DEVELOPMENT OF THE FIJI PINE COMMISSION
An account of the emergence of a major new industry in a developing country.
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ABSTRACT
This paper sketches the evolution of the Fiji Pine Commission, then provides a brief history of New Zealand's involvement in bilateral aid to the Fiji Pine Commission and how the School of Forestry at Canterbury became involved in the project. Various contributions from the School are described, including brief outlines of the inventory and yield forecasting system, management modelling, training of staff in implementing new techniques and research projects in foxtailing, spiral grain, sawn outturn and scheduling harvests. Recent involvement of School personnel in prefeasibility and feasibility studies on proposals to utilise the expanding resource is also outlined. The paper concludes with a discussion of (a) the benefits and drawbacks of the School of Forestry contributions, (b) the problems encountered in getting techniques implemented, and (c) the efforts to complement other aid projects.

INTRODUCTION
The main purpose of this paper is to outline an unusual form of assistance to a forestry project in a developing country through contributions from New Zealand students. Aid for the Fiji Pine Scheme has contained a significant component of resident assistance from undergraduate and postgraduate students studying at the School of Forestry, University of Canterbury, Christchurch. This association has existed continuously since 1975 and may be of interest to both donors and recipients of aid, because it appears to have worked successfully. The intention here, therefore, is to outline the framework within which this university contribution has been provided, to indicate briefly what it has comprised and to give possible explanations for its apparent success.

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HISTORICAL EVOLUTION OF THE FIJI PINE COMMISSION (FPC)

Plantings of Caribbean pine, *Pinus caribaea* Mor. var. *hondurensis* Barr. et Golf., and slash pine, *Pinus elliottii* Engel, in the 1950s and '60s form the oldest crops in the Fiji Pine Commission's present resource in the north-west of Viti Levu. These early plantings were carried out on highly degraded, fire-induced grasslands in the rain shadow zone of the island. A UNDP/FAO report on developing forestry and forest industries in Fiji (Forestal, 1972) led to a quickening in afforestation on communally owned lands which were virtually unused and uninhabited. The programme was funded by loans from the Commonwealth Development Corporation and the Fiji government, then later with substantial aid from New Zealand, and, to a much lesser extent, from the U.K., Australia and the U.S. Peace Corps.

The Fiji Pine Scheme was set up in 1972 as a separate government department responsible to the Minister of Agriculture, Fisheries and Forests. Out of it arose the Fiji Pine Commission, established by Act No. 5 of 1976 to facilitate and develop an industry based on the growing, harvesting, processing and marketing of species, primarily pines, in Fiji. The Commission is a statutory body which has entered into a partnership with the Fijian landowners to develop their land for industrial wood production and to encourage them to participate in the industry. The owners receive rentals on the leased land and royalties on the felled timber. The Commission is governed by a Board of ten members appointed by the Minister of Forests to represent the collective views of the Fiji government, the landowners, the providers of loan moneys, and the FPC management.

By mid-1982, the area established in pine plantations by, and under the management of, FPC amounted to 37,000 ha, consisting almost entirely of Caribbean pine, of which 4,500 ha are on Vanua Levu. About 90% of the area is under ten years of age, but, as a useful mix of sawlogs, poles and posts can be obtained from 15-year-old crops, the advent of very substantial quantities of utilisable wood is imminent. The present target is to establish a net stocked area of 60,000 ha which would give rise to a sustained annual yield of around 1 million m³.

In 1980, FPC called for proposals to utilise all or part of these burgeoning wood resources. Out of the four major bidders, British Petroleum South West Pacific was invited by the FPC Board to carry out a detailed feasibility study on joint-venture processing
options for about one-third of the resource. The final report by
the consultants is now to be submitted to BP and FPC in early
1983. Negotiations will still be proceeding for some time after
that on how best to implement the recommendations of that report.

