

The Maxwell Ralph Jacobs Memorial Oration 2007

Capitalising on forest values in a changing world

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Summary

Forest management has changed significantly in recent decades. A primary focus on timber production has broadened to reflect community interest in biodiversity, water, cultural values, carbon and bioenergy. Global forest area is declining significantly — mostly due to the conversion of forest land to agriculture, a process which contributes greatly to emissions of carbon dioxide to the atmosphere. Fragmentation is diminishing the integrity and quality of the remaining forest area. Ownership is moving from government agencies to communities. Challenges for forest managers are to maintain a broad, long-term perspective, and to keep as many options as possible.

Keywords: forest management; change; conservation; deforestation; ownership; climate; bioenergy

Introduction

A little over 30 years ago I was posted to Coffs Harbour as a trainee forester with the Forestry Commission of New South Wales. As I prepared for this oration I thought about what Coffs Harbour was like then and how dramatically it has changed in the intervening years. This led me to think about the changes we have witnessed generally in the world and more specifically about the changes in the forest sector.

Over the past 30 years our understanding of the value of forests has improved vastly. We have seen the emergence of sophisticated approaches to sustainable forest management that take into account the multiple functions that forests can provide in a landscape. In recent years concerns over climate change and energy have begun to present new market opportunities for forests as well as new challenges for forest management.

I will focus on only a few aspects of changing forest values and in particular to consider the risks and opportunities that emerging markets for carbon and bio-energy present to ensure forest

management is able to optimise the multiple functions that forests can provide.

It is a great honour to be here amongst many old friends and present this oration to you today. Although I did not have the privilege of meeting Max Jacobs, I was influenced by him as a forestry student and in my early career. The late Professor Lindsay Pryor said in the inaugural Max Jacobs Oration in 1985, that Jacobs ... 'more than anyone, influenced the development of the profession and professional foresters' (Pryor 1985). Max Jacobs' influence is still widely felt in forestry circles in Australia and New Zealand and indeed internationally, if my career is anything to judge by.

A changing world

In the past 30 years the world has changed at a breathtaking pace. In the 1980s we witnessed the end of the Cold War and the rise of conservatism where Reaganomics and Thatcherism ruled in the Northern Hemisphere and economic rationalism and Rogernomics² emerged in Australia and New Zealand. The economic models of the 1980s and the changes brought about by the end of the cold war led to rapid globalisation in the 1990s. The development of technologies, such as the personal computer, the internet and the cell phone revolutionised the way we work, while the growth of the environmental movement in the 1980s and 1990s changed public perception about the use and conservation of natural resources.

Two of these factors — economic changes and the rise of environmentalism — have strongly influenced forestry in Australia and New Zealand, and indeed worldwide. The pressure on forest management agencies to simultaneously optimise economic returns from and conserve biodiversity in public forests has transformed forest management, the forest industry, forest research and forestry education.

¹Bill Jackson is currently the Deputy Director General for The World Conservation Union. This paper is the text of the Maxwell Ralph Jacobs Memorial Oration to the Australian and New Zealand Institutes of Foresters (ANZIF) Conference *Growing Forest Values*, 3–7 June 2007, Coffs Harbour, NSW.

²The term Rogernomics, a portmanteau of 'Roger' and 'economics', was created by analogy with Reaganomics to describe the economic policies followed by New Zealand Finance Minister Roger Douglas from his appointment in 1984. <http://en.wikipedia.org/wiki/Rogernomics>

In the current decade climate change has emerged as one of world's most serious issues. The link between the use of fossil fuels and global warming has led many to question current approaches to energy production and distribution. The escalation of fuel prices beyond levels thought possible in the 1990s, and the increasing difficulty, physically and politically, of accessing oil and gas reserves have heightened concerns over energy futures. Both climate change and energy production and use have direct implications for forest values, not only because of the potential impact that climate change and energy systems have on forests, but also because deforestation and forest degradation contribute greenhouse gases to the atmosphere, and because the potential for forests to store carbon and provide bio-energy has been recognised.

In recent years, rapid economic development of China, Brazil, Russia, South Africa and India has had a major impact on the global economy, including the forest industry. Our world is also beset with the threat of terrorism and concerns with security, and destructive natural events. The Asian tsunami, tropical storms, floods and forest fires have brought the linkages between the natural world and our economic and social structures sharply into focus.

