The value of the environment

Dr Ken Henry AC
Secretary to the Treasury

Address to the Environment Business Australia Forum, 4 March 2010

Introduction

Thank you for inviting me to speak here today.

Many of you would have first-hand experience of complementing traditional commercial reporting with social and environmental assessments. Governments also, from time to time, produce reports in these three dimensions. Today, I'd like to run through some of the thinking contained in the Government's most recent contribution in this space: the 2010 Intergenerational Report.

I'm going to focus on the dimension that has received the least attention historically; environmental sustainability.

Broadly, sustainability is concerned with ensuring that the wellbeing of future generations is at least as high as that of the current generation. The Intergenerational Report discusses how the wellbeing of a generation depends in large part on the overall 'stock' of resources that is inherited from previous generations. This stock includes commercial, social, human and environmental resources.

The contribution of environmental resources to wellbeing is broad-ranging. And it has both instrumental and constitutive features. In both ways, we are enriched by its existence. The environment sustains life, supports our physical and mental health and provides psychic enjoyment. Constitutively, Australia's unique biodiversity is integral to our cultural identity. Instrumentally, the environment supports the consumption of market products as an input to production. These inputs include the ecosystem services that generate soil fertility, provide protection from erosion and support tourism.

In intergenerational reporting, a discussion of the environment is especially relevant because, provided it is maintained, the environment is likely to offer even greater benefits for future generations. It is very likely that improvements in our material wealth and our understanding of the environment will enhance our appreciation and enjoyment of the environment over time. And technology developments could generate opportunities for a more sophisticated use of the environment as an input to production. There seems to be great scope, for example, for developing new or improved food crops, medicines and industrial products from our biological diversity.

But this is all a qualitative assessment. A quantitative assessment would be useful. However, as outlined in the Intergenerational Report, it is very difficult to quantify the environment's contribution to wellbeing.

Even so, it is highly significant that there is a renewed global focus on the valuation of intangible contributors to wellbeing, prompted in part by the Report by the

Commission on the Measurement of Economic Performance and Social Progress, led by Joseph Stiglitz, Amartya Sen and Jean Paul Fitoussi.[1]

Valuation difficulties are not unique to environmental contributors to wellbeing. As Stiglitz, Sen and Fitoussi have pointed out, there are considerable difficulties even in measuring the value of market consumption and wealth. But in a world with readily available market measures of things like income and employment, the lack of similarly accepted measures of the value of the environment creates the risk that government policies and project approval processes will fail to get the balance right.

It is important, therefore, that we invest appropriately in techniques for estimating the value of the environment.

Currently available techniques fall into two broad categories: valuation that relies on views in the population, and valuation through reference to 'experts'.

Valuation by the population: revealed preference

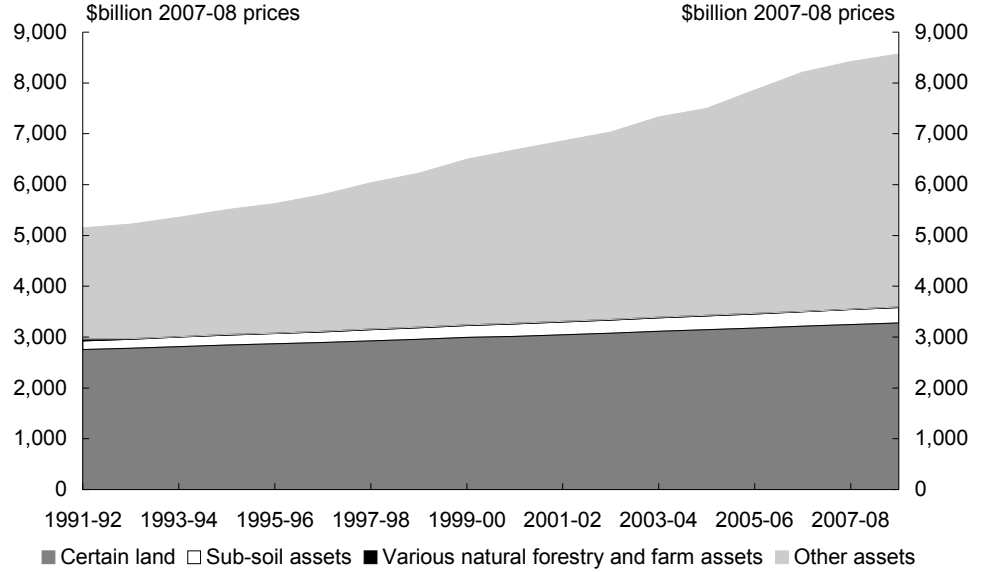
One way to estimate the value of the environment is to consider the population's actual behaviour — their 'revealed preferences', in economic jargon.

