

FROM THE PRESIDENT...

This has been a fairly active first half of the year for AERE with some sad news as well as major decisions we've had to consider. A distinguished colleague and friend to many of us, Allen V. Kneese, has passed away; we have been deep in negotiations over the future of our journal, the *Journal of Environmental Economics and Management (JEEM)*; and we have been preparing for a summer of important meetings and workshops.

- **Allen V. Kneese (1930-2001).** One of the founders of our field passed away earlier this year— Allen Kneese. Allen was the first president of AERE, serving in 1978, and, with Ralph D'Arge, founded *JEEM* in 1974. Allen was a warm and generous person with an ability to see the essence of problems and their solutions. He will be missed by *many*. Among his accomplishments, Allen is often credited with rediscovering the Pigovian fee and suggesting its use for managing pollution—done soon after his arrival at Resources for the Future in 1961. Highlights of his professional life are on the RFF webpage:

www.rff.org/about_rff/web_bios/kneese.htm.

- **AERE's Official Journal: *The Journal of Environmental Economics and Management (JEEM)*.** As many of you know, Bob Deacon's term as editor of *JEEM* ended at the beginning of this calendar year. We certainly thank Bob for his tireless dedication to maintaining and building *JEEM*. In terms of impact as measured by citations, *JEEM* is in the top tier of economics journals, surpassing some general interest journals.

Anticipating Bob's departure, we searched for a new editorial team last year and made a selection, announced at the AERE members' luncheon in January. However, prior to finalizing that selection, we sought to renegotiate our contractual relationship with Academic Press (AP), *JEEM*'s owner. Over the years, there has been some dissatisfaction expressed with the terms of the agreement with AP. During the first four months of this year, the AERE Board has been involved in protracted negotiations with AP to improve the terms under which *JEEM* is AERE's official journal.

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I apologize for the delays and uncertainty these negotiations engendered. But I am happy to say that those negotiations are largely complete. We have a new arrangement with AP that I believe will be to everyone's benefit. Roughly speaking, we have agreed to provide a *JEEM* subscription to all of our members. Commencing with 2002, the cost of a personal membership will rise from \$30 to \$70 annually but will include an electronic subscription to *JEEM*. If a member prefers a paper subscription, that will be \$10 extra. Somewhat more than half of our nonstudent members currently take *JEEM* for a total cost, including membership, of \$109 (U.S./Canada) or \$126 (overseas). Thus the majority of our members will see a substantial reduction in costs.

Academic Press is more than tripling its financial support to the editorial offices of *JEEM*. This will allow the editor to reduce the submission fee (currently \$40) for AERE members. The new editor of *JEEM* is Joseph A. Herriges of Iowa State University in Ames. This was announced at the January meeting, though not finalized until recently, due to the AP negotiations. The AERE Board is very enthusiastic about having Joe as editor and appreciates his willingness to serve.

The editorial structure of *JEEM* will be somewhat different than in the past. A set of co-editors has been named, similar to the associate editors of the past, though with more autonomy. They are Anna Alberini, Brian Copeland, Larry Karp, Charles Mason, Stephen Polasky, and Anastasios Xepapadeas. Although all submissions should be sent to Iowa State, the co-editors will handle the manuscripts they are assigned from beginning to end, making the decision about acceptability and communicating directly with authors. This is the standard practice in many economics journals and should work well for *JEEM*.

- **Award for the 2000 *Publication of Enduring Quality* was presented at the annual meeting.** The award went to Colin Clark: *Mathematical Bioeconomics: The Optimal Management of Renewable Resources* (Wiley Interscience, editions of 1976, 1990). Thanks for the work of the selection committee: Chuck Howe (Chair), Tim Haab and Gardner Brown.

- **Upcoming Workshops and Conferences.** In closing, let me remind you of AERE's upcoming "intellectual" agenda—conferences and workshops on which there is more detail elsewhere in this newsletter. The upcoming AERE Workshop in Bar Harbor, Maine (June 13-15) is entitled "Assessing and Managing Environmental and Public Health Risks." The European Association of Environmental and Resource Economists (EAERE) annual meeting in Southampton is at the end of June. And, of course, AERE sponsors sessions at the American Agricultural Economics Association (AAEA) meetings held this year in Chicago in August and the Allied Social Science Associations (ASSA) meetings in Atlanta in January, 2002. The AERE reunion at the AAEA meetings is always well attended. Last of all, please see the report on the Second Annual World Congress of Environmental and Resource Economists to be held in Monterey, California in June 2002. Mark your calendars for June 23-27, 2002.

We are extremely grateful to all the AERE members who have generously given of their time to our association to make these events happen. I invite any of you who are interested in serving in some capacity to contact me or one of the other officers or board members.

AERE Newsletter

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AERE ANNOUNCEMENTS

NOMINATIONS FOR OFFICERS AND BOARD MEMBERS

This year AERE members will vote for a president-elect whose two-year term will begin in January 2003, a vice president whose two-year term will begin in January 2002, and two new members of the Board of Directors who will serve for three years beginning in January 2002. The nominations are being handled by John Loomis and the elections will occur in the Fall of 2001.

If you have a candidate whom you would like to see nominated, contact John before the **July 1st deadline**. Nominations may also be made by the membership through petitions, each of which contains signatures of 5% of the association's members. **Such petitions should be sent to arrive no later than July 1, 2001 to:**

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PUBLICATION OF ENDURING QUALITY AWARD

The AERE Board of Directors will present the annual award (to co-authors if appropriate) for a publication of enduring quality that appeared at least five years prior to the year of the award. The award will be announced at the annual AERE members' luncheon in January 2002. Nominated works are to be evaluated on their seminal nature and enduring value. Place and type of publication are unrestricted, but posthumous awards will not be given. Nominees may include individuals who are not members of AERE. Evaluation of nominated works and final selection for the 2001 award will be undertaken by a committee chaired by Tim Haab, The Ohio State University.

Nomination packages should consist of four copies each of a cover letter, a document supporting the nomination, and the publication itself. The supporting document (not to exceed three pages) should include quantitative as well as qualitative information (e.g., number of citations or copies printed). Nominations should be sent to arrive **no later than September 1st**. This is an important award for AERE and for the recipients. Please give serious consideration to nominating a publication and to observing the submission requirements.

