nobel laureate who has written with great concern about the environmental crisis as its lead author, are poorly suited for Econ101 courses at institutions that have made a commitment to sustainability and are seeking to integrate sustainability across the curriculum. The standard textbooks give little space to content that addresses environment/economy linkages or that is significant to sustainability – on average, only about 3.2% of the text. Students will read many chapters and up to 289 consecutive pages without encountering any environmental content. The standard textbooks treat the environmental implications of economic activity in an overly stylised manner that is unrealistic, that adds little to student knowledge and that may well confound or even impair student understanding of the nature of our environmental predicament. They leave a long list of environmental side-effects of economic activity unmentioned. They presume that increased output and consumption is desirable, that it enhances well-being and imply, despite empirical evidence indicating otherwise, that richer countries have less environmental impact than poorer countries. While the standard textbooks present the 'limits to growth' debate, the presentation contains errors, is outdated and relies on selective evidence and arguments. The textbooks advocate for growth as society's primary macroeconomic policy objective despite the fact that beyond modest levels of income, economic growth and well-being are poorly linked. While textbooks set out favoured economic tools that might be used to reduce the impact of economic activity, such as pollution charges and emission permits, they downplay the many instances where those tools would not work or where other policies might be more effective and just. They advocate for property rights solutions with little recognition of how private property can contribute to habitat fragmentation, incentives to deplete resources and to allow other environmental insults to occur. They fail to describe

instances where common property regimes or state action have sustained the productivity of natural ecosystems and they downplay the prospects for collective action to address sustainability challenges. They include little or no content that might enhance student understanding of less consumerist lifestyles in rich countries and that redistribution of wealth might play in moving towards sustainability.

Because the standard textbooks tend to compartmentalise material that relates to the environment in chapters on externalities and public goods, and because some textbook authors explicitly suggest in their preface that those chapters are not core chapters and may be omitted due to time constraints [e.g., Parkin and Bade, (2006), p.22], many students will receive little exposure in Econ101 to environment-economy interactions. Compartmentalisation of environmental content allows for the ecological viability of status quo economic policies to be left unexamined in most chapters of the textbook.

Since so few students will become research economists, the relevant criterion for selecting the content to include in the Econ101 curriculum is not that what prepares students for advanced study in economics, nor that which reflects the frontiers of economic thinking, but rather that which will most aid the students' understanding of the economy (Boulding 1988; Colander 2000; Colander 2005; Ormerod, 2003). Given humanity's ecological predicament and the imperative to work towards sustainability and commitments made by universities that imply the integration of sustainability across the curriculum, it seems reasonable to expect that in the 21st century, 'understanding the economy' requires considering economies in their broader ecological contexts.

Of the textbooks considered in this sample, the pair of textbooks written by Goodwin et al. (2009a, 2009b) emerged as the best choice for Econ101 courses at institutions that have made a commitment to sustainability, that are seeking to improve the environmental literacy of their students and that seek to integrate sustainability across the curriculum. Compared to the standard texts, a considerably higher proportion of the text is devoted to the coverage of environment-economy linkages and this content is well-dispersed throughout the textbook. The authors use a sustainability lens to examine a number of important economic issues, drawing upon empirical data to inform the discussion. As opposed to the highly stylised and sometimes inaccurate portrayal of environment/economy linkages in the standard texts, Goodwin and her team have written a pair of textbooks that describe a range of environmental/economy interactions and issues in a sophisticated manner without burying readers in too much detail. At the same time, the texts still cover the core material that students are expected to master in the standard principles course. In part because standard Econ101 textbooks lack tangible connections to the world as it is understood by students, they have been shown to negatively impact student engagement and learning (Richardson, 2004; Paxton, 2007). Because the Goodwin textbooks present economic theory in its environmental and societal 'context', it is likely that many students will find the material less abstract and alien and more relevant, which suggests that the Goodwin textbooks may be a useful tool in improving learning outcomes.

