Forests, carbon and the greenhouse effect

K.R. Klitscher

In discussions of the greenhouse effect, forests are sometimes referred to as a carbon "sink", or a sponge that will soak up excess carbon dioxide; the theory is that we can mitigate the greenhouse effect by planting more forests.

True, say Forest Research Institute scientists, but only up to a point – we must be careful not to overestimate the capabilities of our forests. The best they can do for us is buy a little time while the real causes of the greenhouse problem are addressed.

This claim is made by FRI researchers Piers Maclaren, Steve Wakelin and Bruce Manley in a report prepared for the Ministry for the Environment as part of a comprehensive assessment of the implications of the greenhouse effect on New Zealand.

Trees do indeed soak up carbon dioxide, absorbing it through their foliage, storing the carbon in their tissues, and releasing the oxygen back into the atmosphere.

The carbon remains in storage during the life of the tree, and the life of any product coming from that tree, but when the tree (or its product) begins to decay, the carbon is returned to the atmosphere.

This means that forests act as net absorbers of carbon only while they are growing, while their biomass is increasing.

When new growth is balanced by the death or harvest of older trees, the forest is in equilibrium – carbon absorption through new growth is equalled by carbon loss back to the atmosphere through decay.

Thus mature forests, either native or exotic, contribute little to the mopping up of excess carbon dioxide, though they do act as storehouses for carbon.

But when a forest is destroyed, as is happening in parts of the Amazon Basin, all its stored carbon is released. In the case of a production forest, a small proportion of the carbon remains temporarily in storage in "durable" wood products, but most of it is released within a very few years; if the forest is replanted, the carbon absorption starts all over again.

New Zealand plantation forests have so far tended to be net absorbers of carbon, for three reasons – they consist of relatively young stands and have not yet reached equilibrium; they are increasing in area; and more and more wood products are going into service, locking up their stored carbon for the life of the product.

There must come a time when all these trends will cease – the forest estate will reach equilibrium, plantation forests will stop expanding, and the quantity of wood products going into service will be balanced by those decaying.

When that happens, the net contribution of our plantation estate will be nil – carbon storage through growth will be matched by losses through decay.

Further, any reduction in forest area from that time onwards will result in the release of stored carbon back into the atmosphere, whether the forest lost was native or exotic.

The plantation forests, then, do have an effect, but it is only a temporary one. The faster they grow, the more quickly they mop up carbon, but also, the more quickly they reach equilibrium.

A slow-growing native forest, provided it contained the same biomass, would store just as much carbon as a fast-growing exotic one, but it would take longer to do so. It may therefore be appropriate to plant fast-growing exotics, if the need is to provide rapid relief, or a breathing space while other solutions are sought.

On the other hand, if the primary purpose of afforestation is to maximise carbon storage, then it would be appropriate to plant long-lived species that carry high standing volumes, regenerate themselves, and are not designed to be harvested.

But, says Piers Maclaren, there is little benefit to be gained by substituting one type of forest for another – there are usually advantages in afforestation only if the land being planted had a cover of pasture or short scrub.

How much carbon can plantation forests absorb?

The current estate holds 94.6 million tonnes (Mt) of elemental carbon, and a further 22.5Mt are stored in forest products currently in use – a total of 117.1Mt of carbon locked up.

It has been estimated by another group of FRI scientists (Hollinger, Hunt, Beets and Hunter) that man's activities in New Zealand (mostly the burning of fossil fuels) contribute an additional 6.2Mt of carbon to the atmosphere each year.

It may be that not all this carbon dioxide needs to be removed – up to half of it may be absorbed naturally by the oceans and the biosphere, but that still leaves a lot for the forests to soak up.

The most important factor in determining how much extra carbon the forests can absorb is the rate of new planting. To take up the whole 6.2Mt would require 60,000 hectares of new forest each year, indefinitely; unlikely, as the highest planting rate in New Zealand's history was 54,000 hectares in 1985.

Pessimists suggest that the plantation forest estate may actually decline, if forestry companies were to choose not to replant stands after harvest. If it did decline at a rate of 10,000 hectares a year, 0.20Mt of carbon would be **added**

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In our Contemporaries

What's new in Forest Research

No. 196 Contribution of tree roots to slope stability
No. 197 BUGS and HEALTH – integral part of forest protection strategy
No. 198 The Bavarian connection [Research comparing environmental pollution in Bavaria and NZ. Ed.]
No. 199 DED emergency. An invasion by Dutch Elm Disease

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FRI Bulletins

No. 155 "Alternatives to the Chemical Control of Weeds".
Proceedings of an international conference held at the Forest Research Institute, Rotorua, New Zealand, July 25-27, 1989.
Bassett C., Whitehouse L.J. Zabkiewicz J.A. (Ed). (1990) $40.00+GST
Papers presented at this conference discuss a wide range of alternatives – including use of insects, fungal pathogens (mycoherbicides), grazing regimes, competing plants, cultivation, and mechanical control. Experience with biological control programmes in the UK and New Zealand is described, and the latest ideas and concepts are presented.

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Forest Pathology in New Zealand

No. 21 Bacterial leaf spot and canker of poplar, willow, and alder
Spiers A.G. (1990) $1.00+GST
This leaflet summarises the type of injury caused by leaf spots and stem cankers, their hosts, distribution, economic importance, and control.

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Miscellaneous

"Forestry: A Multiple-use Enterprise". Proceedings of the Thirteenth Commonwealth Forestry Conference.
Tarlton G.L. (Ed.) (1990) $40.00 +GST
The Thirteenth Commonwealth Forestry Conference was held at Rotorua, September 17-30, 1989. It attracted more than 200 delegates from 33 countries. In this Proceedings are published the country reports, papers presented, case studies, group discussions, and Recommendations from the conference.