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HOME PAGE

AERE can be found on the world wide web at:

<http://www.aere.org>

The AERE Home Page is a valuable resource. It provides information about membership, the *Journal of Environmental Economics and Management (JEEM)*, a list of AERE members with web pages, the on-line edition of excerpts from the *AERE Newsletter*, graduate programs in environmental and resource economics, meetings and workshops, job opportunities, on-line discussion lists, and WWW links of interest. Members may access the AERE Handbook and Directory using the membership code. (All members were sent a letter containing the code--please contact Marilyn M. Voigt (voigt@rff.org) if you have misplaced it. Send any and all comments regarding the web page to:

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CALLS FOR PAPERS AND PROPOSALS

2001 INTERNATIONAL SYMPOSIUM ON SOCIETY AND RESOURCE MANAGEMENT

Announcing the 2001 International Symposium on Society and Resource Management to be held November 7 - 10 at La Maddalena National Park, Sardinia, Italy. The theme of the symposium will be "Global Challenges of Parks and Protected Area Management". The symposium hosts are The University of Sassari and Colorado State University.

Some of the Symposium Goals are:

- To present new research findings that enhance our ability to manage park and protected areas (PPA).
- Share management experiences that enhance our capacity for PPA management.
- Promote effective management of PPA on a global scale.

Symposium themes include: Protecting landscapes, balancing traditional uses and park protection, social and political considerations in PPA management, frameworks that guide PPA planning and management, and ecotourism.

The deadline for presentation proposals is **June 1, 2001**. The early symposium registration of \$195 is due July 15. For more information please visit the conference website at:

<http://www.cnr.colostate.edu/NRRT/SSRM>.

SOCIETY, POLITICS, THE ECONOMY & THE ENVIRONMENT: IMPLICATIONS FOR SOCIO-ECONOMIC PROGRESS IN THE 21ST CENTURY

Interdisciplinary International Conference
Bangalore (Silicon Valley of India), India
July 19 – 28, 2001

The last date for submission of abstracts is **June 15, 2001** and the full paper is due **by July 15, 2001**. The registration form is due along with the abstract on June 15, 2001. The abstract should not be more than one page or no more than about 400 words; include the title of the paper, and name(s) and address(es) of author(s).

Registration Fee: \$2,250 (Includes air fare, accommodation, local transportation, two meals a day, and conference registration.) Registration fee for guests: \$1,850. If you are going to make your own arrangements, the conference fee is \$350.

For more information, visit:

<http://resi.tamu.edu/arekere/speeiconf.html>

INTERNATIONAL JOURNAL OF GLOBAL ENVIRONMENTAL ISSUES

The *International Journal of Global Environmental Issues* announces a special issue on "Conflict Resolution/Conflict Management."

Conflict is an inherent characteristic of most natural resource and environmental issues. For example, use of public lands often creates conflict between user segments or stakeholder groups. The primary objective of this special issue is to bring together the insight and experiences from a variety of disciplines in order to increase the understanding of conflict resolution and/or conflict management. Contributions to this special issue should be intellectually rigorous but accessible to nonspecialist readers. Papers that demonstrate applications that address conflicts in the environmental and natural resources areas with public policy implications are encouraged. Research from the fields of economics, decision sciences, consumer behavior, organizational behavior, sociology, marketing strategy, as well as multidisciplinary approaches are encouraged.

Manuscripts should be submitted to the following address **no later than July 31, 2001**:

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MEETINGS AND WORKSHOPS

AERE WORKSHOP

Assessing and Managing Environmental and Public Health Risks

June 13-15, 2001
Bar Harbor, Maine

Papers

Anthony Fisher, University of California, Berkeley and and **Urvashi Narain**, Resources for the Future (RFF), “Global Warming, Endogenous Risk, and Irreversibility.”

Urvashi Narain, RFF, and **Klaas van' t Veld**, University of Michigan, “Long-Term Risks to Developing Countries from Participating in the Clean Development Mechanism.”

Larry Karp and **Jiangfeng Zhang**, University of California, Berkeley, “Regulating Global Climate Change with Bayesian Learning about Damages.”

Scott Farrow, **Liz Casman**, **Benoit Morel**, **Sonia Yeh**, and **Felicia Wu**, Carnegie Mellon University, “Merging Risks Assessment and Real Options: A Quantitative Approach to the Precautionary Principle.”

Martin Weitzman, Harvard University, “Global Warming as Capital Theory.”

Trudy Cameron, University of California, Los Angeles, “Updated Subjective Distributions for Future Climate and Individual Option Prices for Climate Change Mitigation.”

Mark Agee, The Pennsylvania State University, and **Thomas Crocker**, University of Wyoming, “Some Economics of Child Health and Environmental Tobacco Smoke.”

Mark Dickie and **Victoria Ulery**, University of Southern Mississippi, “Valuing Health in the Household: Are Kids Worth More than Adults?”

Timothy Mount, **Weifeng Weng**, and **William Schulze**, Cornell University and **Laurie Chestnut**, Stratus Consulting, Inc., “Automobile Safety and the Value of Statistical Life for Children, Adults, and the Elderly: Results from New Data On Automobile Usage.”

V. Kerry Smith and **Hyun Kim**, North Carolina State University, and **Donald Taylor**, Duke University, “Do the Elderly Really Value Mortality Risks Differently?”

Jason Shogren and **Tommy Stamland**, University of Wyoming, “Skill and the Value of Life.”

Timothy Haab, The Ohio State University, **John Whitehead**, East Carolina University, and **George Parsons**, University of Delaware. “The Effect of Information Conveyance on Behavioral Changes from Perceived Risks: An Application to Seafood Consumption and *Pfiesteria Piscicida*.”

Paul Jakus, University of Tennessee and **Douglass Shaw**, University of Nevada, “Perceived Hazard and Product Choice: An Application to Recreational Site Choice.”

Mario Teisl and **Kevin Boyle**, University of Maine, **Brian Roe**, The Ohio State University, **T. Lynn Riggs** and **Mark Messonnier**, Centers for Disease Control, and **Melissa Herrmann**, I.C.R. “Understanding How Respondents View Safety Risks: Implications for the Design of Willingness-to-Pay Experiments.”

Ana Maria Ibáñez and **Kenneth E. McConnell**, University of Maryland, College Park, “Valuing Morbidity: Acute Respiratory Illness in Bogotá, Columbia.”

James Hammitt, Harvard University, and **Louis Eeckhoudt**, Catholic Faculties of Mons, Belgium and Lille, France, “Does Risk Aversion Increase the Value of Statistical Life?”