Changes in forest area and quality

In the past 30 years the world's forests have not been immune from overall economic, political and technological change. The Global Forest Assessment of the UN Food and Agricultural Organization (FAO 2005) estimates that the net loss in forest area from 2000 to 2005 was 7.3 million ha per year (the equivalent of the entire forest area of New Zealand or 27% of the forest area of New South Wales being lost each year). The rate of global deforestation has slowed compared to the previous ten years (from an estimated loss of 8.9 million ha per year from 1990 to 2000) as a result of new plantations and natural regrowth. However, deforestation, mainly due to conversion of forests to agricultural land, has continued at an alarmingly high rate in tropical countries — some 13 million ha per year in the period 2000–2005³. Quite clearly the economic and social value placed on forests in many parts of the world is more for their ability to be converted to other land uses than to be maintained as forests.

While global data on forest degradation is unreliable, my personal observations of forests in over sixty countries leads me to believe that we are facing a serious loss in forest values due to invasive species, changing fire regimes, overuse, fragmentation and in some cases pollution. Land use change is the major cause of deforestation and thus currently the greatest threat to forest biodiversity. Almost 70% of the total area deforested in the 1990s was due to conversion to permanent agriculture (UNEP 2002).

The increasing fragmentation of forests through, for example, agricultural expansion and infrastructure such as roads, dams and power lines threatens the potential of forests in many countries to maintain ecological processes. This is due to alterations in species composition and forest density, isolation of genetic populations and other causes. Excessive extraction of wood and fuel-wood are also important factors that threaten forests.

Changes in forest ownership and management

One important global change over the past 30 years relates to ownership and rights to manage forests. Governments have devolved ownership of forests increasingly to the private sector, individuals and communities (Sayer 2005). An estimated 77% of the world's forest is owned and administered by governments, 12% is reserved for, or owned by communities and 12% is owned by individuals⁴ (Table 1).

White and Martin (2002) suggest that the area of forest that is community owned and administered will double by 2020. This has considerable implications for the way in which forests are governed and managed, and presents constraints and opportunities for markets and for conserving forests. Let me give a brief example — in the late 1980s and early 1990s I had the privilege of working with Nepali, Australian and New Zealand colleagues on the development of community forestry in Nepal. Even though Nepal has been plagued by civil unrest for much of the past 10 years, communities have continued to manage and use forests while forest officials have been unable to do so due to security concerns. Local communities understand very well the value of forests for their livelihoods and well-being, and have even managed to develop markets for forest products in spite of obstacles placed in their way by government interference and by

Table 1. Estimated distribution of forest ownership (%) (White and Martin 2002)

Categories	Public		Private	
	Administered by government	Reserved for community and indigenous groups	Community/ indigenous	Individual/ firm
Global forest estate	77	4	7	12
Developing countries	71	8	14	7
Developed countries	81	1	2	16

³South America suffered the largest net loss of forests from 2000 to 2005 — about 4.3 million hectares per year — followed by Africa, which lost 4.0 million hectares annually (FAO 2005).

⁴Figures from White and Martin (2005), based on an analysis of forest ownership in 24 countries.

security risks. I have seen similar examples of local forest management systems developing in Asia, Africa and Latin America, and even in Europe.

The management of forests has also changed in the past decades with the expansion of protective approaches including biodiversity conservation, soil and water conservation, coastal zone protection and avalanche control. FAO (2005) estimates that more than 400 million ha of forest have been designated for biodiversity conservation (11.2% of total global forest area⁵).

Establishing and properly managing an ecologically representative network of protected areas has been increasingly accepted as the foundation of forest biodiversity conservation.

What has been less well recognised is that protected areas themselves are insufficient to conserve biodiversity in perpetuity, as the bulk of forest biodiversity inevitably remains in managed and unmanaged forests. The value played by forests outside of the formal protected areas system in conserving biodiversity is often not well understood by decision-makers.

Worldwide there has been a trend to downsize, consolidate and incorporate forest agencies within larger government bureaucracies. Forestry as a discipline worthy of undergraduate and postgraduate education has been watered down and forestry schools amalgamated into larger faculties. In many developing countries the need for forestry skills remains, or is even expanding, but the supply of skilled foresters is declining. Over the past 30 years there has been an increasing drive for governments to obtain a higher return on forest capital. Such changes can send confusing signals to forest management agencies as on the one hand it appears forests have declining political value, and on the other hand forests are seen as economically valuable revenue generators for government.

