A century after Federation, Australians are thinking about what kind of nation we are - and many believe our future lies in science and innovation. Australia was born in science and technology.¹

The Welcome Message to Sixth Conference of the Parties (COP6) on the United Nations Convention on Climate Change (UNFCCC) said *Ever increasing human activity is having a negative effect on our climate.*²

Innovation will be more important in the 21st Century than it was in the 20th Century. In some instances it will be necessary to reinvent what we considered to be forestry from the ground up. In other words, we cannot continue to use only old and traditional methods to solve the environmental issues of today and of the future. What we have learnt is that it will take a greater effort in the next 20 years than in the last 20 years to improve the State of the Environment. We have made a great start but the degradation trend has not been reversed so we need to innovate and adopt new methods and practices. We will call it **New Forestry**. And to this we need to add a **New Agriculture** that

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takes agriculture and forestry to Urban Areas as well as inventing new techniques for Rural Areas.

It is necessary to reinvent or reengineer every industry and job within that industry to ensure continued success.\(^3\)

The Macquarie Dictionary defines *Forest* as follows:

1. A large tract of land covered with trees: Kioloa State Forest. 2. The trees alone: to cut down a forest. 3. Brit. A tract of woody grounds and pastures, generally belonging to the sovereign, set apart for game. 4. Brit. An area, once extensively wooded, now more or less cultivated: Ashdown Forest. 5. A thick cluster of many things. 6. To cover with trees; convert into a forest.

The same Dictionary defines *Forestry* as follows:

1. The science of planting and taking care of forests. 2. The act of establishing and managing forests. 3. Forest land.

Any size or shape of a Plantation of Trees and (other) Vegetation can be a forest. An area as small as 500 sq m is a forest.\(^4\) A line of Trees along a street or in a park should be considered a forest. Once we have widened up the scope of our forest definition then forestry has a different policy framework. There should be no impediment to the use and harvesting of trees on any public and all private land as part of the 21st century view of forestry.

Trees and Vegetation require pruning, thinning and other forms of maintenance to ensure that they perform in an environmentally safe way. For example, the footpath trees need to have a canopy clearance above the ground of sufficient height as not to be a danger to pedestrians, cyclists and joggers but also be far enough away from Council services and driveways. There may be other forms of Vegetation suitable for footpaths such as shrubs or bushes that are clear of the concrete footpath and about 1 m high which are capable of contributing to our new form of forestry. There should be no opportunity lost to use/recycle/reuse the Trees and Vegetation.

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\(^3\) Peters, Tom (1997) in *The Circle of Innovation*, Hodder and Stoughton, UK.

\(^4\) This is the definition of a forest in Austria set out in legislation.
Existing Community Programs can be adapted to take on a Forestry Management Role. For example, the Tidy Towns Competition can also include a forestry element whereby each Town manages its vegetation. That Management should include a Green Waste Conversion Program. Such a Program means that there is no waste. Composting is only one byproduct of the Green Waste Conversion Program. Other products can include firewood, fence posts and garden stakes.

Neighbourhood Watch programs should look at adding a Greenhouse Watch component so that the Community has not only a security interest in vegetation but also an interest in greenhouse sink management (including making sure that waste is recycled into the soil sink).

Australia has been negotiating for a greater recognition of Greenhouse Sinks as part of the Conferences of the Parties (COPs) which is the supreme body (of more than 170 Nations) of the United Nations Framework Convention on Climate Change (UNFCCC). One of the most important Conferences was in Kyoto in 1997 when the Kyoto Protocol was negotiated. The UNFCCC was adopted in 1992 at Rio and came into force on 21 March, 1998 with its primary objective being the stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic (man made) interference with the climate system. Even without the aspirations of the International Community, Australia has the opportunity to be a leader at home and overseas with respect to diversity of positive Greenhouse and Vegetation Programs.

The Australian Government has a number of programs involved with carbon sequestration. For example, the objective of the Plantations 2020 Visions aims to treble Australia's plantation estate by 2020 and thereby increase carbon sequestration. In collaboration with State governments and industry, the program involves removing impediments to Australian commercial plantations and supporting plantation establishment and enhancing investment in plantation based industries.

