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Plenary: 'A 50 year Perspective on Agricultural and Resource Policy'

Natural Resources and the Environment

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Abstract

Australian environments and natural resources have changed substantially since the Society was founded in 1957, partly as a result of changes to the economy, society, technology, and global conditions. This paper documents changes in the stock and condition of Australia's environment and national resources 1955-2005, considering how policy has both responded to and influenced those changes. New resources have been discovered (e.g. minerals and some fish stocks); some resources have experienced long-term stock decline in both quantity and quality (e.g. forests and fisheries); new uses have been found for known resources (e.g. coal exports and agricultural commodities); technology and investment have changed the ways resources are extracted and used; and increased incomes have increased demand for outdoor leisure and conservation. These changes have variously increased and decreased the pressures on resources and the environment. Society has responded – both reactively and proactively – to changing environmental conditions and pressures, including increased scales of effects (e.g. climate change and stratospheric ozone globally). Perceptions have also changed about the extent of and proper limits to environmental and resource degradation, and appropriate responses to such degradation.. Insights gained from this retrospective are used to consider prospects for future policy impacts, and in particular how economists might contribute to policy processes concerning the environment and natural resources.

Nothing in this paper necessarily represents the policies or views of the NSW Government, the Minister for the Environment, or the Department of Environment and Conservation (NSW)

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1. Introduction

It is trite (but correct) to observe that there was extraordinary social, political, economic and technological change in the second half of the twentieth century. The mid-1950s were the height of the Cold War, less than halfway through the Menzies reign, and preceded space flight, the transistor and the Beatles. This social, political, economic and technological change forms the context for the following examination of the Australian environment and natural resources, and related policy.

Australian natural resource and environmental conditions and policy have also changed remarkably over the past 50 years.¹ In the mid-1950s, agriculture contributed approximately 15% to GDP and comprised 80% of exports.² Agricultural expansion was seen as essential for economic growth (McEwen 1952), and major “national development” projects (such as the Snowy Mountains Scheme and 90 mile desert) were seen as essential to national (economic) development. Apart from icon sites (e.g. Broken Hill, Mt Isa, Kalgoorlie) and coal (still largely underground) for domestic use (iron/steel and electricity generation), mining was a small part of the economy; indeed iron ore exports were prohibited (from 1938-60).³ Environmental damage was highly visible in the agricultural sector, with some management successes.⁴ Elsewhere, environmental damage was literally visible but largely policy-invisible.

By contrast, in the first half of the current decade, agriculture has shrunk to 2.7% of GDP and 23% of merchandise exports⁵ (notwithstanding valiant efforts to expand the ANSIC definitions of “agriculture” to include related upstream and downstream activities).⁶ Mining has dramatically expanded to 6.5% of GDP, with mineral fuels, and ores and metals, each comprising about 20% of merchandise exports (with consequent impacts on the exchange rate and the agricultural sector; Gregory 1976, refined in computable general equilibrium e.g. Higgs 1986). Other natural resource extraction industries expanded beyond long-run sustainable output and have contracted (e.g. some fisheries),⁷ or became embroiled in controversy over extraction versus

¹ Considerable effort has been expended in distinguishing between “(natural) resource” economics, “environmental” economics, “ecological” economics, etc. Nature has bequeathed resources, which can be explicitly exploited (agriculture, forestry, fishing and mining), implicitly exploited (by challenging nature’s “assimilative capacity” through emitting wastes and pollution), or conserved (exploitation prevented). These activities are different facets of related problems, and are addressed similarly by economic analysis; it seems unnecessary to maintain arbitrary and unprofitable distinctions, and we don’t.

² The farm sector’s contribution to GDP fell consistently from 22-27% of GDP in the early 1950s to about 12% at the end of the decade. Farm exports fell consistently from over 80% of export value at the start of the 1950s to about 75% at the end.

³ for the prohibition, see the following; Blainey (1969, p.348) noted that the WA Government also refused to grant title to explore for iron ore until 1961:

<http://www.info.dfat.gov.au/info/historical/HistDocs.nsf/vVolume/435C7FF043C60155CA256B7D00810EBF>

⁴ Following European settlement, poor understanding (even disdain) for Australia’s biophysical characteristics led to serious environmental damage which continued into the twentieth century. As part of the disastrous post-World War 1 soldier settlement, farmers were settled in drier margins and quickly succumbed to soil erosion. The WWII Rural Reconstruction Commission noted previous efforts at land clearing had been unwise (and uneconomic), identified serious errors in forestry clearing, and noted development of a “national conscience” about national parks. Even where regulation of land management was attempted, government failure was an ever-present risk. The Rural Reconstruction Commission drew attention to a variety of “unfortunate attempts at regulation and control”, including rabbit control, wind erosion and sand drift, and irrigation control. It noted that bores in the Great Artesian Basin were already beginning suffer reduced flow, or even to fail. A major success against an introduced pest had been achieved via biological control (prickly pear) although offset by the introduction of cane toads. (cf. Godden 1999a)

⁵ 2000-01 to 2001-02; see for example Productivity Commission (2005, Fig 4.1)

⁶ see Econtech (2005); but note their disclaimer: “This work has been produced for the Australian Farm Institute Limited and Horticulture Australia Limited according to strict instructions. Econtech Pty Ltd makes no representation to, and accepts no liability for, reliance on this work by any person or organisation other than the Australian Farm Institute Limited and Horticulture Australia Limited.”

⁷ “Government acts for a sustainable fishing future”, <http://www.mff.gov.au/releases/2005/05230mj.html>

conservation (e.g. forestry). There is considerably greater awareness of local, regional and global pollution (e.g. DEC 2004b, ABS 2005b), with policy efforts to internalise the costs of pollution to emitters or regulate emissions.⁸

There are at least two possible ways of approaching a policy “prospective”. The first is to assume that the current natural resource and environmental stock and condition can simply be taken as given, acknowledge the constraints, and discern the (optimal) policy future. An alternative strategy is to assert that policy options are (partially) path-dependent. That is, the current environmental state is a consequence of how we arrived here, and future options are partly constrained by not just where we are but how we got here. That approach means analysis of future options requires at least a cursory analysis of the past. The latter approach is adopted in this paper.

In section 2, we outline our thinking about how to evaluate policy evolution; this analysis is based on Ruttan's (1978) induced institutional innovation. In sections 3-5, three “checkpoints” (1955, 1980, 2005)⁹ are used to describe contemporary resource and environmental condition, institutional settings and extant policy. In section 6 the key elements are reviewed of institutional and policy change over the past 50 years. In section 7 contemporary and likely future policy challenges in natural resources and the environment are discussed. Finally, in section 8, we discuss what the role of economics might be in fashioning policies for current/future problems.

2. Thinking about policy

Gerritsen and Murray (1986) argued that a policy "field" – such as natural resource and environmental economics – “comprises a complicated welter of interrelationships between policy formation and application, and between that policy set and other policies”. They divided policy into “recurrent” and “intermittent” aspects of policy-making.¹⁰ This paper deals primarily with “recurrent” policy-making.¹¹ The capacity of government to effect change depends on its willingness to devise and effectively implement appropriate measures. The intensity of this willingness results from its balancing the interests of those benefited or damaged by effective action. This balancing act may require ignoring some interest groups, trying to appease all, or symbolic satisficing (Gerritsen and Murray 1986) by enacting legislation, but not effectively implementing it or by not devoting adequate resources to compliance.

2.1 Economists analysing policy – induced institutional innovation¹²

⁸ There is a “helicopter” view of the changes summarised here in Blainey's first Boyer Lecture (Blainey 2001).

⁹ The time “checkpoints” were arbitrarily chosen to condense the survey to manageable proportions. They are simply 1955 (roughly when the society was founded), 2005 (now), and 1980 as the midpoint. The categorisation of what happened “in” 1955, for example, relates roughly to the period 1950-60.

¹⁰ recurrent: occurring with “regularity or predictability … [dealing] with problems that are largely foreseeable and … embedded in the institutional and administrative structures of policy-making and implementation.” “Intermittent policy-making [or] “crisis management”, is more reactive—to events that are usually both ‘unexpected’ and probably beyond the immediate control of policy-makers. [They] arise with a dramatic disruption of one area within the broader policy field [and] are more ‘political’, in the conventional sense of that word. Intermittent policy challenges … attract significant media, client group and public attention, further compounding management difficulties for those responsible (principally politicians rather than bureaucrats, though the latter may have to find the answers!).” (Gerritsen and Murray 1986, pp.7-8)

¹¹ Dovers (2000, p.140) commented: “Australian environmental policy has, not always but too often, been characterised by an episodic, lurching, ahistorical, myopic ad hocery … Even lessons that could be learned from the quite recent past are too often overlooked in the rush of near term imperatives, expediencies and policy fashion.”

¹² This section is drawn from Godden (1997); at the launch of that book at the 1997 AARES Conference on the Gold Coast, John Kerin remarked that this framework was a little too cynical and that the capacity for altruism in politics should not be entirely ignored.

Ruttan (1978, pp.340-341) proposed that institutional change could be modelled as the outcome of the interaction between the “demand” for and “supply” of institutional change. Demand and supply are not (necessarily) continuous relationships between price and consumption or production, but relationships among the benefits and costs of regulation and the amount and type of regulation. Institutional innovation involves aspects of the “economics of regulation” and public choice theory (Ruttan 1978, pp.342-356). Economic agents (profit and not-for-profit firms, consumers, NGOs), may improve economic outcomes through collective action—e.g. by inducing government to intervene to increase their output prices, reduce their input costs, improve their production efficiency, or receiving transfer payments.¹³ Agents face real resource costs such as information collection and processing, lobbying government, or persuading the public and other affected groups of the appropriateness of desired action. Political parties offer regulation in (prospective) exchange for explicit or implicit support.

Equilibrium in such a market is unlikely. Benefits change as market conditions change (e.g. input or output prices, technology) or as costs of lobbying change (e.g. changes in communications technology). Imperfect knowledge of regulatory effects may lead to “collateral damage” on those affected by it; new regulations may also interact unexpectedly with existing or subsequent regulation.

An induced institutional innovation framework is used in sections 3-5 to briefly review the interaction between policy evolution for and economic development in the Australian natural resource industries and environmental management since the mid-1950s. This framework is also used in sections 6-8 to review current institutional settings, and drivers for change, in assessing the current policy framework and its possible future evolution.

In examining resource policy using this framework, we were interested in a series of questions about resources and policy at our time checkpoints (1955, 1980 and 2005). What was resource condition – in terms of the quantity and quality of (known) resources, and what were perceptions about quantity and quality? What were contemporary attitudes to exploitation and conservation of these resources? And what were economic conditions affecting these resources: both the demand for and supply of resources and the products on which they were based, and more general economic conditions affecting the resource industries. We were also interested in contemporary institutional changes affecting the exploitation and conservation of resources, and the policy environment that was driving these changes. Of interest were the policy process and (i) the inter-relationships between resource conditions, associated perceptions and knowledge; (ii) perceptions and knowledge of the efficiency of natural resource use; and (iii) distribution issues concerning natural resource use. Economic interest included not just the conventional issues (property rights and market creation, command and control, persuasion & knowledge, and taxes and subsidies) but also voluntary community action and philanthropy.

2.2 Australian institutional issues

The management of Australian resources and the environment has “traditionally” been seen as a preserve of the States.¹⁴ But Bradsen and Fowler (1987, p.157) argued that the Constitution does not identify States’ powers, rather it defines the Commonwealth’s. In particular, there are no defined rights for the States regarding land use – or, more broadly, with respect to natural resources and the environment. The fact that the States traditionally managed land use was because the Commonwealth had either chosen not to do so, or because it hadn’t developed a suitable vehicle. According to Bradsen and Fowler, “The Commonwealth’s failure to act in this matter of national concern reflects not so much an absence of constitutional power but a lack of political will.”¹⁵

¹³ Illegal collusion is ignored here (cf. Samuel 2004)

¹⁴ e.g. Dovers (2000, p.142): “Australia’s federal system, with constitutional power over resource management largely residing with the states and territories, makes the task of co-ordinating river basin management difficult, politically and logically.”

¹⁵ cf. Coper (1987).

SEAC (1996, p.2-30) observed:

The Australian Constitution does not specifically deal with environmental powers and they are not the sole province of any one sphere of government. Most environmental legislative responsibilities rest with the State and Territory Governments although the Commonwealth does have substantial powers to enact laws affecting the environment and sustainable development. In some cases, the High Court has tested and confirmed these powers. However, many day-to-day government decisions that affect the environment occur at the level of local government. The interconnectedness of the environment means that very few aspects can be managed solely by one sphere of government, or one agency, in isolation from other spheres and agencies; and no aspect of the environment can be managed in isolation from the community. And plenty of other environmentally relevant decisions neither involve nor emanate from governments at all, but rather are taken by industry, various special interest groups and individuals acting alone or collectively.

A key change over the last 50 years – and particularly the last 10 – has been the Commonwealth's increasing intervention in policy regarding environment and natural resources. The Commonwealth has used both its constitutional powers (especially external affairs and s.96 grants) and its persuasive powers (through the Council of Australian Governments, COAG, and the ministerial councils) to effect substantial Commonwealth leverage in environmental and natural resource matters (cf. section 6.1 below).

3. Resources in mid-1950s

3.1 Agriculture

The 1950s were optimistic times in agriculture. The Korean wool boom had more than doubled wool prices (for a brief period), and major commodity prices (wool, wheat, butter, cattle) had more than doubled compared with the mid-1940s (Davidson 1981, Table 15-1). Agriculture (especially grazing) was economically, socially and politically significant. Agriculture directly contributed 15% of GDP and 80% of export income in the mid-1950s. Because of its macroeconomic significance, and contemporary macroeconomic policy constraints, the Federal Government had called for, and financially supported, substantial expansion of agricultural production capacity (McEwen 1952).

Southern and eastern Australia experienced generally good rainfall during the 1950s.¹⁶ In fact there was a marked increase in mean rainfall in southern and eastern Australia, together with a marked increase in rainfall variability, dating from about 1950. By contrast, in south-western Australia, the period was one of generally falling average rainfall which had begun in the mid-1920s.¹⁷ Agricultural expansion continued, including soldier settlement after the Second World War (5.6 million hectares of land, of which at least 1.2 million hectares was "new" land). Other expansion schemes were undertaken or commenced during the 1950s and 1960s including development of approximately 4.2 million hectares of brigalow lands in Queensland; approximately 0.35 million hectares of trace element treated lands on the South Australian-Victorian border (Ninety Mile Desert); and approximately 0.6 million hectares around Esperance in Western Australia (cf. Davidson 1981, chapters 15-16). Donald (1982, pp.59-60) reported an annual rate of new land clearing in WA in late 1960s of 400,000 ha. By contrast, public protests prevented development of the "Little Desert" scheme in Victoria at the end of the 1960s (Donald 1982, p.75; Bolton 1992, pp.159-60; Libby 1998).

There is only sketchy evidence about changes in the state of the (agricultural) environment. Soil erosion seemed generally better controlled (Gretton and Salma, 1996, Table C.2), partly

¹⁶ Thanks to Jason Crean for assistance in accessing rainfall data. There were serious floods in NSW from 1949 to mid-1950s, leading to State Government investment in flood mitigation and, several decades later, to serious problems from acid sulphate soils.

[http://www.dlwc.nsw.gov.au/care/soil/as_soils/causes.html]

¹⁷ cf. http://www.bom.gov.au/cgi-bin/silo/reg/cli_chg/timeseries.cgi

helped by the second dramatic Australian biological success against a scourge in the early 1950s with the successful release of myxomatosis. Superphosphate/annual legume regimes were slowly but invisibly creating soil acidity problems, and irrigation and dryland salinity problems were slowly accumulating, although again largely unrecognised.

3.2 Forestry

The 1950s were equally optimistic times in the forestry sector, with the first serious government attempts to implement sustainable forestry practices, and the beginnings of a drive to reduce Australia's dependence on imported softwood.

Large-scale moves to reduce industry dependence on softwood imports began during the 1950s – primarily through expansion of softwood plantations. Consumption of both sawlogs and pulpwood products (e.g. paper, cardboard, packing boxes) expanded rapidly through the 1950s, but producers were able – by increasing the felling rate and using previously neglected hardwood species – to expand output by more than the increase in consumption. The expansion of production in the sawlog sector is evidenced by the growth in number of mills from 1700 in 1945 to 2700 in the mid-1950s. A similar expansion took place in the pulpwood sector, with finished paper imports dropping to about one third of total consumption by the early 1960s, and not increasing as a proportion of the total market until the 1990s despite the massive growth in consumption over that period.

The problem with increasing domestic production, however, was that a key input, long-fibred softwoods, mostly had to be imported. Softwoods were valued as sawlogs for structural uniformity, and as a component of pulpwood blends for the strength and runnability imparted by its long fibres. The sawlog sector faced the choice of increased imports or increased reliance on native hardwoods; in the pulpwood sector, increased import dependence was unavoidable because softwood was required for 10%-30% of the pulp blend¹⁸ (Dargavel 1995, p.40; AATSE 1988, p.247). Increased imports were a serious problem in the Bretton Woods world of capital controls and foreign currency scarcity, and so both the public and private sectors began investing in softwood plantations, previously on a mass scale only in South Australia where native timber resources were particularly scarce. The first major investments in plantations were motivated by concerns about import dependence in softwoods and not by concerns about the depletion of native hardwood forest stocks. From 1946-59, planted area expanded by on average 6% p.a. By 1967, when the Commonwealth dramatically escalated its promotion of plantations by instituting the Softwood Forestry Agreements (SFAs), the plantation estate had expanded to 170,000 ha (compared with 90,000 ha in 1939).

3.3 Water

The beginnings of water management in Australia were hardly auspicious.¹⁹ For example, the rapid growth of both area under irrigation and irrigation insolvency, led to the conclusion that “most works should never have been started and would not have been if, when they were submitted to the Department of Water Supply, they had been looked at in a common-sense way” (Davidson 1969, p.56). Davidson (1969, p.v) argued that, although

... the area of land irrigated per capita [in Australia] is higher than in any other developed country in the world ... there is a constant demand to conserve more water for irrigation because it is believed that, in the world's driest continent, this must be a profitable method of utilizing the nation's resources. In spite of this belief, it is simple to demonstrate that none of

¹⁸ Australian Newsprint Mills (ANM), Australian Pulp and Paper Mills (APPM) and Australian Paper Manufacturers (APM) had pioneered pulp production using short-fibred native hardwoods 1936-41, but had found that it was impossible to use blends composed entirely of hardwood pulp.

¹⁹ “We believe that too sanguine views of its [irrigation's] profitableness are often entertained from an under-estimate of the cost and an over-estimate of the results ...” (quoted in Davidson 1969, p.52, from 1881 Victorian Parliamentary Papers)

Australia's irrigation schemes operates profitably and that the Australian people would have had a higher standard of living if the area of irrigated land had been much smaller.

Despite this less-than-sanguine assessment that was becoming accepted by economists at the time,²⁰ substantial major irrigation water storages were completed in the 1950s and early 1960s including major Snowy Scheme works; Eildon enlargement, Rocklands, Upper Yarra (Vic); Glenbawn, Keepit, Menindee, Hume and Burrinjuck enlargements, Warragamba (NSW); Somerset, Tinaroo Falls, Koombooloomba (Qld); Lake Echo (Tas) for a mix of urban, irrigation, hydroelectricity and flood control reasons (Crabb 1997).

3.4 Fishing and marine

Active Commonwealth involvement in fisheries management commenced after WWII, and was initially focused on whaling, pearl fishing, fisheries development, and collaboration with the states (Hale 2002, p.112). By the mid-1950s, there were six whaling stations in Australia – three on the east coast (monitored by the Commonwealth Department of Primary Industry) and three on the west coast (monitored by the Western Australian Department of Fisheries). Each station was allocated an annual catch quota by the Commonwealth Minister on advice from the CSIRO and the department until 1962, when the east coast industry collapsed after a sudden and dramatic decline in humpback whale stocks (Hale 2002, p.113). The Commonwealth had, since 1952, also regulated the pearl and pearl shell industries, concentrated in Broome, Darwin and Thursday Island in Queensland. It licensed vessels, divers, areas of operation, and pearl shell take quotas; and was also responsible for monitoring resource stocks and ensuring resource conservation. The pearl shell industry, which peaked in 1957, went into permanent decline after plastics were introduced in many of its markets (e.g. buttons) in the late 1950s and early 1960s (Hale 2002, p.113)

The Commonwealth Fisheries Act 1952 came into force in 1955, commencing the Commonwealth regulation of fisheries. The Act proclaimed Australian jurisdiction over commercial fishing operations to a distance of approximately 200 nautical miles from Australia and its external territories (excepting Antarctica). It also required the licensing of fishermen and boats and the registration of fishing equipment, and gave the Minister the power to prohibit commercial fishing on the basis of species, time period, equipment, and/or fish size. The Commonwealth Department of Primary Industry entered an agreement with the State fisheries authorities whereby State law would apply to fisheries less than three nautical miles from the coast, in return for the states undertaking to administer fishing licences with Commonwealth financial support (Hale 2002, pp.113-116).

3.5 Minerals/Energy

Around 1955, Australia's mining and energy production can be summarised as follows:

		(\$m)		(\$m)
Gold (t)	33	30	Rutile (Kt)	60
Copper (Kt)	50	30	Zircon (Kt)	50
Tin (Kt)	2	3	Black coal (mt)	20
Lead (Kt)	300		exports (Kt)	290
Zinc (Kt)	290	16	Brown coal (mt)	10
Tungsten (Kt)	2		Iron ore (mt)	3.5
Manganese (Kt)	48		Pig iron (mt)	1.8
Uranium (t)	200		Steel (mt)	8

Source: Saddler, H. (1987)

The value of mineral production (including initial processing) was about \$330m, of which about \$140m was exported (current GDP was about \$10,000m in current prices).

²⁰ During the writing of this paper, one author was amused to read in a Branxton café, on a placemat which was a laminated copy of the "Truth" (26 January 1958, p.11), a critique of an unnamed economist who had dared to suggest that irrigation was not an economic investment.

Australia's mining industry was completely transformed in the post-war period. Pessimism about Australia's mineral reserves had prevailed throughout the first half of the twentieth century, with the discovery of Mt Isa's silver, lead and later copper in the 1920s the only find to rival those of the previous century such as Broken Hill and Kalgoorlie. Numerous new metals were developed in the 1950s. Production of tungsten, required for high speed cutting tools, expanded on King Island and elsewhere, and Australia came to provide about 4 per cent of world production. Titanium, valued in aircraft production for its strength and lightness, was drawn from the mineral sands between Sydney and Brisbane (Blainey 1993, pp.327-8). Uranium was a prominent 'new metal' in the 1950s. The Commonwealth effectively had a monopoly over uranium in the immediate post-war period, but when it relaxed these controls a burst of private exploration began. This led to the establishment of a wave of new mines, starting in 1953 with Rum Jungle near Darwin and the small Myponga near Adelaide, and followed the next year by Radium Hill in the Flinders Ranges, where radium had been mined earlier in the century. South Alligator in what is now Kakadu and Mary Kathleen near Mt Isa followed in 1956. By 1964, however, all except Rum Jungle had closed due to world uranium oversupply (Mudd 2003; Blainey 1993, pp.329-30). Iron ore mining was a domestically-oriented industry an export embargo was instigated in 1938 (Lyons 1938, McEwen 1940) and not lifted until 1960. Blainey (1993, pp.338-9) argued that the iron ore embargo, though exceptional, exemplified the misconceptions of the entire Australian mining industry between 1900 and 1960 – a failure to recognise firstly that a mineral cannot be said to be rare before it has been vigorously searched for and, secondly, that unpayable deposits can be made payable by new technology.

In 1955, an aluminium smelter was opened in Bell Bay in Tasmania – located there because of the energy-intensive production process and the relative cheapness of electricity in Tasmania – using bauxite from Malaysia. Bauxite was discovered on both sides of the Gulf of Carpentaria in the 1950s – at Gove in the Northern Territory, and around Weipa on Cape York; a third field was subsequently discovered in south-west WA. The lead-time to production was, however considerable, and exploitation commenced in the 1960s.

The first commercially viable Australian oil and gas fields were also discovered – at Moonie west of Brisbane (1961), nearby Alton (1964), Barrow Island in WA (1964), and multiple fields in Bass Strait. BHP's Bass Strait discoveries, made possible by new offshore drilling techniques, were many times larger than all of the oil and gas previously found in Australia (Blainey 1993, pp.335-7).

3.6 Pollution emissions & waste disposal²¹

From the earliest days of European settlement, Australians were gross polluters of the environment. Sydney's rapid desecration of its water supplies is a well-known story. By the late 1840s, complaints were reported of pollution from noxious industries in the Hawkesbury. As Sydney's urbanisation generally preceded large-scale industrialisation, human wastes and primary product processing were the primary sources of serious pollution problems in the 19th century. In the mid-twentieth century, management of pollution and waste in Australia was largely locally focused.²² These problems were associated with state capitals, industrial cities (e.g. Newcastle, Wollongong, Geelong, Port Pirie, Whyalla, Queenstown), or mining towns (e.g. Broken Hill).

Pollution problems from human wastes and primary product processing were exacerbated in the 20th century with industrialisation, increasing incomes and extensive car ownership by the mid-20th century (Coward, D. 1976a).²³ Coward, P. (1976, pp.93-4) cited a range of extant NSW

²¹ The survey for 1955 focuses on Sydney as this was the material most readily available to us.

²² cf. Europe and North America where regional issues were beginning to emerge such as acid rain and pollution of long rivers.

²³ ?? Godden, D. (1988), From Scarcity to Surfeit: a history of food and nutrition in New South Wales, R. Walker and D. Roberts, R.M.A.E., 56(3), 438-439.

acts to manage pollution including smoke (1902), noxious trades (1902), water, sewerage and drainage (1924),²⁴ and pollution management in general acts for public health (1902), local government (1919) and maritime services (1935) (see also Coward, D. 1976a). There was a range of departments and authorities – including local government – with sometimes overlapping, sometimes contradictory objectives and roles in waste/pollution management. A major player was Sydney's Metropolitan Water, Sewerage and Drainage Board (MWS&DB) which became “progressively a more powerful public authority” (Coward, D. 1976a, p.9). By the 1960s, there were increasing pressures on the MWS&DB for better waste management. The Department of Health (through its Health Inspection Branch) proved inadequate to regulate increasing volumes and kinds of wastes (Coward, D. 1976a, pp.15,17-18).

Water pollution management was also exercised by the Maritime Services Board (MSB, created 1936) which could regulate water pollutants in harbours and navigable waters. The MSB gained powers in 1915 to manage liquid and dangerous goods; Pollution of Navigable Waters Regulations were gazetted in 1941 and superseded by more comprehensive regulations in 1955; and there was a Prevention of Oil Pollution of Navigable Waters Act in 1960.

A Smoke Abatement Committee was appointed in 1955 “to investigate the causes, extent and effect of air pollution, and to recommend preventive measures”, reporting in 1958 and recommending a Clean Air Act. This Act was passed in 1961, and an Air Pollution Control Branch was created in the Department of Health in 1962 (Coward, D. 1976a, pp.20-21).

3.7 Biodiversity & landscape conservation

Of all the environmental and natural resources whose condition is examined in this paper, biodiversity and landscape is the hardest to report on at the three checkpoints. Difficulties arise because, with Australia still being deeply committed to development around 1955, there was little interest in – and therefore slight documentation of – biodiversity and landscape condition. More importantly, biodiversity and landscape condition is difficult to report on in such a short time fragment as “the decade around 1955”. Both biodiversity and landscape have such large timescales and can be both robust against and susceptible to disturbance; thus trying to report on their condition at a particular point in time is difficult. Of particular significance is that rabbit control via myxomatosis in the 1950s had dramatic impacts on the vegetation of both exotic agricultural and pastoral species, and also on native flora; further, the 1950s occurred as most of Australia changed from a long low-rainfall sequence (from the 1890s to the mid-1940s) to a long wetter sequence (to about 1990) (Wilson 1990, pp.240-41).