Ecosystem goods and services values of forests

How society values forests is influenced by peoples' understanding of the role that forests play in society and economies. In 2005 the Millennium Ecosystem Assessment (MA) released a comprehensive global scientific analysis based on the collective wisdom of over 1300 scientists. The MA concluded that 'human actions are fundamentally, and to a significant extent irreversibly, changing the diversity of life on Earth, and most of these changes represent a loss of biodiversity.' Changes in important components of biological diversity were more rapid in the past 50 years than at any time in human history. Projections and scenarios indicate that these rates will continue, or accelerate, in the future.

The IUCN Red List of Threatened Species identifies 23% of mammals and 31% of amphibians as threatened (Fig. 1). If such

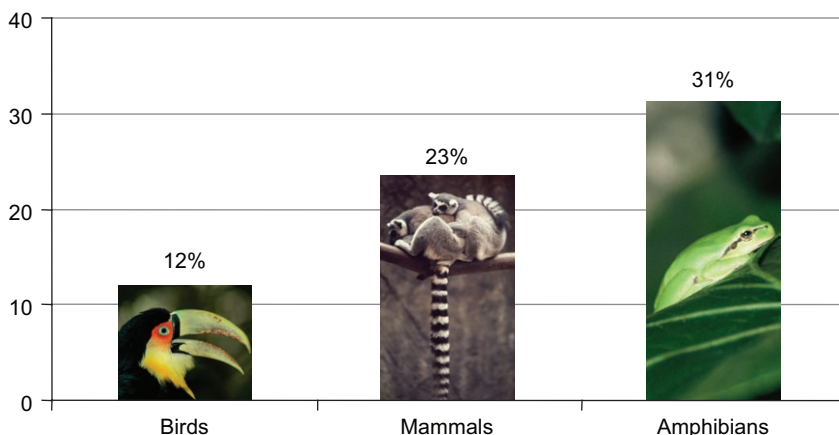


Figure 1. Percentage of threatened species, by major groups, 1996–2004 (IUCN 2005)

trends continue many of the values we currently associate with the natural world could be diminished. This has particular relevance to the forest values, as an estimated 50% of the world's biodiversity and as much as 80% of all terrestrial biodiversity is held within forests; much of this diversity is found in tropical moist forests. Thus, all is not well with the world's biodiversity, indicating to me that society neither recognises nor rewards the true value of biodiversity.

The MA's analysis of ecosystem goods and services has helped reshape the international debate on environmental values, including forest values. Their model (Fig. 2) depicts how biodiversity provides a range of ecosystem services and, in turn, provides some of the key elements of human well-being. This has been a very useful one for me when I describe forest and environmental values to decision-makers. The linkages between biodiversity, ecosystem services and human well-being are probably very familiar to the participants at this conference, but when I have spoken in other international fora, I have been surprised at the low level of awareness of these linkages.

Perhaps the one change in the past 30 years that will have the greatest long-term impact on forests and forest management is human-induced climate change. Although climate change and its link to forests has been discussed in forestry circles for much of the past 30 years, recent developments have heralded the beginning of an accelerating shift in the consciousness of societies regarding the need to urgently address global warming and its effects. At the international level these shifts have been strongly influenced by four factors — the perception that recent extreme weather events are linked to climate change, Al Gore's movie 'An inconvenient truth', the Stern report on the economics of climate change and the recent report of the Intergovernmental Panel on Climate Change.

Forests play a particularly valuable role in climate. About 283 Gt of carbon is stored in forest biomass, compared to 638 Gt in the ecosystem as a whole (FAO 2005). Not surprisingly, increasing the amount of carbon stored in forests in the effort to reduce the atmospheric concentration of CO₂ is an important strategy within the emerging global carbon market. Yet, at the same time, carbon released from forests and forest soils, particularly through

⁵ Figures are based on data from reporting countries and should be treated with some caution