Students would be better served if authors of standard textbooks would improve the sophistication with which their texts address environment-economy interactions. Textbook authors, already under much pressure to add new content to their texts, may well object that a fuller and more sophisticated treatment of environment-economy interactions would expand the total page count well beyond the envelope that can be managed by first year students. There are two rejoinders to this argument. The first is that integrating sustainability into the text – the key word is integration – does not so much

mean adding more topics and hence pages, but rather rewriting existing content such that it more realistically addresses environment/economy linkages. Many of the mundane examples included in standard texts could be replaced with examples that both illustrate economic principles and are environmentally realistic and relevant. The Goodwin texts show how this can be done.

The second rejoinder is that if one goes back to what a good course in introductory economics should accomplish – providing a basis for a better understanding of the economy – much of the existing content could and should be omitted, a point that others have made before (Becker, 2007). For example, few Econ101 students in North America major in economics, fewer still will get a PhD, and but a handful will become Chair of the Federal Reserve. Why then does the typical text so much space to describing how the Federal Reserve influences interest rates? Furthermore, most textbooks have much trite content that could be deleted, such as a page devoted by McConnell and Brue (2008, p.333) to considering whether a robot should replace Bernanke, Chair of the US Federal Reserve. Given humanity's current environmental predicament, it seems more relevant to equip students with an analytical framework for understanding the challenges and potential solutions that society faces in putting the economy on a sustainable footing.

Even within the current inadequate allotment of pages to sustainability relevant issues, there are tradeoffs that authors of the standard texts should consider. Authors would likely write better textbooks if they spent less of their scarce pages exploring the efficiency properties of tradable permit schemes, for example, while instead giving students a more sophisticated description of how the biosphere and the economy are linked. After all, most students are not going to spend their working hours defining a tradable permit scheme or comparing pollution charges to cap and trade systems. They will, however, be working at workplaces that place demands on the environment, voting as citizens in elections where environmental issues will be important and making decisions as consumers that influence their ecological footprints.

The fact that so many inaccuracies and weaknesses have been documented in the standard texts regarding how they (fail to) conceptualise the linkages between the environment and the economy suggest that the textbook peer review process undergone by standard textbooks ought to be revisited. Reviewers should include individuals trained in other disciplines such as the environmental sciences. Furthermore, textbook authors should draw upon and cite recent literature in sustainability and the environmental sciences.

This study is also relevant to non-economics programmes that make Econ101 a required course. Other disciplines should be concerned that what their students are learning in the Econ101 course, if it relies on a standard-type textbook, may actually impede student understanding of sustainability. The next phase of the author's research is intended to examine this issue in more depth.

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References

- Allen, R. (1982) 'The efficiency and distributional consequences of eighteenth-century enclosures', *The Economic Journal*, Vol. 92, No. 368, pp.937–953.
- Allen, R. (2001) 'Community and markets in England: open fields and enclosures revisited', in Aoki, M. and Hayami, Y. (Eds.): *Communities and Markets in Economic Development*, pp.42–69, Oxford University Press, Oxford.
- Allgood, S. et al. (2004) 'What students remember and say about college economics years later', *The American Economic Review*, Vol. 94, No. 2, pp.259–265.
- Ayres, R. (2006) 'Turning point: the end of exponential growth?', *Technological Forecasting and Social Change*, Vol. 73, No. 9, pp.1188–1203.
- Ayres, R. (2008) 'Sustainability economics: where do we stand?', *Ecological Economics*, Vol. 67, No. 2, pp.281–310.
- Ayres, R. and van den Bergh, J. (2005) 'A theory of economic growth with material/energy resources and dematerialization: interaction of three growth mechanisms', *Ecological Economics*, Vol. 55, No. 1, pp.96–118.
- Bailey, I. (2002) 'European environmental taxes and charges: economic theory and policy practice', *Applied Geography*, Vol. 22, No. 3, pp.235–251.
- Bakker, K. (2005) 'Neoliberalizing nature? Market environmentalism in water supply in England and Wales', *Annals of the Association of American Geographers*, Vol. 95, No. 3, pp.542–565.
- Becker, W. (2003) 'How to make economics the sexy social science (reprint from Chronicle of Higher Education)', *Southern Economic Journal*, Vol. 70, No. 1, pp.195–198.
- Becker, W. (2007) 'Quit lying and address the controversies: there are no dogmata, laws, rules or standards in the science of economics', *American Economist*, Vol. 51, No. 1, pp.3–14.
- Beder, S. (1996) 'Charging the earth: the promotion of price-based measures for pollution control', *Ecological Economics*, Vol. 16, No. 1, pp.51–63.
- Benton, R. (1990) 'A hermeneutic approach to economics: if economics is not science, and if it is not merely mathematics, then what could it be?', in Evans, T. and Henderson, W. (Eds.): *The Language of Economics: An Analysis of Economics Discourse*, pp.65–89, Modern English Publications and the British Council, London.
- Berg, B. (1998) *Qualitative Research Methods for the Social Sciences*, 6th ed., Allyn and Bacon, Boston.
- Berger, S. (2008) 'K. William Kapp's theory of social costs and environmental policy: towards political ecological economics', *Ecological Economics*, Vol. 67, No. 2, pp.244–252.
- Bergh, J. (2009) 'The GDP paradox', *Journal of Economic Psychology*, Vol. 30, No. 2, pp.117–135.
- Boulding, K. (1966) 'The economics of the coming spaceship earth', in Jarrett, H. (Ed.): *Environmental Quality in a Growing Economy*, pp.3–14, Johns Hopkins Press, Baltimore.
- Boulding, K. (1988) 'What do we want in an economics textbook?', *The Journal of Economic Education*, Vol. 19, No. 2, pp.113–132.
- Bowles, S. (2004) *Microeconomics. Behavior, Institutions, and Evolution*, Princeton University Press, New York.

