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## Research and Development

The winter issue of *Resources* is the one in which we thank all those who generously supported RFF's work in the last year (see pp. 18–19). Accordingly, I'd like to use this space to talk about "development"—the fundraising part of the operation of a research and educational organization like RFF. To my way of thinking, development is a *substantive* concern. I say so for several reasons.

First and most obviously, we have to be able to pay our bills. No matter how smart RFF's researchers are, no matter how focused on the issues, no matter how skillfully communicated are their results—all is for naught if we cannot attract support.

To give you a sense of the task at hand, even after allowing for the income from our endowment, we must raise about \$25,000 per working day to meet our annual budget. That's why presidents of nonprofits have gray hair, or none at all as in my case!

Development does not proceed independently of the research program. The individuals, foundations, and corporations that support RFF do so because they believe in the quality and independence of our work. They know we will collect all the relevant data for whatever problem is at hand, analyze those data in the most sophisticated way possible, follow the facts wherever they lead us, write up our findings in a clear and convincing way, and make the results available to *everybody* in the policy debate. And they know they can count on these high standards of research on climate change (p. 6), environmental protection in emerging market economies (p. 10), biodiversity, risk management, transportation policy, and the many other issues on which RFF scholars are busily engaged.

Successful fundraising depends not only on a well thought out and carefully executed program of research. It also depends on listening carefully to those from whom one is seeking support. Let me not mince words. I'm sometimes asked whether fundraising is the price I have to pay for the pleasure of interacting with my wonderful colleagues at RFF. The answer is an unequivocal "no."

I've never walked away from a meeting with an individual, foundation, government, or corporate supporter without having learned something I didn't know before. And I do my level best to relay what I've learned to my research colleagues. RFF's research agenda is better focused as a result of this interaction.

Thanks once again to all of you that helped make last year the best in RFF's history from both a financial and a research standpoint. That's the substance on which we're building in anticipation of an even better 1999!

A handwritten signature in dark ink that reads "Paul Portney". The signature is written in a cursive, slightly slanted style.



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## GOINGS ON

## New RFF reader

*Resources* is the subject of a new RFF book. Since 1959 the quarterly publication has shared with the public relatively succinct versions of the more salient findings of the research staff. Now RFF University Fellow **Wallace E. Oates** has gleaned from the files some of those feature articles most frequently requested over the years to create the *RFF Reader in Environmental and Resource Management*.

Oates' teaching career helped inspire the book, he explains in his introduction. As a professor of economics at the University of Maryland, he found himself relying on selected articles from *Resources* for class instruction. A compilation of the most useful of the articles in a single place seemed like a good idea.

The articles appear in their original form and their order of appearance roughly parallels the structure of some university courses. Although the articles serve the needs of students very effectively, Oates adds, they should also be of real interest to the larger community concerned with environmental and resource management.

The contents include essays on such key policy issues as Superfund and global climate change. They also include analyses of the tools of the trade—not only regulation and benefit-cost analysis, but also less familiar concepts like risk analysis, and the role of science in setting environmental policy.

There are essays on resource management, biodiversity, and sustainable development. There are others on environmental justice in this country as well as on equity issues in developing nations and transitional economies.

All but two of the book's selections come directly out of *Resources*. The exceptions include a widely cited article on sustainable growth by the Nobel Prize winning economist (and RFF Board member) **Robert M. Solow** and an introduction to global climate change, which RFF commissioned from former *Washington Post* writer (and RFF journalist in residence) **J.W. Anderson**.

The *RFF Reader* is testament to the longevity of some research findings. Still, the authors do reference events and advances that have occurred since they first wrote these articles. Their updates are included here, along with recommendations for further reading.



To order a copy of the book, see page 20. On the Internet, go to [http://www.rff.org/books/descriptions/rff\\_reader.htm](http://www.rff.org/books/descriptions/rff_reader.htm)

## Saving biodiversity through self-interest

Participants from around the globe gathered in Savannah, Georgia this past fall for a major conference on how to stimulate incentives for protecting species and their habitats. RFF helped the Electric Power Research Institute co-sponsor

the three-day event entitled "Managing for Biodiversity: Incentives for the Protection of Nature" along with the Smithsonian Institution, The Nature Conservancy, Elsevier Science, and the Southern Company.

Program organizers pointed to the emerging recognition of species and their habitats as important contributors both to human enterprise and well-being. Identifying more connections between the value of species and a company's bottom line could provide the rationale for spending more money on protection.

Of course, businesses also have to balance the value received against the cost incurred. At the opening session RFF President **Paul R. Portney** spoke to the need for more experimentation to achieve cost-effective conservation. Later, RFF Fellow **James Boyd** offered observations on the costs of alternative habitat conservation policies. Boyd also reported on an economic analysis that he and Fellow **R. David Simpson** did of a number of conservation easement contracts in Florida. (See the related story on page 14.)

The conference brought together several disparate groups to discuss how economics, science, and policy might encourage people to conserve land that is home to diverse plants and animals. Topics ranged from the merits of bioprospecting and ecotourism to the outlook of the European Union and the Pacific Rim on



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the general subject of incentives for the protection of nature.

Speakers and their listeners included managers in energy and natural resource industries like timber, mining, and petrochemicals, as well as policy-makers and natural resource managers from government agencies and nongovernmental organizations. Biologists, ecologists, other scientists, and environmental risk managers also attended.



For more information about the conference program, contact Bill Coleman, manager, Biodiversity Protection R&D, EPRI 650-855-1084; [wcoleman@epri.com](mailto:wcoleman@epri.com)



## GOINGS ON

### Cleanup not a job threat

Environmental policies involve costs that are unevenly borne by industries and individuals across the economy. The possibility that workers could be hit hard in heavily regulated industries has led labor leaders to fret that increased environmental regulation costs jobs. Business leaders echo the claim.


Just how big is the “job versus environment” trade-off? Not very, researchers in RFF’s Quality of the Environment Division report. Indeed it’s possible that such a trade-off may not even exist, according to **Richard D. Morgenstern**, **William A. Pizer**, and **Jhih-Shyang Shih**.

The three recently studied four heavily polluting industries (pulp and paper, plastics, petroleum refining, and iron and steel) to see whether increased environmental regulation can influence demand for labor. They assessed the effects of increased environmental spending on employment levels in terms of several distinct consequences, including higher production expenditures, lower demand for output, and changes in labor intensity.

After considering the ways the three types of consequences offset each other, the researchers found that increased environmental spending generally does not cause a significant reduction in industry-level employment.

They estimated that a million dollars of increased environmental spending leads to a

loss of about one full-time job, although this finding was not statistically significant. And in two of the industries they examined, a significant *increase* in employment occurred after environmental spending rose.

