



ANALYSIS

Influential publications in ecological economics: a citation analysis

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Abstract

We assessed the degree of influence of selected papers and books in ecological economics using citation analysis. We looked at both the internal influence of publications on the field of ecological economics and the external influence of those same publications on the broader academic community. We used four lists of papers and books for the analysis: (1) 92 papers nominated by the *Ecological Economics* (EE) Editorial Board; (2) 71 papers that were published in EE and that received 15 or more citations in all journals included in the Institute for Scientific Information (ISI) Citation Index; (3) 57 papers that had been cited in EE 15 or more times; and (4) 77 monographs and edited books that had been cited in EE 15 or more times. In all, we analyzed 251 unique publications. For each publication, we counted the total number of ISI citations as well as the total number of citations in EE. We calculated the average number of citations per year to each paper since its publication in both the ISI database and in EE, along with the percentage of the total ISI citations that were in EE.

Ranking the degree of influence of the publications can be done in several ways, including using the number of ISI citations, the number of EE citations or both. We discuss both the internal and external influence of publications and show how these influences might be considered jointly.

We display and analyze the results in several ways. By plotting the ISI citations against the EE citations, we can identify those papers that are mainly influential in EE with some broader influence, those that are mainly influential in the broader literature but have also had influence on EE and other patterns of influence. There are both overlaps and interesting lacunae among the four lists that give us a better picture of the real influence of publications in ecological economics vs. perceptions of those publications' importance.

By plotting the number of citations vs. dates of publication, we can identify those publications that are projected to be most influential. Plots of the time series of citations over the 1990–2003 period show a generally increasing trend (contrary to what one would expect for an “average” paper) for the top papers. We suggest that this pattern of increasing citations (and thus

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influence) over time is one hallmark of a “foundational” paper. Data used in the analysis is available for download from the International Society for Ecological Economics (ISEE) web site to allow further analysis by interested readers.

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1. Introduction

How does one assess which publications in a field are the “most important?” This question can have several possible answers. Practitioners in the field certainly have their own subjective opinions about which papers and books have been most important to them, and one could survey these practitioners as a way to assess which are the most important publications. Alternately, if one equates “most important” with “most influential,” then some easily accessible quantitative tools are available to help answer the question.

The influence of the ideas contained in an academic publication is related to the number of scholars who read the publication and use the ideas. Influence can be positive or negative—but an influential idea is one that stimulates thought and discussion by others. One way to assess the academic influence of a publication is therefore to count the number of times the publication has been cited in subsequent publications by other authors. While in the past, this was a tedious and difficult task, in recent years, it has become relatively simple and accessible using electronic versions of the citation index produced by the Institute for Scientific Information (ISI). Citation analysis has therefore become much more common and itself influential in assessing the influence of individual authors, articles, books, and journals (Costanza, 1996). One recent study (Abt, 2000) compared a list of “important” papers nominated by senior practitioners in a field (astronomy in this case) with the number of citations they have generated and concluded that “important papers almost invariably produce many more citations than others, and citation counts are good measures of importance or usefulness.” Oates and Donnelly (1997) reached similar conclusions in a study of influential papers in the field of child abuse.

There are, of course, well-known issues and limitations related to using citation analysis to assess influence, including the following:

1. The influence of a publication can go well beyond academia, and citation analysis will not pick up this nonacademic influence.
2. Quantity of citations is not the same as quality. A particular paper might influence only a very few others, but those few might be very deeply influenced and might make tremendous further use of the ideas. Some important ideas have lain dormant and “uncited” until they were rediscovered much later.
3. The ISI databases contain only journal articles from a select (albeit large—more than 8500 journals) group of journals and are therefore biased toward those fields that do most of their publishing in the included journals. Most of these are English language journals, and therefore, there is a bias towards the work of English-speaking scientists. The journals of some fields are under-represented, and some fields are more focused on books rather than journals as a publication medium. While citations in books are not counted, citations to books or book chapters that occur in articles in included journals are counted. Citations to journals that are not included in the database are also included in the Citation Index.
4. Because of the slowness of the academic review process, it usually takes a year or two for citations to a publication to begin to appear. Citation analysis is therefore most useful for publications that are at least a few years old.

Despite these well-known limitations, citation analysis is a powerful quantitative guide to the relative influence a publication has had on the academic community, and we have devised some techniques, discussed below, for overcoming or at least clarifying some of its limitations.

2. Methods

A major question in any citation analysis is: how does one choose the publications to analyze? In our case, we used four distinct lists derived using different criteria.

The core of our first list was a group of 92 papers nominated by the Editorial Board of *Ecological Economics* (EE). Each member of the editorial board was asked by Mick Common to nominate five “foundational” papers to be posted on the International Society for Ecological Economics (ISEE) web site. Thirteen board members responded, and the result was 46 papers with a single nomination and 4 papers with two nominations. All of the papers that were included in *The Development of Ecological Economics* (Costanza et al., 1997a) were also nominated in response to this call. This book was another earlier attempt to choose (in this case as judged by the three editors of the book—all also members of the EE editorial board) some of the more “important” papers in the field of ecological economics. This resulted in an additional 42 papers added to the list for a combined list of 92 papers, which we will refer to as the “editorial board” list. While “foundational” does not have the same meaning as “influential” (as we discuss more fully further on), we decided to use this list as a starting point, since it represents those papers the editorial board thought were “important” to the field in some sense.

At the suggestion of Cutler Cleveland (chief editor of EE), we constructed a second list to account for the fact that *Ecological Economics* is the premier journal in the field, and some important and influential papers published in EE may not have been included in the list produced by surveying the subjective opinions of members of the editorial board. We therefore produced a list that included all papers published in *Ecological Economics* that had received 15 or more total ISI citations.

After a review of some preliminary results of this analysis, it was suggested by David Stern that while the second list represented the most influential papers published in EE, many papers published elsewhere were highly influential in the field of ecological economics and may not have been suggested by the editorial board either. A way to capture this effect was to treat the papers published in EE as a representative sample of work in ecological economics and measure

which publications were most influential on that work. This is captured by a list of the papers most cited in papers published in EE. Assembling this list was a bit more tedious. We assembled a database of all the references that appeared in all the articles published in EE, excluding references to institutional authors (i.e., excluding authors such as the UN, World Bank, etc.). This resulted in a list of more than 35,000 individual citations. We then sorted this list and searched for the publications with the greatest number of EE citations. We limited this list to journal articles that had received 15 or more citations in EE. This resulted in a list of 57 journal articles.

Finally, we looked at monographs and edited books separately and assembled a list of these publications from our master list that had been cited in EE 15 or more times in the 10 years from 1994 to 2003. This resulted in a list of 77 monographs and edited books. For edited books, we counted citations to the book itself and to all the chapters within the book as a single unit.

2.1. Citation analysis

The total number of citations to each paper was estimated using the ISI Web of Knowledge. A cited reference search on each publication in our lists provided the number of times that publication had been cited in the journals monitored by ISI. This option searches the ‘Science Citation Index Expanded,’ ‘Social Sciences Citation Index’ and ‘Arts and Humanities Citation Index’ databases. Overall, these databases include approximately 8500 journals and over 23 million articles. The multiple database search was imperative given the transdisciplinary nature of *Ecological Economics*. We performed this analysis for the first two lists between July 10 and 20, 2003. The ISI database includes citations in journals published from 1945 (or 1955 for the social sciences) to the present. Only a few of the publications we analyzed were published before 1955 (i.e., Hotelling, 1931), so the total number of citations to each article (with few exceptions) represents the total citations in all ISI journals over its lifetime. For the publications in the remaining two lists for which we had not counted citations in July 2003, we counted the total ISI citations as of the end of 2003. The starting point for citations in EE to articles was the first year of publication of the journal (1989), while 1994, the first year ISI fully

archived EE, was used as the starting point for citations in EE to books.

A variety of techniques were used to ensure that all of the citations to a publication were counted. For instance, we searched the preceding and succeeding years along with the year a journal article was published. In this way, we were able to pick up additional citations that were entered into the database incorrectly. In addition, multiple spellings for an author's name were entered. For example, the article by [Funtowicz and Ravetz \(1994\)](#), "The Worth of a Songbird—Ecological Economics as a Post-Normal Science," was searched as

Cited Author: Funtowicz OR Funtowitz OR Functowicz
Cited Year: 1993 OR 1994 OR 1995

In this way, we were able to pick up additional citations that used a misspelling of the author's name or the wrong year. Care was also taken to ensure that alternately coded entries for the same journal were included. When an entry was in question, the source journal was consulted.

For the monographs and edited books, a slightly different approach was taken, because the way the titles of these volumes were entered into the ISI database showed quite a bit of variation. First, we searched the author's or editor's name(s) with the publication year in order to pick up all of the various ways a title had been entered in the ISI database. These variations were then searched without the year and author or editor name. With this sweep, we got a large list of possible references to the volume, without the fear of misspellings or incorrectly entered publication dates and without having to individually enter each contributing author's name in an edited volume. For example, [Gretchen Daily's \(1997\)](#) edited book "Nature's Services: Societal Dependence on Natural Ecosystems" was searched first as

Cited Author: Daily G*
Cited Year: 1997

This search picked up the following range of title entry variations:

Nature Services Hum, Natures Services Hum, Nature Services Soc, Natures Services Hum, Natures Service Soc, Natures Ec Soc, Ntures Services Soc, Societal Dependence. These were then searched as the

"CITED WORK" (while at the same time eliminating "Daily" as the cited author) in order to pick up all of the citations to all the individual contributing authors in the volume.

For each of the four lists, we entered the total ISI citations (by looking up the publication in the ISI database as described above) and the total EE citations (by counting the citations from our master list).

Many sophisticated indicators have been developed in citation analysis to determine the influence of particular journals, research groups, or authors, or to identify core literatures, scientific networks, etc. ([Wouters, 1999a,b](#); [Hargens, 2000](#)). Authors, journals, etc. all extend through a period of time during which they can cite others and be cited mutually. Single publications, however, are points in time. They can only be cited by future publications and cite past publications. Therefore, many of the more sophisticated techniques are not applicable, and we simply count citations imported and exported to EE.

3. Results

Our primary results are displayed in Appendix [Tables A1–4](#), which list all articles and books ranked (columns 1 and 2) by total number of citations either in ISI (column 3) or in EE (column 5).³ The articles and books were published over a broad span of time, from 1920 to 2001 (column 8). Older publications can be expected to have received more total citations than younger publications, but total influence should be related to total, cumulative citations, and it does indeed take time for publications to accumulate influence. To compensate for this age effect, we also calculated the average number of citations per year (columns 4 and 6). The average number of citations per year is a "predictor" of ultimate influence that can better compare older and younger articles. For example, in [Table A1](#), [Ayres and Kneese \(1969\)](#) has accumulated 197 total ISI citations,

³ When there was a tie in the rankings, we sorted by alphabetical order of the first authors. For example, in [Table A3](#) [Costanza, 1980](#), [Norgaard, 1989](#), and [Stern et al., 1996](#), all have 22 total EE citations, but [Costanza, 1980](#) is ranked as number 18, [Norgaard, 1989](#), as number 19 and [Stern et al., 1996](#), as number 20. In fact, they should all be ranked as tied at number 18. Since this was such a frequent occurrence and we were doing so many manipulations with the data, we did not correct this.

but its average citations per year were only 5.8, implying that many other papers on the list published subsequently have higher rates of citation and would eventually exceed the total number of citations of Ayres and Kneese (if their current citation rate is maintained) when they became as old as that paper is now. Citations per year is also a closer approximation to the “impact factor” often used to rank journals, which is the average number of citations per year to all articles published in a journal in the most recent 2 years.

We also calculated the percentage of the total ISI citations to each publication that occurred in EE (column 6). This gives an indication of the relative influence a publication has had on EE compared to the broader academic community. For example, in Table A1, we see that Hardin (1968) received 2525 total citations, while only 30 of these (1.2%) were in EE. This is an example of a paper that has had a huge influence in the broader academic community, and that has also had a large influence on EE. In contrast, Cleveland et al. (1984) received 76 total citations with 29 (or 38.2%) of these in EE. This is an example of a paper with relatively balanced influence on EE and on the larger community. At the other end of the spectrum, van den Bergh and Verbruggen (1999), with 21 total citations and 19 (90.5%) of those in EE, is an example of a paper whose influence has been mainly in EE.

Table 1 shows the mean values and standard deviations for the citation values and the years of publication listed in Tables A1–4. One can see, for

example, that papers published in EE (Table A2) are on average much younger (1994) than the other three lists (1986–1988). This is as it must be, since EE only started publishing in 1989. The standard deviation of publication date is also much smaller, as expected. Books cited in EE (Table A4) had a much higher average ISI citation rate (449.9) than articles cited in EE (Table A3; 252.6). Articles published in EE (Table A2) had only 27.2 ISI cites on average, while the Editorial Board nominations (Table A1) had 93.4 ISI cites on average. The pattern for ISI cites per year is similar to that for total cites with the rate for books 2.5 times higher than that for articles (32.8 vs. 13.1). The pattern for average EE cites is similar to that for ISI cites, but the differences are not as pronounced. Books lead with 29.0, followed by articles cited in EE (21.8), the Editorial Board list (11.4) and finally articles published in EE (10.1). The percent EE cites are similar for the Editorial Board list (Table A1; 27.3%) and for articles cited in EE (Table A3; 25.3%). Articles published in EE (Table 2) have a significantly higher percent of their citations in EE (36.7%) as one might expect. Book cited in EE (Table A4), on the other hand, have a much lower percentage of their citations in EE (17.7%). Again, this is to be expected since many of the books cited are classics that have accumulated a huge number of ISI citations. Almost half of the books in Table A4 have less than 10% of their cites in EE.

Figs. 1 and 2 represent a way of displaying this complex set of data that reveals some interesting

Table 1
Descriptive statistics for the four lists (Tables A1–4)

List	<i>n</i>	Average year of publication	S.D. of year of publication	Average ISI cites	S.D. of ISI cites	Average. ISI cites/year	S.D. of ISI cites/year	Average EE cites	S.D. of EE cites	Average EE cites/year	S.D. of EE cites/year	Average. % EE cites	S.D. of % EE cites
Table A1: Editorial Board nominations	92	1988	10.2	93.4	277.7	5.0	10.6	11.4	11.7	1.0	1.3	27.3	22.4
Table A2: Articles published in EE	71	1994	2.9	27.3	13.5	3.0	1.3	10.0	6.5	1.1	0.9	36.7	20.7
Table A3: Articles cited in EE	47	1986	13.1	252.4	465.7	13.1	16.6	21.8	9.0	2.0	1.4	25.3	20.2
Table A4: Books cited in EE	77	1987	12.4	491.8	984.5	26.6	32.5	29.0	20.5	2.6	2.0	17.7	15.0