The uptake of carbon dioxide in trees and vegetation offers significant potential to reduce the overall level of Australia's greenhouse gas emissions. This is part of the corporate funding of Natural Heritage Trust revegetation projects through Bushcare. Companies or investors will obtain recognition for the stored carbon reservoir created. By allowing companies to invest in revegetation activities, companies will have a method to offset emissions created by their activities elsewhere. Projects selected would have significant carbon sink potential and would meet the range of other Bushcare objectives.
Data on Australia's carbon stocks will be verified by satellite monitoring and audited by on ground sampling procedures. This form of carbon accounting, which has been adopted by the Intergovernmental Panel on Climate Change (IPCC), will enable Australia to benefit from the full carbon value of its sink development initiatives such as Plantations 2020 vision and Bush for Greenhouse.

These ideas should be expanded. Commercial Forest Plantations alone are not the answer. A diversity of different Agricultural Practices for Urban and Rural Areas is required. To understand the scope of the problem it is worth setting out an overview analysis of the history and impacts of land clearing in Australia.

Based on the intensity of land use, the continent of Australia can be divided into two regions: Intensive Landuse Zone (ILZ) and Extensive Landuse Zone (ELZ). The ELZ is approximately 61% of the central core of the continent and contains less than 10% of national population. The ILZ is about half size of the ELZ, but carries more than 90% of national population.

There has been a traumatic change in Australian native vegetation cover since the first European settlement. By 1990, a total 1,029,640 kilometres squared of forests and woodlands had been cleared and modified in the last 200 years. This represents 50% ILZ and 20% of the entire continent.

Major pressures on the extent and condition of forests and woodlands have been clearing and thinning for cropping and pastoral activities. Extensive clearing for agriculture occurred after World War II, and reached a peak in the 1960s and 1970s, but has since declined. However, vegetation clearance is still continuing. Almost 5 million hectares of briguallow (Acacia harpophylla) open forest and woodland have been cleared in Queensland since 1962. Substantial logging of rainforests still occurred in 1980 in Queensland, particularly in the northern region. Within the agriculture regions in South Australia, more than 82% of native vegetation has been cleared. The area of remnant vegetation within the agricultural region is now only 2.18 million hectares. Since 1983, clearing has been regulated. The introduction of the Native Vegetation Act 1991 played an important part in reducing the clearing in South Australia.

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Based on BRS/ALCC, in Victoria, 1,040,000 hectares of forest area has been transformed into agriculture between 1972 to 1987. From 1990 to 1995, approximately 9,000 hectares were cleared annually. In New South Wales (NSW), land clearing was 16,400 hectares per annum between 1990 to 1995.

In Western Australia, extensive land clearing occurred in south west up until the 1980s, when restrictions on clearing native vegetation were introduced. Private land accounted for 20.8 million hectares in the south west agricultural region, 18.0 million hectares has been cleared. Between 1990 to 1995, approximately 106,000 hectares of native vegetation were cleared for agriculture.

While land clearing has been slowed down in other states, it is taking place in Queensland which accounted for 80% of the national decrease in woody vegetation for the period 1990-1995. Queensland currently accounts for one third of the national forest in Australia. A majority of the native forest cover is woodland. Since European settlement, Queensland has lost more than half of the native woody vegetation.

Based on SLATS (Statewide Landcover And Tree Study), land clearing is 475,000 hectares per year for 1988 –1991, 289,000 hectares per year and 340,000 hectares per year for 1991-1995 and 1995-1997 respectively.

Land clearing has also occurred and continues to occur for Urban expansion.

Broadscale clearance or the severe modification of native vegetation is the major human activity causing the loss and fragmentation of habitat. Habitat loss remains the greatest threat to biodiversity. It may be possible to restore some plant cover in cleared or degraded areas as part of a managed revegetation program, however the original diversity of plants and animals as well as their interactions will never be recovered.