 For a complete description of the methodology and results of the study, download “Jobs versus the Environment: Is There a Trade-off?” (RFF Discussion Paper 99-01) at [http://www.rff.org/disc\\_papers](http://www.rff.org/disc_papers). To order by mail, see page 20.

### Model behavior

EPA’s attempt to forecast reductions in tailpipe pollution by modeling the outcome of state vehicle inspection and maintenance (I/M) programs has some serious shortcomings, RFF researchers say. **Winston Harrington**, **Virginia McConnell**, and **Matthew Cannon** came to that conclusion after they assessed how well the agency’s “MOBILE” computer model reflects the actual behavior of drivers, mechanics, and state regulatory authorities.

The researchers focused on the model’s use in estimating the number of credits states earn for reducing emissions through I/M programs. They concluded that the model’s calculations are “overly optimistic” about actual emissions reductions likely to occur through these programs.


Generally speaking, the model’s biggest flaw is simply that it is insufficiently realistic, the researchers contend. It does

not reflect what is really happening in I/M programs today. Many of the assumptions that underlie MOBILE’s configuration are based on relatively small amounts of data collected in a laboratory setting. And the output is difficult to compare with real world data from ongoing state programs about such things as effectiveness of vehicle repair and program participation. It also does not incorporate motorists’ actions taken in response, such as scrapping their cars or selling them outside the region subject to I/M regulations.

Revealing the EPA model’s assumptions about I/M program methods and results was a major part of the RFF assessment. Right now, states that use the model to tally their credits earned through I/M program emissions reductions enter a handful of parameters that characterize their programs and the model calculates the credits the states can use in the future. This arrangement makes it unnecessary for states to either

confirm or contradict the model’s assumptions, let alone try to match the forecasts with actual reductions.

The researchers stress the need to use evidence from ongoing I/M programs rather than rely on abstract assumptions. They suggest that the larger issue of how to grant credits for I/M programs should be reassessed.

 To download a copy of “A Behavioral Analysis of EPA’s MOBILE Emission Factor Model” (RFF Discussion Paper 98-47), go to [http://www.rff.org/disc\\_papers](http://www.rff.org/disc_papers). To order by mail, see page 20.

### Insuring with gas

Paying for car insurance at the fuel pump is an idea that has been kicking around at least since Henry Swift Ives of the Cincinnati Automobile Club promoted it in a speech in 1925. Instead of paying fixed, lump sums to finance auto insurance, why not just pay a few cents extra every time you



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gas up and make the collection system as simple and painless as possible, Ives asked.

Proponents of what is now known as “Pay-at-the-Pump” (or PATP) have been asking the same question ever since.


**J. Daniel Khazzoom**, who organized an RFF workshop in January to address criticisms of the concept, sees economic efficiency through PATP. He also sees other benefits that flow from efficiency: equity, safety, lower insurance cost, enhanced welfare of the poor, improved quality of the environment, and less global warming.

In his papers on the subject, Khazzoom notes that the current fixed-cost nature of auto insurance destroys any incentive to cut down on driving, even though miles traveled increases both accident risk and environmental degradation. Under PATP, however, the connection between the price of insurance and these factors would be made. The more you drove, the more you would pay for insurance in the form of a surcharge tacked onto the price per gallon of gasoline. If your vehicle didn't get good gas mileage, you would pay more, also.

Aside from the environmental benefits, PATP would mean universal insurance coverage. Everyone who purchased gas at the pump would automatically purchase insurance, too, thus eliminating the inequity and expense of subsidizing uninsured motorists.

Despite the merits that proponents point to, however,

PATP has failed to pass muster in any state legislature that has taken the proposal up. Khazzoom believes it is time for proponents and critics to sit down together and see if they can resolve their differences. The January workshop was a first step in the process.

 For more information on PATP and the workshop, contact J. Daniel Khazzoom; [khazzoom@rff.org](mailto:khazzoom@rff.org). Khazzoom is a professor of quantitative studies at San Jose State University. In 1997–98 he was a Gilbert White fellow in RFF's Quality of the Environment Division.

## Climate beat

Climate policy continues to be a major focus of activity at RFF. In addition to sponsoring the digital forum *WeatherVane*, RFF continues to host “live” talks on the topic in all its intricacy and controversy.

Following a June 1998 workshop with European researchers and officials, RFF held a second event in October, which featured an exchange of views between U.S. and Japanese analysts.

**Masahiro Kuroda**, a professor at Japan's Keio University, co-hosted the event with **Michael A. Toman**, who directs RFF's climate economics and policy program. Some twenty analysts from both countries discussed their positions on emissions trading, joint implementation, and the use of the Clean Development Mechanism to support cooperative efforts between economi-

cally developed and emerging nations to reduce greenhouse gas emissions.

 For an outline of the workshop discussion and points of agreement, go to [http://www.weathervane.rff.org/research/US-japan\\_flex.html](http://www.weathervane.rff.org/research/US-japan_flex.html) or contact the co-hosts: Masahiro Kuroda, [kuroda@fbc.keio.ac.jp](mailto:kuroda@fbc.keio.ac.jp); Michael Toman, [toman@rff.org](mailto:toman@rff.org).

RFF's **Wednesday Seminar Series** continues to be a forum for airing some high-profile opinions on climate.

At a seminar held in December, Yale University's A. Whitney Griswold Professor of Economics **William D.**

**Nordhaus** pronounced the Kyoto Protocol “flawed, maybe fatally” so.

To a standing-room-only crowd, Nordhaus pointed out two main defects. First, the protocol imposes no constraints on the rapidly growing emissions of greenhouse gases in developing countries. Second, it relies on emissions trading as a way to limit emissions quantities. Since great uncertainty—and probably volatility—exist about the prices of such permits, Nordhaus said it would be better to use a system of harmonized carbon taxes.


Before another capacity crowd in January, RFF University Fellow **Hadi Dowlatabadi** discussed the effects of climate change on human health. Growing the global economy remains the best way to promote public



health worldwide—more so than curbing climate change, he believes. Having said that, however, Dowlatabadi cited a number of reasons why health conditions might not improve despite economic growth.

As for trying to estimate the economic costs of climate change, Dowlatabadi doubted that we can. Amid profound change, costs cannot be calculated nor cost-benefit analysis applied, he said. It might be more useful, he suggested, to take a legal rather than an economic approach and consider the rights of people threatened by climate change.

Dowlatabadi's opinions are based on years of research directing Carnegie Mellon University's Center for Integrated Study of The Human Dimension of Global Change.

 For a synopsis of each of these lectures, see J.W. Anderson's briefings at <http://www.weathervane.rff.org/archives>. For more information on RFF's Wednesday Seminar series, go to [http://www.rff.org/easy\\_instant\\_free.htm](http://www.rff.org/easy_instant_free.htm).



# At Buenos Aires and Beyond

by *J.W. Anderson, Richard D. Morgenstern, and Michael A. Toman*

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RFF analysts pinpoint where the latest round of international negotiations leaves us in the world's politically tinged efforts to cope with climate change.