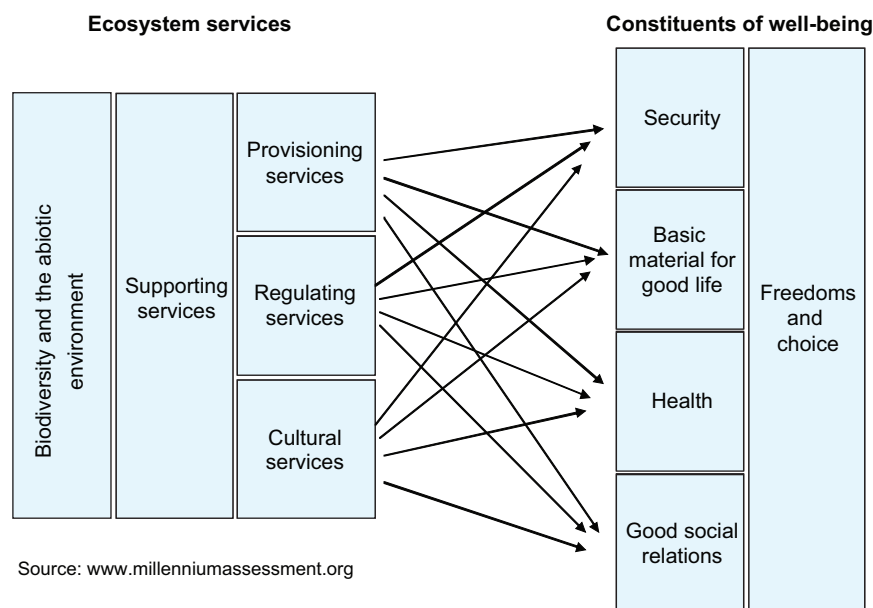


Figure 2. Consequences of ecosystem change for human well-being (Millennium Assessment 2005)

deforestation, is a substantial contributor to atmospheric CO₂. Over recent years there has been a worrying decrease of carbon in forest biomass in Africa, Asia and South America (Fig. 3), with tropical deforestation accounting for about 20% of human-caused greenhouse gases worldwide (Houghton 2005).

Capitalising on forest values

Putting an economic value on biodiversity is difficult, as ultimately biodiversity and the ecosystem services that biodiversity supports provide the life support system on earth. Thus in one sense biodiversity has infinite value. However, from a more practical perspective biodiversity provides space to live, food, medicine, building material and genetic material for agriculture, as well as employment and livelihoods for millions of people.

In a recent analysis of fuelwood use, Arnold *et al.* (2003) note that estimates of global annual consumption of fuelwood appear to have peaked in the mid-1990s at about 1600 million m³, while global consumption of charcoal is growing rapidly (estimated at 270 million m³ in 2000).

It is not only rural communities that depend on forest goods and services — even the well-being of city dwellers in the most industrialised countries relies to some extent on forests, for example for water, climate regulation and recreation. The diversity of services that can be provided from forests is an important point that foresters often fail to get across to decision-makers.

Globally, market conditions for conventional forest products have been changing and will likely continue to change. There has been substantial growth in demand for wood products, and global trade in forest products has been expanding. This is likely to continue as the rapidly emerging economies, and in particular China, soak

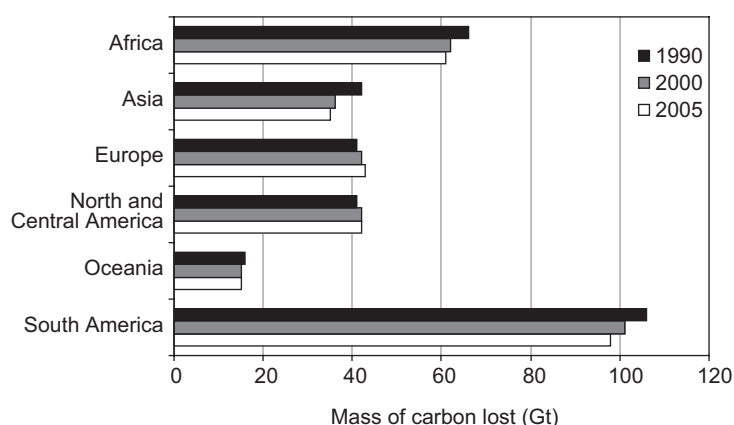


Figure 3. Loss of carbon stocks in forest biomass 1990–2005 (FAO 2005)

up vast amounts of internationally-traded timber and timber products. FAO (2005) estimated that global wood removals amounted to about 3.1 billion m³ in 2005, with nearly half of this being wood fuels (most likely a considerable underestimate).

In 2003, the global production of industrial roundwood was close to an estimated 1.6 billion m³, with an increasing proportion of timber originating from planted forests. Trade in industrial roundwood has doubled in volume over the past 40 years and is expanding rapidly, although the value per unit has decreased in the last 15 years. Trade in processed products is increasing as well (FAO 2005). It is difficult to estimate the volume and value of non-wood forest products that are harvested globally, but they are substantial and growing.