**AMERICAN AGRICULTURAL
ECONOMICS ASSOCIATION (AAEA)
AND THE CANADIAN AGRICULTURAL
ECONOMICS SOCIETY (CAES)
ANNUAL MEETINGS**

**August 5 - 8, 2001
Chicago, Illinois**

***Agricultural Economics at the Margins:
Expanding Our Reach and Deepening Our
Understanding***

The joint meeting of the AAEA and CAES will explore the theme *Agricultural Economics at the Margins: Expanding Our Reach and Deepening Our Understanding*, providing an outstanding opportunity to look at what is ahead, challenge our conventional thinking, and address new and emerging issues.

Registration and information about the meeting is available on the AAEA home page at: www.aaea.org or contact the AAEA office at 515-233-3202 for more information. Registration deadline is **June 29th** for reduced rates.

All AERE members are cordially invited to attend a reception on **Monday, August 6th** tentatively scheduled in the Normandie Lounge room of the Hilton Chicago Hotel from 6:00 to 7:30 p.m. Please check the final program to confirm the location.

AERE Contributed Papers Sessions

Session I

Pollution, Technical Change, and Regulation

Papers:

1. **Y. Hossein Farzin**, University of California, Davis, and **Jinhua Zhao**, Iowa State University, "Pollution Abatement Investment when Firms Lobby Against Environmental Regulation;"
2. **Mu-Yen Hsu**, National Yunlin University of Science and Technology, "Integrating Environmental Regulation and Technology Policy B to Promote Pollution Abatement Innovation and Diffusion;"

3. **Allen Blackman**, Resources for the Future (RFF), and **Arne Kildegaard**, University of Guanajuato, Mexico, "Clean Technological Change in Developing Country Industrial Clusters: Mexican Leather Tanning."

Session II

Issues in Climate-Change Policy

Papers:

1. **Urvashi Narain**, RFF and **Klaas van't Veld**, University of Michigan, "Long-Term Risks to Developing Countries from Participating in the Clean Development Mechanism;"
2. **Wolfram Schlenker**, **Anthony Fisher**, and **Michael Hanemann**, University of California, Berkeley, "Will U.S. Agriculture Really Benefit from Global Warming? The Importance of the Weighting Procedure in a Cross-Sectional Estimation;"
3. **Michael Finus** and **Bianca Rundshagen**, University of Hagen, "Endogenous Coalition Formation in Global Pollution Control."

Session III

Resource Conservation: Policy Approaches and Valuation

Papers:

1. **Heidi Albers**, RFF, and **Amy Ando**, University of Illinois at Urbana-Champaign, "Private Conservation Agents: How Many Should There Be?"
2. **Andrew Plantinga**, Oregon State University, and **SoEun Ahn**, North Carolina State University, "Cost-Effective Policies for Environmental Protection: An Econometric Analysis of Incentives for Land Conversion and Retention."
3. **Daniel McCollum**, U.S. Department of Agriculture (USDA) Forest Service, **Randall Rosenberger**, West Virginia University, and **Michelle Haefele**, USDA Forest Service, "A Systematic Evaluation of Cross-Scenario Effects in Multiple Scenario Contingent Valuation Studies."

**ASSOCIATION OF SOUTHERN EUROPEAN
ECONOMIC THEORISTS (ASSET)
2001 EUROCONFERENCE**

The Association of Southern European Economic Theorists (ASSET) is an organization of approximately fifteen economic departments and economic research centers in Spain, France, Portugal, Italy, Turkey, Greece and Cyprus. Its purpose is to promote research and the exchange of ideas and knowledge in all fields of economics. Within this framework, ASSET organizes an international conference each year which gathers about 150 economists from all over the world.

This year's conference will be held on October 26-27, 2001 in Rethymno, on the island of Crete in Greece and will be organized jointly by the Athens Laboratory of Economic Policy Studies (IMOP) of the Athens University of Economics and Business and the University of Crete. In the tradition of ASSET meetings, the program will include parallel sessions, discussion panels and lectures given by eminent scholars. Registration will be handled electronically exclusively. Hard copy, diskette or e-mail submissions will not be accepted. For further inquiries, please contact:

asset2001@ebusiness.uoc.gr

**EUROPEAN ASSOCIATION OF
ENVIRONMENTAL AND
RESOURCE ECONOMISTS (EAERE)**

Annual Conference

University of Southampton, United Kingdom

June 28-30, 2001

This year's annual EAERE conference will be hosted by the Department of Economics of the University of Southampton at their Boldrewood Conference Centre. Easily accessible by land, sea and air, Southampton is on the South Coast of England and has a rich and varied heritage. Southampton is an ideal base from which to explore the rest of the South of England. Historical cities such as Winchester and Salisbury, and important sites such as Stonehenge and the New Forest, are all within easy reach. Southampton is one hour by rail and motorway from London, with fast and easy access from London Airports Heathrow and Gatwick. Southampton

International Airport serves a wide range of European cities as well as internal flights within the UK. Sealink Ferries operates from Cherbourg to Southampton.

The program includes 50 contributed paper sessions with about 200 contributed papers. In addition, there are the following keynote speaker sessions:

- *Growth and the Environment:*
Professor Geoffrey Heal, Columbia University and **Professor Sjak Smulders**, Tilburg University
- *Valuation:*
Professor Bengt Kristrom, Swedish University of Agricultural Sciences and **Professor Alan Randall**, The Ohio State University
- *Incentives:*
Professor Tracy Lewis, University of Florida and **Professor Domenico Siniscalco**, Fondazione Eni Enrico Mattei (FEEM)

There will also be a plenary Policy Session on "Making Sustainability Operational."

The following have provided generous financial support for the conference:

European Commission

Department of Economics, University of Southampton

Environment Agency

For additional information see the EAERE web site at: <http://www.eaere.org>

Conference Executive

Alistair Ulph (Chair)
Alan Ingham
Robin Mason
Jan Podivinsky
Peter Smith

**KINGSTON UNIVERSITY
SCHOOL OF ECONOMICS
AND
THE CENTRE FOR THE UNDERSTANDING
OF SOCIETY AND POLITICS**

*Why Economic Growth? The Meaning and
Measurement of GDP*

August 30-31, 2001

For registration and other information, please contact:

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**SECOND WORLD CONGRESS
OF ENVIRONMENTAL AND
RESOURCE ECONOMISTS**

Monterey, California
June 23-27, 2002
Monterey Marriott Hotel

The Congress will meet from Monday, June 24 through Thursday June 27, 2002, with an initial reception and registration session in the late afternoon on Sunday, June 23rd. It will be held at the Monterey Marriott Hotel in Monterey, California.

