

URBAN TREES AND THE GLOBAL GREENHOUSE

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INTRODUCTION

"Humanity is conducting an unintentional, uncontrolled, globally pervasive experiment, whose ultimate consequences could be second only to a global nuclear war...It is imperative to act now!" (World Conference on the Changing Atmosphere, 1988)

This chilling summary from an international conference nearly twenty years ago emphasizes the significance of global warming, and the associated climate change on the planet's environment. A great deal of data has been collected since, and the debate today is now more about the extent of change and how it might be managed than it is about whether and when the changes might occur.

Since most urban environment and public open space managers have a firm grasp of these issues, only a brief synopsis of the causes of the greenhouse effect (which highlights elements that are relevant to urban tree management) are presented here. Gases produced by human activity have changed the composition of the earth's atmosphere and altered the amount of radiation that is reflected from the Earth's surface. This extra radiation warms up the atmosphere (Figure 1).

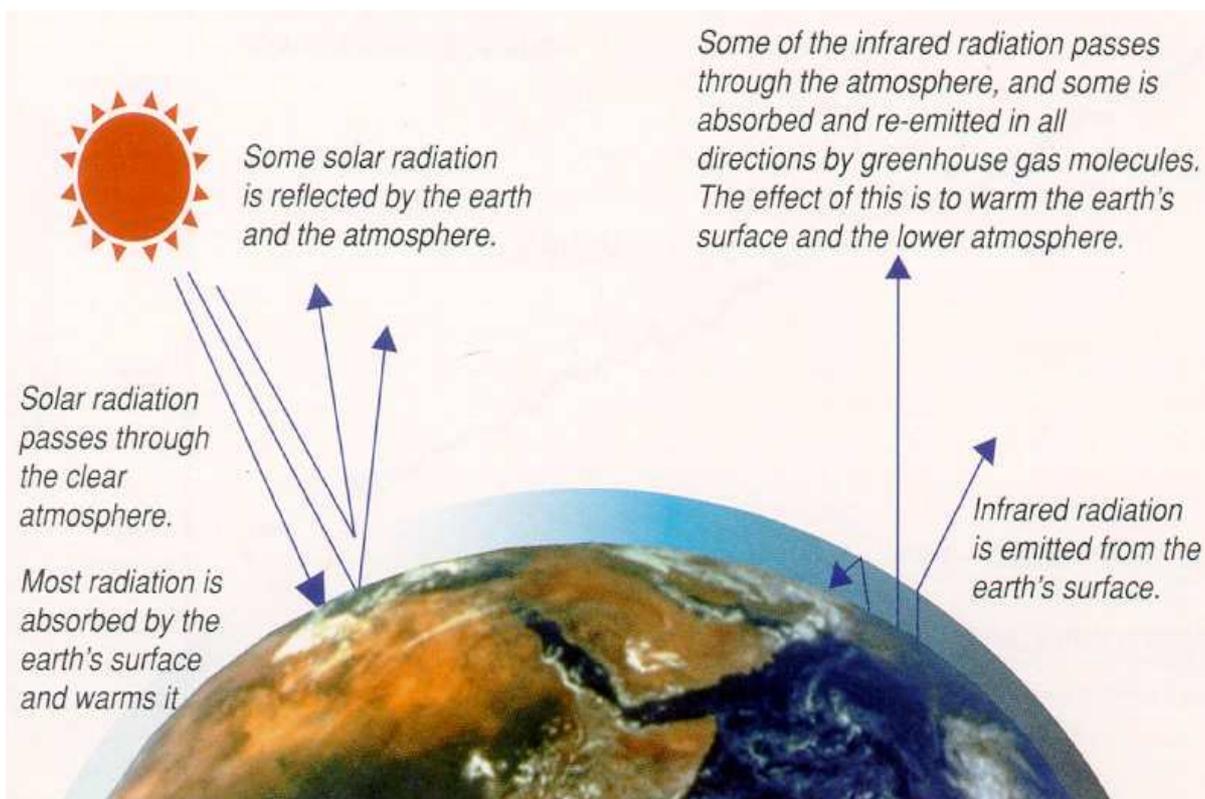


Figure 1 Causes of the Greenhouse Effect and the Subsequent Global Warming which is responsible for climate change (Anon, 2001)

The major gasses responsible for these changes and the warming are referred to as the greenhouse gases. These include carbon dioxide, methane, the oxides of nitrogen, and other gases in smaller amounts that are included under the Kyoto protocols (Table 1).

