

CRAWFORD SCHOOL  
OF ECONOMICS AND GOVERNMENT

Economics and  
the Environment

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ANU COLLEGE OF ASIA & THE PACIFIC

ENVIRONMENTAL ECONOMICS RESEARCH HUB  
**POLICY BRIEFS**

Environmental Economics Research Hub

# POLICY BRIEFS

Economics and the Environment

Environmental Economics Research Hub  
Policy Briefs 1

Crawford School of Economics and Government  
The Australian National University

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# ENVIRONMENTAL ECONOMICS RESEARCH HUB POLICY BRIEFS

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### About the Environmental Economics Research Hub

The goal of the Environmental Economics Research Hub is to address Australia's major environmental management challenges with integrated economic research that provides immediate and continuing policy impacts. It brings together leading environmental economists, scientists, educators and policymakers to face the challenges of sustainable water use, soil loss and salinity, biodiversity loss and adaptation to climate change. The hub's integrated research, modelling and capacity-building encompasses the establishment of markets to achieve environmental goals, environmental valuation and the assessment and development of government intervention in environmental management. It will provide end users with the tools, understanding and framework to promote environmental sustainability in Australia.

The Environmental Economics Research Hub is based at the Crawford School of Economics and Government under the Direction of Professor Jeff Bennett.

Funding for the Environmental Economics Research Hub is provided by the Department of Environment and Water Resources under the Commonwealth Environment Research Facility, a government initiative to facilitate world-class public-good research on the environment through collaborative work between Australia's best environmental researchers.



**Australian Government**

**Department of the Environment and Water Resources**

## About the authors

**Professor Jeff Bennett** has 30 years experience researching, consulting and teaching in the fields of environmental economics, natural resource economics, agricultural economics and applied microeconomics. His current research interests focus on the development and application of techniques to estimate the value of non-marketed environmental benefits and costs, and the analysis of alternative institutional structures that give private owners/managers of natural resources the incentive to provide environmental benefits. He was President of the Australian Agricultural and Resource Economics Society, is Academic Advisor to the Centre for Independent Studies and is Principal of the consulting group, Environmental and Resource Economics. He is co-editor of the *Australian Journal of Agricultural and Resource Economics*.

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# Economics and the Environment

## Economics and the environment: friends or foes

Jeff Bennett

We seem to be deluged by stories in the press and on TV that tell of dying rivers, disappearing forests, species extinction, polluted air and water and glaciers and ice caps in retreat. Often the explicit or implicit cause for much of this environmental doom and gloom is deemed to be 'economics'. The presumption is that somehow the discipline of 'economics' and its hand maidens, the 'economists', are the driving force behind 'economic growth' that in turn spells disaster for the environment.

The goal here is to dispel the presumption of 'economics' being the root of all environmental evil by rectifying some common misconceptions about what economics is and how it can be used. Part of that task involves demonstrating that economics can offer some significant insights into why environmental issues arise and some useful, pragmatic approaches to overcoming them.

Fundamentally, economics is about choices. Choices arise because we as individuals, and collectively as a society, can't have everything we want. We are all familiar with the choices that need to be made in our households between new shoes, a night out or the next tank of petrol. The choice is made necessary by our limited incomes. As a society, we choose between using our available resources for more schools, better health care services or an improved defence capacity. We simply can't have it all!

Some choices we face have environmental dimensions. We may want to preserve forests as beautiful places to visit and sanctuaries for endangered species but we also like to have timber furniture and paper to write on. We may like to have crystal clear air in our cities but we also like to be able to drive our cars around and in so doing cause air pollution. Again, we can't have it all.

The recognition economics brings is that the resources we have available to use—be they forests and fresh air or land, cars, skills, oil, pigmy possums, water, ozone, etc etc—are not sufficiently abundant for everybody, both now and in the future, to have all

their needs met. We face a situation of resource scarcity and that's why choices have to be made. Economics is the study of how we organise ourselves to make those choices.

Societies over the centuries have developed all sorts of different mechanisms by which resource use choices can be made.

One choice mechanism is the market. With ownership over resources clearly defined and those ownership rights well defended, voluntary exchange between individuals has been demonstrated to provide striking results in generating efficient social coordination for many resources. Dramatic improvements in the well being of people have been generated through the installation of private property rights over resources and the facilitation of mutually advantageous trade. So it's not surprising that economists are interested in markets and money.

However, economists have also recognised that the conditions under which markets can perform the social coordination process are not universal. Property rights are not always easily defined. How can ownership of the upper atmosphere be defined? Property rights cannot always be readily defended. How can people who haven't paid be stopped from the enjoyment that comes from knowing that an endangered species is protected? Hence, economists are also interested in different forms of 'collective action' to make resource use choices, most notably through the action of governments.