It is clear that globalisation has had considerable impact on forest values, in terms both of changing market values for internationally-traded forest products and of providing the economic

incentives to clear large tracts of forests, particularly in tropical countries, for large-scale agriculture and tree crops such as oil-palm. For example, Indonesian forests have been cleared for pulp plantations, oil palm and agricultural development. Soy bean and beef cattle production have driven much of the deforestation in Brazil, and even in Australia the clearing of woody vegetation for agriculture continues in all states and territories, and especially in Queensland (Department of Environment and Water Resources – Australia 2006) — although recent legislative changes will reverse this trend. On the other hand, evidence from the Global Partnership on Forest Landscape Restoration indicates that land degradation can be addressed effectively by taking into consideration a full range of forest values and forest restoration approaches within a landscape.

While increasing forest values through conventional markets has considerable potential, new market-based approaches that incorporate biodiversity and social concerns are becoming increasingly important. Forest Trends has estimated the current size and the huge potential for growth of ecosystem markets globally, with carbon sequestration through forestry estimated at US\$100 million and likely to increase tenfold within five years. Australia and New Zealand have been amongst the leaders in developing, testing and applying these approaches, and there are many opportunities to use market-based approaches as tools for forest conservation and management.

I will give two examples of emerging market-based mechanisms for increasing forest values — bio-carbon and bio-energy.

Cashing in on climate change

The Kyoto Protocol of the United Nations Framework Convention on Climate Change (UNFCCC) allows greenhouse gas emissions targets to be met through a range of activities including those associated with land use, land use change and forestry (LULUCF). These include forest management, cropland and grazing land management, and re-vegetation activities which sequester carbon in biomass and, as a result, offset emissions from the combustion of fossil fuels and other sources. Outside the Kyoto Protocol, national and regional voluntary markets for carbon offsets have also capitalised on the potential of forests to reduce emissions.

There is little doubt that the value of forests as a store of carbon is increasing, but to date most LULUCF activities have not incorporated biodiversity and social considerations effectively. Approaches that aim to sequester carbon through fast-grown plantations of non-native, or native but non-endemic, species have limited biodiversity values and may even lead to loss of biodiversity in some circumstances. They often have very limited social value and can instead have negative impact. There is considerable potential, however, to develop carbon markets that provide opportunities for sustainable forest management while conserving biodiversity and improving local livelihoods. These markets are often referred to as bio-carbon markets. As Bishop *et al.* (2006) explain,

the idea behind 'biocarbon' is simple — it is premised on being able to use carbon finance to stimulate projects with higher biodiversity value, by embedding in the price paid for sequestered carbon a premium for biodiversity. The payment is

contingent upon verification that the biological sequestration has taken place, and that the biodiversity benefit has either happened or is likely to materialise in the future.

The key challenge to developing a stable bio-carbon market will be to demonstrate that measurable carbon sequestration and biodiversity outcomes have been realised, through better forest management, than would have occurred otherwise. Early indications are that there is growing corporate interest in bio-carbon, although like the overall market for carbon, the real potential is unlikely to be realised until there is a global greenhouse gas emissions reduction target that enables large-scale trading.

Even if the bio-carbon market remains a niche market today, the potential scale of the overall global carbon market and the speed at which the market is growing suggest a major opportunity for the forest sector. Capoor and Ambrosi (2007) note that in 2006 the equivalent of 1639 million t of carbon dioxide (CO₂e) was transacted globally, worth Euro 23 billion (US\$30 billion), three times the volume traded during the same period in the previous year.

One area that is currently receiving considerable attention in international discussions is the potential opportunity to reduce greenhouse gas emissions through reduced emissions from deforestation and degradation, or REDD. As shown in Figure 4, deforestation and land degradation are estimated to account for 18% of global greenhouse gas emissions. The REDD approach is based on the fact that most carbon emissions associated with deforestation and land degradation occur within a few years of forest clearance, and on the assumption that reducing the rate of deforestation and forest degradation will produce a more immediate effect on global atmospheric CO₂ levels than will afforestation or reforestation measures (FAO 2001).

If it is properly applied, REDD has the potential to restore degraded forest lands using endemic species, and to sequester carbon while meeting biodiversity conservation objectives.