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When several thousand diplomats, politicians, and lobbyists from nearly every country on earth met in Buenos Aires last November to talk about climate, they were pursuing a process of negotiations that had begun in the late 1980s. In 1992 that process led to the Framework Convention on Climate Change. The convention sought to avoid “dangerous interference” with the world’s climate, albeit without specific atmospheric goals or mandatory emissions limits. In late 1997 negotiators agreed on the Kyoto Protocol to the Framework Convention. If it goes into effect, Kyoto will set legally binding emissions targets for the industrialized countries, to be met in the period 2008 to 2012.

But the protocol omits, or leaves vague, a number of important points. These include the nature of commitments by developing countries, specification of mechanisms for international emissions trading, and terms for making qualified emissions-reducing investments in developing countries (the so-called Clean Development Mechanism). More broadly, the fate of any binding agreement on climate change hinges on a number of issues that, at least up to this point, have stayed below the diplomatic radar.

One is the issue of equity between rich countries whose emissions are high and poor countries whose emissions are low but rapidly growing. Other issues involve the high cost of quickly reducing emissions to meet Kyoto’s fairly demanding targets, which would begin less than nine years from now. A number of experts who readily acknowledge the virtue of taking actions to restrict greenhouse gas emissions also worry that the Kyoto targets may be too much, too soon, and too rigid.

In this article we first review the status of some of the main issues discussed at Buenos Aires and that remain part of the ongoing international dialogue on climate policy. We then turn to other issues that have received less public attention but are likely to loom at least as large in determining the ultimate fate of the Kyoto process.

## Emissions Trading and the Clean Development Mechanism

The United States continues to press hard for free and open trading in greenhouse gas emissions rights, relying in part on its own very successful experience with cost-reducing sulfur-dioxide trading by utilities under its acid rain control program. The Clinton administration has used figures implying that the United States could buy from other countries as much as 85 percent of the emissions reductions it needs to meet its Kyoto obligations, permitting substantial expansion of domestic emissions. These purchases could include a large quantity of low-cost surplus emissions permits that might be supplied by Russia. Other countries, especially several European nations, have denounced the U.S. strategy on several grounds. These include fears of lost competitiveness vis-à-vis the United States, doubts about the long-term U.S. commitment to reducing greenhouse gases at home, concerns about the integrity of Russian emissions permits, and beliefs that international equity requires domestic sacrifice by all developed countries. Critics of the U.S. view have demanded stringent limits on the number of permits that any country can buy abroad, which the United States has strongly resisted.

The Clean Development Mechanism could allow developing countries to be beneficially engaged in greenhouse gas limitation investments. Under the CDM, for example, a firm in an industrial country wishing to expand emissions at home might finance a facility such as a highly efficient power station in a developing country, reducing that country's emissions and providing emissions credits for the industrial-country investor. But the concept raises a number of questions that negotiators have not yet adequately addressed.

One is whether the CDM will require new institutions to facilitate and vouch for international trades. The CDM might be conceived as a centralized agency playing a role in screening, selecting, financing, and assisting in project implementation. But experience suggests that many of those functions could be carried out more effectively by the private sector. The CDM would also require some mechanism to measure, monitor, and verify the claimed reductions of emissions. No agreement exists on who would do that work, or how.

Further, the protocol says that a "share" of the proceeds from CDM projects is to be used to help particularly vulnerable countries meet the costs of adapting to climate change. There is no consensus on the size of this fee, or the administrative machinery for allocating and spending the money. Nor have the negotiators confronted the reality of who is to bear the burden of this fee. It will not be international investors who can choose from a diverse menu of competitive investment options. Rather, host countries will receive a lower net return on the projects.

The CDM remains a work in progress. Yet there is little time to spare in settling these questions since, under the protocol, credit for early emissions could begin in the year 2000.

### International Equity Debates

Progress on the Kyoto Protocol is slow not solely because of the technical, administrative, and political disputes on the current negotiating agenda, important though many of them certainly are. The lack of momentum is due also to a growing sense that larger questions must be cleared up before governments can confidently commit themselves to a treaty with enormous implications for their economic life.

A basic issue of equity underlies the tension

between some of the industrial countries, led by the United States, and most of the developing countries, led by China and India. The issue can be summarized by observing that in 1995 the United States emitted 20 metric tons of carbon dioxide per capita, compared with about 2.5 tons in China and just under 1 ton in India. Why, these and other developing countries ask, should we take control actions now when the rich countries have contributed so much more to the problem?

What is a fair solution to that disparity? There has been some discussion of formulae for national emissions limits that would eventually bring about equality in per-capita emissions between developed and developing countries at some point in the future. However, the viability of this approach is open to question, at least for a number of years. A per-capita emissions target for rich countries down near China's and India's current emissions levels would require the developed world to make draconian emissions cuts or gigantic payments to poorer countries for extra emissions rights. A target up near the United States' current level of emissions per capita implies such an immense increase in worldwide emissions that the whole treaty becomes futile. Any agreement on emissions "convergence" would have to occur well into the future to be acceptable to all the parties. Sufficient progress in developing nonfossil energy sources would also have to occur so that the convergence would meet longer-term climate protection goals without being seen as excessively burdensome by rich or poor.

In the meantime, other avenues exist through which to approach equity in ways that build on the self-interests of different countries. In the shorter term, for instance, leaders of some developing countries may agree to modest limits on the growth of their greenhouse gas emissions in order to reap collateral benefits at home—such as improved economic efficiency and reduced conventional air pollutants, which damage the health of their own citizens—as well as to increase the availability of international investment through the CDM or other channels. But for such activities to succeed, they must be seen as beneficial by developing as well as developed countries. The climate negotiations have only begun the difficult exercise of deciding what concepts of fairness can attract such agreement.

### Abatement Costs and Policy Design

The cost of emissions controls has figured prominently in domestic policy disputes, but has been much less significant in the international negotiations. Article 3.3 of the Framework Convention observes that “policies and measures to deal with climate change should be cost-effective so as to ensure global benefits at the lowest possible cost.” But this observation does not speak to the more fundamental question of what costs are seen as acceptable to bear in exchange for reducing the long-term risks of climate change.

The Clinton administration argues that the United States can achieve compliance with the Kyoto requirements for less than \$25 per ton of carbon avoided, assuming an idealized system of international participation in carbon control through emissions trading. Other estimates, some based on comparably pessimistic assumptions, go much higher, into the range of \$300 a ton. These figures are all produced by technically competent models. The differences arise from their varying assumptions about international emissions trading, and cost-effective opportunities for carbon abatement, among other factors.