The Organizing Committee is delighted to announce that the plenary speakers at the Congress will be **Kenneth Arrow, Partha Dasgupta, Dan McFadden, and Martin Weitzman.**

We are planning a variety of sessions and special events. These will be announced together with the call for papers through the Congress web page, which will open on July 1. The Congress web page will be accessible through a link from www.aere.org and www.eaere.org. The web page can be used:

- to register for the Congress and reserve hotel accommodations;
- to submit papers for consideration by the Program Committee;
- to download papers included in the program;
- to obtain information on the program and related activities;
- to obtain travel information and information about the Monterey area.

About 700 people attended the first World Congress in Venice in 1998, and we are hoping for similar attendance at Monterey. Monterey is located on the Monterey Peninsula, 105 miles south of San Francisco International Airport (SFO), accessible via a two-hour drive or by a connecting flight to Monterey Airport.

The city lies beside Monterey Bay, the largest marine sanctuary in the U.S. It served as the capital of Alta California under Spanish and Mexican rule, and was the first capital of California as a U.S. territory. The area is famous for its scenic beauty and natural attractions, including Pebble Beach, Pacific Grove, Carmel, and Big Sur. Four nearby state parks offer abundant hiking and camping opportunities as well as many recreational opportunities associated with the Bay itself, including kayaking, boating, scuba diving, and whale watching. Areas of local historical interest include the Monterey State Historic Park, centered around the main public buildings of the original Spanish and Mexican capital, Cannery Row, the Maritime Museum, and the breathtaking Monterey Bay Aquarium, which the Congress will take over for a reception and dinner. The timing of the conference should coincide with the annual Carmel Art and Wine Festival, the Monterey Bay Blues Festival, and shortly before the Carmel Bach Festival.

We look forward to seeing many of you there in 2002.

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ESSAYS

How Large Are the Gains from Technological Innovation Induced by Environmental Policies?

Ian W.H. Parry¹

Pollution regulations can potentially improve economic efficiency by addressing two sources of resource misallocation. As we all know from the standard Pigouvian model, pollution is excessive when firms do not take into account the resulting environmental harm: up to a point, policies that reduce firms' pollution can yield environmental benefits that are larger than the economic costs of the measures taken by firms to curtail pollution.

But, in the absence of policy intervention, the market for developing cleaner production technologies is also distorted. If firms see no benefits to themselves from reducing pollution, they have little incentive to develop cleaner production methods over time, such as better techniques for blending clean fuels into the production process, or more effective end-of-pipe technologies for cleaning up waste emissions. The problem can be more acute when other firms in an industry benefit from adopting or imitating innovations made by one firm. In this case the innovating firm may be unable to appropriate the spillover benefits of new technologies to other firms, leading an even larger difference between the benefits to society from cleaner technologies, and any private benefit that might accrue to the individual firm. Under these conditions—that is, when the private benefits from innovation are below the social benefits—pollution regulations produce an additional source of welfare gain to the extent that they encourage more environmentally focused technological innovation.

When assessing the welfare impacts of pollution regulations, economists usually focus only on the benefits and costs of reducing pollution, taking the current state of technology as given. It is often acknowledged that policies may also produce important

benefits over the long haul by promoting the development of cleaner technologies. Clearly, over a period of decades, innovation may go a long way in alleviating unpalatable short-run trade-offs between economic activity and the environment. For example, it is conceivable that by the middle of this century, improvements in fuel efficiency, the spread of hybrid (electric and gasoline) vehicles, and fuel cells, will have greatly reduced pollution emissions caused by driving.

But when evaluating policies on a cost/benefit criterion, what matters is the *welfare gain* from induced innovation. A few economists (myself included) have speculated that the welfare gains from induced innovation might be more important than the welfare gains from pollution control. If so, this would have some strong implications for public policy, and for the way economists evaluate environmental policies. If the economic gains from induced innovation were relatively large in magnitude, the primary concern in the design of environmental policies should be to promote the appropriate level of technological innovation; there is less economic welfare at stake from fine-tuning policies to achieve the optimal amount of pollution control each year. In the context of climate policies, for example, this might mean that the additional gains from putting in place direct incentives to develop carbon-saving technologies—such as research subsidies and research prizes—may be much larger than the initial gains from implementing emissions control programs, such as a system of tradable emissions permits. From an academic perspective, if the gains from induced innovation are relatively large, this means that cost/benefit studies of environmental policies, which generally take the state of technology as exogenous, may have omitted the most important source of economic benefit!

Clearly then, it would be very useful to know whether in fact the gains from induced technological innovation are large or not relative to the welfare gains from pollution control. In a recent paper, Billy Pizer, Carolyn Fischer, and myself at Resources for the Future have attempted to get a handle on this issue. And what we found came as something of a surprise to us: in general we found that the welfare gains from induced innovation over time are smaller in most cases, rather than larger, than the welfare gains from pollution control.

¹ Resources for the Future, 1616 P Street, Washington, DC 20036. Phone: 202-328-5151; Email: parry@rff.org; web: www.rff.org/~parry. I am grateful to Carolyn Fischer, John Loomis, and Richard Newell for very helpful comments.

A Closer Look

We used a fairly simple dynamic model in which each period a “social planner” chooses the amount of pollution control and also decides the amount to invest in research and development (R&D) into cleaner technologies. R&D augments a knowledge stock, and the larger the knowledge stock in future years the lower the abatement costs associated with reducing pollution to a given level. The model is general rather than being applied to a specific pollutant, and we consider a wide range of scenarios for the magnitude of the environmental benefits from pollution abatement relative to the (initial) level of pollution abatement costs. We also calibrate the R&D cost function to imply different scenarios for the difficulty of achieving a given reduction in abatement costs through innovation. To keep things simple, we assume that in the absence of technological innovation, abatement costs and baseline emissions would be the same in all future periods.

Some of the insights from our analysis can be explained with the aid of Figure 1. Along the horizontal axis in this figure we have the reduction in economy-wide emissions of the pollutant in a given period from 0% to 100%. MAC is the marginal cost of reducing pollution assuming no technological innovation, and it represents the cost of installing end-of-pipe treatment technologies, using cleaner but more expensive fuels in the production process, and so on. This curve comes out of the origin when there are no pre-existing pollution regulations. It is upward sloping, reflecting the increasing difficulty to firms of finding ways to reduce pollution by an additional amount. The MB curve is marginal environmental benefits from reducing pollution and represents, for example, the health benefits to seniors from cleaner air. Suppose that marginal benefits are constant and equal to b .²

As we know from the traditional Pigouvian model, it is optimal to reduce pollution up to a^* in Figure 1, beyond which the cost of additional abatement rises above the benefits from additional abatement. The environmental benefits in the current period from reducing pollution by a^* equals rectangle $Obxa^*$, the area under the marginal benefit curve between 0 and a^* . Assuming MAC is linear, the total cost of this abatement is triangle Oxa^* , the area under the marginal cost curve between 0 and a^* . Thus, the net benefit, or Pigouvian welfare gain,

² As discussed in Parry et al. (2000), if the marginal environmental benefit curve were downward sloping this would further reduce the magnitude of the welfare gains from innovation relative to the welfare gain from pollution control.

is given by the shaded triangle Obx , and this has area $ba^*/2$. If we repeated this exercise over all future periods, the present discounted value of the Pigouvian welfare gains (PV^P) would be $ba^*/2r$, where r is the discount rate.

