prices. Only one of the 15 respondents assumes any real growth in log prices over time (after any movement is made to constant trendline prices).

A comparison of the responses of the eight respondents to the 1997 survey with their responses to the 1999 survey indicates that:

- Three valuers use the same discount rate, one valuer uses a lower discount rate (0.5% lower) and four valuers use a higher discount rate (0.25%, 0.5%, 0.5% and 1.75% higher). (If a valuer responded with a range of discount rates, their midpoint discount rate was used for this comparison).
- There is an increasing use of average recent log prices with adjustment to longer term trends rather than unadjusted current prices.
- None of the three 1997 respondents who assumed real growth in log prices now makes this assumption.

(ii) Estimate of the discount rate implicit in the transaction price of recent sales of forests or interests in forests (See Table 2)

These estimates are based on a very limited response. However the estimates of the discount rate implicit in recent "non-distressed" New Zealand transactions generally fall within the consensus range (8 to 9% for post-tax cashflows or 9 to 11% for pre-tax cashflows) of survey responses given in (i) above. Estimates of the discount rates implicit in Australian forest sales show a wider range. Substantially higher discount rates are implicit in "distressed" sales.

One feature of the survey was the low number of transactions reported. A number of respondents provided examples of other forests which had been put on the market but which did not sell because of different expectations between buyer and seller. One example was given where buyers were basing bid prices on discount rates of 10 to 11% (post-tax cashflows) whereas the seller was setting the reserve price using a discount rate of 9%. Consequently a willing buyer/willing seller transaction did not take place.

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Can forestry restore whitebait fisheries?

Dr D.K. Rowe

Whitebait catches mostly contain three species of native galaxiid fish. These species, commonly called inanga, banded kokopu, and koaro are the aquatic equivalent of kiwis and are referred to as galaxiids because the diffuse spotting on the sides of adults resembles a galaxy of stars. The adult stage of one of these species, the banded kokopu, is an attractively camouflaged, scaleless fish found only in New Zealand. It was known as the native trout, and is what makes New Zealand whitebait unique. Because of where it lives, it is a significant species for forest managers.

Galaxiid life cycle

Adults inhabit rivers and streams where they spawn on stream banks at high water levels. The eggs develop out of the water. When inundated by a rise in water level, the eggs hatch and the larvae are washed out to sea. Here they grow into the transparent juveniles called whitebait which migrate into river mouths during spring. Those that don't end up as fritters continue to swim upriver until they reach adult habitats where they grow to adulthood before spawning starts the cycle again.

Once, galaxiids were common throughout New Zealand river catchments but today they are scarce and whitebait fisheries have declined. Although trout predation can take some of the blame for this decline, changes in land use may have been more significant. For example, adult banded kokopu are still common in the smallest (< 2 m wide) streams running through dense native forest, but they are rare in pasture streams. Therefore, the historic conversion of native forest to pasture will have greatly reduced adult populations of banded kokopu.

Recent research by NIWA scientists has revealed that high densities of banded kokopu now occur in streams running beneath mature pine plantations in the Coromandel and Bay of Plenty. This land was once farmed, so it is clear that banded kokopu have recolonised the streams after the pine plantations became established. It is also apparent that the type of forest cover (native tree, or exotic pine tree) is not as important as the presence of forest cover *per se*. This finding raises the prospect that the spread of pine plantations now occurring throughout the country could help restore banded kokopu populations and hence whitebait fisheries.

Being good climbers, banded kokopu are capable of ascending most waterfalls and can colonise small streams at altitudes up to 600 m. However, they usually occupy streams above those frequented by inanga (the lowland galaxiid), and below those occupied by the koaro (the upland species). One of the reasons for this mid-altitude distribution is that banded kokopu prefer to live in the small (1-10 m^2) pools that form in small moderate-gradient streams. They are less common in the large pools of lowland rivers (where inanga occur) and in the faster flowing waters of steep-gradient streams (where koaro often occur). Therefore, prior to the spread of agriculture, when native forest and bush covered much of the land, juvenile banded kokopu will have penetrated into most small streams and adults will have occupied most of mid-altitude, hill country throughout New Zealand.

This hill-country land would have contained a vast amount of habitat for adult banded kokopu, particularly in the North Island. The numbers of adults must have once been huge and they probably contributed to the barrowloads of whitebait that were once commonly caught in our rivers. Today, however, the forest and bushis gone (replaced by pasture) and banded kokopu whitebait are relatively scarce. In most rivers their numbers fall well below those of their pasture-tolerant, lowland cousin, the inanga.