The higher estimates have figured in the opposition within the U.S. Senate to ratifying the Kyoto Protocol. This deadlock over the cost figures is unlikely to be resolved until there is more information about abatement costs from actual experience. But the protocol does not allow for small-scale experiments. Instead, it would commit most of the industrial countries to substantial emissions cuts in the near future. The U.S. Energy Department estimates that, if nothing is done, emissions will be more than 30 percent above 1990 levels by the year 2010. Thus, U.S. compliance with the Kyoto Protocol—which would entail a 7-percent reduction below 1990 levels—would require cutting emissions by more than one-third below business-as-usual, and doing it in little more than a decade. This prospect raises another central question, this one about basic economic strategy.

Given the large uncertainties about the cost of reducing greenhouse gases, what is the best way to proceed? One option is to introduce more flexibility regarding the emissions target to be achieved. This flexibility could take the form of a ceiling on the cost of compliance. In the context of an emissions trading program the cost ceiling could be implemented by the

government standing ready to sell additional permits at a prespecified price. The price ceiling could start at a relatively modest level and escalate gradually over time, causing a corresponding drop in the total quantity of emissions.

Proponents of the Kyoto target may be correct in asserting that the costs are not that large—either because the economic models are underestimating the quantity of cheap reductions available or because international markets for greenhouse gas trading would flourish with developing country participation. If so, then additional permits offered by the government would not be needed to meet the Kyoto target. If the higher cost estimates are right, however, and firms did purchase additional permits, the emissions reduction would be less. But the burden on the economy would be limited to a predictable level.

Policy can set either price or quantity targets with some assurance, but not both. If the objective is to cap the cost of control, the amount of emissions actually eliminated cannot be guaranteed. If on the other hand the objective is to cut emissions by a certain amount, the cost of doing so cannot be predetermined, either. Environmentalists prefer the certainty of quantity over the certainty of cost. However, this preference does not give full weight to the fundamental differences between climate change and most other environmental problems. The uncertain and potentially large size of greenhouse gas abatement costs argues for a price ceiling to start the process, with the possibility of converting to a fixed-quantity approach once more information is available on the true costs of emissions reductions and agreed-upon mechanisms are established to better monitor international activities.

### Long-Term Timing of Emissions Control

Changes in the earth's climate, and thus the risks of climate change, are affected by the long-term concentration of greenhouse gases in the atmosphere, not simply by year-to-year increases in emissions. This reality highlights the need for a long-term focus in setting policy targets, in contrast to the Kyoto approach of setting one relatively near-term set of targets and leaving future targets open for negotiation.

A substantial body of economic analysis has developed since the start of the climate negotiations, which suggests that the lowest-cost path to any plausible longer-term target for greenhouse gas concentrations in

the atmosphere would start with relatively modest cuts in emissions, restricting them more severely in later decades. In this kind of scenario the price of emissions control would start at a low level, giving people time to learn the new rules and develop reliable data on strategies for operating in a low-emissions regime. Over time, the price would be increased as needed to keep the concentrations within the target.

One important reason for this gradual acceleration approach is that a faster turnover of capital equipment, like electric generating plants, might be very expensive. Another reason is that a more gradual approach allows greater opportunities for taking advantage of future developments in technology. There is a need to promote development of new technological options. This promotion could be enhanced through increased support for R&D as well as through the gradual but inexorable effect of rising energy prices.

### Where Do We Go from Here?

As we noted at the outset, a number of policy issues within the scope of the Kyoto Protocol remain to be worked out. On international trading mechanisms, while there is room for compromise, we believe that the positions held by the United States and its allies in the debate are basically sound. In practice, achieving the Kyoto targets requires the kind of extremely flexible and cost-effective policy mechanisms that the United States advocates. The private sector can play the lead role in developing the necessary market mechanisms for trading. We further believe such mechanisms can be developed without compromising the integrity of emissions targets through development of appropriate international capacities for monitoring

and compliance evaluation. The results will not be perfect but, to cite a tired Washington cliché, perfection should not be the enemy of the good in international climate policy.

Yet, these efforts will not address some of the more fundamental concerns we have raised about the path on which the world has embarked to restrict greenhouse gases, concerns related to cost, timing, and economic uncertainty. The kinds of policies we have described above provide a long-term approach to a long-term risk, and they reduce short-term uncertainty about costs. Of course, a long-term approach cannot be carved in stone today, since our current analyses require assumptions that, in many cases, are little more than educated guesses. However, some concrete first steps along the lines we have discussed could provide opportunities for experimentation and learning in an area in which we believe policy cannot wait for complete scientific and economic certainty.

Issues of equity, cost, and long-term strategy are only partially on the climate negotiators' agenda. But it seems unlikely that an effective international agreement on greenhouse gases will go into effect until these concerns are seriously addressed. Some of the policies we have discussed are inconsistent with the Kyoto Protocol. They nonetheless should remain part of the policy debate, since international climate policy is a work in progress.

*J.W. Anderson is RFF's Journalist in Residence. Richard D. Morgenstern is a visiting scholar in RFF's Quality of the Environment Division. Michael A. Toman directs the Energy and Natural Resources Division.*



# Environmental Liability in Transition

## A Look at the Record in Hungary

by *Maria Csanádi and Ruth Greenspan Bell*

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The records of privatization in a former communist country offer a rare glimpse at how environmental liability fits into the puzzle of moving toward a market economy.

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When the Soviet Bloc crumbled almost ten years ago, countries in Central and Eastern Europe resolved to transfer into private hands property that had been under state control for forty-five years. Privatizing many thousands of industrial enterprises was complicated by a legacy of environmental neglect, sometimes predating communist times. The privatization process came to be entangled in questions about responsibility for environmental liability.

If such questions were new to privatization officials in what were once collective economies, they were routine to prospective buyers from the West. Years of experience with the Superfund regime in the United States caused them to worry about paying for past pollution; they were hardly reassured by the lack of clear liability principles in the former Soviet Bloc countries.

The transition to market-based economies has been going on for some time now. Nevertheless, little is known about how these countries have responded to investors anxious about how much liability might come with the facilities they purchased. Our ignorance about this issue is partly a consequence of government secrecy, but investors, too, have been reluctant to share specifics. As a result, whatever information is available has been largely anecdotal.

This article reports on one of the first opportunities to review the written records of a governmental entity responsible for privatization, in this case what is referred to here for simplicity's sake as Hungary's state property agency (SPA). The records reflect privatization activities between 1990 and 1998. Co-author Maria Csanádi traced how Hungary's SPA, with little law or experience to guide it, evolved in its management of contamination issues in privatization transactions. For Hungary, like many of its neighbors, did not have laws on compensation for the restoration of environmentally damaged industrial sites, should remediation be required; nor did it have soil cleanup standards. At the same time, however, Hungary's Civil Code, written long before site contamination became an issue, broadly provides that a purchaser acquires property with all rights and duties pertaining to it.