To the first settlers Australia must have seemed like an endless frontier; there was little apparent need to conserve anything, be it timber, soil or pasture. We now know that Australia's natural resources are not inexhaustable [sic], but we are still mining the soil and vegetation at an alarming rate. (Hobbs and Hopkins 1990, p.107)

Seddon (1976, pp.10-11) argued, since European settlement, there have been two contrasting and mutually-exclusive responses to the Australian landscape. The first – bleak and unfavourable – is utilitarian, emphasising the paucity of natural resources for a European lifestyle.²⁵ The second – favourable – focuses on its picturesqueness to European eyes.²⁶ Seddon (p.13) argued that, as a highly urban country, Australian people are (generally) insulated by technology from biophysical realities, and startled by every episode of its intrusion

²⁴ The Metropolitan Water, Sewerage and Drainage Board (now Sydney Water) was founded in 1888 (Coward, D. 1976a).

²⁵ see also Turner (1966, pp.134-5). Even in acknowledging Australia's past “iconic” mineral resources, and despite the contemporary expansion of knowledge of Australia's mineral wealth, Seddon (p.13) emphasises the transience of mineral resources – indeed that “Mineral wealth seems to engender a recklessly expansive view of the future ...” (Seddon 1976, p.13).

²⁶ Kathleen Fitzpatrick (quoted in Bolton 1976, p.115) added a nuance: this picturesqueness was obvious to those who had overseas “standards of comparison”; those “born and bred in the bush” took it for granted. For the “picturesque”, see also Proudfoot (1979).

(e.g. of natural disasters). He asserted this insulation gives rise myths, such as the “big-ness” of Australia, whereas – in reality – Australia has a small natural resource base. Frankel (1976, p.59) commented on the “recent” widespread interest in and concern for Australian wildlife, and contemporary questioning of the wisdom of (tax deduction promoted) bush clearing.²⁷ Elite (literary and visual) images of Australia are surveyed in chapters by Elliott, Kramer and Thomas in Seddon.

Hobbs and Hopkins (1990, pp.106-07) argued that Europeans came to Australia from a highly modified and resilient European landscape where non-resilient species had been lost and highly-resilient invasives gained. The pre-1788 Australian landscape had not been modified as intensively, and was not as resilient. Large-scale clearing, deliberate and inadvertent plant and animal introduction, particularly of ungulates, substantially disturbed the landscape. Much of the clearing of and modification to vegetation depicted in the 1996 national State of the Environment report (Figure 2.15, or comparing maps on pp.6-8 and 6-9) had occurred by the 1950s.

By the early twentieth century, much of the original flora had been cleared²⁸ (in the case of timber) or damaged by introduced livestock or rabbits in the cases of herbs and grasses. The Rural Reconstruction Commission had noted that previous efforts at land clearing had been unwise (and uneconomic), and identified what it saw as serious errors in the clearing of forestry resources, and noted development of a “national conscience” with regard to national parks.

Turner (1966, p.139) recorded an earlier estimate of the establishment of 5 new weed species per year 1870-1930. Turner recognised that in post-WWII Australia, the scale and intensity of intervention in “nature” had been revolutionised by mechanical and chemical advances, and investment in infrastructure. He reported an estimate that, for Victoria, 12 plant species were presumed extinct, 36 had not recently been observed, and 201 restricted to a very few colonies or individual specimens (pp.141-2). Turner argued that, even more important than species loss was the loss of so many plant communities, identifying the Brigalow as the next threatened by clearing (p.142-4; see also Webb 1966, pp.187ff.). Apart from clearing threats, Turner discussed the dilemma of fire management, eucalyptus dieback,²⁹ and over-grazing in arid areas as threats to ecosystem protection. He urged the creation of adequate conservation areas, especially in the arid zone.

“The Crown is too often regarded as a private landlord instead of as a universal trustee with a large and valuable property which it has to manage for the public good, and to protect against numberless forms of trespass. ... At present, public interests suffer to benefit only a few individuals. ... The forests can only receive proper treatment when regarded from the standpoint of a large national property handed down to us by the past generation and which we are bound to maintain in a state of unimpaired productiveness for the benefit of present and future generations.” (Vincent 1887 quoted in Webb 1966, pp.196-7)

Marshall (1966, chapter 2) discussed the post-European impact on Australian fauna, including the 1927 “appalling massacre” of koalas in Queensland when nearly 600,000 were killed in a few months. He listed 28 endangered marsupials, 13 marsupials known from a very small number of specimens, 10 endangered rodents, and 6 extinct marsupials. In chapter 3 Marshall listed one extinct bird, and 20 endangered birds.³⁰ Worrell (1966) argued that protection

²⁷ Describing Australian landscapes as “(the) bush” or “scrub” connotes biodiversity of low value which could easily – perhaps should – be cleared for both material and aesthetic “progress”.

²⁸ “The initial task was to recreate a European landscape in this foreign land and to beat the natural vegetation into submission ...” (Hobbs and Hopkins 1990, p.106)

²⁹ see also Landsberg et al (1990) Ecol soc

³⁰ Marshall (pp.66-7) noted that bird fanciers “frequently claim that, by capturing rare species, they save them from extinction.” (In Vietnam, only a few years later, it was reported that “It became necessary to destroy the village in order to save it.”) Marshall argued that – at that time – there was no evidence that rare birds bred in captivity had been released into the wild. He detailed the ending of commercial wild bird export in the 1950s.

measures were required to prevent extinction of the 2 crocodile species noting that, as prolific egg layers, it probably was not too late to save them. Similarly, species of other reptiles such as turtles, tortoises and lizards were under threat; one amphibian Worrell reported as not threatened by humans was the introduced cane toad which had spread at an alarming rate through eastern Queensland. Pollard and Scott (1966) surveyed the status of both marine and freshwater fish. Most marine species are not endemic, which decreases the capacity for damage from purely Australian actions, although over-fishing was indicated in some species and spear-fishing was especially indicted in some local areas (pp.103-4, 105-6). A major threat to fish, particularly stream and estuarine, was from pollution, both industrial (especially in NSW and Queensland) and agricultural (chemicals). A small number of exotics, such as trout and carp, were reported as damaging to native species (pp.107-10), although human changes to the riverine environment (e.g. de-snagging, cold water pollution) have been especially damaging, as has siltation from clearing.

Areas dedicated to conservation, now known as "national" parks, nature reserves, etc had their beginnings in Australia with "The (later, Royal) National Park" on Sydney's southern outskirts in 1879 – as an 7,280 hectare recreation area, and for "acclimatisation" of exotic species

(Pettigrew and Lyons 1979; Strom 1979).³¹ Ku-ring-gai Chase was declared in 1894,^{32,33} and other colonies also declared various kinds of reserves up to Federation (e.g. Wescott 1991).³⁴ In NSW from about 1910, bushwalking groups involving Myles Dunphy agitated for dedication of conservation areas from Kosciuszko to the Upper Hastings on the coast and the Warrumbungles in the central-west, and including the Blue Mountains. Their efforts resulted in some 14 declared national parks and reserves by 1969, and several others added subsequently (Dunphy 1979). By 1968, there were some 340 Australian national parks covering 2.9 million ha, with no more than 1% conserved in any of the mainland states (Wescott 1991). Most of these areas were still available for conservation from the late nineteenth century as they had little commercial value.

3.8 Scourges (pests, diseases & weeds)

Groves (2002, p.12) reported that in the period 1870-1980 approximately 5 alien plant species per year were introduced into the eastern mainland states. Many serious weed species had been introduced by 1955; only one had been vanquished.³⁵ Weed species have detrimental

³¹ "Mudflats and mangroves were replaced with grassed parklands, and some 3700 ornamental trees were planted. Buildings, roads and exotic landscaped gardens were all installed. Areas were set aside for the 'acclimatisation' of exotic animals for farming in Australia. Native trees were extensively logged. Military exercises were carried out in the park and deer, rabbits and foxes were introduced for sport. They still live in the park, and are serious pests."

<http://www.nationalparks.nsw.gov.au/parks.nsf/ParkContent/N0030?OpenDocument&ParkKey=N0030&Type=Xk>

³² "Ku-ring-gai Chase National Park was created in 1894. This was largely the work of one man - Eccleston du Faur. Disgusted at the destruction of local native plants, particularly by Sydney's flower sellers, he lobbied for a public reserve. When the national park was gazetted, Du Faur became its managing trustee. He held this position for 10 years, and was involved in the Ku-ring-gai Chase Trust until his death in 1915."

<http://www.nationalparks.nsw.gov.au/parks.nsf/parkcontent/n0019?opendocument&parkkey=n0019&type=xk>

³³ Some of our best natural parks have come to us by accidents of the past. They were 'reserved' only because nobody wanted them for any other purpose. Thus the splendid National Park and Kuringai Chase, respectively south and north of Sydney, remained ... because this country was totally unsuited to agriculture. ... Nowadays, when real estate spivs would like to divide these sandstone escarpments, and the valleys between, into fifty-foot blocks, they find them reserved, by a lucky accident of topography, unscathed for Australians of the future. (Marshall, 1966, pp.209-10)

³⁴ "Until 1959, *no* land in Victoria had been specifically set aside and managed for wild-life conservation, although there were, and are, various 'reserves'. Most of these were such in name only. In all of them the wild-life was ignored, and often misused in the commercial interests of grazing and forestry. Today [1966] there are 100,000 acres of State Wildlife Reserves, none of which had formerly been protected in any way." (Marshall, 1966, p.211)

impacts on agricultural (includes pastoral and horticultural) and biodiversity ecosystems,³⁶ and animal and human health. The exotic crop and improved pasture species of Australian agriculture form the major biodiversity impact because of extensive clearing in the cropping zones (SoE Cth 1996, pp.6-8 to 6-9) and biological dominance in their ecosystems. Apart from beneficial agricultural and ornamental uses, some of these species may also be detrimental – e.g. ryegrass as both a valuable pasture grass, and a cereal crop weed and asthma allergen.

Similarly, most serious animal pest species had been introduced by 1955; the first major control success was just being recorded, although the pest (rabbits) was far from conquered. Other serious vertebrate pests included fox, goat, pig, mouse, cat, dog, donkey, horse, buffalo, camel, black rat, cane toad,³⁷ and several birds and fish³⁸ (Bomford and Hart 2002). Not all of these species were solely pests – e.g. cat, dog and horse as companion/working animals, with movement between beneficial and pest populations; rabbits and cats as food sources for indigenous people. Human activity had also created pests of some indigenous species; e.g. stock watering permitted growth in some kangaroo populations.³⁹ Most pest species damaged both agriculture and natural ecosystems.

Invertebrate pests may have medical, veterinary, agricultural/forestry and marine impacts, or combinations of these (Canyon et al 2002).⁴⁰ Important invertebrate pests well-established by 1955 included the cattle tick;⁴¹ and bovine tuberculosis and brucellosis. The European wasp established in the 1950s; the European fan worm appeared in 1965 and was dominant in Port Philip Bay by 1992. Most of Australia's major insect pests were introduced prior to 1955 – e.g. Mediterranean fruit fly, stored grain pests, and internal and external livestock parasites (e.g. sheep blowfly). Canyon et al (2002) did not deal with either major indigenous pests (such as locusts) or organisms simpler than insects. Cereal rusts and viruses were a major problem, both in terms of prevention costs and episodic crop losses as the fungi/viruses mutated/evolved.⁴² Phytophthora, apparently introduced in the 19th century, is both a major environmental and important horticultural disease.

Efforts to control and manage pests, diseases and weeds occurred in all jurisdictions. Commonwealth and State governments managed quarantine in an attempt to prevent new incursions. State governments were responsible for outbreaks within their jurisdictions, although considerable work occurred at local government level. In NSW, for example, local councils and some weeds county councils controlled weeds, and Pastures Protection Boards managed livestock pests and, at least indirectly, diseases. By contrast Western Australia's Agriculture Protection Board integrated the control of declared plants and animals.⁴³ CSIRO, the universities and State agriculture departments (and some other agencies such as museums and botanic gardens) undertook research to identify and better understand damaging species.

Despite all the above, the major change to and damage of Australian ecosystems has been inflicted, directly or indirectly, by a single species – *Homo sapiens* var post-1788.⁴⁴

3.9 'Of droughts and flooding rains'

³⁵ prickly pear, effectively controlled by a biological agent; St John's Wort was also partially controlled by a beetle released in 1931.

³⁶ e.g. bitou bush, introduced to stabilise sand dunes (Department of Environment and Conservation 2004); Mimosa pigra, a serious weed of northern Australia (CRC for Australian Weed Management 2003)

³⁷ as is well known, introduced as a biological control agent.

³⁸ 2 of which are important angling species (trout), and one introduced as an (unsuccessful) biological control (gambusia).

³⁹ Landsberg et al (1997)

⁴⁰ Canyon et al's categories excluded environmental/ecosystem; except for cattle tick, their discussion of pests and diseases focused on recent introductions.

⁴¹ the importance of *Bos indicus* cattle to mitigate the effect of cattle tick was known from the early 20th century, and spread extensively in northern Australia from the 1950s.

⁴² or were, in an Intelligent Design world, continuously spontaneously created.

⁴³ Agriculture Protection Board Act 1950.

⁴⁴ "Man, the most destructive animal that the earth has ever seen ..." (Turner 1966, p.138)

On a large, old, sparsely-populated continent well away from the edges of its tectonic plate, Australia is less susceptible to natural disasters than many other countries. Its chief disasters are severe storms and cyclones, floods, bushfires and infrequent large earthquakes.⁴⁵

There is limited data available about natural disasters in the 1950s. To facilitate comparison with better estimates for later periods, data is summarised below from the Emergency Management Australia (EMA) natural disaster database⁴⁶ for 1951-60 (while noting serious caveats about its use in Bureau of Transport Economics 2001). Disasters during 1951-60 were estimated to have cost about \$1,450 million in 1998 dollars and cost 378 lives, of which an Adelaide earthquake in 1954 was estimated to have cost \$940 million in 1998 dollars. The other 2 major costed events were Queensland cyclones in 1958 and 1959 totalling about \$520 million in 1998 dollars. Extensive floods in eastern Australia in the first half of the 1950s – e.g. the 1954 Lismore flood which claimed 22 lives and the Hunter Valley floods of 1955 which claimed 50 lives – have no cost estimates in the database, nor do most other natural disasters including the drought of 1958 and the heatwaves of the same year which reportedly claimed 98 lives. BTE (2001, Fig 3.26) reported low bushfire costs in the 1950s (less than \$100 million in 1998 dollars) and high bushfire costs in the 1960s (nearly \$800 million in 1998 dollars).⁴⁷

4. Resources circa 1980

4.1 Agriculture

Large scale land clearing for agriculture was still occurring into the 1990s; anon (1996, Table 6.1) reported Queensland as clearing 3,000 square kilometres on average 1983-93 and 4,500 in 1990 whereas NSW cleared 1,500 square kilometres on average 1983-93 and 1,500 in 1990. Queensland and NSW undertook 90 per cent of the estimated Australian clearing in 1990. Subsequent Queensland estimates were an estimated rate of land clearing in 1991-95 of 262,000 hectares per annum, an estimated decline of 21 per cent compared to 1988-91. More than half the clearing (53 per cent) was occurring on brigalow lands; approximately 55 percent of all clearing was on leasehold land, and 42 per cent on freehold. There may be a high regrowth rate, as high as 43 per cent of the clearing rate, although there is considerable uncertainty about this estimate (Resource Sciences Centre 1997).

The first national systematic evaluation of land degradation in Australia was undertaken in the mid-1970s (Woods 1983). Information was collected by way of questionnaires completed by field officers of State soil conservation authorities. The primary data collection mechanism was via the question “What treatments are necessary to repair existing rural land degradation?” (p.2). It is not immediately clear whether such a question would be interpreted as “repair to pre-1788 state” (which would be unknown to the respondent) or repair to some state subjectively-determined by the respondent. In the arid zone, the eastern portion in NSW and Queensland and parts of the Channel country were reported as affected by erosion and land degradation. In non-arid grazing lands, substantial portions of the eastern states were reported to be highly affected by various forms of erosion. Both the eastern states’ and WA’s cropping zones were reported as substantially affected by erosion, and WA’s also by dryland salinity.

By the 1980s there was increasing national government involvement in environmental issues such as the National Soil Conservation program. A remarkable alliance of the National Farmers’ Federation and the Australian Conservation Foundation emerged in the late 1980s to seek government support for the financing of environmental preservation and restoration works, particularly on farm lands.

⁴⁵ “... a disaster is defined as an emergency event that is too large or complex for emergency management agencies to respond to effectively with resources available locally or regionally.” (Bureau of Transport Economics 2001, p.7)

⁴⁶ <http://www.ema.gov.au/ema/emadisasters.nsf/>

⁴⁷ for a summary of major Australian bushfires since the nineteenth century, see Ellis et al (2004, Appendix D)

4.2 Forestry

A hardwood woodchip export industry had commenced in 1970, driven largely by Japanese demand. In 1965 Japanese trading companies adopted woodchipping as a cheaper and more convenient alternative to shipping whole logs, opening up new horizons for Japanese wood procurement. Though Japanese importers had initially sought softwoods, once these sources were exhausted they turned to Australian hardwoods, attracted by the accumulated expertise of industry and government (in particular the CSIRO) in hardwood pulpwood production (AATSE 1988, p.258). Between 1970 and 1976, five major woodchip mills began operating in Australia – one in NSW (Eden 1970), three in Tasmania (Triabunna 1971, two on the Tamar River 1972), and one in Western Australia (Bunbury 1976) (Dargavel 1995, pp.90-102). The production of one million tonnes of pulpwood in 1970 increased to four million tonnes by 1976 (Dargavel 1995, p.88)

The Softwood Forestry Agreements (SFAs) of 1967, 1972 and 1976 had financed the development of publicly-owned softwood plantations primarily for use as sawlogs. Around 1980, Australia's plantation regime entered a transitional period, shifting both to privately-owned softwood plantations and to hardwood (eucalypt) plantations for industrial uses (DAFF 2002). Over the same period, softwood plantations established after 1945 for import replacement in pulpwood production were reaching maturity. By 1984-1985 about 50% of the forest cut for pulpwood production was from plantations, compared with about 18% in 1964-1965 (before the SFAs). The SFAs' import replacement objective was also being achieved – by the mid-1980s, Australia was about 70% self-sufficient in pulpwood (including paper) production, and 75% self-sufficient in newsprint production (AATSE 1988, pp.254-7). This abundance of softwood plantations created new opportunities for the forest industry to move away from dependence on native forest clearance. This was an ironic outcome for the environment movement, which had opposed the plantation push in an earlier period because it often occurred through native forest clearance, but which by the 1980s increasingly looked to plantations as a means of winding down native forest extraction (Clark 2003).

The two decades either side of 1980 were characterised by growing output alongside shrinking employment in forest industries. Between 1971-1972 and 1991-1992, the forests harvest grew by 37%, but forestry industry employment fell by 36%, from 55,000 to 35,000. Employment decline was smallest amongst loggers (5200 to 4100) and forestry workers (7100 to 5600), with the biggest job losses in sawlog and pulpwood production, as wood was increasingly diverted to woodchips (Dargavel 1995, pp.112-120). Forestry interests tended to blame environmentalists for job losses, but this attribution sits uncomfortably with the increase in forest cut over the same period, and the fact that employment decline was smallest amongst job categories in closest contact with the forests (loggers and forestry workers).

4.3 Water

The 1950-80 period was one of generally above long-term average rainfall in eastern Australia; in south-west western Australia, the period 1970-2000 appears to have been a period of below-average and downward-trending rainfall.⁴⁸ Despite a vigorous public debate about the economic value of irrigation in Australia in the 1960s, in the 1970s Australia exactly doubled its water storage capacity to 69,085 gigalitres. Large dams completed in the 1970s included Copeton (1364 gigalitres), Talbingo (921) (NSW); Fairbairn (1440), Fred Haigh (586), Ross R (417) (Qld); Ord (5,797) (WA); Lake Gordon (11,316) and the controversial Lake Pedder (2,960) (Tas). Completions in the 1980s totalled another 10,165 gigalitres: Glenbawn (870) (NSW); Dartmouth (4,000), Thomson (1,122) (Vic); Burdekin (1,860), Wivenhoe (1,150) (Qld); Burbury (1,070), Tullabardine (949), Mackintosh (914), Reece (641) (Tas) (Crabb 1997). Tasmania's proposed Gordon-below-Franklin Scheme precipitated a major controversy in the 1983 Federal

⁴⁸ http://www.bom.gov.au/cgi-bin/silo/reg/cli_chg/timeseries.cgi

election, and two High Court cases, the second of which successfully blocked construction of the scheme.⁴⁹

4.4 Fishing and marine

Commonwealth involvement in fisheries policy was extended in the 1970s and 1980s, firstly to define Australia's maritime jurisdiction for fishing purposes, and subsequently to address widespread depletion of fish stocks. The major development in fisheries policy during the 1970s was the definition and extension of Australia's exclusive fishing zone. This drew the Commonwealth further into the management of a resource that had hitherto overwhelmingly been the responsibility of the states. In 1968, provoked by a Soviet trawler's taking of prawns from an Australian fishery off the Gulf of Carpentaria, Australia established the Declared Fishing Zone as an exclusive fishing zone extending twelve nautical miles from the Australian coast (Hale 2002, p.158).

Five years later, the Third United Nations Conference on the Law of the Sea commenced. The resulting Convention on the Law of the Sea, declared in 1982 and coming into force in 1994, legitimised the concept of twelve-nautical-mile Territorial Seas, and also established the concept of exclusive economic zones extending 200 nautical miles from the territorial sea baseline. Australia quickly took advantage of this concept before the Convention was even declared, establishing in 1979 the 200-nautical-mile Australian Fishing Zone (AFZ), within which all fishing for swimming species was regulated. The Convention required Australia to concurrently establish a licence and access fee regime for foreign fishing vessels to take any allowable catch inside the AFZ that Australia could not or did not want to catch (Hale 2002, p.159). After 1979, such licenses were issued to Japan for tuna, Korea for squid, Taiwan for shark and trawling, and Thailand for trawling. The practice of international licensing ceased in 1997 as Australia no longer had excess fish stocks. In 1994, Australia extended the AFZ concept from fisheries to all types of resources (such as minerals, oil and gas), establishing an Exclusive Economic Zone extending 200 nautical miles from the coast (Hale 2002, p.202).

By the 1980s, the struggle to respond to resource depletion and establish the fishing industry on a sustainable long-term footing was the defining preoccupation of fisheries policy. The Commonwealth's first fisheries legislation with explicitly environmental purposes was passed in 1968, when it regulated the taking of sedentary organisms (i.e. species inhabiting the seabed) on the Continental Shelf. Whaling entrenched the idea of Commonwealth responsibility for the sustainable environmental management of Australia's marine territory. In 1978, Australia's last whaling station (Cheynes Beach, Albany, WA) was closed, and Prime Minister Fraser commissioned an inquiry into whaling. The government subsequently adopted the inquiry's recommendations that Australia prohibit whaling domestically and push for an international ban on whaling (Hale 2002, p.160).

New restrictions on the fishing industry were introduced steadily throughout the 1980s, in response to regulatory authorities' increasing realisation of the seriousness of fish stock depletion. In response to declining resource stocks in the Northern Prawn Fishery (Australia's most valuable fishery), the Commonwealth imposed seasonal closures in 1977, and restrictions on boat and gear size in 1984. These restrictions were gradually extended to other fisheries threatened by declining resource stocks. In 1983, the first Commonwealth-mandated catch controls and fish size limits were introduced in the Southern Bluefin Tuna Fishery, and likewise extended gradually to other fisheries. The first restrictions on the number of Commonwealth fishing boat licences issued occurred in 1985, together with the first structural adjustment program in the fishing industry (\$3 million to compensate operators in the Northern Prawn Fishery). Similar schemes were introduced nation-wide in 1986 through the National Fisheries Adjustment Program (Hale 2002, pp.160-3).

⁴⁹ Tasmanian Wilderness Society Inc. v. Fraser [1982] HCA 37; (1982) 153 CLR 270 (18 June 1982); The Commonwealth of Australia v. Tasmania. The Tasmanian Dam Case [1983] HCA 21; (1983) 158 CLR 1 (1 July 1983)

The Commonwealth-State relationship remained sensitive on fisheries matters, with many in the State fisheries authorities feeling that their Commonwealth counterparts did not possess sufficient knowledge or experience of the industry (Hale 2002, p.116). Commonwealth-State relations, managed after 1968 through the Australian Fisheries Council, were especially disrupted by a 1975 High Court ruling that the Commonwealth had jurisdiction over all marine resources in Australian waters beyond the low water mark. This effectively precluded State jurisdiction over fisheries in the first three nautical miles that had been formalised in the 1952 Fisheries Act. The Fraser government, unhappy with this ruling's affirmation of centralism, negotiated a series of Offshore Constitutional Settlements with the States to delineate responsibilities in the spirit of the 1955 agreement. These OCS agreements, sixteen of which had been signed by 1987, defined the basic parameters of Commonwealth-State responsibility for fisheries. The states manage inshore fisheries and state-specific fisheries, while the Commonwealth managed fisheries spanning more than one State (such as the Northern Prawn Fishery or the Southern Bluefin Tuna Fishery) (Hale 2002, pp.159-60).

4.5 Minerals/Energy

Around 1980, Australia's mining and energy production can be summarised as follows (cf. section 3.5):

		(\$m)			(\$m)		
Gold (t)	17	200	Rutile (Kt)	310		Bauxite (mt)	27
Copper (Kt)	240	340	Zircon (Kt)	490		Alumina (mt)	7
Tin (Kt)	12	170	Black coal (mt)	93	1800	Aluminium (Kt)	300
Lead (Kt)	390		exports (mt)	43		Nickel (Kt)	70
Zinc (Kt)	495	170	Brown coal (mt)	33		Ilmenite (mt)	1.4
Tungsten (Kt)	4.5		Iron ore (mt)	95	1000	Oil (ML)	24000
Manganese (mt)	2		Pig iron (mt)	7		LPG (ML)	9000
Uranium (t)	1800		Steel (mt)	8		Natural gas (ML)	3000

Source: Saddler, H. (1987)

The changes between this table and that in section 3.5 illustrate the minerals boom that began in the late 1950s. While the production of base metals (copper, tin, lead, zinc) increased, their rate of increase was dwarfed by that of manganese, rutile, zircon, black coal (especially for export). The most dramatic changes were in expansion of the "new" minerals and energy – iron ore (production up nearly 30-fold from 1955), and the production of bauxite/alumina/aluminium, nickel and ilmenite, and oil, LPG and natural gas which had not featured in 1955.

Australia began exporting iron ore from the Pilbara in 1966 (Mt Goldsworthy and Mt Tom Price, soon followed by Mt Newman and Robe River). Combined with new or expanded production from South Australia, Tasmania, and elsewhere in Western Australia, by 1984 Australia was exporting about fifteen per cent of the total iron ore produced in the western world (GSWA 1995, pp.4-5). Dampier and Port Hedland became the country's largest volume ports, followed by the two coal ports, Newcastle and Hay Point (serving the Bowen Basin mines) (Blainey 1993, p.342-3). New discoveries followed the iron ore boom: nickel around Kalgoorlie; diamonds in the Kimberleys (which came to provide 40 per cent of world production); and gold throughout the country (stimulated by the jump in gold prices following the end of Bretton Woods in 1971). New uranium was also discovered, but expansion was limited by the election of the Hawke Labor Government in 1983, which had originally pledged to end all uranium mining but retreated to a 'Three Mines' policy after intense pressure from the mining industry.