Now consider the implications of technological innovation that reduces the costs associated with pollution control. We can easily put an upper bound on the relative welfare gains from innovation. Consider a highly extreme (and highly unrealistic) scenario where there are no costs to doing R&D, and it is possible to develop technologies that completely and instantaneously eliminate the costs of pollution control. With technological innovation, there will be 100% pollution abatement with no abatement costs across all future periods, and the environmental benefits in each period would be rectangle $Obyz$, the area under the marginal benefit curve from 0 to 100% abatement. Thus, technological innovation increases welfare in a given period by the trapezoid $Oxyz$ in Figure 1, which has area $a^*b/2 + (100-a^*)b$. The present discounted value of the welfare gains from innovation over all future periods (PV^I) would be $(a^*b/2 + (100-a^*)b)/r$.

Using these formulas, PV^I/PV^P is simply $1+2(100/a^* - 1)$. This ratio equals 19 when the Pigouvian abatement level a^* is 10%; it equals 3 when the Pigouvian abatement level is 50%; and it equals 1.5 when the Pigouvian abatement level is 80%. Straight away then, we can see that the present value of welfare gains from innovation cannot swamp the present value of the Pigouvian welfare gains, if the initially optimal abatement level is above 50%. If, prior to any innovation, it is optimal to do a lot of abatement (a^* is nearer to 100% than 0%), by definition trapezoid $Oxyz$ is less than three times the size of triangle Owx .³

But the trapezoid/triangle ratio in Figure 1 can greatly overstate the relative welfare gains from innovation for two reasons. First, it takes a long time, perhaps decades, to accumulate enough know-how to completely eliminate pollution, without raising the overall cost of producing products. This means that for a whole range of future periods the marginal abatement cost curve will lie between MAC and the horizontal axis in Figure 1, say MAC' , and the optimal abatement level will be a' ,

³ Intuitively, when the MAC curve is very steep the initial Pigouvian welfare gain is small, and there is a lot of potential for innovation to increase welfare by rotating the MAC curve downwards. Conversely, when the MAC curve is relatively flat the initial Pigouvian welfare gain is already large, and there is less scope for innovation to increase welfare.

between a^* and 100%. Thus, the benefits from innovation in that period will be triangle $0xw$, which is smaller than trapezoid $0xyz$ in Figure 1, hence the present value of the benefits from innovation over future periods will be well below $0xyz/r$.

Second, in general, R&D is costly. Designing a new production technique involves the time of scientists and engineers, as well as capital inputs like research labs. The present value of the opportunity costs of these research inputs over time needs to be taken off from the discounted stream of benefits from innovation in order to obtain the discounted net welfare gains from innovation.

In short, the relative welfare gains from innovation depend on two main factors in our model. First, the height of the marginal benefit from abatement curve relative to the (initial) marginal cost curve, reflected by the Pigouvian abatement level a^* in Figure 1. Second, the speed with which abatement costs are reduced by a given amount on the optimum path for innovation. This reflects different assumptions about the costs of doing innovation.⁴

Table 1 shows calculations of PV^I/PV^P from Parry, Pizer and Fischer (2000). The first column shows different values for a^* . The next column shows PV^I/PV^P when abatement costs will be reduced by 50% in 10 years (and ultimately by 100%) when the optimum amount of R&D is done over time. Here we see that PV^I is only larger than PV^P when the Pigouvian abatement level is around 40% or less. But if it takes twenty or more years to halve abatement costs because it is more costly to develop new technologies (third and fourth columns), PV^I is always smaller than PV^P in these scenarios. In short, for PV^I to be much larger than PV^P requires not only that there is the potential for innovation to substantially reduce abatement costs fairly quickly, but also that the initial Pigouvian level of abatement is fairly modest.

Are these conditions likely to be met in practice? Consider the examples of sulfur and carbon. Under the sulfur-trading program, emissions have been reduced by around 50%, and abatement costs do seem to have roughly halved during the first decade of the program (Burtraw 2000). If we assume that the sulfur emissions reduction was originally optimal from a Pigouvian perspective, then our calculations suggest the welfare gains from innovation could be about the same size as the Pigouvian welfare gains. But this crucially assumes that all

⁴ The relative size of PV^I is also somewhat sensitive to the discount rate. This is because the benefits from one period's innovation occur across a range of future periods while the costs occur in that period. Thus, a higher discount rate reduces the discounted net gain from that period's innovation.

of the reduction in abatement costs was due to innovation—in practice a significant portion of the cost reduction appears instead to have resulted from deregulation of the railroads, which reduced the costs of transporting low-sulfur coal.

In the context of climate change, under the Kyoto treaty the United States has pledged to reduce emissions of carbon and other greenhouse gases by around 30% below baseline levels in 2010. In this case the prospects for innovation to substantially cut abatement costs are less promising since there are currently no end-of-pipe technologies for scrubbing carbon. It seems unlikely to us that US dependency on fossil fuels, and hence carbon abatement costs, could be cut by 50% in 10 years from innovation. For these two examples then—sulfur and carbon—our guess is that PV^I is smaller than PV^P .

Further Discussion

To sum up so far, we find that the conditions for the welfare gains from innovation to be larger in magnitude than the welfare gains from pollution control seem to be fairly stringent: not only must innovation have the potential to reduce abatement costs substantially in a short period of time, but also the initially optimal level of abatement must be pretty modest. But there are a number of qualifications to this result; our analysis is only a preliminary stab at assessing the relative welfare gains from innovation.

Our analysis assumes that technological innovation is always costly. However there is a possibility that some, perhaps more incremental, innovation may occur over time through learning-by-doing, rather than through deliberate investments in R&D efforts (Goulder and Mathai 2000). In this respect we may have overestimated to some extent the costs of innovation, and understated the welfare gains from innovation.