### The Records Reviewed

The Hungarian government made available for examination twenty-six hundred contracts memorializing privatization transactions. The transactions selected for study were those officially registered as having environmental aspects. In seventy-nine cases, the contracts clearly indicated SPA commitments to shoulder in some

way the cost of cleaning up contamination at the sites purchased. Another sixty-eight contracts set out similar commitments by the purchasers. However, many of the records examined were incomplete or contained inconsistent information, suggesting some caution in analyzing results. Whether these shortcomings were a result of the speed with which a transaction was conducted, sloppiness, or more fundamental problems (such as falsification of data) could not be determined.

In addition, privatized properties were not routinely subjected to environmental audits. Thus, it is impossible to verify, for example, whether the 147 transactions were the only ones that involved environmentally contaminated properties; in fact, it seems unlikely that they were. As in Poland, another country with an active privatization program, the issue of contamination was probably ignored unless raised by a purchaser. It is a safe assumption that numerous contaminated properties were transferred to domestic buyers without any consideration of environmental liability. Potential liability was a concern principally of prospective Western European and North American buyers, although not among all of them. Among the purchasers that did not express concern, some may have hoped to benefit in the short term precisely because of the uncertain legal environment.

### Sophistication in Three Stages

The records suggest that SPA treatment of environmental liability in the privatization process grew progressively more sophisticated as it developed in roughly three stages. As privatization began, Hungary developed its first laws to govern management of the process. But these laws did not address potential responsibility for onsite contamination. Officials acting on behalf of the state had little guidance on how to negotiate such issues.

A transaction involving the purchase of the Hungarian refrigerator manufacturer Lehel is an example of what occurred in this early period. Without specified cleanup standards, the SPA agreed to cover the cost of cleanup at the site, up to the total purchase price. When a post-purchase audit revealed significant site contamination, the record indicates that the purchaser responded by making only the first of two installments toward the purchase price. The buyer diverted the balance it owed to finance cleanup, and continues to bill the SPA for cleanup costs to this day.

In what might be considered the second stage of privatization, between 1992 and 1995, investors began to demand environmental guarantees. In some cases, purchasers sought blanket assurances of exemption from the costs of any future cleanup requirements. Or, they negotiated for discounted purchase prices to compensate for projected costs. In response, Hungary began to establish policies and laws, but the process of considering environmental contamination remained irregular at best. The SPA had not worked out consistent ways of obtaining site information from the Environment Ministry and the local environmental offices. Even when environmental obligations were placed in contracts, the SPA did not routinely communicate this information to the local agencies, which might have been able to track compliance.

In the third stage that began after 1995, Hungary developed laws with explicit provisions governing how environmental liability was to be handled in privatization. And by then the SPA had had time to develop institutional expertise (and was partly obliged by government order) to manage liability issues as part of the privatization process. As its understanding of the issue grew, the SPA also developed internal regulations to guide environmental negotiations. The percentage of a purchase price that the SPA would commit to cleanup fell from 100 percent to the 10- to 25-percent range, and a buyer had a limited time in which to claim it, usually three to five years.

### Audits Avoided

At the outset, Hungarian officials resisted involving environmental experts in the privatization process because they feared their input would slow or divert transactions, an approach that also characterized the early period of privatization in Poland. Eventually, however, the government included such experts on its transaction teams. This integration of environmental considerations into the privatization process should not, however, suggest that the SPA embraced its environmental responsibilities enthusiastically. The environmental experts were never made full members of the privatization team and were excluded from upper-level decisionmaking.

Nor did the SPA make consistent efforts to learn about site contamination. The review of the records indicates that the SPA commissioned pre-negotiation environmental audits in only a fraction of the transac-

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tions examined. Early in the process of privatization, audits were simply an unfamiliar tool for privatization officials; officials feared highlighting problems with the properties they were trying to sell and thereby weakening Hungary's negotiating position.

Over time, officials learned the utility of understanding site conditions, so as to be able, for example, to dispute sometimes extravagant purchaser claims of contamination. However, the closest Hungary came to mandating environmental audits was in the 1995 environment and privatization laws, which required a company or local environmental agency to report onsite conditions in the context of a real estate analysis prepared for privatization.

The SPA viewed environmental audits as costly and in conflict with other pressing objectives. The SPA's goal was to maximize proceeds from privatization as quickly as possible, and to minimize its own costs in the process. The environment was a secondary concern at best. In what might be characterized as a "Wild West" atmosphere, SPA employees were working under enormous pressure to complete transactions. On-the-job training matched them against some purchasers with much greater understanding of the issues. Documentation was poor, process controls were few,

and staff frequently had to make ad hoc decisions based on their limited experience, as did their supervisors and managers. Some transactions may have been tainted by outright corruption.

Perhaps the most significant effort the SPA made to understand the extent of the problem was a 1996 survey that the agency director commissioned of hazardous environmental contamination at the enterprises in which SPA still owned 50 percent or more of the shares. The survey relied on information provided by the enterprises themselves.

However, the review of the records showed that, for whatever reason, SPA made many commitments without audits. Of the seventy-nine contracts reviewed in which the SPA made some commitment to pay for cleanup, only about one-third involved an SPA-requested audit of the sites. The records do not show whether purchasers conducted their own environmental audits, how many of these were done, and how they affected negotiations. However, officials interviewed indicated their belief that large multinational purchasers routinely ordered audits, which supported cleanup costs on the high end. This belief alone raises questions as to why the SPA did not prepare itself better for negotiations with more audits.

### Guarantees Take Shape

Where environmental liability was addressed in the course of a transaction, the records indicate that the SPA took several approaches to facilitate transfers. In some instances, the state simply sold the clean parts of a physical plant or company and retained the polluted parts. In at least one case, the agency arranged for hazardous waste from the privatized site to be removed and trucked to a part of the property excluded from the purchase. The state retained responsibility for the part of the property with the relocated waste, which was placed in bankruptcy.

The state also offered financial guarantees, as it did in the case of the Lehel purchase cited earlier and in the energy sector. The guarantees usually earmarked portions of the proceeds from the sale of property. The designated funds could then be drawn down to cover the costs of cleaning up contamination onsite at the time the purchase contract was signed and for which the SPA had not contractually avoided responsibility. The SPA called such arrangements "undisclosed liabilities."

“First phase” privatization in the energy sector illustrates the government’s growing savvy. Having assessed the strength of its position in discussions with potential investors, the state was able to contract on favorable terms. The SPA agreed, for example, to cover a maximum of 10 percent of the purchase price for cleanup at gas company sites and 25 percent at electricity company sites. The agency also established tough criteria for drawing on guarantees. For example, the new owner of a firm had to prove a decrease in the value of share prices entirely related to environmental contamination. In addition, the new owner was allowed only three years to identify contamination and work out an environmental cleanup plan. The process of drawing on the state guarantees was made particularly difficult by a requirement at each step for approvals from the local environmental authority and/or the SPA’s environmental expert.