The Pilbara mines established a new benchmark scale of operation and capital commitment. Blainey identifies the key contributors to the cost of establishing these mines as the isolation of the ports, the greater isolation of the mines, the consequent large transport infrastructure costs, the massive scale of operations, and the lack of government aid (Blainey 1993, p.342). This scale was also seen in other minerals: between 1955 and 1968, the aluminium industry, from mines to smelters, absorbed some \$600 million in investment; between 1946 and 1966, investment in oilfield exploration and establishment exceeded \$400 million. The capital

intensiveness of mining after the 1960s created the appearance of high profits, but most of the new mines would not have been profitable without such capital-intensive methods (Blainey 1993, p.353-4). On the one hand, the massive scale of the ores being discovered meant that companies could often finance their own expansion after a small initial injection of outside capital; on the other hand, when outside capital was required, the scale of the requirement was such that it often had to come from overseas (Blainey 1993, p.352). Thus as Australian mining firms established this new benchmark scale of operation and capital requirement, their geographical reach also expanded. Just as the giants of Australian mining expanded from being field-wide to nation-wide during the 1950s and 1960s, in the 1970s and 1980s they expanded beyond the nation-state to become truly international firms. From the 1960s onwards, Australia's mining industry was further integrated into international minerals and capital markets.

4.6 Pollution emissions & waste disposal

Most States created environmental protection authorities in the early 1970s (cf. Table 11) to address substantial waste problems that had emerged with urban growth and rapid industrialisation after 1950. Comprehensive and systematic data took several decades to emerge and so, for 1980, evaluation of pollution emission and waste disposal is still based on relatively sketchy information. An indication of the issues involved is provided in SEAC's (1996, Table 3-20) summary of resource use and waste output for Sydney in 1970 and 1990. Energy use per head grew about 30%; water use per head grew about 25%; disposal of solid waste disposal per head grew about 30%; sewage disposal grew at least 30%.⁵⁰ Per capita atmospheric emissions of carbon dioxide grew by 25%. Per capita atmospheric emissions of other key pollutants fell: carbon monoxide and nitrous oxides by 10-15%; hydrocarbons by over 30%; and sulphur oxides and particulates by 80-85%.

Australian city car use (as vehicle kilometers per head) rose 26% in the 1970s and a further 12% in the 1980s; public transport use (trips per head) fell 20% in the 1970s, then stabilised (SEAC 1996, Table 3-29). Motor vehicles were major sources of nitrogen oxides and volatile organic compounds (photochemical smog precursors) in urban areas in the mid-1980s, and significant sources of carbon monoxide, particulate matter and lead (SEAC 1996, p.5-11, Tables 5-3 to 5-5).

One-hour concentrations of sulphur dioxide were high in Sydney in 1980 but fell rapidly in that decade; concentrations for Melbourne and Brisbane were well below the NH&MRC Guideline. Eight-hour carbon monoxide concentrations for Adelaide and Melbourne were above the NH&MRC Guideline and rising in the early 1980s; Sydney exceedances of the Guidelines were high in the mid-1980s, but fell substantially (SEAC 1996, Figures 5-23 to 5-25). Annual average concentrations of total suspended particles generally fell substantially during the 1980s in some metropolitan and industrial cities (SEAC 1996, Figures 5-26).

In the later 1980s, two atmospheric pollution issues dominated: CFCs and stratospheric ozone, and greenhouse gas emission and climate change. Australian consumption of CFCs had been falling overall from the early 1970s to the mid-1980s, although aerosol uses were falling substantially while non-aerosol (e.g. refrigerant) uses were rising rapidly (SEAC 1996, Figure 5.37). The 1987 Montreal Protocol of the Vienna Convention for the Protection of the Ozone Layer was implemented to manage global uses of CFCs and similar substances.

As an energy-intensive economy with large energy reserves, Australia's energy intensity of GDP fell at a substantially lower rate 1970-90 compared to other OECD countries (SEAC 1996, Table 5-7) and its per capita greenhouse gas emissions were high although as a small country its total contribution to global emissions was small (SEAC 1996, p.5-9). Melbourne had substantially higher per capita energy use than Sydney in the mid-1970s (SEAC 1996, Table 3-24); comparable carbon dioxide emissions are difficult to derive from this crude data because

⁵⁰ data for 1970, but not 1990, included stormwater; there was a major expansion in Sydney's sewerage system in the 1970s as a major plank of the Labor Government.

although Melbourne's electricity was generated from brown coal, by the mid-1970s gas from Bass Strait was becoming an important fuel. Melbourne's particulate emissions probably fell substantially as gas especially replaced brown coal briquettes for household heating. Adelaide's per capita energy use was slightly higher than Sydney's, and Perth and Brisbane's about 30% lower.

Environmental management also targeted other noxious and dangerous emissions, although not necessarily systematically or successfully by 1980. Some gains, however, were made. For example, heavy metal concentrations in mussels in Corio Bay (Victoria) fell – in some cases substantially – between the late 1970s and late 1980s (SEAC 1996, Table 3.34)..

4.7 Biodiversity & landscape conservation

Recher and Lim (1990, p.289-90) concluded that European settlement had most affected mammals and amongst Australian vertebrates, especially in grazing and farming areas. Mammals in south-western Australia were reported as being less severely affected until the 1970s than in the east or arid interior. Northern Australian was also less severely affected, although some mammalian species abundance had declined. Small mammals (0.035-5 kg) were reported as most affected by European settlement, especially in arid and semi-arid areas. With two exceptions, forest habitats have not lost their mammals, although abundance has declined and there have been some regional extinctions. Recher and Lim (1990, p.290-91) noted the paucity of data on birds, few extinctions, and an "illusion of well-being" because of common species abundance. Ground dwelling and ground foraging birds of grazing and farming areas have been most affected. Parrots have been particularly affected because they are important in aviculture and trapping is cheaper than breeding. Reptiles and frogs were reported as being more robust to human impact. Recher and Lim also note that some species had thrived following European settlement – e.g. large kangaroos, some parrots (presumably well-adapted to Australian farmed grains), and birds easily adapting to urban environments (see also Fox, 1990). Most of the observed changes occurred within 20-30 years of an area's settlement (Recher and Lim (1990, p.291). There may however be several stages to change – e.g. if some patches are left after initial clearing, vertebrates may retreat to these patches but the patches are vulnerable to (especially exotic) predation, may not be sufficiently large to sustain populations in severe events (e.g. drought, fire) or have sufficient genetic diversity to be robust over time. There may also be several agricultural "settlements" – e.g. large-scale cropping of the heavy black soils of northern NSW and the Darling Downs succeeded pastoralism through development of adequate machinery and subsequently herbicides; cropping is currently succeeding pastoralism on the eastern margins of NSW's Western Division; irrigation succeeds either extensive cropping or pastoralism.

Despite the long-standing interest in soil conservation at the state level, more general concerns surfaced in the 1970s that all was not well with Australia's environmental capital stock. Individuals had lobbied strenuously for decades over relatively local environmental issues (especially national parks – e.g. Thompson 1986; Libby 1998) and the first major environmental battles were fought over non-agricultural issues – such as the Tasmanian hydro schemes involving Lake Pedder (circa 1970) and the Gordon-below-Franklin (early 1980s). By the late 1980s, an increasingly unpopular Federal Labor Government had resorted to courting the "green" vote to retain office at the 1990 election (cf. Godden 1997, pp.133-4).

By 1978, the number of Australian national parks had grown to 469 covering 9.8 million hectares (more than a threefold increase from 1968), and representing a range of 0.2% (Northern Territory) to 2.1% (NSW) of area in the mainland states, being 1.3% for Australia as a whole. Area then more than doubled 1978-90, with Victoria having 10% of its area in conservation by 1990; the other mainland states were considerably less (NSW: 3.9%; SA: 3.1%; Queensland and WA: about 2%) (Wescott 1991).

4.8 Scourges

Scourges continued to be major – and, in many cases, growing – problems of both agricultural and natural ecosystems. In successes, one form of skeleton weed was controlled by introduction of a rust fungus in 1971. Failures included the collapse of the infant cotton industry in the Ord in the 1970s due to insect pests, especially helicoverpa/heliothis (Michael and Woods 1980).⁵¹ Extensive scrub clearing in central Queensland greatly expanded the favourable habitat of the migratory locust causing a major plague of this species 1973-75, and lesser outbreaks in the 1990s.⁵² The narrow genetic base of lucerne (the single variety Hunter River) led to devastation of lucerne stands when two invasive aphids appeared in the late 1970s; control was achieved by varietal development and biological control (Hughes et al 1987).

A major switch from crop weed control via cultivation to chemical control commenced 1955-80. However as early as 1982, herbicide resistance was reported in ryegrass and barley grass in Australia, and several years later in wild oats.⁵³ Pesticide resistance in cattle tick had been observed much earlier, as the tick evolves rapidly to reduce its susceptibility to chemicals, even to chemical classes.⁵⁴

Policy innovations included the establishment of the Australian Plague Locust Commission in 1974, jointly funded by the Commonwealth and the eastern mainland states.⁵⁵ In the 1970s, the Commonwealth and states commenced an ambitious bovine tuberculosis and brucellosis eradication campaign which took until the late 1990s to complete (Neumann 1999). The Australian Cereal Rust Control Program was established in 1973 at the University of Sydney; it emphasises disease control by resistance breeding.

4.9 'Of droughts and flooding rains'

Bureau of Transport Economics (2001) extended the Emergency Management Australia natural disaster database, examining in detail the period 1967 to 1999 for events exceeding a \$10 million total cost threshold. As the reporting quality has improved over time in this database, the Bureau of Transport Economics cautioned against both using earlier data, and examining trends over time. The EMA database also includes non-natural disasters such as large-scale accidents (e.g. air, rail, road, shipwreck), explosions, urban fires and disease outbreaks.⁵⁶ The database, however, does not cost droughts.

The Bureau of Transport Economics estimated disaster costs for the 1960s of about \$1,000 million (1998 dollars); over \$12,000 million for the 1970s (of which Cyclone Tracy was about \$2,000 million according to BTE and \$4,200 million according to EMA); and over \$10,000 million for the 1980s (\$4,500 million for the Newcastle earthquake, and about \$1,400 million according to EMA) (BTE 2001, Fig 3.2). To provide perspective to these estimates, the Bureau of Transport Economics estimated that the cost of road accidents in the single year 1996 was approximately \$15,000 million in 1996 dollars (BTE 2000, p.xi)

Natural disasters for the period 1967-99 were estimated to have cost about \$10,400 million for floods; over \$9,000 million for severe storms; about \$9,000 million for tropical cyclones; about \$4,800 million for earthquakes; and about \$2,500 million for bushfires (BTE 2001, Fig 3.13). Flood costs were low in the 1960s, about \$4,000 million in the 1970s and about \$2,500 million in the 1980s (BTE 2001, Fig 3.16). Severe storm costs were low in the 1960s, rising to about \$1,500 million in both the 1970s and 1980s (BTE 2001, Fig 3.19). Tropical cyclone costs are

⁵¹ An irony was that "At the Ord, immediately after heavy spraying had ceased [on cotton], and even in some unaffected areas during the period of commercial cotton production, the pest problems on other crops such as sorghum and oilseeds was eased to such an extent that usually no chemical controls were necessary." (Michael and Woods 1980, p.17)

⁵² <http://www.affa.gov.au/content/output.cfm?ObjectID=D2C48F86-BA1A-11A1-A2200060B0A00407>

⁵³ <http://www.regional.org.au/au/roc/1990/roc199001.htm>

⁵⁴ <http://regional.org.au/au/roc/1990/roc199043.htm?PHPSESSID=1889bf8231e00cddcb7dfa4e8dc5feda>

⁵⁵ for Australian Plague Locust Commission, see <http://www.affa.gov.au/aplc>

⁵⁶ it also includes some non-Australian events; for example, there is a reported death toll of 273,687 for 2004, of whom 273,636 are tsunami victims outside Australia; the 2002 Bali bombing is also included as is the attack on Washington's World Trade Centre in 2001.

dominated by Cyclone Tracy (Darwin, 1974) which cost over \$4,000 million, cyclone costs in 1971 and 1973 were also over \$500 million (BTE 2001, Fig 3.21). The 1970s costs of cyclones exceeded \$7,000 million, with no other decade exceeding \$1,000 million (BTE 2001, Fig 3.22). There were low bushfire costs in the 1970s, moderate in the 1960s but high in the 1980s (BTE 2001, Fig 3.26). There was one major earthquake event (Newcastle, 1989) which was estimated to comprise 94% of total earthquake costs since 1967 (BTE 2001, p.44).

5. Resources around 2005

The Brundtland report, *Our Common Future*, prompted some rethinking of the ways that contemporary economies used natural resources:

Many present efforts to guard and maintain human progress, to meet human needs, and to realize human ambitions are simply unsustainable—in both the rich and poor nations. They draw too heavily, too quickly, on already overdrawn environmental resource accounts to be affordable far into the future without bankrupting those accounts. They may show profits on the balance sheets of our generation, but our children will inherit the losses. We borrow environmental capital from future generations with no intention or prospect of repaying. They may damn us for our spendthrift ways, but they can never collect on our debt to them. We act as we do because we can get away with it: future generations do not vote; they have no political or financial power; they cannot challenge our decisions. (p.8)

Both Brundtland, and local Australian resource management controversies in the 1980s, prompted a range of responses that significantly changed both the policy and information landscapes. A “snapshot” of resources around 2005 is both more possible than those of 1955 and 1980, and more difficult because of an embarrassment of riches in source material.

By the mid-1990s there was substantial documentation, but essentially in a “snapshot” form, of the “state of the environment” – e.g. from the Ecologically Sustainable Development process and the short-lived Resource Assessment Commission’s inquiries into forestry and coastal zone management; formal State of Environment reporting (e.g. SEAC 1996, NSW Environment Protection Authority 1997); and from establishment of resource management bodies (e.g. Australian Fisheries Management Authority). ABS (1996a, chapter 1) briefly discussed water stocks and a variety of contaminants (e.g. salinity, nutrients, agricultural chemicals, blue-green algae); soils and problems (e.g. erosion, acidity, and salinity); environmental hazards (e.g. cyclones, floods, bushfires, droughts and pestilence). More detailed snapshots of problems with soils, exotic flora and fauna, pollutants were documented in ABS (1996a, sections 6.7, 9.3, 12.1). ABS (1996a, Tables 13.1.1, 13.3.2) documented extensive contemporary Federal, State and Territory legislation that affects environmental resources and schemes to manage environmental resources. By 2005, there was improved documentation and analysis through later State of Environment reports (e.g. the Commonwealth’s in 2001, States’ in a variety of years, and the National Land & Water Resources Audit and associated Australian Natural Resources Atlas).⁵⁷

By the mid-2000s, continued policy debate resulted in more detail on some natural resources: e.g. forestry (from the Regional Forest Agreements process),⁵⁸ fisheries (e.g. from the production of Environmental Impact Statements for NSW coastal fisheries).⁵⁹

⁵⁷ e.g. <http://www.deh.gov.au/soe/index.html>; <http://www.dec.nsw.gov.au/soe/soe2003/>; <http://www.ces.vic.gov.au/ces/wcmn301.nsf/childdocs/-E6B87D4214877024CA256F250028E4A7?open> http://www.epa.qld.gov.au/environmental_management/state_of_the_environment/ http://www.environment.sa.gov.au/sustainability/measuring_progress.html http://portal.environment.wa.gov.au/portal/page?_pageid=673,1&_dad=portal&_schema=PORTAL <http://www.rpdc.tas.gov.au/soer/>;

⁵⁸ <http://www.nlwra.gov.au/topics.asp>; http://audit.ea.gov.au/ANRA/atlas_home.cfm

⁵⁹ see a variety of EISs for individual fisheries at <http://www.fisheries.nsw.gov.au/commercial>

Notwithstanding major changes that occurred during the 1990s, the Australian State of the Environment Committee (2001, p.2) concluded that:

Despite initiatives such as noted above [listed in section 7.1 below], the state of the Australian natural environment has improved very little since 1996, and in some critical aspects, has worsened.

5.1 Agriculture

The 1990s were declared the Decade of Landcare (ABS 1996a, pp.170-1; 1996b, pp.138-41). Climate change emerged as an issue, with agriculture identified both as a source of greenhouse gas emissions (especially methane and nitrous oxide) and also as a potential casualty of changed environmental conditions.

A comprehensive spatial survey of contemporary Australian agriculture is provided in 5 sections of the Australian Agriculture Assessment 2001 in the Australian Natural Resources Atlas.⁶⁰ The sections “The changing face of agriculture” and “Profile of Australian agriculture” provide a physical analysis, including spatial. The sub-section “Trends in agricultural productivity” evaluates partial factor productivity even though more sophisticated analyses are readily available (e.g. Productivity Commission 2005, section 6). There are more thorough agricultural industry analyses in Productivity Commission (2005) and ABS (2005). A dramatic commodity change has been the long run decline in sheep-based products in exports (from 40% in 1969-70 to 10 % in 2003-04; Productivity Commission 2005, pp.66-7). The area cropped in Australian agriculture increased from about 17m ha 1980 to 23m ha 2003 (ABS 2005, Fig 14.11; changes at the state level from 1979-80 to 2002-03 being: NSW (increase 27%), Vic (increase 45%), Qld (increase 17%), SA (increase 59%), WA (increase 42%))

Australian agriculture both produces in a challenging biophysical (and international economic) environment, and affects that biophysical environment through both on-site and off-site effects (e.g. Australian Agriculture Assessment 2001 in ANRA).

Hajkowicz and Young (2002) presented an interesting attempt to examine the net economic effect of agriculture’s performance in a spatial context. Their study detached annualised costs of capital (as depreciation) and labour costs (imputed) from synthesised value added estimates based on regional estimates of gross margins for 1 km² grids across the 450 million hectares used by agriculture. Implicitly this provides estimated net returns to natural resources in agriculture,⁶¹ which were estimated at \$7,530 million on-farm, and \$6,560 million when adjusted for assistance to agriculture (pp.12-13).⁶² Average returns to fixed natural resources (land and water) show high values of returns per physical unit in irrigation agriculture, and especially in vegetables, fruit, tobacco, grapes, tree nuts, cotton which (except for cotton) have low demand elasticities because focused on domestic markets and therefore little capacity to use more natural resources because of likely output price effects. Unfortunately the study did not decompose returns in the “Dryland cropping and grazing” sector (which occupies 470 m hectares, as opposed to irrigation’s 2.4 m hectares) into extensive grazing (which occupies about 430 m hectares) and arable land (occupying about 40 m hectares) as it is clear from the basin-by-basin and spatial results that profit at full equity is low in the extensive grazing areas (Table 2.5, Figure 2.2).

5.2 Forestry

The implementation of the Regional Forestry Agreement (RFA) process following the 1992 *National Forest Policy Statement* (Commonwealth of Australia 1992), has fundamentally

⁶⁰ http://audit.ea.gov.au/anra/agriculture/docs/national/Agriculture_Contents.html

⁶¹ Oddly, it is claimed that “profit at full equity [is] the return to land, water, capital and managerial skill” even though depreciation is included in estimating PFE (Hajkowicz and Young 2002, p.62 cf. pp.52-3)

⁶² the method is comparable to Costanza et al (1997) – see section 8.6(b)

transformed native forest management in Australia. The RFA process, intended to provide twenty-year certainty on resource use in the forestry industry for all stakeholders, arose in response to an unprecedented wave of protests against the decision of the Commonwealth Resources Minister to approve, contrary to the Environment Minister's advice, a number of woodchip licences (Hutton and Connors 1999).

Eleven RFAs have been decided thus far at a total cost to government of \$300 million (Redwood 2001), with mixed results. The first three RFAs, covering the biggest woodchipping regions in Tasmania and Victoria, delivered for industry but were condemned by conservationists.⁶³ In contrast, the SE Queensland RFA agreed to a complete replacement of native forest logging on Crown land with plantation timber within 25 years. It was praised by both the Queensland Timber Board and conservationists,⁶⁴ but the Commonwealth government did not recognise the agreement because of its view that the RFA "must provide for a continued, viable native timber industry" (Tuckey 1999).⁶⁵ At least two RFAs, one in Western Australia and one in NSW, have already been modified to strengthen conservation outcomes – despite the central purpose of the RFA process being to provide twenty-year certainty. The WA RFA was released in May 1999 but, in the face of community outrage, was revised eight weeks later to phase out (karri and tingle) or scale back (jarrah) old-growth logging. Even this did not assuage public concern, and the Labor Opposition won the 2001 state election promising to end old-growth logging altogether (Walsh 2000; Brueckner and Horwitz 2005; Hollander 2004). In the lead-up to the NSW state election in March 2003, the Premier announced 65,000 ha of new reserves in the zone covered by the North East RFA.

The outcomes of the RFA process have rarely been welcomed by all parties. Nevertheless, they have partly served their purpose of providing medium-term certainty over resource use. The forest resources accessible to the timber industry have significantly declined in many regions, but its access to that which remains is much more secure, for the time being at least. The conservation movement, although remaining partly focused on the reversal of the most negative RFA outcomes, has largely moved on to tackling other issues, such as restrictions on land clearing on private land, and conserving areas not covered by the original RFA (e.g. the Brigalow Belt South in central western NSW, significant sections of which were conserved by the NSW Government in April 2005).

The plantation sector continues to grow strongly, with 715,531 ha of hardwood plantations and 1,000,642 ha of softwood plantations as of 2004. The plantation estate expanded by 53,586 ha in 2004, with the new areas planted demonstrating both the trend to private ownership (which accounted for 47,074 ha or 88% of the growth) and to hardwoods (which accounted for 46,263 ha or 86% of the growth). However, the total plantation estate of 1.7 million ha is dwarfed in comparison with the total native forest area where timber production is permitted (11.4 million ha) (DAFF 2004).

5.3 Water

Australia appears close to having finished its love affair with building large dams.⁶⁶ There are some 447 large dams with a combined capacity of 79 000 GL; and farm dams comprise 9% of total storage.⁶⁷ Approximately 70% of regulated water is used in agriculture, households and water supply/management organisations use about 16%, electricity (excluding hydro) and gas

⁶³ TWS 2000; Cadman 1998. These agreements were rushed through in 1997-1998 because the Commonwealth had threatened to revoke woodchip export licenses in regions without RFAs by 2000.

⁶⁴ The Queensland outcome was made possible by a prior rapprochement between these two groups (TWS 1999; McInnes 1998).

⁶⁵ As Brown (2001, p.24) commented, the Commonwealth view amounted to "a conviction that because native forests *could* be sustainable indefinitely into the future... they *must* be logged – irrespective of whether other [potentially economically superior] options such as plantations were available".

⁶⁶ Although there are several still on the drawing boards such as the Fitzroy (northern WA) and Clarence (northern NSW); e.g. <http://www.ourwaterfuture.com.au/kwsp/index.asp>; <http://www.abc.net.au/gnt/people/Transcripts/s1223860.htm>

⁶⁷ http://audit.ea.gov.au/anra/water/docs/national/Water_Availability.html

used about 7%, and manufacturing and mining the rest (ABS 2005, p.669). About 50% of household use is “outdoor” (ABS 2005, Fig 24.22). Except more recently in agriculture, there is little effective re-use of water (ABS 2005, Fig 24.24). The extensive regulation of most southern rivers and recognition of externalities such as salinity slowly began to change the emphasis from expanding irrigation schemes to making more efficient use of existing harvested water.

ANRA reported that NSW’s inland catchments were over-developed; most of Victoria’s inland catchments were at least fully developed; and most of Queensland’s south-eastern catchments were highly developed.⁶⁸ Surprisingly, in-stream water quality data is somewhat limited except for well-known problems like salinity:

Water quality trend data were limited by the lack of monitoring sites with adequate long-term records. There are generally sufficient salinity data to assess trends in most of the more intensively developed catchments and a relatively good coverage of turbidity data for trend analyses in the intensive land use areas. Victoria is the only State that monitors both nitrogen and phosphorus with sufficient frequency to provide data across the State on which good trend analysis can be undertaken.⁶⁹

There have been substantial changes in water regimes: in terms of seasonal flow, construction of artificial barriers and removal of natural ones, changes in water temperature, nutrient content and turbidity.⁷⁰

There has been little effective action to reduce water use except in the short term when water is “scarce” (most capital cities and many smaller centres have had water restrictions in recent years). Beginning in the early 1990s, there was a move to replace the funding of water supply authorities via annual standing charges and to introduce a greater reliance on volumetric charging in both agricultural and household uses. This change was intensified by the Competition Policy Agreement requiring prices oversight of government business enterprises, competitive neutrality, and structural reform of public monopolies (Competition Principles Agreement 11 April 1995). This trend was accentuated in the National Water Initiative.

5.4 Fishing and marine

Despite the piecemeal natural resource management strategies introduced in Australian fisheries through the 1980s, by the end of the decade biological research was making it obvious that “many fish stocks were either fully or over-exploited and [that] unless remedial action was taken there was a strong risk of stock collapse” (Battaglene 1998). Species most seriously depleted included Southern Bluefin Tuna, gemfish, and several varieties of shark (FAO 2003a). Accompanying this natural resource problem were a number of economic problems – overcapitalisation,⁷¹ accompanying economic inefficiency, and resource allocation problems resulting in some fisheries with excess capacity existing alongside others being over-fished (AFFA 2003).

The Commonwealth government’s response to these environmental and economic challenges came in 1989 with the release of a comprehensive policy statement, *New Directions for Commonwealth Fisheries Management in the 1990s* (DPIE 1989). These proposals attempted to put the fishing industry in Australia on an environmentally and economically sustainable footing by establishing the principles of ecological sustainable development and cost-recovery as the two main pillars of fisheries policy (FAO 2003a). The subsequent enabling legislation, especially the *Fisheries Administration Act 1991*, established the basic governance framework for Australian fisheries that still exists. Reforms arising from *New Directions* included the

⁶⁸ Figure 29 in http://audit.ea.gov.au/anra/water/docs/national/Water_Sust_Mgmt.html

⁶⁹ http://audit.ea.gov.au/anra/water/docs/national/Water_Overview.html

⁷⁰ http://audit.ea.gov.au/anra/water/docs/national/Water_Quality.html

⁷¹ Overcapitalisation arises when the allocated take quotas significantly exceed existing fish stocks, creating competitive pressures that lead to investment of significantly more capital and labour than necessary to harvest fish stocks efficiently.

creation of an independent statutory authority (the Australian Fisheries Management Authority, AFMA); the allocation of responsibility for the production of standardised data on fish stocks to the Bureau of Resource Sciences (later, the Bureau of Rural Sciences); and the increased use of cooperative management approaches between government and stakeholders. Many of the most important reforms to the licence and quota system were economic in nature, establishing new and more secure property rights (statutory fishing rights); new tradeable commodities (individual transferable quotas); and new market-based forms (e.g. tendering or auctioning) for the allocation of rights in new fisheries (AFFA 2003).

Many of these changes mirrored the New Public Management reforms implemented throughout OECD member governments in the 1980s and 1990s (Hood 1991, 1995) – such as moves to complement input-based regulation (e.g. limiting boat numbers) with output-based regulation (e.g. limiting catch quotas); the establishment of monitoring systems including performance indicators to improve transparency in government; the implementation of cost-recovery in government fisheries management; the extension of market-based forms of regulation; and the shift from government-directed regulation to co-management involving multiple stakeholders. In this sense, the *New Directions* reforms were a response not only to over-fishing and over-capitalisation, but also to the changed policy environment of the 1980s and 1990s.

The *New Directions* reforms were accompanied by the continued tightening of management regulation of fisheries through the 1990s – the number of Commonwealth fishing boat licences dropped from over 5000 in the early 1990s to 1283 in 2002 (Hale 2002, p.200). Despite these efforts, however, since 1992 the number of Australian commercial fish stocks or species considered to be overfished has increased from five to seventeen (of 74) (Caton and McLoughlin 2004). The challenges posed by the continuing deterioration of fisheries resource stocks led the Commonwealth government to announce a \$220 million adjustment package for the fishing industry in November 2005. The bulk of the funds will go to licence buybacks, and the number of Commonwealth licences is expected to fall from 1200 to 600 (ABC Online 2005; Macdonald 2005).