GREENHOUSE GAS	SYMBOL
Carbon dioxide	CO ₂
Methane	CH ₄
Nitrous oxide	N ₂ O
Hydrofluorocarbons	HFCs
Perfluorocarbons	PFCs
Sulphur hexafluoride	SF ₆

Table 1 Greenhouse gases included under the Kyoto Protocols

These gases contribute to the greenhouse effect and global warming to different extents. Some have a greater effect and others a relatively smaller impact, and so the contributions of the gases can vary for different parts of the world due to their different societies, cultures and economies. In the Australian context, by far the greatest contributor to the greenhouse gases is carbon dioxide. This is due to a complex of factors including such things as transport infrastructure, methods of energy generation and the fact that there is a relatively small population occupying a very large continent. In Victoria the significance of carbon dioxide as a greenhouse gas is emphasized due to its use of brown coal to generate electricity (Table 2)

GREENHOUSE GAS	CONTRIBUTION (%)
Carbon dioxide	68.4
Methane	25.0
Nitrous oxide	6.4
Hydrofluorocarbons	Negligible or 0
Perfluorocarbons	0.2
Sulphur hexafluoride	Negligible or 0

Table 2 Contributions of different Greenhouse gases to the overall Greenhouse Effect (as a %) for the state of Victoria

These data are useful because they explain, or perhaps justify, the current emphasis by scientists, environmentalists and politicians on dealing with carbon dioxide as a greenhouse gas and climate change priority. CO₂'s contribution globally to the overall greenhouse effect is at least 45% or more and so if something can be done about reducing carbon dioxide emissions then it will have a significant impact. This is not to say that other gases are not important.

THE ELEMENTS OF THE KYOTO PROTOCOL

The Kyoto Protocol is an international agreement adopted at the third conference on Climate Change held in 1997 in Kyoto, Japan (Anon 2000). It extended the commitments that assenting nations made under the United Nations Framework Convention on Climate Change (UNFCCC). The main objective of the UNFCCC is stabilisation of atmospheric gases to prevent dangerous anthropogenic interference with the climate system. While the global impact of these changes is well-known, some of the local effects (Anon 2001) are far reaching (Table 3).

The Kyoto Protocol is one mechanism for achieving this target of stabilization through legally binding targets. It recognizes *sources* of emissions and *sinks* in assigned amounts and targets. Clear-felling a forest, for example, would be a *source* of emissions, while establishing a forest is a *sink* for emissions. Under the protocol, the emission target, called the assigned amount, must be achieved over the commitment period of 2008-2012. Developed countries that sign the protocol commit to reducing their collective emissions of the 6 key greenhouse gases (Table 1) by at least 5% by the end of the commitment period in 2012.

Warmer winters and hotter summers
Fewer frosts and more days above 30C
Higher summer rainfall and more tropical climate
Flooding of lowland coastal areas – probably minor
More easterly winds leading to summer storms
For every one degree temperatures rise, the snowline rises 100m
Agricultural productivity will change, in some cases improving
Some crops will not be grown but others become viable
Housing and building construction processes will change
Energy demands and patterns of use will alter

Table 3 Some of the consequences of global warming for South Eastern Australia

Interestingly, Australia was very active in the development of the protocol and was initially seen as a strong supporter of its objectives and intended outcomes. However, with a change of Federal Government, support was withdrawn and the Australian delegation at Kyoto was seen as negative. In the subsequent negotiations, Australia's assigned amount under the emission target was set at 108% of 1990 emission levels. This represents an actual increase in emissions rather than the expected 5% decrease and was essentially negotiated in an attempt to keep what was seen as a recalcitrant Australia involved in the process. Australia has still not ratified the protocol and seems unlikely to do so in the near future.

There are some important terms used under the protocol which have entered the popular vernacular, but which are not always clearly understood (Anon 2000, Anon 2001). A **SOURCE** is any process or activity which involves releasing any of the greenhouse gases, while a **SINK** is any reservoir or process that stores carbon, thus lowering the amount of carbon dioxide in the atmosphere. **SEQUESTRATION** is any removal of greenhouse gases from the atmosphere by plants or technological measures over a period of time. Thus carbon sequestration is the absorption of carbon, usually by biomass, such as trees, soils and crops.

There are three major mechanisms for achieving emission reduction targets. One is emissions trading, which has tended to focus on carbon trading and has raised the profile of the carbon credit concept. Joint Implementation is where projects between two countries are negotiated, and clean development mechanisms (CDMs) allow negotiation between developed and developing countries to meet the developed country's targets, but at the same time allowing capital to flow to developing nations.

Under the Kyoto protocols, urban vegetation cannot be included in calculations of greenhouse gas emissions, as either sinks or for purposes of sequestration. Nor is it intended that urban vegetation can be used in carbon credit calculations or carbon trading. This is primarily because of difficulties that relate to verification of data and the relatively small scale of urban plantings in relation to the large scale of forests or plantations.

It is also worth noting that carbon credit trading and markets are not yet properly functioning in Australia. The Federal Government has not implemented a national trading scheme or market, and while there is a state based scheme operating in New South Wales that other states are expected to soon follow, the lack of a national approach to carbon credits, taxes

and markets has delayed a full implementation of what might have been envisaged under the Kyoto protocol.

It should also be remembered that the term of the Kyoto protocol ends in 2012, and that prior to that date a successor protocol or post-Kyoto protocol needs to be developed. It is expected that such a protocol would be even more demanding on nations that agree to it than the current arrangements. While Australia has not signed the Kyoto protocol, it is actively taking part in the preparatory discussions for the post-Kyoto protocols, which suggest that it will sign at a date in the future.