- Brander, J. (2007) 'Viewpoint: sustainability: Malthus revisited?', *Canadian Journal of Economics*, Vol. 40, No. 1, pp.1–38.
- Bromley, D. (1991) *Environment and Economy: Property Rights and Public Policy*, Basil Blackwell, Cambridge.
- Bromley, D. (1992) 'The commons, common property, and environmental policy', *Environmental and Resource Economics*, Vol. 2, No. 1, pp.1–17.
- Bromley, D. (2004) 'Reconsidering environmental policy: prescriptive consequentialism and volitional pragmatism', *Environmental and Resource Economics*, Vol. 28, No. 1, pp.73–99.
- Bromley, D. (2006) *Sufficient Reason: Volitional Pragmatism and the Meaning of Economic Institutions*, Princeton University Press, Princeton.
- Bromley, D. (2007) 'Environmental regulations and the problem of sustainability: moving beyond market failure', *Ecological Economics*, Vol. 63, No. 4, pp.676–683.
- Charmaz, K. (2001) 'Grounded theory', in Emerson, R.M. (Ed.): *Contemporary Field Research: Perspectives and Formulations*, pp.335–352, Waveland Press, Long Grove.
- Cipriani, G., Lubian, D. and Zago, A. (2009) 'Natural born economists?', *Journal of Economic Psychology*, Vol. 30, No. 3, pp.455–468.
- Clark, C. (1973) 'The economics of overexploitation', *Science*, Vol. 181, No. 4100, pp.630–634.
- Cleveland, C., Costanza, R., Hall, C.A.S. and Kaufmann, R. (1984) 'Energy and the U.S. economy: a biophysical perspective', *Science*, Vol. 225, No. 4665, pp.890–897.
- Colander, D. (2000) 'Telling better stories in introductory macro', *The American Economic Review*, Vol. 90, No. 2, pp.76–80.
- Colander, D. (2003) 'Integrating sex and drugs into the principles course: market-failures versus failures-of-market outcomes', *Journal of Economic Education*, Vol. 34, No. 1, pp.82–91.
- Colander, D. (2005) 'What economists teach and what economists do', *Journal of Economic Education*, Vol. 36, No. 3, pp.249–260.
- Costanza, R. and Patten, B. (1995) 'Defining and predicting sustainability', *Ecological Economics*, Vol. 15, No. 3, pp.193–196.
- Costanza, R. et al. (2007) 'Quality of life: an approach integrating opportunities, human needs, and subjective well-being', *Ecological Economics*, Vol. 61, Nos. 2–3, pp.267–276.
- Daly, H. (1991) 'Towards an environmental macroeconomics', *Land Economics*, Vol. 67, No. 2, pp.255–259.
- Daly, H. (1992) *Steady State Economics*, 2nd ed., Earthscan, London.
- Daly, H. (2002) 'Reconciling the economics of social equity and environmental sustainability', *Population and Environment*, Vol. 24, No. 1, pp.47–53.
- Davis, J. (2005) 'Robbins, textbooks, and the extreme value neutrality view', *History of Political Economy*, Vol. 37, No. 2, pp.191–196.
- Dietz, T., Ostrom, E. and Stern, P. (2003) 'The struggle to govern the commons', *Science*, Vol. 302, No. 5652, pp.1907–1912.
- Dinda, S. (2004) 'Environmental Kuznets curve hypothesis: a survey', *Ecological Economics*, Vol. 49, No. 4, pp.431–455.
- England, P. (2003) 'Separative and soluble selves: dichotomous thinking in economics', in Ferber, M. and Nelson, J. (Eds.): *Feminist Economics Today: Beyond Economic Man*, University of Chicago Press, Chicago.
- Ewert, A. and Baker, D. (2001) 'Standing for where you sit: an exploratory analysis of the relationship between academic major and environment beliefs', *Environment and Behavior*, Vol. 33, No. 5, pp.687–707.
- Ferber, M. and Nelson, J. (1993) *Beyond Economic Man: Feminist Theory and Economics*, University of Chicago Press, Chicago.