The evolution of the fisheries policy framework since the mid-1970s is strikingly different from that of other more contested natural resource policy areas such as forestry. Forestry and fisheries policies were faced with similar policy challenges in the 1980s and 1990s – the realisation that current resource extraction rates were unsustainable. But whereas this incipient crisis spawned fundamentally incompatible policy paradigms in the case of forestry, the fisheries policy debate remained centred on the notion of ecologically sustainable development, which is interpreted to mean the maximisation of sustained yield while ensuring non-reduction in resource stocks and the conservation of ecosystem, rare and endangered species, and a representative marine habitat (FAO 2003a). Coastal fishing industries have been affected in places by the establishment of Marine Protected Areas for conservation purposes, but the conflict over these moves has not been comparable to that concerning forestry, partly because governments have tended to address fishing industry concerns by offering license buy-outs that often represent a way out of the industry for license-holders in over-fished areas. Additionally, except in the Great Barrier Reef, Marine Protected Areas have largely been small and established in State waters of relatively low fisheries productivity.

Australia's wild-capture fishing industry appears to be reaching or has reached full production. Production from fisheries resources has remained fairly constant in terms of mass, around 230,000 tonnes per annum, since 1995-1996 (FAO 2003a). BRS's 2001 Fishery Status Reports declared none of Australia's commercial fish species to be under-fished for the first time.⁷² In the 2004 Fishery Status Reports, the BRS collapsed the categories of 'fully fished' and 'under-fished' into a single 'not over-fished' category, appearing to suggest that policy approaches based on increasing the rate of resource extraction were no longer appropriate for any commercial Australian fish stock. Commercial inland fisheries are in particular decline, having virtually ceased in Queensland, New South Wales, and the Murray River in South Australia (FAO 2003a).

⁷² That is, all were classified as fully fished, over-fished, uncertain, or status not classified.

The best prospects for fishing industry growth probably depend on growth in aquaculture. As fish stocks declined through the 1980s-90s, aquaculture became the fastest growing sector of Australian fisheries. Between 1990-1991 and 1997-1998, aquaculture production increased by over 160 per cent to nearly \$500 million (twenty-six per cent of the value of total Australian fisheries production) (Hale 2002, p.200).

5.5 Minerals/Energy

In 2002-03, Australia's mining and energy production can be summarised as follows (cf. section 3.5):

Gold (t)	386	Rutile (Kt)	880	Bauxite (mt)	54
Copper (Kt)	537	Zircon (Kt)	458	Alumina (mt)	16
Tin (Kt)	708	Black coal (mt)	274	Aluminium (Kt)	1855
Lead (Kt)	267	exports (mt)		Nickel (Kt)	210
Zinc (Kt)	570	Brown coal (mt)	67	Ilmenite (mt)	2
Tungsten (Kt)		Iron ore (mt)	199	Oil (ML)	33,321
Manganese (mt)	3	Pig iron (mt)		LPG (ML)	4,682
Uranium (t)	9,222	Steel (mt)	9.4	Natural gas (m ³)	33,162
				Diamonds (ct,m)	32

Source: Australian Bureau of Statistics (2005a)

Iron ore's dominance in Australia's resource export profile was challenged in the 1990s by the massive oil and gas discoveries on Australia's North West Shelf. In 1963, Woodside Oil Company was awarded marine exploration rights over 367,000 square kilometres of the North-West Shelf. Vast reservoirs of natural gas were discovered in the early 1970s. The North West Shelf Gas venture was established in 1984 to exploit the almost 50 trillion cubic feet of gas that were eventually identified. Since then, \$14 billion has been invested in the venture, making it Australia's largest ever resource development project. Led by Woodside but equally owned amongst six partners (also BP, Chevron, Shell, BHP and Japan Australia LNG (Mitsui and Mitsubishi)), it is currently responsible for one third of Australia's oil and gas production (NWSG 2006). Being far in excess of domestic consumption, the majority of production is intended for compression, freezing and export (NWSG 2006; Blainey 1993, p.359). Shipments to Japan commenced in 1989, eighteen years after the first under-water gas field was discovered. In 2002, the NWSG venture signed Australia's largest ever single export deal – a \$25 billion contract to supply gas to China (Allard and Garnaut 2002). This deal was itself eclipsed in 2003, when a separate deal with China potentially worth \$30 billion was signed (AAP 2003).

A significant development after 1980 was the emergence of WMC (now BHP)'s Olympic Dam mine as one of the world's largest producers of copper, silver, gold and uranium. Olympic Dam commenced production in 1988 with permission to draw 33 ML of water per day from the Great Artesian Basin, making it the largest single user of water in Australia.⁷³ Despite the present Commonwealth Government's desire to expand uranium production, only three mines – Olympic Dam, Beverley (SA) and Ranger (NT) – were in production in 2006. Two others – Jabiluka (NT) and Honeymoon (SA) – have been approved but not commenced production for a variety of reasons – including until recently the low world price of uranium, and in the former case a strong indigenous and environmental campaign. The nuclear industry remains controversial in Australian politics, as evidenced by the Commonwealth government's current difficulties attempting to establish a nuclear waste dump.

Australian mining companies have rapidly diversified internationally since the 1980s. Significant exploratory capital was diverted from Australia to overseas during the 1990s, with companies often citing "uncertainties" about native title claims to justify such moves. Many of the largest

⁷³ Since the 1990s, the mining sector's water requirements have become an increasing source of conflict, as seen also with the Century Zinc mine in North Queensland and with coal mines in Queensland, NSW and Victoria (Mercer 2000, pp.249-52).

overseas projects involving Australian mining companies – such as Panguna in Bougainville (CRA, now Rio Tinto), Ok Tedi in PNG (BHP), and Tampakan in the Philippines (WMC, now BHP) – have become mired in controversy with indigenous inhabitants over environmental issues (Mercer 2000, pp.238-41). Domestically, indigenous and environment groups are now important players in the mining policy matrix. Nevertheless, the general tendency since the 1980s has been for both Commonwealth and state governments to modify the regulatory environment in the mining industry's favour, including most notably the present Commonwealth Government's abolition of export controls on all minerals except uranium, and introduction of new native title legislation to provide greater "certainty" to the resources sector (Mercer 2000, pp.218-22, 237-8).

5.6 Pollution emissions & waste disposal⁷⁴

Wastes and pollution emissions are usefully categorised as:

solid – municipal/household, commercial and industrial, construction & demolition
liquid – sewage & stormwater
gaseous⁷⁵
hazardous (solid, liquid)
intractable (solid, liquid)⁷⁶
radioactive (solid, liquid)

Yencken and Wilkinson (2000, Table 5.2) reported data showing that, by mass, most solid wastes are produced in primary production – 79% in mining and 17% in farming (data for 1990-91). However, in general these are not wastes of major economic importance (i.e. damage costs are low),⁷⁷ although economic and environmental problems can arise if leachates escape, or if over-burden dumps are not stabilised or interfere with ecosystem processes. Most liquid wastes (65% by mass) originate in municipal sewerage systems, with 17% from manufacturing and 10% commercial. Yencken and Wilkinson (2000, p.96) noted that the key issue is which wastes cause the most harm – both human and environmental health (i.e. "pollutants") and management costs.

On the major wastes of economic importance, Australian State of the Environment Committee (2001) reported:

- . greenhouse gas emissions – high per capita, small in total, and possibly some success in decoupling economic growth from emissions (p.26)
- . urban air quality – general decline to 1999 (except Sydney) in 4-hour ozone concentrations; leaded petrol phased out; general improvement in VOCs (but not necessarily to those sources to which individuals are most exposed)
- . regional air quality – general decline in SO₂, but dust is major regional air quality issue which was being managed in mining areas
- . coastal degradation by diffuse pollution, especially on the Great Barrier Reef, largely unchecked: "Maintenance or restoration of water quality, particularly in coastal margins, is arguably the most critical marine environmental issue confronting Australia in 2001." (p.39)

⁷⁴ The survey for 1955 focuses on Sydney as this was the material most readily available to us.

⁷⁵ There may be considerable non-anthropogenic gaseous emissions – e.g. SO₂ from volcanoes, nitrogen oxides from soils, volatile organic compounds (VOCs) from vegetation. Total VOCs emissions from Sydney, Newcastle and Wollongong are 148,491 t/yr; *biogenic* VOCs emissions in the Pilbara are estimated as 2 million t/yr. (Source: National Pollutant Inventory <http://www.npi.gov.au>; comments from Nick Agapides and Greg Storrier, NSW DEC, gratefully acknowledged)

⁷⁶ e.g. Independent Panel on Intractable Waste (1992)

⁷⁷ in agriculture, most wastes appear to be manure, which is a fertiliser input not a waste, and straw from cereal production which is either grazed or incorporated as organic matter in low tillage cropping (cf. Poldy and Foran 1999).

- . many coastal and inland rivers still carry high nutrient loads from both agricultural and municipal sources
- . pesticide contamination low in both environment and food products
- . some reduction in solid waste disposal rates in most states, with increased recycling but highly variable; increased liquid waste; rapid increase in hazardous waste.

Productivity Commission (2005b) noted the paucity of good economic data about Australian wastes. It also noted the emphasis on technical approaches to waste management (e.g. the waste hierarchy) and significant ambiguity about “resource efficiency” with respect to waste policy.^{78,79}

5.7 Biodiversity & landscape conservation

ABS (1996b) summarised and extended in some key areas the environmental information in ABS (1996a). ABS (1996b, Figures 2.8 and 2.9) compared the likely vegetation cover in 1788 and the 1980s, showing the contraction of forest to woodland particularly on the eastern seaboard, and the replacement of forest, woodland and shrubland by pasture and cropping in the south east, South Australia, and the eastern seaboard (cf. Barr and Cary 1992, chs.3-4 and especially plates I-V).⁸⁰ Maps illustrated areas – of most interest in the major agricultural zones – which were susceptible to water and wind erosion, and affected by soil structure decline (extensive in all the cropping areas), soil acidification (extensive in southern and western cropping areas), soil salinity (extensive in the Western Australian wheat belt, and more patchy in the cropping and high rainfall areas of south and eastern Australia), and “woody weed” encroachment (extensive in the semi-arid pastoral areas) (ABS 1996b, chapter 6; see also Industry Commission 1997, chapter 3, Gretton and Salma 1996, Appendix C).

Public conservation of land and biodiversity is summarised in Table 1. South Australia, Victoria and Tasmania have very substantial proportions (18-30%) of the State in conservation holdings compared to Western Australia, NSW and Queensland, each with around 7% conserved. Note that the estimate for the Northern Territory is understated because it does not include Kakadu (2 million ha) and Uluru – Kata Tjuta (130,00 ha) National Parks jointly managed by the traditional owners and Commonwealth. The estates vary enormously in management intensity, with one ranger to about 200,000 hectares in South Australia and Western Australia, one ranger to about 20,000 hectares in NSW and Queensland, and one ranger to about 10,000 hectares in Victoria.

Table 1: Australian Public Conservation by State, and New Zealand

State	Agency	2001-02	2002-03	2003-04	Area of State (m ha)	Area of Parks (m ha)	Per cent of State	Rangers: hectares	2002-03 Rangers per capita**
SA	DEH*	92	92		98.38	21.0	21.3	1:228,000	0.06
WA	Dept of Conservation & Land Management		80		252.52	16.8	6.6	1:210,000	0.04

⁷⁸ the Productivity Commission (2005b, p.17) was implicitly critical of the Federal Treasurer: “Resource efficiency is used repeatedly in the terms of reference, but is not defined.”

⁷⁹ State of the Environment Advisory Council (1996, p.3-41, Table 3.37) noted Industry Commission data that State capital cities have lower average quantity of collected household waste than country areas: “This provides supporting evidence that larger cities have a more efficient metabolism than smaller settlements” and also higher municipal solid waste per head than OECD average. Productivity Commission (2005b) noted that composition of waste streams may mean aggregate quantities are not directly comparable. Differential waste disposal costs may also lead to different (but efficient) outcomes.

⁸⁰ there is more detail in the Australian Natural Resources Atlas:

http://audit.ea.gov.au/ANRA/vegetation/vegetation_frame.cfm?region_type=AUS®ion_code=AUS&info=veg_clearing

Vic	Parks Victoria	400	400		22.75	4.1	18.0	1:10,000	0.08
NSW	National Parks & Wildlife Service	253	253		80.13	5.4	6.7	1:21,000	0.04
Qld	Qld EPA - Parks Division	666.5	665		172.69	11.9	6.9	1:18,000	0.18
NT	Dept of Infrastructure, Planning & Environment - Parks & Wildlife Services		139		134.78	3.0	2.2	1:22,000	0.71
Tas					6.83	2.1	30.0		
N.Z.	Department of Conservation			1000	25.00	8.0	32.0	1:8,000	0.26

* FTE Numbers of rangers

** Rangers per 100,000 population

There are substantial differences between states in the structure of the protected area estate. For example, national parks and nature reserves/ wilderness parks (which comprise the bulk of the estate) average 28,400 and 2,200 hectares respectively in NSW, and 71,500 and 67,300 respectively in Victoria. There are likely to be significant differences in management with such disparities in firm "size".

5.8 Scourges

There has been a large number of studies into the costs of scourges in the last decade. Agtrans Research/Dawson (2005, p.viii) summarised a wide range of these studies, concluding that for non-native, non-marine invasive species:

Some weeds are spreading and some weeds are being contained, but there is no generalised information available on the broad picture of spread and containment. The impression is that the total number and area of weeds is increasing.

In the main the national distribution and abundance of terrestrial vertebrate pests has not been largely reduced by management in the past ten years, except for the decline in rabbit numbers due to Rabbit Calicivirus Disease.

There is no significant trend in the establishment of new insect pests or diseases of plants, at least between 1971 and 1995. For other invertebrate pests no trends were reported in the literature surveyed.

Some gains, however, were recorded: e.g. successful conclusion of bovine tuberculosis and brucellosis eradication (Neumann 1999) and some developments towards successful biological control of plague locusts and Pattersons curse.⁸¹ Local successes included eradication of horses from Finke Gorge National Park in the Northern Territory with substantial environmental benefits for flora and fauna.⁸² Losses included developing chemical resistance – e.g. herbicide resistance in ryegrass⁸³ and insects.⁸⁴

Agtrans Research/Dawson (2005) summarised estimates of the costs of these scourges, mainly on marketed commodities, ranging:

weeds: \$2.096 billion for 1981-82; \$3.3 billion estimated in 1995 and just under \$5 billion estimated in 1996; \$4.039 billion annual cost of weeds over 1997/98 to 2001/02 (p.6)

terrestrial vertebrates: \$420 million p.a.; \$370 million for 10 species; \$600 million for rabbits alone prior to the spread of rabbit calicivirus (pp.9-15)

⁸¹ <http://www.affa.gov.au/content/output.cfm?ObjectID=D2C48F86-BA1A-11A1-A2200060B0A00566>
<http://www.abc.net.au/landline/content/2005/s1358941.htm>

⁸² <http://www.abc.net.au/stateline/nt/content/2003/s900420.htm>

http://www.ecnt.org/pdf/land_2004_08_02_sub.pdf

⁸³ <http://wahri.agric.uwa.edu.au/News%20&%20Views%20Articles/Autumn05/MOCUryegrasssurvey.htm>
<http://www.general.uwa.edu.au/u/dpannell/dpap0007.htm>

⁸⁴ <http://regional.org.au/au/roc/1990/roc199043.htm?PHPSESSID=1889bf8231e00cddcb7dfa4e8dc5feda>

aquatic vertebrates: for carp alone, \$4 million annually for Australia, to \$175 million for the Gippsland Lakes in Victoria (p.15)

plant pests and diseases: possibly at least \$2,000 million (pp.17-18)

animal pests and diseases: could be at least \$1.5 billion p.a.

other pests: e.g. Red Imported Fire Ant approximately \$700 million p.a. (calculated from data provided, assuming 7% discount rate) (p.19)

Information on scourges of environmental importance is summarised by Agtrans Research/Dawson (2005, pp.19ff) who noted that “environmental effects of invasive species has generally been aggravated/accelerated by other land use and management practices such as clearing, grazing and agricultural chemical use (to combat invasives)”. As noted in Agtrans Research/Dawson (2005) and as argued in section 8.5(a) below, economically relevant information is marginal rather than total costs of scourges.

5.9 'Of droughts and flooding rains'

BTE (2001, Figs. 2.1 & 2.2) showed – at least for their sample of 3 years in the mid-1980s and 3 years in the late 1990s – that while about 60% of events were below its \$10 million analysis threshold, such events counted for less than about 15% of the total economic cost of natural disasters. Floods in the 1990s cost nearly \$4,000 million (1998 dollars); severe storms cost over \$6,000 million (much in the 1999 Sydney storm); and cyclones about \$500 million (BTE 2001, Figs. 3.16, 3.19, 3.22 respectively). Bushfires in the 1990s cost less than \$400 million (1998 dollars) (BTE 2001, Fig. 3.26), but the study does not include the 2001-02 east coast fires nor the 2002-03 ACT/Vic/NSW fires. The bulk of Australia's wildfires occur in remote regions, especially in northern and central Australia, causing little damage to marketed goods and services (Ellis et al 2004 Table 1.1)

Wildfires only comprise about 6% of BTE's estimated costs of natural disasters but are probably the most politically contentious form. This contentiousness has been heightened in recent years by the Ash Wednesday fires in Victoria and South Australia in 1983 in which 76 people died; NSW bushfires including within Sydney in January 1994; and the recent fires noted above. Coronial investigations into firefighters' deaths – both fighting fires (Linton, Vic) and undertaking hazard reduction (Ku-ring-gai Chase National Park, NSW)⁸⁵ – are reported to have led to changes in the way fire fighting occurs (Select Committee 2003, paras.4.50-4.53. 4.106-4.120). There is also controversy over the correct mix of hazard reduction, especially on public lands and especially in national parks, as opposed to asset protection (e.g. through land-use planning to separate flammable areas from valuable assets) and fire suppression.⁸⁶ There are significant tradeoffs in fire management, and also between hazard reduction and ecological protection – economic dimensions over which economists have passed lightly (e.g. Ellis et al 2004, p.84).

In the 1950s, there was considerable optimism that human effort, particularly the development and application of new technologies, could solve any problem. Where there were risks in the landscape – for example in the form of fire or flood – humans could force the landscape to adapt to them, rather than the other way around. Ellis et al (2004, p.92) noted that they supported:

the view, expressed in *Natural Disasters in Australia*, that land use planning that takes into account natural hazard risks is the single most important mitigation measure for preventing future disaster losses (including from bushfires) in areas of new development. Planning and development controls must be effective, to ensure that inappropriate developments do not occur.

⁸⁵ see Ellis et al (2004, Appendix C) for summary of these coronials, and other fire reports.

⁸⁶ e.g. Select Committee (2003)

6. Institutional & policy change 1955-2005

In this section there is a review of some key institutional changes that occurred over the period 1955-2005. The first three – Commonwealth/State relations, National Competition Policy, and environmental activism and litigation – are induced institutional innovation issues affecting the policy framework. Changes in Commonwealth/State relations indicate almost-irrevocable change to the role of jurisdictions in future policy. Some of the remaining four issues – native title, forest policy, transfer pricing, evolution of pollution management – have substantially resolved bitter policy controversies (e.g. forestry) or resolved underlying problems (e.g. transfer pricing). Native title and environmental activism are still highly-contested policy areas. These changes provide a context for a subsequent review of current and future resource and environmental policy.

6.1 Commonwealth/State relations

There have been marked political changes since the mid-1950s. One pronounced change has been the attitude of the Federal Coalition towards “centralism” and “States Rights”. The Coalition in government occasionally intervened in “State” issues in the earlier part of the period – e.g. financial support for non-government schools (Menzies), confirming a decision of the Whitlam Government to block mineral sands exports from Fraser Island⁸⁷ (Fraser). However, the Coalition vociferously opposed what it saw as the centralist tendencies of the Federal Labor Government (1972-75) engineered by extending s.96 grants and innovative use of the “treaties” power.⁸⁸ By the mid-1990s, the Federal Coalition still strongly had a “States Rights” persuasion.⁸⁹ As an incoming Federal Government in 1996, it established with the agreement of COAG on 14 June 1996 a Treaties Council. The inaugural – and, to date, only – meeting of the Treaties Council was held on 7 November 1997.⁹⁰

The (increasingly) centralist tendencies of successive national governments have not been entirely untrammelled. Because increasing Commonwealth power at the expense of the States has been evolutionary rather than revolutionary, there has been extensive use of “ministerial councils” to reconcile interests among the States, and between the States and the Commonwealth. Currently (2005) there are 4 heads of government councils (Council of Australian Governments, Treaties Council, Premiers’ Conference, Australian Loan Council), 31 Commonwealth-State Ministerial Councils (3 of which have sub-councils from 1993 rationalisation), and 12 other ministerial forums (DPMC 2005). The importance of environmental/resource policy issues is indicated by COAG’s consideration of such issues since the release of the Ecologically Sustainable Development Working Groups’ reports in 1991 (Table 2).⁹¹ The Commonwealth has driven some of these agendas with sole or shared financial assistance (e.g. competition policy until 2004; the Intergovernmental Agreement on

⁸⁷ which survived a High Court challenge: see *Murphyores Incorporated Pty. Ltd. v. The Commonwealth* [1976] HCA 20; (1976) 136 CLR 1 (14 April 1976), <http://www.austlii.edu.au/au/cases/cth/HCA/1976/20.html>

⁸⁸ “The power to enter into treaties is an executive power within s. 61 of the Constitution. This is to be distinguished from the legislative power to implement treaties in domestic law which is granted in s. 51(xxix) of the Constitution and is known as the external affairs power.” (Senate Legal and Constitutional Committee 1995, Executive Summary)

⁸⁹ Senator Minchin 1995 “I am pleased to join with my colleagues in condemning the treaty making processes of this government. Treaty making under this government is undermining the sovereignty of this country, undermining the legislative role of the parliament and subverting the constitutional division of powers in this country. It is in desperate need of reform. There must be much more public and parliamentary scrutiny of the treaty making processes in this country.” http://parlinfo.aph.gov.au/piweb/view_document.aspx?id=400446&table=HANSARDS

⁹⁰ http://www.coag.gov.au/treaties_council.htm; it is understood that a Standing Committee on Treaties meets twice per year to facilitate Commonwealth-State discussions on treaty matters.

⁹¹ in addition to these changes agreed to by the top-tier Ministerial Council, there have been significant changes overseen by second-tier councils such as Natural Resource Management Ministerial Council [http://www.mincos.gov.au/about_nrmmc.htm] and Environment Protection and Heritage Council [<http://www.ephc.gov.au/>] and their predecessors.

addressing Water Overallocation and Achieving Environmental Objectives in the Murray-Darling Basin which was a shared Commonwealth-State financial scheme; water reform under the National Water Initiative is currently being supported by the Commonwealth's \$2 billion Australian Government Water Fund). Conversely, there are areas that – despite the Commonwealth's attempting to promote the issue – it has decided that (for now at least) not to use either carrot or stick to drive change. For example, in biodiversity, COAG has recently noted "the work of the State and Territory Governments in the area of management of native vegetation and biodiversity and encourages their continued examination of appropriate regulation."⁹²

Table 2: COAG consideration of environmental/resource policy issues*

Topic	Date (and comments)
Environment generally	November 1997
Environment - ESD and Greenhouse	December 1992, November 1997 (EGE)
Water Resource Policy**	December 1992, June 1993, February 1994, April 1995, August 2003 (National Water Initiative), June 2004 (National Water Initiative), June 2005 (National Water Initiative)
Salinity and Water Quality	November 2000, June 2001, April 2002 (and property rights)
Water Property Rights	December 2002
International Convention on Biological Diversity	June 1993
Native Vegetation	June 2005
Disaster Relief and Mitigation	June 2001
National Competition Policy	June 1993 (Micro-Economic Reform), February 1994 (Micro-Economic Reform), August 1994, April 1995, November 2000, June 2005
Energy	June 2001
Electricity Arrangements	December 1992, June 1993, February 1994, August 1994
Interstate Trade in Gas	December 1992, June 1993, February 1994, June 1996, November 1997

Source: <http://www.coag.gov.au/>

Notes: * COAG met only once between November 1997 and November 2000 for the "drugs summit" in April 1999

** Western Australia and Tasmania have not yet signed the National Water Initiative, and Queensland has not yet signed the Murray-Darling Basin Water Agreement.

Not all nationally-significant initiatives are recorded at the COAG website. One significant development in the 1990s was the Special Premiers' Conference in October 1990 which agreed to an Intergovernmental Agreement on the Environment (IGAE) (effective 1 May 1992). This agreement provided for a National Environment Protection Council (established under complementary Commonwealth-State legislation), and which is the framework under which National Environment Protection Measures operate.⁹³

The current Federal Coalition government has highly refined the centralist tendencies of the Whitlam Labor Government in some areas including education (particularly tertiary⁹⁴), has recently introduced centralising industrial relations legislation, and has flirted with doing similarly in health.⁹⁵ COAG agreed in 1997 to an expanded environmental role for the Commonwealth⁹⁶

⁹² June 2005, see: <http://www.coag.gov.au/meetings/030605/index.htm#vegetation>; cf the Productivity Commission's "Impacts of Native Vegetation and Biodiversity Regulations" inquiry <http://www.pc.gov.au/inquiry/nativevegetation/index.html> and preceding research.

⁹³ http://www.ephc.gov.au/nepc/origins_nepc.html

⁹⁴ Larkins, R. "Micro-regulation of universities ignores real issues", Sydney Morning Herald 16/12/2005, <http://www.smh.com.au/text/articles/2005/12/15/1134500961618.html>

⁹⁵ Ironically, Neal Blewett, former Labor government minister, recently argued that the ALP "is now one of the last bastions of federalism, dominated as it is by state oligarchies with state concerns pre-eminent and state officers powerful, with federal secretariat relegated to little more than a branch office." (Blewett 2005, p.11)

⁹⁶ The Council gave in-principle endorsement to a Heads of Agreement which will result in fundamental reform of Commonwealth/State roles and responsibilities for the environment. These reforms will deliver

and the *Environment Protection and Biodiversity Conservation Act 1999* commenced on 16 July 2000. Prior Commonwealth legislation in the environmental area had involved Commonwealth powers explicitly in external affairs matters (e.g. Antarctica, including Heard Island and McDonald Islands), marine (including Great Barrier Reef), territories, trade (e.g. in hazardous materials), intergovernmental (including agreements and ministerial councils) and world heritage. The EPBC Act replaced the *Environment Protection (Impact of Proposals) Act 1974* (for Commonwealth Government activities, including State activities financed by the Commonwealth), the *Endangered Species Protection Act 1992* (for Australian Government controlled lands and waters), the *National Parks and Wildlife Conservation Act 1975* (for Australian Government controlled lands and waters and under the external affairs power), the *World Heritage Properties Conservation Act 1983* (under the external affairs power) and the *Whale Protection Act 1980* (external affairs power) (all but the last were acts of Labor administrations).

In principle, at least, the EPBC Act asserts considerably more expansive Commonwealth powers than prior legislation; its objects include (s.3):

- . protection of the environment, especially those matters of national environmental significance
- . promotion of ecologically sustainable development through the conservation and ecologically sustainable use of natural resources
- . conservation of biodiversity, and protection and conservation of heritage
- . implementation of Australia's international environmental responsibilities (Constitution, s.51(xxix))
- . recognise the role of indigenous people in the conservation and ecologically sustainable use of Australia's biodiversity and promote cooperative use of their knowledge (Constitution, s.51(xxvi))

However, at least some environmental groups were concerned that, despite the apparently more expansive ambit of the Act, its provisions limited rather than widened the Commonwealth's existing purview:

the Environment Protection and Biodiversity Conservation Bill in July 1998 drew unanimous criticism from all environment groups. We were concerned at the limited range of triggers for Commonwealth requirements for environmental impact assessment, the narrow avenues for genuine public involvement, the lack of targets for environmental outcomes and the numerous escape clauses available to the Commonwealth to duck its responsibilities altogether or to hand them to the states. (Garrett 1999)

Because COAG does not publish its deliberations, only "communiqués", it is difficult to know whether the limitations asserted as being in the EPBC Act arose from States', or "states rights", concerns.⁹⁷ Some indications of outcomes under the Act are shown in Tables 4 and 5. There were 125 "referrals" under the EPBC Act in 2000; 417 in 2001; 370 in 2002; 403 in 2003; 416 in 2004; and 437 to 27 October in 2005. The spatial distribution of these referrals is shown in Table 3 and the affected areas in Table 4.

more effective measures to protect the environment. It will also remove duplication and result in a more efficient development approvals process. The Heads of Agreement provides the following benefits:

- Commonwealth responsibilities and interests to be focussed on matters which are of genuine national environmental significance;
- Significant streamlining, greater transparency and certainty in relation to environmental assessment and approval processes;
- Rationalisation of existing Commonwealth/State arrangements for the protection of places of heritage significance through the development of a co-operative national heritage places strategy;
- Improved compliance by the Commonwealth and the States with State environment and planning legislation; and
- Establishment of more effective and efficient delivery mechanisms and accountability regimes for national environmental programs of shared interest.