The fact that the Kyoto protocol does not apply to urban vegetation may mean that those in public open space and urban tree management fail to see its significance. While the protocol may not apply to urban vegetation directly, it will alter the political environment surrounding urban vegetation, and see the value of urban vegetation increase substantially. Furthermore, it is possible that the post-Kyoto protocol will include urban vegetation, particularly trees. Either way, there will be an opportunity to increase the public awareness of trees in urban open space, an opportunity to have the real value of urban vegetation calculated and recognized, and the potential to significantly affect decision making processes that involve urban vegetation. It is essential that these opportunities are neither missed nor squandered by urban open space and vegetation managers.

IMPLICATIONS FOR URBAN TREE MANAGEMENT

While the values of vegetation and large trees are recognised by some people many others have perceived trees as nuisances (Spirn 1984). The costs associated with trees in urban landscapes are often well known but their real direct and indirect benefits are rarely, if ever, fully costed. Economists driven by the huge real costs of damage to the environment, and the costs of attempting environmental amelioration and rehabilitation, are only now starting to redress this problem and put some economic balance back into the economic models and equations.

The concern about the environment generated by the Earth Summits at Rio de Janeiro, Kyoto and Johannesburg and the implementation of the Kyoto protocols have altered the political and environmental landscape, in ways that do impact on urban vegetation and urban trees in particular. The impact of trees on the urban microclimate and city infrastructure are rapidly being recognised. The role of trees as filters for pollutants, improving the quality of air, reducing wind speed and influencing water infiltration and absorption are the subject of intense investigation (Finnigan 1994). It is interesting to note that the presence of shady trees can increase the useful life of asphalt pavement by 30% (Killicoat, Puzio and Stringer, 2002).

As climate changes, the impact of vegetation on water run off during stormwater events could save billions of dollars in infrastructure costs to Australia's major cities. It is not economically possible to retrofit larger drains and alter levels at which they enter waterways for Australia's larger cities. However, trees not only hold significant amounts of water on their canopies, but through transpirational water use can reduce the amount of water entering drains significantly. Some estimates suggest that trees may hold up to 40% of the rain water that impacts on them, and that as little as 40% of water striking trees may enter drains. Furthermore, the root systems may act as effective biofilters in improving the quality of the storm water before it enters watertables, drains or river systems (Denman et al 2006). This would see an expansion of street tree and public open space plantings, and a premium placed on the current value of urban trees. In short, the value of urban trees can only rise.

Given that carbon dioxide is the most significant of the greenhouse gases, especially for the states of South Eastern Australia, its sources, sinks and sequestration will be particularly politically sensitive. Sources of carbon dioxide from the use of fossil fuels are often obvious, but many citizens fail to associate electricity with greenhouse gas emissions. However, in this region of Australia considerable energy is derived from coal powered generators, and as people become more aware of climate change, the focus on green issues associated

with power generation will increase. This could have a profound impact on current line clearing practices in the eastern states.

The Kyoto protocol recognizes the value of carbon sequestration by perennial woody vegetation, such as trees, as a means of locking up carbon for significant periods of time. While the protocol does not recognize urban trees, the public will soon be aware that power generation is producing large volumes of green house emissions and that the clearing of trees for powerlines and general tree pruning is reducing the level of carbon sequestered in the canopy structures of urban trees. Thus the power generating and distribution companies and authorities are compounding their contributions to the greenhouse effect and global warming. On the one hand they are major greenhouse gas emitters and on the other they are causing significant carbon losses by their line clearing activities.

These circumstances could contribute to a situation where citizens demand an end to line clearing to protect the carbon sequestered in urban trees. Under such a scenario, the Kyoto protocol has no legal impact on urban tree management but a changed political environment could provide an opportunity to press for undergrounding of services and the end to powerline clearing. Once again this would see a rise in the real economic value of urban trees and landscapes.

Another consequence of the protocols is the recognition of trading carbon sequestration and outputs through a system of carbon credits. Clearly these protocols recognise the value and role of woody vegetation in balancing atmospheric levels of carbon, but for the present urban trees are not recognized under the Kyoto framework. However, this does not seem logical and it is difficult to imagine that under the more stringent Post-kyoto protocols, urban woody vegetation would not have some value after 2012. Again this should translate into an added recognition of the increased value of urban woody vegetation in real terms.

CONCLUSION

Although the Australian government has not signed the Kyoto protocol, its impact is not due to take full effect until 2012. It is highly likely that by then the Australian government will have become a signatory to the protocols, so that it does not suffer the sanctions and trade barriers that failure to comply with the Kyoto protocols might entail. Australia is also taking a leading role in the development and negotiation of the treaties and protocols that will succeed the Kyoto agreements in 2012. Consequently, it would seem logical that the present situation, which often substantially undervalues woody vegetation, may change dramatically once the impact of the Kyoto (or more likely its successor) protocols on greenhouse gas emissions are recognised.

While these protocols do not impact upon urban vegetation and small-scale plantings, there will be an impact, as the political dynamic is likely to change. Such opportunities come but rarely, and they must be seized upon if public open space and urban trees are to be professionally managed. Carpe diem!

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