In practice, environmental policies may not be set to reduce emissions optimally. A possible reason is dispute over the benefits from reducing pollution, which are often difficult to quantify. In addition, for political reasons governments may be unwilling to implement environmental regulations if they would cause significant economic harm. If the full benefits from emissions control cannot be reaped, the case is strengthened for focusing policies more on promoting innovation. In some ongoing research, Carolyn Fischer is assessing the welfare gains from innovation in the (more realistic) case when environmental regulations are set sub-optimally.

In our analysis the benefit from innovation includes

the spillover benefits to other firms in the polluting industry in terms of reduced abatement costs from innovation at one firm. But other spillover benefits might be present. For example, if firms adopt energy saving technologies, they may lower production costs in addition to satisfying an emissions limitation. But we have to be careful here: to the extent that innovations would produce benefits to firms even in the absence of pollution controls, these benefits should already be internalized by firms, subject to the caveat that imperfections in the patent system may prevent full appropriation of spillover benefits.

Finally, in one respect our analysis may overstate the welfare gains from induced innovation. Our analysis is partial equilibrium, and only considers efficiency impacts in the market for environmentally focused innovation. But as discussed by Nordhaus (1998) and Goulder and Schneider (1999), more resources for environmental R&D may crowd out some R&D in other markets of the economy, for example R&D into ordinary commercial (i.e., nonenvironmental) innovations, including more efficient production methods and new products. If, as appears to be the case, the social benefits from R&D in these markets exceed the private benefits, there will be an indirect efficiency loss in these markets that is not taken into account in our analysis.

Concluding Remarks

Although subject to some qualifications, the results of Parry et al. (2000) cast doubt on the assertion that the welfare gains from induced innovation dominate the welfare gains from pollution control. From a cost-benefit perspective then, this implies that pollution control may be a more important consideration than innovation incentives in the design of environmental policies. But

this is not to say that technological innovation is unimportant. Clearly, the welfare gains from induced innovation could still be significant, even if they are smaller than the welfare gains from pollution control. Moreover, over the very long run innovation can greatly reduce the costs of protecting the environment, even if in present value terms, the cost savings appear fairly modest.

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Figure 1

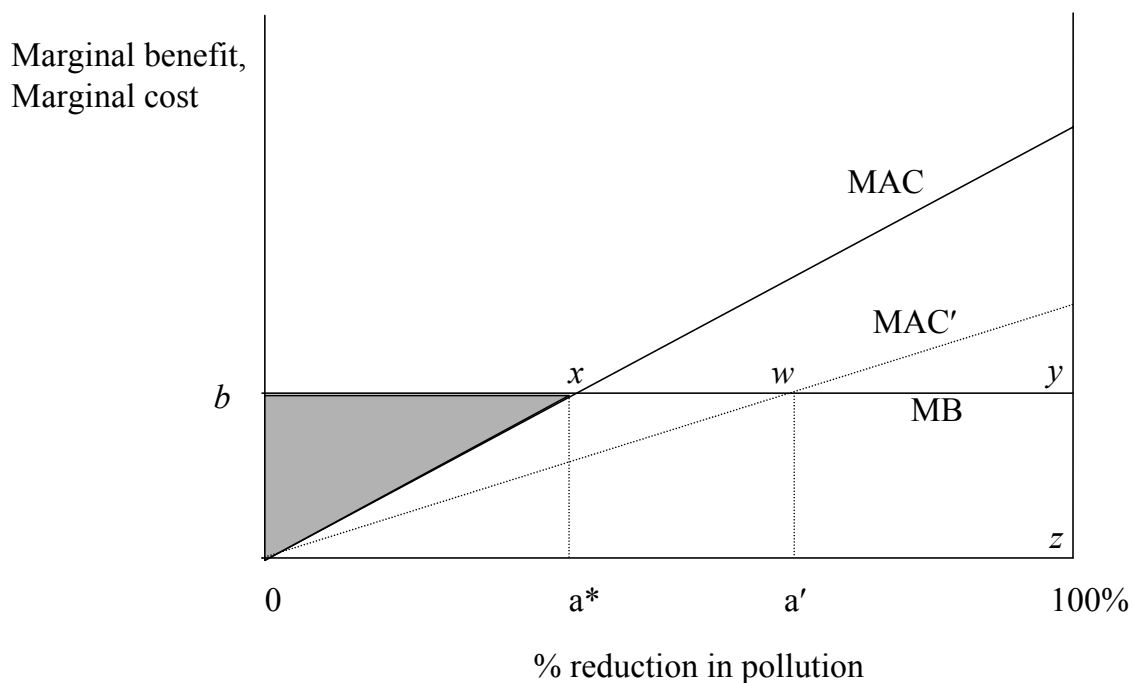


Table 1: Ratio of Welfare Gains from Innovation to Welfare Gains from Pollution Control, PV^I/PV^P

Pigouvian abatement level	Time lag until abatement costs halve		
	10 years	20 years	40 years
10%	2.98	0.88	0.16
40%	1.07	0.46	0.16
60%	0.79	0.41	0.17

The Political Economy of Greening the National Income Accounts

by Gernot Wagner*

While the United Nations and many other countries are actively exploring green accounting, official efforts in the United States have come to a virtual halt. In 1994, Congress commissioned a high-level study reviewing the Bureau of Economic Analysis's (BEA) work on its Integrated System of Environmental and Economic Accounts (ISEEA), but since its publication in 1999 has ignored the results and continued to bar BEA from its efforts. The debate surrounding green accounting in the U.S. should be freed from the partisan struggle in Washington and moved in the hands of the scientific community. Green accounting efforts should seriously focus on including ecological services as well as mere resource depreciation, but in line with the recommendations of Nordhaus and Kokkelenberg (1999), the existing national income and product accounts framework should be used as a point of departure, and the creation of official accounts should employ an incremental approach, giving first priority to areas where the necessary research is available.

History of Green Accounting in the U.S.

In 1989, Repetto *et al.* (1989) drew considerable attention to the shortcomings of economic indicators in a report entitled *Wasting Assets*. Using Indonesia as a case study, it concluded that the country's reported economic growth throughout the 1970s and 80s would be cut in half if GDP calculations were modified to a so-called "Net" Domestic Product, taking timber, oil, and soil depletion into account. This World Resource Institute study was by no means the first to point out major shortcomings in national income measurements, but it sparked a considerable debate about "green accounting"—integrating environmental and economic accounts.¹ At that time, the U.N. Statistical Office was working in cooperation with several other international institutes and expert groups to amend its System of National Accounts (SNA) for publication in 1993, the

first major revision in almost three decades. The 1993 revision did not include guidelines for an integrated system of environmental and economic accounts, but in the appendix suggested the use of so-called "satellite accounts" for environmental statistics. Such a system leaves the core economic accounts untouched while providing some environmental information in a compatible, yet not fully integrated, set of supplementary statistics (SNA 1993: chapter XXI). In addition, the U.N. (1993) published a handbook on the system of integrated environmental and economic accounting (SEEA), with the goal of guiding national accountants in their efforts to create physical and monetary environmental statistics.