Council of Australian Governments' Communiqué, 7 November 1997

<http://www.coag.gov.au/meetings/071197/index.htm#environmental>

⁹⁷ Garrett (1999) had noted "Resources Minister Senator Parer in a press release in late 1997 'we are working towards a Commonwealth-State environmental regime which confirms prime responsibility for environmental management lies with States and Territories.'"

Table 3:		Table 4:	
ACT	75	Agriculture, fishing & forestry	98
NSW	368	Mining & exploration	322
VIC	310	Water management	102
QLD	395	Manufacturing	44
WA	180	Waste management (incl sewage)	67
SA	110	Energy	162
NT	40	Urban development	401
TAS	67	Tourism	161
Commonwealth Marine	124	Transport	205
Commonwealth Territories	47	Communication	45
Inter-state	3	Defence	22
	1719	Commonwealth land dealings	26
		Miscellaneous	61
			1716

Source: [http://www.deh.gov.au/cgi-bin/epbc/epbc_ap.pl?name=current_referrals&limit=999999&text_search=\[as at 30/10/05\]](http://www.deh.gov.au/cgi-bin/epbc/epbc_ap.pl?name=current_referrals&limit=999999&text_search=[as at 30/10/05])
 Note: the most recent permit is number 2368, but only 1720 are reported.

Source and Note: as for Table X2

There is some hint in the referrals under the EPBC that the Commonwealth's (and COAG's) objective of streamlining and rationalising approvals processes may not be being achieved via the EPBC Act. Seventy-five percent of the referrals in 2005 up to 30/10/05 did not require Commonwealth approval, and some of those that did had approval conditions under State acts. For example, a proposal – even if subsequently determined that approval is not required – by an undergraduate student to take a 200 gram soil sample in a state national park (presumably with its own protocols for scientific research) does not seem relevant to a Act dealing with environmental issues of national significance.

Even if the EPBC Act is currently having little impact other than bureaucratic busy-ness, its longer-term significance may lie in the Commonwealth having asserted a claim to environmental management over all Australia's terrestrial and marine domain. Once it has established a policy bridgehead, the Commonwealth rarely retreats. A future, even more centralist federal government, is likely to expand the Commonwealth's role in environmental matters. The Coalition Government's use of the "corporations power" (Constitution, s.51(xx)) as a head of power for the recent industrial relations legislation – to be tested in the High Court by at least NSW⁹⁸ – is one mechanism to consolidate the Commonwealth's reach in environmental policy.

Even within the present Commonwealth Government, there is not necessarily unanimity – at least in politically advantageous circumstances – about limiting the Commonwealth's environmental purview. For example, the highly charged 2003 House of Representatives Select Committee into bushfires argued that:

Whilst the Committee heard some evidence to suggest that the Commonwealth could do more to meet its obligations under the EPBC Act, the point relevant to the inquiry, as far as the Commonwealth interest is concerned, is that the Commonwealth has a statutory obligation in the protection of threatened species. (Select Committee 2003, para. 1.22, see also surrounding paras.)

However, the Commonwealth is not always successful; for example, it appears to have failed in its attempt to locate a low-level nuclear waste facility in South Australia,⁹⁹ and has now turned its attention to the Northern Territory where (given the Northern Territory's statehood referendum failed in 1998) the Commonwealth can over-ride local control.¹⁰⁰

⁹⁸ "High Court Challenge": <http://www.fairgo.nsw.gov.au/FederalIRChanges/HighCourtChallenge.html>; see George Williams, in particular on the "narrow" and "broad" views of the Commonwealth's corporations power, "The constitution and a national IR regime", 20 July 2005, <http://www.onlineopinion.com.au/view.asp?article=3687>

⁹⁹ *State of South Australia v Honourable Peter Slipper MP* [2004] FCAFC 164 (24 June 2004)

In the last decade, “centralisation” has occurred in parallel with “regionalisation” for natural resource management. Catchment Management Authorities have been established in Victoria and NSW to manage the catchments for which they are responsible. In some cases, earlier incarnations were only advisory. Regional Natural Resource Management bodies are required by the “National Framework for Natural Resource Management Standards and Targets” endorsed by the Natural Resource Management Ministerial Council in May 2002.¹⁰¹ The longer-term implications are unclear of inserting a layer of semi-autonomous regional natural resource management between State and local governments. While many of the social welfare functions of local government are remote from catchment management, functions such as urban planning – particularly land management, water supply and waste management – both overlap with and potentially integrate local government activities.

6.2 National Competition Policy

In 1992 an enquiry into competition policy was commissioned by the Federal Government with the agreement of the States and Territories. The principles underlying this enquiry were the prevention of “anti-competitive conduct against the public interest”; “universal [sic] and uniformly applied rules of market conduct” irrespective of business ownership; an “appropriate transparent assessment process” to investigate potential net public benefit of anti-competitive conduct; and to develop open, integrated domestic markets for both goods and services by eliminating barriers and reducing red tape (Hilmer et al. 1993, p.361). The major recommendations of the enquiry were accepted by the Council of Australian Governments (COAG) in 1994, and a Competition Principles Agreement to implement these recommendations was signed in 1995. COAG also signed a Conduct Code Agreement and an Agreement to Implement National Competition Policy and Related Reforms. The latter was reinforced by Commonwealth financial rewards to the States for progress on implementing competition policy. The Federal Parliament enacted the *Competition Policy Reform Act 1995*, and all States passed legislation required under the Conduct Code Agreement (cf. Godden 1997, pp.375-381). The Agreement to Implement National Competition Policy and Related Reforms particularly targeted the State-regulated natural resource industries of electricity, gas, water (both irrigation and urban), as well as transport.¹⁰²

National Competition Council (2005) provided a culminating report for the reform process that had begun in the early 1990s. Ironically, except for Western Australia, the Commonwealth demonstrated least progress in completing priority review and reform of extant legislation; the Commonwealth was actually more successful in reviewing and reforming *non*-priority legislation (NCC 2005, Figure 1, Table 9.1:).

While the National Competition Policy particularly targeted State-regulated natural resource industries, there is little evidence of comprehensive and systematic consideration of the implications of these changes for the natural resource industries or related environmental condition. Of course, as Productivity Commission (2005c, p.119) noted, the National Competition Policy Reforms were aimed at competition, not the environment. However, simple economics would suggest that changes in the competitive environment – particularly changes that were expected to reduce prices for commodities such as electricity and gas, and services such as transport – would increase the consumption of these commodities and services, and increase resource extraction or associated pollution. Reform of statutory marketing arrangements is likely to affect the profitability of agriculture, possibly variably spatially, and thus affect how farmers use their natural resource base. In its 450 page review of National

¹⁰⁰ “After an unseemly squabble, Howard announced in July he would shelve plans to build a low-level radioactive waste repository at Woomera in South Australia. ... Now Canberra wants to build a facility on commonwealth land at one of three potential sites in the Northern Territory. Science Minister Brendan Nelson’s department will shortly issue a request for tender for field studies to take place at the sites.” (Murphy 2005) The Commonwealth Radioactive Waste Management Act was passed 8/12/05.

¹⁰¹ 3 May 2002 Meeting [<http://www.nrm.gov.au/publications/standards/pubs/standards.pdf>]

¹⁰² cf. Industry Commission (1998b) for a summary of 2½ decades of microeconomic reform in Australia.

Competition Policy Reforms, Productivity Commission (2005c) devoted 4½ pages to environmental and natural resource considerations. It commented:

The Commission has only been able to identify a few instances where the NCP reform process has arguably been associated with a deterioration in environmental outcomes. In this regard, several participants voiced particular concern about the recent increase in greenhouse gas emissions from electricity generation. (Productivity Commission 2005c, p.120)

However, it is arguable that the Productivity Commission does not have the expertise to assess environmental outcomes, whether or not associated with National Competition Policy reforms. Since the Commission, and others, have extensively used economic modelling to examine the effects of reforms, it is a pity that it did not do the same for environmental aspects. As suggested by the National Competition Council (2005), there is still considerable unfinished environmental business relating to timber, mining, water, fishing, pollution (e.g. chemical residues and aerial spraying controls), and transport. Without a quasi-independent environmental umpire – which the now-defunct Resource Assessment Commission might have become – it is arguable whether satisfactory analysis is being undertaken of the environmental effects of the National Competition Policy Reforms.¹⁰³

6.3 Environmental activism and litigation

A key agent in environmental policy over the last 50 years has been environmental lobbyists and activists.¹⁰⁴ Libby (1998) documented the roles that “activists”, including a founder member of AARES, had played in conserving Victoria’s Little Desert. Protest was unsuccessful in the case of Tasmania’s Lake Pedder, but successful in the Franklin. Greenpeace has campaigned against pollution at Kurnell, and chemical pollutants in general.¹⁰⁵ Protest played a major role in forest conservation in all States, ultimately leading to the National Forest Policy Statement in 1992 and the Regional Forest Agreements.¹⁰⁶ From one perspective, environmental lobbyists and activists are key agents in the kind of policy market envisaged under induced institutional innovation. Environmental activists might also be seen as fulfilling a compliance role where – for whatever reason – government is reluctant to undertake.¹⁰⁷

Walters (2003, chapter 2) documented cases where, irrespective of “[w]hether this has been the intended effect or not, threats of legal action have inhibited public debate on important and controversial development proposals.” Walters’ examples included a number in the environmental area.

Walters (2003, p.64) drew attention to the phenomenon of “SLAPP” suits in the USA:

In the United States the expression “SLAPP suit” has been used as an acronym for Strategic Litigation Against Public Participation. Because they restrict public debate, an increasing number of defamation suits today might be regarded as SLAPP suits. But whether or not they are so motivated is a matter for the courts to determine. We need to be careful about describing specific legal actions as SLAPP suits because defamation actions have been

¹⁰³ cf House Standing Committee on Environment and Heritage’s recent sustainable cities report and recommendation for a Australian Sustainability Commission
<http://www.aph.gov.au/house/committee/environ/cities/report.htm>

¹⁰⁴ And, indeed, earlier – e.g. Myles Dunphy and the National Parks and Primitive Areas Council for a number of national parks, and earlier Eccleston Du Faur for Ku-ring-gai Chase National Park
[\[http://www.nationalparks.nsw.gov.au/parks.nsf/ParkContent/N0004?OpenDocument&ParkKey=N0004&Type=Xk\]](http://www.nationalparks.nsw.gov.au/parks.nsf/ParkContent/N0004?OpenDocument&ParkKey=N0004&Type=Xk) and
[\[http://www.nationalparks.nsw.gov.au/parks.nsf/parkcontent/n0019?opendocument&parkkey=n0019&type=xk\]](http://www.nationalparks.nsw.gov.au/parks.nsf/parkcontent/n0019?opendocument&parkkey=n0019&type=xk)

¹⁰⁵ respectively Boyle (1991) and <http://pandora.nla.gov.au/parchive/2000/Q2000-Feb-1/www.greenpeace.org.au/info/archives/toxic/dioxin/>

¹⁰⁶ e.g. Cohen (1998), Blackburn and Stone (2002), Russell (2003)

¹⁰⁷ e.g Boyle (1991)

successfully brought on the basis that someone has made just such a claim. In other words, because a person said that an action has been brought to silence public participation, that person has been successfully sued (and ordered to pay damages).

Irrespective of their merits or outcome, legal action may substantially change the balance of power in environmental activism. Walters (2003) argued that individuals, and many (particularly voluntary) organisations, are financially and legally ill-equipped to defend such actions, especially if the action is tax-deductible for the plaintiff but not the defendants.¹⁰⁸ Quoting US Supreme Court Justice Holmes (in a dissenting judgement):

the ultimate good desired is better reached by free trade in ideas - that the best test of truth is the power of the thought to get itself accepted in the competition of the market, and that truth is the only ground upon which their wishes safely can be carried out. That at any rate is the theory of our Constitution. (Walters 2003, p.51)

Walters (2003, p.51) argued that:

For a marketplace to work fairly, there must be equality of access, and equality of information. If information is suppressed, especially by powerful interests, then any marketplace of ideas is distorted, and may even cease to function. Where there is no equality of information, and an equal right to speak, the participants in that marketplace of ideas lose their "buying power."

However, Walters (2003, p.52) also argued that "Helpful though the marketplace metaphor may be, it is not sufficient to fully encompass the importance of dialogue in the community":

Freedom of speech is a fundamental requirement for a democratic society. Since democracy depends on the exchange of ideas and opinions, and community requires communication between its members, it is essential that citizens have the freedom, in any medium, to engage in public debate, to express points of view, and to make their own responses to the world around them. Freedom of expression permits knowledge to flourish and prejudices to be challenged, and diminishes the alienation of those who are not heard.

Walters (2003, chapter 4) argued that changes to defamation law were necessary to remove injustice. These changes included: freedom to speak about corporations; freedom to speak on matters of public interest; freedom to speak about the performance of public officers; freedom to speak with the fear of unspecified damages. He also argued that SLAPP suits should be outlawed, noting that:

In a number of jurisdictions in North America, there is specific legislation designed to make such suits unlawful, and to bring them to an early end. For example, the Minnesota Anti-SLAPP Statute provides immunity from suit for "lawful conduct or speech genuinely aimed in whole or in part at procuring favourable government activity," and provides for summary dismissal where an action has been brought against public participation. Courts may award damages to a defendant where an action has been brought to inhibit their right to public participation. The damages may be for actual loss, and may also be punitive (in other words, calculated to punish the person bringing the action).

Many other US jurisdictions, including New York, Delaware, Nebraska, Utah and California, have similar statutes. This legislation imposes a serious commercial risk on developers or others tempted to silence opponents by intimidatory court actions.

At least advocacy groups are unlikely to be caught by section 52 of the Trade Practices Act: viz. "A corporation shall not, in trade or commerce, engage in conduct that is misleading or deceptive or is likely to mislead or deceive" (cf. Miller, 2005, pp.549-50).

¹⁰⁸ see also John Quiggin: <http://www.uq.edu.au/economics/johnquiggin/news/2005-07-21-AFR.htm>

Potential and actual litigation threats against individuals and community groups is likely to substantially change the nature of participation in the policy process.¹⁰⁹ Individuals (unless wealthy) and community groups (unless incorporated and insured) are much less likely to be active where other protagonists are willing to use the courts and have the resources to do so. This makes it more likely that larger and better resourced non-local environmental lobby groups will become the mainstay of environmental activism. Such groups are likely to employ professional staff, better versed in the art of selling the message while remaining out of the courts. However, such groups are less likely to focus on local environmental issues, making it more likely that environmental damage will occur via the “death of a thousand cuts”, even while major environmental issues are still being fought (and, perhaps, won). Substantial defamation law reform occurred in late 2005, but whether these changes will level the playing field for environmental campaigners is yet to be demonstrated.¹¹⁰

6.4 Native title¹¹¹

In 1986 Pope John Paul II said:

From the earliest times men like Archbishop Polding of Sydney opposed the legal fiction adopted by European settlers that this land was 'terra nullius' - nobody's country. He strongly pleaded for the rights of the Aboriginal inhabitants to keep the traditional lands on which their whole society depended. The Church still supports you today. Let it not be said that the fair and equitable recognition of Aboriginal rights to land is discrimination. To call for the acknowledgement of the land rights of people who have never surrendered those rights is not discrimination. Certainly, what has been done cannot be undone. But what can now be done to remedy the deeds of yesterday must not be put off till tomorrow. (Wojtyła 1986, p.)

The setting, Alice Springs, was ironic since the *Aboriginal Land Rights (Northern Territory) Act* 1976 (conceived by a Labor Government and passed, with important deletions,¹¹² by a Coalition one) gave the highest contemporary recognition to Australian Aboriginal land rights. In 1986, the case of Eddie Mabo and his co-plaintiffs was being litigated in Queensland – in 1985, the Queensland Government had attempted to retrospectively extinguish Merriam title to the Murray Islands.¹¹³

The High Court's 1992 decision in Mabo re-asserted indigenous rights to title in land recognised by common law (*Mabo and Others v State of Queensland*). The decision was controversial because many Australians believed indigenous Australians had never owned land in a way recognised by English law and, even if they had, they had long since lost it by “settlement” or “conquest”. The Court reviewed general principles underlying native title in Australia generally, thus affecting both Torres Strait Islanders and Aborigines. Approximately 9 square kilometres were granted to the claimants by the Mabo decision.¹¹⁴

¹⁰⁹ e.g. Shoebridge (2005); Environmental Defender's Office, NSW (2005)

¹¹⁰ cf. <http://www.aar.com.au/pubs/ldr/fodefapr05.htm#top>

[http://www.corrss.com.au/corrss/website/web.nsf/Content/Pub_ME_Medialine_Autumn_2005/\\$FILE/Medialine%20Autumn%202005.pdf](http://www.corrss.com.au/corrss/website/web.nsf/Content/Pub_ME_Medialine_Autumn_2005/$FILE/Medialine%20Autumn%202005.pdf)

<http://www.freetvaust.com.au/SiteMedia/w3svc087/Uploads/Documents/8b04b652-f74f-4de2-8b89-407f82233a41.pdf> <http://www.wilderness.org.au/campaigns/corporate/gunns/deflawref/>

<http://www.parliament.nsw.gov.au/prod/parlment/hansart.nsf/V3Key/LA20050504020>

http://www.presscouncil.org.au/pcsite/fop/fop_ar/ar05.html#defam

http://www.ag.gov.au/agd/WWW/MinisterRuddockHome.nsf/Page/Media_Releases_2005_Fourth_Quarter_15_December_2005_-Belated_State_defamation_laws_-2372005

¹¹¹ The first part of this section is drawn from Godden (1999b); see also Justice Brennan's readable summary of the Mabo judgement in the Wik judgement.

¹¹² http://www.nlc.org.au/html/land_act.html

¹¹³ <http://www.atns.net.au/biogs/A000320b.htm>

¹¹⁴ “It might have been better to redress the wrongs of dispossession by a true and unqualified settlement of lands or money than by an ultimately futile or unsatisfactory, in my respectful opinion, attempt to fold native title rights into the common law” (Callinan, J para. 970 in *Western Australia v Ward* (2002)). Of

The general effects of the Mabo decision may be summarised as follows. Native title was extinguished where contemporary indigenous people had no continuing and traditional association with land. Native title was also extinguished where land had been dealt with so that its use was inconsistent with native title – e.g. freehold land (which explicitly granted exclusive possession). Native title has also been extinguished on non-alienated (i.e. “Crown”) land with a dedicated use. Opportunities only existed for potentially successful native title claims on vacant Crown land without a dedicated use. The status of pastoral leasehold land was unclear because the High Court did not address that issue in Mabo, but did subsequently in Wik.

Despite populist views to the contrary, the Mabo case did not grant land rights to indigenous Australians. It simply determined the circumstances in which land had *not* been taken from them, i.e. where native title had not been extinguished. The case did not create new law, but revisited the context in which Australian settlement had occurred and how land had been expropriated from indigenous inhabitants. The broad categories where expropriation had not (yet) occurred were identified in the judgement and, therefore, the situations in which native title remained unexpropriated. Since expropriation of resources, even with compensation, is unlikely to be Pareto efficient, especially where there are non-marketed goods involved, the Court’s decision in Mabo (and the subsequent Native Title Act) was likely to prevent future Pareto-inefficient seizures of indigenous Australians’ land.¹¹⁵

Following the Mabo decision, two broad strategies were open to government. The decision could have been ignored, leaving it up to the courts to determine case-by-case whether or not native title had been extinguished. Alternatively, governments could have attempted to facilitate the process by creating a framework for an orderly process for native title determination. Both Commonwealth and State Governments opted for the latter course, with the Commonwealth’s Native Title Act receiving assent in late 1993 and commencing on 1 January 1994.¹¹⁶

In the 1996 Wik judgement, the High Court concluded that pastoral leases did not grant exclusive possession to the lessees, as the Queensland pastoral leasehold legislation contemplated the co-existence of pastoral lessees and indigenous people. The situation varied across the States. Prior to the Wik decision, the new Federal Coalition Government had proposed changes to the *Native Title Act 1993*. In contrast to the delayed response to the earlier Mabo decision, the political response to Wik was swift, indeed pre-emptive. In the aftermath of Wik, the government sought to achieve a solution which fell short of “blanket legislative extinguishment” but which would provide the “bucketloads” of extinguishment sought by the Deputy Prime Minister on behalf of his rural constituents. Of the 20 points and sub-points in the Prime Minister’s “Amended Wik 10 Point Plan”, nine related to native title on pastoral leases explicitly, seven related to the NTA generally, and four related to both. Nineteen of these 20 points were directed towards extinguishment or substantial restriction on native title, and one was a transitional arrangement. As Senator Harradine noted “I understand the disappointment of indigenous people that, once again, their rights are to be diminished in order to overcome a problem not of their making.” (Harradine 1998, para.4961; cf. Godden (1999b) for Wik, and Padgett (1999) for native title generally).

Subsequent to Mabo, Wik and the Native Title Act, there have been major High Court decisions that have further refined native title concepts (see recent summaries in Wright 2003, Neate

course, *had* governments appropriately legislated prior to Eddie Mabo’s action, the native title case may never have arisen. But they didn’t, and it did. And, in the absence of appropriate legislation, the courts were *obliged* to make some sort of judgement once Mabo commenced his action.

¹¹⁵ “Native title under Mabo principles may not be, in the long run, the optimal form of title for successful grantees. In the short run, however, native title was likely to be far superior to the alternative of no title at all. Mabo principles offered a route to future title which may be superior in the long run—and this may have been the real foundation of the objection to the Mabo judgement.” (Godden 1997, p.292)

¹¹⁶ The political process of arriving at this Act was discussed in Godden (1997, pp. 286-91). The WA Government’s approach was inconsistent with the Commonwealth’s and the former, together with South Australia, challenged the federal legislation in the High Court; this challenge was dismissed in March 1995.

2004).¹¹⁷ Cases have included (non-exclusive) marine rights, and that NSW Western Land leases did confer exclusive possession rights (and thus native title was extinguished). Wright (2003) examined themes emerging from recent High Court cases, involving conceiving and defining native title under the Native Title Act, matters relating to the proof of native title, and principles relating to extinguishment or suspension of native title. The WA Government has recently completed an agreement to extend the Ord irrigation scheme which involves agreements relating to the complex Miriuwung Gajerrong cases (Government of WA and Kimberley Land Council (2004) and Gallop (2005) cf. Western Australia v Ward (2002)). The Commonwealth Government appears to have decided to act on the controversial¹¹⁸ Reeves 1998 review of the *Aboriginal Land Rights (Northern Territory) Act 1976* to "strengthen provisions of the Act and improve their workability";¹¹⁹ and also to review the Native Title Act.¹²⁰

6.5 Forest policy

During the 1950s state government forestry services consolidated and expanded their management of Australia's forests, and made the first attempts to develop long-term forest plans. Since the 1920s, Australia's professional foresters had advocated more active and coherent government forest management consistent with the principle of "sustained yield forestry" (forestry ensuring adequate regeneration to replenish removed wood) (AATSE 1988, p.207). They had adopted improved management methods seeking to operationalise this principle, but had been hampered by inadequate technologies and insufficient financial resources. In the 1950s, foresters finally found a sympathetic political-economic environment, with expanded forestry budgets (now funded through loans as well as forest products revenue) enabling greater attention to research and infrastructure especially construction of logging roads and fire trails. Additionally, with aerial photography allowing clearer assessment of forest resource extent, foresters could now theoretically calculate a forest's "sustained yield", and hence the "allowable cut" that could be allocated to each sawmill (Dargavel 1995, p.76).

In the early 1960s, this comfortable and confident arrangement – expanding domestic production managed within a government policy of "sustained yield forestry" – was shaken by the realisation that the existing rate of native forest clearance could not be sustained in the long term – let alone accommodate rising consumption. Australia's native forests were reaching the limits of their productive capacity (Dargavel 1995, 76). In response to this new policy challenge, governments decided to actively intervene to hasten the expansion of the plantation estate. Foresters argued that softwood plantations could simultaneously achieve the two policy objectives of import substitution and sustained yield forestry. In 1964, the States and Commonwealth established an Australian Forestry Council (Carron 1985, pp.303-7; Clark 2003). There was, however, a lack of rigorous debate concerning the estimated production requirements for softwood self-sufficiency (Clark 2003). Further, softwood self-sufficiency was an article of faith within the forester community, and the Agreements were justified simply on the basis of replacing the \$200 million of annual softwood imports (Clark 2003; Carron 1985).

To the extent that the plantation industry so created eventually achieved market-competitiveness and enabled a reduction in native forest clearing, the SFAs were not without positive outcomes.¹²¹ Nevertheless, by allowing the objective of self-sufficiency to guide policy, governments ruled out the possibility that Australia's comparative or competitive advantage lay elsewhere, and effectively gave over land to plantations without a serious economic

¹¹⁷ see also WA's set of URL's listing native title milestones
[<http://www.nativetitle.dpc.wa.gov.au/index.cfm?event=aboutKeyEvents>]

¹¹⁸ Department of the Parliamentary Library, (2002); see also House of Representatives Standing Committee on Aboriginal and Torres Strait Islander Affairs (1999)

¹¹⁹ – see "Legislation Proposed for Introduction in the 2005 Spring Sittings"
[<http://www.pmc.gov.au/parliamentary/index.cfm>]

¹²⁰ http://www.ag.gov.au/agd/WWW/MinisterRuddockHome.nsf/Page/Media_Releases_2005_Fourth_Quarter_17_October_2005_-_Review_to_improve_the_resolution_of_Native_Title_Claims_-_1952005

¹²¹ In reality, however, the SFAs often subsidised the clearing of native forests (which were replaced by plantations) rather than preventing it.

assessment of alternative possible uses for the land or the capital provided at concessional rates.

Official wood consumption projections and the self-sufficiency objective were challenged by the nascent environment movement. Since the SFA was financing native forest clearance for plantation expansion, new environmental groups such as the Australian Conservation Foundation attributed blame for native forest loss to the overestimates of future wood consumption, and to the self-sufficiency objective itself. Routley and Routley's (1973) seminal environmentalist critique, *The Fight for the Forests*, was a detailed analysis of the consumption projections underlying the SFAs, arriving at an estimate of wood consumption in 2000 of 19.8-22.6 million cubic metres, which proved much more accurate than the official figures (Clark 2003). Moreover, the Routleys exposed the economic irrationality of the self-sufficiency objective, especially in the context of a substantial overall trade surplus, in terms that would make any supporter of the principle of comparative advantage proud:

Not even the most ardent proponent of the pine planting scheme has attempted to argue that the material in question can be produced more *cheaply* here. The only thing that would be saved is foreign exchange... no attempt has been made to argue that growing the material locally is better economically than importing it. Instead vague but apparently persuasive nationalistic considerations about the importance of self-sufficiency have been put forward...

In this situation [of a substantial trade surplus,] economists have questioned the wisdom of continuing to regard the elimination of imports *per se* as either necessary or beneficial...If, as there is reason to suppose, much of the home-grown product produced at such environmental expense will require *protection* in order to compete against more economically produced imports resulting in higher prices for the relevant goods unless they are further subsidised, such a program would be positively harmful economically (Routley & Routley 1975, pp.22-4).

The environmental critique quickly penetrated official policy circles; in the parliamentary debate over the 1972 SFA bill, speakers raised concerns first voiced by environment organisations that the projections were too high, and were leading to excessive native forest clearance for pine plantations. In 1974 and 1975, government advisory bodies proposed that no more native forests should be cleared for plantations until better information was gathered about the economic and environmental effects of the program (Carron 1985, pp.310-14). Although softwood planting did not cease, this disquiet set the scene for the expansion of native hardwood plantations discussed later in the paper.

