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**Looking Forward
with a Glance Backward**

An environmental scan for Australia

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Background

On World Environment Day it is appropriate to reflect on successes and failures in the past year and also to look to the future. As we approach the 30th anniversary of the first World Environment Day, something a little more comprehensive seems worthwhile with regard to the Australian situation — hence this “scan” of the future.

Scans versus forecasts

A scan is different to a prediction or a forecast. The former can be defined as a quick but wide look, as in “scanning the horizon”. By necessity, a scan has to rely on existing knowledge of the person doing the scan. On the other hand, making predictions and/or forecasts involves a formal, structured and investigative approach. While this requires the person who is doing the work to have existing knowledge - to know what to look for or expect - it relies on quantitative and, often, qualitative data and modelling. By necessity prediction and/or forecasting is a far more resource demanding than a scan; for example, extrapolation of demographic and economic trends would be involved (using quantitative tools) plus qualitative expert opinion by utilizing the Delphi technique or other “foresight” methods. As a general rule, the further one looks into the future, the greater the need to rely on expert opinion rather than quantitative models.

Probabilities and rates of change

If one scans no more than 5 years hence, one can assign higher probabilities to scenarios than to those developed for 20 years hence. For example, barring nuclear war or a pandemic, one can use existing demographic data and models to predict world population with a high degree of accuracy 5 years hence. This is not necessarily the case for 20 years hence, as population growth rates are influenced by such variables as changes in per capita income, the education of women and government policies (as in China) and these have to be forecast before an estimate of the world population is made. It is for this reason that scenarios well into the future are usually based on a “business-as-usual” (or mid-range estimate) with high and low estimates either side of it.

Nevertheless, even looking 5 years hence is fraught with uncertainty because one cannot rule out “surprises”. One only needs to recall the recent disintegration of the Soviet Union and its economic system, or the present financial crises in a number of Southeast and Northeast Asian economies, to be reminded of the reality of surprises. Scientific breakthroughs can also come as a surprise, if not to those who have spent years on the research problem, certainly to society generally. The pace of diffusion of technology can also be surprising. And then there are human health disasters such as AIDS which came as a surprise.

However, while being mindful of the possibility of surprises, if one takes a relatively long (in human terms) look at history, one finds that change (if it comes) can be slow or that there can be “regressions”. If one looks back 20 years, there is much that has not changed as there is that has. For example, the rapid growth rate of many Asian economies has grabbed the world’s attention, yet the poor rural people in the developing countries are hardly any better off (if at all) than they were 20 years ago, and likewise for the slum dwellers and the urban poor. If one wants examples of regressions, there is no need to look further than the

internecine wars following the breakdown of what was Yugoslavia, and similar situations in some of the ex-Soviet Union nation-states.

Globalisation

The present infatuation with “globalisation” is an example of not taking a “long view” of history. We know that at least from the time of recorded history globalisation, if that means movement of people and traded goods around the world, has occurred. The Roman Empire stretched to Britain and Ireland. The Vikings left their mark on much of Europe and beat Columbus to North America.

In more recent times, at the beginning of this century, the world economy was more “globalised” than any time until the present. The existence of widespread colonial empires meant that international trade was very significant. Early Australian European history, and the development of the Australian economy, needs to be viewed from this perspective. Until 1948 when the first Holden car was made, Australia relied on imports for its passenger vehicles. It “rode of the sheep’s back” and then recently on exporting minerals, agricultural products and inbound tourism. For many years it relied on immigration for its rapid population growth.

The two World wars this century, the end of colonization, and the Cold War had dramatic influences on globalisation. Today globalisation is best understood as *globalisation of financial markets*. The resources that produce the goods and services in the *real* economy (such as factory workers, mineral deposits, and land) are either completely immobile or are very limited in their mobility. That stated, one should not overlook the influence of financial markets on the real economy.

While there might be surprises in store (the internal political responses to the currency crises in a number of Asian countries cannot be foreseen), the present thrust to globalisation could be expected to continue to diminish the importance of national borders.

Ron Johnston (one of Australia’s leading analysts of change) has described globalisation in the mid-1990’s thus:

Globalisation describes increasing convergence and interdependence of national economies.... One key driving force in the globalisation process is the convergence of national economic and social systems. In terms of the structure and specific nature of industrial and consumer demand and in distribution systems, marketing and infrastructure, **countries are becoming increasingly similar**.....Multinational firms have played a major role in the process of globalisation, and have themselves been dramatically transformed by it.... the traditional distinction between the domestic and international or external environment has largely disappeared. **Gone are the days when national governments were able to control all or even most, of what goes on within their borders**, or could confidentially claim to be in total control of the major settings of their national economy (Johnston, 1996, p. 235, my emphasis).

Whether or not Johnston overstates the case is open for debate, what is clear is that global financial markets can have an enormous influence - can effectively bankrupt - a nation. The only effective means to counteract the financial markets is that of the collective power of a group of industrialized countries (acting via the International Monetary Fund), as we are

witnessing at the present in the Asian currency crisis. A message from this “rescue” is that complete *laissez faire* will not be permitted free reign where the interests of powerful nations or organisations are at risk.

If the reader is wondering why considerable space has been given over above to globalisation and events outside of Australia, the answer is found in the above quote by Johnston. **In very simple terms, what happens in Australia - the demands put on its resources - is going to be significantly influenced by the rest of the world; that is by global issues.**

The Key Issues

Much more could be written about the complexities and issues involved in looking to the future. Here is not the place for that. What has to be done is to abstract from the complexity and select some key variables which, whether in 5 years time or 20, are likely to be the most influential on environmental management in Australia.

Let us list these central issues. First there is *world population growth and consumption levels*. Notwithstanding technological change, sooner or later population growth confronts bio-physical limits (resource depletion, pollution and the assimilative capacity of the environment). These days the conventional wisdom is that there are limits to growth. The attacks on the computer modeling by Meadows et al (1972) in The Limits to Growth, generally not deserved because of a misrepresentation of what the book said (Common, 1995, p. 87), are a thing of the past. The sequel to this book published 20 years later, titled Beyond the Limits (Meadows et al. 1992), has generated far less criticism, notwithstanding the fact there is not much in the way of substantive difference in the conclusions (Common, 1995, p.88).

World population growth and consumption have a direct impact on the next three central issues: (i) *food security*; (ii) *human induced climate change*, and; (iii) *biodiversity loss*.

The two other key variables which will influence the future are independent of population size and levels of consumption. These are to do with human ingenuity in science and changing behaviour. They are: (i) *technological change*, and; (ii) *human attitudes and behaviour*. The latter are reflected, ultimately, in the type of society we live in and how we govern ourselves. Our emphasis will be on the attitudes to the environment.

To summarise, 6 key variables have been singled -out as worthy of detailed consideration. They are:

- world population and consumption levels
- food security
- human-induced climate change
- biodiversity loss
- technological change
- environmental attitudes and behaviours

Each of these is dealt with separately below. The order is changed. We will start with *environmental attitudes and behaviour* because our concern for a *sustainable future* - for the change in attitude to the environment, if you like - needs to be understood.

1. Environmental Attitudes and Behaviour: The Greening of Society

Tracing the world history

It has been aptly said that one thing in the world is invincible - an idea whose time has come. Such an idea, in these days, is the care of man's environment, or, in a word, conservation (Nicholson, M., 1972, p.17).

Max Nicholson, writing in 1970, uses the words above as the very first sentence in his book titled The Environmental Revolution. This book is an historical account of the development of human awareness of environmental issues, and consequent action, commencing with the earliest known civilizations and ending at, what many would deem, the start of modern environmentalism.