- Ferraro, F., Pfeffer, J. and Sutton, R. (2005) 'Economics language and assumptions: how theories can become self-fulfilling', *Academy of Management Review*, Vol. 30, No. 1, pp.8–24.
- Fischer, J. et al. (2007) 'Mind the sustainability gap', *Trends in Ecology & Evolution*, Vol. 22, No. 12, pp.621–624.
- Folsom, D. and Brauer, J. (1998) 'Sustainable development: coverage in principles of economics texts', *Mountain Plains Management Conference Refereed Proceedings*, pp.107–113, Denver, CO.
- Fourcade-Gourinchas, M. and Babb, S. (2002) 'The rebirth of the liberal creed: paths to neoliberalism in four countries', *The American Journal of Sociology*, Vol. 108, No. 3, pp.533–579.
- Frank, B. and Schulze, G. (2000) 'Does economics make citizens corrupt?', *Journal of Economic Behavior & Organization*, Vol. 43, No. 1, pp.101–113.
- Frank, R., Gilovich, T. and Regan, D. (1993) 'Does studying economics inhibit cooperation?', *The Journal of Economic Perspectives*, Vol. 7, No. 2, pp.159–171.
- Frank, R., Gilovich, T. and Regan, D. (1996) 'Do economists make bad citizens?', *The Journal of Economic Perspectives*, Vol. 10, No. 1, pp.187–192.
- Frey, B. and Meier, S. (2005) 'Selfish and indoctrinated economists?', *European Journal of Law and Economics*, Vol. 19, No. 2, pp.165–171.
- Freyfogle, E. (2003) 'Private land made (too) simple', *Environmental Law Reporter*, Vol. 33, No. 2, pp.10155–10169.
- Galbraith, J. (1998) *The Affluent Society: 40th Anniversary Edition*, Houghton Mifflin, New York.
- Georgescu-Roegen, N. (1971) *The Entropy Law and the Economic Process*, Massachusetts, Harvard University Press, Cambridge.
- Giljum, S. and Eisenmenger, N. (2004) 'North-south trade and the distribution of environmental goods and burdens: a biophysical perspective', *The Journal of Environment Development*, Vol. 13, No. 1, pp.73–100.
- Gottesman, A., Ramrattan, L. and Szenberg, M. (2005) 'Samuelson's economics: the continuing legacy', *The Quarterly Journal of Austrian Economics*, Vol. 8, No. 2, pp.95–104.
- Haberl, H., Fischer-Kowalski, M., Krausmann, F., Martinez-Alier, J. and Winiwarter, V. (2009) 'A socio-metabolic transition towards sustainability? Challenges for another great transformation', *Sustainable Development*, Vol. 19, No. 1, pp.1–14.
- Haigh, M. (2005) 'Greening the university curriculum: appraising an international movement', *Journal of Geography in Higher Education*, Vol. 29, No. 1, pp.31–48.
- Hall, C., Lindenberger, D., Mmel, R., Kroeger, T. and Eichhorn, W. (2001) 'The need to reintegrate the natural sciences with economics', *BioScience*, Vol. 51, No. 8, pp.663–673.
- Hall, C., Tharakan, P., Hallock, J., Cleveland, C. and Jefferson, M. (2003) 'Hydrocarbons and the evolution of human culture', *Nature*, Vol. 426, No. 6964, pp.318–322.
- Hardin, G. (1968) 'The tragedy of the commons', *Science*, Vol. 162, No. 3859, pp.1243–1248.
- Hardin, G. (1998) 'Extensions of the tragedy of the commons', *Science*, Vol. 280, No. 5364, pp.682–683.
- Heilbroner, R. and Milberg, W. (1995) *The Crisis of Vision in Modern Economic Thought*, Cambridge University Press, Cambridge, UK.
- Holling, C. (2001) 'Understanding the complexity of economic, ecological, and social systems', *Ecosystems*, Vol. 4, No. 5, pp.390–405.
- Howarth, R. (2007) 'Towards an operational sustainability criterion', *Ecological Economics*, Vol. 63, No. 4, pp.656–663.
- Huesemann, M. (2003) 'The limits of technological solutions to sustainable development', *Clean Technologies and Environmental Policy*, Vol. 5, No. 1, pp.21–34.
- Huesemann, M. (2004) 'The failure of eco-efficiency to guarantee sustainability: future challenges for industrial ecology', *Environmental Progress*, Vol. 23, No. 4, pp.264–270.