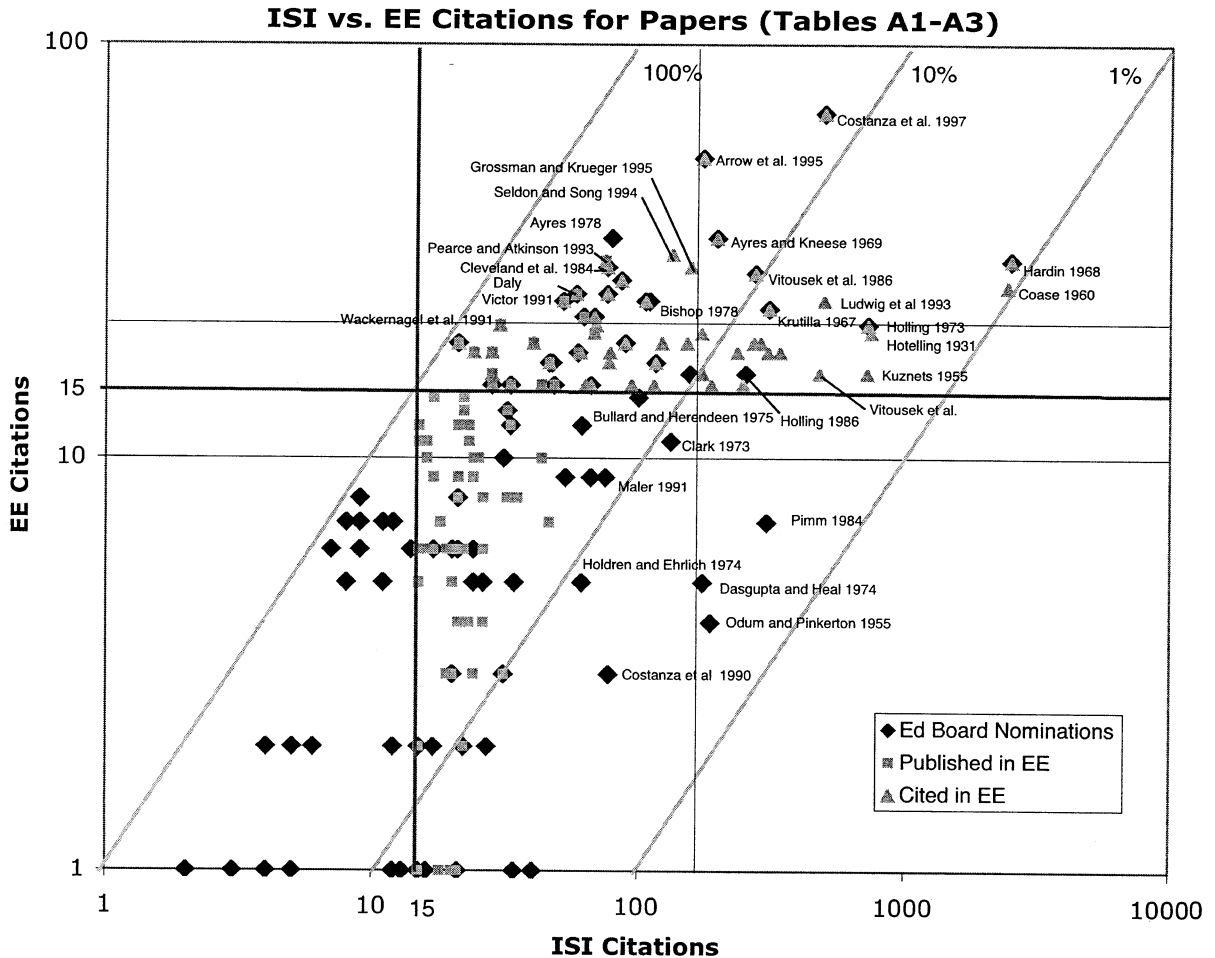


Fig. 1. Log–log plot of ISI citations vs. EE citations for all the articles included in Tables A1–3. Lines indicating a constant ratio of EE citations to ISI citations are straight diagonals, labeled on the plot as 1%, 10% and 100%. Lines at 15 citations for both the EE and ISI citations are also shown.

patterns. Fig. 1 is a log–log plot of ISI citations vs. EE citations for all the journal articles included in Tables A1–3. On a log–log plot, lines indicating a constant ratio of EE citations to ISI citations are straight diagonals, labeled on the plot as 1%, 10% and 100%. Lines at 15 citations for both the EE and ISI citations are also shown, since this was the cutoff for including papers in Table A2 (15 ISI citations) and Table A3 (15 EE citations). Some of the papers are labeled on the plot.

One can easily see in Fig. 1 the degree of overlap of articles in Tables A1–3. It is clear, for example, that

while the Editorial Board list (Table A1—dark diamonds) included many papers that were in the upper ranges of both ISI and EE cites, it also included many papers (57 out of 92 or 62%) that were not cited in EE 15 or more times. Among these were several papers (i.e., Pimm, 1984; Dasgupta and Heal, 1974; Odum and Pinkerton, 1955) that had received many ISI citations, but whose influence on EE (as assessed by number of citations in EE) was not as great. Table A1 also included many papers that had been cited only lightly in both ISI and EE. Likewise, the list of papers published in EE (Table A2; squares) included 53 (out

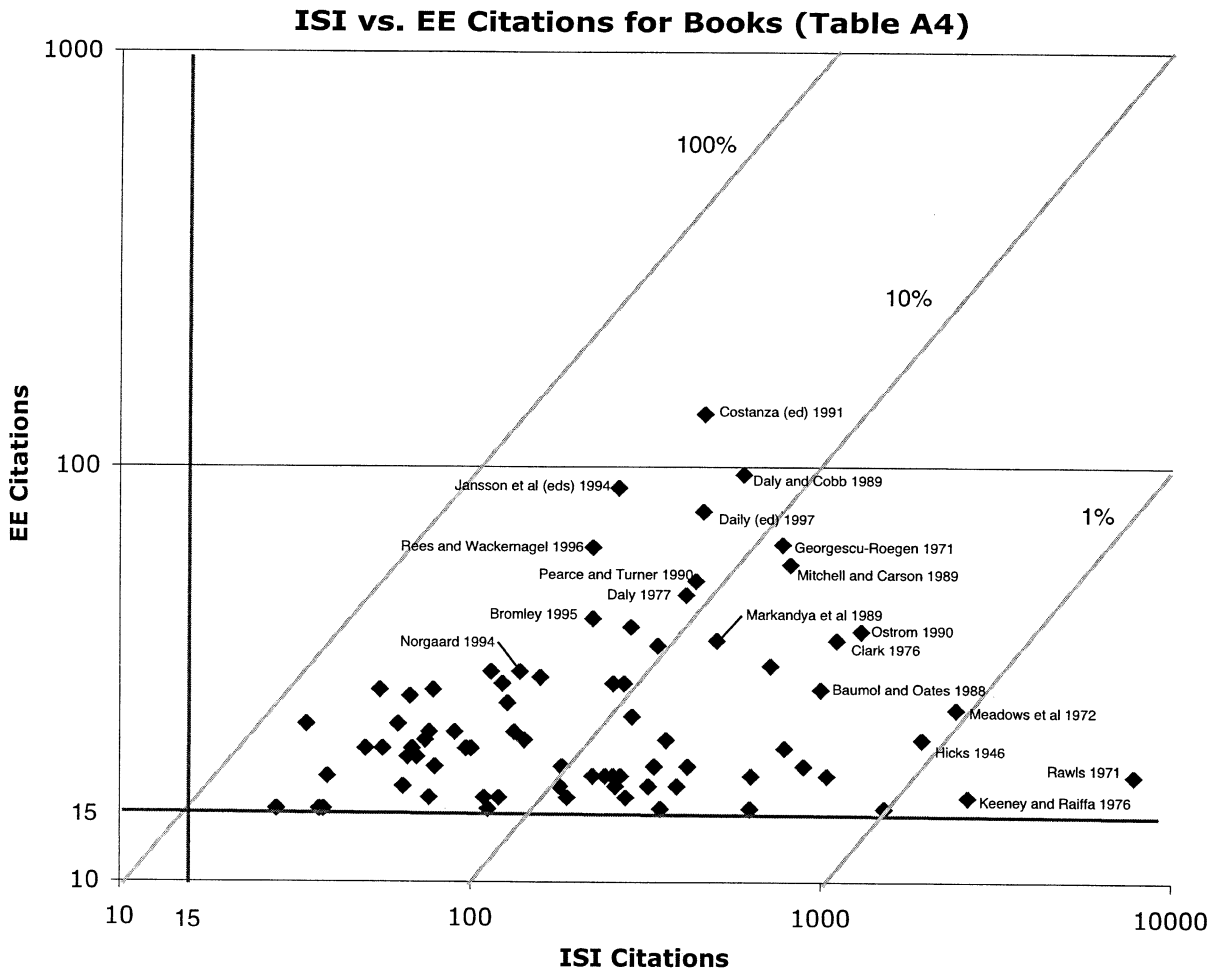


Fig. 2. Log–log plot of ISI citations vs. EE citations for all the books included in Table A4. Lines indicating a constant ratio of EE citations to ISI citations are straight diagonals, labeled on the plot as 1%, 10%, and 100%. Lines at 15 citations for both the EE and ISI citations are also shown.

of 71) papers (or 75%) that were not cited in EE 15 or more times, though they received 15 or more ISI citations. This is due, in part, to the relatively recent vintage of EE and the fact that it takes time for articles to accumulate citations.

Table A3 (triangles) thus seems to be the best place to start for an assessment of the influence of papers on both EE and the broader community. It picked up several papers missed by both Tables A1 and A2 that have had a large influence, both in terms of ISI and EE cites (i.e., Coase, 1960; Ludwig et al., 1993; Hotelling, 1931; Kuznets, 1955) and several others whose influence has mainly been on EE. The only papers it “missed” were a few book chapters (book

chapters were explicitly not included in Table A3) that were nominated by the Editorial Board (i.e., Ayres, 1978; Holling, 1986). A total of 17 of the 57 papers listed in Table A3 (30%) were published in EE.

The top 20 articles in terms of EE citations (Table A3) are those triangles above the horizontal dashed line in Fig. 1. The top 20 articles in terms of ISI citations are those triangles to the right of the vertical dashed line in Fig. 1. Articles that appear in the top 20 in both rankings are in the upper right quadrant of the intersection of these lines. There are eight papers on this list, none of which were published in EE. Half of them were published in *Science* or *Nature*, by far the most highly cited journals of all (with impact factors

above 30). Costanza et al. (1997b) and Arrow et al. (1995) also had the extra advantage of being the subjects of invited “fora” in EE that no doubt increased their EE citations by at least the number of invited commentaries (about 13). Of the other four papers, three were published in mainstream economics journals (two in *American Economic Review* and one in *Journal of Law and Economics*), and one was published in a well-known biological science journal (*BioScience*). All of the articles published in the mainstream economics journals were published before 1969, indicating that they are basic background pieces for important subject areas in EE. Ayres and Kneese (1969) deals with material and energy flow accounting, Coase (1960) deals with social costs, and Krutilla (1967) deals with the economics of conservation, all arguably core subject areas for EE and also for the larger community. Only one of these four (Ayres and Kneese, 1969) has received more than 10% of its citations in EE, however. Four of the eight papers have received more than 10% of their citations in EE, and these might be considered the most influential to EE of this group. They deal with material and energy flow accounting (Ayres and Kneese, 1969), estimating the “scale” of the economy (Vitousek et al., 1986), carrying capacity, the environmental Kuznets curve and resilience (Arrow et al., 1995) and valuation of ecosystem services (Costanza et al., 1997b). These have certainly been core ideas within EE and also ones that have been “exported” to the larger community.

Table 2 is another way of looking at this data. It shows the top 20 papers in Table A3 ranked by total EE cites (on the left) and by total ISI cites (on the right). The eight papers that appear on the top 20 in both rankings are shown in bold. Papers below the double line are those that are in the top 20 on at least one ranking (i.e., those in the top 20 in the ISI ranking but not in the EE ranking are shown below the double line in the EE ranking). Three intermediate rankings are also shown, using a simple weighted average index of the EE and ISI ranks of the form Rank Index = $w \times \text{EE Rank} + (1-w) \times \text{ISI Rank}$. This is just one of the many possible ways to combine the EE and ISI influence, and there is no obvious right way to do this.

Fig. 2 is a plot (similar to Fig. 1) of ISI citations vs. EE citations for all the books included in Table A4. This plot focuses (by definition) on those books cited

in EE 15 or more times in the period from 1994 to 2003. As in Fig. 1, reading top to bottom, one sees the books most cited in EE, while reading right to left, one sees the top books in terms of ISI cites. Costanza (1991) is the most cited book in EE. This makes sense, since it was an edited volume with 42 contributing authors, many of whom are prominent throughout Tables A1–4. It was a product of a workshop following the first ISEE meeting in Washington, DC, in 1990. It therefore set the stage and the research agenda for much of the work subsequently published in EE. The third ranking book on the list in terms of EE cites (Jansson et al., 1994) was a similar edited volume that came out of the second ISEE conference in Stockholm in 1992. The second ranking book (Daly and Cobb, 1989) is a classic in the field, as is the fourth ranking book (Georgescu-Roegen, 1971). Others on the list are similarly well known in the field for various reasons, including Rees and Wackernagel (1996) on the ecological footprint, Daily (1997) on ecosystem services, Pearce and Turner (1990) on environment and natural resource economics and Daly (1977) on steady-state economics. Starting at the right-hand side of Fig. 2, the top 4 books in terms of ISI citations are Rawls (1971) on ethics and justice, Keeney and Raiffa (1976) on multi-criteria analysis, Meadows et al. (1972) on global systems modeling and Hicks (1946) on value and capital. These are all mega-classics from a range of perspectives and show the range of influences that have been important to EE.

Table 3 is a list of the publishers of books in EE, ranked according to the number of EE citations to their books appearing in Table A4. Island Press leads this ranking with 304 EE citations to the 7 books on the list they have published, followed by Columbia University Press with 284 cites to 2 books and Cambridge University Press with 201 cites to 8 books. In terms of total ISI citations to books appearing in Table A4, Wiley leads the ranking, followed by Cambridge, Oxford and Island. Of the publishers with more than 1 book in Table A4, Columbia had, by far, the largest percentage of the citations to their books in EE at 39.7%, followed by Routledge at 25.5% and the World Bank at 24.8%. Wiley books on the list had only 2.9% of their citations in EE. In terms of number of books on the list, Cambridge was first with eight, followed by Island with seven and Wiley with six. Six publishers had three books each on the list, and nine publishers

Table 2

Range of rankings for papers that appear in the top 20 of Table A3 ranked by EE cites (left) and by ISI cites (right)