Much of the action only starts to occur in closing decades of the 19th century. A number of initiatives in the United States of America, including the declaration of the world's first National Park (Yellowstone) in 1872 "may be said, for the first time in any country, to have put conservation on the map as a serious public issue" (Nicholson, 1972, p.197). [We can note in passing that in 1909 President Theodore Roosevelt attempted to convene an International Conservation Conference in Washington, the subject of which was to be "world resources and their inventory, conservation and wise use" (quoted in Nicholson, 1972, p.218). The idea was killed by incoming President Taft. It was not until 1972 that the first world environmental conference was held in Stockholm.]

From a modern vantage point, we would not call the last century a period of "modern environmentalism". There would be a strong temptation to put the start of modern environmentalism - or "the age of ecology" as it was dubbed - as 1970 when the first Earth Day was celebrated (22 April).

Donald Worster (1994, p.342) in his history of ecological ideas argues that "the age of ecology" commenced in 1945 in a New Mexico desert with the detonation of the first atomic bomb. He, nevertheless, states that it was not until the 1960's that ecology became an international issue. It was during this decade that Rachel Carson's Silent Spring was published.

At the beginning of 1970, the United States of America introduced the concept of the "environmental impact statement" to the world with the enactment of the National Environmental Policy Act of 1969. This was the start of a gradual move to integrate environmental effects with economic and social effects. Other countries were to follow suit. In 1972, the first United Nations environmental conference was held in Stockholm, the UN Conference on the Human Environment. Some would dub this "the start of the road to Rio".

Ten years later, the terms of reference for what was to herald *new environmentalism* were discussed. The United Nations World Commission on Environment and Development was set up the next year (1983), with Gro Harlem Brundtland, Prime Minister of Norway, as its head.

In 1987, the Commission published its report, titled Our Common Future (commonly referred to as the Brundtland Report). From then on, *sustainable development*¹ was on the public policy agenda for all the nations of the world.

We can, therefore, consider 1987 the date of commencement of new environmentalism. New environmentalism is based on the concept that the “environment” and “development” (properly defined) are inseparable, that in the long term the economy is dependent on a healthy environment.

Sustainable development, according to the Brundtland Report (1987, p. 43) is “development that meets the needs of the present without compromising the ability of future generations to meet their needs”. Based on this general principle, the Brundtland Report developed the very broad operational principle that economics, ecology and distributional equity had to be married in all decision-making.

As eminent environmental economist, David Pearce (1993, p, 7), argues: ” defining sustainable development is really not a difficult issue. The difficult issue is in determining what has to be done to achieve it”. Common (1995, p.220) points to the obvious enormous challenge involved: “any claim to have discovered the definitive solution to the sustainability problem is, almost certainly, false”. That stated, Common (1995, p. 138) argues that we should think of sustainable development as “a state where it is impossible to increase consumption in any period except at the cost of reducing it in some other period”. The concept can be thought of as *sustainable income*.

The 1992 Earth Summit

Five years after the publication of the Brundtland Report, world leaders gathered in Rio de Janeiro for the UN Conference on Environment and Development (the “Earth Summit”). The broad goals of the conference were set out in Agenda 21, a 40 chapter action plan for achieving sustainable development. A new institution was formed, the United Nations Commission on Sustainable Development. Its role is to review implementation of Agenda 21 and provide co-ordination of relevant UN environment and development programs.

At a global level, three issues stood out and are the subject of three separate international agreements. They are: (i) human - induced climate change - the 1992 Framework Convention on Climate Change; (ii) loss of biodiversity - the 1992 Convention on Biological Diversity, and; (iii) population increase and consequent consumption demands - the 1994 Population Action Plan.

What Progress after 5 years?

A key question is what progress has been made since the publication of the Brundtland Report in moving the world towards a sustainable future? That is extremely difficult to answer, and the initiatives vary dramatically between countries. Furthermore, some resource uses and activities have been the subject of greater attention than others; for example, climate change has dominated world and national affairs in recent years.

¹ In Australia, it has come to be called “ecologically sustainable development”.

A recent report (Flavin, 1997, p.p. 3 - 22, my emphasis) considers progress since the Rio meeting in 1992. It states that “the international community has begun to embrace the concept of sustainable development and to use that notion to shift priorities”; however, it argues that “**the fastest progress is now occurring on those issues that were first identified decades ago**”², and “**the world has so far failed to meet the broader challenge of integrating environmental strategies into economic policy**”. What is true at the global level is also true on a country-by-country basis; for example, only a few countries are using environmental taxes and then not generally, while may continue to subsidise water and energy use and inefficient forestry (see Hamilton et al, 1987 for a discussion on the Australian situation).

Sustainability has become a mainstream issue and no longer relies on the initiative of “green” lobby groups and activists to keep it on the public policy agenda. It is likely that the slow progress in bringing about reforms will keep sustainability clearly in the public eye.

The new environmentalism (sustainability) is a paradigm shift. Attitudes have changed, even if behaviour has not done so as yet, to any noticeable extent.

Environmental Attitudes in Australia

Australia has had a relatively influential environmental lobby for 30 years or more and this has been reflected in changes in official policies and laws; it has also changed practices in industry and public attitudes generally.

The official reaction to the Brundtland Report was (at Commonwealth level) the publication in 1989 of Our Country Our Future. This echoed the sentiments of the Brundtland Report and committed the Commonwealth to formulate a more rigorous approach to the implementation of sustainable development. One outcome of this was the National Strategy for Ecological Sustainable Development in 1992.

Governments

The concept of sustainable development is now recognised in a number of laws (at Commonwealth level, it was recognised first in fisheries management). Major policies are now formulated on the basis of promoting sustainability (as was the case with the Better Cities Program and as is the case with the Oceans Policy). All of Australia’s World Heritage Areas are managed on sustainable development principles. All three levels of government are committed to the sustainability principles via the Intergovernmental Agreement on the Environment. State and Territory governments (as does the Commonwealth) prepare state-of-the-environment reports. Some local governments are preparing local Agenda 21 strategies.

Industry

² Flavin (1997, p. 7) states: “In most industrial countries, for example, air and water pollution are now less severe than they were during the Stockholm Conference on the Human Environment in 1972”.

Industry is increasingly taking on board elements of the new environmentalism, particularly where firms foresee a commercial advantage in, for example, advertising their “green” credentials or improving their profits by cleaner production techniques. For example, the recently introduced National Ecotourism Accreditation Program will result in more tourism operators adopting sustainable development criteria and promoting their services accordingly. Environmental auditing (as recently done for the sugar industry), the formulation of *environmental management systems (EMS)* and reporting on environmental achievements in annual reports are all becoming fashionable, particularly for larger businesses.

The differences between larger business and small and medium enterprises (SMEs) in terms of being able to deal with environmental issues can be significant. An owner or manager of an SME (whether it be a farm or a motel) has little time or financial resources to undertake environmental audits or prepare an EMS. However, given the dominance of SMEs in the economy, their environmental impact can be significant. To the extent that the impacts fall on the general community, the market will fail to deliver the appropriate outcome, and thus warrant public expenditure on research and extension services.

Notwithstanding the progress made to date, environmental disputes are still a feature of Australian natural resource management and are all likely to continue to occur in the short to medium term. Change will be slow. For a marked change there will need to be recognition that long term profitability is dependent on, amongst other things, ecological sustainability. While understanding and attitudes are important, the incentive structures will need to change if consumers and producers are to alter their behaviour. This will require “getting prices right” by the use of pollution charges and eliminating subsidies. This will not guarantee sustainability, but in a number of resource uses it is likely to move society in the right direction. Further progress should come from initiatives to complement national accounts (the standard measures of economic change) with natural resource accounts. These show stocks and flows of natural resources (for example, forests or fish) during the accounting period, but measured in physical terms not monetary units. The Australian Bureau of Statistics is presently developing such accounts (called satellite accounts) and these should lead to a better informed public.