- Jaccard, M. (2005) *Sustainable Fossil Fuels: The Unusual Suspect in the Quest for Clean and Enduring Energy*, Cambridge University Press, Cambridge, UK.
- Jackson, T. (2009) *Prosperity without Growth: The Transition to a Sustainable Economy*, Sustainable Development Commission, London, UK.
- Kapp, K. (1970) 'Environmental disruption and social costs: a challenge to economics', *Kyklos*, Vol. 23, No. 4, pp.843–847.
- Kirchgassner, G. (2005) '(Why) are economists different?', *European Journal of Political Economy*, Vol. 21, No. 3, pp.543–562.
- Klamer, A. (1990) 'The textbook presentation of economic discourse', in *Economics as Discourse: An Analysis of Language in Economics*, pp.129–154, Kluwer, Boston.
- Knoedler, J. and Underwood, D. (2003) 'Teaching the principles of economics: a proposal for a multi-paradigmatic approach', *Journal of Economic Issues*, Vol. 37, No. 3, pp.697–725.
- Konow, J. and Earley, J. (2008) 'The hedonistic paradox: is homo economicus happier?', *Journal of Public Economics*, Vol. 92, Nos. 1/2, pp.1–33.
- Limburg, K., O'Neill, R., Costanza, R. and Farber, S. (2002) 'Complex systems and valuation', *Ecological Economics*, Vol. 41, No. 3, pp.409–420.
- Lourdes, B. (2003) *Gender, Development, and Globalization: Economics as if All People Mattered*, Routledge, London.
- Ludwig, D., Hilborn, R. and Waters, C. (1993) 'Uncertainty, resource exploitation, and conservation: lessons from history', *Science*, Vol. 260, No. 5104, pp.17–36.
- Lukman, R. and Glavič, P. (2007) 'What are the key elements of a sustainable university?', *Clean Technologies and Environmental Policy*, Vol. 9, No. 2, pp.103–114.
- Luten, D. (1980) 'Ecological optimism in the social sciences: the question of limits to growth', *The American Behavioral Scientist*, Vol. 24, No. 1, pp.125–149.
- Lutz, M. and Lux, K. (1979) *The Challenge of Humanistic Economics*, Benjamin/Cummings Publishing, Menlo Park, California.
- Marglin, S. (2008) *The Dismal Science: How Thinking Like an Economist Undermines Community*, Harvard University Press, Cambridge, Mass.
- Meadows, D., Meadows, D., Randers, J. and Behrens, W. (1972) *Limits to Growth*, Potomac Associates, Washington, DC.
- Moore, J. (2004) 'Recreating the university from within: sustainability and transformation in higher education', PhD dissertation, Dept. of Curriculum Studies, Faculty of Education, University of British Columbia.
- Muradian, R., O'Connor, M. and Martinez-Alier, J. (2002) 'Embodied pollution in trade: estimating the 'environmental load displacement' of industrialised countries', *Ecological Economics*, Vol. 41, No. 1, pp.51–67.
- Neeson, J. (1993) *Commoners: Common Right, Enclosure and Social Change in England, 1700–1820*, Cambridge University Press, Cambridge.
- Nelson, J. (1993) 'The study of choice or the study of provisioning? Gender and the definition of economics', in Ferber, M. and Nelson, J. (Eds.): *Beyond Economic Man: Feminist Theory and Economics*, University of Chicago Press, Chicago.
- Norgaard, R. (1985) 'Environmental economics: an evolutionary critique and a plea for pluralism', *Journal of Environmental Economics and Management*, Vol. 12, No. 4, pp.382–393.
- Norgaard, R. (1990) 'Economic indicators of resource scarcity: a critical essay', *Journal of Environmental Economics and Management*, Vol. 19, No. 1, pp.19–25.
- Northrop, E. (1996) 'The greening of introductory economics', in Aslanbeigui, N. and Naples, M. (Eds.): *Rethinking Economic Principles: Critical Essays on Introductory Textbooks*, pp.198–211, Irwin, Chicago.
- Northrop, E. (2000) 'Normative foundations of introductory economics', *American Economist*, Vol. 44, No. 1, p.53.