Other process and financial controls included requirements off and on from 1993 that the country’s Environmental Ministry be consulted before privatization officials made guarantees worth more than 100 million Hungarian forints (roughly \$480,000 in 1998 dollars). By the second phase of privatization in the energy sector (1996–98), local authorities, the SPA, and the Finance Ministry all had to approve cleanup investments.

### The State Cleans Up

Guarantees generated concern in the Hungarian government that cleanup commitments would drain profits from privatization. The growing oversight and limitations placed on guarantees reflect the SPA’s response to that concern. In fact, however, it appears that guarantees were rarely given and that guarantees supporting cleanup were rarely exploited. In the period studied, environmental guarantees amounted to about 74 billion forints. For purposes of comparison, total Hungarian proceeds from privatization through 1996 was 1,070 billion forints. Thus, roughly 7 percent of the proceeds from privatization were vulnerable to claims for cleanup.

More than 80 percent of these guarantees have now expired and it is possible to draw some modest conclusions. Despite investor concerns expressed in the course of privatization transactions, they ended up claiming only about 4.1 percent (3.1 billion forints) of

the funds earmarked for site cleanup, roughly three-tenths of 1 percent of total privatization proceeds. The relatively low claims disprove the general fear of the government and privatization experts that state property agents overcommitted themselves when they agreed to establish guarantees. The records do not reveal why so few purchasers used the guarantees to fund site cleanup. There have also been exceptions to the government’s general reluctance to pay for cleanup, such as a recent decision to allocate a portion of revenues from the sale of the “clean” part of a company to pay for remediation of the polluted part that the government retains.

In retrospect, guarantees and the other devices that Hungary used apparently helped the SPA close deals. In most cases, the solutions designed to respond to environmental liability were not costly to the government, at least in terms of having to draw down proceeds from privatization. It is unknown whether information about site conditions or alternate negotiating strategies might have improved the price Hungary received in some transactions or whether stronger bargains might have been struck. In some instances, Hungary appeared to be taking chances with guarantees that committed the state to support cleanup in the absence of site-specific information at the time of contract negotiation.

What the records do not tell us is also revealing. They do not, for example, tell us the status of contaminated sites now in private hands, or whether contamination poses environmental or health problems at those locations no longer under government control. The contracts reflect power relations between seller and buyers, more than they do any considered, deliberate environmental strategy. To the extent that this approach has deferred cleanup into the future, environmental liability may come home to roost as unfinished business, if the European Union membership to which Hungary aspires demands the eventual cleanup of contaminated sites.

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Ruth Greenspan Bell is a visiting scholar in RFF’s Center for Risk Management, where she directs IIIDEA (International Institutional Development and Environmental Assistance). [bell@rff.org](mailto:bell@rff.org)



# Incentives May Protect Nature, but Conservation Still Costs

Self-interest is being seized on of late as a promising way to save biodiversity and enhance environmental integrity. To explore prospects for land conservation that also benefit land owners, RFF participated as one of several co-sponsors in a major conference put on by the Electric Power Research Institute this past autumn called “Managing for Biodiversity: Incentives for the Protection of Nature.” (See the description of the conference in the “Goings On” section, page 3.)

As EPRI acknowledged in its invitation to conference participants, efforts to protect species and habitats and improve ecosystem health tend to be contentious. On a hopeful note, however, the conference organizers pointed to a recent convergence of policy, economic, and social trends that they say signal new opportunities to bridge the traditional gap between environmental and economic goals. The bridge would be built on conservation policies that incorporate flexibility, as well as on advanced scientific methods, and new business strategies that recognize the value of intact ecosystems.

Forward-looking policies could, for example, unlock the commodity value of such intangibles as ecological resources and ecosystem services, the organizers suggested. Eventually, a “currency” for species and habitats might even reflect an exchange value based on acknowledged contributions of biological diversity to ecosystem health and integrity.

RFF President Paul R. Portney and RFF Fellow James Boyd were among the invited speakers at the three-day event addressing incentive-based habitat protection from the perspectives of economics, science, and environmental policy. In his remarks at the opening session, Portney spoke to the first of these. Sounding a cautionary note, he pointed out that not all species and habitats can be preserved; we will have to engage in at least some “triage,” which will be controversial. Still, in keeping with the

conference’s general optimism, Portney observed that both environmentalists and developers can find some common ground in the recognition that society should spend its dollars on habitat preservation so as to do as much good as possible. What is needed, Portney concluded, is plenty of experimentation to see how close we can come to maximizing biodiversity preservation, given available budgets.

Jim Boyd also warned against easy “win/win” optimism while urging extended experimentation. He summarized for his audience an analysis of easement contracts in south Florida, which led him and RFF

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Fellow R. David Simpson to remain “agnostic” about the current ability to confidently rank conservation policies in terms of cost-effectiveness.

The contracts illustrate the complexities associated with turning conservation into reality, Boyd and Simpson found. The easements posed some recurrent challenges, several due to the long-run nature of the protection process.

“Conservation means much more than doing deals today,” the two researchers wrote in a paper whose findings provided the basis of Boyd’s presentation at the conference. “It means a commitment that

will be fulfilled generation after generation. Monitoring, management controls, and enforcement are issues that will never go away. To ignore them is to ignore the safeguards that provide protection itself.”

As for the promise of incentives, we should be careful not to “harbor unrealistic expectations,” the economists warn. The ultimate cost of conservation, Boyd and Simpson remind us, is determined by one consistent, inviolable principle: That is, the value of whatever other economically useful activities are forgone to preserve the habitat in its natural state. No free lunches here, either, in other words.

Having emphasized that the baseline cost of preservation is the difference between land values “with and without” restrictions, the researchers say it is no cause for despondency. Agriculture, grazing, and forestry can all be economically compatible with the maintenance of habitat for some indigenous species. So may be some residential land use.

As RFF President Portney did, the two researchers called for more experimentation to understand the diverse array of strategies available for biodiversity conservation. The options include everything from fee-simple purchases to easements to tradable development rights to preferential tax treatment for conservation-compatible land use to regulatory restrictions. Experimentation, they maintain, will lead to improvements in policy implementation and yield greater insight into the relative desirability of the options.

Meanwhile, they add, the greatest unresolved issue remains the question of how properties to be protected for biodiversity are chosen, especially given the complex interplay of scientific debate about priorities for preservation and the unpredictability of development patterns. That issue is likely to be another important focal point in an ongoing struggle to balance the costs and benefits of biodiversity conservation. ☞



# Risk in the Real World

## A New Guide to Analysis

People who assess risk for a living are beginning to recognize the need for new methods to match the complexity of some of the problems they must confront—say, for example, ascertaining the risk associated with thousands of chemicals at a nuclear waste or Superfund site. As the science advances, the rest of us need to understand at least superficially what risk assessors do and how their work affects our prospects for health and safety.