Societal expectations

What also needs to be recognised is that societal expectations are changing as knowledge and awareness of environmental issues spreads. There has been a marked change in both environmental attitudes and behaviour in recent years, and as the younger generation moves into a position of influence there will be even more significant changes.

Attitudes regarding the environment influence behaviour. Indirectly, a range of other societal attitudes (and policies flowing from them) also influence the way we deal with the environment. Water use is a prime example. Since 1982, when a pay-by-use system was introduced in the Hunter region, Australia has been very gradually moving to a user-pays philosophy. There are many examples in urban Australia of a two part tariff system being applied. A two part tariff has an access charge plus a usage charge for each unit of water supplied. Both economic efficiency and environmental objectives can be pursued by such pricing systems. Recently the ACT Electricity and Water Corporation commissioned a study to estimate economic values of environments affected by new storages or changed flow regimes (CIE, 1996) and the Corporation could use these data to set more realistic water charges. However, attitudes to the user-pays philosophy vary around the nation and there is

not necessarily ready acceptance of the approach. The proposed introduction of user-pays in Cairns is meeting with some public objection.

Rural water pricing is of greater significance than urban water prices as rural industries account for the bulk of all water use in Australia. Irrigation alone accounts for three quarters and when other rural uses are included the rural sector makes up over 80 per cent of the total use (Industry Commission, 1992, p. 193).

The Industry Commission (1992, p.40) put the case thus:

Current pricing practices for irrigation water and drainage are largely an outcome of past governments' social and development policies, rather than sound commercial practices..... The legacy is charges which, although sometimes covering the direct costs of operating and maintaining irrigation and drainage systems, generally make little provision for depreciation of assets, let alone any return on the capital invested in dams and irrigation networks. Also charges make little or no allowance for the costs of countering salinity and waterlogging in a number of Australia's irrigation areas.

The Industry Commission called for reform of irrigation water pricing in 1992. However, the political realities of reforming rural water use need to be recognised. Very slow progress has been made in the past 5 years and, realistically, another 5 years might pass before real progress is made.

Pressure to speed up reform is being brought to bear on governments by environmental lobby groups and other parties who believe their commercial or recreational interests are being adversely effected by subsidised rural water use. Ultimately, tension between urban and rural water users is likely to make reform imperative.

Summary

Natural resource management in Australia increasingly will be influenced by the growth of strong pro-environment attitudes - attitudes which become reflected in government laws and policies. The management of World Heritage Areas, tourism, water use (particularly for rural industries) and land clearing are the likely major environmental influences on what happens in Australia.

It is likely that for the next 5 years at least, the benchmarks for management based on sustainability criteria will be set by the management regimes in World Heritage Areas. The public expects these areas to be managed on such principles.

The natural environment is the attraction for approximately half of international visitors (Blamey, 1995). Tourism (one of the nation's largest industries) is very important in Australia with the great Barrier Reef and the Wet Tropics being major drawcards. The growth of ecotourism should be strong. However, whether or not the high growth rates in international tourism which have been forecast will be met (given the currency crisis in Asia) must be an open question. It should be noted that the Tourism Forecasting Council (1997) has revised downwards its scenarios for growth to 2006. Regardless of the growth rate, the tourism industry is one which more than most is likely to base its future on environmental awareness.

Changes to water pricing will eventually come, if not within 5 years, during the next 10 years. The National Competition Council will pressure the states to accelerate the pace of reform, particularly the adoption of two-parts tariffs in urban areas. It will also push for the implementation of trading arrangements for water allocation/entitlements. These changes will occur much earlier (maybe by the end of 1998) than changes to rural water pricing.

2. World Population and Consumption Levels

The current situation

At the beginning of 1997, the World's population was 5.77 billion. During 1996, it increased by 80 million with virtually all the increase occurring in the developing countries.

While population growth, its impacts, and proposals to control it are subject to some debate, the conventional environmental perspective is:

Population growth is a driving force behind many environmental and social problems (Flavin, 1997, p.16)

The Cairo conference in 1994 (the International Conference on Population and Development) addressed these links for the very first time in an international forum.

World population growth has slowed from a peak of 2.2 percent a year in 1963 to 1.4 percent (Mitchell, 1997, p.80). A significant number of countries have stabilized their populations. Flavin nominates 31, and China, with the world's largest population, has fertility falling from close to 6 births per woman in the 1960's to 1.9 in 1995 (Flavin, 1997, p.p. 17-18).

Notwithstanding the relative success, world population will continue to grow. At the high estimate, the population will have approximately doubled by 2050.

Optimal Populations

A fundamental issue which has exercised the minds of many environmental scientists is what level of global population is "optimal" given the constraints? There is no easy answer to this. One view is that expressed by eminent ecological-economist Herman Daly (who spent some time with the World Bank). He argues:

..the scale of human activity relative to the biosphere has grown too large. In the past 36 years.....population has doubled....Over the same time period, gross world product and fossil fuel consumption have each roughly quadrupled. Further growth beyond the present scale is overwhelmingly likely to increase costs more rapidly than it increases benefits, thus ushering in a new era of 'uneconomic growth' that impoverishes rather than enriches (Daly and Cobb, 1994, p.2).

While being very much concerned with the future, Daly is clearly impressed with achievements so far:

During the past two centuries, the economy has transformed the character of the planet and especially of human life. It has done so chiefly by industrialization.

Industry has vastly increased the productivity of workers, so vastly that in spite of the great population increases in industrialized nations, the goods and services available to each have increased still more. The standard of living has soared from bare subsistence to affluence for most people in the North Atlantic nations and Japan. Singapore, Hong Kong, Taiwan and South Korea share in this prosperity. These are immense accomplishments (Daly and Cobb, 1994, p.3).

Malthus put the issue of population versus standard of living as an implicit trade-off: “**There should be no more people....than could enjoy a glass of wine or a piece of beef with their dinner**” (quoted in Daly and Cobb, 1994, p.239, my emphasis). At present, in a number of countries the issue is not population growth but per capita consumption.

The one thing we know with certainty is that (barring catastrophes) world population will continue to grow and could be double its preset level before leveling out. With nearly as much certainty we can expect that (as a consequence of wide-spread adoption of modern mass communications) more and more people will come to aspire to “middle class” North America consumption patterns and behaviour. To a limited extent, we consider below what this might mean in feeding the world.

Not only will the rest of the world impact significantly on Australia, so will Australia’s population growth. Doug Cocks (1996) has spelt out in considerable detail Australia’s population choices. His conclusion is:

The Australian Government should...develop and carry out a population policy which has as its central objective the achievement and maintenance of a more or less stable population...the current policy-relevant boundaries for Australia’s population options are for a near-stable population within several generations, somewhere in the size between one and two times the present population (Cocks, 1996, p.200).

In arriving at this conclusion Cocks considers amongst many matters the number of people Australian farmers could feed if there were no exports. He considers both a “well-fed” domestic population and a subsistence one. Cocks (1996, p.p.82-85) points out that there is enormous variability in the estimates of the number who could be reliably and indefinitely “well fed”. The reason for variability is the large range of discretionary assumptions made in the estimates. The range is from in the order of 20 million to 188 million.

What is grown is a major factor. Cocks (1996, p.83) refers to an estimate that Australia could support more than 50 million additional people if potatoes, vegetables etc. were grown rather than meat. Agricultural technologies, fertilizers and water are very important variables, with Australia being highly dependent on liquid fossil fuels which might run out in 100 years.

Population growth is not itself the issue. It is rather, **the demands put on the environment that come with the larger numbers, and the nature of those demands** depend on the degree of poverty or affluence of the population.

Poverty - cause or outcome?

Brundtland and many others since have recognised **that poverty is a major force for environmental degradation** - the starving can not concern themselves with future

generations; conversely as the United Nations Development Program Human Development Report 1997 (p.32) states:

Continued environmental deterioration is a source of continued impoverishment. Poor people depend of natural resources for their livelihoods- especially on common property resources”

This report points out that half a billion poor people in developing countries live in ecologically fragile regions.