About 400 new permanent jobs are likely to be generated by
1985 if this development goes ahead. About one-half of these
jobs are in harvesting, the remainder in mill operations, all of
which are to be made as labour-intensive as is practicable, given
the log categories and wood products that have to be produced.
This number is in addition to the 120 permanent staff and 250
hourly workers that FPC already employs all year round, and
to the 2,000 or so contractors involved in nursery work, planting,
releasing and other silvicultural practices who are engaged for
shorter periods at a time.

Rentals, royalties and employment provide monetary benefits
to the indigenous population, but there are also other benefits.
On the social side, the expanding, extensive FPC road network
(already over 600 km) has provided access to and from fifteen
remote villages and numerous farms, good housing has been
provided for FPC employees, the multi-racial composition of the
FPC staff (Fijian, Indian, Chinese and European ethnic groups)
has undoubtedly promoted better racial harmony, and the multi­
plier effect has been of benefit to the infra-structural servicing
groups in and around Lautoka and Nadi.

**NEW ZEALAND/FIJI BILATERAL AID**

In 1972 the Ministry of Foreign Affairs in New Zealand com­
misioned a report by two senior Forest Service personnel, J. W.
Levy and R. Usmar, on the viability of the Pine Scheme as it
was then called. These two foresters recommended that aid from
New Zealand would be a worthy project. Accordingly, aid has
been given since that time in the form of funds to finance cost
of establishment operations, donations of plant and equipment,
and provision of special expertise in fields such as roading,
vehicle repairs and maintenance, surveying, general forestry, silvi­
cultural and wood-quality research, cattle grazing, mensuration,
planning systems, utilisation and administration. Financial assist­
ance to the Pine Commission since 1972 has exceeded NZ$8
million.

Three crucial benefits from this particular bilateral aid pro­
gramme are worth emphasising:
(1) About half the annual cash grant is used to employ villagers in establishing new plantations which, together with rentals and royalties, represents welcome inputs of money away from urban centres.

(2) Technology and systems of work are deliberately made labour intensive, so that as many rural people as possible can be gainfully employed.

(3) There has been a firm, continued commitment to training local staff in all aspects of the work involved in modern industrial forestry.

Partly on account of these features, and because of other positive aspects of the whole project, the aid programme has been hailed a success. Herein lies a problem, however, in that pressures are mounting daily to ensure the continued success of the scheme, particularly now that the technology and investments needed to utilise the whole wood resource will involve a massive increase in resources. The Fijian landowners were quick to appreciate the benefits of, and to learn the techniques needed for afforestation, but the next phase of harvesting and manufacturing will be much harder to assimilate within the framework of past and present Fijian culture, life-style and experience.

SCHOOL OF FORESTRY INVOLVEMENT WITH FPC

In 1974 the now General Manager of the Fiji Pine Commission, E. W. Gregor, sought assistance, through the Ministry of Foreign Affairs, from the Canterbury School of Forestry to refine management modelling and forward planning for the young resource. This represented a shift in emphasis from purely afforestation problems to a wider perspective of management of the maturing and expanding resource. The task was greatly simplified by the timeliness of this important decision: if it had been delayed any longer, a great deal of ground would have had to be covered in a much shorter time, which, from experience obtained in other projects, can lead to poor, hurried planning. Early in 1975, then, the writer visited Fiji, recommended the implementation of an integrated inventory system for monitoring early establishment, assessing development of the maturing resource and forecasting the outturn, in quality as well as quantity, of the final crops. It was also suggested that, if the system were to be adopted, young New Zealand students could be used to train the local staff and
also provide a research back-up in the field of mensuration and planning models.

In 1975, the first three students from Canterbury took up the challenge of first familiarising themselves with the suggested inventory procedures, then passing on these skills to local Fijian staff. The major benefit of this approach was that the local staff were far less reticent about questioning and discussing technical points than they would have been (and still are) with more senior training personnel. They identified themselves as of the same peer group as the students and, from the ensuing dialogue that became an integral part of the training process, a much better appreciation of the techniques was obtained. It may well have been due to this commitment to comprehensive training that the inventory system has been run for several years now entirely by local Fijian staff.