What all this means is that economics is about devising ways of making better choices. It is not restricted to money matters because many of the choices that are made in society are not coordinated through markets. But it is fundamentally concerned with improving human well-being by developing improved choice processes and hence through society making improved resource choices.

While these fundamentals give economics the credentials to consider environmental issues, it is worth noting that it is only comparatively recently in the

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discipline's history that it has been used in this context. That is largely because it is only relatively recently that society has begun to recognise the environment as being a valuable, scarce resource. Even fifty years ago, environmental resources were considered abundant even to the point where they were a hindrance. There were too many forests, too many wild animals, too much water. Now, with environmental resource stocks diminished and a growing recognition of their importance to the well-being of society, scarcity is real and the role of economics has come to the fore.

As an example, consider the insights that economics can provide into the classic 'environmental protection vs development' choice. This might be in the context of logging a forest for woodchips vs protecting an endangered species, clearing remnant vegetation for cattle grazing vs protecting downstream water quality or mining coal for electricity generation vs maintaining climatic stability. All of the competing options provide value to society. Choosing which option is better for society is difficult.

It is useful to think about how alternative choice mechanisms work in these contexts. Will markets give incentives to owners and users of resources that generate the best choices? Markets reward those who can sell access to owned resources. Hence markets provide strong incentive for resource owners to peruse the 'development' option. They do not provide an incentive for resource owners to choose the 'protection' option because it generally does not involve the production of saleable goods and services. Property rights to the goods and services arising from environmental protection are frequently inadequately defined and /or defended.

Hence, markets send strong signals for resources to be developed rather than protected. Markets will deliver choices that favour development over protection.

Will collective action through government intervention generate better choices? A different set of incentives lie behind collective action. Politicians for instance may be more motivated by their success at elections than the greater good of society. They may therefore make choices that focus on satisfying vested interest groups that can deliver marginal seats. Similarly, bureaucrats within government may be more self interested in the pursuit of promotion, power, prestige and pay than being motivated by the community well being derived from the choices they influence.

Hence government action alone may not generate environmental resource use choices that are any better than markets. The environmental track record of Eastern European countries during the communist era and the case of North Korea are instructive.

With pure market and pure collective action not being able to deliver outcomes that are satisfactory to society at large, attention has been focused on developing an appropriate mix of the two choice mechanisms that will. Economics, as the discipline that focuses on choice offers some useful and pragmatic approaches to that development process.

For instance, a lesson that economics brings to the environmental debate is the success of market processes in the generation of societal wealth. Economic thinking is being used to harness the strengths of the market mechanism to provide incentives for sound environmental management. Similarly, economic tools are being developed to ensure that government interventions made in the name of environmental protection are both transparent and in the best interests of society at large.

Examples of economics in action to secure environmental outcomes are to be found in the context of biodiversity protection. The best use of resources that provide biodiversity such as forests, grasslands, rivers, oceans etc occurs when they are allocated to their most highly valued uses. Markets do a fine job in telling us the value that society puts on their development uses. They don't provide information of the values held by people for their protection values. Economic techniques are being developed to estimate those values so that the trade-off between protection and development can be assessed in an objective manner. Once that balance has been struck, markets can be formed to ensure cost-effective provision of the protection outcomes. Such markets can be established by governments calling for tenders to supply the required levels of protected biodiversity in the format of an auction.

In conclusion, the economist has a lot to offer the environment. However, the way of thinking that economics brings to the consideration of environmental issues is quite different from that which is commonly observed in conservation debates. Primarily, economics specifically recognises the trade-offs between competing uses of scarce environmental resources. Advocacy for absolute positions is out. Developing an appropriate balance between environmental resource development and protection is in. Economics also brings with it a deal of skepticism regarding the capacity and effectiveness of governments to achieve environmental protection goals using simple 'command and control' type mechanisms. In particular, the economics approach embraces the concepts of property rights, trade and prices as means to achieve environmental goals as well as material wealth.

# Economics and the Environment

## Markets and the environment

R. Quentin Grafton

Markets are where we buy and sell items of value. If we want to buy a car, we go to a vehicle dealership, if we want to eat bananas we go to the greengrocer or supermarket to get them, and if we want to fly to Sydney we can purchase our tickets on the internet. But where do we go if we want to 'buy' a cleaner environment in terms of air or water quality, or if we simply want to keep on enjoying the native parrots in our backyards?