Between 1987 and 1993, the number of income-poor people in the world increased from 1.2 billion to 1.3 billion; but in Asia, in the countries with three-fifths of the developing nations’ people³, progress was made in reducing income poverty (UNDP, 1997, p.33). The rapid economic growth in parts of Asia has clearly caught the imagination of the west. A book title which captures this is The New Rich in Asia: Mobile Phones, McDonalds and Middle-class Revolution (Robison and Goodman, 1996). In somewhat similar enthusiasm, the World Bank in 1993 published The East Asian Miracle.

Population growth, changing consumption demands and attitudes towards the environment (coming as a result of economic growth) make any assessment of the future environmental impacts a very complex task.

Some developing countries with relatively large populations will experience a doubling of population in under 50 years or sooner; for example; Indonesia’s population will grow from approximately 200 million to double that by 2040; the Philippines with about 70 million will double its population in under 30 years; Vietnam with approaching 80 million will double its population in about the same time; India with approaching 1 billion people will have twice that number in under 40 years (UNDP, 1997, p.p. 194-195).

The rise of the middle class

The fastest growing economies, in particular the high-performing Asian ones, have undergone change equivalent in degree and scale to the Industrial Revolution of last century in half, or less, the time that revolution took in Britain; for example, the Republic of Korea developed from a war-torn country 50 years ago to status as one of the “Four Tigers”.

Associated with both population growth and economic growth is growing urbanisation and life-style changes for the new “middle-class”. For example, Korea with a population approaching 50 million, has a “middle-class” in the order of one-fifth to one-third of its population (Cotton and van Leest, 1996, p.187). Indonesia presently has a “middle-class” of about the same size as the entire Australian population. A “middle-class” lifestyle is not just associated with mobile phones and McDonalds, but higher energy use, private transport, imported foodstuffs, etc. The ecological footprint of a modern Asian city is much larger than that of the past. It certainly reaches to Australia.

³ These countries are: China, India, Indonesia, Pakistan and Bangladesh.

On the one hand with the growth of the “middle class” we witness a greater demand on the environment. On the other, “middle class” people ask for, and can afford, a cleaner environment - and they tend to have less children.

Summary

Both global and domestic population growth and consumption levels will have significant influences on the demands put on Australia’s environment, and this is likely to be most obvious in agricultural production.

We can readily formulate population growth scenarios. It is much more difficult to determine, beyond subsistence needs, the consumption demands of much of the world’s population. While we can be relatively confident of demands by people in the industrialized countries, the rate of expansion of “middle class” consumption patterns in the developing countries is much more difficult to forecast.

For countries like Australia which are major exporters of grains, meat and minerals, the demands on their environmental resources are inextricably linked to global (and regional) population growth and consumption levels.

What this means for natural resource use in Australia is difficult to say. However, we ought to immediately improve our knowledge of the land’s capabilities, particularly in sustainable agriculture. There are going to be more people to feed. Feeding them is the subject matter of the next section.

3. Food Security

The World produces more food per head of population today than ever before in human history. In 1985, it produced nearly 500 kilograms per head of cereals and root crops, the primary sources of food. Yet amid this abundance, more than 730 million people did not eat enough to lead fully productive working lives. There are places where too little is grown; there are places where large numbers cannot afford to buy food. And there are broad areas of the Earth, in both industrial and developing nations, where increases in food production are undermining the base of future production (WCED, 1987, p.118)

The quote above is from the Brundtland report of 1987. Feeding a growing world population — on a sustainable basis — is one of the fundamental concerns of that report.

The food production: food demand balance

The Green Revolution (in the period post 1950 to the mid 1980s) was very much a success in increasing food production. Its achievements were due primarily to increased use of fossil energy for fertilizers, pesticides and irrigation to raise crops as well in improved seed (Kindall and Pimentel, 1994).

The increases in production have come at some environmental cost, as Kindall and Pimentel (1994) argue:

The Revolution has been implemented in a manner that has not proved to be environmentally sustainable. The technology has enhanced soil erosion, polluted groundwater and surface water resources, and increased pesticides use has caused serious public health and environmental problems. Opportunities exist to reduce these negative environmental and social impacts. Research is underway at most of the International Crop Research Centres to make the Revolution more environmentally and socially sustainable.

The bio-physical limits to any increase in food production must be recognised. First there is the amount of land available. Second there is the quality of the land, and soil in particular. Then there is the availability of water. The world situation can be summarised thus:

Less than half of the world's land area is suitable for agriculture...nearly all of the world's productive land, flat and with water, is already exploited....Expansion of cropland would have to come at the expense of forest and rangeland, much of which is essential in its present uses.... **Land degradation has now become a major threat to the sustainability of world food supply.** This loss arises from soil erosion, salinization, waterlogging, and urbanization.....Nutrient depletion, overcultivation, overgrazing, acidification, soil compaction contributes as well.....Water is the major limiting factor for world agricultural production...irrigation is vital to global food production (Kindall and Pimentel, 1994, my emphasis).

Amongst other things, the quote points to various trade-offs; for example, to address human-induced climate change and to protect biodiversity, forests should not be cleared; continued use of fertilizers is only likely to mask deterioration; competition for water, between rural and urban use and between countries, will increase and could lead to conflict.

Assuming no significant breakthrough in technology (say, a new "super" rice), a number of experts believe the future for food production is not as promising as it has been in the past. Lester Brown (1997, p. 35, p.33 and p.24, my emphasis) of the Worldwatch Institute sums up the situation thus:

The growth in food production is slowing while the growth in demand, driven by both population growth and rising affluence, **continues strong**....In the absence of a dramatic technological breakthrough that will restore a rapid rise in cropland productivity - a discovery comparable to that of fertilizer - the world will soon face unprecedented belt-tightening...All the basic indications of food security - grain production per person, seafood catch per person, carryover stocks of grain, seafood prices, and grain prices - signal a tightening situation during the nineties.

Dietary changes

From this perspective we start from a deteriorating environmental situation compounded by production trends and change in diets. With regard to the latter, Brown (1997b, p.19) makes the point that there is a worldwide trend to consume more high-quality protein, such as seafood, meat, and soybeans. Brown (1997a, p.24) refers to the developing dietary changes in Asia (where half the world's population lives) and states:

A large share of Asia's 3.1 billion people are moving up the food chain, eating more pork, poultry, beef, and eggs and drinking more beer, all of which are grain-intensive products.

Traditionally a major source of high-quality animal protein has been seafood. Most experts believe that the world's fish catch has peaked (at approximately 90 million tons) and **the wild caught harvest will need to be complemented by fishing farming. The prospects for increased fish farming require urgent consideration.** Environmental problems have arisen in south-east Asia, and there is inevitable trade-offs between aquaculture and other landuses, and the health of adjacent wild fisheries.

Key role of grains

In terms of calorie intake, grains directly provided about half of human consumption, and indirectly a significant share in the form of meat, eggs and milk. Brown (1997a, p.26) argues that the world grain harvest could expand, however **some unknown share of present harvest is based on unsustainable use of land and water**; he wonders if continued productivity gains are possible and, if so, whether they can offset growing consumption. This is a **potential problem for most Asian countries which are likely to shift to import dependence.**

If, or when, these Asian countries come to depend on imports, this is a potential opportunity for the major exporting countries. These are the United States, the European Union, Canada, Argentina and Australia. These countries account for about four fifths of the world's grain exports. They will compete to meet whatever demand arises elsewhere in the world. How they compete (fairly - in a free trade environment, or otherwise) is another matter, notwithstanding the trade liberalisation goals of the World Trade Organisation.

In the near future there is likely to be demands by some Asian countries for imported rice. Australia could be well placed to meet some of this demand, from, say, the Burdekin or Ord-Keep River districts, assuming no environmental constraints; and, of course, irrigation is essential (but subject to both economic and environmental variables).