BEA is implementing the recommendations presented in the SNA with some modifications in its National Income and Product Accounts (NIPA). Even before the publication of the U.N. handbook, it had started to compile its own version of Integrated Environmental and Economic Satellite Accounts (IEESA) in 1992, following a recommendation of the Council of Economic Advisers under President Bush.² Two years later, BEA (1994) presented initial findings in its monthly *Survey of Current Business*. The issue included an overview of its efforts, as well as guidelines for the future and preliminary estimates for mineral resources. With the 1995 Appropriations Bill, however, the 103rd Congress stopped BEA's work on all environmental accounts. In response to this order, the Department of Commerce, of which BEA is a part, asked the National Academy of Sciences (NAS) to review the current state of environmental accounting in the U.S. (U.S. Congress, 1994). In 1999, a commission of leading environmental economists and national income statisticians published *Nature's Numbers*, which analyzed the state of green accounting in the U.S. and prospects for future work (Nordhaus and Kokkelenberg, 1999). The study concluded that extensive research is still needed for developing a consistent set of accounts, but that "the rationale for augmented accounts is solidly grounded in mainstream economic analysis" and that BEA's work on IEESA is the best place for this research. So far, however, Congress has given BEA no mandate to continue its work on environmental accounts.

Politics of Green Accounting

Throughout the last decade, the issue of green accounting has been highly polarized. The political

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¹ For earlier critiques of the national income accounts, see Nordhaus and Tobin (1972) and Eisner (1988), among others.

² Earlier calls for environmental accounting in the U.S. reach back even further. The Ford Administration was the first to call for environmental accounting to track capital investment expenditures on pollution abatement, an initiative supported by President Carter (Nordhaus and Kokkelenberg (1999), p. 154).

debate splits along party lines: generally speaking, Democrats have favored environmental accounting, while Republicans have opposed it. In *Earth in the Balance*, Vice President Al Gore (1992) called for a full integration of environmental and economic accounts, even though he acknowledged that national accountants did not believe this was feasible given the state of knowledge at the time.

President Clinton also addressed the importance of environmental accounting in his 1993 Earth Day address. Following the publication of the NAS study *Nature's Numbers*, the 2000 Economic Report of the President included an entire chapter on "Making Markets work for the Environment," which contains a discussion entitled "Taking Account of the Environment." In this section, the President's economic advisors stressed the lack of "a coherent framework for accounting for environmental quality and natural resource use in tandem with market economic activity" and referred to the recommendations presented in *Nature's Numbers*. They urged the creation of supplementary accounts for "assets and production activities associated with natural resources and the environment." The conclusion specifically states that integrated environmental and economic accounts do not merely contribute to the understanding of societal welfare or human development but to the nation's economic development ("Economic Report of the President," 2000). Consistent with the platform of the Clinton administration, congressional Democrats have also been in favor of green accounting.

One notable exception in this support, however, was the decision of the 103rd Congress to stop funding for BEA's green accounting activities. Alan B. Mollohan, a Democratic House Representative from West Virginia and a longstanding member of the Appropriations Subcommittee responsible for allocating funds to the departments of Commerce, Justice and State, sponsored the bill (U.S. Congress, 1994). This is not surprising, considering that he represented a district in West Virginia's coal country. The National Mining Association indicated it did not actively lobby on the issue, but it did express support of Representative Mollohan's action.³ Mining corporations are afraid of being marginalized by a reform of the SNA and that instead of producing tangible wealth, their activities would be viewed as depleting one form of (natural) wealth and creating other forms of (human-made) wealth—a potential blow to their public image. Despite calls from economists and national

³ According to Connie Holmes, Vice President of Policy of the National Mining Association, formerly known as the National Coal Association (phone conversation on January 30, 2001).

income accountants negating this claim, it was used as one of the arguments in support of Congress's decision to stop BEA's activities, which overshadowed the fact that the stop had its scientific merits. Similarly to the development of NIPA in the early parts of the last century, green accounting is a highly contentious field with many methodological problems. Moving the discussion from BEA to an independent scientific panel was an important step to reexamine the underlying issues. However, now that the findings have been published, Congress should again give BEA the opportunity to continue its research.

Congress commissioned the NAS study when stopping BEA's efforts, but the publication of *Nature's Numbers* has been ignored.⁴ This is not surprising to political scientists, who would be hard pressed to cite an example of when an NAS report triggered direct political action. Members of Congress answer to their constituents, not to scientific panels, unless it is politically expedient. The main ideological argument on the side of Republican lawmakers is that integrating environmental statistics into economic data would give what some might consider 'environmentalist ideas' too much weight in economic decision making. Instead of being based purely on intangible values and quality of life factors that are virtually impossible to measure, an integration of environmental and economic accounts would give these ideas real dollar values, providing quantifiable data and therefore rendering them comparable to other policy decisions.

Ironically, Republicans are in favor of benefit cost analyses while Democrats generally oppose it. However, this division is reversed when it comes to taking account of ecological services. One example is the debate of mechanical treatment versus controlled burning in forest management.⁵ Republicans, backed by the forest industry, favor mechanical treatment, while Democrats, catering to greens, prefer controlled burnings. However, the two parties support their positions with entirely different sets of facts. The Republican arguments for mechanical treatment are largely backed by hard economic data such as the number of jobs created in the logging industry. Democratic arguments for controlled burns, however, are to a large extent based on "soft" data such as increased ecological value. Assigning a dollar value to the ecological services a healthy forest provides,

⁴ After the 103rd Congress halted BEA's work, every successive house report to the annual Appropriations Bill included a passage barring BEA from its work on the IEESA.

⁵ See Bennett (2000) and Udall (2000) for a more complete discussion of this issue.

would put the argument for burning on equal footing with the economic arguments favored by Republicans. It is not surprising that the GOP would therefore oppose any such attempts to integrate environmental and economic accounts.

The debate of whether or not to go ahead with green accounting in the U.S., however, should rise above party politics. As Nordhaus and Kokkelenberg (1999) concludes, “a set of comprehensive accounts would illuminate a wide variety of issues concerning the economic state of the nation” (p. 158). Many theoretical and methodological issues have yet to be resolved, but this should be reason for an expansive research agenda, not for a stop of BEA’s efforts.