Many of us assume that regulations or laws will prevent environmental harm so that polluters are prohibited from releasing undesirable emissions, or farmers are not allowed to chop down trees that would harm native birds. Regulations are most certainly required to prevent a range of ills—it should be unlawful and, indeed, criminal behaviour for someone to store highly radioactive level nuclear wastes in their garden shed. However, all forms of activity, whether it be doing the laundry or driving to work or simply living creates some form of pollution. Is it desirable, or even possible to control every such activity to conserve the environment?

An alternative to the 'command-and-control' approach to environmental conservation is to provide incentives to individuals and firms to 'do the right thing'. For instance, instead of prohibiting farmers from

removing any trees and then monitoring compliance and imposing penalties, it might be more cost-effective to provide incentives to farmers to keep their trees. For instance, a market for biodiversity could be created that would allow farmers to tender or bid for a range of conservation actions in return for biodiversity payments. A regulator could then pick the bids that offer the best value for money in terms of dollars spent to achieve desired environmental outcomes. Such a market could deliver on environmental goals (more native parrots) at a lower cost than alternative approaches. The key is to use the power of markets to provide incentives so that the actions of individuals are much more closely aligned with societal interest.

Market-based approaches or instruments can, and have been applied to a wide range of environmental challenges. For instance, salinity credits are used to control salinity in the Hunter River while 'bush tenders' have been used to conserve biodiversity in Victoria. In the next three years the research projects in the Environmental Economics Research Hub will be exploring how environmental markets and also prices in existing markets, such as for water, can be used to generate better environmental outcomes. The goal is to have increased water security and more cost-effective and robust approaches to biodiversity conservation.

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## Surveillance and control of exotic pests and diseases: how much to spend, how best to manage?

Tom Kompas

Making choices on how best to protect the environment requires relevant information and data. It also needs a series of analytical constructions that assist the setting of objectives so that all of the attendant tradeoffs and constraints are considered. The 'analytical capacity and enhancement' theme of the CERF Environmental Economics Research Hub, will develop tools and modeling contexts to address this need.

One project in this theme, on quarantine and surveillance activities, seeks to determine how many resources should be devoted to monitor, prevent and manage potential incursions of exotic pests and diseases, especially those that can bring substantial (occasionally catastrophic) damage to the environment and local plants and habitat. An example of this sort of incursion is the accidental introduction of yellow crazy ants on Christmas Island. The crazy ant has had a significant destructive impact on the island's ecosystem, killing and displacing crabs on the forest floor. Super-colonies of the ant also devastate crab numbers (famously) migrating to the coast. This has seen a rapid depletion of land crab numbers which are vital to Christmas Island's biodiversity, as they are a key species in forest ecology.

Nothing can be done now to prevent the incursion of crazy ants on Christmas Island, but the question is how much, in principle, should be spent on quarantine and surveillance activities to prevent and monitor incursions and spreads in other cases. There will be cases where an introduced disease or pest is so devastating that the direct costs of an incursion and spread will require vast expenditures on quarantine

and surveillance activities. On the other hand, for some pests and diseases, reducing the risk of an incursion to zero may imply that the cost of the quarantine and surveillance measures is reasonable, while still allowing for the slight possibility of an incursion. This project seeks to determine how much should be spent on quarantine and surveillance activities against selected diseases and pests, balancing all of the relevant costs and benefits. Put simply, the idea is to minimise the sum of the direct costs of a potential disease or pest incursion (such as the loss in output and productivity and the cost of any potential export trade restrictions due to the presence of the disease, along with any environmental damages), the cost of the quarantine and/or surveillance program and any resulting welfare losses from import-trade restrictions, through a variation in the likely rate of an incursion and spread. In many cases it is optimal to have quarantine and surveillance programs that do allow entry, with some probability of incursion. Others may require a much larger commitment by government to prevent incursion and spread to the greatest extent possible.

Once an incursion has occurred, as in the case of yellow crazy ants on Christmas Island, the issue becomes one of how to best manage the containment and possibly to initiate the eradication of the disease or pest. Eradication is the preferred outcome only in cases where potential damages from the disease or pest outweigh the costs of the eradication process. With containment it is preferable to allow some limited environmental impact, balancing costs and benefits.

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## Climate change analysis

Jack Pezzey

Australia's greenhouse emissions, which contribute to global climate change, come from most parts of the economy, especially from burning the carbon fuels which provide the vast bulk of our energy. Likewise, climate change would affect most of Australia's economy, directly or indirectly. Because of this pervasiveness, we cannot significantly and affordably reduce either greenhouse emissions or climate change impacts using just a few 'magic bullet' technologies, and using just government regulations would be inefficient and unacceptably restrict our freedom. The pervasive power of markets can be used to both abate emissions and improve adaptation to future climate change. But using markets for abatement and adaptation is not simple, and economic analysis will be important in finding the best ways.