Other food products

It is not only grain imports that the growing number of more affluent Asians will be seeking. They will want to import beef, dairy and horticultural products, and sugar - to list the key ones where Australia should be competitive. For some products, beef in particular, the fact that Australia has large (low-cost grass) properties give it some comparative advantage.⁴

Finally, there are a number of products at the high-value end of the scale which will experience increased demand in the wealthier parts of Asia (and these products are likely to penetrate markets in the temperate world). They included a range of fruits, such as mangoes, avocados, lychees, papaws (papaya), pineapples, bananas and melons, plus farm-grown prawns and fresh, wild-caught table fish.

Australia's Opportunities and Limits

⁴ However, it is possible that the large free range operations will be replaced eventually with feedlots.

In the previous section, the case has been made that Australia will have an important role (particularly as a major grain producer, but also in terms of other agricultural production) in helping to feed a world with increasing population - and *possibly* increasing disposable income. **However, there are environmental constraints which must be recognised.**

The availability of suitable land and water is crucial. Already sugar cane growing has expanded onto marginal land. Land use planning controls are limiting the expansion of agriculture, due to tourism and residential land-use requirements. The value of certain ecosystems for other economic uses (for example, wetlands for fisheries production) and more general ecosystem services is, at last, being recognised. As a consequence they are imposing constraints on agricultural expansion.

There is, in addition, real concern with the potential impact on the great Barrier Reef through nutrient and sediment delivery, as a consequence of run-off from existing agricultural lands. Much more scientific work needs to be done so that these potential effects are better understood. Then there are the existing problems of weed invasion and feral animal damage to both agricultural lands and protected areas.

Many of these environmental constraints can be seen as biodiversity conservation imperatives. Biodiversity protection is a global and national goal in most countries, including Australia; a goal which will not just be met by declaring and managing protected areas, but will require off-reserve protection. We turn our attention to biodiversity next. We can conclude this section by suggesting that **there are no strong indications that the economic structure of agriculture in Australia will change radically in the next 10 or more years.**

Summary

Growth in demand for food is growing while land degradation in a number of countries is a threat to the sustainability of food supply. Australia could have a significant role to play by increasing agricultural productivity within ecological limits. Increased aquaculture production is one specific area demanding immediate consideration. Obtaining a better understanding of the ecological limits is a prerequisite for any proposed land use changes and expansion of food production.

4. Biodiversity Loss

The two environmental issues which presently demand most attention, both globally and locally, are human-induced climate change and threats to biodiversity. At the local or regional scale, the latter commands more attention. The loss of biodiversity, as a consequence of the felling of forests, is something all can see - it makes for good television coverage. One does not see the gradual build-up of carbon dioxide in the atmosphere. **Land use changes that threaten, or are perceived to threaten, biodiversity will be opposed. Herein lies a major constraint for those who may wish to expand agriculture, convert natural forests, or even build tourist resorts in highly-valued environments.**

History

The global community came to officially recognise the need to conserve biodiversity at the Rio Earth Summit in 1992 with the adoption of the Convention on Biological Diversity. Quite quickly (by the end of 1996) most nations (160) had ratified the Convention; three conferences of the Parties have taken place and a permanent secretariat been established. Notwithstanding these initiatives, there remains a lack of clarity (and even controversy) about what the Convention was intended to accomplish and how it was to do so.

It is true that conservation of biodiversity did not suddenly emerge as a critical environmental issue. Well before the Rio meeting, protection of highly-valued natural ecosystems was being pursued by such arrangements as the declaration of National Parks (starting late last century in North America) and World Heritage Areas under the World Heritage Convention. Furthermore, other international treaties, such as the Ramsar Convention (protecting wetlands), the Convention on International Trade in Endangered Species (CITES), the Bonn Convention (for the protection of migrating species) and FAO's International Undertaking on Plant Genetic Resources, need to be seen as giving thrust to biodiversity conservation - and well before the 1992 "Framework Convention".

Does Biodiversity have economic value?

The reason that much of the world's natural environments have been converted to other land uses is that they were not considered to have economic value in their natural state. That has changed recently. Anyone who has read the 15 May, 1997 edition of Nature would have discovered that **the marginal value of the world's ecosystem services and natural capital has been estimated in the range of US \$16-54 trillion per year.**⁵ The average is US \$33 trillion per year, which is **nearly twice the world's gross national product of around US \$18 trillion per year** (Costanza et al, 1997, p.p. 253 - 259). These ecosystem services refer to habitat, biological and systems properties and processes of ecosystems (to take one example, waste assimilation) and ecosystem goods (such as food).

It should be noted that it is not possible (by applying some simple arithmetic) to use this global estimate as a basis for calculating the dollar value of specific ecosystems. However, the fact that eminent economists have measured the environment services and natural capital of the world and found it to be a very large number - recall close to twice world GNP - has some very real relevance for Australia.

Where is the most Biodiversity?

If we consider what remains of biodiversity world-wide and measure that in species richness, in the top 10 countries only one developed country ranks, and that is Australia (Swanson, 1997, p.47). The majority of the world's remaining species are to be found in a small number of countries, mainly relatively large tropical ones. Think of Britain, the forests in that country were largely destroyed during the Iron Age, while countries such as Indonesia and Brazil (to name just two) still have vast forests that have been there since time immemorial.

⁵ Please note this is not the value of the environment per se, as humans would not exist, let alone economies, without services of the environment, and hence the notion of economic value is pointless.

The point is Australia “owns” a reasonable share of that US \$33 trillion because it has the Wet Tropics, the Western Tasmanian Wilderness, Fraser Island, the Central Eastern Rainforests as heavily-forested World Heritage Areas, and, of course, the Great Barrier Reef as the largest marine park in the world.

Whereas a wealthy, industrialised country like Australia can afford to put in place appropriate management regimes for its protected areas, this is not the case for many of the National Parks (and other protected areas) in the developing countries. It is not only relative wealth and strong environmental attitudes (such as in Australia) that lead to adequate management, but it helps if protected areas generate dollar income from non-threatening uses (such as ecotourism).⁶

A very real problem in much of the developing world, where most of the species richness exists (countries such as Indonesia, Brazil, India, China and Peru), is that the short-term incentives for protecting biodiversity do not exist. As Swanson (1997, p.83) argues: “countries, in making these decisions, will be considering the domestic benefits that such protected areas will render and counterbalancing them with the costs they will incur. Since biodiversity is a resource that renders benefits to many countries other than the host country, there will of necessity be inadequate consideration of the external benefits when making these decisions.” Swanson devotes most of his book to means of resolving this problem. He deals with the “externality” problem identified above, as well as the lack of property rights (or poorly defined property rights) for naturally occurring organisms (important for so-called “bio-prospecting” and plant breeding research and development), both of which hinder the development of a properly function market for biodiversity. The urgency in finding a solution is, according to Swanson (1997, p.76, my emphasis) that: **“modern economies are heavily reliant upon biodiversity, not merely for abstract sustainability or for the occasional anecdotal genetic jackpot, but for the simple and continual maintenance of two of our most important industries”**. **These industries are agriculture and medicine.**

The Australian Biodiversity Scene

Australia has a relatively comprehensive system of protected areas, including National Parks, Marine Parks and World Heritage Areas, which provide for conservation of biodiversity. **It is virtually impossible for governments to downgrade the status of these areas given the very strong support for environmental protection in the country. Even relatively minor land-use changes on the periphery of such areas causes major controversy** (a case in point being the tourism/residential development at Oyster Point south of Cardwell). Given this situation, public attention is starting to focus on two issues: adequate management of existing protected areas and “off-reserve” biodiversity conservation. As greater focus is given to the latter, **there will be additional environmental constraints on “traditional” land-uses (such as farming) as well as opportunities to integrate biodiversity conservation with such land-uses.** The latter could be achieved by, for example, protecting remnant vegetation, reforestation and rehabilitation of degraded land, and altering the allocation of water such that environmental flows are adequate. In pursuing this, integrated catchment management (ICM)⁷ has the potential to be an extremely useful land-use planning tool. While the concept has been promoted and talked about for some years now, much more

⁶ Driml's 1994 study, “Protection for Profit”, documents the dollars generated by tourism and recreation use of a number of Australia's protected areas. Large sums are involved. Money from visitors to the Great Barrier Reef is being used for research to further the goal of sustainable use.