The public debate in green accounting is currently dominated by the emerging field of ecological economics. Costanza *et al.* (1997a) attempted to evaluate the entire globe’s environmental services drew considerable public attention. There is definitely some merit in this work for the environmental community, but such numbers have very limited value for economic policy in the U.S.⁶ Rather than estimating total “Green GDP,” analysts who aim to influence policy should focus on specific environmental values in the form of satellite accounts. Research efforts should focus on smaller aspects of green accounting that correspond to clear policy questions. The debate surrounding prescribed burning versus mechanical treatment, for instance, could be considerably improved by means of U.S. forest satellite accounts. Similarly, such accounts could aid in the policy analysis of the Forest Service’s Roadless Area Conservation initiative.

Application to Forestry

Nature’s Numbers also identified the refinement of timber value estimates as a next logical step in the implementation of the IEESA, and offered concrete suggestions. In its previous estimates, BEA used a shortcut approach similar to Repetto *et al.*’s method in *Wasting Assets* which is theoretically incorrect and, in practice, can vastly overestimate actual timber values.⁷ Nordhaus

⁶ See Bockstael *et al.* (2000) for a comprehensive critique of Costanza *et al.*’s work, as well as Daily *et al.* (1999) for further explorations of the underlying issues.

⁷ Under idealized conditions of a single, managed forest stand in perfect rotation sustaining its annual harvest at a constant rate into perpetuity, the Repetto method underestimates the actual timber value, since it ignores future timber growth and undervalues all tree stands up to the optimal rotation age. Since in most countries only a fraction of the total forest area is

et al. propose an alternative method for timber evaluation based on an unpublished manuscript which has been further developed by Jeffrey Vincent (1999). *Nature’s Numbers* erroneously states that the present discounted value (PDV) method, which calculates the current value $V(t)$ as the sum of discounted future income streams, harvest rate $q(t)$ times stumpage value $p_s(t)$, to yield

$$V(t) = \sum_{t=0}^T \frac{p_s(t)q(t)}{(1+r)^t},$$

is only theoretically correct for the case of “timber mining” of old-growth forests (Nordhaus and Kokkelenberg, 1999: p. 137–8.). The study then suggests the use of Vincent’s method for managed second-growth forests. However, Vincent’s approach is derived from this PDV method. Assuming T equal infinity, the PDV method correctly depicts the timber-value for any forest type—regardless of whether it is an old-growth or managed second-growth forest. Vincent’s method still has the significant advantage that under certain conditions, it is easier to use current data, rather than future projections, which are required for the PDV approach. Nevertheless, the quality of physical forest data in the U.S. does not allow the Vincent method to be used to calculate precise results due to its particular sensitivity to fluctuations in forest area estimates. It is easier to obtain future projections of quantity and price paths than accurate current area data. Considering these caveats, it is relatively straightforward to calculate a theoretically correct set of timber values using the standard PDV approach in conjunction with projections based on already existing physical timber models (Wagner 2001).

Accounting for Ecological Services

Timber-values, however, are only part of the picture. Nontimber values arguably constitute a much larger fraction of the total forest value. Considering the functions of watershed protection, prevention of soil erosion and the provision of wildlife habitats, as well as use and existence values, estimates of nontimber values are of crucial importance for policy evaluations, as in the case of prescribed burnings versus mechanical treatment, or the Roadless Area Conservation initiative. While the theory for including timber values is relatively well developed, the rationale behind including other ecological values has been less investigated. Even the question of whether or not to account for these services is a contentious issue. The ecological economics argument is based on the idea that we should focus on total societal welfare instead of economic welfare, and that human

optimally managed and old-growth forests are considerably overvalued, in practice, the Repetto method overestimates the actual timber value.

society is an integral part of the natural world.⁸ This criticism of neo-classical economics has its validity, but the answers provided are still inherently flawed and impractical. Our national income accounts have served us well in economic policy decisions, and currently practical solutions should focus on them as a point of departure.

In particular, one ought to start with the definition of what it is we are trying to measure. Martin Weitzman accomplished this for the case of the depreciation of natural resources in 1976.⁹ Weitzman's paper lends theoretical credibility to the creation of timber accounts, but it does not do the same for comprehensive forest accounts. A theoretical argument would have to follow the notion of expanding the production function itself to include ecological services and provide a credible relationship between timber extraction and decreases in services the forest is able to provide.¹⁰ Aggregated to a global scale, this calculation would evoke the same misleading notion criticized in Costanza *et al.*'s *Nature* article. This fallacy, however, can be avoided by applying the concept to a considerably smaller level, in this case, U.S. forests.

In contrast to timber accounts, which are theoretically well grounded, comprehensive forest satellite accounts would involve large uncertainties inherent in nonmarket valuation techniques. Nevertheless, attempts are being made to overcome these barriers.¹¹ In this regard, green accounting can also have a positive impact on the traditional nonmarket evaluation literature since it uses the same valuation methods.

Conclusion

Nature's Numbers makes clear that timber accounts illustrate an area appropriate for immediate implementation, even though the specific procedure cited should be questioned. It would be premature to fully integrate ecological services into a comprehensive set of forest accounts, but more research in this area would undoubtedly be of high value to both green accounting efforts and, to a lesser extent, also to the nonmarket valuation literature. There are clear economic policy arguments for integrating environmental and economic accounts. The fact that some tough theoretical questions must still be addressed should not deter from tackling the issue, but should rather act as a call for more funding and research. Whether and how to use the actual accounts in policy decisions will undoubtedly be a political issue, but the debate about creating the numbers in the first place should be moved from the political arena back to BEA and the economics community. Instructing BEA to resume work on a domestic green accounting system, in accord with the NAS recommendations, would be a first necessary step to do so.

⁸ Very accessible overviews of this issue can be found in *You can't eat GNP: economics as if ecology mattered* by Eric Davidson (2000) as well as in Jane Jacobs (2000). Costanza *et al.* (1997b) contains a comprehensive discussion of the ecological economics perspective.

⁹ Weitzman (1976) proves that including the net-depletion of subsoil assets in a comprehensive Green NNP measure sets it equal to the current sustainability equivalent of production, a notion which could equally well be applied to the depreciation of timber.

¹⁰ See Heal (1998) for a comprehensive treatment of this subject.

¹¹ Compare Adger *et al.* (1995) who created comprehensive forest accounts for Mexico.

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