It has been estimated that there were approximately 16,000 vascular plant species in NSW at the time of European settlement. Currently, approximately 390 of there species are extinct, approximately 435 species threatened in NSW, and approximately 307 threatened nationally. There was 75,000 hectares of the Big Scrub- subtropical rainforest between Lismore and Bangalow in

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Northern NSW. By 1900, it had been reduced to about 300 hectares scattered over ten remnant patches.11

In Queensland, there were six million hectares of brigalow which was the dominant vegetation in the State. By the 1970s, a large portion of the brigalow has disappeared. Currently, only 0.5% of the vegetation remains.12

Australia loses 500,000 hectares of native vegetation to land clearing every year, which places 7.5 million birds in danger. This has recently attracted several international media’s attention including Britain’s Sunday Telegraph, the South China Post newspaper and Swiss television.13 It has been estimated that 10 to 20 birds permanently lose their habitat for every hectare of woodland cleared.14

The Swift Parrot feeds and breeds in the flowering Blue Gum forests and woodlands of Tasmania, where its habitat is threatened by woodchipping operations. In winter, the entire population migrates to the mainland to feed in the now diminishing woodlands of flowering Ironbark and Box trees in Victoria, NSW and Queensland. Fewer than 1,000 breeding pairs remain. The Barking Owl lives in the temperate and tropical woodlands. It is now critically endangered in temperate woodlands due to loss of habitat from clearing, logging and overgrazing. Star Finch was once common along streams in the grassy woodlands of northern NSW and southern Queensland. One subspecies has been found to be extinct, lost to clearing and overgrazing, while major declines are occurring among northern populations living in tropical woodlands.15 The clearing of mallee for wheat kills more than 85% of the resident reptiles – on average, more than 200 individual reptiles per hectare.16

Soil degradation is damage to the chemical, physical and/or biological states of the soil to the extent that the soil’s productive capacity is reduced.

Unlike those of the Northern Hemisphere, the Australian continent has been unaffected by glaciation during the last two million years. Consequently the majority of Australian soils, which

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15 The Wilderness Society (2000), Breaking the chain of destruction.
developed on ancient and deeply weathered parent materials, have not had an opportunity to be rejuvenated with nutrient input, following glaciation, in the way that soils in European and Northern America have.17

In the 200 years since European settlement, soil degradation has reached a serious level and more than half of the total agricultural and pastoral lands require some forms of soil conservation treatment.

The economic impacts of land degradation are significant. One study shows that the yearly production losses in Australia resulting from various land degradation problems: $180m for waterlogging, $80m for erosion and $200m for both loss of soil structure and salinity.18

A major impact of native vegetation clearance on land degradation is the alteration of water cycles and the resultant rise in water tables and salinity problems. Salinity is one of major forms of land degradation in south western of Australia and the Murray-Darling Basin. As part of the agricultural development of the Murray-Darling Basin, about 50,000 kilometres squared of native vegetation has been cleared19 and lost 12 to 15 billion trees.20 The changed land use, particularly the broadscale clearing of native vegetation and its replacement with farming systems which use less water, is the principal cause of secondary dryland salinity in the region.21

To solve the salinity problem, the Murray-Darling Basin Salinity Audit recently has outlined the following:

- Between 3 and 5 million hectares of land in the eastern and southern regions of the Murray-Darling Basin will be salt affected within 50-100 years.
- Rises in average salinity in many key tributary systems will endanger their use for irrigation and urban purposes in 20-50 years.
- The salinity threat could cost up to $1 billion per year in 100 years and cause significant environmental damage.22

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The opportunity for **New Forestry** and **New Agriculture** is available to the private sector as well as to the public sector. The Non Government Organisation (NGO) sector will be an important part of all new Strategies. The ability for all sectors to become involved is something that needs to be facilitated by leadership in Government. It can no longer be legitimately said that one level of government has sole responsibility because all three levels of government need to be actively participating financially and in kind. To expand the concept of Forestry there needs to be a change of emphasis throughout the whole of the Australian Community.