By 1980, one issue dominated Australian forestry – the export of native hardwoods as woodchips. The emergence of export woodchipping engendered a long and ongoing debate about 'value-adding' in forestry. From the time that Japanese trade envoys began appearing in Australia in search of forest products in the mid-1960s, Australian governments developed concerns about the prospect of native forests being exported virtually unprocessed. In 1968, in response to a somewhat undignified scramble by local firms to enter into contracts with Japanese representatives, the Commonwealth government extended its constitutional power to control foreign trade to woodchips, requiring amongst other things that exports be at or above the world price, and that further processing in Australia be investigated and, if feasible, undertaken (Dargavel 1995, pp.89-90).

State governments subscribed to the value adding doctrine by pushing for the creation of pulp mills wherever export woodchip mills were established. The New South Wales and Tasmanian governments, in conjunction with the Commonwealth, used various policy instruments to this end. The construction of a pulp mill was made a condition of ongoing access to forest concessions for the Triabunna woodchip mill, and a condition of the export license for both the Eden and first Tamar River woodchip mills. The second Tamar River woodchip mill was required to conduct a feasibility study into the establishment of a pulp mill. All this policy

entrepreneurship came to nought – the only apparently serious proposal to upgrade a woodchip mill to an export pulp mill, made by the owners of the first Tamar River woodchip mill in 1989, collapsed in the face of environmental opposition (Dargavel 1995, pp.90-102; AATSE 1988, pp.258-9).

In 1987, the Commonwealth established the National Afforestation Program, which provided \$15 million over three years for the development of hardwood plantations. By making funds available to private landholders as well as the states, it was the first government forestry initiative that directly promoted private plantations (Donaldson 2001). The NAP was superseded in 1992 by the Farm Forestry Program, which increased the emphasis on private ownership and collaboration with farmers. In 1997, the Commonwealth brought the Farm Forestry Program under the newly-established Natural Heritage Trust and, in conjunction with industry, released the *Plantations for Australia: the 2020 Vision* strategy, which established the objective of trebling Australia's plantations (softwood and hardwood combined) by 2020 (Donaldson 2001; Plantations2020 2002; Austin 2000)

By the early 1990s, Australia's native forests had been a cause celebre of the environment movement for twenty years and showed no signs of ceasing to be so. Since the world's first blockade of forest operations at Terania Creek in 1979, the environment movement had adopted direct action as a standard part of its toolkit, alongside legal action, lobbying and public education. Several factors pointed to the need for a new approach to forest policy and management: ongoing conflicts over logging, including the increasing mobilisation of timber communities;¹²² an increasing international acknowledgement of environmental concerns;¹²³ the rise of the green vote (which was widely understood to have delivered the ALP the 1990 election); and conflicts both within federal Cabinet and between Commonwealth and State governments over forestry. The environment movement wanted to conserve native forests – ideally by shifting all production to plantations, but at least by conserving representative samples of each ecosystem. The forestry companies wanted secure ongoing access to wood resources for both domestic and export purposes, and forestry workers and unions wanted secure jobs (Dargavel 1998, pp.25-6).

In 1992, the *National Forest Policy Statement* or NFPS (Commonwealth of Australia 1992), the first comprehensive national forest policy, was signed by the Commonwealth and all State governments.¹²⁴ It adopted the objective of ecologically sustainable development in forestry, to be achieved by establishing a system of "comprehensive, adequate and representative" conservation reserves through cooperation between Commonwealth and State governments. These conservation reserves were to be established by region-based assessments (Comprehensive Regional Assessments or CRAs), followed by binding agreements (Regional Forestry Agreements or RFAs) providing 'certainty' concerning forest use and management over twenty years. Notwithstanding the rhetoric about Commonwealth-State cooperation, in practical terms the RFA process was overseen by the states, leading many commentators to view them as an example of Commonwealth abrogation of responsibility for environmental protection (Dargavel 1998, p.29; Hollander 2004, pp.13-15; Garrett 1999; Economou 1999).¹²⁵

The RFA process was spurred by the forest protests of 1994. In 1997, the meaning of 'comprehensive, adequate and representative' was clarified (JANIS 1997) to mean *inter alia* the conservation of 15% of the pre-1750 area of each forest ecosystem; 60% of all vulnerable ecosystems; 60% of all old growth forest; and all rare and endangered ecosystems, along with

¹²² There were 1300 arrests of forest blockaders in SE NSW in 1989-1990 alone.

¹²³ In particular, the 1987 Brundtland report on sustainable development, and the 1992 Rio de Janeiro Earth Summit, where Australia signed a 'Global Statement of Principles on Forests'.

¹²⁴ Tasmania did not sign the NFPS until 1995. The following summary focuses on the economic dimensions of the RFA process. For reviews considering other dimensions of the process, see Ashe 2002; Dargavel 1998; Hollander 2004; Kirkpatrick 1998. For WA, see Brueckner & Horwitz 2005; Worth 2003; Walsh 2000; for Queensland, see Brown 2001; for NSW, see Mobbs 2003; for Victoria, see Skee 2001; Redwood 2001; for Tasmania, see Cadman 1998.

¹²⁵ Although forests had traditionally been a state responsibility, the process leading up to the release of the NFPS had raised hopes that the Commonwealth would play a more active role in forest management.

additional measures to protect biodiversity and reduce the risk of adverse events such as bushfires (JANIS 1997).

Economic analyses have criticised the JANIS criteria, with Slee (2001) arguing that they imparted a regulatory character to the CRA-RFA process that circumscribed possibilities for the use of economic instruments to determine the welfare-maximising level of conservation (by equating the marginal net benefits from forestry and the marginal net benefits from conservation).¹²⁶ While Slee's point is certainly correct, the JANIS criteria placed only lower limits on conservation requirements and not upper limits, meaning that scope did remain for the use of economic instruments, with the JANIS criteria representing scientifically-grounded minimum standards below which conservation levels could not fall.¹²⁷

Slee's study of the Northeast Victorian RFA (Slee 2001) highlighted three deficiencies in the economic component of the CRA process¹²⁸ – a failure to attempt a valuation of non-market goods associated with native forests, such as recreation, wildlife and water; a failure to link qualitative social assessment with economic assessment, leaving the social values of forestry and conservation largely unquantified; and a failure to identify which rural activities have strong regional multiplier effects through input-output analyses. It is not known whether non-market valuation techniques were avoided because of time and resource constraints or because of the controversy aroused by past attempts to employ them in Australian policy formulation (Bennett and Carter 1993; Bennett 2005). However, it is reasonable to suppose that a greater incorporation of non-market forest values would have enhanced the case for conservation by highlighting the value of non-logging forest uses. Greater efforts to quantify the social values of forest-related economic activities may have had the opposite effect, by magnifying the net benefits of the forest industry. Finally, input-output analysis would probably have revealed that agriculture and tourism have relatively strong regional linkages, but that the regional multiplier effects of woodchipping are fairly low.

In conclusion, while the *process* involved in formulating the RFAs (assessment, data gathering, consultation and reporting) has justly been described as “exemplary”, lifting “environmental decision-making and management... to a new level of professional excellence” (Dargavel 1998, p.28), it has not in itself settled the dispute over forest use or resolved the intractable differences between protagonists. As Slee (2001, p.28) noted, the RFA process exposed not only “an absence of values for certain outputs of forest, but an underlying conflict of value systems”. There is potential for public choice analysis to shed light on the mechanisms by which the RFA process sought to reconcile these differences, but this is yet to be undertaken.

As of 2005, the fundamental reason for the ongoing intractability of forest conflicts seems clear – the environment movement's demand for a total end to native forest logging, which it has maintained for thirty years and from which it is unlikely to resile. Until this objective or something close to it is realised, the environment movement will have no qualms about seeking to modify RFAs in their favour. The Queensland RFA appears to show the path to an ultimate resolution of forest use conflicts – an end to native forest logging and a shift to plantations, subsidised by government and phased in over a lengthy period.¹²⁹ As Clark (2003) noted, the irony for conservationists is that their long-term objective – an end to native forest logging – is now achievable precisely because of the massive expansion of plantations since WWII, which they previously opposed because plantations were often themselves established through native forest clearance.¹³⁰

¹²⁶ For example, it would not be possible to conserve less than 60% of old growth even if an economic analysis suggested that it would be welfare-maximising to do (although, as Ashe (2002) noted, no RFA except that for East Gippsland has fully met the JANIS criteria).

¹²⁷ The environment movement was critical of the JANIS criteria for different reasons, arguing that meeting the criteria did not guarantee the existence of a comprehensive, adequate and representative reserve system if Ecologically Sustainable Forest Management to conserve biodiversity did not occur outside the reserve system (TWS 2000).

¹²⁸ Similar criticisms can be found in Redwood 2001 and Brown 2002.

¹²⁹ It is unfortunate in this respect that the Commonwealth government has refused to sign on to the SE Queensland RFA.

¹³⁰ Some environmentalists (e.g. Cadman 2000) remain opposed to plantations on biodiversity grounds.

6.6 Transfer pricing

Rapid growth of the mining sector from 1960 required substantial overseas capital and, as a quid pro quo, subsequent repatriation of profits. Large international firms invested in mining developments, providing capital and technology. The resulting large-scale, related party financial transactions provided the possibility for profit shifting between countries, particularly to low tax countries. “Transfer pricing” is the self-determination of related-party prices to effect profit shifting.¹³¹ The subsequent substantial deregulation of the financial sector intensified this trend.

In 1980, the High Court heard an appeal by the Federal Commissioner of Taxation against lower court judgements relating to a transfer pricing case.¹³² As described in Blackshield et al (1986, p.224):

The Commonwealth Aluminium Company, an Australian company 'controlled' by overseas aluminium companies, was in a position to avoid tax [by manipulating international prices to transfer profits from high tax jurisdictions to tax havens]. The taxpayer sold bauxite to a customer in Japan—not directly, but through a paper company in Hong Kong. In this manner profits which would normally accrue to the Australian company were instead realised by the Hong Kong company.

Section 136 of the Act prevented avoidance schemes of this sort where an Australian company was controlled by non-residents. The taxpayer argued that 'control' was synonymous with 'ownership' and claimed that since half its shares were owned by residents, section 136 did not apply. Although these 'resident' shareholders were subsidiaries of overseas parent companies, the argument was accepted by a majority of the High Court. Only Mr Justice Murphy, interpreting section 136 in the context of the economic reality of the aluminium industry, took a different view.

The Court decided 4:1 to disallow the Commissioner's appeal. In his judgement, Justice Murphy referred *inter alia* to economic analysis on transfer pricing from the Transnational Corporations Research Project from the (“radical”) political economy wing of the Department of Economics at the University of Sydney.

By the 1990s, there was a marked change in attitude to transfer pricing. Killaly (2000) noted that the Australian Taxation Office (ATO) established a better organisational focus on globalisation in 1993. In particular, “Transfer pricing was an area that had not received extensive scrutiny for many years”. In 1998, related party international transactions were valued at \$76 billion, and the value of cross-border related party loans was around \$62 billion providing significant opportunities for profit shifting by transfer pricing. Killaly documented both the ATO's domestic and international activity in addressing transfer pricing, commencing with Tax Ruling TR94/14, and documenting some subsequent activity.¹³³ In its 2004-05 Compliance Program report, the ATO reported “29 audits finalised, with a focus on transfer pricing: \$868.5 million tax and penalties raised, \$157.3 million in losses disallowed” for large business.¹³⁴ In its 2002-03 report, the ATO reported “Transfer pricing audits have, over the last three years, resulted in tax and penalty assessments of \$655 million, and disallowed losses of \$796 million.”¹³⁵ By the 2005-06 report, the ATO commented “87 risk reviews completed, 26 audits conducted, 7 finalised (with a focus on transfer pricing), raising \$42.2 million in tax and

¹³¹ e.g. http://www.oecd.org/topic/0,2686,en_2649_33753_1_1_1_1_37427,00.html

¹³² *Federal Commissioner of Taxation v. Commonwealth Aluminium Corporation Ltd.* [1980] HCA 28; (1980) 143 CLR 646 (12 August 1980) [<http://www.austlii.edu.au/au/cases/cth/HCA/1980/28.html>]

¹³³ A search for “transfer pricing” on the ATO's website yields tax rulings additional to those documented by Killaly.

¹³⁴ http://www.ato.gov.au/taxprofessionals/content.asp?doc=/content/47980.htm&page=110&H12_1

¹³⁵ <http://www.ato.gov.au/taxprofessionals/content.asp?doc=/content/27818.htm&page=10>

penalties. This work suggests that most multinationals are working to comply with the transfer pricing regime.”¹³⁶

What had been “radical” economics in the 1970s was – with bipartisan agreement – conventional economic policy by the 1990s, presumably in an effort to protect the revenue.¹³⁷

6.7 Evolution of pollution management

Christoff (2003) argued that development of public management of Australia’s natural resources and environment had international roots in the turn of the 19th-20th centuries, the 1970s and the late 1980s-early 1990s. In the first phase:

Public authorities were created in most capital cities to limit urban pollution, manage urban open space, parks and gardens, and to provide or supervise the development of infrastructure providing clean drinking water, sewerage, and the disposal of domestic and industrial waste ... At the same time, influenced by American as well as Imperial models, departments and statutory bodies to facilitate the ‘wise use’ of natural resources were established in all colonies, or, later, States. (Christoff 2003, p.303)

In the second phase of the late 1960s and early 1970s which:

profoundly reshaped domestic attitudes and opinions about environmental degradation, only three Australian States - New South Wales, Victoria and Western Australia - established environment protection agencies intended to rationalise and focus environmental powers drawn from the plethora of laws and departments which had been partially responsible for environmental matters to this point, and to increase the capacity to regulate and manage urban pollution. ... Similarly, departments of conservation were established to aggregate responsibility for the management and preservation of wildlife, and of nature conservation reserves on public land. (Christoff 2003, p.303-4)

At this time, the Commonwealth also innovated comparable agencies, whose purview was restricted to the Territories and other Commonwealth land.

In the third phase, especially stimulated by emergence of global issues such as ozone depletion, climate change and biodiversity loss, “laggard” states established environmental management agencies, “lead” states revised existing agencies, and the Commonwealth and States innovated the Intergovernmental Agreement on the Environment (IGAE), the National Environment Protection Council (NEPC), and the National Biodiversity Strategy. Victoria and Western Australia also experimented with the creation of mega-departments which encompassed both the resource exploitation agencies (agriculture, forestry, fishing, mining) and the environmental management agencies (EPAs, park services); neither has persisted (Christoff 2003, p.304).

7. About the future

In the 1950s perceptions and policy focus were on local and regional environmental problems and traditional resource industries. By 1980 both perceptions and policy focus had changed dramatically: the environmental focus had shifted to national and in some cases trans-boundary problems, and the resource focus was on dramatic expansion of the “new” mining sector and its deleterious economic impact on traditional primary industries such as agriculture. By 2005, some environmental problems had been recognised as global ones.

7.1 Trans-boundary

¹³⁶ or the transfer pricing departments of the major accounting firms are getting smarter

¹³⁷ and still it continues: Garnaut (2005) cf. Rawlings (2005)

Some important trans-boundary environmental matters involving Australia are listed in Table 5. In only one of them has there been successful international policy action (chlorofluorocarbons).¹³⁸ The importance of addressing CFC emissions for Australia was that, had emissions continued and the Antarctic “ozone hole” continued to expand and intensify, it might have affected the Australian mainland.

Table 5: Australia and Trans-boundary Issues

		Policy management
Ozone hole	CFC emissions reduced, but molecules are long-lived so decades to successful completion	<i>Montreal Protocol</i>
Climate change	Australia: optimal economic strategy vs optimal international relations strategy; irrespective of optimal international relations strategy, what is optimal adaptation strategy	Kyoto Protocol*
Marine mammals	how to handle increasing whale numbers; clash of cultures (consumption vs vicarious enjoyment)	International Convention for the Regulation of Whaling
Southern Ocean fishing	open access – Australian difficulties with protecting own fishing zone, let alone beyond	UN Convention on the Law of the Sea
Timor Gap	how to equitably share resources between a very rich country (Australia) and a very poor country (East Timor)	Timor Sea Treaty [#]
Quarantine	will increasing international regulation of trade raise probability of quarantine breaches	World Trade Organisation
Environmental management	will free trade agreements compromise national environmental management	US-Australia Free Trade Agreement

* United Nations Framework Convention on Climate Change, <http://unfccc.int/2860.php>

Timor Sea Treaty: <http://www.timorseaoffice.gov.tl/aboutus.htm>

Three economic classes of problems characterise the remaining issues:

(a) severe conflicts in national interests:

(i) Although a party to the United Nations Framework Convention on Climate Change (UNFCCC), Australia has not signed the Kyoto Protocol on climate change because “it does not provide an effective global framework for meeting long-term objectives ... [and] ... does not include all major emitters and thus fails to address the issue of economic activity and emissions moving from emissions-restricted countries to unrestricted countries, with no overall greenhouse benefit”.¹³⁹ The carbon-intensity of Australia’s economy provides a government focused on management of the contemporary economy sufficient rationale to avoid emissions-reduction action; for example, by focussing on the never-arriving future – “The Australian Government believes that it is now time to look beyond Kyoto and concentrate on identifying truly effective options to help address climate change”.¹⁴⁰ Unlike other parties to the UNFCCC, Australia is able to increase emissions over the target period.

(ii) The gas resources of the Timor Gap provided a strong nationalist rationale to maximise Australia’s export potential through minimising Timor-Leste’s jurisdiction, even though Timor-Leste was a micro- and highly vulnerable State. At the time of signing the Timor Sea Treaty (20 May 2002), Timor-Leste was deeply indebted to Australia for its role in leading INTERFET. The 2002 Timor Sea Treaty does not finalise the jurisdictional dispute from Timor-Leste’s perspective.^{141,142}

¹³⁸ and there are always doubters; e.g. www.nationalcenter.org/npa159.html

¹³⁹ <http://www.dfat.gov.au/environment/climate/>

¹⁴⁰ <http://www.dfat.gov.au/environment/climate/>

¹⁴¹ cf. <http://www.timorseaoffice.gov.tl/aboutus.htm>

¹⁴² Timor-Leste and Australia signed (??) a new petroleum revenue sharing agreement on 12/1/06; the finalisation of the maritime boundary has been deferred for up to 50 years; one commentator asserted that the delay had jeopardised development of the Greater Sunrise field: see

(iii) In the case of marine mammals, the deep cultural differences between whale-meat consumers (Japan, Norway) and vicarious whale beneficiaries (e.g. Australia) means there is little prospect of resolution.

(b) decision making under uncertainty:

if, as the Australian Government argues, reducing Australian greenhouse gas emissions will have little impact on global concentrations of greenhouse gases,¹⁴³ then effective *domestic* policy should focus on adaptation. The National Climate Change Adaptation Programme devotes \$14.2 million over 4 years "to commence preparing Australian governments and vulnerable industries and communities for the unavoidable impacts of climate change."¹⁴⁴ During 2005, several commentators (e.g. Garrett, Hawke) questioned whether, given the increasing likelihood of serious environmental damage from global warming, it was time to consider the future role of nuclear energy in Australia.¹⁴⁵ The peaceful use of nuclear energy has had a cloud over it because of its connections to nuclear weapons proliferation, the need for high security to limit the terrorism risk, and because of the long half-lives of many fission by-products. However, increasing knowledge about environmental threats from (hydro)carbon combustion, means that re-evaluation of the coal/nuclear tradeoff might be appropriate. This is of economic interest for at least two reasons. Firstly, Australia has 40% of the world's known uranium reserves. Secondly, Australia relies almost entirely on coal for electricity generation, and is a major coal exporter – and, increasingly, a major exporter of hydrocarbons such as LNG. A reassessment of the appropriate coal/nuclear balance for Australia might include expansion of the uranium exporting industry, or domestic nuclear generation of electricity. The latter may never be technologically appropriate for Australia because the small scale and geographical dispersion of its domestic electricity industry means there may never be sufficient economies of scale in the industry to make this an efficient option. An irony of expanding uranium exports is that, in a economically rational world, such exports should lead to the generation of carbon credits.

(c) compliance costs:

Successful management of Southern Ocean fishing fisheries depends on the efficiency of monitoring and enforcement. The individual illegal fisher's problem is: what is the probability of being detected; if detected, what is the probability of evading capture; if captured, what is the probability of successful prosecution; if convicted, what is the penalty. Since the Southern Ocean fishery is unregulated (Baird 2004) – and Australia's Exclusive Economic Zone within it remote and contiguous to the open access fishery – compliance is expensive and there are considerable opportunities for evading capture (cf. Baird 2004, Darby 2005).

There are unlikely to be simple economic solutions to resolving these policy problems.

Australia is also engaged in two great international trade adventures. The first, the multilateral GATT/WTO process, has been evolving since the 1950s. The second, is the bilateral Free Trade Agreement process which the current Federal Government favours, particularly with the USA. In both cases, there have been environmental concerns. With the WTO, there have been concerns that the sanitary and phytosanitary (SPS) provisions reduce the capacity of national governments to control the entry of agricultural and environmental invasive species. Pauwelyn (1999) argued that while formal requirements for a scientific approach to assessing risk limited national capacity to "fiddle" SPS provisions, risk management procedures provided opportunities to introduce "non-scientific" national interest provisions in deciding whether or not a particular level of risk was nationally acceptable. The "precautionary principle" might be

http://www.theaustralian.news.com.au/common/story_page/0,5744,17749334%255E643,00.html

¹⁴³ "Like all smaller emitters, Australia's efforts cannot make a significant difference alone."

<http://www.dfat.gov.au/environment/climate/>

¹⁴⁴ <http://www.greenhouse.gov.au/impacts/index.html>

¹⁴⁵ http://www.heraldsun.news.com.au/common/story_page/0,5478,16753217%255E5000107,00.html

invoked as part of risk management, although only if a state undertakes “sufficient” scientific research to reduce the uncertainty that might justify invoking this principle.

In the case of the US-Australia Free Trade Agreement, there was considerable concern within environmental groups during the negotiations between the respective governments. These concerns partly arose because the negotiations occurred in private with only favoured interest groups knowing likely provisions of the US-AFTA. The US’s objective of entering this FTA from an environmental perspective was nakedly commercial rather than environmental.¹⁴⁶

Environmental groups were concerned that this trade agreement would mirror the North American Free Trade Agreement with its provisions for investors to challenge national environmental management legislation (e.g. Echeverria 2003, Bottari and Wallach 2005; cf. Canner 2003). However, it appears that – to date at least – the US-AFTA has avoided some of the potential for investor litigation arising from government policy, including environmental policy, that has been contentious in NAFTA:

In recognition of the unique circumstances of this Agreement -- including, for example, the long-standing economic ties between the United States and Australia, their shared legal traditions, and the confidence of their investors in operating in each others' markets -- the two countries agreed not to implement procedures in this FTA that would allow investors to arbitrate disputes with governments. Government-to-government dispute settlement procedures remain available to resolve investment-related disputes. (Office of the United States Trade Representative 2004)

7.2 National

“National” issues are those where (i) the Commonwealth Government has constitutional responsibility (e.g. marine resources beyond the three nautical mile State limits, including fisheries,¹⁴⁷ the Great Barrier Reef, and mining/energy extraction in the Exclusive Economic Zone (EEZ)); (ii) issues unequivocally have a national character (e.g. inter-generational issues); or (iii) a consistent national approach might be socially desirable (e.g. drought policy) (Table 6).

Table 6: National Issues

		Policy management
Constitutional		
fishing	sustainable fishing (within limits of high degree of uncertainty & climate change) – latest announcement http://www.afma.gov.au/information/newsroom/announcement.htm	Australian Fisheries Management Authority
GBR	reef protection	Great Barrier Reef Marine Park Authority
oil & gas	exploration and production in Commonwealth waters	EPBC*
minerals/energy	is national management of exported agricultural and forestry commodities simply vestigial cf. minerals/energy	export control powers (Constitution s.51(i))
National character		
energy	– Australia’s self-sufficiency in liquid hydrocarbons – under threat or not ? does it matter ? (optimal to extract early if climate change a reality) are renewables a solution?	Potential to use (i) export control powers (ii) EEZ powers (iii) external affairs (EGE) or (iv) taxation

¹⁴⁶ e.g. with respect to environmental-related trade: “U.S. companies face stiff competition [in Australia] from Japan in air pollution control, and France in water pollution control. Germany competes with the United States in pollution abatement equipment and waste management technologies. The Agreement will immediately enhance the competitive position of U.S. exporters of all of these types of equipment. Both Australia and the United States will eliminate all tariffs on environmental goods immediately upon implementation of the Agreement.” (Statement of Why the United States-Australia Free Trade Agreement is in the Interests of U.S. Commerce

[http://www.investaustralia.gov.au/media/AUSFTA_Benefits_ALLSectors.pdf]

¹⁴⁷ some “Commonwealth” fisheries may actually be managed by States

electricity/gas	will reorganisation including corporatisation and privatisation lead to efficient long run investment	National Competition Policy, s.96
land	- native title – Cth's overriding interests to limit claims and encourage conversion to freehold (not independent of broader social policy) - degradation on private land (e.g. acidification, biodiversity) – socially inter-temporally optimal	<i>Native Title Act 1993</i> (as amended) Intergovernmental Agreement on the Environment
biodiversity	. optimal conservation of Aust's unique flora/fauna, ecosystems & landscapes, & most efficient means of doing so (MBIs – or cart before the horse) . ecosystems other than forests	external affairs power; COAG stt
National policy		
drought policy –	continued environmental collateral damage	Exceptional circumstances (s.96)
forestry policy	(see section 6.3)	Regional Forest Agreements (s.96)

Notes: * <http://www.deh.gov.au/esd/national/igae/>

Conversely, there are some issues which, even if managed nationally or where the Commonwealth intervenes, clearly have a regional character even if involving more than one State (e.g. water, in-stream salinity) (see sections 7.4-7.5). Key generic economic characteristics of these issues are:

1. uncertainty

(i) most Australian fisheries in the EEZ are sparsely distributed which compounds the general fisheries management problem of poor knowledge of stock levels and recruitment. Until recently there has been cautious optimism about the sustainability of fisheries in the EEZ, even though it has been previously reported that some fisheries or species are fully or over-fished (BRS, latest report). The Commonwealth's recent action to financially support restructuring of this fishery acknowledges the continuing uncertainty problem. The difficulty for policy is that the cost of reducing this uncertainty may be so large that it cannot be economically undertaken. There is little guidance that economics can offer in this case – policy making could proceed and run the risk of fishery collapse (e.g. as with the rich cod fields off the Canadian east coast in the early 1990s) or (implicitly) adopt a precautionary approach. In the case of the latter, fishers are always likely to want to fish more than a precautionary approach would suggest, leading potential problems of illegal fishing.

(ii) the general problem of uncertainty of marine knowledge is less severe for the Great Barrier Reef as its waters are shallow and knowledge is easier to obtain. Considerable research funds have been made available for the GBR because of its iconic international status. The great uncertainty for the GBR is climate change, as it is known that coral growth and persistence is sensitive to water temperature. However, coral appears to be adaptable in sub-geological timeframes – albeit at greater than human timescales – as the GBR survived the last ice age when sea levels were substantially lower than present.

2. reconciling conflicting interests

(i) as well as suffering uncertainty problems, the GBR is also at risk from severe conflicts of interest arising from trade-offs between protecting the reef and the direct effects of commercial activities such as fishing on the Reef, and indirect effects of land-based activities such as agriculture (nutrient and sediment discharges), industry (pollution emissions at harbours), and marine transport (oil and bilge discharges by ships in transit, and ships running aground on the reef). The GBR was previously contentious when mining the Reef, particularly for oil, was considered 1960-80s. The GBR however has a distinct advantage over many other marine resources in that it has highly valuable associated activities such as international tourism which is economically valuable to

regional Queensland and the state as a whole, and to Australia generally. Fishing has recently been reduced, following a buy-out package.¹⁴⁸ Pollution on a large scale, particularly with diffuse agricultural pollutants, is likely to be much more difficult to manage, although nutrient run-off is theoretically manageable through cap-and-trade on fertiliser use. However, the differential effects of nutrient discharge to waters depending on the location and biophysical characteristics of the site on which fertiliser is applied probably makes cap-and-trade an infeasible tool. Even theoretically, sedimentation is a less-easy problem to address, and is not exclusively agricultural in origin. It is likely therefore that “command and control” approaches are the most feasible for protecting the Reef, however much they may be disliked by economists.