Cost-effective emission abatement needs three broad markets to be created or improved. The first is for abatement itself, created mainly by a carbon pricing scheme, either carbon trading, carbon taxation, or some hybrid. The design of such schemes raises complex economic, political and administrative issues. As just one example, is it better to control the amount of emissions using tradable permits, or the price of emissions using taxation, particularly if future climate change might be abrupt? The second broad market is for new zero or low-carbon technologies, such as for carbon capture and storage, or for renewable energy sources like solar electricity or liquid fuels from farm or forest biomass. This market exists but often works

poorly, because new knowledge can easily be used by those who haven't paid for its production, which reduces incentives to innovate. So government has a role to support innovation, but it's hard to know which technologies to support, and how much to do by direct spending or by indirect tax breaks. The third market is for energy efficiency, which again exists but works poorly, because many people paying energy bills can't control how much is used, or don't know how to fulfil their energy needs more efficiently. Again government has a role, for example to provide information and set standards, but this role needs to be better understood. Over the next three years the Environmental Economics Hub will explore many of these issues, with the aim of helping Australia reduce its overall cost of abatement.

Research on adaptation to climate change will aim to improve the understanding of possible market responses to climate change, and the role of public policy. How do economic systems respond to changes in environmental conditions, both gradual and abrupt, and what can be learned from past changes? How might Australian economic systems change under future climate change? What is the role for public policy in climate change adaptation? Can Australian approaches to climate change adaptation be transferred to countries in the Asia-Pacific region? The Environmental Economics Hub will use a range of economic and interdisciplinary research methods to improve understanding of these issues, and thus support policy formulation.

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## Environmental economics and decision making

J.C. Rolfe

Environmental economics can be used to help industry, communities and policymakers to understand the tradeoffs involved in improving natural resource management, and to understand how changes in management and policy can lead to increased efficiencies. There are three key areas of operation for environmental economics.

- Understanding why environmental and production problems might arise, and why there may be groups in society who disagree with the way that resources are allocated and used. Understanding why environmental and production problems occur is a key step in designing solutions.
- Identifying whether it is worth addressing an environmental or production issue. Solutions are not costless, so a decision framework normally involves not only an assessment of whether it is worth fixing a problem, but also an assessment of the balance to be chosen between bearing the problem and imposing the solution. Cost-benefit analysis is a key tool used to identify whether projects or policy changes are worthwhile to society overall.
- Designing policy instruments and other solutions to achieve desired outcomes. Once a decision has been made to address an issue, a key task is to identify the most efficient ways and appropriate tools to achieve the desired level of resource use and environmental protection.

Application of cost benefit analysis and other evaluation techniques in the second key area of environmental economics often involves the use of specialist non-market valuation techniques to allow assessment of different environmental and social impacts. It is important to be able to estimate the value of impacts that do not necessarily occur in markets so that these are properly accounted for in the evaluation of different resource use alternatives. Non-market

valuation techniques can be grouped into two broad categories of related market and stated-preference techniques.

### Related market techniques

Related market techniques operate by taking some actual market data on spending by people on goods with environmental or other characteristics, and then isolating out the components of that spending that relate to the characteristic of interest. Because the data are drawn from actual spending occurrences, where people have purchased and used something, these techniques are only capable of estimating direct use and indirect use values. They are not appropriate for estimating non-use values (values that people might hold for something like an endangered species without ever using it).

The main advantages of related market techniques is that they draw on actual transactions that have been made, and thus avoid some of the potential problems of bias that can be associated with the other group of valuation methods, stated-preference techniques. There are two main types of related market techniques—the travel cost method and hedonic pricing.

### Stated-preference techniques

In stated-preference techniques reference data are typically collected through some survey format, where people are asked to indicate their preferences between certain hypothetical scenarios. This gives the analyst far more flexibility than can be achieved using related market techniques. Questions are asked about new potential situations. Peoples' responses are based on their intentions for the future, not on their past actions. As well, the techniques are suitable for the assessment of non-use values as well as a range of use values.

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Such flexibility comes at a potential cost. Because these valuation techniques are based on the preferences that people state they have, rather than on the results of actual behaviour, there is the potential for differences to emerge between stated and actual intentions through the form of various biases. Much of the development work in these stated-preference techniques has been focused on the identification and correction of potential biases.

The main stated-preference technique that has been in use for more than twenty years is the contingent valuation method. In more recent times, an alternative technique—choice modeling—has been developed.

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A key challenge and topic for research is to improve the effectiveness and application of non-market valuation techniques in Australia, with the key aims of

- making results more relevant to policymakers
- improving the accuracy of techniques and confidence about the results generated
- developing appropriate protocols for the conduct of the techniques
- improving the cost-efficiency of applications and usefulness of results.