$w=1.0$ (EE rank given all weight)				$w=0.75$				$w=0.5$				$w=0.25$				$w=0$ (ISI rank given all weight)			
Rank	Rank	Rank	Paper	Rank	Rank	Rank	Paper	Rank	Rank	Rank	Paper	Rank	Rank	Rank	Paper	Rank	Rank	Rank	Paper
(total index)	(total index)	(total index)		(total index)	(total index)	(total index)		(total index)	(total index)	(total index)		(total index)	(total index)	(total index)		(total index)	(total index)	(total index)	
EE	ISI	$w=1$		EE	ISI	$w=0.75$		EE	ISI	$w=0.5$		EE	ISI	$w=0.25$		EE	ISI	$w=0$	
cites)	cites)			cites)	cites)			cites)	cites)			cites)	cites)			cites)	cites)		
1	6	1	Costanza et al., 1997a,b	1	6	2.25	Costanza et al., 1997a,b	5	1	3.00	Hardin, 1968	5	1	2.00	Hardin, 1968	5	1	1	Hardin, 1968
2	19	2	Arrow et al., 1995	5	1	4.00	Hardin, 1968	1	6	3.50	Costanza et al., 1997a,b	11	2	4.25	Coase, 1960	11	2	2	Coase, 1960
3	17	3	Ayres and Kneese, 1969	2	19	6.25	Arrow et al., 1995	11	2	6.50	Coase, 1960	1	6	4.75	Costanza et al., 1997a,b	25	3	3	Hotelling, 1931
4	24	4	Selden and Song, 1994	3	17	6.50	Ayres and Kneese, 1969	3	17	10.00	Ayres and Kneese, 1969	25	3	8.50	Hotelling, 1931	22	4	4	Holling, 1973
5	1	5	Hardin, 1968	11	2	8.75	Coase, 1960	2	19	10.50	Arrow et al., 1995	22	4	8.50	Holling, 1973	45	5	5	Kuznets, 1955
6	36	6	Pearce and Atkinson, 1993	4	24	9.00	Selden and Song, 1994	9	13	11.00	Vitousek et al., 1986	15	7	9.00	Ludwig et al., 1993	1	6	6	Costanza et al., 1997a,b
7	34	7	Cleveland et al., 1984	9	13	10.00	Vitousek et al., 1986	15	7	11.00	Ludwig et al., 1993	17	10	11.75	Krutilla, 1967	15	7	7	Ludwig et al., 1993
8	22	8	Grossman and Krueger, 1995	8	22	11.50	Grossman and Krueger, 1995	22	4	13.00	Holling, 1973	9	13	12.00	Vitousek et al., 1986	47	8	8	Vitousek et al. 1997
9	13	9	Vitousek et al., 1986	15	7	13.00	Ludwig et al., 1993	17	10	13.50	Krutilla, 1967	3	17	13.50	Ayres and Kneese, 1969	35	9	9	Hanemann, 1984
10	31	10	Costanza and Daly, 1992	6	36	13.50	Pearce and Atkinson, 1993	4	24	14.00	Selden and Song, 1994	2	19	14.75	Arrow et al., 1995	17	10	10	Krutilla, 1967
11	2	11	Coase, 1960	7	34	13.75	Cleveland et al., 1984	25	3	14.00	Hotelling, 1931	45	5	15.00	Kuznets, 1955	36	11	11	Kahnemann and Knetsch, 1992
12	45	12	Daly, 1992	10	31	15.25	Costanza and Daly, 1992	8	22	15.00	Grossman and Krueger, 1995	35	9	15.50	Hanemann, 1984	27	12	12	Arrow and Fisher, 1974
13	35	13	Vatn and Bromley, 1994	17	10	15.25	Krutilla, 1967	27	12	19.50	Arrow and Fisher, 1974	27	12	15.75	Arrow and Fisher, 1974	9	13	13	Vitousek et al. 1986
14	28	14	Bishop, 1978	14	28	17.50	Bishop, 1978	7	34	20.50	Cleveland et al., 1984	36	11	17.25	Kahnemann and Knetsch, 1992	31	14	14	Solow, 1974a
15	7	15	Ludwig et al., 1993	22	4	17.50	Holling, 1973	10	31	20.50	Costanza and Daly, 1992	47	8	17.75	Vitousek, et al., 1997	54	15	15	Nordhaus, 1991
16	46	16	Victor, 1991	13	35	18.50	Vatn and Bromley, 1994	6	36	21.00	Pearce and Atkinson, 1993	31	14	18.25	Solow, 1974a	38	16	16	Solow, 1974b
17	10	17	Krutilla, 1967	25	3	19.50	Hotelling, 1931	14	28	21.00	Bishop, 1978	8	22	18.50	Grossman and Krueger, 1995	3	17	17	Ayres and Kneese, 1969
18	38	18	Costanza, 1980	12	45	20.25	Daly, 1992	35	9	22.00	Hanemann, 1984	4	24	19.00	Selden and Song, 1994	53	18	18	Leontief, 1970
19	42	19	Norgaard, 1989	18	38	23.00	Costanza, 1980	31	14	22.50	Solow, 1974a	38	16	21.50	Solow, 1974b	2	19	19	Arrow et al., 1995
20	43	20	Stern et al., 1996	27	12	23.25	Arrow and Fisher, 1974	36	11	23.50	Kahnemann and Knetsch, 1992	14	28	24.50	Bishop, 1978	44	20	20	Hanemann, 1994
22	4	22	Holling, 1973	16	46	23.50	Victor, 1991	13	35	24.00	Vatn and Bromley, 1994	54	15	24.75	Nordhaus, 1991	8	22	22	Grossman and Krueger, 1995
25	3	25	Hotelling, 1931	19	42	24.75	Norgaard, 1989	45	5	25.00	Kuznets, 1955	10	31	25.75	Costanza and Daly, 1992	4	24	24	Selden and Song, 1994
27	12	27	Arrow and Fisher, 1974	20	43	25.75	Stern et al., 1996	38	16	27.00	Solow, 1974b	44	20	26.00	Hanemann, 1994	14	28	28	Bishop, 1978
31	14	31	Solow, 1974a	31	14	26.75	Solow, 1974a	47	8	27.50	Vitousek et al. 1997	53	18	26.75	Leontief, 1970	10	31	31	Costanza and Daly, 1992
35	9	35	Hanemann, 1984	35	9	28.50	Hanemann, 1984	18	38	28.00	Costanza, 1980	7	34	27.25	Cleveland et al., 1984	7	34	34	Cleveland et al., 1984
36	11	36	Kahnemann and Knetsch, 1992	36	11	29.75	Kahnemann and Knetsch, 1992	12	45	28.50	Daly, 1992	6	36	28.50	Pearce and Atkinson, 1993	13	35	35	Vatn and Bromley, 1994
38	16	38	Solow, 1974b	38	16	32.50	Solow, 1974b	19	42	30.50	Norgaard, 1989	13	35	29.50	Vatn and Bromley, 1994	6	36	36	Pearce and Atkinson, 1993
44	20	44	Hanemann, 1994	45	5	35.00	Kuznets, 1955	16	46	31.00	Victor, 1991	18	38	33.00	Costanza, 1980	18	38	38	Costanza, 1980
45	5	45	Kuznets, 1955	47	8	37.25	Vitousek et al. 1997	20	43	31.50	Stern et al., 1996	19	42	36.25	Norgaard, 1989	19	42	42	Norgaard, 1989
47	8	47	Vitousek et al., 1997	44	20	38.00	Hanemann, 1994	44	20	32.00	Hanemann, 1994	12	45	36.75	Daly, 1992	20	43	43	Stern et al., 1996
53	18	53	Leontief, 1970	54	15	44.25	Nordhaus, 1991	54	15	34.50	Nordhaus, 1991	20	43	37.25	Stern et al., 1996	12	45	45	Daly, 1992
54	15	54	Nordhaus, 1991	53	18	44.25	Leontief, 1970	53	18	35.50	Leontief, 1970	16	46	38.50	Victor, 1991	16	46	46	Victor, 1991

Papers in bold appear in the top 20 in both rankings. w is a weighting factor used to produce rankings which combine the EE and ISI rankings as a simple weighted average: Rank Index= $w \times$ EE Rank+(1- w) \times ISI Rank.

Table 3
Publishers listed in Table A4 in order of total EE cites

Rank (total EE cites)	Rank (total ISI cites)	Total ISI cites	Total EE cites	% EE cites (EE/ISI cites)	Number of books in Table A4	Publisher
1	7	1596	304	19.0	7	Island Press, Washington, DC
2	13	716	284	39.7	2	Columbia University Press, New York, NY
3	3	3676	201	5.5	8	Cambridge University Press, Cambridge, UK
4	15	712	128	18.0	2	Beacon Press, Boston
5	2	4347	125	2.9	6	Wiley, New York, NY
6	11	947	96	10.1	3	Johns Hopkins University Press, Baltimore MD
7	10	1088	88	8.1	2	Resources for the Future, Washington, DC
8	8	1556	86	5.5	2	Harvard Univ. Press, Boston, MA
9	18	467	80	17.1	3	Blackwell, UK
10	21	357	80	22.4	3	Kluwer, Dordrecht, Netherlands
11	23	322	80	24.8	3	World Bank, Washington, DC
12	26	302	77	25.5	3	Routledge, London
13	29	222	64	28.8	1	New Society Publishers, San Francisco
14	5	2376	56	2.4	3	Oxford University Press, Oxford
15	16	530	53	10.0	2	Earthscan, London
16	25	313	46	14.7	2	Elsevier, Amsterdam
17	22	338	40	11.8	2	MIT Press, Cambridge, MA
18	17	479	36	7.5	2	St. Lucie Press, Delray Beach, FL
19	6	1660	33	2.0	2	Macmillan, London
20	14	714	33	4.6	1	National Academy Press, Washington, DC
21	32	123	30	24.4	1	UCL Press, London
22	31	127	27	21.3	1	United Nations University Press, Tokyo
23	4	2417	26	1.1	1	Universe Books, New York, NY
24	35	76	23	30.3	1	Edward Elgar, Cheltenham
25	20	359	22	6.1	1	Chelsea Green Publishing
26	36	68	21	30.9	1	Wolters-Noordhoff, Amsterdam
27	12	890	19	2.1	1	Prentice Hall, NY
28	1	7823	18	0.2	1	Clarendon Press
29	27	254	18	7.1	1	Pearson Addison Wesley, NY
30	28	241	18	7.5	1	University of California Press, Berkeley
31	37	39	18	46.2	1	University Press of America, New York
32	24	320	17	5.3	1	Institute for International Economics, Washington, DC
33	19	386	17	4.4	1	Rowman and Allanheld, Totowa, NJ.
34	34	76	16	21.1	1	Center for International Forestry Research, Bogor
35	33	120	16	13.3	1	Pergamon Press, NY
36	30	188	16	8.5	1	University of Chicago Press, Chicago IL
37	38	28	15	53.6	1	Earthscan, London
38	9	1508	15	1.0	1	Pinter Publishers, London

had two. The remaining 20 publishers had one book each on the list.

Fig. 3 is a plot similar to (Figs. 1 and 2), but showing the number of EE citations vs. the number of ISI citations for publishers of books appearing in Table A4. This plot shows the importance of Island Press, Columbia University Press and Beacon Press in publishing books that have been influential to EE. Likewise, it shows the importance of Cambridge and Wiley in publishing books that have been broadly influential and also important to EE.

4. Patterns of citation over time

The top papers in Tables A1–3 covered a broad range of key topics in ecological economics. But are these papers “foundational?” Fig. 4 is a plot of the number of ISI citations per year since 1990 for the top 20 papers in Table A1. Likewise, Fig. 5 is a plot of the number of ISI citations per year since 1990 for the top 10 papers in Table A2. Note the log scale on the y-axis. These plots clearly shows the general upward trend of ISI citations per year for these groups of papers,

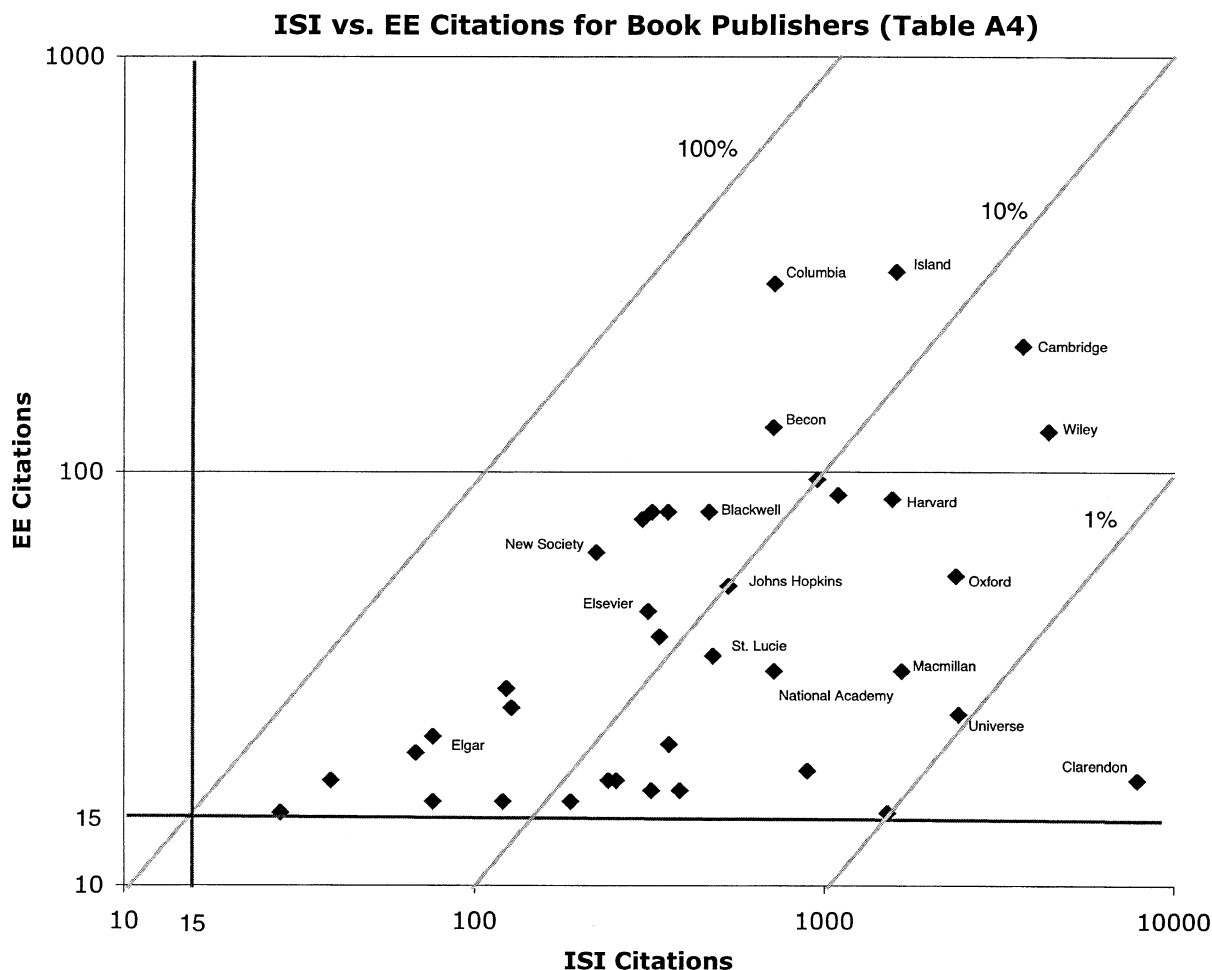


Fig. 3. Log–log plot of ISI citations vs. EE citations for all the publishers of books included in Table A4. Lines indicating a constant ratio of EE citations to ISI citations are straight diagonals, labeled on the plot as 1%, 10%, and 100%. Lines at 15 citations for both the EE and ISI citations are also shown.

indicating that these papers are gaining influence over time rather than fading from memory (and citation) as most papers do. We suggest that this does indeed indicate the “foundational” nature of these papers.

Fig. 6 is a plot of total ISI citations vs. the year of publication for all the papers included in Tables A1–3. Fig. 7 is a plot of total ISI citations vs. the year of publication for all the books included in Table A4. This highlights some of the patterns we have been discussing and reveals some interesting additional patterns. Lines of constant citations per year have been drawn on the plots. One can immediately see by

comparing (Figs. 6 and 7) the much higher average citation rate for books (32.8 cites/year) compared to journal articles (7.3 cites/yr). One can also readily see those articles and books that have enduring influence and those that have been published more recently that are on track to achieve high total citations as they age.

5. Discussion and conclusions

Citation analysis provides a rich and easily accessible resource for understanding the complex

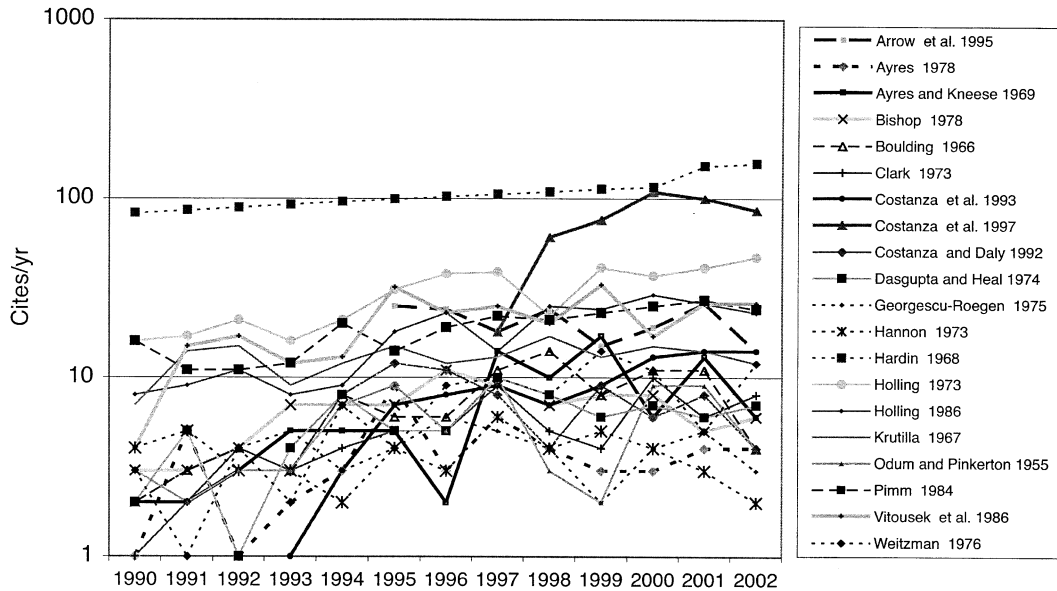


Fig. 4. Time trends of ISI citations to the top 20 papers in Table A1. The large number of total citations to Hardin (1968) prevented us from identifying the year of citation before 2000, so we simply extrapolated a straight line back to the publication date consistent with the total citations.

patterns of influence in the academic literature. Our analysis of influential publications in ecological economics has revealed some interesting patterns and provided the basis for further discussion and analysis. It can also serve as a guide for those just entering the field.

We conclude that the total number of citations and average citations per year in both the field of interest

(EE in this case) and ISI are useful, but by no means perfect, ways to help assess the degree of influence of academic articles to a field. This is consistent with other recent assessments of the utility of citation analysis in assessing influence or importance (Oates and Donnelly, 1997; Abt, 2000).

Table A1 and Fig. 1 shows that the Editorial Board list included many papers (62.92 or 67%) that had less

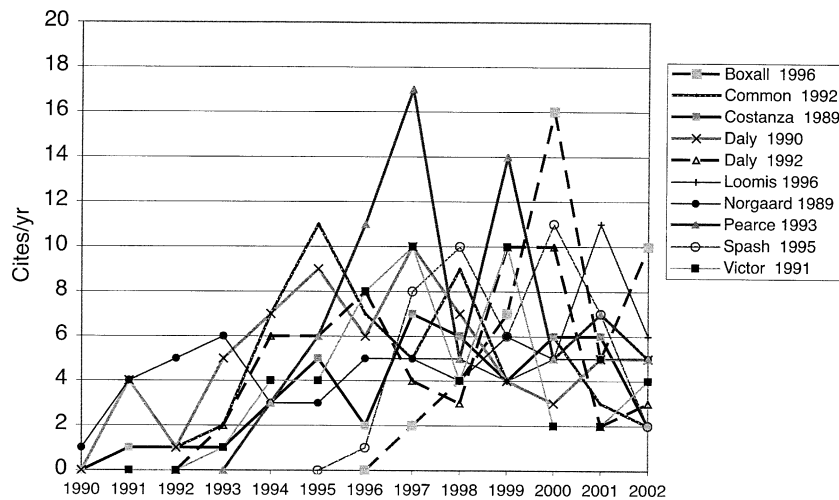


Fig. 5. Time series of ISI citations for the top 10 articles ranked by ISI citations published in Ecological Economics (Table A2).