Bio-carbon and REDD may help move the carbon market beyond a primary focus on carbon to a more comprehensive approach

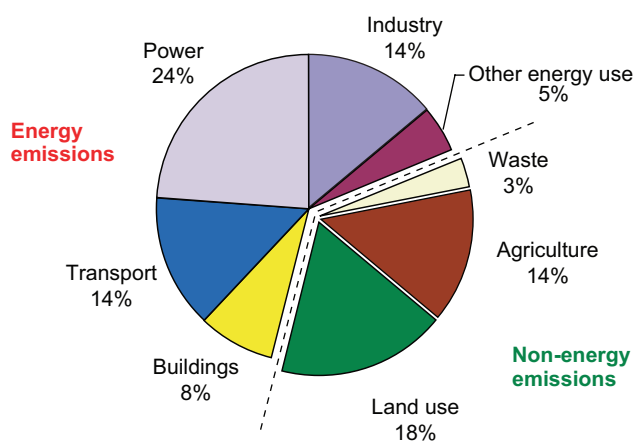


Figure 4. Sources of greenhouse gas emissions (Stern 2007)

that addresses forest-related land use change through a market-based mechanism. For this to succeed, governments, civil society and businesses will need to better balance land-use decisions by taking into account greenhouse gas emissions, poverty reduction, biodiversity and economic growth. Perhaps one of the more interesting developments with bio-carbon and REDD is the emphasis on national and sectoral approaches which helps reduce 'leakage' of carbon, rather than on the project-by-project approach that dominates much of the current carbon market. The broader sectoral approach has the potential to enable accounting for emissions from forest-based land-use changes overall rather than from simply the project site itself. The current international debates on REDD are moving very rapidly, with some countries such as Papua New Guinea and Costa Rica arguing for market-based approaches and others including Brazil preferring an approach based on official development assistance.

Whether bio-carbon and REDD will become effective tools to address global warming is yet to be seen. There are considerable political, economic and technical hurdles to overcome before they become a viable market mechanism under the UNFCCC or through voluntary carbon markets. Not the least in relation to REDD is the need to develop baselines, that is feasible mechanisms to measure what would have happened without the payments for REDD. Recent technological advances in approaches to measuring carbon stocks through satellite imaging and the use of computers may enhance the probability of the international community establishing clearer rules to monitor carbon stocks and perhaps to accept bio-carbon and REDD as tools in the climate change toolbox.

Bio-energy

Recently there has been an upsurge of interest in bio-energy including bio-fuels as an alternative to fossil fuel energy sources⁶. Even in the most industrialised countries such as Switzerland, a variety of innovative approaches are being developed to use wood, agricultural residue and other organic waste as bio-energy for heating and electricity production. The fastest-growing markets for bio-energy, however, are those for bio-fuels (bio-diesel and bio-ethanol) which produce liquid fuels from biomass for transport and electricity generation purposes.

The growing interest in bio-fuels relates to three key factors — high energy prices make investments in bio-fuels increasingly attractive, concerns over climate change are driving up interest in more environmentally-friendly energy sources, and there are growing concerns over energy security as access to fossil fuels becomes increasingly difficult due to physical and political circumstances.

The current sources of bio-diesel feedstock include vegetable oils — from soybean, rape seed, canola palm and the succulent *Jatropha curcas* — animal fats and even algae. Bio-ethanol is an alternative to petroleum and is produced from starch and sugar

from crops such as sugarcane, corn, beets, wheat, and sorghum. Bio-ethanol can be combined with petroleum fuels or used in its pure form with specially adapted engines.

Current sources of bio-fuel are referred to as 'first-generation' feedstocks to distinguish them from second-generation feedstocks that are currently being developed. Examples of the latter are lignocellulosic fuels that include a variety of forest products and so-called energy grasses, as well as straw, cereal crop and agricultural waste.

The world output of bio-fuels is projected to grow on average 7–9% per year (IEA 2006). This will create an increased demand for feedstock, including second-generation feedstock when enzyme technologies and gasification become increasingly available.

Emerging bio-fuel markets offer both opportunities and risks to forests. A rapid expansion of first-generation bio-fuel markets could pose a risk to some forests through the expansion of agriculture into forest areas. In any case, most grain-based bio-fuels cannot be considered as necessarily environmentally friendly as they often have minimal impact on reducing emissions and they encourage agricultural intensification.

Because of the connectivity of markets in a globalised world, the risks to forests from bio-fuel production will not necessarily come from within a national economy. For example the recent 'tortilla wars' between the USA and Latin America arose because corn meal for tortilla production — normally exported from the USA — was being re-directed to domestic US markets as bio-fuel feedstock, thus increasing pressure elsewhere for agricultural production of corn. While there is no sound evidence that this is resulting in deforestation yet, it remains a distinct probability.