⁷ In some states ICM is called “total catchment management “(TCM)

conceptual and practical work has to be done before it reaches its potential. ICM is an approach that depends upon good science (in soils, hydrology, etc) and the creation of suitable institutions (which can handle both on-site and off-site impacts).

Summary

The imperative to continue to make progress on biodiversity conservation is going to place real limits on the expansion of agriculture (and other land-uses) and the use of water throughout most of the world. This also applies to Australia. Given this, an important research focus **will need to be on productivity gains on existing farm properties** - and productivity gains will need to be measured correctly by taking into **account any adverse impacts, and by looking far into the future.**

The notion of proper measurement and **getting more out of existing agricultural enterprises** becomes even more crucial when we turn our attention to what has to be done to address human-induced climate change, our next topic.

5. Human-induced Climate Change

Progress to date

In 1995, the Intergovernmental Panel on Climate Change (IPCC), a United Nations panel of 2,500 scientists, found that: “the balance of evidence suggests a discernible human influence on global climate” (quoted in Dunn, 1997, p.58). The IPCC predicted that if greenhouse gas concentrations doubled the global temperature would increase by 1 to 3.5 degrees Celsius by the year 2100.

The United Nations Framework Convention on Climate Change has only recently been signed by some 160 countries. The aim is to stabilise greenhouse gas concentrations at levels which will avoid potentially disastrous climate change. The Convention commits industrialised countries to reduce carbon levels to below 1990 levels early next century.

The science behind climate change predictions is complex and the predictions uncertain. The politics and economics of addressing global warming are just as complex and notwithstanding the most recent agreement (reached in Kyoto, Japan in December 1997) **there is still enormous uncertainty with regard to future progress.** Sooner or latter the developing economies will have to become part of the solution. Very large increases in emissions are occurring in a number of these countries; for example, between 1990 and 1995 emissions grew by 27 percent in China, by 28 percent in India, by 40 percent in Indonesia, and by 20 percent in Brazil (Dunn, 1997, p.58). While per capita emissions are highest in industrialised countries like the USA and Australia, China contributes 14 percent to the global total (Dunn, 1997, p.58).

Given the vast literature on the greenhouse issue, including that on impacts both globally and regionally, there is no need to attempt to summarise that here. What should be useful is brief consideration of matters agreed at the Kyoto meeting. The Kyoto meeting was (formally) the Third Session of the Conference of Parties to the Framework Convention of Climate Change. The outcome of this meeting is referred to as the Kyoto Protocol to the United Nations Framework Convention on Climate Change.

Each participating country (“parties to the Convention”) is committed to achieving a quantified emission limitation or reduction in emissions “in order to promote sustainable development”. In working towards this goal, Article 2(a) the Protocol is important. It is quoted in full here (my emphasis):

Each Party shall:

- (a) Implement and/or further elaborate policies and measures in accordance with its national circumstances, such as:
 - (i) Enhancement of energy efficiency in relevant sectors of the national economy;
 - (ii) **Protection and enhancement of sinks and reservoirs of greenhouse gases** not controlled by the Montreal Protocol, taking into account its commitments under relevant international environmental agreements; promotion of sustainable forest management practices, afforestation and reforestation;
 - (iii) **Promotion of sustainable forms of agriculture** in light of climate change considerations;
 - (iv) Promotion, research, development and increased use of new and renewable forms of energy, of **carbon dioxide sequestration technologies and of advanced and innovative environmentally sound technologies;**
 - (v) Progressive reduction or phasing out of market imperfections, fiscal incentives, tax and duty exemptions and subsidies in all greenhouse gas emitting sectors that run counter to the objective of the Convention and apply market instruments;
 - (vi) Encouragement of appropriate reforms in relevant sectors aimed at promoting policies and measures which limit or reduce emissions of greenhouse gases not controlled by the Montreal Protocol;
 - (vii) Measures to limit and/or reduce emissions of greenhouse gases not controlled by the Montreal Protocol in the transport sector;
 - (viii) Limitation and/or **reduction of methane** through recovery and use in waste management, as well as in the production, transport and distribution of energy (United Nations FCCC, 1997).

Possible Developments

Under the Protocol, virtually all countries (Australia, Iceland and Norway are exceptions) are to reduce emissions by at least 5 percent below 1990 levels in the, so-called, “commitment period” 2008 to 2012. In Australia’s case, recognition was given to reduced land clearing, leading to acceptance of a 8 percent increase in emissions.

It is possible that during the time leading up to the commitment period **international trading in emissions will occur**. A properly-functioning market should bring gains to all parties. However, as with establishing the appropriate global institutional arrangements for biodiversity conservation, there are numerous hurdles to overcome before a global trading system could be put in place.

Even the short-term requirement to ratify the Kyoto is clouded with some uncertainty. The Protocol is to be ratified during the period 16 March 1998 to 15 March 1999. Of immediate interest is how the US Congress handles the issue.

From a scientific perspective much still has to be done. Clearly, the IPCC will attempt to further refine its predictions. Considerable research is yet to be done on various carbon sinks, including the creation of sinks, the role of the oceans, and technological research on sustainable energy. In all these scientific fields, **scientists will need to be pro-active. They cannot wait for “market signals” to set their research agendas. Climate change and biodiversity conservation are *global commons* issues which means that by itself no individual country (or for that matter large multinational firm) has the incentive to spend money doing research which will benefit other countries (without them spending any money).**

The scientific, political and economic complexities involved will mean the progress will be slow on addressing climate change. There could be a tendency to adopt a business-as-usual approach until the next international meeting, or until the commitment period (which is 10 years away). As a crucial date approaches there will be a focusing of minds. **In between times much is going to depend on the commitment of scientists and environmental lobbyists to draw attention to potential disasters, and to opportunities to overcome them.**

Australia and the Greenhouse Issue

Here is not the place to discuss likely adverse impacts on Australia from global warming. The issue is, given the outcome of the Kyoto meeting, what should Australia do to meet its commitment.

For a sensible list of actions one can refer to Article 2(a) of the Protocol, quoted previously. However, it needs to be emphasised (once again) that **the research community cannot afford to sit back and wait for financial resources to appear, nor can governments view the necessary research as a private sector problem**. Publicly funded research and government action to change institutional settings (for example, abolishing subsidies to greenhouse gas emitters) are needed.

What the Kyoto decision has done is make it virtually politically impossible for extensive land clearing to continue in Australia. It is likely that the Australian public believes we got a “free kick which was not deserved” (as someone put it) at Kyoto and given that we must treat the land clearing issue seriously. The environmental lobby groups will clearly take this position.

As with the constraints imposed by the requirement to conserve biodiversity, so the Kyoto outcome imposes further constraints on land-use practices in Australia. **More will have to be done to improve productivity on existing farms.**

There is an important scientific issue which needs fairly urgent attention. It is to better understand the impacts of different land-use practices on climate change; for example, what happens in terms of carbon release from soil when land is cleared, in different rainfall areas, with different soil types? Or what is the effect of pasture improvement in terms of a greenhouse sink? What else do we need to know about biomass above and below the ground? If one is to replant forests, say in the tropics, what does one plant? Numerous other questions in similar vein could be posed.