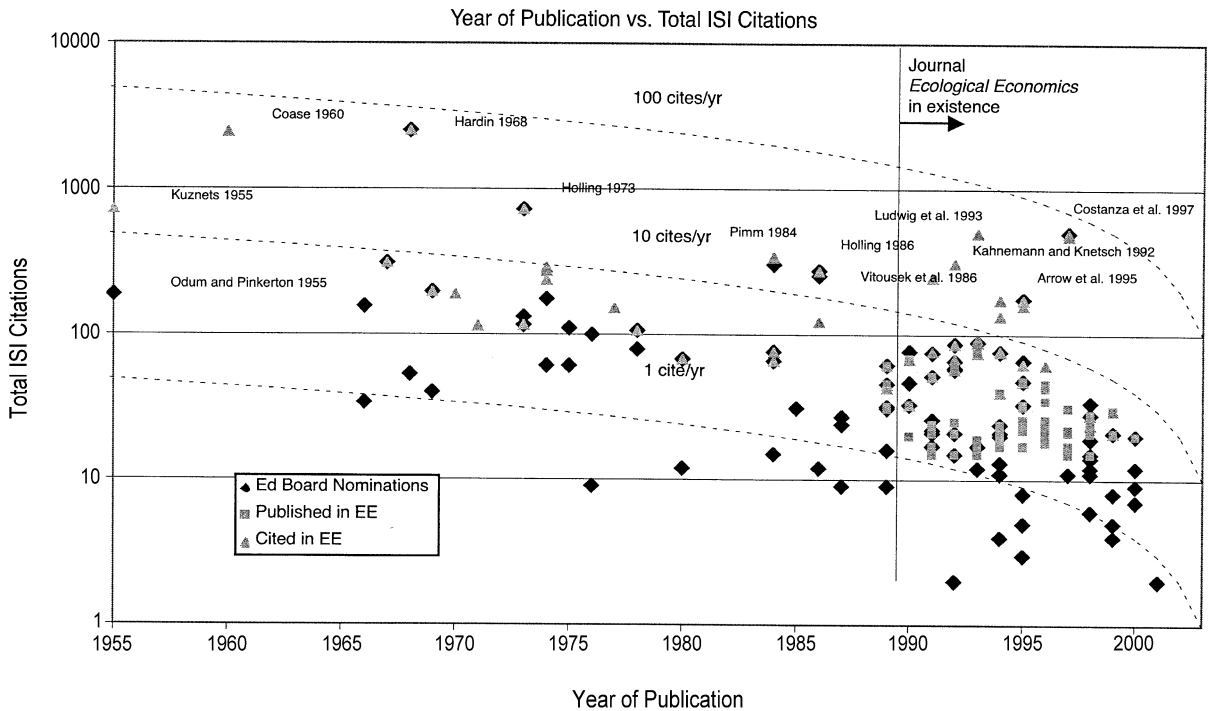


Fig. 6. Plot of total ISI citations for the all the articles listed in (Tables A1–3) against their year of publication. Curved lines are constant ISI citations per year. Note log scale on total citations.

than 15 citations in EE. This indicates the limitations of subjective expert assessments alone and the importance of quantitative assessments of influence, like the citation analysis we have reported here.

The papers published in EE (Table A2) also turned out to be an inadequate starting point, given the recent vintage of EE and the broad, transdisciplinary range of topics and influences it includes. Papers published in EE are not yet well represented in either EE citations or ISI citations, but this can be expected to change with age, as the high rates of citation to some of these papers indicate.

Fig. 1 shows that starting with a list of papers cited in EE (Table A3) is probably a better place to start. Although this method is more tedious than the first two, it yields a list of papers (and books) that are known to be important to the field and represents a more objective and reliable assessment of the full range of influences on the field. This list can be ranked by the number of EE cites, the number of ISI cites or some combination to look at the relative

influence of publications in the field and on the broader community. This list overlaps with the Editorial Board list for all journal articles that are important to EE but also captures several that the Editorial Board missed (i.e., Coase, 1960; Ludwig et al., 1993). Fig. 2 applies this approach to books. We would recommend this approach for studying influence in other fields.

The relative influence of journal articles relative to books is an interesting comparison and probably varies significantly across fields. EE, being young and transdisciplinary, has been influenced heavily by books and by journal articles published in other journals, based on our analysis. This might be expected to change somewhat over time as the field matures, but the transdisciplinary nature of EE would indicate an ongoing broader range of influences than a typical disciplinary field. A more “focused” and mono-disciplinary field might be expected to rely more heavily on journal articles and more heavily on articles published in its own journal(s).

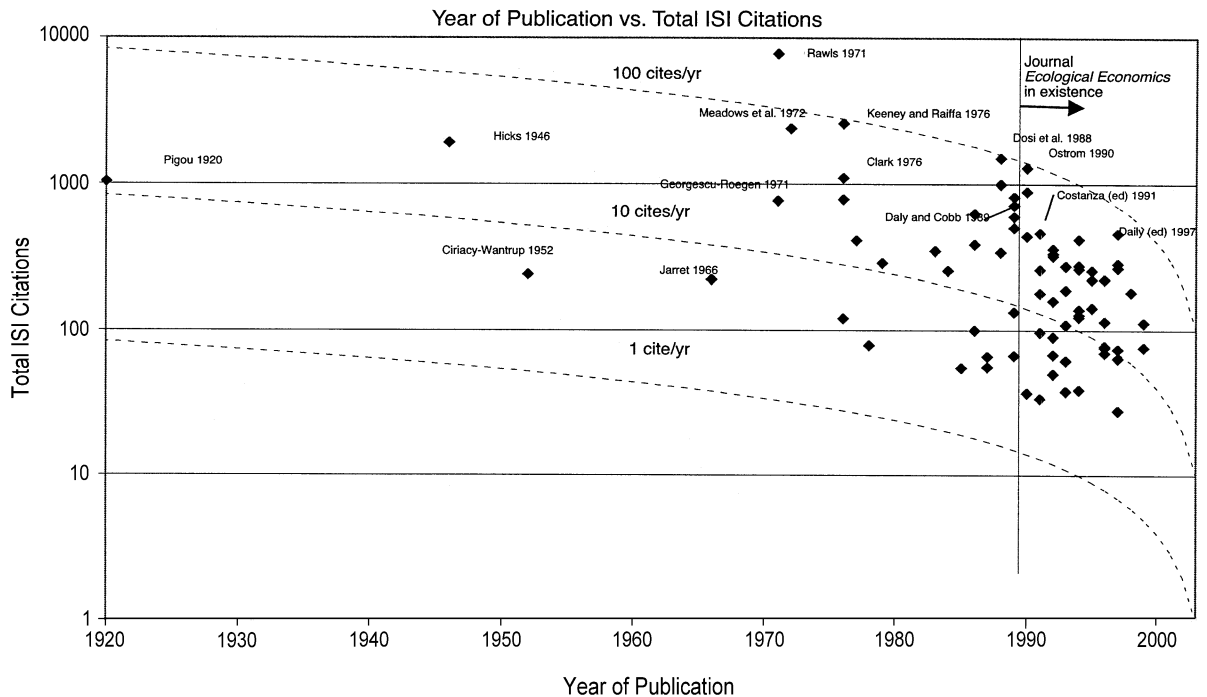


Fig. 7. Plot of total ISI citations for the all the books listed in Table A4 against their year of publication. Curved lines are constant ISI citations per year. Note log scale on total citations.

We have also suggested a way to distinguish “foundational” papers based on the time trend of their citations. We have suggested that papers with an increasing time trend of citations per year over a number of years are indeed “foundational” since their scope of influence is increasing over time rather than decreasing, as one would expect for the “average” paper. Our top papers definitely exhibit this “foundational” characteristic (Figs. 4 and 5). Many of the other publications in Tables A1–4 are still too young to adequately assess in terms of their ultimate influence, but their high rates of citation (Figs. 6 and 7) indicate that they will ultimately become very influential indeed.

Finally, we have made all the data and spreadsheets used in this analysis available for download from the ISEE web site. There are many ways to use and analyze this data, and we have admittedly only scratched the surface. In addition, we had to make several decisions about how to select, rank, sort and display the data that were guided only by the goals of

our analysis and our own judgment. Readers are therefore encouraged to select, rank, sort and display the data in other ways, for other goals, and to draw their own additional conclusions.

Acknowledgements

The idea for this paper arose from an e-mail discussion started by Mick Common, who was asked to assemble a short list of “foundational” papers in ecological economics to post on the ISEE web site. After 6 months of e-mail discussions among members of the Editorial Board, Mick abandoned the project because of disagreement on the method that should be used to further narrow the list of nominees, which we used as a starting point for our analysis. We also thank Shuang Liu, Joshua Farley, Matthew Wilson, Cutler Cleveland and two anonymous referees for helpful comments on earlier drafts and Dan Dias for his help with collecting some of the data on citations in EE.

Appendix A

Table A1

List of all papers nominated by the EE editorial board, ranked total ISI citations

Rank	Rank (Tot ISI cites)	Total ISI Cites	ISI Cites/yr	Total EE Cites	EE Cites/yr	% EE Cites (EE/ISI Cites)	Author(s)	Year	Title	Journal	Specifics
1	5	2525	70.1	30	2.0	1.2%	Hardin, G.	1968	The tragedy of the commons.	<i>Science</i>	162: 1243-1248.
2	17	731	23.6	21	1.4	2.9%	Holling, C.S.	1973	Resilience and stability of ecological systems.	<i>Annual Review of Ecological Systems</i>	4: 1-24.
3	1	499	71.3	68	9.7	13.6%	Costanza, R., R. d'Arge, R. de Groot, S. Farber, M. Grasso, B. Hannon, S. Naem, K. Limburg, J. Paruelo, R.V. O'Neill, R. Raskin, P. Sutton, and M. van den Belt.	1997	The value of the world's ecosystem services and natural capital.	<i>Nature</i>	387: 253-260.
4	14	310	8.4	23	1.5	7.4%	Krutilla, J. V.	1967	Conservation Reconsidered	<i>American Economic Review</i>	57: 777-784.
5	42	303	15.2	7	0.5	2.3%	Pimm, S.L.	1984	The complexity and stability of ecosystems.	<i>Nature</i>	307: 321-326.
6	7	275	15.3	28	1.9	10.2%	Vitousek, P.M., P.R. Ehrlich, A.H. Ehrlich, and P.A. Matson	1986	Human appropriation of the products of photosynthesis.	<i>Bioscience</i>	34: 368-373.
7	24	254	14.1	16	1.1	6.3%	Holling, C.S.	1986	The resilience of terrestrial ecosystems: Local surprise and global change.	In: W. C. Clark and R. E. Munn (ed.). Sustainable development of the biosphere.	Cambridge University Press, Cambridge.
8	3	197	5.6	34	2.3	17.3%	Ayres, R.U., and A.V. Kneese	1969	Production, consumption and externalities	<i>American Economic Review</i>	59: 282-97.
9	62	187	3.8	4	0.3	2.1%	Odum, H.T., R.C. Pinkerton	1955	Time's Speed Regulator: The Optimum Efficiency for Maximum Power Output in Physical and Biological	<i>American Scientist</i>	43: 331-343.
10	2	175	19.4	53	5.9	30.3%	Arrow, K., B. Bolin, R. Costanza, P. Dasgupta, C. Folke, C.S. Holling, B.-O. Jansson, S. Levin, K.-G. Mäler, C. Perrings, and D. Pimentel	1995	Economic Growth, Carrying Capacity, and the Environment.	<i>Science</i>	268:520-521.
11	55	175	5.8	5	0.3	2.9%	Dasgupta, P., and G. M. Heal.	1974	The optimal depletion of exhaustible resources	<i>Review of Economic Studies</i>	41: 3-28.
12	25	156	4.1	16	1.1	10.3%	Boulding, K.E.	1966	The economics of the coming spaceship earth.	In: H. Jarret (ed.), Environmental Quality in a Growing Economy.	Johns Hopkins University Press, Baltimore.
13	34	132	4.3	11	0.7	8.3%	Clark, C.W.	1973	The economics of overexploitation.	<i>Science</i>	181: 630-634.
14	21	116	3.7	17	1.1	14.7%	Hannon, B.	1973	The Structure of Ecosystems.	<i>Journal of Theoretical Biology</i>	41: 535-546
15	11	110	3.8	24	1.6	21.8%	Georgescu-Roegen, N.	1975	Energy and Economic Myths	<i>Southern Economic Journal</i>	41: 347-381
16	12	106	4.1	24	1.6	22.6%	Bishop, R. C..	1978	Endangered species and uncertainty: the economics of a safe minimum standard.	<i>American Journal of Agricultural Economics</i> ,	60: 10-18.
17	30	100	3.6	14	0.9	14.0%	Weitzman, M.	1976	Prices vs Quantities	<i>Quarterly Journal of Economics</i>	90: 156-162
18	18	89	8.1	19	1.7	21.3%	Costanza, R., L. Wainger, C. Folke, and K.-G. Maler,	1993	Modeling Complex Ecological Economic Systems: Towards an Evolutionary, Dynamic Understanding of People and Nature.	<i>BioScience</i>	43: 545-555.
19	8	86	7.2	27	2.3	31.4%	Costanza, R., H. Daly.	1992	Natural Capital and Sustainable Development.	<i>Conservation Biology</i>	6: 37-46
20	4	79	3.0	34	2.3	43.0%	Ayers, Robert U.	1978	Application of physical principles to economics	Ch 3 in Resources, Environment and Economics	Wiley, NY

(continued on next page)

Table A1 (continued)

Rank (Tot ISI EE Cites/yr)	Total ISI Cites/yr	Total EE Cites/yr	% EE Cites/yr	Author(s)	Year	Title	Journal	Specifics			
21	63	77	5.5	3	0.2	3.9%	Costanza R, Sklar FH, White ML, Vatn, A., Bromley, D.	1990	Modeling coastal landscape dynamics	<i>Bioscience</i>	40: 91-107
22	9	76	7.6	25	2.5	32.9%		1994	Choices without Apologies	<i>Journal of Environmental Economics and Management Science</i>	26: 129-148
23	6	76	3.8	29	1.9	38.2%	Cleveland, C.J., R. Costanza, C.A.S. Hall and R.K. Kaufmann	1984	Energy and the United States economy: a biophysical perspective.		225: 890-897
24	36	75	5.8	9	0.7	12.0%	Maler, Karl-Goran	1991	National accounts and environmental resources	<i>Environmental and Resource Economics</i>	1: 1-15
25	15	68	2.8	22	1.5	32.4%	Costanza, R.	1980	Embodied energy and economic valuation.	<i>Science</i> .	210: 1219-1224
26	37	66	7.3	9	1.0	13.6%	Holling, C.S., D.W. Schindler, B.W. Walker and J. Roughgarden.	1995	Biodiversity in the functioning of ecosystems: an ecological synthesis.	In: C. Perring, K.-G. Mäler, C. Folke, C.S. Holling and B.O. Jansson (eds) Biodiversity Loss; Economic and	University Press.
27	38	66	5.5	9	0.8	13.6%	Daly, G.C. and P. Ehrlich	1992	Population, Sustainability, and Earth's Carrying Capacity.	<i>Bioscience</i>	42: 761-771
28	26	66	3.3	15	1.0	22.7%	Norgaard, R.B.	1984	Coevolutionary development potential	<i>Land Economics</i>	60: 160-173.
29	16	62	4.1	22	1.5	35.5%	Norgaard, R.B.	1989	The case for Methodological Pluralism	<i>Ecological Economics</i> ,	1: 37-57.
30	32	61	2.1	12	0.8	19.7%	Bullard, C.W., and R. Herendeen.	1975	Energy costs of goods and services.	<i>Energy Policy</i>	4: 263-278.
31	56	61	2.0	5	0.3	8.2%	Holdren, J. P. and P. R. Ehrlich	1974	Human population and the global environment.	<i>American Scientist</i>	62: 282-292.
32	20	59	4.9	18	1.5	30.5%	Common, M., and C. Perrings	1992	Towards an ecological economics of sustainability.	<i>Ecological Economics</i>	6: 7-34.
33	10	58	4.8	25	2.1	43.1%	Daly, H.E.	1992	Allocation, distribution, and scale: towards an economics that is efficient, just and sustainable.	<i>Ecological Economics</i>	6: 185-193.
34	39	53	1.5	9	0.6	17.0%	Daly, H.E.	1968	On economics as a life science.	<i>Journal of Political Economy</i>	76: 392-406.
35	13	52	4.0	24	1.8	46.2%	Victor, P.	1991	Indicators of Sustainable Development: Some Lessons for Capital Theory	<i>Ecological Economics</i> ,	4: 191-213
36	27	48	5.3	15	1.7	31.3%	Spash, C., N. Hanley	1995	Preferences, Information and Biodiversity Preservation.	<i>Ecological Economics</i>	12: 191-208
37	22	47	3.4	17	1.2	36.2%	Bromley, D.	1990	The Ideology of Efficiency: Searching for a Theory of Policy Analysis	<i>Journal of Environmental Economics and Management</i>	19: 86-107
38	23	46	3.1	17	1.1	37.0%	Costanza, R., S. C. Farber, and J. Maxwell	1989	The valuation and management of wetland ecosystems	<i>Ecological Economics</i> .	1: 335-361.
39	76	40	1.1	1	0.1	2.5%	Isard, W.	1969	Some notes on the linkage of ecologic and economic systems.	<i>Papers of the Regional Science Association</i>	22: 85-96.
40	57	34	5.7	5	0.8	14.7%	Costanza, R. F. Andrade, P. Antunes, M. van den Belt, D. Boersma, D. F. Boesch, F. Catarino, S. Hanna, K. Limburg, B. Low, M. Molitor, G. Pereira, S. Rayner, R. Santos, J. Wilson, M. Young.	1998	Principles for sustainable governance of the oceans.	<i>Science</i>	281: 198-199.
41	77	34	0.9	1	0.1	2.9%	Crocker, T.	1966	The Structuring of Atmospheric Pollution Control Systems.	in H. Wolozin, (ed.), The Economics of Air Pollution	Norton, New York.