NZ Tree Grower

Woodnet – A system of marketing wood and wood products

Smith M.E.F. Vol. 10 (4): 21 (1989)
This brief article draws attention to a simple method of putting buyers and sellers (particularly of uncommon woods) in touch with each other. The author acts as an information clearing house.

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Forestry and the greenhouse effect

Klitscher, K.R. Vol. 11 (1): 2 (1990)
This article describes surveys made by the Forest Research Institute among scientists and leading industrial figures to gauge the likely effects of global warming on forests and on industry. The survey defined both positive and negative effects and concluded that, because tree rotations are so long, research needs to begin now to find the answers to the important questions arising from the prospect of climatic change.

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The International Radiata Pine Handbook

Vol. 11 (2): 22-23 (1990)
This article gives notice of the preparation of an international handbook of radiata pine. It is a joint project between the main radiata-growing countries; the NZ Co-ordinator is Don Mead of the School of Forestry, University of Canterbury. The end product is likely to be in two volumes, one a bound reference book with wide international coverage and the other a silviculture manual of more regional Australasian relevance.

The project team would welcome comment or enquiry, especially on what type of information farm foresters would like to see in the handbook.

NZ Environment

How real is the "greenhouse" warming?

Bray J. Roger No. 63: 24-25 (1990)
This article presents a table of temperature variation in each hemisphere and globally from 1861 to 1989, and a graph of temperature sequence from A.D. 1600 to 1989. It sets out to put the variations into long-term perspective and says: "It would also be a great blessing if the environment movement stopped using every bit of weather that indicates warming to score cheap political points." The author concludes that "greenhouse" warming is a real possibility but that it has been oversold by enthusiasts and resisted by some who refuse to believe in climate. change. A careful scientific approach is advocated.

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Forest and Bird

The fungal world of the beech forest

Buchanan P., Johnston P. Vol. 21 (2): 30-37 (1990)
This is a popular account, by professional mycologists, of some of the fungi to be found in beech forests. It is written in an interesting and readable style and is beautifully illustrated with outstanding photographs taken by the late Jack Bedford.

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Wilding pines – A growing problem

Harding M. Vol. 21 (2): 38-41 (1990)
This article describes the natural spread of introduced conifers, restating their significance as a threat to wilderness areas, native plant communities and high-country farm production.

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Possum peril

James Ian Vol. 21 (3): 30-33. (1990)
This article reviews the threat posed by possums to the natural environment and to dairy farming through the spread of bovine tuberculosis. It is supplemented by articles by Fiona Edwards on trapping and 1080 poisoning.

Timber investment aimed at boosting exports

A $600,000 investment in a new timber planing and moulding machine has been made by KDV Industries, owned by Benchmark Building Supplies, a subsidiary of Burns Philp.

The machine was commissioned recently at the company's Morningside plant and its operation signals a major vote of confidence in KDV Industries and the future of high-quality dressed timber products on both New Zealand and export markets.

"The first container of dressed timber products has been shippéd to Australia and the company has definite plans to expand the volumes exported," said KDV's Manager, Maurice Greenheld.

"The installation of the new Weinig machine, from Germany, ensures we are operating the latest technology. It has boosted our potential output and will ensure the quality of our products is maintained at the high standard the company has built up since its inception in 1932. The automatic feed mechanism in and out of the machine will increase productivity."

Pinus radiata is the main timber dressed by the machine and it is supplemented by native timbers and imported cedar.

Sizing up the quality of a cedar weatherboard straight off the new $600,000 timber planing machine at KDV Industries are (right) Company Manager Maurice Greenheld and Pierce Brown, Regional Manager, Benchmark Building Supplies.

Applications for consultant recognition

The following individual has applied for recognition as a General Forestry Consultant in New Zealand:

Mr Harry Saunders, Hawkes Bay

The following individual has applied for recognition as a Specialist Forestry Consultant in New Zealand and overseas:

Mr Alan C. Bell, Wellington –
"Assessment and Valuation of Forest Resources in New Zealand and overseas"

Under the NZIF constitution, any members of the Institute may send objections in writing to the: Registrar of Consultants, NZ Institute of Forestry, PO Box 19840, Christchurch.

Forests, carbon and the greenhouse effect
(Continued)

to the atmosphere each year as harvesting wastes decayed.

If the estate were to remain stable, 0.92Mt of extra carbon would be stored annually, until the equilibrium point was reached.

A new planting rate of 20,000 hectares a year (which is likely to be a realistic and sustainable level) would remove an extra 2.2Mt of carbon annually, and 46,000 hectares of new forest each year would remove 4.55Mt of carbon. This latter planting level was the average for 1976 to 1986, and could presumably be repeated if the conditions that gave rise to it were to be restored.

The authors of the FRI report note that carbon dioxide is only a part of the problem – there are other, far more potent, "greenhouse gases", such as methane, ozone, nitrous oxide and chlorofluorocarbons.

The authors also believe that there is a need for a great deal more research on the subject. They want to see studies to determine:

– a full carbon (and other "greenhouse gas") budget for New Zealand so that levels of emission and storage may be better understood;

– the energy consumption of each industrial sector in New Zealand, and how it contributes to the greenhouse effect;

– ways in which wood products can replace greenhouse-aggravating products and fuels, such as concrete or coal;

– the ultimate destination of all wood products, and the time taken for these products to decay and release their carbon back into the atmosphere.

When this information is available, it may be possible to define precisely the role that can be played by forests in mopping up carbon dioxide. Until then, it would be wise to regard them only as an opportunity to buy some time while a permanent solution is found.

"Afforestation is not a long-term solution to the Greenhouse Effect," says Piers Maclaren. "It is only a way of delaying the problem. There is no long-term substitute for reducing the global consumption of fossil fuels."