In the right circumstances the development of second-generation bio-fuel technologies may provide resources for increasing the area of land under forest and for promoting agro-forestry to produce feedstock. Where managed in an environmentally and socially responsible manner, such forest expansion could provide a viable tool for improving rural livelihoods and recovering abandoned agricultural and degraded lands. Compared to intensive agriculture, such land use has greater potential to conserve biodiversity, require less use of external inputs such as fertilisers and pesticides, and potentially provide a greater opportunity to sequester more carbon in soils. If the technological aspects of second-generation fuels can be sorted out in an economically viable manner, cellulosic fuels have the potential to reduce greenhouse gases and provide biodiversity and social benefits.

Financial flows from bio-fuels may also strengthen the economic viability of sustainable forest management and provide markets for waste products from wood processing. There have been proposals from some forest industry actors to develop approaches that provide for a sequence or cascade of uses of forest products. For example, from an initial harvest, wood products are used for primary purposes such as timber, panels and paper; once used these products are recovered and used as recycled products; and finally material that is not economically viable for recycling is used for bio-energy. There is also considerable potential for forest

⁶ Proceedings of a recent Australian forum on this topic will be available from The ATSE Crawford Fund, <http://www.crawfordfund.org>.

industries to further improve vertical integration of their market chains by adding bio-fuel production and use from forest to mill and beyond. Many pulp and timber mills already use bio-fuels to produce energy for their own use, and in some cases excess energy generated is sold as heat or power to local communities or to the public grid (UNECE/FAO 2006). For example SAMARTEX, in Ghana, provides electricity for the town in which it is located (Stewart Maginnis, Forest Conservation Programme IUCN, *pers. comm.*)

Risks, however, are posed to sustainable forest management by the expansion of the bio-fuel market. They include:

- The intensification of forest management leading to simplification of forest ecosystems and, potentially, loss of biodiversity and soil nutrients, and negative social impact. On the other hand the increased use of undergrowth and harvesting by-products can reduce the risk of forest fires in some forest types (UNECE/FAO 2006).
- The beneficial effect of substituting fossil fuels with bio-fuels may be lost through increased greenhouse gas emissions when natural forests are replaced with short-rotation bio-fuel plantations or coppice systems.
- The reduction in greenhouse gases from the production of bio-fuels may not be as great as is claimed if large quantities of fossil fuels and other inputs (e.g. fertilisers) are used to grow and process the feedstock.
- Increased competition with existing forest products. Some panel and pulp and paper companies have reported reduced availability and higher prices of their core raw material as a result of competition from energy users (UNECE/FAO 2006). However, the strong vertical integration of much of the world's pulp and paper industry does not immediately suggest that bio-fuels will present any serious market threat to the pulp and paper industry.

There is also the potential for bio-fuel expansion to have adverse social effects as is the case of some areas in Brazil, for example, where the conversion of arable soil to bio-fuel plantations limits the area available for crops and consequently reduces the potential for agriculture to support the livelihoods of the poorest.

Capitalising on forest values in a changing world

When I started my career, forests were largely accounted for as a function of their timber value and to a lesser extent their recreational and conservation values. As a result of changing socio-economic values over the past 30 years, biodiversity, water supply, cultural values and more recently carbon have all risen to be of significance when accounting for forest values. Hans Drielsma, in the 1993 Max Jacobs Oration, ably described the dilemmas facing forestry when the values of society shift; it is worth quoting from Hans' paper:

Perhaps in reaction against the greedy years of the eighties our society has rejected economic viability as an argument in environmental issues. We are dealing with a pendulum which has swung from one extreme to the other ... (Drielsma 1993).

Sustainability is about making trade-offs to optimise social, economic and environmental outcomes, but it is also about

understanding that our societies and economies depend on healthy and productive ecosystems and that healthy societies are those that are just, equitable and ensure the safety and well-being of people. Trade-offs that erode environmental and social assets in favour of economic growth are unsustainable. Similarly, it is unlikely that environmental or social goals can be achieved in the absence of economic viability.

In the past 30 years forestry worldwide has been caught up in broader change processes as societies struggle to determine and re-determine acceptable balances between social, economic and environmental well-being. As Gary Bacon identified in the 1997 Max Jacobs Oration, the future of forestry depends on gaining and holding societal acceptance of production forestry in native forests. To do this Gary noted the need to define appropriate use in the forests and to use best-practice ecologically sustainable forest management (Bacon 1997).

Bio-fuel and carbon are just two examples of emerging markets that may have profound impacts on forest values. A key challenge in both Australia and New Zealand will be how to capitalise on these markets while ensuring a balance between social, economic and environmental factors that is acceptable to society, including meeting the aspirations of Maori, Aboriginal peoples and Torres Strait Islanders.