42	33	3.7	12	1.3	36.4%	Bockstael N, Costanza R, Strand I, Boynton W, Bell K, Waehler L	1995	Ecological Economic Modeling and valuation of ecosystems	<i>Ecological Economics</i>	14: 143-159
43	28	33	2.4	1.1	45.5%	Costanza, R., and C. Perrings	1990	A flexible assurance bonding system for improved environmental management.	<i>Ecological Economics</i>	2: 57-76.
44	31	32	2.1	0.9	40.6%	Christensen, P.P.	1989	Historical roots for ecological economics: Biophysical versus allocative approaches.	<i>Ecological Economics</i>	1: 17-36.
45	64	31	2.1	0.2	9.7%	Ehrlich, P. R.	1989	"The limits to substitution: Metaresource depletion and a new economic-ecological paradigm."	<i>Ecological Economics</i>	1: 9-16
46	35	31	1.6	0.7	32.3%	Norgaard, R.B.,	1985	Environmental Economics: An Evolutionary Critique and a Plea for Pluralism.	<i>Journal of Environmental Economics and Management</i>	12: 382-394.
47	29	28	4.7	2.5	53.6%	Norton, B., R. Costanza, and R. Bishop	1998	The evolution of preferences: why 'sovereign' preferences may not lead to sustainable policies and what to do about it.	<i>Ecological Economics</i>	24: 193-211.
48	66	27	1.6	0.1	7.4%	Braat LC, van Lierop WFJ	1987	Integrated economic-ecological modeling	in Economic-Ecological Modeling in R. Costanza (ed.)	Chapter 4
49	58	26	2.0	0.4	19.2%	El Serafy, S.	1991	The Environment as Capital	<i>Ecological Economics: The Science and Management of Sustainability</i>	Columbia University Press, NY
50	59	24	2.4	0.5	20.8%	Larsson J, Folke C, Kautsky N.	1994	Ecological limitations and appropriation of ecosystem support by shrimp farming in Colombia	<i>Environmental Management</i>	18: 663-676
51	48	24	1.4	0.4	25.0%	Goodland, Robert and Georg Ledec.	1987	Neoclassical Economics and Principles of Sustainable Development.	<i>Ecological Modelling</i> ,	38: 29-46.
52	67	22	1.7	0.2	9.1%	Cleveland CJ, Kaufmann RK	1991	Forecasting ultimate oil recovery and its rate of production: Incorporating economics forces into the models of M. King Hubbert	<i>The Energy Journal</i>	225: 890-897
53	19	21	4.2	3.8	90.5%	van den Bergh, J.C.J.M., and H. Verbruggen	1999	Spatial sustainability, trade and indicators: an evaluation of the 'ecological footprint',	<i>Ecological Economics</i>	29: 63-74
54	40	21	2.1	0.8	38.1%	Munda, G., P. Nijkamp, and P. Rietveld,	1994	Qualitative multi-criteria evaluation for environmental management.	<i>Ecological Economics</i>	10: 97-112.
55	49	21	1.8	0.5	28.6%	Berkes, F. and C. Folke.	1992	A Systems Perspective on the Interrelations between Natural, Human-made and Cultural Capital.	<i>Ecological Economics</i>	5:1-8.
56	78	21	1.6	0.1	4.8%	Baker KA, M.S. Fennessy, W.J. Mitsch	1991	Designing wetlands for controlling coal mine drainage: and ecologic-economic modelling approach	<i>Ecological Economics</i>	3: 1-24
57	65	20	5.0	0.8	15.0%	Gibson, C.C., E. Ostrom, and T.K. Ahn.	2000	The concept of scale and the human dimensions of global change: a survey.	<i>Ecological Economics</i>	32: 217-239.
58	50	20	2.0	0.6	30.0%	Ruitenbeek HJ	1994	Modelling economy-ecology linkages in mangroves	<i>Ecological Economics</i>	10: 233-247
59	89	19	3.2	0.0	0.0%	Costanza, R. and M. Ruth.	1998	Using dynamic modeling to scope environmental problems and build consensus.	<i>Environmental Management</i>	22: 183-195.
60	68	17	1.5	0.2	11.8%	Stern, D.I.	1993	Energy and Economic Growth in the USA: A Multivariate Approach.	<i>Energy Economics</i> ,	15: 137-150

(continued on next page)

Table A1 (continued)

Rank	Total	ISI	Total	EE	% EE	Author(s)	Year	Title	Journal	Specifics	
(Tot	ISI	Cites/	EE	Cites/	Cites						
ISI	EE	Cites	Cites	yr	(EE/ISI						
cites)	cites)	yr	yr		Cites)						
61	51	17	1.3	6	0.5	35.3%	Vandenbergh J.C.J.M., P. Nijkamp	1991	Operationalizing sustainable development: dynamic ecological economic models	<i>Ecological Economics</i>	4: 11-33
62	79	16	1.1	1	0.1	6.3%	Ayres, Robert U.,	1989	Industrial metabolism and global change.	<i>International Social Science Journal</i>	121: 364-373
63	69	15	2.5	2	0.3	13.3%	Levin et al. (17 authors),	1998	Resilience in natural and socioeconomic systems.	<i>Environment and Development Economics</i>	3: 222-235.
64	80	15	1.3	1	0.1	6.7%	Crocker, T.D., and J. Tschirhart	1992	Ecosystems, externalities and economics.	<i>Environmental and Resource Economics</i>	2: 551-567.
65	90	15	0.8	0.0	0.0%		Ayres, Robert U. and Indira Nair,	1984	Thermodynamics and economics.	<i>Physics Today November</i>	37: 62-71.
66	52	14	2.3	6	1.0	42.9%	Martinez-Alier, J., G. Munda and J. O'Neill	1998	Weak comparability of values as a foundation for ecological economics.	<i>Ecological Economics</i>	26: 277-286.
67	81	13	1.3	1	0.1	7.7%	Liu J., Cabbage F.W. and Pulliam H.R.	1994	Ecological and economic effects of forest landscape structure and rotation length	<i>Ecological Economics</i>	10: 249-263
68	70	12	3.0	2	0.5	16.7%	Costanza, R., H. Daly, C. Folke, P. Hawken, C.S. Hollings, A. J. McMichael, D. Pimentel, and D. Rapport.	2000	Managing our environmental portfolio.	<i>BioScience</i>	50: 149-155
69	71	12	2.0	2	0.3	16.7%	Perrings, C.	1998	Resilience in the dynamics of economy-environment systems.	<i>Environmental and Resource Economics</i>	11: 503-520.
70	82	12	1.1	1	0.1	8.3%	Hall C.A.S. and Hall M.H.P.	1993	The efficiency of land and energy use in tropical economies and agriculture	<i>Agriculture, Ecosystems and Environment</i>	46: 1-30
71	43	12	0.7	7	0.5	58.3%	Perrings, C.A.	1986	Conservation of mass and instability in a dynamic economy-environment system	<i>Journal of Environmental Economics and Management</i>	13: 199-211
72	83	12	0.5	1	0.1	8.3%	Burness, S. et al.	1980	Thermodynamic and Economic Concepts as Related to Resource-Use Policies	<i>Land Economics</i>	56: 1-9
73	44	11	1.8	7	1.2	63.6%	Ayres, Robert U.	1998	Eco-thermodynamics: Economics and the second law.	<i>Ecological Economics</i>	26: 189-209.
74	45	11	1.6	7	1.0	63.6%	Stern, D.I.	1997	Limits to substitution and irreversibility in production and consumption: a neoclassical interpretation of ecological economics.	<i>Ecological Economics</i>	22: 197-215.
75	60	11	1.1	5	0.5	45.5%	de Groot R.S.	1994	Environmental functions and the economic value of natural ecosystems	Ch. 9 in Investing in Natural Capital: The Ecological Economics Approach to Sustainability	Island Press, Washington, DC
76	41	9	2.3	8	2.0	88.9%	Campbell, B.M., Doré, D., Luckert, M., Mukamuri, B. and Gambizo, J.	2000	Economic comparisons of livestock production in communal grazing lands in Zimbabwe.	<i>Ecological Economics</i>	33: 413-438

77	46	9	0.6	7	0.5	77.8%	Proops, J.L.	1989	Ecological Economics: Rationale and Problem Areas.	<i>Ecological Economics</i>	1: 59-76
78	53	9	0.5	6	0.4	66.7%	Cleveland, C.J.	1987	Biophysical Economics: Historical Perspective and Current Research Trends.	<i>Ecological Modelling</i>	38: 47-73
79	91	9	0.3		0.0	0.0%	Herendeen, R., and J. Tanaka.	1976	Energy cost of living.	<i>Energy</i>	1: 163-178
80	61	8	1.6	5	1.0	62.5%	Söderbaum, P.	1999	Values, ideology and politics in ecological economics	<i>Ecological Economics</i> ,	28: 161-170
81	47	8	0.9	7	0.8	87.5%	Ruth, M.	1995	Information, Order and Knowledge in Economic and Ecological Systems: Implications for Material and Energy Use,	<i>Ecological Economics</i>	13 : 99-114
82	54	7	1.8	6	1.5	85.7%	van den Bergh, J.C.J.M., A. Ferrer-i-Carbonell, and G. Munda	2000	Alternative models of individual behaviour and implications for environmental policy.	<i>Ecological Economics</i>	32: 43-61
83	72	6	1.0	2	0.3	33.3%	Bernow, S., R. Costanza, H. Daly, R. DeGennaro, D. Erlandson, D. Ferris, P. Hawken, J. A. Horner, J. Lancelot, T. Marx, D. Norland, I. Peters, D. Roodman, C. Schneider, P. Shyamsundar, and J. Woodwell. 1	1998	Ecological tax reform.	<i>Bioscience</i>	48: 193-196
84	84	5	1.0	1	0.2	20.0%	Daly, H.E.	1999	Globalization versus internationalization - some implications.	<i>Ecological Economics</i>	31: 31-37
85	73	5	0.6	2	0.2	40.0%	Kaufmann R.K.	1995	The economic multiplier of environmental life support: Can capital substitute for a degraded environment?	<i>Ecological Economics</i>	12: 67-79
86	74	4	0.8	2	0.4	50.0%	Ayres, R.U.	1999	The second law, the fourth law, recycling and limits to growth,	<i>Ecological Economics</i>	29: 473-483
87	75	4	0.8	2	0.4	50.0%	Gowdy, J.M., and A. Ferrer-i-Carbonell	1999	Toward consilience between biology and economics: the contribution of Ecological Economics.	<i>Ecological Economics</i>	29: 337-348
88	85	4	0.4	1	0.1	25.0%	Duchin F, Lange GM	1994	Strategies for environmentally sound economic development	in <i>Investing in Natural Capital: The Ecological Economics Approach to Sustainability</i>	Island Press, Washington, DC
89	86	3	0.3	1	0.1	33.3%	Ayres, R.U.	1995	Thermodynamics and process analysis for future economic scenarios.	<i>Journal of Environmental and Resource Economics</i>	6: 207-230
90	92	2	0.7	1	0.0	0.0%	Costanza, R.	2001	Visions, values, valuation and the need for an ecological economics.	<i>BioScience</i>	51: 459-468
91	87	2	0.7	1	0.3	50.0%	Hall, C.A.S., D. Lindenberger, R. Kummel, T. Kroeger, and W. Eichhorn.	2001	The need to reintegrate the natural sciences with economics.	<i>BioScience</i>	51: 663-673
92	88	2	0.2	1	0.1	50.0%	Shogren, J.F. and C. Nowell	1992	Economics and ecology: a comparison of experimental methodologies and philosophies.	<i>Ecological Economics</i>	5: 101-126

Rows in light gray indicate papers that were included in Costanza et al., 1997b, and not otherwise nominated. See text for additional details.

Table A2

List of all papers published in Ecological Economics which received 15 or more total ISI citations, ranked in order of total number of ISI citations

Rank (total ISI cites)	Rank (total EE cites)	Total ISI Cites	ISI Cites/ year	Total EE Cites	EE Cites/ year	% EE Cites (EE/ISI Cites)	Author(s)	Year	Title	Journal	Specifics
1	1	75	6.8	30	2.7	40.0	Pearce, D.W., and G. Atkinson	1993	Capital theory and the measurement of sustainable development: an indicator of weak sustainability	<i>Ecological Economics</i>	8: 103–108
2	6	68	4.9	20	1.4	29.4	Daly, H.E.	1990	Toward some operational principles of sustainable development	<i>Ecological Economics</i>	2: 1–6
3	4	62	4.1	22	1.5	35.5	Norgaard, R.B.	1989	The case for methodological pluralism	<i>Ecological Economics</i>	1: 37–57
4	9	59	4.9	18	1.5	30.5	Common, M., and C. Perrings	1992	Towards an ecological economics of sustainability	<i>Ecological Economics</i>	6: 7–34
5	2	58	4.8	25	2.1	43.1	Daly, H.E.	1992	Allocation, distribution, and scale: towards an economics that is efficient, just and sustainable	<i>Ecological Economics</i>	6: 185–193
6	3	52	4.0	24	1.8	46.2	Victor, P.	1991	Indicators of sustainable development: some lessons for capital theory	<i>Ecological Economics</i>	4:191–213
7	14	48	5.3	15	1.7	31.3	Spash, C., and N. Hanley	1995	Preferences, information and biodiversity preservation	<i>Ecological Economics</i>	12: 191–208
8	12	46	3.1	17	1.1	37.0	Costanza, R., S. C. Farber, and J. Maxwell	1989	The valuation and management of wetland ecosystems	<i>Ecological Economics</i>	1: 335–361
9	41	46	5.8	7	0.9	15.2	Boxall P.C., W.L. Adamowicz, J. Swait, M. Williams, and J. Louviere	1996	A comparison of stated preference methods for environmental valuation	<i>Ecological Economics</i>	18 : 243–253
10	15	43	2.9	15	1.0	34.9	Costanza, R.	1989	What is ecological economics?	<i>Ecological Economics</i>	1: 1–7
11	30	43	5.4	10	1.3	23.3	Loomis J.B., and D.S. White	1996	Economic benefits of rare and endangered species: summary and meta-analysis	<i>Ecological Economics</i>	18: 197–206
12	7	40	4.0	19	1.9	47.5	Funtowicz, S.O., and J.R. Ravetz	1994	The worth of a songbird—ecological economics as a post-normal science	<i>Ecological Economics</i>	10: 197–207
13	37	35	4.4	8	1.0	22.9	Azar C., and T. Sterner	1996	Discounting and distributional considerations in the context of global warming	<i>Ecological Economics</i>	19: 169–184
14	16	33	2.4	15	1.1	45.5	Costanza, R., and C. Perrings	1990	A flexible assurance bonding system for improved environmental management	<i>Ecological Economics</i>	2: 57–76
15	23	33	3.7	12	1.3	36.4	Bockstael N, R. Costanza, I. Strand, W. Boynton, K. Bell, and L. Wainher	1995	Ecological economic modeling and valuation of ecosystems	<i>Ecological Economics</i>	14: 143–159
16	20	32	2.1	13	0.9	40.6	Christensen, P.P.	1989	Historical roots for ecological economics: biophysical vs. allocative approaches	<i>Ecological Economics</i>	1: 17–36
17	38	32	3.6	8	0.9	25.0	Bateman, I.J., I.H. Langford, R.K. Turner, K.G. Willis, G.D. Garrod	1995	Elicitation and truncation effects in contingent valuation studies	<i>Ecological Economics</i>	12: 161–179
18	59	31	2.1	3	0.2	9.7	Ehrlich, P.R.	1989	The limits to substitution: metaresource depletion and a new economic-ecological paradigm	<i>Ecological Economics</i>	1: 9–16
19	60	31	4.4	3	0.4	9.7	Geoghegan, J., L.A. Wainger, N.E. Bockstael	1997	Spatial landscape indices in a hedonic framework: an ecological economics analysis using GIS	<i>Ecological Economics</i>	23: 251–264
20	5	30	6.0	21	4.2	70.0	Wackernagel, M., L. Onisto, P. Bello,A.C. Linares, I.S.L. Falfan, J.M. Garcia, A.I.S. Guerrero, C.S. Guerrero	1999	National natural capital accounting with the ecological footprint concept	<i>Ecological Economics</i>	29: 375–390