As exotic forestry replaces pasture over large tracts of this hill country, banded kokopu may re-establish in the streams under pine plantations, just as they have done in the Coromandel and Bay of Plenty. If this occurs throughout the country,

then adult populations will increase and it is quite feasible that the spread of exotic forests will result in the return of banded kokopu and an increase in whitebait.

However, one problem with this promising scenario is the sensitivity of banded kokopu juveniles to turbidity. Laboratory tank studies carried out by NIWA have indicated that it is the most sensitive species. Migrant juveniles avoid suspended sediment concentrations over 120 mg l^{-1} (turbidities of 20 Nephelometric Turbidity Units or NTU) and turbidity levels over 20 NTU reduce their feeding. Such levels are not particularly high and fall well short of what most people would call slightly discoloured water. Nevertheless, such levels occur in a number of New Zealand rivers and may be inhibiting the upstream movement of banded kokopu whitebait.

Proof of this was recently obtained by NIWA scientists, who found that rivers that are turbid during the fish migration season (August –December) contain fewer adult banded kokopu than clear rivers. As the density of adults in pristine habitat was low in the turbid rivers, it appears that the turbidity in lower reaches inhibits the upstream migrations of juveniles so that fewer migrants reach adult habitats.

If plantation forestry is to play a role in helping to restore whitebait fisheries, then forest managers will need to be careful to minimise turbidity levels in streams during the fish migration season. Carter Holt Harvey Forests has helped fund the FRST research into the effects of turbidity and land use on banded kokopu. The Company takes a pro-active role in environmental management and realises that more needs to be known about habitat quality in streams and the positive and negative effects that forestry practices might have on native fish such as the banded kokopu.

Road construction and runoff from recently harvested areas can contribute to turbidity problems in streams unless handled carefully, and many forest managers already work hard to prevent this from occurring. Riparian strips may help reduce turbid runoff, and FRST research is underway to determine the effects of riparian strips on stream ecosystems. However, these efforts will all be in vain if downstream sources of turbidity are not reduced. In this respect, the farming industry will need to be encouraged to do its share, because much turbidity in the lower reaches of rivers is likely to be due to soil erosion from pasture.

As turbidity levels will need to be low throughout the entire banded kokopu migration pathway (i.e. from river mouth to headwater stream), FRST funded research is now being completed to determine the turbidity level which inhibits the upstream migration rate of juvenile banded kokopu in the wild. The results will then be presented to industry and regulatory agencies to determine how best to implement the findings on a river-wide basis.

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Forestry Books

The following is a list of books newly available or becoming available.

Forestry, People and Places: Selected Writing from Five Decades. By Dennis Richardson.
Business Media Services Ltd
Professor Richardson has collected his many and varied writings in this special collection. The work includes essays, papers and addresses prepared during a career extending from the early days of modern forestry practice to the jungle tribes of Irian Jaya, the islands of the Pacific, and the highways and by-ways of European forestry. All works written in Professor Richard's usual insightful and readable style.
Price: $39.95
Available: Summer 2000.
Business Media Services Ltd, PO Box 6215, Whakarewarewa, Rotorua, New Zealand; Tel: (07) 349 4107; Fax: (07) 349 4157; email: bms@wave.co.nz

The Business of Sustainable Forestry - Strategies for an Industry in Transition
By Michael B. Jenkins and Emily T. Smith; John D. and Catherine T. MacArthur Foundation
Publisher: Island Press
A series of 21 case studies of industry leaders carried out by the Sustainable Forestry Working Group is integrated and analysed. The motivation of the pioneering firms studied are as varied as their characteristics, yet each has made significant progress.
Price: US$35.00
Available: Island Press
www.islandpress.org/

Atlas of Endemics of the Western Ghats (India) : Distribution of Tree Species in the Evergreen and Semi-evergreen Forests. B.R. Ramesh and J.P. Pascal. 1997, 403 p., maps, plates, CD Rom listing images, maps, US$70 (inclusive of CD ROM) (net. Inclusive of registered airmail postage and packing).
http://www.vedamsbooks.com
Available from the UNFAO Regional Office for Asia and the Pacific, Bangkok, Thailand:

Code of Practice for Forest Harvesting in Asia Pacific. 1999, 133 pages. An excellent reference, broad in scope yet sufficiently detailed with respect to field applications that can be applied throughout most of the region to enhance forest management.
Asia-Pacific Forestry Towards 2010. 242 pages. The report of the Asia-Pacific Forestry Sector Outlook Study. The study considers the status, trends and prospects for the forestry sector to 2010.
Both reports available from Patrick Durst, Regional Forestry Officer, FAO Regional Office for Asia and the Pacific. Phone: (66-2) 281 7844; Fax: (66-2) 280 0445; email: patrick.durst@fao.org