We have had a number of good examples of Programs that have increased awareness of and participation in Environmental Tree and Vegetation Projects. The **National Tree Program** was a pilot introduced by the Hon Malcolm Fraser in 1982. The **Decade of Landcare** was a joint project of the National Farmers Federation and the Australian Conservation Foundation starting in 1987. The Hon Bob Hawke launched the **Billion Trees Program** in 1989. The **National Heritage Trust** commenced in 1997 as an initiative of the government of the Hon John Howard. Vegetation is one of the five key environmental themes of the Trust and it includes Farm Forestry, Bushcare and Bush for Greenhouse. In 2000 the Australian Conservation Foundation and the National Farmers Federation got together again to launch a Report on **Repairing the Country**. That Report demonstrates that much more work needs to be done to overcome environmental degradation. Trees and Vegetation play an important part in the continuing work needed as part of Best Environmental Practice.


Greenhouse Gas Emissions from Australia continue to grow. In 1998 there was 455.9 million tonnes of Carbon Dioxide equivalent (mtCO₂e) excluding emissions from land clearing. That was an increase of 5.2% on 1997 and 16.9% increase on 1990. Forestry is estimated to be a net sink (carbon capture is greater than carbon release to the atmosphere) of 21.6 mtCO₂e in 1998 being similar to 1997 but 11.5% less than 1990. Land Clearing is an estimate that is said by the Australian Greenhouse Office to be highly uncertain and should be regarded as interim. It represents 64%

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23 Published in December, 1994 by the National Environmental Law Association Limited and funded by the then Department of the Environment, Sport and Territories after an Australia wide consultative study and the publication of a background report *Greenhouse Action and Local Government – Making Change Count* and a discussion paper *Greenhouse Action and Local Government – Issues for Today and Tomorrow* in March, 1994.
mtCO$_2$e in 1998. The area of Plantation Forests planted has increased by 12% from 1990 to 1998.

The base year in the **Kyoto Protocol** is 1990. Australia is allowed to increase its emissions by 8% over the 1990 levels during the first commitment period under the Protocol being 2008 to 2012. For calculation of the Sinks during 2008 to 2012 the Forest has to have been planted since 1990.

The Protocol includes in Article 2 the promotion of sustainable forest management practices, the regulation of afforestation and deforestation together with the promotion of sustainable forms of agriculture in the light of climate change considerations. Article 3 allows for the net changes in greenhouse gas emissions by sources and removals by sinks resulting from direct human induced land use change and forestry activities measured as verifiable changes in carbon stocks to be used in each commitment period.

Greenhouse Sinks relate to carbon sequestration in context of the Kyoto Protocol. It generally refers to capturing carbon in forests and soils (as well as oceans). The Sink keeps the carbon out of the atmosphere. Relevantly, the carbon (dioxide) from greenhouse gases is converted to carbohydrates in Trees and Vegetation. Through photosynthesis oxygen is released into the atmosphere after the carbon dioxide has been captured in the plant.

**Green Waste Recycling** gives the opportunity to condition the soil and to capture carbon so that it is not released to the atmosphere. Other soil conditioning processes are being trailed or used in parts of Australia and this can only increase the productivity of the soil and reduce what would otherwise be waste discharges to the environment. Minimum tillage and pasture improvement practices increase the sink capability of the soil.

Prescribed burning and wildfires add to the emissions to the atmosphere. Carbon sequestration to the soil instead of carbon emissions to the atmosphere for forest litter, pruning and thinning needs to be added to the list of improved practices that will increase the net sink effect. Composting helps convert carbon from an atmospheric release to a soil sink.

Composting (including worm farms) and Green Waste recycling generally has enormous potential to improve soils and reduce emissions to the atmosphere for **New Agriculture** in Urban and Rural Areas.

Keeping the carbon locked up in the wood (eg building products) and not allowing its release to the
atmosphere (e.g., having no waste from timber harvests) are methods to retain the sequestered value. Biomass accumulation as part of Forest Management is another method of increasing the sink value of the forest.