For environmental assets that are owned and tradable in functioning markets, such as private land and mineral rights, the asset prices that are revealed when people trade can provide some measure of value.

Even though only a subset of the environment is owned and traded in functioning markets, the value of this subset represents a significant share of the total value of Australia's commercial assets. The national balance sheet produced by the ABS only includes assets over which ownership rights are enforced and from which economic benefits may be derived by their owner. As shown in Chart 1, some natural assets that meet these criteria — including mineral deposits, certain land, and various natural forestry and farm assets — represent more than a third of Australia's total commercial assets.

1 Stiglitz, J, Sen, A, and Fitoussi, J 2009, *Report by the Commission on the Measurement of Economic Performance and Social Progress*, www.stiglitz-sen-fitoussi.fr.

Chart 1: Estimated commercial value of subset of natural assets



Source: ABS cat. no. 5204-18 and Treasury.

A couple of things to note about the chart.

The commercial value of assets other than natural assets has grown strongly in recent decades, mainly in the categories of dwellings, other construction, machinery and equipment and financial assets. But the commercial value of our land (in this case, land in private hands or owned by government business enterprises) has also grown significantly and remains the largest category of asset. Embedded in these land values would be the commercial value of ecosystem services that support agricultural productivity (offset to some degree by the perceived costs to agricultural productivity from what are considered pests and weeds).

The value of Australia's mineral deposits has also grown over time despite ongoing extraction, reflecting price increases, upgrades in the status of known reserves driven by price and technology changes, and new discoveries.

The commercial value of natural forestry and farm assets seems low by comparison. This category includes: standing timber in plantations and native forests where logging is allowed; fruit trees, dairy cows and breeding stock; and current crops, aquaculture and livestock. The category would capture little of the commercial value to future generations of plants and animals: much of this value would be embedded in the value of land, and some may be captured in intellectual property assets. The category also does not capture the commercial value of animals that are harvested from the wild.

There are also important natural assets, like water and wild fish, whose commercial value is not captured in the national balance sheet. Establishing the commercial value of water is difficult given that prices are only available for some forms of water supply. Estimating the commercial value of wild fish may be more achievable, with the New Zealand statistical agency taking the lead in this area. They have estimated the commercial value of wild fish by analysing prices revealed in New Zealand's system of transferable fishing quotas.[2]

For environmental assets that are not privately owned and traded in functioning markets, prices in related markets can sometimes be used to infer value. For example, the prices of houses that are similar other than with respect to aircraft noise have been compared to yield an estimate of the negative value (cost) of such noise.[3] Estimates of this sort can be helpful in assessing development proposals. In principle, the technique could also be used to 'unpack' the various types of commercial value embedded in land prices. For example, if we compared the price of parcels of rural land that are similar except for the presence of windbreaks, or if we compared the price of suburban blocks that are similar except for the proximity to parks and nature reserves, we might be able to estimate the commercial value of these environmental services.

These 'revealed preference' techniques have the advantage of being connected with people's decisions to actually part with their money.

The Office of Best Practice Regulation advises Australian Government agencies that revealed preference valuation is potentially credible.

That said, there are a number of problems with relying on asset prices to indicate value — even if we are limiting ourselves to commercial value.

Asset prices reflect perceived benefits. Because of perception errors, to which I will refer in a moment, perceived benefits are not the same as real benefits.

Asset prices reflect the anticipation of both certain and contingent benefits (with the component of the price relating to the latter referred to as option value). But if property rights are insecure, not only will rapid over-exploitation be encouraged, but prices will not reflect distant anticipated benefits. There is also debate about whether the extent to which individuals discount future benefits is in their objective interests. And, of course, benefits that are not anticipated are not reflected in prices.