To help meet this need, there exists a new booklet called *Understanding Risk Analysis, A Short Guide for Health, Safety, and Environmental Policy Making*, which the American Chemical Society and RFF have jointly published. Publishing the booklet is part of the joint effort the two organizations have made to educate Congress about risk issues and to facilitate communication about the subject among the three branches of government.

The booklet traces the history of risk analysis—noting the relative newness in public debate of terms like risk analysis, risk assessment, and risk management. It points out, too, that professional risk assessors were on the job as long ago as 3200 B.C. offering advice on uncertain or difficult decisions in Babylon. It wasn't until early in this century, however, that serious scientific study began of the risk factors associated with certain technologies and substances. Development of this knowledge led to the use of a "no-observed-effect level" or "NOEL" to demarcate (sometimes misleadingly) the line between safety and danger.

NOEL is one of the foundational elements of contemporary quantitative risk assessment. When concerns turned to low-dose exposures to ionizing radiation and to potentially carcinogenic chemicals in the 1960s, however, this concept proved problematic: it wasn't possible to establish a no-effect threshold for such substances. This shortcoming prompted the Nuclear Regulatory Commission and the Food and

Drug Administration to search for ways to detect and quantify the risks of exposures to radiation and carcinogens in food.

Meanwhile, Congress' passage in the early 1970s of major environmental statutes, and its creation of the Environmental Protection Agency and the Occupational Safety and Health Administration, enlarged the role of risk analysis in the regulatory process and stimulated professionalization of the field.



Since that time, risk analysis has become a central component of the nation's policymaking regarding health, safety, and environmental quality.

From the beginning, the technique has been composed of a hybrid mix of disciplines pieced together to meet a policy need. Perhaps not surprisingly, then, risk analyses have been a source of controversy more than consensus, the booklet reveals. As the tool has become more important, the tensions surrounding its proper use

have risen and are expected to take years to resolve.

The difficulties are both scientific and political. Despite, for example, the aforementioned efforts of NRC and FDA, the current state of scientific understanding in the field is still not up to the task of answering important questions about the type and size of specific hazards. Neither is the field capable of answering questions about the acceptability of certain risks and how to balance trade-offs among competing interests, which are beyond the realms of technology and science in any case.

What ACS and RFF hope to accomplish by publishing the booklet is to acquaint readers with the strengths and limitations of risk analysis even as it grows in prominence. After all, it is part of the process of regulating a wide range of potential dangers, such as pesticide residues, food additives, pollutants in drinking water, and certain features of industrial processes and transportation equipment, to name but a few.

Ray Garant of ACS and Terry Davies of RFF supervised publication of the text written by Mark Boroush, formerly of the Congressional Office of Technology Assessment.

As part of their joint education effort, ACS and RFF also co-sponsored a series of talks on environmental risk for members of Congress and their staffs. The ACS Risk Education Project is funded by a grant from the Eastman Kodak Company. The Carnegie Corporation of New York supported RFF's co-sponsorship of project activities.



Download the booklet at [http://www.rff.org/misc\\_docs/risk\\_book.htm](http://www.rff.org/misc_docs/risk_book.htm). To order a hard copy, contact the ACS by telephone (202-872-4386) or e-mail ([risk@acs.org](mailto:risk@acs.org)). The first ten copies ordered are free; additional copies cost \$2.00.



## INSIDE RFF

## Putting People in the Picture

*Resources talks to Jim Boyd, a fellow in RFF's Energy and Natural Resources Division.*

A researcher's life is devoted to learning, so it's not unusual for the quest to lead back and forth across fields that cross-fertilize. Occasionally, too, illumination lies along paths that are unconnected. Take the presidential papers of Gerald R. Ford. And the poetry of the thirteenth-century Sufi mystic Mevlāna Jalāluddīn Rumi. For RFF Fellow Jim Boyd, each of these sets of documents has been a discrete source of guidance. As an undergraduate in history at the University of Michigan, Boyd used Ford's papers to write his thesis on what was then the new federal Office of Science and Technology Policy. Today Boyd reads Rumi's mystical meditations to round out workdays spent analyzing problems from the less mystical point of view of economics and the law.

"Life is definitely a yin-yang deal," Boyd says by way of explanation. "Being an economist twenty-four hours a day is not a way to lead a balanced life, emotionally or intellectually. So, given that I definitely care about balance, it's not surprising that my profession forces me to be open to other aspects of life. Economics offers a rational view of the world, whereas my more general view is that rationality can take you only so far. It's a useful but limited perspective."

Still it is a perspective that Boyd sought out, winding up

at the Wharton Business School, although he had never taken a course in economics and had expected to earn a doctorate in public policy instead.

"I had some math aptitude and Wharton took a chance on me," he says. "I wanted to do policy analysis and realized that, if you want credibility, you need a structure for your ideas. Economics seemed the best way to do that. It is scientific in ways that other disciplines are not."

What attracted him also was that Wharton is a sort of a "hybrid," rather than a pure school of economics. While his teachers were all economists, the applied side of the curriculum opened a window onto the worlds of business and finance. The rigor of mastering a methodology while getting exposure to the way people actually behave kept him interested. It still does.

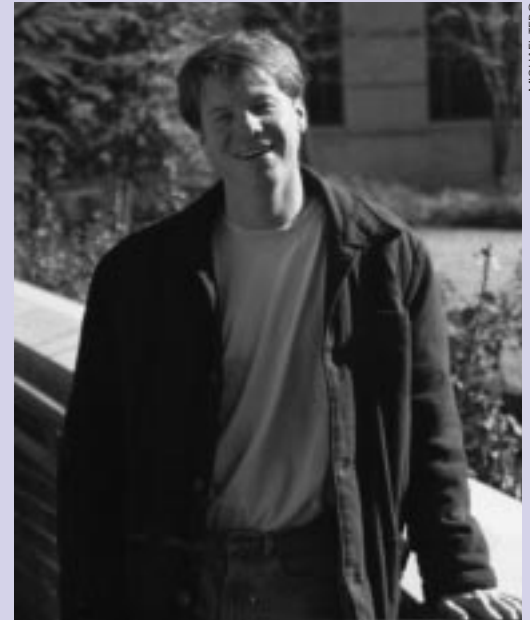
"I ended up with a skill, but it's the means, not the end," he points out. "I'm probably less interested in being an economist per se than most of the people at RFF," Boyd confesses. "I don't really like the math. The math takes you away from what economics is really talking about: namely, the real world."

If he is nonetheless committed to being rigorous in a mathematical sense, he doesn't expect other people to be. To

him it is crucial to translate his research findings into language that is uncomplicated and unfancy. "Taking what you've learned and applying it to make a difference means putting your results into terms that are useful. And they're only useful if they're understandable to people who are not economists."