The current markets for bio-fuels and carbon are not particularly sensitive to supporting environmental and social values, and while this is changing, there remains a risk that forest managers and the forest industry in general could have its agenda increasingly dictated by the energy and climate change discourses and policies as the markets expand. This situation is perhaps depressingly familiar to many of you who have spent your careers dealing with the tension between forest preservation and use.

Hans Drielsma (1993) wrote that the 'resolution of environmental problems requires more than understanding their scientific bases. It involves developing political and social alliances between individuals and institutions.' I agree with Hans, but would replace the term environmental problems with societal problems in relation to the situation in which we find ourselves today.

However, at the present time forests are considered increasingly for simplistic values rather than for their multi-functional values. Within the current frenzy to sequester carbon one technical solution is seen as planting trees, any trees in any place. If we need alternative sources of energy then plant trees that can produce bio-fuel. As my colleague Stewart Maginnis puts it

... the failure to consider a more integrated approach to forest management in relation to climate change and energy reflects just how passive the forest sector's engagement has been in the debate.

By allowing the forest debate to be hijacked by climate change, energy or indeed any other technologically-driven agenda we risk the erosion of the past 30 years of learning about how to manage forests for multiple functions. I challenge you to seize the opportunity to turn the rapidly expanding interest in bio-carbon and bio-energy to promote more integrated approaches to forests, climate change and energy.

The threat posed by global warming provides an opportunity to promote sustainable forest management and forest conservation and to bring forests back to the attention of decision-makers, particularly in relation to the potential of forests to conserve biodiversity, provide a broad range of ecosystem goods and services and provide for the livelihoods of millions of people. Opportunities can be created for forest managers, businesses, local communities and the conservation movement to join forces and promote environmentally sustainable, equitable and economically viable new markets, including for bio-fuels and bio-carbon.

While these new and emerging markets may not offer a 'silver bullet' solution for sustainable forest management, and indeed they may not even come near to the values that can be derived from more conventional markets, we should not underestimate their political value. New and emerging markets for forests have the potential to raise political and public awareness of forest values.

Capitalising on emerging markets in a socially responsible and environmentally sustainable manner will require numerous changes in policies, markets and technologies. While experience with market-based approaches for forests is growing rapidly, particularly in Australia and New Zealand, the evidence is still insufficient to convince many public and private sector actors, particularly potential investors. Perhaps the largest constraint to adopting market-based approaches relate to the lack of agreed targets for biodiversity conservation and an associated lack of agreed indicators to measure progress towards targets. Such uncertainties create insecure market conditions and scepticism about the biodiversity and social values that will be generated.

New markets require willing buyers and willing sellers, the basics of any market, and if they are to help better balance social, economic and environmental expectations of society, forest managers will need to be able to attract a premium for these new products and services compared to other mechanisms, or at very least add value to existing mechanisms. In other words, these new markets should provide additional biodiversity and social benefits and not simply displace current approaches.

Businesses and governments will need to demonstrate accountability for these new markets, using approaches employing transparent and reliable systems for accounting, monitoring and reporting. Recent changes in remote sensing technologies as well as data processing and storage will be important tools for monitoring changes in forest condition (see for example Defries *et al.* 2005) and in determining whether biodiversity values are sustained.

The successful development of new markets for forests depends on having supportive governance, laws, policies and institutions. Markets operate best in well-regulated — but not overly regulated — situations. Market-based mechanisms should not be seen as a replacement for public-sector funding, although equally it is important to avoid unrealistic claims against governments to pay for ecosystem services.

The rapid changes in the past years placed us under many strains and tensions, but change also provides opportunities. We are at

one of those points in history when foresters, conservationists, businesses, local communities and others need to stand together to demonstrate that forests are crucial to our future well-being, and that they should not be simply accounted for as sticks of carbon or timber.

As I prepared for this oration I wondered what lessons from Max Jacobs' career may help us to deal with changes. I believe Max taught us to act in the best interest of society by:

- taking a long-term view and maintaining as many options as possible for developing future forest values
- encouraging research and using the results in a scientifically rigorous manner
- taking calculated risks, but remembering that mistakes will show for a long time as forests, unlike agricultural crops, have a long growth cycle
- observing, questioning and deducing⁷.

I hope you will take up the challenge I have put to you and also find time to reflect on the career of Max Jacobs.

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⁷E.H. Bunn said in the 1991 Max Jacobs oration that Max had taught him to observe, to question and to deduce (Bunn 1991).

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