- O'Neill, J. (2007) *Markets, Deliberation and Environment*, Routledge, London.
- Ormerod, P. (2003) 'Turning the tide: bringing economics teaching into the twenty first century', *International Review of Economics Education*, Vol. 1, No. 1, pp.71–79.
- Ostrom, E. (2008) 'Institutions and the environment', *Economic Affairs*, Vol. 28, No. 3, pp.24–31.
- Owens, C. and Moore, J. (2008) 'Taking stock: the current state of sustainability in British Columbia universities and colleges', Vancouver, British Columbia, BC Working Group on Sustainability Education.
- Padilla, E. (2002) 'Intergenerational equity and sustainability', *Ecological Economics*, Vol. 41, No. 1, pp.69–83.
- Paxton, M. (2007) 'Tensions between textbook pedagogy and the literacy practices of the disciplinary community: a study of writing in first year economics', *Journal of English for Academic Purposes*, Vol. 6, No. 2, pp.109–125.
- Pearce, D. et al. (1994) *The Economic Value of Biodiversity*, Earthscan/James & James, London.
- Polanyi, K. (1944) *The Great Transformation*, Beacon Press, Boston.
- Raven, P. (2002) 'Presidential address: science, sustainability, and the human prospect', *Science*, Vol. 297, No. 5583, pp.954–959.
- Reardon, J. (2007) 'How green are principles of economics textbooks? An investigation into how mainstream economics educates students pertaining to energy, the environment and green economics', *International Journal of Green Economics*, Vol. 1, Nos. 3/4, pp.381–393.
- Rees, W. (2003) 'Economic development and environmental protection: an ecological economics perspective', *Environmental Monitoring and Assessment*, Vol. 86, No. 1, pp.29–45.
- Richardson, P.W. (2004) 'Reading and writing from textbooks in higher education: a case study from economics', *Studies in Higher Education*, Vol. 29, No. 4, pp.505–521.
- Robbins, L. (1935) *An Essay on the Nature and Significance of Economic Science*, Macmillan, London.
- Robinson, J. (2004) 'Squaring the circle? Some thoughts on the idea of sustainable development', *Ecological Economics*, Vol. 48, No. 4, pp.369–384.
- Robinson, J., Francis, G., Legge, R. and Lerner, S. (1990) 'Defining a sustainable society: values, principles and definitions', *Alternatives*, Vol. 17, No. 2, pp.36–46.
- Salemi, M. and Siegfried, J. (1999) 'The state of economic education', *The American Economic Review*, Vol. 89, No. 2, pp.355–361.
- Samuelson, P. (1938) 'A note on the pure theory of consumer's behaviour', *Economica*, Vol. 5, No. 17, pp.61–71.
- Simpson, R., Toman, M. and Ayres, R. (2005) *Scarcity and Growth Revisited: Natural Resources and the Environment in the New Millennium*, RFF Press, Washington, DC.
- Skousen, M. (1997) 'The perseverance of Paul Samuelson's economics', *The Journal of Economic Perspectives*, Vol. 11, No. 2, pp.137–152.
- Sleeper, J.A. (2007) 'Is current economic thought reflected in the principles textbook?', Dissertation, George Mason University, Virginia, USA.
- Sneddon, C., Howarth, R. and Norgaard, R. (2006) 'Sustainable development in a post-Brundtland world', *Ecological Economics*, Vol. 57, No. 2, pp.253–268.
- Sorrell, S. (2009) 'Jevons' Paradox revisited: the evidence for backfire from improved energy efficiency', *Energy Policy*, Vol. 37, No. 4, pp.1456–1469.
- Stigler, G. (1978) 'The literature of economics: the case of the kinked oligopoly demand curve', *Economic Inquiry*, Vol. 16, No. 2, pp.185–204.
- Stiglitz, J. (1988) 'On the market for principles of economics textbooks: innovation and product differentiation', *Journal of Economic Education*, Vol. 19, No. 2, pp.171–177.
- Stiglitz, J. (2006) *Making Globalization Work*, W.W. Norton, New York.