The clearing of land for Urban purposes and wood used for energy and heat needs to be replaced by at least 10 times the clearing/harvest rate in hectares because:

1. Younger trees and other vegetation sequestrate faster but from a lower carbon base line so more are needed to replace the more mature trees that are felled.
2. Logging disturbs the understorey so carbon losses occur here.
3. The biomass of the forest is disturbed so that the soil sequestration is reduced compared with intact forest.
4. A lead time is required to replace the felled trees.
5. There is a need to reduce the clearing rate and get onto the credit side of the ledger when it comes to vegetation cover.
6. Once Australia’s domestic greenhouse targets are reached Australia can help the World by carbon trading for dollars with developed countries and as foreign aid to developing countries.
7. Some insurance is needed against loss of carbon to the atmosphere by controlled burning and wildfires.
8. Extra planting is required as insurance against drought.
9. Insurance is also required against pests and disease by making sure that there are extra hectares planted to account for future losses.
10. The imbalance between past Vegetation Clearing and the more recent Revegetation efforts means that many concentrated efforts are needed to replace the vegetation cover.

**Land Use, Land Use Change and Forestry** are included under the Kyoto Protocol. The International Community is still working out the details. The decision of COP6 on 25 November, 2000 was to adjourn without reaching agreement but it takes note of the Informal Note of the President of 23 November, 2000 as an element of political guidance for the completion of negotiations. The President of COP6 wrote to his colleagues on 26 January, 2001 saying that *The Hague was a missed opportunity for the international community to strengthen the implementation of the UNFCCC and trigger sufficient ratifications to bring it into force...Yet COP6 was not a failure. The game is not over. The “extra time” granted to us can be put to constructive use. COP6 resumes in May, 2001 in Bonn. The COP is yet to agree on the definitions of Forest (although the*
Informal Note of the President shows that the FAO definition may apply with some flexibility), or the definitions of afforestation, reforestation and deforestation (the Note of the President refers to the IPCC definitions). It is still yet to be agreed whether the 1990 emissions from land use, land use change and forestry will be included in the 1990 year calculations. The International Community needs to resolve these issues and get ready for the first commitment period. By 2005 the Parties have to have made demonstrable progress in achieving their targets (Article 3.2 of the Kyoto Protocol).

Whilst we need to keep in mind the International negotiations, the Australian Community has to make a substantial reduction and a reversal in the next 5 and 10 years with respect to environmental degradation. The adoption of new and innovative Forestry and Agricultural practices is absolutely necessary.

As a contribution to the debate it is appropriate to set out some species that can be used as part of private and community **New Forestry** and **New Agriculture**. There will be climatic and other local variations that will lead to other species being used. The species selection is not necessarily for Biodiversity reasons because in degraded landscapes there is already a significant change over the native vegetation that was there originally. Biodiversity areas and plantings need separate consideration. These new approaches are to expand the opportunities for Australia in the 21st Century to improve the devegetated environments that have been created by past activities.

Many tree species can be used for Urban and Rural area. For example, Lilly Pilly (*Acmena smithii*) is one of these species. Lilly Pilly is a medium-sized tree and widely distributed from Victoria to northern Queensland. It grows on a wide range of soil, temperature and rainfall condition. Foods from Lilly Pilly are attracted to birds. Lilly Pilly is propagated either from seeds or cuttings.

Other species are currently recommended for plantation development in South-east Queensland. These include Gympie messmate (*Eucalyptus cloeziana*), blackbutt (*Eucalyptus pilularis*), western white gum (*Eucalyptus argophloia*) and spotted gum (*Corymbia variegata*).

These are examples only and there will be other species that can be added for different regions of Australia.

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The results of clearing include habitat loss, biodiversity decline, land degradation and greenhouse gas emission increase. The replacement of perennial, deep-rooted trees with shallow, short-lived crops or pastures has reduced the evapotranspiration of water from soil, raising the watertable and causing salinity problems. The impacts of salinity are not only on agricultural productivity but also on water quality for urban and industry.

While past land use practices have served Australia well there is a need for an innovative and dynamic approach for the future. Many areas of the country have been severely damaged. We are now in a critical stage. Sustainability is the only way to approach natural resource management. It is wise to prevent rather than reclaim, and to treat causes rather symptoms.

New vegetation management strategies are needed for retention of native vegetation and new plantings. We recommend the ideas of New Forestry and New Agriculture as discussed in this Paper and as can be developed further as more people adopt innovative approaches towards Vegetation Management.

REFERENCES