Three students for each of the last eight years have now spent their long vacations working with the Fiji Pine Commission. In addition to training local staff in new techniques or refinements of existing ones, each student collects research data while in Fiji, then analyses these data during the following academic year at Canterbury and presents a dissertation, thesis or report on his or her findings. These findings are integrated within the existing inventory, forecasting or planning systems and form part of the training projects for the following year’s students to undertake. The continuity of effort and the length of time (i.e., three months) for each student assignment have apparently contributed greatly to the high rate of routine implementation of the research findings. This is no mean achievement in an applied discipline such as plantation forestry, where there is an ever-widening gap worldwide between knowledge possessed by researchers and the extent to which this knowledge is accepted and routinely practised by forest managers.

TECHNICAL CONTENT OF SCHOOL OF FORESTRY CONTRIBUTIONS

A full list of School of Forestry research studies related to the Fiji Pine Commission is given in the Bibliography. Only a brief outline of the various stages of development and implementation of the research is given in this section. The extent of the contributions to forest industrial planning and management, however, is depicted in Fig. 1.
Boxes 1 and 2 refer to inventory and yield forecasting systems which are more fully documented in an earlier article (Whyte, 1978). They represent integrated systems for (1) monitoring the success of establishment and seedling survival, (2) collecting stand information on the present quantities of resources, and (3) forecasting up to ten years ahead the potential volume assortments that could be produced. The yield forecasting model (see also Broad, 1978) uses actual and predicted stand diameter statistics (mean and minimum diameter and variance of all diameters) together with age and stocking to forecast future numbers of stems by one centimetre dbhob classes using the Weibull distribution. Heights of trees are predicted from dbhob and age. Potential assortment volumes by one centimetre dbhob classes are estimated from regional, compatible volume and taper equations. Merchantability specifications and empirical cull factors are then included in the forecasts of potential production for up to ten years ahead (Box 4). Use is also made of the management record system referred to in Box 3 (an early version of which was suggested by Bennison (1976) but which was developed in its present form by Fickes and Dunn (1980).
Box 5 refers to pre-harvesting inventories carried out on crops which are candidates for felling in the following year. For each logging setting, tree size and defect data are assessed on a sample of about 400 trees. The information collected in this kind of inventory includes measurements of the position and extent of crook, sweep and any other lack of stem straightness, and also a sub-sample of dendrometer readings of upper stem diameters to allow checks to be made of the representativeness of the current volume and taper equations. The size and defect data are then analysed (see Box 6) using dynamic programming to identify the optimum bucking pattern for single stems assuming unconstrained demands for any one log type, and then the DP results from all settings are pooled to obtain through linear programming the best allocation of bucking strategies that satisfies market demands (see Eng, 1982). Remeasurement of matched plots allows checks to be made of the forecasts of stand diameter statistics, while log-scaling and cut-over waste assessments, when added together, are used to calibrate the reliability of the yield forecasting model (Box 7). From the results procured in Box 8, which identifies the determination of the next year’s production, management modelling of the whole resource allows revision of both the short- and longer-term forecasts of output (Boxes 9 and 10) using a combination of generalised mathematical programming models (e.g., Whyte and Baird, 1982) and a simulation model (Garcia, 1981).

The important characteristics of the overall system are: (a) The coherent structure of the individual components, (b) the stand-table type of forecasting of future crop statistics, (c) the use of compatible taper and volume equations, (d) the use of inventory both to derive the yield forecasts and monitor the reliability of each component of the yield forecasting and bucking models, and (e) the recognition of the need to assess defect and its effect on production and utilisation. The bucking model recognises the need for something more than just the “best” strategy for each stand on its own, and so allocates a year’s production on the basis of realistic market constraints.