The general thrust should be clear. The answers to such questions could prove to be extremely useful in tightening up the methodology for determining *how* land clearing will enter into any revised United Nations protocols. **It would surely be in Australia's interest to pursue such scientific investigations, and do so immediately.**

Summary

Human-induced climate change is *the* environmental issue. Responses, both globally and at a national level, will have significant impacts on north-south relationships, on the direction of future economic development, and will influence some sectors (such as energy, transport, forestry and agriculture) much more than others. The inclusion of land clearing in the Kyoto decision means that the eyes of the world will be on Australia. We will need a far better understanding of a number of issues relating to land use, and our land use decisions will have to be consistent with the Kyoto protocol.

6. Technological Change

Recent trends

We now come to the last key issue which will shape the future — of the world, and of Australia. It is technological change. Its role in bringing about better environmental outcomes (and sustainable development) is often disputed.

So-called “technological optimists” believe that as environmental problems emerge (for example, depletion of non-renewable fuels or the depletion of soil nutrients) price signals, an increase in prices, will bring forth technological “fixes”. So-called “technological pessimists” point to some of the problems that have resulted from new technologies, or they argue that there are so many distortions in terms of prices that the appropriate signals will not be evident.

What is fascinating is that some of the technological pessimists have become optimists. Instead of preaching doomsday scenarios, they talk of **“eco-efficiency”, “resource productivity”, and “cleaner production”** — all meaning more can be produced with less. The major proponents of this concept are Weizsacker and Amory and Hunter Lovins, who in 1997 got together to produce the book Factor 4: Doubling Wealth - Halving Resource Use. The sub-title captures the idea.

In the forward to this, the President of the Club of Rome wrote:

Factor Four is the right idea, at the right time, to become a symbol of progress...how can we ever return to an ecological balance on earth unless we are able to cut resource use in half?

The authors preface their book by stating:

we are taking up the concerns expressed in the early 1970's by the Club of Rome, which shook the world with its report *Limits to Growth*...This time, however, we give an optimistic answer to these concerns.

Technological progress is the most obvious feature of human history. It took humans 2 to 3 million years to go from the Stone Age to the Iron Age which was ushered in about 1000 BC. From 1700 to the present, a very short time in human history, we have gone from the first steam engine, to the train, to the motor vehicle, to the computer. Human inquisitiveness, the accumulation of knowledge, the evolution of ideas and institutions have all played their role. **One should not expect an end to this process.**

Environmental concerns have influenced research and development, business investments and governmental law making over the past 25 years, and in some cases much longer. There has been increasing emphasis on resource efficiency, waste minimisation and recycling in the past 10 years. These have drawn technological change in a pro-environment direction.

Because many environmental problems (particularly pollution, but also use of common property resources) are not dealt with adequately in market transactions (they are "externalities"), government has been forced to play a key role. Some countries take a stronger stand than others; for example, northern European countries have been in the forefront in devising innovative regulations and economic incentives; Germany is a world leader in recycling laws; California, has taken the lead on vehicle pollution⁸. Policy and/or laws such as the US CAFÉ (Corporate Average Fuel Efficiency) standards and German recycling laws set trends for the world when it comes to motor vehicles.

In such cases, **the industry responds to the changed environment**. We have witnessed the development over the last 10 years of a very large "environmental sector" in the world economy. Various estimates of its size exist. The Industry Commission (1993) reported estimates which suggest that the world market could be approaching US\$600 billion (\$A1 trillion) by 2000. The Australian share of the market was estimated at about 1 percent. **The "environmental sector" was until relatively recently largely focusing on "end-of-pipe" solutions rather than "resource efficiency"** (or cleaner production) as advocated by Weizsacker et al.

The resource efficiency concept *should* appeal to industry. It is about reducing costs (that is, increasing profits) while simultaneously meeting an environmental objective. In this way it differs from past regulatory approaches. It should produce what some call "no regrets" outcomes: that is, as a business person or consumer you would take the environmentally friendly action and be no worse off.

The fact that the resource efficiency — cleaner production philosophy is not yet widely adopted suggests that either the actual benefits (to firms or consumers) are not as great

⁸ By 2003, 10 percent of new cars sold in California are to be "zero-emission".

as claimed or there are impediments to adopting the approach. It could be that both are relevant. Some would see the claims made by Weizsacker et al. (even though well documented) as somewhat optimistic. And there is evidence, as documented in the ANZECC Draft Cleaner Production Strategy, that a range of impediments exist. These include underpricing of resources and waste discharges, lack of information and a “short-term” attitude to the pay-back period from energy and/or water saving devices.

Australian Experience

Australia has a well-developed technological base, world-class scientists and research institutions; however, funding from the private sector is very low on world standards.

That stated, the environmental challenges posed by climate change, biodiversity conservation and global demands for food should provide the incentive for increased efforts to advance technological solutions. However, the research and development has to be financed and it is not obvious that the right policy framework is yet in place.

There are a range of technological issues to be pursued in Australia (more efficient agriculture, transport, residential and tourism development), and not only by “hard” technologies but bio-technology and “social” technology. Much of the demand for such is of a public good nature — if pursued at the generic level — and, therefore, will require the proactive involvement of publicly-funded researchers.

Summary

Technological change will, obviously, continue. The speed of change has increased dramatically in the past century and there are no signs of a slow-down. Environmental issues have had a significant influence on the focus of technological change (for example, in the development of lightweight materials and pollution control equipment). Advocates of resource efficiency (cleaner production techniques) are pro-environment “technological optimists”. However, until environmental costs are factored into all prices, the uptake of cleaner production will be slow. Australia is well-placed to make a serious contribution to technological change given its scientific skills base.

7. A Look to the Future

We can now attempt to sketch out what the future (up to 20 years hence) might look like. This is done in general terms first, then attention is turned to natural resource management and some key industries and sectors. For the general discussion we will use the headings used previously.

Environmental Attitudes and Behaviour

Environmental management has become a mainstream issue and there is no prospect that it will not continue to be so indefinitely—just as economic management is a continuing mainstream issue.

Slow progress will be made in taking up the challenges of sustainable development; in particular, integrating environmental and economic decision-making at all levels (from the individual and firm level to the highest level of government). Within five years, we can expect considerable progress in measuring the contribution environmental services make to economic production; and the necessary institutional changes, such as operational natural resource accounts, to complement GNP, and systems for trading environmental permits, should be in place. Such changes themselves will influence values and attitudes at both the individual and organisation level. (For an initial attempt at environmental accounting see Hamilton et al, 1997 and for alternatives to traditional approaches see Hamilton and Saddler, 1997)

Within 20 years it is likely that there will be much greater emphasis on the ethical and political means of furthering sustainable development. We will have discovered that the present infatuation with using the economist's calculus can only take us so far in meeting sustainable development goals and that multi-criteria (in particular, ethical criteria related to intergenerational issues and north-south issues) are needed.

Within 20 years, the world society will have put in place appropriate institutions and frameworks to manage global environmental problems (for example, climate change and use of the oceans), to deal with trans-boundary pollution and resource sharing (with water use being a key resource sharing matter) and to compensate those nations who preserve major ecosystems (such as forests).

However, changes in attitude and behaviour will not be universal across the globe. It is likely that a number of developing countries in 1998 will still be struggling in 20 years time to provide the social and physical infrastructure needed for general acceptance of the sustainable develop ethic by their people. In other words, poverty will still exist and, consequently, the poor will still be degrading the environment in order to survive.

Population and Consumption Levels

World population growth will follow the middle path suggested by the United Nations (see Figure 1). However, as we approach the end of the 20 years, the path will diverge towards the low variant.

Australian population growth will continue on its recent trend line, which is just over one percent. Certain geographical areas (a prime example being south-east Queensland) will experience higher than national population increases.