- Strober, M., Cook, A. and Fuller, K. (1997) 'Making and correcting errors in student economic analyses: an examination of videotapes', *The Journal of Economic Education*, Vol. 28, No. 3, pp.255–271.
- Tacconi, L. (1996) 'Dissent from choice theory: implications for environmental decision making', *International Journal of Social Economics*, Vol. 23, Nos. 4/5/6, pp.331–345.
- Tietenberg, T. (1998) 'Ethical influences on the evolution of the US tradable permit approach to air pollution control', *Ecological Economics*, Vol. 24, Nos. 2–3, pp.241–257.
- Underwood, D. (2004) 'Principles of macroeconomics: toward a multiparadigmatic approach', *Journal of Economic Issues*, Vol. 38, No. 2, pp.571–581.
- United Nations Environment Program (2005) *Living Beyond Our Means: Natural Assets and Human Well-Being. Statement of the Millennium Ecosystem Assessment Board*, UNEP, New York.
- Vatn, A. and Bromley, D. (1994) 'Choices without prices without apologies', *Journal of Environmental Economics and Management*, Vol. 26, No. 2, pp.129–148.
- Vatn, A. and Bromley, D. (1997) 'Externalities-a market model failure', *Environmental and Resource Economics*, Vol. 9, No. 2, pp.135–151.
- Victor, P. (1991) 'Indicators of sustainable development: some lessons from capital theory', *Ecological Economics*, Vol. 4, No. 3, pp.191–213.
- Victor, P. (2008) *Managing Without Growth: Slower by Design, Not Disaster*, Edward Elgar Publishing, Northampton, MA.
- Wada, Y. (1999) 'The myth of 'sustainable development': the ecological footprint of Japanese consumption', PhD dissertation, School of Community and Regional Planning, University of British Columbia, Vancouver, Canada, available at <http://hdl.handle.net/2429/10130>.
- Walstad, W. and Allgood, S. (1999) 'What do college seniors know about economics', *American Economic Review*, Vol. 89, No. 2, pp.350–354.
- Warr, B., Schandl, H. and Ayres, R. (2008) 'Long term trends in resource energy consumption and useful work supplies in the UK, 1900 to 2000', *Ecological Economics*, Vol. 68, Nos. 1–2, pp.126–140.
- Wright, T. (2002) 'Definitions and frameworks for environmental sustainability in higher education', *International Journal of Sustainability in Higher Education*, Vol. 3, No. 3, pp.203–220.
- Yezer, A., Goldfarb, R. and Poppen, R. (1996) 'Does studying economics discourage cooperation? Watch what we do, not what we say or how we play', *The Journal of Economic Perspectives*, Vol. 10, No. 1, pp.177–186.
- York, R., Rosa, E. and Dietz, T. (2004) 'The ecological footprint intensity of national economies', *Journal of Industrial Ecology*, Vol. 8, No. 4, pp.139–154.