21	17	28	4.7	15	2.5	53.6	Norton, B., R. Costanza, and R. Bishop	1998	The evolution of preferences: why 'sovereign' preferences may not lead to sustainable policies and what to do about it	<i>Ecological Economics</i>	24: 193–211
22	10	28	4.7	18	3.0	64.3	Torras, M., and J.K. Boyce	1998	Income, inequality, and pollution: a reassessment of the environmental Kuznets curve	<i>Ecological Economics</i>	25: 147–160
23	13	28	4.7	16	2.7	57.1	Rothman, D.S.	1998	Environmental Kuznets curves—real progress or passing the buck? A case for consumption-based approaches	<i>Ecological Economics</i>	25: 177–194
24	39	26	2.9	8	0.9	30.8	Martinez-Alier, J.	1995	The environment as a luxury good or too poor to be green	<i>Ecological Economics</i>	13: 1–10
25	43	26	2.9	6	0.7	23.1	Nortongriffiths, M., and C. Southey	1995	The opportunity costs of biodiversity conservation in Kenya	<i>Ecological Economics</i>	12: 125–139
26	56	26	3.3	4	0.5	15.4	Tol, R. S. J.	1996	The damage costs of climate change towards a dynamic representation	<i>Ecological Economics</i>	9: 67–90
27	31	25	2.1	10	0.8	40.0	Ruitenbeek, H.J.	1992	The rainforest supply price: a tool for evaluating rainforest conservation expenditures	<i>Ecological Economics</i>	6: 57–78
28	61	24	1.8	3	0.2	12.5	Hanley, N., and S. Craig	1991	Wilderness development decisions and the Krutilla–Fisher model: the case of Scotland's 'flow country'	<i>Ecological Economics</i>	4: 145–164
29	34	24	2.4	9	0.9	37.5	Boyce, J.K.	1994	Inequality as a cause of environmental degradation	<i>Ecological Economics</i>	11: 169–178
30	32	24	2.7	10	1.1	41.7	Bingham, G., R. Bishop, M. Brody, D. Bromley, E. Clark, W. Cooper, R. Costanza, T. Hale, G. Hayden, S. Kellert, R. Norgaard, B. Norton, J. Payne, C. Russell, and G. Suter	1995	Issues in ecosystem valuation—improving information for decision makers	<i>Ecological Economics</i>	14: 73–90
31	11	24	4.0	18	3.0	75.0	Suri, V., and D. Chapman	1998	Economic growth, trade and energy: implications for the environmental Kuznets curve	<i>Ecological Economics</i>	25: 195–208
32	24	23	2.6	12	1.3	52.2	Costanza, R., and B.C. Patten	1995	Defining and predicting sustainability	<i>Ecological Economics</i>	15: 193–196
33	57	23	2.9	4	0.5	17.4	Azar, C., J. Holmberg, K. Lindgren	1996	Socio-ecological indicators for sustainability	<i>Ecological Economics</i>	18: 89–112
34	27	23	3.8	11	1.8	47.8	Sagoff, M.	1998	Aggregation and deliberation in valuing environmental public goods: a look beyond contingent pricing	<i>Ecological Economics</i>	24: 213–230
35	21	22	2.4	13	1.4	59.1	MaxNeef, M.	1995	Economic growth and quality of life: a threshold hypothesis	<i>Ecological Economics</i>	15: 115–118
36	65	22	2.8	2	0.3	9.1	Moran, E.F., A. Packer, E. Brondizio, and J. Tucker	1996	Restoration of vegetation cover in the eastern Amazon	<i>Ecological Economics</i>	18: 41–54
37	22	22	2.8	13	1.6	59.1	O'Hara, S.U.	1996	Discursive ethics in ecosystems valuation and environmental policy	<i>Ecological Economics</i>	16: 95–107
38	18	22	3.1	14	2.0	63.6	Hinterberger, F., F. Luks, F. Schmidt Bleek	1997	Material flows vs. natural capital—What makes an economy sustainable?	<i>Ecological Economics</i>	23: 1–14
39	44	22	3.7	6	1.0	27.3	Costanza, R., R. d'Arge, R. de Groot, S. Farber, M. Grasso, B. Hannon, K. Limburg, S. Naeem, R.V. O'Neill, J. Paruelo, R.G. Raskin, P. Sutton, M. van den Belt	1998	The value of the world's ecosystem services and natural capital (reprinted from <i>Nature</i> , vol. 387, p. 253, 1997)	<i>Ecological Economics</i>	25: 3–15
40	67	21	1.6	1	0.1	4.8	K.A. Baker, M.S. Fennessy, and W.J. Mitsch	1991	Designing wetlands for controlling coal mine drainage: and ecologic-economic modelling approach	<i>Ecological Economics</i>	3: 1–24

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Table A2 (continued)

Rank (total ISI cites)	Rank (total EE cites)	Total ISI Cites	ISI Cites/ year	Total EE Cites	EE Cites/ year	% EE Cites (EE/ISI Cites)	Author(s)	Year	Title	Journal	Specifics
41	45	21	1.8	6	0.5	28.6	Berkes, F. and C. Folke	1992	A systems perspective on the interrelations between natural, human-made and cultural capital	<i>Ecological Economics</i>	5:1–8
42	35	21	1.8	9	0.8	42.9	Kaufmann, R.K.	1992	A biophysical analysis of the energy/real GDP ratio: implications for substitution and technical change	<i>Ecological Economics</i>	6: 35–56
43	40	21	2.1	8	0.8	38.1	Munda, G., P. Nijkamp, and P. Rietveld	1994	Qualitative multi-criteria evaluation for environmental management	<i>Ecological Economics</i>	10: 97–112
44	58	21	3.0	4	0.6	19.0	Feamside, P.M.	1997	Environmental services as a strategy for sustainable development in rural Amazonia	<i>Ecological Economics</i>	20: 53–70
45	25	21	3.5	12	2.0	57.1	de Bruyn, S.M., J.C.J.M. van den Bergh, J.B. Opschoor	1998	Economic growth and emissions: reconsidering the empirical basis of environmental Kuznets curves	<i>Ecological Economics</i>	25: 161–175
46	8	21	4.2	19	3.8	90.5	van den Bergh, J.C.J.M., and H. Verbruggen	1999	Spatial sustainability, trade and indicators: an evaluation of the 'ecological footprint'	<i>Ecological Economics</i>	29: 63–74
47	54	20	1.4	5	0.4	25.0	Bergstrom, J.C., J.R. Stoll, J.P. Titre, and V.L. Wright	1990	Economic value of wetland-based recreation	<i>Ecological Economics</i>	2: 129–147
48	62	20	1.4	3	0.2	15.0	Tisdell, C.	1990	Economics and the debate about preservation of species, crop varieties and genetic diversity	<i>Ecological Economics</i>	2: 77–90
49	46	20	2.0	6	0.6	30.0	Ruitenbeek, H.J.	1994	Modelling economy–ecology linkages in mangroves	<i>Ecological Economics</i>	10: 233–247
50	47	20	2.5	6	0.8	30.0	Brown, M.T., and R.A. Herendeen	1996	Embodied energy analysis and EMERGY analysis: a comparative view	<i>Ecological Economics</i>	19: 219–235
51	68	20	2.5	1	0.1	5.0	Walker, R., A.K.O. Homma	1996	Land use and land cover dynamics in the Brazilian Amazon: an overview	<i>Ecological Economics</i>	18: 67–80
52	63	20	5.0	3	0.8	15.0	Gibson, C.C., E. Ostrom, and T.K. Ahn	2000	The concept of scale and the human dimensions of global change: a survey	<i>Ecological Economics</i>	32: 217–239
53	64	19	1.7	3	0.3	15.8	Altieri M.A., and O. Masero	1993	Sustainable rural development in Latin America—building from the bottom up	<i>Ecological Economics</i>	7: 93–122
54	48	19	1.9	6	0.6	31.6	Ruitenbeek, H.J.	1994	Neoclassical economics and principles of sustainable development	<i>Ecological Economics</i>	10: 233–247
55	69	18	1.8	1	0.1	5.6	Izac Amn, Swift M.J.	1994	On agricultural sustainability and its measurement in small-scale farming in sub-Saharan Africa	<i>Ecological Economics</i>	11: 105–125
56	71	18	1.8		0.0	0.0	Ropke, I.	1994	Trade, development and sustainability—a critical assessment of the free-trade dogma	<i>Ecological Economics</i>	9: 13–22

57	42	18	2.3	7	0.9	38.9	Darwin R., M. Tsigas, J. Lewandrowski, A. Ranese	1996	Land use and cover in ecological economics	<i>Ecological Economics</i>	17: 157–181
58	49	17	1.3	6	0.5	35.3	Vandenbergh, J.C.J.M., and P. Nijkamp	1991	Operationalizing sustainable development: dynamic ecological economic models	<i>Ecological Economics</i>	4: 11–33
59	50	17	1.5	6	0.5	35.3	Bergstrom, S.	1993	Value standards in sub-sustainable development—on limits of ecological economics	<i>Ecological Economics</i>	7: 1–18
60	19	17	1.7	14	1.4	82.4	Daly, H.E., and R. Goodland	1994	An ecological economic assessment of international commerce under GATT	<i>Ecological Economics</i>	9: 73–92
61	51	17	1.9	6	0.7	35.3	B.G. Norton	1995	Evaluating ecosystem states—2 competing paradigms	<i>Ecological Economics</i>	14: 113–127
62	36	17	2.4	9	1.3	52.9	S.I. Higgins, J.K. Turpie, R. Costanza, et al.	1997	An ecological economic simulation model of mountain fynbos ecosystems—dynamics, valuation and management	<i>Ecological Economics</i>	22: 155–169
63	33	16	1.5	10	0.9	62.5	Binswanger, M.	1993	From microscopic to macroscopic theories: entropic aspects of ecological and economic processes	<i>Ecological Economics</i>	8: 209–233
64	28	16	2.3	11	1.6	68.8	Rennings, K., and H. Wiggering	1997	Steps towards indicators of sustainable development: linking economic and ecological concepts	<i>Ecological Economics</i>	20: 25–36
65	52	16	2.3	6	0.9	37.5	Wackernagel, M., and W.E. Rees	1997	Perceptual and structural barriers to investing in natural capital: economics from an ecological footprint perspective	<i>Ecological Economics</i>	20: 3–24
66	66	15	1.2	2	0.2	13.3	Colby, M.E.	1991	Environmental management in development: the evolution of paradigms	<i>Ecological Economics</i>	3: 193–213
67	70	15	1.3	1	0.1	6.7	Pinedo-Vasquez, M., D. Zarin, P. Jipp	1992	Economic returns from forest conversion in the Peruvian Amazon	<i>Ecological Economics</i>	6: 163–173
68	26	15	1.4	12	1.1	80.0	Bianciardi, C., E. Tiezzi, S. Ulgiati	1993	Complete recycling of matter in the frameworks of physics, biology and ecological economics	<i>Ecological Economics</i>	8: 1–5
69	29	15	2.1	11	1.6	73.3	deBruyn, S.M., J.B. Opschoor	1997	Developments in the throughput-income relationship: theoretical and empirical observations	<i>Ecological Economics</i>	20: 255–268
70	53	15	2.1	6	0.9	40.0	Hanna, S.S.	1997	The new frontier of American fisheries governance	<i>Ecological Economics</i>	20: 221–233
71	55	15	2.5	5	0.8	33.3	Bystrom, O.	1998	The nitrogen abatement cost in wetlands	<i>Ecological Economics</i>	26: 321–331

Table A3
Journal articles most cited in *Ecological Economics*, ranked by total EE citations

Rank	Rank	Total	ISI	Total	EE	% EE	Author(s)	Year	Title	Journal	Specifics
(total	(total	ISI	cites/	EE	cites/	cites					
EE	ISI	cites	year	cites	year	(EE/ISI					
cites)	cites)					cites)					
1	6	499	71.3	68	9.7	13.6	Costanza, R., R. d'Arge, R. de Groot, S. Farber, M. Grasso, B. Hannon, S. Naeem, K. Limburg, J. Paruelo, R.V. O'Neill, R. Raskin, P. Sutton, and M. van den Belt	1997	The value of the world's ecosystem services and natural capital	<i>Nature</i>	387:253–260
2	19	175	19.4	53	5.9	30.3	Arrow, K., B. Bolin, R. Costanza, P. Dasgupta, C. Folke, C.S. Holling, B.-O. Jansson, S. Levin, K.-G. Mäler, C. Perrings, and D. Pimentel	1995	Economic growth, carrying capacity, and the environment	<i>Science</i>	268:520–521
3	17	197	5.6	34	2.3	17.3	Ayres, R.U., and A.V. Kneese	1969	Production, consumption and externalities	<i>American Economic Review</i>	59: 282–297
4	24	134	13.4	31	3.1	23.1	Selden, T.M., and D. Q. Song	1994	Environmental-quality and development—Is there a Kuznets Curve for air-pollution emissions	<i>Journal of Environmental Economics and Management</i>	27: 147–162
5	1	2525	70.1	30	2.0	1.2	Hardin, G.	1968	The tragedy of the commons	<i>Science</i>	162: 1243–1248
6	36	75	6.8	30	2.7	40.0	Pearce, D.W., and G. D. Atkinson	1993	Capital theory and the measurement of sustainable development: an indicator of “weak” sustainability	<i>Ecological Economics</i>	8: 103–108
7	34	76	3.8	29	1.9	38.2	Cleveland, C.J., R. Costanza, C.A.S. Hall, and R. Kaufmann	1984	Energy and the United States economy: a biophysical perspective	<i>Science</i>	225: 890–897
8	22	158	17.6	29	3.2	18.4	Grossman, G.M. and A.B. Krueger	1995	Economic-growth and the environment	<i>Quarterly Journal of Economics</i>	110: 353–377
9	13	275	15.3	28	1.9	10.2	Vitousek, P.M., P.R. Ehrlich, A.H. Ehrlich, and P.A. Matson	1986	Human appropriation of the products of photosynthesis	<i>Bioscience</i>	34: 368–373
10	31	86	7.2	27	2.3	31.4	Costanza, R., and H. E. Daly.	1992	Natural capital and sustainable development	<i>Conservation Biology</i>	6: 37–46
11	2	2452	55.7	26	1.7	1.1	Coase, R.H.	1960	The problem of social cost	<i>Journal of Law and Economics</i>	3: 1–44
12	45	58	4.8	25	2.1	43.1	Daly, H.E.	1992	Allocation, distribution, and scale: towards an economics that is efficient, just and sustainable	<i>Ecological Economics</i>	6: 185–193
13	35	76	7.6	25	2.5	32.9	Vatn, A., and D.W. Bromley	1994	Choices without prices without apologies	<i>Journal of Environmental Economics and Management</i>	26: 129–148
14	28	106	4.1	24	1.6	22.6	Bishop, R.C.	1978	Endangered species and uncertainty: the economics of a safe minimum standard	<i>American Journal of Agricultural Economics</i>	60: 10–18
15	7	499	45.4	24	2.2	4.8	Ludwig, D., R. Hilborn, and C. Walters	1993	Uncertainty, resource exploitation, and conservation—lessons from history	<i>Science</i>	260: 17–36
16	46	52	4.0	24	1.8	46.2	Victor, P.	1991	Indicators of sustainable development: some lessons for capital theory	<i>Ecological Economics</i>	4: 191–213
17	10	310	8.4	23	1.5	7.4	Krutilla, J.V.	1967	Conservation reconsidered	<i>American Economic Review</i>	57: 777–784
18	38	68	2.8	22	1.5	32.4	Costanza, R.	1980	Embodied energy and economic valuation	<i>Science</i>	210: 1219–1224
19	42	62	4.1	22	1.5	35.5	Norgaard, R.B.	1989	The case for methodological pluralism	<i>Ecological Economics</i>	1: 37–57
20	43	62	7.8	22	2.8	35.5	Stern, D. I., M.S. Common, and E.B. Barbier	1996	Economic growth and environmental degradation: the environmental Kuznets curve and sustainable development	<i>World Development</i>	24: 1151–1160
21	37	69	5.8	21	1.8	30.4	Beckerman, W.	1992	Economic-growth and the environment—whose growth—whose environment	<i>World Development</i>	20: 481–496
22	4	731	23.6	21	1.4	2.9	Holling, C.S.	1973	Resilience and stability of ecological systems	<i>Annual Review of Ecological Systems</i>	4: 1–24

