

SCIENCE AND RESEARCH INTERNAL REPORT NO.74

**FISHERIES AND FORESTRY**

by

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# **FISHERIES AND FORESTRY**

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## **Summary**

A conference on the effects of forestry on fisheries was held recently in Christchurch. Overseas participants emphasised the need for long-term, interdisciplinary studies to understand fully the effects of forestry on riverine ecosystems. Extensive harvesting of exotic pine plantations in New Zealand is expected over the next 10-15 years, and the impacts of this on fisheries was discussed.

## **INTRODUCTION**

A one and a half day conference on fisheries and forestry was organised by MAFFish at Christchurch on February 27-28. The main stimulus for this conference came from visits to New Zealand by three Canadian researchers who have been involved in long term studies of logging effects on fisheries, and the return of Brendon Hicks from Oregon where he investigated impacts of logging on fish communities as part of his doctoral work. The conference was well attended and included people from the forestry industry, regional councils, MAF, DSIR as well as DOC (three representatives).

### **1. Description of Carnation Creek Project by G.F. Hartman**

The Carnation Creek project in British Columbia is a long-term interdisciplinary study with 3 main objectives:

- a) To understand how coastal forest stream ecosystems work;
- b) To measure and determine forestry impacts;
- c) To communicate information to people who need it.

The sampling design was rather unconventional in that the control section of stream was downstream of the two treatment sections (logged to stream side or some riparian vegetation left). Specifics of this project are available from the author if required, but the following comments pertain to points that are relevant to New Zealand and DOC.

- Carnation Creek was set up in response to the unwillingness of forest industry people to accept findings from studies not conducted locally.

- This study displayed a need for long-term data bases and multidisciplinary studies to understand what processes are operating. Short-term studies can give expedient answers.
- There is a need to understand the complexity of the ecosystem to appreciate what the problems of resource use are (i.e. where and how they impinge).
- Variability in time and space is an important consideration (e.g. how does rainfall locally or during the study period fit in with overall climatic patterns?).

## **2. Processes underlying fish population changes by G.F. Hartman & J.C. Scrivener**

- Human impacts on ecosystems are complex and are integrated with natural processes.
- Different human activities affect different natural processes and can be positive as well as negative.
- Whether logging impacts increase or decrease fish production depends on the timing of logging, the species of fish and its life history strategy.
- Impacts differ in duration of effect depending on ecosystem location in time and space.
- Impacts may not become severe until coupled with external ecosystem pressures such as fishing pressure or extreme climatic events.

Hartman illustrated these points with examples from Carnation Creek. However, because of differences in fish species, rotation times (their 100 years compared with our 25 years) and climate, the magnitude and duration of many of these effects would not be directly relevant to New Zealand (details can be supplied if necessary).

## **3 & 4. Influence of geology and forestry on stream structure and salmonids & Forest management and stream flow and their effects on fish by B. Hicks.**

Hicks described his doctoral work on streams draining catchments of sandstone and basalt that had been subject to different degrees of logging. This was a short-term study (4 years) compared to Carnation Creek, and highlighted the earlier contention that long-term studies provide greater understanding of the processes operating. Hicks' work showed that logging effects on fish were more severe in streams draining sandstone than basalt catchments, indicating that geology plays a role in determining the magnitude of forestry impacts.

Hicks' second address drew on New Zealand and overseas examples to outline the effects of forestry development on hydrology and fish. Overall, there appears to be a general increase in water yield following logging and this decreases with time due to succession of secondary vegetation. However, the time-frame for these events can vary widely depending on catchment size. Interestingly, the Carnation Creek study revealed little change in catchment hydrology following logging. In his Oregon study, Hicks found that survival of fish was positively related to stream flow. However, one participant suggested that more flow did not necessarily mean more habitat for fish.

Hicks' conclusion was that, when assessing forestry impacts, we need to know:

- a) annual precipitation patterns;
- b) responses of different habitat types;
- c) responses of fish species and their interactions.

## **5. Forest management considerations in New Zealand by R. Coker**

Coker outlined the history of forestry production in New and its present status. He pointed out the high production of pines in New Zealand compared with Canada ( $20 \text{ v } 3 \text{ m}^3 \cdot \text{ha}^{-1} \cdot \text{y}^{-1}$ ) and the consequent pressure to develop land in the past. He did not consider most remaining indigenous stands (with the exception of some lowland areas) to be under threat from logging because of unsuitable terrain, legislative protection or previous activities removing economically viable timber. Presently, 4.5% of New Zealand's land area is in exotics (mostly on the Volcanic Plateau), and Coker believes that this is unlikely to increase in the foreseeable future. Thus, in his view, future effects of forestry on fisheries will mainly occur in areas of intensively managed exotic forest.

Of the exotic forests currently under production, 42% is less than 10 years old and 43% is 11-25 years old. Thus most of the harvesting and future impacts on rivers/streams are yet to come. According to Coker, the main effects on fish habitat occur at the beginning and end of the logging operation, with forest management activities between these times having little impact. Up to 8% of total forest area can be in roads, tracks or landings and these are the main contributors of fine sediments to streams. Road construction can double at the time of harvesting.

Coker outlined 4 main problems faced by the forest industry:

- a) there is a lack of hard data on measures needed to protect fish;
- b) foresters feel as though they are singled out for criticism compared to arable farmers who may have more overall impact on fisheries;
- c) responsibility for riparian vegetation needs to be defined clearly;
- d) they need to know whether fine woody debris produced after logging causes problems in first order streams.