(ii) if Hajkowicz and Young’s argument is correct that little Australian agriculture is profitable (cf. section 5.1), then this has significant implications for future management of land, especially biodiversity. Although, as noted above, Hajkowicz and Young’s disaggregation into “dryland” and “irrigated” agriculture was very coarse, the former was found to be less profitable, probably of zero profitability. The more arid parts of dryland agriculture are likely to be the less profitable. In many (but not all) cases, these lands also have higher biodiversity values because they have been farmed less intensively than higher rainfall land. However, these more arid lands probably can’t simply be abandoned – they need some form of management, even only for fire management. Thus the issue becomes which is the most appropriate form of management for land which is marginally profitable or unprofitable. The three broad options are: (I) continue with agricultural production (perhaps as the least cost option, even if socially uneconomic); (ii) convert to conservation lands, perhaps retaining existing owners and workforce as conservation managers; or (iii) reducing the existing production intensity of these lands, perhaps with the State purchasing conservation outputs such as feral animal control and increased numbers of (especially rare) native animals and plants, and permitting the sustainable harvest of native flora and fauna.¹⁴⁹

3. equity

From the beginnings of the native title debate in 1993, the current Federal Government (then as Opposition) was ill-disposed to native title and grasped the opportunity offered by the Wik judgement to limit its effects; and it currently appears be doing the same with Northern Territory land rights legislation (cf. Godden; cf. section 6.2 above). It is likely that it will continue to promote the freeholding of native title land as a solution to Aboriginal disadvantage (cf. Duncan 2003). Godden (1997) argued that, while native title might not be an ideal land tenure, it was likely to be preferable in an interregnum to the alternative of continuing indigenous dispossession. Ultimately, it is up to indigenous Australians themselves as to whether or not – or in what circumstances – common property land is superior to freehold. To insist that whites know best about preferred social and economic organisations for indigenous Australians is simply a continuation of the paternalism that has been unhelpful in securing long-term security and dignity for indigenous citizens. Further, to assert that common property is inferior to individual private property betrays an ignorance of the key role played by common property in Western economic development (cf. section 8.1 below).

4. inter-generational equity and efficiency

Land degradation on private land represents a challenge to economists. The conventional approach is that land degradation will be reflected in land value and that, following Hotelling, should good quality land become scarce, its value will rise and discourage degradation. The short-run exigencies of natural calamity (e.g. drought), asset fixity and poverty, divergence between private and social rates of time preference, and – above all – imperfect knowledge and foresight are ignored in this simplistic assessment. More importantly, the values of future generations are ignored. On the one hand, land degradation – even if understood at the time – might have previously been an acceptable

¹⁴⁸ <http://www.mffc.gov.au/releases/2004/04243mj.htm>

¹⁴⁹ the last would be permissible under the Green Box provisions of WTO.

tradeoff enabling private and social capital accumulation in Australia's economic development. Whether – and if so, to what extent – it continues to be acceptable private and social policy is a question that continually needs to be addressed. One way of envisaging the issue is to think of Australia in 2005 as a larger-scale version of Easter Island circa 1500AD. If Easter Islanders had known in 1500 that continuation of their social policy of private competitiveness would ruin their stock of natural resources by 1600AD, would their rate of time preference have been sufficiently low – and their social cohesiveness have been sufficiently high – that they would have modified private rivalry? Similarly, if Australians could perfectly foresee 2105AD under current “business as usual” conditions, would its resource state be such that institutional change – including presently-sacrosanct private property rights – would be desirable to preserve Australian society? It is unacceptable simply to *assume* that private actions will achieve an acceptable social outcome, when such private actions are simply the outcome of social choices about institutions.

Some kinds of modification that might be made to existing rates of land degradation are similar to institutional changes already innovated to modify degradation of other natural resources. The USA implemented a cap on (and trade in) sulphur dioxide emissions in the mid-1990s; more recently, Australia established a cap on water extraction in the Murray-Darling Basin; limits have been placed on pollution emissions; native forest harvesting has been reduced; and the Commonwealth has recently announced reductions in fishing catch in the EEZ. Where there is controversy about these policies – e.g. water cap, forest harvesting – it appears to be primarily about whether compensation should be payable on equity or efficiency grounds, not whether the state has to right to control the exploitation of natural resources. It would not be a large step to ask whether current rates of land degradation or extraction rates for minerals and energy are appropriate from an inter-temporal national perspective. Ultimately, a society seeking sustainable uses of natural resources might institutionally innovate a variant of the Roman law concept of “usufruct” – where a “usufructuary” has “the right to use and enjoy the profits and advantages of something belonging to another as long as the property is not damaged or altered in any way”¹⁵⁰ – rather than continuing to rely on a property right system of effectively unfettered rights, including rights to degrade.¹⁵¹ (Of course, should usufruct be adopted, the issue arises as to whether or not compensation for the “lost” rights is appropriate on efficiency or equity grounds. This would be an interesting argument on Coasian grounds – the compensation of current owners is readily comprehensible, but the conjugate argument of future generations’ being compensated for inheriting degraded land is equally valid.)

Biodiversity has elements of all the above issues: uncertainty; reconciling conflicting interests; and both contemporary and inter-generational equity. A good national understanding of the difference between the conservation of ecosystems, species and their populations would be useful in establishing a framework for what society wants to preserve – if simply DNA, a genebank or museum will do; if species, a zoo or arboretum will do; if populations, then iconic species at least will survive in commercial trade (but not necessarily “uglies” like spiders). But if it is desired to preserve both the genetics and behavioural characteristics of species, then populations and habitats at least are essential; and, to preserve interactions amongst species, then viable ecosystems are necessary. The further up this hierarchy, the more uncertain the knowledge required to ensure preservation. The lower down the preservation hierarchy, the more reasonably future generations might demand adequate compensation for being denied access to biodiversity that still currently exists. Conflicting interests include the opportunity costs for both the present (for not being able to fully exploit natural resources) and the future (for never having access to extinguished resources).

7.3 Regional

¹⁵⁰ <http://www.bartleby.com/61/89/U0158900.html>

¹⁵¹ cf. Margaret Thatcher: “No generation has a freehold on the earth. All we have is a life tenancy — with a full repairing lease.” (quoted in Industry Commission 1998, p.1)

Many environmental and natural resource issues increasingly being dealt with at the national level are actually regional rather than national (cf. above). There may be advantages from having consistent “high level” policies for natural resources – indeed *all* commodities and services – such as efficient pricing. However, since many natural resources are not tradeable – although there may be spatial trade-offs – efficient management of natural resources (including policy determination) is likely to occur at the regional rather than national level. The importance of regional management has been especially recognised in Victoria with Catchment and Land Protection Regions established in the mid-1990s, and subsequently replaced by Catchment Management Authorities operating since the second half of the 1990s. NSW operated Catchment Management Trusts and Catchment Management Committees from about 1990, but the current Catchment Management Areas were only established in 2003 and in most cases are still in their formative stages. Other States have Natural Resources Management Regions (SA, 2004).

Table 7: Regional Issues

		Policy management or experiment
water	quantity quality – esp. eutrophication	National Water Initiative; Murray Darling Basin Agreement; States' water acts
soils	salinity acid sulphate soils other pollutants	National Action Plan for Salinity and Water Quality;* Acid Sulphate Soils Hotspots Remediation Program; Hunter River Salinity Trading Scheme
biodiversity & ecosystems	• ecosystems/species crossing State borders • limitations of publicly-owned conservation (e.g. wheat-sheep belt, economies of size and site fragmentation) • determining optimal conservation on private land (auctions etc. as subsidy-allocation mechanisms, not optimum-identifying mechanisms)	• • e.g. Qld's Southern Desert Uplands** • e.g. BushTender, BioBanking**
urban space liveability	both existing conurbations, and developing coastal conurbations	
waste disposal		e.g. NSW regulations under Protection of the Environment Operations Act 1997+
air pollution		e.g. NSW regulations under Protection of the Environment Operations Act 1997+
fisheries	optimal management of sparse fisheries	

Notes: * Although a “national” programme, has a regional focus; see <http://www.napsdq.gov.au/>

** <http://www.napsdq.gov.au/mbi/round1/project18.html>

<http://www.dse.vic.gov.au/dse/nrence.nsf/LinkView/15F9D8C40FE51BE64A256A72007E12DC8062D358172E420C4A256DEA0012F71C>; <http://www.epa.nsw.gov.au/threatspec/biobankscheme.htm>

+ <http://www.environment.nsw.gov.au/legal/summariesreg.htm> and

Regional environmental resource issues may be characterised economically as:

1. uncertainty

Comparable to Australia's being a low rainfall country, from a natural resources perspective Australia is also a low income country – i.e. low GDP per hectare. Australia's

GDP per land surface square kilometre is \$80,000 compared to \$1.3 million for the USA; between \$6-10 million for Germany, UK and Japan; and \$174.5 million per land surface square kilometre for Singapore. By contrast, Indonesia's GDP per land surface square kilometre is \$453,000.¹⁵² These comparisons would be even more dramatic if the area of the EEZ were included. Thus Australia's resources available to catalogue and understand environmental and natural resources are commensurately scarce, and have been concentrated in marketable commodities (e.g. agriculture and minerals). Crafting appropriate decisions for managing environmental and natural resources will always be based on very scarce data. For example, knowledge of non-point source eutrophication and salinity, biodiversity and fisheries at the micro level is extremely sparse.¹⁵³

Information scarcity has been significantly reduced since about 1990 following the ESD process and the substantial raising of the importance of the environment in national policy. However, Australia will necessarily make decisions about natural resources and the environment using a much less rich information set than comparable developed countries. But, as shown in the above "snapshots" for 1955 and 1980, there was probably sufficient available *contemporary* knowledge to indicate that contemporary environmental condition was unsustainable and that policy change was appropriate.

2. reconciling conflicting interests

Regional issues often starkly reveal conflicting interests. Severe stress on wetlands in highly-regulated river basins – e.g. the Macquarie Marshes – can only be relieved if more water is made available. In the Macquarie Marshes, graziers as well as the marshes suffered from reduced flooding as lower rainfall and increased irrigation led to reduced unregulated flows below Burrendong. Unless there is significant "waste" in river systems, more water to improve environmental condition means some users will obtain less water. Further, environmental water is about quantity, quality (e.g. water temperature) and timing of release – increased water release at times of naturally high flows may reduce the likelihood of maximum water storage being achieved. Conflicting interests at the regional level also include salinity (higher catchment versus lower catchment); acid sulphate soils (terrestrial modifiers of land versus river and estuarine users); air pollution (emitters versus recipients). Solution of these conflicts generally requires emitters to modify their behaviour and generally, but not exclusively, reduces emitters' welfare. From an efficiency perspective, the key issue is the relative changes in welfare for emitters and recipients.

3. equity

Regional environmental policy often has regional emitters and regional recipients. An extreme case is the Wimmera catchment in western Victoria which has a closed hydrology (Dunn 2005). Using a Coasian argument (and noting that future generations may have a stake in the outcome), efficient outcomes occur where marginal damage costs equal marginal abatement costs. However, if *all* the benefits and *all* the costs are regional, efficient solutions could occur by regional action alone.¹⁵⁴ However, a popular confusion of the economics concept of "public good" with public funding has led to an expectation that – wherever there are public goods (or externalities), especially relating to the environment – general taxpayers ought to fund the required outcome irrespective of the winners and losers (cf. section 8.6(c) below). There may be good reasons for the State to become involved – e.g. there may be public goods in information about environmental processes that are wider than any individual catchment that might most efficiently occur through taxpayer funding. However, economists should not be caught up in the presumption that, simply because there are public goods or externalities, policy requires State intervention and/or funding.

¹⁵² calculations based on data from the USA's CIA "The World Factbook", <http://www.cia.gov/cia/publications/factbook/index.html>

¹⁵³ except for some high value fisheries, for example, such as abalone

¹⁵⁴ cf. footnote in last paragraph of section 8.1 below.

4. inter-generational equity and efficiency

Most conflicting regional interests are contemporary conflicts – e.g. pollution emitters and recipients. However, some conflicting interests are intergenerational, where either environmental damage accumulates (e.g. salinity) or environmental change once initiated is difficult to reverse (e.g. acid sulphate soils). As previously argued, intergenerational efficiency issues are generally “solved” by assigning a zero weight to the utility of future generations.

7.4.1 Water – unfinished business

There is a sad continuum from the early degradation of Sydney’s Tank Stream water supply, through early doubts about the profitability of irrigation in Australia and the realisation of these doubts by irrigation failure in the late nineteenth century, to Davidson’s (1969) conclusion that irrigation had been an economic failure.¹⁵⁵ In the second half of the twentieth century, the more than doubling of storage capacity between 1969 and 1993 (Crabb 1997, Table 16)¹⁵⁶ suggests that Davidson’s conclusion was not heard, or not heeded. The environmental effects of river regulation – first evidenced in rising salinity especially in the Murray, and subsequently by spectacular blue-green algal blooms in the summer of 1991-92 in many NSW rivers – indicated that not merely were the economics of irrigation dubious, but its environmental externalities were substantial. Combining the direct economic effects and environmental externalities suggested that irrigation in Australia had been infelicitous policy.

Despite the “National” Water Initiative, water is essentially a regional issue, not a national one. There is little connection, for example, between water in Western Australia, the Northern Territory or Tasmania unless pipelines are built under Bass Strait or from tropical Australia. Except in the case of the Snowy and Thomson rivers, there is currently no physical connection between coastal and inland rivers in Victoria, NSW and Queensland; and it is far from clear in the Snowy case that this was an economically sensible investment.

In a recent address to the Sydney Institute, the Commonwealth Secretary to the Treasury argued that because water is differentially charged for in Australia (e.g. 0.3 cents for kilolitre for rural water in Queensland as opposed to more than \$1 in Brisbane)¹⁵⁷ “it is difficult to see how we could be achieving anything like an efficient allocation of water [among] its various uses” (Henry 2005, p.10). However, spatial equilibrium analysis teaches that, where there are different markets with initially different prices, prices will only equilibrate at the same value if transport costs are zero.¹⁵⁸ Further, it only makes sense to transport water long distances if the present value of water transport infrastructure costs (plus net value of water in current use) is lower than the present value of other options (e.g. water saving, or “industrial” production of water). Having made decisions to build uneconomic irrigation dams “on the driest continent on the planet”,¹⁵⁹ it is probably economically sensible “to grow highly water-intensive crops” if transport costs preclude alternative uses and externalities are properly addressed. However, Henry (2005) correctly observed that water charging regimes only seek to recover operating costs and return on infrastructure, and that scarcity values are ignored. But he carefully

¹⁵⁵ “If the aim of the nation is to use its resources as efficiently as possible and to give its people the highest possible standard of living, the establishment and continued expansion of irrigation in Australia can only be regarded as a mistake.” Davidson (1969, p.241)

¹⁵⁶ Nearly 40% of the increased storage capacity was for hydroelectricity in Tasmania (Crabb 1997, Tables 15-16)

¹⁵⁷ And, indeed, urban water only costs half as much in Australia as in many European cities.

¹⁵⁸ Hence, for example, land prices for housing in metropolitan and coastal areas tend to be higher than in regional or rural areas.

¹⁵⁹ second driest; Antarctica is drier.

avoided mentioning that this is mandated in the National Water Initiative (clauses 65-66)¹⁶⁰ and that scarcity value is ignored.¹⁶¹

There does not appear to be independent Australian economics literature on efficient urban water pricing, other than focusing on cost recovery. Relevant issues include: whether pricing at (long run) marginal costs would be achieved and if so lead to (more) efficient outcomes; and whether additional water-producing infrastructure is necessary or desirable,¹⁶² or whether water saving (e.g. through scarcity pricing) is a more efficient outcome. Particularly in the larger urban areas, modelling requires disaggregated demand (e.g. for “indoor” and “outdoor” residential uses, commercial, industrial, agricultural) to enable investigation of how different demands would adjust to pricing. Efficient pricing might involve (i) higher prices (reflecting scarcity value); and (ii) prices that vary through time that reflect changes in storage levels with varying seasonal conditions, increases in demand as populations grow, and possibly reduced rainfall with climate change.

8. Role of economics in fashioning policies for current/future problems

There is a paradox in using induced institutional innovation as a framework for evaluating policy. That framework focuses on the importance of *distribution* for explaining what policies are innovated and how. By contrast, neoclassical economics from which induced institutional innovation draws its techniques focuses on the *efficiency* of resource use. Thus, in thinking about economics’ role in fashioning policies for current and future environmental and resource problems, clarity is required in identifying whether analysis focuses on what policies might emerge compared to what might be the best policies to achieve optimal resource use. The following discussion emphasises the latter.

8.1 Property rights and market based instruments

(a) false dilemmas

Assuming a myriad of technical conditions hold, private property rights are a sufficient but not a necessary condition for efficient resource allocation. Much recent economic analysis, particularly for the environment, stresses the creation of private property rights to increase resource use efficiency (e.g. marketable pollution permits, tradeable water rights etc.). Sometimes this preference for private property rights elides into an ideological assertion that *only* private property rights create the necessary conditions for efficient resource allocation. There is frequently also a presumption that common property requires conversion to private property to permit most efficient use of resources (e.g. in the native title context Duncan 2003 cf. Godden 1997, pp.291-2). There has also been continued confusion between common property and open access resources.

¹⁶⁰ under the National Water Initiative (clause 66), metropolitan pricing is to move towards “full cost recovery for water services to ensure business viability and avoid monopoly rents, including recovery of environmental externalities, where feasible and practical” by 2008, whereas rural and regional pricing is to move towards full cost recovery, where practicable. In rural and regional areas, however, there will be some small community services that will never be economically viable but need to be maintained to meet social and public health obligations. Oddly, there is no mention of public health obligations arising from water and sewerage provision in metropolitan areas where, historically, they were the primary rationale for State intervention once the role of microorganisms in disease was demonstrated in the 19th century.

¹⁶¹ In principle, scarcity values should be accounted for in irrigation with appropriate property rights, where the value of the right reflects scarcity. Whether farmers use these implicit water prices in decision making has not (???) been demonstrated. These values may be used when major decisions are made (e.g. inter-generational transfer, drought), but not for routine year-in year-out decision making. In this case, efficient water use may only eventuate in the long run (cf. Keynes)

¹⁶² the National Competition Council (2001, p.3) appears to have been seduced by secondary benefits in benefit-cost analysis: “The Council suggests that where broader regional benefits (such as increased economic activity and employment) are included in the analysis they should be estimated through a robust and transparent methodology.”

The growth in productivity in capitalist societies in the past two centuries has been founded on one of the most significant institutional innovations in the past millennium – a common property institution. The “joint stock” company is a legal fiction with a common property form¹⁶³ – the company (and its assets) is owned in common by shareholders who have “shares” in the value of the company, but no individual owns a particular part of the company. This common property legal fiction freed capital accumulation from a dependence on family and partnerships, and permitted much larger-scale capital accumulation than would otherwise have been likely to eventuate. The consequent growth in productivity has been the greatest and most sustained the world has ever known.

Even in the case of real property (including land) a general presumption against common property is demonstrably false. Common property plays a major role in “modern” land tenure. The innovation of strata title has, at its heart, common property in a building (e.g. a block of units, offices in an office block) and common property in the land on which the building stands. This common property innovation – in the case of dwellings, for example – permitted a remarkable increase in productivity because, better than previous titles (e.g. company title), larger numbers of individual dwellings per unit of land area were feasible, and an increased number of dwellings per dollar of construction materials was possible. Joint tenancies are also a form of common property; ironically, “tenants in common” is less like common property than a joint tenancy.

Particularly in a resource and environmental context, it is of fundamental importance to determine the optimal form of property right to enable best use of resources, both now and in the future.

(b) Market Based Instruments

There has recently been keen interest in market based instruments for environmental management. Traditional approaches to environmental management – whether pollution control or conservation more broadly – have been “command and control” (by government direction or “regulation”, or government ownership¹⁶⁴); moral suasion, education and research; taxes or subsidies; and property rights (e.g. pollution permits). All these instruments create or modify markets and, without precision, “market based instruments” easily cover the entire conservation policy domain. It is useful to identify four classes of market based instruments:

- . “real” property rights – i.e. where there is real scarcity, such as land (at least without land-augmenting technical change such as irrigation or fertilisers, or high-rise buildings), water extraction rights, fishing catch entitlements, etc.
- . “quasi” property rights – i.e. where there is scarcity by government fiat, such as pollution permits (e.g. NSW’s Hunter River Salinity Trading Scheme¹⁶⁵), offsets (Biobanking,¹⁶⁶ Godden and Vernon 2003))
- . direct taxes and subsidies – on provision of commodities, or services (e.g. NSW Load-based Licensing which implements a Pigouvian tax,¹⁶⁷ Landcare, research)
- . market mechanisms to purchase environmental services or distribute government conservation subsidies (e.g. Victoria’s BushTender auction schemes,¹⁶⁸ NSW’s

¹⁶³ Martin and Verbeek (2002, p.83)

¹⁶⁴ e.g. national parks or other Crown estate; pastoral leasehold.

¹⁶⁵ “The NSW Government’s Hunter River Salinity Trading Scheme leads the world in using economic instruments for the effective protection of waterways.”

<http://www.environment.nsw.gov.au/licensing/hrsts/index.htm>

¹⁶⁶ Department of Environment and Conservation NSW (2005)

¹⁶⁷ see <http://www.environment.nsw.gov.au/licensing/lbl/index.htm>

¹⁶⁸ see

<http://www.dse.vic.gov.au/DSE/nrence.nsf/LinkView/15F9D8C40FE51BE64A256A72007E12DC8062D358172E420C4A256DEA0012F71C>

Environmental Services Scheme¹⁶⁹). There is often a fine line between government purchase of environmental services and government subsidy for conservation. This distinction partly depends on whether or not government undertakes compliance activities, often over a considerable period of time, to identify whether the “purchased” environmental services are, indeed, delivered.

There is currently considerable experimentation into MBIs in Australia.¹⁷⁰

(c) philanthropy and volunteerism

A focus on “economic” solutions to environmental problems diminishes the focus on alternative solutions. Traditional “economic” analysis of environmental problems is based on the assumption of profit-maximising firms and utility-maximising individuals. Public choice theory extends this blackboard characterisation to include government organisations. However, modern society also depends on other organisations to effect activities which substitute for, or are complementary to, those of firms and governments. There has been extensive analysis of “non-profit” (or “not-for-profit”) firms in North America, particularly in the medical and educational industries. Australian interest has been more recent, with ABS recently estimating a Non-Profit Institutions Satellite Account showing that NPIs comprise approximately 5% of GDP and 7% of employment (Australian Bureau of Statistics 2002). The imputed wages for volunteer services were estimated to comprise 1.4% of GDP. As noted above, volunteerism is a key part of Australia’s bushfire services but, as part of the general decline in volunteerism and also because of particular features of Australian firefighting, bushfire volunteerism is currently under some pressure (e.g. Select Committee 2003, para. 6.25-6.43, 6.54-6.70; Ellis et al 2004, chapter 12).

Non-profit conservation organisations are common in both North America and the UK.¹⁷¹ Volunteerism has played a major role in Australian conservation associations such as Greening Australia and Landcare since the 1980s.¹⁷² Non-profit conservation organisations now own considerable tracts of land managed for conservation, most of which is in arid areas (Table 9).

Table 9: Private Conservation

	Area (ha)
Australian Bush Heritage	372,156
Australian Wildlife Conservancy	670,493
Australian Landscape Trust	343,800
Trust for Nature (Vic) *	35,898
Birds Australia	316,390
Wildlife Land Fund (Qld)	1820

Sources: organisations’ Annual Reports and websites, 2004
 Notes: * also has a covenanting program and a revolving fund

Reeson (2005) noted potential tensions between volunteer activities and market-based instruments, similar to those that have arisen in firefighting. Where public (or private) funding becomes available for previously-volunteer activities, some volunteers may switch from being volunteers to paid providers of conservation services. The gross amount of conservation (or other volunteer) activity may not change, but simply be recorded as a direct cost. There are similar arguments regarding proposals for a “duty of care” for the environment or “stewardship” (cf. Bates 2001). These ideas also intersect with notions of “cost sharing” for maintenance or

¹⁶⁹ see http://www.forest.nsw.gov.au/env_services/ess/default.asp

¹⁷⁰ <http://www.napsq.gov.au/mbi/>

¹⁷¹ e.g. USA: Ducks Unlimited, National Audubon Society, Conservation Trusts, The Nature Conservancy; UK: Royal Society for the Protection of Birds

¹⁷² <http://www.landcareonline.com/index.asp>; <http://www.greeningaustralia.org.au/GA/NAT/>; see also Australian Bush Heritage Fund, Australian Landscape Trust, Australian Wildlife Conservancy, Birds Australia, Trust for Nature (Victoria); see also Australian Register of Environmental Organisations at: <http://www.deh.gov.au/tax/reo/index.html#reo>

improvement of environmental condition (e.g. Aretino et al 2001).¹⁷³ The economic problem is to discern optimal (or 2nd, 3rd or n-th best attainable) conservation outcomes, and identify least cost (and distributionally, socially and politically feasible) mechanisms for achieving these outcomes where analysis includes the impact (if any) of the use of MBIs on previously-voluntary conservation.

8.2 Information on economic values of environment

The extraction of natural resources has traditionally been well documented by statistics agencies. National accounts and related data document the production and value of commodities from agriculture, fisheries, forestry, mining and energy at least annually. Labour and intermediate outputs use, and formation of produced capital, in these industries is similarly well-documented. However, the stock and quality of natural resource capital in these industries is generally poorly documented by statistics agencies. Individual firms may know the stock/value of readily recoverable resources but often the value even to firms of good quality information about their natural capital obviates the collection of high quality data. With fugitive resources (e.g. fish) or dispersed resources (e.g. timber) the cost of acquiring high quality data often if not generally precludes its collection.

The assembly of high quality data by statistics agencies on other environmental or natural resources is still in its infancy. The National Land and Water Resources Audit provides a contemporary and comprehensive snapshot of Australian biophysical conditions, and an embryonic framework for monitoring and reporting on future condition.¹⁷⁴ The ABS's Environment "Theme" page¹⁷⁵ presents an eclectic range of documents on energy, transport, fish, minerals, water, salinity, environmental attitudes, environmental protection expenditure. The quality of this data is variable, and not consistently collected. This site also presents links to a wide range of other environmental data, including ABS's own *Australia's Environment: Issues and Trends, 2003* (ABS 2003), itself an integration of environmental data much of which is published by other agencies.

What is missing from Australia's statistical agency is a coherent theoretical understanding – comparable with the national accounts – of the key information necessary to describe and analyse the environment and natural resources. There is also a suggestion that precious statistical resources will be wasted by inventing another industry to report on within the national accounts – the ABS has followed the OECD in proposing a new industry upon which to report:

The environmental goods and services industry consists of activities which produce goods and services to reduce, prevent, limit, minimise or correct environmental damage to water, air and soil, as well as problems related to waste, noise and eco-systems. This includes cleaner technologies, products and services that reduce environmental risk and minimise pollution and resource use. (ABS 2001)

These activities are defined in terms of business activities (the columns in Table 10) and environmental activities (rows in Table 10, described in greater detail in Box 1). This "industry" will cut across many of the industries currently defined by ANZIC codes, and it will possibly be a matter of luck as to whether or not an activity is recorded as part of an environmental industry. Consider the following examples:

1. farmer plants deep-rooted species to reduce water tables and dryland salinity on- or off-site – "environmental industry" depends on whether the farmer collects and uses seeds of

¹⁷³ Coase's original conclusion that, ignoring transactions costs, bargaining could lead to optimal allocation of externalities was somehow transformed into political slogans of polluter or beneficiary pays. (cf Pannell: <http://www.general.uwa.edu.au/u/dpannell/pd/pd0021.htm>)

¹⁷⁴ <http://www.nlwra.gov.au/topics.asp>; <http://www.nlwra.gov.au/about.asp?section=93>

¹⁷⁵ <http://www.abs.gov.au/websitedbs/c311215.nsf/22b99697d1e47ad8ca2568e30008e1bc/36f96955a6e59068ca2568f2001ae1cb!OpenDocument> See also National Land & Water Resources Audit http://lwa.gov.au/downloads/publications_pdf/ER041012.pdf

local provenance (ANZSIC Subdivision 01: Agriculture), plants an exotic like lucerne (Crop and Plant Growing nec ANZSIC industry 0169), plants local provenance, native or exotic trees (plant nurseries ANZSIC industry 0111). The “environmental industry” is at least contained within an ANZSIC Subdivision (01: Agriculture).