---

2 Statistics New Zealand, 2008, *Fish Monetary Stock Account 1996 – 2007*, www.stats.govt.nz/publications/businessperformanceenergyandagriculture/fish-monetary-stock-account-1996-2007.aspx.

3 Holsman, A and Aleksandric, V 1977, 'Aircraft noise and the residential land market in Sydney', *Australian Geographer*, 13, pp 401-408.

Asset prices reflect benefits that are specific to the owner. But benefits that are provided to others, be they adjacent landholders or the community at large, now and in the future, will not be reflected fully in asset prices.

And asset prices only indicate the anticipated, owner-specific benefits perceived by participants in recent trading. The benefits to incumbent owners who don't choose to engage in trade may be higher than the prices observed in recent trades. Reference to prices from recent trades could understate the value of the entire stock of the asset class. The extent to which prices indicate value is further muted if property rights are inflexible and trade is restricted.

For these reasons, other techniques for estimating environmental value are necessary.

Valuation by the population: stated preference

An alternative technique is simply to ask people about their willingness to pay for the environment. An advantage of so-called 'stated preference techniques' is that respondents can be asked about the benefits they derive from an environmental asset that they do not privately own. This allows for the generation of estimates of value beyond owner-specific value.

A recent example of estimating value through surveys is a study into the valuation of Victoria's river red gum and East Gippsland forests.[4] Victorians living both in and outside of these regions were asked to choose among several scenarios. Scenarios involved paying various amounts over twenty years in order to achieve different areas of protected forests, different numbers of parrots, owls, potoroos, native fish including Murray cod, and different numbers of campsites. The approach, appropriately called choice modelling, provided enough information to derive monetary estimates of the non-use value to Victorians of incremental changes in forest area, animal numbers and campsite numbers.

As an example of the post-survey valuations possible through choice modelling, the survey response can be used to infer that setting aside 500 more hectares of healthy river red gum forest as a nature conservation reserve rather than production forest — yielding 10 additional breeding pairs of parrots, 5 per cent more of pre-European numbers of Murray cod, and 2 more camping sites — would generate non-use value

4 Bennett, J, Dumsday, R, Lloyd, C, and Kragt, M 2007, *Non-use Values of Victorian Public Land: Case Studies of River Red Gum and East Gippsland Forests*, Prepared for the Victorian Environmental Assessment Council, http://www.veac.vic.gov.au/documents/VEAC_Final_CM_report_1_June_07.pdf.

for Victorians of $6.5 million a year for 20 years.[5] In concept, comparing this valuation with the opportunity cost of reduced timber harvesting or grazing would yield an estimate of the net impact on community wellbeing from the hypothetical land use change.[6]

However, there are significant problems with relying on surveys to estimate the value of the environment. Many of these problems — such as respondents being unrepresentative, and replies being affected by differing understanding, financial circumstances and strategic approaches among respondents — have been recognised for a long time and there is a lengthy literature on survey technique and design that deals with methods to manage these problems.

Today I'll touch on a more fundamental problem with relying on surveys for estimating environmental value; a problem that we are only now grappling with, at least in the economics profession.

Our understanding of the problem comes largely from Daniel Kahneman, a recent Nobel Prize winner for his work in behavioural economics.[7] He argues that, while our tendency to rely heavily on intuition when making decisions generally serves us well, it nonetheless leads to frequent predictable mistakes.

We make mistakes when undertaking market transactions, which casts doubt on our ability to rely on market prices to indicate value. But we make these mistakes even more when answering surveys: as less is riding on our survey responses, we are more likely to resort to quick intuition rather than reasoning, which requires time and effort.

Kahneman outlines various types of mistakes from our heavy reliance on intuition. For example, we tend to put different value estimates on the same scenario depending on the nature and order of surrounding questions, whether the scenario is cast as a loss or a gain, and how risks within the scenario are cast.

The value estimates we assign to scenarios with different dimensions are often peculiar. For example, survey respondents might, on average, be willing to pay more to save all blue whales than they would be prepared to pay to save all whales of all species, even though the latter obviously includes the former. The value estimates we

---

5 As I'll discuss valuation by experts shortly, it is worth noting that choice modelling, and this study in particular, relies heavily on expert scientific opinion for survey design and the analysis of the survey results.