23	52	30	6.0	21	4.2	70.0	Wackemagel, M., L. Onisto, P. Bello, A.C. Linares, I.S. L. Falfan, J.M. Garcia, A.I.S. Guerrero, and C.S. Guerrero	1999	National natural capital accounting with the ecological footprint concept	<i>Ecological Economics</i>	29: 375–390
24	39	68	4.9	20	1.4	29.4	Daly, H.E.	1990	Toward some operational principles of sustainable development	<i>Ecological Economics</i>	2: 1–6
25	3	747	12.7	20	1.3	2.7	Hotelling, H.	1931	The economics of exhaustible resources	<i>Journal of Political Economy</i>	36: 137–175
26	21	173	19.2	20	2.2	11.6	Porter, M.E., C. van der Linde	1995	A new conception of the environment—competitiveness relationship	<i>Journal of Economic Perspectives</i>	9: 97–118
27	12	288	9.6	19	1.3	6.6	Arrow, K.J. and A.C. Fisher	1974	Environmental preservation, uncertainty, and irreversibility	<i>Quarterly Journal of Economics</i>	88: 312–319
28	30	89	8.1	19	1.7	21.3	Costanza, R., L. Wainger, C. Folke, and K.-G. Maler	1993	Modeling complex ecological economic systems: towards an evolutionary, dynamic understanding of people and nature	<i>BioScience</i>	43: 545–555
29	50	40	4.0	19	1.9	47.5	Funtowicz, S.O., and J. R. Ravetz	1994	The worth of a songbird—ecological economics as a post-normal science	<i>Ecological Economics</i>	10: 197–207
30	23	152	5.6	19	1.3	12.5	Hartwick, J.M.	1977	Intergenerational equity and investing of rents from exhaustible resources	<i>American Economic Review</i>	5: 972–974
31	14	272	9.1	19	1.3	7.0	Solow, R.M.	1974	Economics of Resources or Resources of Economics	<i>American Economic Review</i>	64: 1–14.
32	25	122	6.8	19	1.3	15.6	Solow, R.M.	1986	On the intergenerational allocation of natural resources	<i>Scandinavian Journal of Economics</i>	88: 141–149
33	57	21	4.2	19	3.8	90.5	van den Bergh, J.C.J.M., and H. Verbruggen	1999	Spatial sustainability, trade and indicators: an evaluation of the ‘ecological footprint’	<i>Ecological Economics</i>	29: 63–74
34	44	60	5.0	18	1.5	30.00	Common, M. S., and C.A. Perrings	1992	Towards an ecological economics of sustainability	<i>Ecological Economics</i>	6: 7–34
35	9	340	17.0	18	1.2	5.3	Hanemann, W.M.	1984	Welfare evaluations in contingent valuation experiments with discrete responses	<i>American Journal of Agricultural Economics</i>	66: 332–341
36	11	307	25.6	18	1.5	5.9	Kahnemann, D., and J.L. Knetsch	1992	Valuing public-goods—the purchase of moral satisfaction	<i>Journal of Environmental Economics and Management</i>	22: 57–70
37	32	78	7.8	18	1.8	23.1	Shafik, N.	1994	Economic-development and environmental-quality—an econometric-analysis	<i>Oxford Economic Papers—New Series</i>	46: 757–773
38	16	235	7.8	18	1.2	7.7	Solow, R.M.	1974	Intergenerational equity and exhaustible resources	<i>Review of Economic Studies</i>	41: 29–45
39	56	24	4.0	18	3.0	75.0	Suri, V., and D. Chapman	1998	Economic growth, trade and energy: implications for the environmental Kuznets curve	<i>Ecological Economics</i>	25: 195–208
40	53	28	4.7	18	3.0	64.3	Torras, M., and J.K. Boyce	1998	Income, inequality, and pollution: a reassessment of the environmental Kuznets curve	<i>Ecological Economics</i>	25: 147–160
41	48	46	3.1	17	1.1	37.0	Costanza, R., S. C. Farber, and J. Maxwell	1989	The valuation and management of wetland ecosystems	<i>Ecological Economics</i>	1: 335–361
42	26	116	3.7	17	1.1	14.7	Hannon, B.	1973	The Structure of Ecosystems	<i>Journal of Theoretical Biology</i>	41: 535–546
43	33	77	5.9	17	1.3	22.1	Stevens, T.H.	1991	Measuring the existence value of wildlife: what do CVM estimates really show?	<i>Land Economics</i>	4: 390–400
44	20	174	17.4	16	1.6	9.2	Hanemann, W.M.	1994	Valuing the environment through contingent valuation	<i>Journal of Economic Perspectives</i>	8: 19–43
45	5	722	14.7	16	1.1	2.2	Kuznets, S.	1955	Economic growth and income inequality	<i>American Economic Review</i>	49: 1–28
46	54	28	4.7	16	2.7	57.1	Rothman, D.S.	1998	Environmental Kuznets curves—real progress or passing the buck? A case for consumption-based approaches	<i>Ecological Economics</i>	25: 177–194
47	8	479	68.4	16	2.3	3.3	Vitousek, P.M., H.A. Mooney, J. Lubchenco, and J.M. Melillo	1997	Human domination of Earth’s ecosystems	<i>Science</i>	277: 494–499

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Table A3 (continued)

Rank (total EE cites)	Rank (total ISI cites)	Total ISI cites	ISI cites/ year	Total EE cites	EE cites/ year	% EE (EE/ISI cites)	Author(s)	Year	Title	Journal	Specifics
48	49	43	2.9	15	1.0	34.9	Costanza, R.	1989	What is ecological economics?	<i>Ecological Economics</i>	1: 1–7
49	51	33	2.4	15	1.1	45.5	Costanza, R., and C.A. Perrings	1990	A flexible assurance bonding system for improved environmental management	<i>Ecological Economics</i>	2: 57–76
50	27	114	3.5	15	1.0	13.2	Ehrlich, P.R., and J.P. Holdren	1971	Impact of population growth	<i>Science</i>	171: 1212–1217
51	29	94	8.5	15	1.4	16.00	Gregory R., S. Lichtenstein, and P. Slovic	1993	Valuing environmental resources—a constructive approach	<i>Journal of Risk And Uncertainty</i>	7: 177–197
52	41	63	7.0	15	1.7	23.8	Holtz-Eakin D, and T.M. Selden	1995	Stoking the fires—CO ₂ emissions and economic-growth	<i>Journal of Public Economics</i>	57: 85–101
53	18	188	5.5	15	1.0	8.0	Leontief, W.	1970	Environmental repercussions and economic structure—input–output approach	<i>Review of Economics and Statistics</i>	52: 262–271
54	15	247	19.0	15	1.2	6.1	Nordhaus, W.D.	1991	To slow or not to slow—the economics of the greenhouse-effect	<i>Economic Journal</i>	101: 920–937
55	40	66	3.3	15	1.0	22.7	Norgaard, R.B.	1984	Coevolutionary development potential	<i>Land Economics</i>	60: 160–173
56	55	28	4.7	15	2.5	53.6	Norton, B., R. Costanza, and R. Bishop	1998	The evolution of preferences: why 'sovereign' preferences may not lead to sustainable policies and what to do about it	<i>Ecological Economics</i>	24: 193–211
57	47	48	5.3	15	1.7	31.3	Spash, C.,I and N. Hanley	1995	Preferences, information and biodiversity preservation	<i>Ecological Economics</i>	12: 191–208.

Articles receiving 15 or more citations in EE are included.

Table A4

Monographs and edited books most cited in *Ecological Economics*, ranked by total EE cites

Rank (total EE cites)	Rank (total ISI cites)	Total ISI cites	ISI cites/ year	Total EE cites	EE cites/ year	% EE cites (EE/ISI cites)	Author/editor	Earliest year	Title	Publisher
1	19	462	35.5	134	10.3	29.0	Costanza, R. (Ed.)	1991	Ecological Economics: The Science and Management of Sustainability	Columbia University Press, New York
2	17	598	39.9	96	6.4	16.1	Daly, H.E., and J.B. Cobb	1989	For the Common Good: Redirecting the Economy toward Community, the Environment, and a Sustainable Future	Beacon Press, Boston
3	35	263	26.3	89	8.9	33.8	Jansson A.M., M. Hammer, C. Folke, and R. Costanza (Eds.)	1994	Investing in Natural Capital: The Ecological Economics Approach to Sustainability	Island Press, Washington, DC.
4	20	458	65.4	78	11.1	17.0	Daily G.C. (Ed.)	1997	Nature's Services: Societal Dependence on Natural Ecosystems	Island Press, Washington, DC
5	13	771	23.4	65	4.3	8.4	Georgescu-Roegen, N.	1971	The Entropy Law and the Economic Process	Harvard Univ. Press, Boston, MA
6	40	222	27.8	64	8.0	28.8	Rees, W., and M. Wackernagel	1996	Our Ecological Footprint: Reducing Human Impact on the Earth	New Society Publishers, San Francisco
7	11	815	54.3	58	3.9	7.1	Mitchell, R.C., R.T. Carson	1989	Using Surveys to Value Public Goods: The Contingent Valuation Method	Resources for the Future, Washington, DC
8	21	437	31.2	53	3.8	12.1	Pearce, D.W., R.K. Turner	1990	Economics of Natural Resources and the Environment	Johns Hopkins Univ. Press, Baltimore, MD
9	23	410	15.2	49	3.3	12.0	Daly, H.E.	1977	Steady-State Economics	Island Press, Washington, DC
10	41	222	24.7	43	4.8	19.4	Bromley, D.W. (Ed.)	1995	Handbook of Environmental Economics	Blackwell, UK
11	31	285	40.7	41	5.9	14.4	Birkeland, C. (Ed.)	1997	Life and Death of Coral Reefs	Kluwer Academic Publishers, Dordrecht
12	6	1296	92.6	40	2.9	3.1	Ostrom, E.	1990	Governing the Commons: The Evolution of Institutions for Collective Action	Cambridge University Press, Cambridge, UK
13	18	502	33.5	38	2.5	7.6	Markandya, A., E.B. Barbier, D.W. Pearce	1989	Blueprint for a Green Economy	Earthscan Publications, London
14	7	1103	39.4	38	2.5	3.4	Clark, C.W.	1976	Mathematical Bioeconomics: The Optimal Management of Renewable Resources	Wiley-Interscience, New York, NY
15	27	340	21.3	37	2.5	10.9	Sagoff, M.	1988	The Economy of the Earth: Philosophy, Law and the Environment	Cambridge University Press, Cambridge, UK
16	14	714	47.6	33	2.2	4.6	Wilson, E.O. (Ed.)	1989	Biodiversity	National Academy Press, Washington, DC
17	53	114	14.3	32	4.0	28.1	Daly, H.E.	1996	Beyond Growth: the Economics of Sustainable Development	Beacon Press, Boston, MA
18	48	138	13.8	32	3.2	23.2	Norgaard, R.B.	1994	Development Betrayed: The End of Progress and A Coevolutionary Revisioning of the Future	Routledge, London
19	46	158	13.2	31	2.6	19.6	Low, P. (Ed.)	1992	International Trade and the Environment	World Bank, Washington, DC
20	33	273	24.8	30	2.7	11.0	Freeman, A.M.	1993	The Measurement of Environmental and Resource Values	Resources for the Future, Washington, DC
21	37	254	28.2	30	3.3	11.8	Gunderson, L.H., C.S. Holling, and S.S. Light (Eds.)	1995	Barriers and Bridges to the Renewal of Ecosystems and Institutions	Columbia University Press
22	51	123	12.3	30	3.0	24.4	Brown, K., and D.W. Pearce (Eds.)	1994	The Causes of Tropical Deforestation	UCL Press, London

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Table A4 (continued)

Rank (total EE cites)	Rank (total ISI cites)	Total ISI cites	ISI cites/ year	Total EE cites	EE cites/ year	% EE cites (EE/ISI cites)	Author/editor	Earliest year	Title	Publisher
23	9	995	62.2	29	1.9	2.9	Baumol, W.J., W.E. Oates	1988	The Theory of Environmental Policy	Cambridge University Press, Cambridge, UK
24	60	78	9.8	29	3.6	37.2	Costanza, R., O. Segura, and J. Martinez-Alier (Eds.)	1996	Getting Down to Earth: Practical Applications of Ecological Economics	Island Press, Washington, DC
25	71	55	2.9	29	1.9	52.7	Kneese A.V., and J.L. Sweeney (Eds.)	1985	Handbook of Natural Resource and Energy Economics	Elsevier, Amsterdam
26	66	67	4.5	28	1.9	41.8	Ahmed, Y., S. El Serafy, and E. Lutz (Eds.)	1989	Environmental Accounting for Sustainable Development, a UNEP-World Bank Symposium	World Bank, Washington, DC
27	50	127	12.7	27	2.7	21.3	Ayres R.U. and U. Simonis (Eds.)	1994	Industrial Metabolism: Restructuring for Sustainable Development	United Nations University Press, Tokyo
28	3	2417	75.5	26	1.7	1.1	Meadows D.H. , D.L. Meadows, J. Randers, W.W. Behrens	1972	The Limits to Growth	Universe Books, New York, NY
29	30	288	11.5	25	1.7	8.7	Smith, V.K. (Ed.)	1979	Scarcity and Growth Reconsidered	John's Hopkins University Press, Baltimore
30	76	34	2.6	24	1.8	70.6	Kuik, O., and H. Verbruggen (Eds.)	1991	In Search of Indicators of Sustainable Development.	Kluwer Academic, Dordrecht
31	69	62	5.6	24	2.2	38.7	Daly, H.E., and K.N. Townsend (Eds.)	1993	Valuing the Earth: Economics, Ecology, Ethics	MIT Press, Cambridge, MA
32	49	133	8.9	23	1.5	17.3	Repetto R., W. McGrath, M. Wells, C. Beer, F. Rossini	1989	Wasting Assets: Natural Resources in the National Accounts	World Resources Institute, Washington, DC
33	61	76	15.2	23	4.6	30.3	van den Bergh J.C.J.M. (Ed.)	1999	Handbook of Environmental and Resource Economics	Edward Elgar, Cheltenham
34	58	90	7.5	23	1.9	25.6	Ekins, P., and M. Max-Neef (Eds.)	1992	Real-Life Economics	Routledge, London
35	25	359	29.9	22	1.8	6.1	Meadows, D. H., D. L. Meadows, J. Randers	1992	Beyond the Limits: Confronting Global Collapse, Envisioning a Sustainable Future	Chelsea Green Publishing
36	4	1931	33.3	22	1.5	1.1	Hicks, J.R.	1946	Value and Capital	Oxford Univ. Press, Oxford, UK
37	47	142	15.8	22	2.4	15.5	Perrings, C.A., K.-G. Maler, and C. Folke, C.S. Holling, B.-O. Jansson (Eds.)	1995	Biodiversity Loss: Economic and Ecological Issues	Cambridge Univ. Press, Cambridge, UK
38	63	74	10.6	22	3.1	29.7	Foster, J. (Ed.)	1997	Valuing Nature? Economics, Ethics and Environment	Routledge, London
39	65	68	5.7	21	1.8	30.9	De Groot, R.S.	1992	Functions of Nature: Evaluation of Nature in Environmental Planning, Management and Decision-Making	Wolters-Noordhoff B.V, Amsterdam
40	70	56	3.3	21	1.4	37.5	Perrings, C.A.	1987	Economy and Environment: A Theoretical Essay on the Interdependence of Economic and Environmental Systems	Cambridge University Press, Cambridge, UK
41	56	100	5.6	21	1.4	21.0	Hall, C.A.S., C.J. Cleveland, R.K. Kaufmann	1986	Energy and Resource Quality: The Ecology of the Economic Process	Wiley Interscience, NY
42	12	785	28.0	21	1.4	2.7	Hirsch, F.	1976	Social Limits to Growth	Harvard Univ. Press, Boston