2. farmer shifts from weed control via cultivation to minimum tillage – is the “environmental industry” defined in terms of the producer of the minimum tillage cultivation implement (“machinery industry”, ANZSIC industry 2861), the herbicide manufacturer (“chemical industry”, ANZSIC industry 2544), or the farmer who combined all these elements (somewhere in ANZSIC Subdivision 01: Agriculture). Unless this innovation is attributed to agriculture, the “environmental industry” will be in a different ANZSIC Subdivision from the industry where the environmental benefit (ecosystem effects including improved soil structure, and possibly chemical residues and herbicide resistance) will occur.

3. miner innovates new technology which reduces greenhouse gas emissions per tonne of ore or per petajoule of energy recovered - the “environmental industry” could be defined in terms of the mining industry (Division B – Mining); manufacturing if new equipment was required (Division C – Manufacturing); construction (Division E – Construction); or Subdivision 81: Government Administration (if CSIRO developed the new technology) or ANZSIC industry 8431 Higher Education (if a university developed the new technology).

Box 1

Environmental activities are also broken down into 3 main categories:

- Pollution management activities, including:
 - air pollution control
 - waste water management,
 - solid waste management,
 - remediation and clean up of soil & water,
 - noise & vibration abatement, and
 - environmental monitoring, analysis & assessments
- Cleaner technologies and products, including:
 - cleaner/resource efficient technologies & processes
 - cleaner/resource efficient products
- Resource management activities, including:
 - indoor air pollution control
 - water supply
 - recycled materials & manufacturing
 - renewable energy
 - energy saving & management
 - sustainable agriculture & fisheries
 - sustainable forestry
 - natural risk management
 - eco-tourism
 - other (e.g. nature conservation, habitat & biodiversity)

Table 10

Types of Environmental Activity	Types of Business Activity		
	Production of equipment and specific materials	Provision of services	Construction and installation of facilities
Pollution management			
Cleaner technologies & products			
Resource management			

None of this addresses the substantive issues, however. ABS (2003, Table 1.1) summarises “Techniques for Estimating Environmental Values in Monetary Terms” and acknowledges that there are difficulties with existing methods – and that there is some controversy about whether environmental values should be monetised – but fails to note that this is the single biggest gap in statistical reporting on the environment. There is – as indeed summarised in ABS (2003) – considerable, regular collection of physical data by other agencies – e.g. State of Environment reporting at national, state and local government level, the National Land and Water Resources Audit,¹⁷⁶ – but there is a conspicuous lack of regular, consistent, comprehensive economic data about values relating to the environment (other than resource extraction). There is reasonable knowledge (as summarised in ABS 2003, Table 1.1) about how to value the environment, but it's not undertaken routinely – there is a need to make environmental valuation systematic, rather than ad hoc as at present. However, it is also necessary – perhaps for ABS to investigate – the development of better measures of environmental values; for example, do current measures which are based on individualistic utilitarian values only provide a lower bound on environmental values? Further, do we need to do a better job in understanding how to incorporate future individuals' environmental values (of both benefits and costs of what we bequeath to them) into contemporary environmental reporting.

8.3 GIS and economics

Economics, including resource economics, has a long history of including spatial dimensions. Von Thünen's locational theory of production, and even Ricardo's extensive margin, were early attempts to recognise the importance of location in economics. The theory of comparative advantage investigates why different forms of production are best performed in particular countries. More sophisticated models – such as transportation models, spatial equilibrium analysis, regional CGE modelling, and ultimately global CGE models – have extended the capacity to account for greater richness in modelling the relationship between production and spatial location.

¹⁷⁶ <http://www.deh.gov.au/land/nlwra/>

The capacity to model spatially has been dramatically increased over the last decade by the availability of software to implement Geographic Information Systems (GIS). Together with declassification of much of the defence-developed Global Positioning System (GPS) network, it is possible to map and model spatial characteristics on the desktop. In particular, since natural resources vary spatially – e.g. soil quality, timber resources, water flow (and thus, for example, salinity), biodiversity quantity and quality – it is then possible to think of optimal resource allocation on a spatial scale. Precision agriculture is one implementation of spatial management of a natural resource;¹⁷⁷ others include conservation areas in Sydney,¹⁷⁸ and Community Access to Natural Resources Information (CANRI).¹⁷⁹

Although resource information may be available at high resolution, economic data may not be available at such a fine scale. It may be possible to concoct (quasi) economic data at this scale. In the case of agriculture, high resolution yield data may be used as a proxy for profitability at high resolution, or gross margins may be estimated at this scale (Hajkowicz and Young (2002). Or it may be possible to model resource policy options (e.g. salinity management) at high resolution, and then evaluate at a coarser scale. Census data at the collector district level may provide a good understanding of economic profiles (e.g. retirees on the NSW coast).

8.4 Inter-temporal

Developed economies dictate the resources inherited by their descendants. Over the last two centuries, developed economies have bequeathed increasing knowledge, human and produced capital, some temporary increases in natural resources (e.g. new mineral discoveries), and generally (but not exclusively) declining environmental quality. The consequences of these bequests can be illustrated in Figure 1. In the top left-hand panel, the convex curve represents the current generation's choice set between current consumption (horizontal axis) and its bequest to the succeeding generation (vertical axis). Consequent on private and social decisions, the current generation has preference function (W1) between current consumption and bequest; given this preference function, the current generation consumes $C1^*$ and bequeaths $Y2^{**}$ to the next generation. Depending on the succeeding generation's inheritance (i.e. $Y2^{**}$), its choice set (the convex curve in the top right-hand panel), and its own preference function for consumption and bequest (W2), the second generation bequeaths $Y3^{**}$ to the generation that succeeds it. The bequest which a succeeding generation obtains depends on the preceding generation's weighting of current consumption and *that preceding generation's* attitude to bequest – i.e. a preceding generation is dictatorial towards all succeeding generations.¹⁸⁰

All this, of course, violates the assumptions of Pareto welfare economics which provides the philosophical underpinnings for neoclassical economics – both static and intertemporal. Randall (1987) and Pannell (2005) recognised that, while discounting is appropriate to use for investment decisions involving “near” time periods, in the long term it appears to produce nonsensical results. The problem is that the discount rate is doing two things – it is both (i) acting as the price/cost of investment and savings (which is market-relevant for those in the current generation making investment and saving decisions) and (ii) the discount rate is also acting as a weight in an intertemporal social welfare function. Intertemporal economic analysis which is consistent with the assumptions of Pareto welfare economics needs to distinguish between the interest rate as the price/cost of investment and savings (relevant to each generation's decision making for itself) and each generation's weight in the intertemporal social welfare function.¹⁸¹

¹⁷⁷ see Australian Centre for Precision Agriculture <http://www.usyd.edu.au/su/agric/acpa/pag.htm>

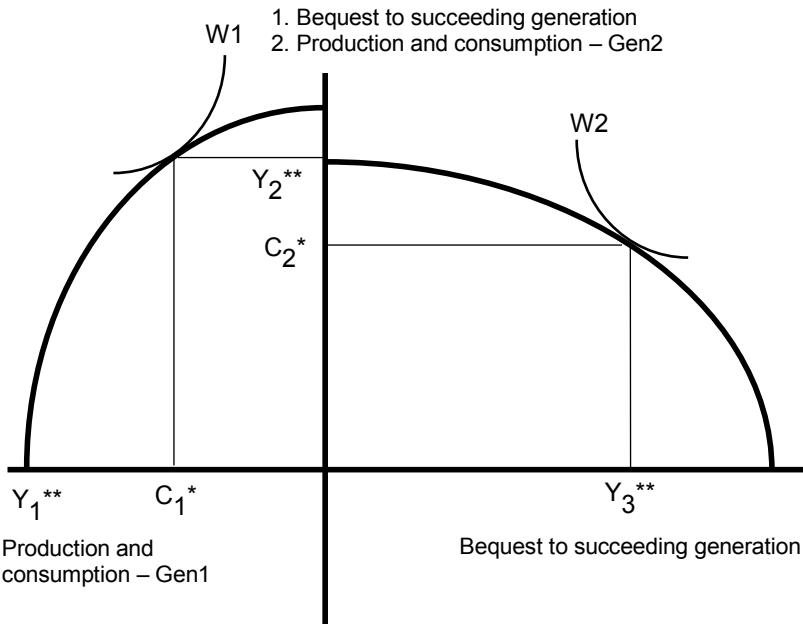
¹⁷⁸ <http://www.nationalparks.nsw.gov.au/npws.nsf/content/get+hold+of+maps+data+and+reports>

¹⁷⁹ <http://www.canri.nsw.gov.au/about.html>

¹⁸⁰ “overlapping generations” models (cf. Barro 1974) accept the dictatorial nature of bequests.

¹⁸¹ e.g. Godden (2004)

Figure 1: Determining Bequests to the Future



8.5 Mythbusters

In the 1950s-70s, Australian agricultural economists had a well-deserved reputation as mythbusters. Two icons of iconoclasm were Bruce Davidson's *Australia Wet or Dry* and *The Northern Myth*. For a variety of reasons, (public) iconoclasm in the profession has declined in recent decades.¹⁸²

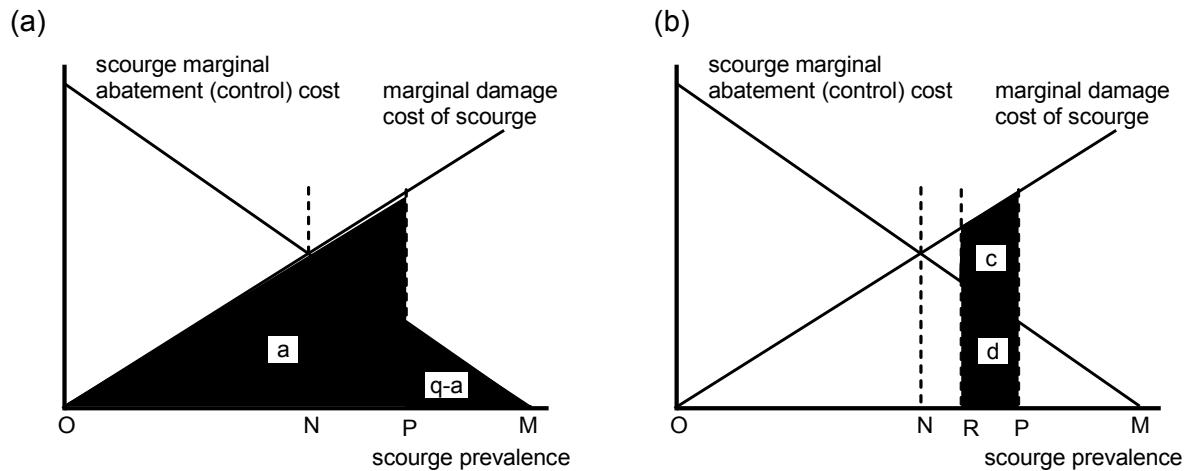
(a) Costs of scourges and natural disasters

As reported in sections 5.9-5.10, considerable effort has been expended since about 1990 in estimating the costs of scourges (pests, diseases and weeds) and natural disasters. While it might be interesting to know, for example, that a particular drought or severe storm "cost" (or reduced GDP by \$X billion), it is not obvious what other use might be made of this information. Even more so in the case of scourges. Consider scourge Q at prevalence P, which "costs" \$q million p.a., comprising \$a million p.a. of lost production and \$(q-a) million p.a. in control costs. Its economics may be represented in a conventional externality/pollution diagram like Figure 2(a). The upward sloping line is the scourge's marginal damage cost, and hence the area \$a million p.a. is the annual damage cost at prevalence P. Similarly, the downward sloping curve is – starting from the scourge's maximum prevalence at M – the marginal cost of abating or controlling the scourge. Hence, \$(q-a) million p.a. is the annual control cost to reduce the scourge from prevalence M to prevalence P.

However, it is more useful to consider Figure 2(b). Assume that the existing scourge prevalence is P, and the existing control strategy is intensified to reduce prevalence to R (e.g. more baits spread per hectare, or more hectares baited). The annual benefit (reduced damage cost) of the intensified control strategy is \$(c+d) million p.a., which is clearly greater than the additional control costs of \$d million p.a. This result holds to the socially optimal control level of N. Other scourge management strategies can also be considered – e.g. an anti-clockwise rotation of the marginal abatement cost curve represents increased control efficiency such as introducing rabbit calicivirus to replace or supplement myxomatosis which both reduces the cost of control up to the existing equilibrium N, and creates a new equilibrium to the left of N. Note also that better crop yields or higher product prices would rotate the marginal damage cost curve anti-clockwise around the origin, and similarly increase the optimal level of control to the left of N. In all these cases the total damage bill is irrelevant; only the marginal costs of control and damage are relevant.

¹⁸² David Pannell has a good selection of mythbusting at <http://www.general.uwa.edu.au/u/dpannell/>

Figure 2: Economics of Scourge Q



This suggests that considerable effort has been misplaced in estimating total costs of scourges, rather than benefits and costs of scourge control. There have been useful investigations of the latter, including environmental scourges (e.g. Odom et al 2003) and disaggregated CGE modelling of a substantial impact from an hypothesised weed control program (Wittwer et al 2005).

Whether scourges are evaluated in a total or marginal context, environmental scourges pose particular difficulties because of the difficulties of estimating damage costs in other than biological terms. In the absence of marginal damage cost estimates, estimation of marginal control cost provides little guidance in a neoclassical economics context (a) as to whether or not to pursue control and (b) the relative economic importance of difficult-to-estimate environmental damage compared to easy-to-estimate damage in commercial agriculture. Making the right decisions, therefore, may depend on decision makers who are prepared to decide on non-economic grounds on the distribution of funds between commercially-important and environmental scourges, and the right management intensity for the latter. Border protection is particularly problematic because successful colonisation of Australian ecosystems will often not be apparent *ex ante*.

(b) Valuing ecosystems

Environment Australia (2003, p.52) asserted (without citation):

One estimate in 1997 valued terrestrial Australian ecosystems at US\$245 billion annually and US\$640 billion annually for marine ecosystems. While these figures are relatively coarse, they emphasise the major contribution biodiversity makes to healthy and functioning landscapes.

At the time, Australian GDP was about \$A600 billion at current prices, less than half this estimated value of Australian ecosystems. The source of these estimates is a paper by Jones and Pittock (1997) in *Proceedings of the Ecological Society of Australia National Conference*,¹⁸³ whose estimates were inferred from Costanza et al. (1997).¹⁸⁴ The methods used are opaque. Costanza (2002) noted that Costanza et al. (1997) was a very heavily cited article, although

¹⁸³ Bulletin of the Community Biodiversity Network, Vol. 4 No. 1 Autumn 1998; <http://www.nccnsw.org.au/member/cbn/news/life41.htm>

¹⁸⁴ Neither Costanza et al. (1997) nor Jones and Pittock (1997) appeared in the refereed economics literature. It is ironic that these values, and the “ecological footprint”, have become prevalent despite widespread scepticism by environmentalists of economic aggregates such as GDP. However, at least Costanza et al avoided the Cambridge Capital controversies by aggregating output flows from “ecosystem capital” rather than trying to estimate the size of the stocks themselves.

Howarth and Farber (2002, p.422) writing in the same issue acknowledged that this article was “both widely cited and widely criticized.”

Costanza et al. used several methods for estimating ecosystem services value, one of which is the sum of producer and consumer surplus in Figure 3(a), converted to per hectare values per biome, and aggregated to the global level using biome areas. As Costanza et al. (1997, p.257) noted, national/global income measures based on microeconomic aggregates mean that “cost + net rent” in Figure 3(a) aggregates to national income, and “ecosystem services value” being defined as “consumer surplus + net rent” in Figure 3(a) may be more or less than national income. The key implicit assumptions behind this procedure are (i) all labour costs (labour value added) including managerial and entrepreneurial activity are included in the supply curve (unlikely); (ii) that the “supply = marginal cost” curve in Figure 3(a) is the *long run* supply/marginal cost curve (unlikely), otherwise the “net rent” is attributable to produced capital as well as ecosystem services, and (iii) that *all* the “consumer surplus” is attributable to ecosystem services (no rationale was provided for this attribution). Costanza et al. assert that some ecosystem services are not valued in markets and would be represented as in Figure 3(b). Costanza et al. allow that demand for at least some of these ecosystem services, e.g. water, may be (nearly) perfectly inelastic at low quantities – in this case, if price tends to infinity more rapidly than quantity falls, the consumer surplus estimate will be extremely large (infinite, cf. p.257,258). The authors claim these estimates are similar to CGE estimates of ecosystem service value.

Figure 3: Valuing Ecosystem Services, Costanza et al. (1997, Figure 1)

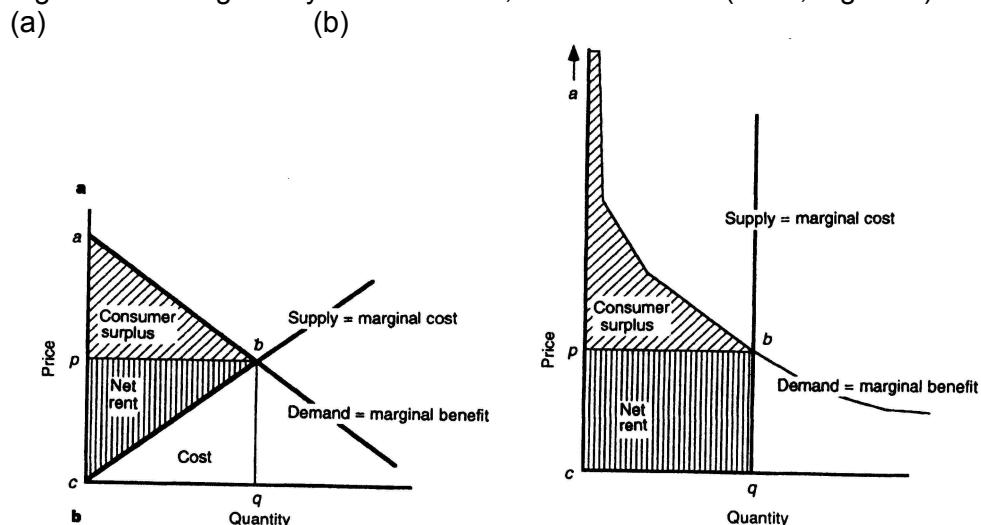


Figure 1 Supply and demand curves, showing the definitions of cost, net rent and consumer surplus for normal goods (a) and some essential ecosystem services (b). See text for further explanation.

One set of criticisms of these estimates is that they are “too large” – i.e. greater than total income (e.g. Howarth and Farber 2002, p.422 on Pearce). However, at its simplest, this criticism overlooks that Costanza et al include consumer surplus in their estimates. While *in principle* consumer surplus reflects what individuals would be prepared to pay rather than what they actually do pay, this is a partial equilibrium concept. In aggregate, consumer surpluses are so large that, when all commodities and services are included, income effects mean that partial equilibrium demand curves are no longer relevant. There is, therefore, a fallacy of composition. Note that GDP is defined as income earned from creating goods and services or, conversely, expenditure on goods and services. It does not include the theoretically desirable economic measure of consumer surplus – if it did then, for marketed goods and services at least, this augmented GDP would exceed the estimated value of ecosystem services – but then it, too, would suffer a fallacy of composition.¹⁸⁵

¹⁸⁵ Because environmental commodities are generally not marketed, they don't directly enter the national accounts – but would do so if the national accounts were welfare rather than expenditure based. Hence Prime Ministers can say silly things like “the idea that we can address climate change matters successfully at the expense of economic growth, is not only unrealistic but it [sic] also unacceptable to the

Common (1997, p.331) commented:

There is little doubt that ecosystem services are typically given too little weight in policy decisions. But it is surely a mistake to attribute this solely to the fact that they do not have prices attached to them. Politicians and voters give lots of weight to things that do not have prices attached to them: national identity and sovereignty, civil liberty, public health, crime levels and so on. The idea that putting prices on ecosystem services is necessary and sufficient for getting politicians and voters to take them seriously seems to me to involve a very curious view of politics and of human psychology. It is a view that is apparently shared by most economists who embrace the agenda of sustainable development as set out in the Brundtland report and who want to devote non-trivial amounts of scarce intellectual talent to producing 'green national income accounts' and related endeavours ...

The key objection to the Costanza et al. (1997) estimates – and indeed to subsequent analysis – is the same as to the scourge cost estimates: "so what?". Even if there were no objections to the methods used to estimate the total value of ecosystem services, the estimates are meaningless – as would be corresponding estimates of global GDP, and even estimates of national GDP. At the bare minimum, national GDP estimates make sense as they *change*, and reasons are sought for these changes. Particularly for micro- – including environmental/natural resource – economists, it is the *composition* of GDP that matters, what accounts for this composition, and what are reasons for its change. Similarly, it is the *composition* of ecosystem services that matters, what accounts for this composition, and reasons for change – not aggregates such as global (or even national) value of ecosystem services, or the "ecological footprint".

(c) Meaning of "public"

"Public good" is economic jargon that is poorly understood outside economics. Technically it means a good or service whose use is non-rival and non-(price)-excludable. In non-economic parlance, a "public" good may be one that is (or should be) publicly provided (i.e. by government), or closer to economists' conception of a merit good (a good/service that individuals or society ought to consume). Invariably, when economists evaluate "public goods", many non-economists' policy response is that such public goods ought to be at least funded by government, and perhaps government provided.

However, not all public goods are "public" in the sense that they have a national or even State reach. For enclosed catchments, where environmental public goods and services generated and utilised within the catchment, there is no obvious policy role for funding from outside the catchment to achieve optimal allocation of public goods within the catchment.¹⁸⁶ Only where a public good has boundaries beyond the catchment – e.g. a species or ecosystem may also occur outside an enclosed catchment or be valued outside that catchment – or if public policy (e.g. creation of property rights) are also relevant outside the catchment, might it be relevant for wider funding of a catchment's environmental issues. However, if a beyond-catchment public good (e.g. biodiversity) is provided jointly with a private good such as animal shelter or within-catchment public good such as predator reservoir, the mere existence of a beyond-catchment public good may not be Pareto-relevant to the provision of the environmental good within the catchment.¹⁸⁷

9. Conclusion

population of Australia" [<http://www.pm.gov.au/news/speeches/speech1741.html>] – the notion of an economic growth/environmental condition tradeoff is largely semantic because the "environment" is defined to be outside the measured economy.

¹⁸⁶ e.g. the Wimmera CMA in Victoria is – at least hydrologically – an enclosed catchment (Dunn 2005)

¹⁸⁷ e.g. see David Pannell on "cost sharing" – <http://www.general.uwa.edu.au/u/dpannell/pd/pd0021.htm>

Much of the exploitation of Australia's natural resources has occurred under private ownership – often with urgings to create private property rights – where high private discount rates have prevailed, where there has been substantial (even wilful) ignorance of the consequences of resource exploitation, and where there have been substantial externalities.¹⁸⁸ It is easy to say, in 2006, that sunk costs are sunk costs. And that the high ratio of natural resources to labour (and capital) dictated the substantial wastage of renewable resources which had taken aeons to grow and where extraction technologies precluded regrowth of the resource (e.g. red cedar) or aeons to accumulate and decades to denude (e.g. soils under rainforests). What is more difficult to reconcile is that much of this was known by the 1950s, but that so little has been done to ameliorate the environmental condition.

McKibben (1990. pp.60,78 original emphasis) argued that "*But we have ended the thing that has, at least in modern times, defined nature for us — its separation from human society. ...But now we make that world, affect its every operation (except a few - the alternation of day and night, the spin and wobble and path of the planet, the basic geological and tectonic processes).*" The Indian Ocean tsunami (2004) and Hurricane Katrina (2005) have reminded us of the power of "nature".¹⁸⁹ However, especially since 1950, *Homo sapiens* has developed mechanical and chemical power to mould nature on a spatial scale – and at an intensity – never previously available. On a global scale, we are like the Easter Islanders of about 1550 (cf. Ponting 1991, chapter 1), having been warned by Kenneth Boulding in the 1960s of the economics of the coming spaceship earth. Robyn Eckersley commented:

In his bestseller *The End of Nature* (1990), Bill McKibben singled out global warming as the most momentous and disturbing environmental problem confronting humankind because we have not only changed the weather but also rendered extinct the *idea* of nature as something eternal and separate from us: 'We have deprived nature of its independence, and that is fatal to its meaning. Nature's independence *is* its meaning; without it there is nothing but us.' (Eckersley 2006, p.20)

Humans have always played games against nature – but generally only on a local scale. Since mid twentieth century, humanity has been playing games against nature on a global scale – population and food supply; CFCs and ozone; greenhouse gases and global warming. Now nearly all the elements of the pay-off matrix – e.g. the probabilities of "natural" events and their pay-offs – are endogenous. While global warming has often been addressed using CGE, it is generally addressed non-stochastically and without uncertainty over quite short time periods and with little if any thought as to effects on future generations. Other large-scale problems are often treated non-stochastically using the tools of static partial equilibrium. But if humanity is actually playing dynamic, stochastic and uncertain games against nature – of which post-European experience in Australia since 1788 is a microcosm – then many of the answers economists generate are actually wrong, and the policy advice economists give is culpable.

The "environmental" side of environmental and natural resources is playing in this game with its hands tied behind its back. Because many environmental goods and services are unmarketed there are no associated market values. Because decisions about their exploitation or retention are made relative to marketed commodities with quantifiable values, there is a problem of misplaced concreteness – it is invariably easy to justify additional environmental degradation, because the values of marketed commodities are calculable, visible, direct, and (largely) affect the current generation. However, environmental goods and services whose values are difficult

¹⁸⁸ "In the evolution of a newly settled country, the first stage of land use is inevitably exploitative. In Australia, the tendency to take a sporting chance became a national characteristic, and 'if anything went wrong it was either the result of bad luck or caused by the politicians'. Landholders in early and even more recent times were out to make a fortune by carving a makeshift home in the wilderness, with the idea of returning as soon as possible to more comfortable surroundings. The bonanza days soon passed, and they either abandoned the land or realized that this was truly home, and 'instead of abusing the land to make a fortune, the farmers begin to use it within its capabilities to make a permanent living'" (Webb 1966, p.197)

¹⁸⁹ it might be argued that Katrina was part of anthropogenic climate change.

to quantify may ultimately be most valued by future generations, whose utility is weighted at zero in the economic calculus.

Economic analysis of environmental retention and resource conservation mirrors market decision making – not because it is “right”, but because both are dictatorial and deal with highly imperfect information. A little more humility in economics, especially in making contributions to policy, might be in keeping especially if – as McCloskey (2002, p.34) noted – economists are “tempted to *arrogance in social engineering*”¹⁹⁰

¹⁹⁰ “Lots of intellectual professions are arrogant. Physicists, for example, are contemptuous of chemists, whom they regard as imperfect versions of themselves. In fact physicists are contemptuous of most people. But when a physicist at North Carolina named Robert Palmer went in 1989 to a conference in which physicists and economists were to educate each other he remarked, “I used to think that physicists were the most arrogant people in the world. The economists were, if anything, more arrogant.” (McCloskey 2002, p.35).

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