As demand on environmental resources is correlated to per capita real income, the latter is much more important than population growth per se. A key feature of the recent past has been the high economic growth rates in parts of Asia. This region is presently undergoing a "currency crisis" and in the short term the rates of growth will drop back considerably. The demand by the middle class in this region for such commodities as imported foodstuffs will fall. While it is a financial crisis not an economic one (the real economy of land, minerals, factories and workers does not disappear overnight), there will be a period of austerity and, in some countries, political tension. World leaders understand the mistakes made in the Great Depression of the 1930's and will not allow a major global recession to occur. However, the next five years will not be like the past five. A return to the very high rates of economic growth will not occur in that period.

Because the real economies remain intact (and will not be allowed to fall into disrepair as in Russia), within the next 20 years the Asian countries will return to a path of relatively high economic growth. With that will come increased per capita income and demands for products and services similar to those consumed in the industrialised countries. This will lead to increased pressure on the environment (in terms of pollutants, climate change, waste assimilation) and this will be the catalyst for a major paradigm shift (widespread adoption of resource-efficiency/cleaner production, severe restrictions on pollution and population policies).

Food Security

Feeding, at adequate levels of nutrition, a growing world population is an ethical necessity. There are major international and economic barriers to meeting this objective. Notwithstanding the efforts to free-up world trade, little will change in the next five years. Furthermore, those people who presently have too little to eat will not see their financial position improve within five years.

Food production in some parts of the world is already undermining the environmental base of future production. Increasing population will put further pressure on the environment.

The imperative of producing more food in a sustainable manner will force governments (except for those regions where government is weak or countries are wracked by civil strife) to intervene to a far greater extent at the production level. Policies and laws aimed at reducing land degradation will be in place in most countries within 10 years and, importantly, monitoring and policing efforts will be substantially increased.

Farming and food production practices will have changed dramatically within 20 years, with significant productive gains coming from improved practices on the farm and technological (and bio-technological) breakthroughs.

The wild caught seafood harvest (which will remain stable at present levels) will be complemented to a significant extent by aquaculture.

Biodiversity Loss

Global biodiversity will continue to be lost, certainly for the next five years, if not longer. The significant losses will be in the tropical developing countries. Political pressure will cause industrialised countries to be extremely cautious within their own jurisdictions and, therefore, we will not see any significant loss of biodiversity in these countries.

In about five years time, there will be in place global (north-south) institutional arrangements which will compensate developing countries if they retain forests (and biodiversity generally). This will lead to a sharp reduction in further losses, commencing about 2005.

Climate Change

Notwithstanding the agreement reached at Kyoto in late 1997, human-induced build-up of greenhouse gases will increase, at least, over the next five years.

As the date to reduce emissions approaches (the so-called “commitment period” 2008 to 2012), industrialised countries will take very deliberate action to meet their commitments. At the same time institutional arrangements will come into being such that the developing countries will be involved in overall global reductions.

Unless there are significant technological break-throughs and/or widespread adoption of state-of-the-art energy efficient production and transport, forced emission reduction will come as a shock.

Technological Change

The adoption of waste minimising production and consumption, recycling and cleaner production will accelerate in the next five years. There will be even faster rates of adoption after that as a consequence of widespread acceptance of life-cycle costing, environmental taxes and charges, and the imperative to meet greenhouse gas emission reductions.

There will be significant breakthroughs in bio-technology which will help improve the efficiency of agricultural production and processing. This will take some of the pressure off opening up new land.

Fuel efficiency will be greatly improved in automobiles and aircraft.

8. The Future and Specific “Sectors”

Conservation

The environmental lobby groups in Australia will remain strong and oppose further land clearing, large-scale tourism development in valued environments, and will take a considerably tougher stance on potential threats to World Heritage Areas. Public support for the environmental lobby will grow.

The lobbyists will take a greater interest in advocating environmental taxes and other institutional arrangements which better integrate the environment with the economy.

Indigenous Communities

Native title issues will be resolved (if not to everyone’s satisfaction) within the next five years. However, the process of determining specific claims will continue beyond then. Notwithstanding a general agreement, the specifics of each claim—in terms of land uses, restrictions, etc—will be important in establishing any constraints on presently-permitted activities.

The resolution of native title will not have a significant adverse impact on existing land uses (farming, tourism, mining or urban development).

Local Government

The major role of local government in terms of environmental management is in town planning. In parts of Australia (the Queensland east coast in particular) where tourism is a major sector, town planning decisions will favour tourism development, and associated

residential development, over other land uses. The expansion of cities such as Cairns, and coastal strip development (as is occurring north of Cairns), will continue. Agricultural land will be converted via this process. In most cases, prime conservation land (for example, mangroves) will not be converted.

Increasingly, local governments will attempt to get the appropriate balance between tourism/residential development and preservation of rural lifestyles and conservation. Population caps will be imposed through the application of town planning controls.

Local governments, again particularly those with relatively large urban populations, will have a very keen interest in water supply. Conflicts between competing demands (urban versus rural, environmental flows versus extraction) will arise and be a political problem for the next five years. Appropriate pricing policies will be in place within 10 years and water will be allocated to the highest value use. This will favour tourism/urban uses and high priced horticultural crops.

State/Territory Government

As the level of government with prime responsibility for land management, state/territory governments will come to enforce strict land clearing policies as a consequence of the Kyoto climate change agreement.

This level of government will also come to impose (either by administering economic incentive schemes or stricter legislation) soil conservation measures. Off-site environmental issues (such as sedimentation, salinisation, pesticide/herbicide run-off) will be much more strictly controlled within five years. Measures such as these will impose costs on those responsible while benefiting industries downstream.

State/territory governments, in association with local government where appropriate, will change the way water is allocated, with the consequences discussed above.

Commonwealth Government

Environmental management will continue to be a joint responsibility of Commonwealth and state/territory governments (with a role for local government) under the IGAE. However, given the global significance of climate change and biodiversity conservation—and the fact that such are subject to international conventions—the Commonwealth increasingly will come to take the lead role in these areas of environmental management. This is an inevitable consequence of dealing with problems which do not recognise political boundaries.

Services

In Australia, the one dominant activity which could be placed in a “services” sector is tourism. Given the natural attractions (particularly on the Queensland east coast) and the increasing willingness and ability to travel, tourism will become the dominant sector. This will be the case notwithstanding a significant slow-down in inbound visitation from Asia.

Within 20 years, it will be necessary for the Australian tourism sector to “rejuvenate” itself so as to meet changing tourism “fashions”.

Research Institutions

Given the environmental management imperatives outlined in the previous sections, research institutions which have a focus on land use and other environmental issues in Australia will face an increased workload, at least, for the next 10 or so years. They will play the key role in advancing the science which underpins future action on climate change (in particular, sinks and sink enhancement). They will assist the agriculture sector to become much more resource efficient—more productive using the same land. They will help provide information to manage tourism resources (such as the Wet Tropics, Kakadu and the Barrier Reef) on a sustainable basis.

As such research is of a public good nature, the funding will have to come from the public sector. There is a real danger that the need to fund this research will not be recognised in time for it to bring the greatest benefits.

9. In Conclusion

Throughout this essay, the fundamental point has been that environmental health, land use and industry development, or decline, in Australia will be markedly and inextricably influenced by global events: population growth, per capita consumption, addressing human-induced climate change and biodiversity loss.

In any scenario barring a global disaster, ecotourism will become a dominant, sustainable sector. Mining of minerals and particular coal for export will remain a significant part of the economy, but ever so gradually the imperative of switching to alternative energy will have its impact. Demand for meat, grains and seafood (in particular, aquaculture products) will increase as the Asian middle class expands. Production of these products will be able to increase, within sustainability constraints, by improving on-farm productivity—otherwise they will not achieve their potential.

As we rapidly approach the 21st Century, Australian society is faced with either embracing whole-heartedly the new environmentalism or falling behind those countries who are keenly taking this road.

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