43	72	50	4.2	21	1.8	42.0	Costanza, R., B. Norton, and B.J. Haskell (Eds.)	1992	Ecosystem Health: New Goals for Environmental Management	Island Press, Washington, DC
44	57	97	7.5	21	1.6	21.6	Goodland, R., H.E. Daly, and S. El Serafy (Eds.)	1991	Environmentally Sustainable Economic Development: Building on Brundtland	World Bank, Washington, DC
45	67	66	3.9	20	1.3	30.3	Martinez-Alier, J.	1987	Ecological Economics: Energy, Environment, and Society	Blackwell, UK
46	64	70	8.8	20	2.5	28.6	Hanna, S., C. Folke, and K.G. Maler (Eds.)	1996	Rights to Nature—Ecological, Economic, Cultural, and Political Principles of Institutions for the Environment, Island Press, Washington DC.	Island Press, Washington, DC
47	10	890	63.6	19	1.4	2.1	Greene, W.H.	1990	Econometric Analysis	Prentice Hall, NY
48	59	79	3.0	19	1.3	24.1	Ayres, R.U.	1978	Resources, Environment, and Economics: Applications of the Materials/Energy Balance Principle	Wiley, NY
49	44	182	30.3	19	3.2	10.4	Berkes, F., and C. Folke (Eds.)	1998	Linking Social and Ecological Systems. Management Practices and Social Mechanisms for Building Resilience. Cambridge University Press, Cambridge, UK.	Cambridge University Press, Cambridge, UK
50	28	333	27.8	19	1.6	5.7	Cowling, R.M. (Ed.)	1992	The Ecology of Fynbos: Nutrients, Fire, and Diversity	Oxford University Press, Cape Town
51	22	415	41.5	19	1.9	4.6	Davis, S.M. and J.C. Ogden (Eds.)	1994	Everglades: The Ecosystem and Its Restoration	St. Lucie Press, Delray Beach, FL
52	38	254	12.7	18	1.2	7.1	Tietenberg, T.H.	1984	Environmental and Natural Resource Economics	Pearson Addison Wesley, NY
53	1	7823	237.1	18	1.2	0.2	Rawls, J.	1971	A Theory of Justice	Clarendon Press
54	39	241	4.6	18	1.2	7.5	Ciriacy-Wantrup, S.V.	1952	Resource Conservation: Economics and Policies	University of California Press, Berkeley
55	8	1035	17.5	18	1.2	1.7	Pigou, A.C.	1920	The Economics of Welfare	Macmillan and Co., London
56	42	222	5.8	18	1.2	8.1	Jarret, H. (Ed.)	1966	Environmental Quality in a Growing Economy	John Hopkins University Press, Baltimore MD
57	15	628	34.9	18	1.2	2.9	Clark, W.C., and R.E. Munn (Eds.)	1986	Sustainable Development of the Biosphere	Cambridge University Press, Cambridge
58	34	267	38.1	18	2.6	6.7	Kohn, K.A., and J.F. Franklin (Eds.)	1997	Creating a Forestry for the 21st Century: The Science of Ecosystem Management	Island Press, Washington, DC
59	73	39	3.9	18	1.8	46.2	Cobb, C., and J. Cobb (Eds.)	1994	The Green National Product: A Proposed Index of Sustainable Welfare	University Press of America, New York
60	68	64	9.1	17	2.4	26.6	Costanza, R., J. Cumberland, H.E. Daly, R. Goodland, R.B. Norgaard	1997	An Introduction to Ecological Economics	St. Lucie Press, Delray Beach, FL
61	29	320	26.7	17	1.4	5.3	Cline, W.R.	1992	The Economics of Global Warming	Institute for International Economics, Washington, DC
62	45	179	13.8	17	1.3	9.5	Bromley, D.W.	1991	Environment and Economy: Property Rights and Public Policy	Blackwell, Oxford, UK
63	36	258	19.8	17	1.3	6.6	Braden, J.B., and C.D. Kolstad (Eds.)	1991	Measuring the Demand for Environmental Quality	Elsevier, Amsterdam
64	24	386	21.4	17	1.1	4.4	Cummings, R.G., D.S. Brookshire, and W.D. Schulze (Eds.)	1986	Valuing Environmental Goods: An Assessment of the Contingent Valuation Method	Rowman and Allanheld, Totowa, NJ

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Table A4 (continued)

Rank (total cites)	Rank (total ISI cites)	Total ISI cites	ISI cites/ year	Total EE cites	EE cites/ year	% EE cites (EE/ISI cites)	Author/editor	Earliest year	Title	Publisher
65	32	276	27.6	16	1.6	5.8	Nordhaus, W.D.	1994	Managing the Global Commons: The Economics of Climate Change	MIT Press, Cambridge, MA
66	2	2609	93.2	16	1.1	0.6	Keeney, R.L., and H. Raiffa	1976	Decisions with Multiple Objectives	Wiley, NY
67	52	120	4.3	16	1.1	13.3	Georgescu-Roegen, N.	1976	Energy and Economic Myths: Institutional and Analytical Economic Essays	Pergamon Press, NY
68	43	188	17.1	16	1.5	8.5	Ferber, M., and J. Nelson (Eds.)	1993	Beyond Economic Man: Feminist Theory and Economics	University of Chicago Press, Chicago IL
69	62	76	9.5	16	2.0	21.1	Campbell, B. (Ed.)	1996	The Miombo in Transition: Woodlands and Welfare in Africa	Center for International Forestry Research, Bogor
70	55	109	9.9	16	1.5	14.7	Turner, R.K. (Ed.)	1993	Sustainable Environmental Economics and Management	Wiley and Sons, Chichester, Sussex
71	77	28	4.0	15	2.1	53.6	Von-Weizsacker, E. U., A. Lovins, and H. Lovins	1997	Factor Four—Doubling Wealth, Halving Resource Use	Earthscan, London
72	74	38	3.5	15	1.4	39.5	Ruth, M.	1993	Integrating Economics, Ecology and Thermodynamics	Kluwer, Dordrecht, NL
73	75	37	2.6	15	1.1	40.5	North, D.C.	1990	Institutions, Institutional Change and Economic Performance	Cambridge Univ. Press, Cambridge, UK
74	16	625	34.7	15	1.0	2.4	Walters, C.J.	1986	Adaptive Management of Renewable Resources	Macmillan, London
75	26	347	16.5	15	1.0	4.3	Odum, H.T.	1983	Systems Ecology: An Introduction	Wiley Interscience, NY
76	5	1508	94.3	15	1.0	1.0	Dosi, G., C. Freeman, R. Nelson, G. Silverberg, and L. Soete (Eds.)	1988	Technical Change and Economic Theory	Pinter Publishers, London
77	54	112	22.4	15	3.0	13.4	Bateman, I.J., and K.G. Willis (Eds.)	1999	Valuing Environmental Preferences—Theory and Practice of the Contingent Valuation Method in the US, EU, and Developing Countries	Oxford University Press, Oxford

Edited books are denoted by Ed. or Eds. after the author's name(s).

References

- Abt, H.A., 2000. Do important papers produce high citation counts? *Scientometrics* 48, 65–70.
- Arrow, K.J., Fisher, A.C., 1974. Environmental preservation, uncertainty, and irreversibility. *Quarterly Journal of Economics* 88, 312–319.
- Arrow, K., Bolin, B., Costanza, R., Dasgupta, P., Folke, C., Holling, C.S., Jansson, B.-O., Levin, S., Maler, K.-G., Perrings, C., Pimentel, D., 1995. Economic-growth, carrying-capacity, and the environment. *Science* 268, 520–521.
- Ayres, R.U., 1978. Application of physical principles to economics. In: Ayres, R.U. (Ed.), *Resources, Environment and Economics: Applications of the Materials/Energy Balance Principle*. Wiley, New York, pp. 37–71.
- Ayres, R.U., Kneese, A.V., 1969. Production, consumption and externalities. *American Economic Review* 59, 282–297.
- Bishop, R.C., 1978. Endangered species and uncertainty: the economics of a safe minimum standard. *American Journal of Agricultural Economics* 60, 10–18.
- Cleveland, C.J., Costanza, R., Hall, C.A.S., Kaufmann, R., 1984. Energy and the United States economy: a biophysical perspective. *Science* 225, 890–897.
- Coase, R.H., 1960. The problem of social cost. *Journal of Law and Economics* 3, 1–44.
- Costanza, R., 1980. Embodied energy and economic valuation. *Science* 210, 1219–1224.
- Costanza, R. (Ed.), 1991. *Ecological Economics: The Science And Management Of Sustainability*. Columbia University Press, New York. 525 pp.
- Costanza, R., 1996. The impact of ecological economics. *Ecological Economics* 19(1), 1–2.
- Costanza, R., Daly, H.E., 1992. Natural capital and sustainable development. *Conservation Biology* 6, 37–46.
- Costanza, R., Cleveland, C., Perrings, C. (Eds.), 1997a. *The Development of Ecological Economics*. Edward Elgar, Cheltenham.
- Costanza, R., d'Arge, R., de Groot, R., Farber, S., Grasso, M., Hannon, B., Naeem, S., Limburg, K., Paruelo, J., O'Neill, R.V., Raskin, R., Sutton, P., van den Belt, M., 1997b. The value of the world's ecosystem services and natural capital. *Nature* 387, 253–260.
- Daily, G. (Ed.), 1997. *Nature's Services: Societal Dependence on Natural Ecosystems*. Island Press, Washington, DC.
- Daly, H.E., 1977. *Steady-State Economics*. W. H. Freeman, San Francisco, CA.
- Daly, H.E., 1992. Allocation, distribution, and scale: towards an economics that is efficient, just and sustainable. *Ecological Economics* 6, 185–193.
- Daly, H.E., Cobb, J.B., 1989. *For the Common Good: Redirecting the Economy Toward Community, the Environment, and a Sustainable Future*. Beacon Press, Boston.
- Dasgupta, P., Heal, G.M., 1974. The optimal depletion of exhaustible resources. *Review of Economic Studies* 41, 3–28.
- Funtowicz, S.O., Ravetz, J.R., 1994. The worth of a songbird—ecological economics as a post-normal science. *Ecological Economics* 10(3), 197–207.
- Georgescu-Roegen, N., 1971. *The Entropy Law and the Economic Process*. Harvard Univ. Press, Boston, MA.
- Grossman, G.M., Krueger, A.B., 1995. Economic-growth and the environment. *Quarterly Journal of Economics* 110, 353–377.
- Hanemann, W.M., 1984. Welfare evaluations in contingent valuation experiments with discrete responses. *American Journal of Agricultural Economics* 66, 332–341.
- Hanemann, W.M., 1994. Valuing the environment through contingent valuation. *Journal of Economic Perspectives* 8, 19–43.
- Hardin, G., 1968. *Tragedy of the Commons*. *Science* 162, 1243–1248.
- Hargens, L.L., 2000. Using the literature: reference networks, reference contexts, and the social structure of scholarship. *American Sociological Review* 65, 846–865.
- Hicks, J.R., 1946. *Value and Capital*. Oxford Univ. Press, Oxford, UK.
- Holling, C.S., 1973. Resilience and stability of ecological systems. *Annual Review of Ecological Systems* 4, 1–24.
- Holling, C.S., 1986. The resilience of terrestrial ecosystems: local surprise and global change. Sustainable development of the biosphere. In: Clark, W.C., Munn, R.E. (Eds.), *Sustainable Development of the Biosphere*. Cambridge Univ. Press, Cambridge.
- Hotelling, H., 1931. The economics of exhaustible resources. *Journal of Political Economy* 36, 137–175.
- Jansson, A.M., Hammer, M., Folke, C., Costanza, R. (Eds.), 1994. *Investing in Natural Capital: The Ecological Economics Approach to Sustainability*. Island Press, Washington, DC. 504 pp.
- Kahnemann, D., Knetsch, J.L., 1992. Valuing public-goods—the purchase of moral satisfaction. *Journal of Environmental Economics and Management* 22, 57–70.
- Keeney, R.L., Raiffa, H., 1976. *Decisions with Multiple Objectives*. Wiley, New York.
- Krutilla, J.V., 1967. Conservation reconsidered. *American Economic Review* 77(7), 784.
- Kuznets, S., 1955. Economic growth and income inequality. *American Economic Review* 49, 1–28.
- Leontief, W., 1970. Environmental repercussions and economic structure—input-output approach. *Review of Economics and Statistics* 52, 262–271.
- Ludwig, D., Hilborn, R., Walters, C., 1993. Uncertainty, resource exploitation, and conservation—lessons from history. *Science* 260, 17–36.
- Meadows, D.H., Meadows, D.L., Randers, J., Behrens, W.W., 1972. *The Limits to Growth*. Universe Books, New York, NY.
- Nordhaus, W.D., 1991. To slow or not to slow—The economics of the greenhouse-effect. *Economic Journal* 101, 920–937.
- Norgaard, R.B., 1989. The case for methodological pluralism. *Ecological Economics* 1, 37–57.
- Oates, R.K., Donnelly, D.A., 1997. Influential papers in child abuse. *Child Abuse and Neglect* 21, 319–326.
- Odum, H.T., Pinkerton, R.C., 1955. Time's speed regulator: the optimum efficiency for maximum power output in physical and biological systems. *American Scientist* 43, 331–343.
- Pearce, D.W., Turner, R.K., 1990. *Economics of Natural Resources and the Environment*. Johns Hopkins Univ. Press, Baltimore, MD.

- Pearce, D.W., Atkinson, G.D., 1993. Capital theory and the measurement of sustainable development: an indicator of "weak" sustainability. *Ecological Economics* 8, 103–108.
- Pimm, S.L., 1984. The complexity and stability of ecosystems. *Nature* 307, 321–326.
- Rawls, J., 1971. *A Theory of Justice*. Clarendon Press.
- Rees, W., Wackernagel, M., 1996. *Our Ecological Footprint: Reducing Human Impact on the Earth*. New Society Publishers, San Francisco.
- Selden, T.M., Song, D.Q., 1994. Environmental-Quality and Development-Is there a Kuznets Curve for Air-Pollution Emissions. *Journal of Environmental Economics and Management* 27, 147–162.
- Solow, R.M., 1974a. Economics of resources or resources of economics. *American Economic Review* 64, 1–14.
- Solow, R.M., 1974b. Intergenerational equity and exhaustible resources. *Review of Economic Studies* 41, 29–45.
- Stern, D.I., Common, M.S., Barbier, E.B., 1996. Economic growth and environmental degradation: the environmental kuznets curve and sustainable development. *World Development* 24, 1151–1160.
- van den Bergh, J.C.J.M., Verbruggen, H., 1999. Spatial sustainability, trade and indicators: an evaluation of the 'ecological footprint'. *Ecological Economics* 29, 63–74.
- Vatn, A., Bromley, D.W., 1994. Choices without prices without apologies. *Journal of Environmental Economics and Management* 26, 129–148.
- Victor, P., 1991. Indicators of sustainable development: some lessons for capital theory. *Ecological Economics* 4, 191–213.
- Vitousek, P., Ehrlich, P.R., Ehrlich, A.H., Matson, P.A., 1986. Human appropriation of the products of photosynthesis. *Bio-science* 34, 368–373.
- Vitousek, P.M., Mooney, H.A., Lubchenco, J., Melillo, J.M., 1997. Human domination of Earth's ecosystems. *Science* 277, 494–499.
- Wouters, P., 1999a. *The Citation Culture*. Doctoral thesis, University of Amsterdam.
- Wouters, P., 1999b. Beyond the holy grail: from citation theory to indicator theories. *Scientometrics* 44, 561–580.