How systems actually operate and how ideas play out in practice fascinate Boyd. He has spent a fair amount of time, for example, looking at how businesses come to terms with their environmental responsibilities in the course of their day-to-day decisionmaking and long-term investment planning.

As systems of regulation have matured, so too has the ability of business to anticipate and head off environmental problems in the first place rather than pay for them later when regulators call for action. But win-win opportunities to save money by preventing pollution may not be as abundant as many hope, Boyd learned through case studies he conducted earlier this year at



MICHAEL TERO

several U.S. chemical firms.

If business managers don't opt for "environmental" investments, Boyd says, it is not because they are environmental villains. In fact, most of them are pretty environmentally concerned as private citizens at home, he thinks. However, as managers making investment decisions, they need to know, for example, if the benefits of an upgrade in facility efficiency will exceed a certain rate of return on the cost of capital before giving such a project the green light. Right now environmental benefits are difficult to quantify financially. A list of prices or costs usually isn't available to assign a dollar value to reduced emissions.

Meanwhile, people in the private sector often have a hard

time communicating what it is they do in their day-to-day problem solving, Boyd observes. Through his case studies, he says, he tried to shed light on accounting and capital budgeting and to explain what the private sector is worrying about when engaged in such common everyday business practices. "To best motivate action in favor of the environment, regulators need to understand how the private sector operates."

While his interest hasn't flagged in furthering such understanding, Boyd is turning

to other issues of concern as well, such as the difficult goal of striking a balance between economic growth and preservation of endangered habitats. He is also planning to sit at the feet of RFF's senior water guru Ken Frederick to understand the challenges involved in allocating the resource more efficiently, especially in the West.


These areas require a whole different set of skills and perspectives than his work on business practices, economics, and the law. "But that's one of the great things about working at RFF. There are no constraints if you have an interest in an

area and a willingness to learn. That's basically why I'm here."

In some respects, Boyd says, the unconnected paths he has gone down are beginning to converge. Not that he is drumming for dervishes at the office yet, but there is less of a disconnect between his professional and private lives. A big reason, he says, is the security of the tenure he received at RFF this year, which has led to a sense of liberation.

"I'm willing to take more chances on what I'm working on and how I go about it." The case studies for the pollution prevention study are a case in

point. "Having a more secure position here allowed me to pick the method I thought was best for the purpose, rather than the safest in terms of publication."

To some extent, Boyd has always seen himself as a kind of frustrated artist. And yet he has found that a researcher's life is a lot like a painter's or a writer's, holed up in a garret somewhere. "You have to self-generate and follow your own muse. It's also entrepreneurial. No one's telling you what to paint. You've got to go out and buy your own canvas." 

## New fellows

RFF's Quality of the Environment Division hired two new fellows this past fall, each with a background in resource economics. Before coming to RFF, **Heidi J. Albers** was an assistant professor at Stanford



Heidi J. Albers

University's Food Research Institute where in her teaching and research activities she focused on renewable resource economics, especially in developing countries.

At RFF Albers plans to continue developing models to study biodiversity conservation, forest fragmentation, and shifting cultivation patterns, using her knowledge of geology and environmental studies as well as economics.

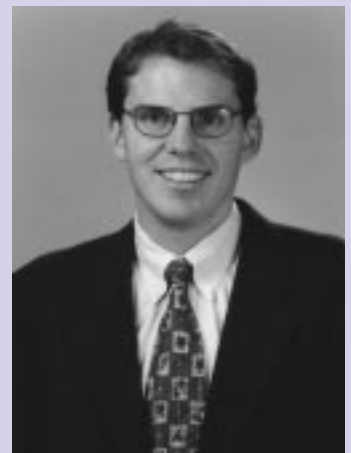
Albers received a Ph.D. in economics from the University of California at Berkeley and a master's degree from Yale University's School of Forestry and Environmental Studies. She has published on the economic management of tropical forests, the impact of economic reform on China's forest composition, and the conflicts

between protected area management and rural people in China and Thailand.


**James N. Sanchirico** earned his Ph.D. in agricultural and resource economics from the University of California at Davis after graduating with distinction in economics and mathematics from Boston University.

Before coming to RFF, he was a postdoctoral researcher for the Pacific States Marine Fisheries Commission investigating multispecies fisheries management in the Bering Sea/Aleutian Islands groundfish fishery.

At RFF, Sanchirico will continue to focus on developing bioeconomic models to study the effects of renewable resource management policies. For example, he is looking at



James N. Sanchirico

the impacts of marine reserves on the harvesting industry and fish populations. He is also attempting to refine methodologies that are used to determine appropriate economic and ecological scales for resource management. 



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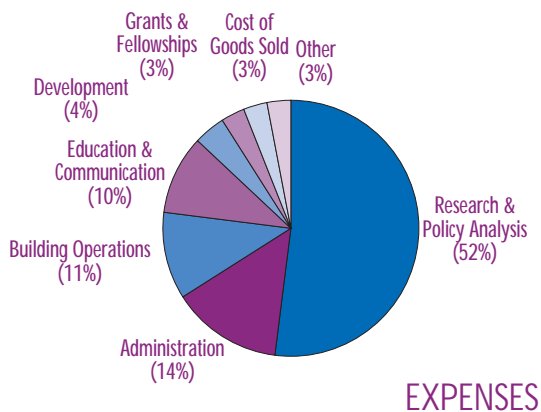
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# ANNOUNCEMENTS

## Summer internships

RFF is now accepting applications for its 1999 summer internships, scheduled to run this year from June 2 through August 29. Approximately a dozen students will be selected to work directly with RFF researchers in one of three divisions on a variety of ongoing projects and to assist in developing new areas of research and policy analysis. A modest stipend is offered.

All three divisions seek candidates in the social or natural sciences with policy analysis and writing skills and an interest in environmental policy problems that lend themselves to interdisciplinary analysis. The Energy and Natural Resources and Quality of the Environment divisions additionally require strong backgrounds and interests in micro-economics and quantitative methods.

Applicants may apply to one or more divisions by submitting the follow-

ing materials: cover letter describing interests, resume, academic transcript, and letter of recommendation sent directly by faculty member.

All materials should be post-marked or faxed to 202-939-3460 by **March 12, 1999**. For more information, see <http://www.rff.org>

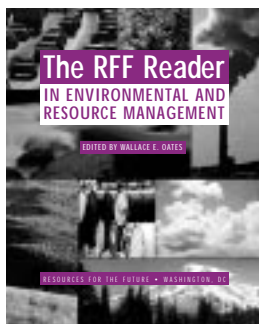
### China Program

Graduate students with a special

interest in environmental economics and public policy issues as they affect China are encouraged to apply for the **Walter O. Spofford Jr. Memorial Internship**, named to honor the late RFF researcher who helped launch RFF's China Program.

The application requirements, deadline, and calendar are the same as for the other RFF summer internships.

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