Appendix A

Textbooks included in the study

Standard texts

- Frank, R., Bernanke, B., Osberg, L., Cross, M. and MacLean, B. (2005a) *Principles of Macroeconomics*, 2nd ed., McGraw-Hill, Toronto.
- Frank, R., Bernanke, B., Osberg, L., Cross, M. and MacLean, B. (2005b) *Principles of Microeconomics*, 2nd ed., McGraw-Hill, Toronto.
- Krugman, P., Wells, R. and Myatt, A. (2007a) *Macroeconomics*, Canadian ed., Worth, New York.
- Krugman, P., Wells, R. and Myatt, A. (2007b) *Microeconomics*, Canadian ed., Worth, New York.

- Mankiw, G., Kneebone, R., McKenzie, K. and Rowe, N. (2007a) *Principles of Macroeconomics*, 4th ed., Thomson Nelson, Toronto.
- Mankiw, G., Kneebone, R., McKenzie, K. and Rowe, N. (2007b) *Principles of Microeconomics*, 4th ed., Thomson Nelson, Toronto.
- McConnell, C. and Brue, S. (2008) *Economics: Principles, Problems, and Policies*, 17th ed., McGraw Hill, New York.
- Parkin, M. and Bade, R. (2006) *Economics: Canada in the Global Environment*, 6th ed., Pearson Education Canada, Toronto.
- Ragan, C. and Lipsey, R. (2008) *Economics*, 12th ed., Pearson Education Canada, Toronto.
- Samuelson, P. and Nordhaus, W. (2005) *Economics*, 18th ed., McGraw Hill, New York.
- Stiglitz, J.E. and Walsh, C.E. (2006a) *Principles of Macroeconomics*, 4th ed., W.W. Norton, New York.
- Stiglitz, J.E. and Walsh, C.E. (2006b) *Principles of Microeconomics*, 4th ed., W.W. Norton, New York.

Sustainability-oriented texts

- Goodwin, N., Nelson, J.A., Ackerman, F. and Weisskopf, T.E. (2009a) *Microeconomics in Context*, 2nd ed., M.E. Sharpe, Armonk, New York.
- Goodwin, N., Nelson, J.A. and Harris, J. (2009b) *Macroeconomics in Context*, M.E. Sharpe, Armonk, New York.

Appendix B

Methodology used to record and weight textbook content

- 1 Any environmental content is identified, recorded and annotated. Environmental content includes:
 - a Occurrence of key words (e.g., biodiversity, environment, etc.), discussion of environmental topics such as global warming, economic analysis of environmental issues and policy responses (e.g., tradable permit schemes).Environmental content excludes:
 - b Occurrence of the words 'land', 'resources' or 'natural resources' in an abstract sense (e.g., "Capital, labour and land/natural resources are the factors of production" would not merit inclusion; while "Concerns about the depletion of natural resources..." would be included).Content considered on a case by case basis:

- c Discussion invoking two economic terms in particular, ‘externalities’ and ‘public goods’ may or may not be related to environment. For instance, biodiversity and a healthy atmosphere are public goods, but so is national defence and building a lighthouse. Externalities include both those with environmental content (e.g., a factory emitting wastewater into a stream) and those that do not (e.g., one person getting vaccinated reduces likelihood of disease transmission to others). Where the passage in question related to the natural environment, they were recorded; otherwise, they were not recorded. Petty instances of externalities unlikely to impact ecosystems – most often, disturbances of stereo noise or cigarette smoke – were also excluded from the scoring.
 - d Population growth was not recorded unless it was discussed in an environmental context.
- 2 Also recorded was any reference to a publication that drew on an environmental sciences/natural science literature.
 - 3 Also recorded were images or graphics with an environmental focus (e.g., picture of billowing smokestacks).
 - 4 For each page with environmental content, an estimate was made of the proportion of the page that is devoted to environmental content. The following convention was used:
 - a if one or two words occurred in a sentence, but the sentence is not specifically related to the environment, 1% (e.g., “the government budget must cover expenditures for defence, health care and environmental protection”)
 - b a single sentence, focused on environmental content, 5%
 - c otherwise, the available proportion of the page covered by environmental content was estimated, providing a value from 0 to 100%.
 - 5 In calculating statistics, any pages that were blank or that contained no substantive content were deducted.

Note that the omission of web-based chapters will affect the environmental content tally of the textbooks that use them (i.e., McConnell). The rationale for excluding such chapters is that if the authors present them as so clearly optional that they must be downloaded then students are unlikely to read them.