6 This estimate would not capture 'indirect use benefits' from the change, such as improved water filtration.

7 Kahneman, D 2002, 'Maps of Bounded Rationality: A Perspective on Intuitive Judgment and Choice', Lecture upon receipt of the Prize in Economic Sciences in Memory of Alfred Nobel, http://nobelprize.org/nobel_prizes/economics/laureates/2002/kahneman-lecture.html.

assign to scenarios that differ in scale can also be peculiar. For instance, a study found that the amount households would be willing to pay to save migratory birds from drowning was unaffected by whether the number of birds saved was 2,000, 20,000 or 200,000.[8]

Kahneman argues that the key driver of decision-making in these survey responses is the emotion that is evoked by the questioning. Losses are felt more heavily than gains, the idea of blue whales evokes a richer mental image than the idea of whales in general, and the idea of drowning birds probably conjures up an image of only one bird — a single bird drowning or being saved from drowning — irrespective of the actual number of birds at risk (2,000, 20,000 or 200,000). Numbers in the thousands are so large that the human mind 'cheats' with a simple prototype heuristic that neglects scope.

Policy makers need to exercise great care, therefore, in relying on such survey results when shaping environmental programs.

Valuation by experts

The opinions on the value of the environment of those deemed to be experts can be useful since they should have a better understanding than the general population of the workings of the environment and of the likelihood of certain environmental developments. Some experts may also be well placed to predict future benefits offered by the environment.

Kahneman puts the case in this way: some people — being more intelligent, having a stronger grasp of concepts like probability, and deriving unusual enjoyment in thinking — can be less susceptible to intuitive mistakes, and more likely to review intuitive decisions with reasoning, than the rest of us. If these people operate in positions where they are considered experts, then these skills might be further honed through repeated consideration of problems of a certain type.

The time and analytical tools an expert has to analyse the value of the environment, compared to the necessarily constrained time that a respondent has to peruse and answer a survey, can also lead to a more information-rich valuation.

---

8 Desvousges, WH, Johnson, F, Dunford, R, Hudson, S, Wilson, K, and Boyle, K 1993, cited in Kahneman, D, 2002, 'Maps of Bounded Rationality: A Perspective on Intuitive Judgment and Choice', Lecture upon receipt of the Prize in Economic Sciences in Memory of Alfred Nobel, http://nobelprize.org/nobel_prizes/economics/laureates/2002/kahneman-lecture.html.

For instance, experts have at their disposal various tools for considering uncertainty, which is especially important in environmental valuation. These tools include: sensitivity analysis, which involves asking what the outcome would be if parameters differed from the central estimates; break-even analysis, which involves asking what the uncertain parameters would need to be to achieve a given outcome; and real options analysis, which involves staging decision-making so as to coincide with expected information developments.

Expert valuation is a key component of Victoria's BushTender program, where the Victorian Government purchases environmental services from private land managers through a competitive tender process. In order to allocate an overall budget into separate funding pools for the purchase of distinct environmental services, experts have been called on to estimate the relative values of the various environmental services. A similar approach and reliance on expert opinion underpins the Australian Government's Environmental Stewardship program.

The benefits of expert assessment of the value of the environment shouldn't be overstated, however.

Kahneman makes the qualification that the quality of the opinions of experts depends heavily on whether they are given the time and space to think, and he cautions that sometimes reasoning is used simply to reinforce original bias or intuition.

There's also the issue of bias in the selection of experts — specifically, a risk of governments selecting experts whose values align with their own, and whose views can therefore be 'trusted'.

And it is important to keep in mind that a little learning can be a dangerous thing. Experts are experts only in the specific area in which they have demonstrated expertise — even if they have strong opinions on matters in which they are not expert. Expert opinion is not the same thing as the untested and uninformed opinion of an expert.

These qualifications might seem a bit pedantic. But the risks of an abuse of process due to improper reliance on the opinion of an expert is especially high in politically contentious debate on environmental matters. It is very important not to confuse the utilisation of expert opinion on environmental values with the more common appeal to illegitimate or inappropriate authority that characterises a lot of debate about politically contentious environmental issues.