This talk stimulated a lot of heated discussion. Points to come out of this were:

- In Carnation Creek the fish did not appear to be affected by large amounts of woody debris BUT problems can occur if it lowers dissolved oxygen or moves and destabilises the channel.
- Can New Zealand soils continue to support such rapid rotations of pines? Overseas work suggests that 3x25 year rotations may be the maximum, but some New Zealand plantations are already on their third rotation. Viability of future rotations unknown.
- There is a danger in picking up the "North American experience" and applying it here. The forestry industry needs hard data on New Zealand fish species BUT they need it NOW.

## **6. Forest management effects on stream flow and water quality in New Zealand by R.J. Jackson.**

Jackson highlighted the difference between results from Carnation Creek where little water is lost as quickflow (runoff that occurs during and soon after a storm) and his work in where up to 90% of rainfall can be lost in this way. Interestingly, is less than 2% in pumice soils of the Volcanic Plateau where most exotic plantations occur. Work on pakihi has shown that sediment yields can return to pre-disturbance levels within 2 years, but the relevant question for the fishery is what effects does this sediment have downstream of forestry

A problem with much research into the effects of forestry is that experiments are carried out in small catchments that are planted or harvested at once, and have little road construction. In reality, planting and harvesting are gradual processes, and the experimental work described above may over-estimates the true effects of forestry. However, reduced effects may persist for longer periods of time.

## **7. Logging impacts and the effectiveness of buffer strips in the Gilbert Creek drainage, Golden Downs Forest, Nelson by E. Graynoth.**

Graynoth presented some data from his 1973-74 study in Golden Downs Forest (see *New Zealand Journal of Marine and Freshwater Research* 13: 79-109) which he revisited in 1990. On his recent visit flows of rivers were very low in catchments planted in pines. Furthermore, size-frequency distributions of *Galaxias divergens* were similar in 1990 to pre-logging distributions, but these data were derived from samples collected only once and on a different date to pre-logging data.

## **8. Getting the message across to foresters -the British Columbia experience by T. Northcote**

Northcote outlined the format of a course he was teaching called Fishery/Forestry Interactions in the School of Forestry, University of British Columbia which he saw this as the best way to combat irresponsible forestry practices. He also described work in forest industry education in which he runs short courses on the forester's territory to show them examples of problems that are real to them. Furthermore, he outlined his involvement with the general public through open house displays, speaking events and visiting schools. Northcote emphasises that education is a two-way process, and that scientists should also learn from foresters about the real issues and concerns they face.

## **9. Forestry Codes of Practices by L. Vaughan**

This was a short unscheduled talk by Lindsay Vaughan of the Logging Industry research Association. He discussed efforts currently underway to draw up a code of practices for logging which DOC should have the opportunity to comment on before publication.

The aim of the code is to plan and manage forest operations with due regard to environmental effects and commercial values. Vaughan outlined the need for site-specific studies and long-term work to determine the implications of the impending increase in exotic tree harvesting on ecosystems.

## **10. Applying the results from fisheries/forestry research by G.F. Hartman and B. Hicks**

This final address drew together conclusions on various aspects of the effects of logging. Hicks reviewed the general effects of logging practices, and pointed out that they can vary depending on location (e.g. latitude or altitude). He stated that the effects of logging were likely to be more severe on fish species that have resident adult populations, and that the quick rotations of New Zealand exotic plantations may mean that streams never get the opportunity to recover fully.

Gaps in our current knowledge of logging impacts on New Zealand fish include:

- a) habitat requirements and optima for different species;
- b) effects of flow changes on fish habitat and species interactions;
- c) effects of changes in channel morphology on fish;
- d) effects of changes in sediment (fine and coarse) concentration over time and space on fish.

Hicks stated that comparisons with overseas studies were helpful but we need to remember that we have different species of fish and a different climate. This aspect was taken up by Hartman who stated that, although it was difficult to extrapolate results from one situation to another, results could be applied in a management context WITH CARE. Where the systems become less comparable in drainage etc, more and more literature should be taken into account before correct management decisions can be made.

Hartman suggested that in New Zealand we need to consider:

- a) the complexity of the system (processes and responses);
- b) duration of changes (think long-term);
- c) species biology.

## **11. General comments**

The wide range of participants at the conference meant that many points of view were aired and discussed. There appeared to be some support from scientists and the forestry industry for long-term, site-specific, multidisciplinary studies in New Zealand to investigate the effects of logging pine plantations on aquatic ecosystems. The obvious location for such studies would be on the Central Volcanic Plateau where most exotic plantations occur. However, the need for studies should be balanced against two factors:

- a) can reliable data and management recommendations be provided before the bulk of logging occurs within the next 10-15 years?
- b) given that only 4.5% of New Zealand land area is in exotic forestry and is unlikely to increase if current forecasts are accurate, can such intensive research be justified, and are there other areas (e.g. agricultural development) that warrant more immediate attention?

In general, participants from the forestry industry appeared willing to accept reasonable management recommendations if they were based on sound data and the reasons for the recommendations could be made clear. Obviously, there is a need for mutual communication and education between conservation and industry groups. A major vehicle for this in the logging industry could be the Logging Industry Research Association. This education should include efforts to expand awareness in industry and scientific groups of the full range of stream and riparian values, and should not emphasise only the value of the fishery.