As a personal aside, I recall a recent example of the latter, which involved one of our sub-national governments asking a panel of grassland ecologists to offer advice on the difficult ethical question of whether it is more humane to kill a kangaroo than it is to

relocate it. Ethics, too, requires expertise — and it is an expertise that should not be assumed to be positively correlated with scientific training.

Even where the expertise is real or relevant, policy makers should exercise caution, especially in areas of complexity.

As Stiglitz, Sen and Fitoussi point out, anyone's overall assessment of a complex situation is inherently subjective, difficult to compare with the assessment of others, and usually difficult to replicate.

By the way, we in the Treasury, who are often called on by governments to offer such assessments are very aware of the risks in claiming too much, and of the need to ensure that the evidence is relevant and the judgements transparent.

A technique with the grandiose name of multi-criteria analysis illustrates some of the pitfalls. This technique involves an expert scoring the various impacts of a proposal, then weighting these scores according to the relative desirability of the impacts, to come up with an overall quantitative assessment. Where a proposal includes environmental impacts, such multi-criteria analysis essentially reflects the expert's subjective valuation of the environment.

Recent examples include multi-criteria analyses of options for meeting the future water needs of Far North Queensland, options for routing the pipeline for diverting Goulburn River water to Melbourne, and options to reduce the run-off to the Great Barrier Reef of nutrients, pesticides and sediments from agricultural land. While these are worthy areas of expert consideration, putting numbers on what are essentially qualitative assessments gives a false impression of scientific certainty, particularly since the number produced by one multi-criteria analysis cannot be replicated or compared with the number produced by another. Multi-criteria analysis might also allow preconceived conclusions and the influence of consulted stakeholders to be embedded in the approach, without this being readily detected and subject to scrutiny.[9]

Information provision

While there are problems with estimating the value of the environment through revealed preference techniques, stated preference techniques and a reliance on experts, our ability to arrive at a sound estimate of the value of the environment is helped by

9 See Dobes, L, and Bennett, J 2009, 'Multi-criteria analysis: "good enough" for government work?' *Agenda (ANU College of Business and Economics)*, 16 (3), pp 7-29, http://epress.anu.edu.au/agenda/016/03/pdf/whole.pdf.

the fact that, at least in some instances, the techniques can be mutually supporting. The key to this mutual support is the sharing of information between experts and the wider population.

Experts can provide the population with an improved understanding of the state of the environment and its workings. This can improve the capacity of the population to make well informed decisions in both the marketplace and constructed surveys. Even if some of the details of the workings of the environment cannot be readily passed on to the population at large, the communication process is important for building trust in experts, and in building confidence that issues are subject to robust scrutiny.

The information flows should not be all the one way. Experts can learn about the preferences of the population; something which might better direct their analysis.

Much of the communication from experts to the population involves communicating the physical state of the environment rather than value estimates. Physical and value estimates should be related.

But the relationship might not be obvious. A value measurement of the environment, such as the estimated value of a particular type of native habitat, could rise — due to preference changes, technology developments or increased scarcity — even though the corresponding physical measurement, such as the remnant area of the habitat, could decline.

The presentation of physical measures of the environment to allow others to form their own subjective views about the value of the environment and its contribution to our wellbeing is an approach endorsed by Stiglitz, Sen and Fitoussi. They have suggested, in particular, that countries present a dashboard of indicators showing changes in various environmental resources, with some indication of the proximity to dangerous levels of environmental damage.

As an example, the Government's 2010 Intergenerational Report presents two indicators of our physical environment that are of great concern — threatened and extinct species and changes in the composition of Australia's vegetation cover since European settlement. These indicators draw on the much more extensive reporting on environmental statistics in the Government's periodic State of the Environment.

Conclusion

So where does this leave us? We have various techniques for estimating the value of the environment, each with its advantages but also significant disadvantages, each offering prospects for further progress. We have the potential for experts to improve the environmental understanding of the wider population, and for experts to gain a better understanding of what matters to the wider population. We can bring together the various estimates of the environment's value from the population and from experts. We've made a start. But it's only a start. Much more needs to be done if we are to be able to say that the wellbeing of future generations is not to be threatened by poor valuation of the environment.