Extensive use of the bucking model has been made by the consultants engaged by British Petroleum in helping them to estimate proportions of various end-use categories and in guiding them in the design of the handling requirements for various utilisation plants. Box 6 also contains reference to other research studies that have currently been of relevance in evaluating possible utilisation options — e.g., the extent of spiral grain and its
effect on quality of poles and sawn outturn; the frequency and implications of foxtailing; sawn outturn of various end-use categories in relation to size of logs and trees; analysis of past timber sales; and harvest scheduling models.

Much of the earlier data-processing was aimed at programmable and non-programmable calculators after initial development on large computers at the University. This self-sufficiency, although extremely useful in encouraging the participation of local staff, soon became a limiting factor that FPC staff wished to circumvent. FPC staff then started to make use of larger computers in Lautoka and Suva, until the level of contracting became so high that a small micro-computer at FPC itself was justified. Within 12 months of the initial purchase, a second such machine has had to be ordered to cope with the increased demands. Training in the early local calculator systems and, latterly, appreciation courses in computer data-processing have paved the way for routine implementation of FPC's own computers by local, but non-computer specialist staff.

**DISCUSSION**

The design of the inventory and yield forecasting system for FPC was tailored to suit the specific needs in 1975 of the organisation. Although those needs have changed as the emphasis has shifted from purely afforestation considerations and chip sales, towards large-scale industrial manufacture of a range of wood products, the original system is still basically the same; there has simply been the addition of special components which reflect various sophistication factors in the management of resources. The stability of the procedures is important where data are scarce and consistency of information is therefore of great benefit. The early start to designing a system proved invaluable, since the time was then available to put systems in place before there was a compelling need to have data and results in hand. The General Manager’s foresight, therefore, sets a good example for others in his position to take note of and, moreover, to follow.

The inventory and yield forecasting systems were made deliberately labour-intensive to employ as many rural people as possible both in field-work and in data-processing. The sound educational background of the Fijian staff together with the gradual build-up in sophistication of techniques has allowed local staff to run the routine work most competently and attain a
standard of management servicing that is at least on a par with forestry firms of that size in both developed and developing countries throughout the Pacific. The present level need not be stretched any higher, but merely consolidated by increasing the number of staff trained to the same depth.

The role played by forestry students in promoting useful dialogue between instructor and trainee should not be lightly dismissed. There are examples in several parts of the world of specialists' recommendations that lie idle simply because there has been insufficient interaction among specialists, trainers and trainees. It is generally recognised in UNDP projects, for example, that what is often missing in implementing recommended procedures is the long-term physical presence of people to explain why things should be done in certain ways (A. J. Leslie, formerly Director of Forest Industries Division of FAO, pers. comm.). The forestry students have provided that type of support to a degree, and involvement in this way may well be the prime reason for the apparent success of this experimental approach.

There have been problems, of course, in that some, but not all of these young instructors have a flair and the patience for the interactive teaching they must do. A few do not find it easy to adapt to a different environment from their own, while others shine more at the research side than teaching (and vice-versa, of course).

There is, too, a recurring problem of a young organisation such as FPC not being able to absorb short-term costs of research like slowing or halting normal production processes to reduce the possible effects of confounding factors during a special investigation. Unless almost instantaneous savings can be guaranteed in the long term, there is an obvious reluctance on managers' parts to spend money just on the off-chance of deriving benefits. The most challenging problem, however, is the need to coordinate all aid projects of which the one examined here is but a single example at FPC. It is unrealistic to assume that the existing management alone can cope with co-ordinating research, routine management and training aspects. There needs to be someone who has a foot in each camp and who has a long-term presence in the organisation to ensure that conflict and unnecessary duplication are reduced to a minimum. FPC has appointed, therefore, a Special Projects Manager and also a Training Officer, both of whom have assumed responsibilities for such co-ordination in the future.
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BIBLIOGRAPHY AND REFERENCES


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There have been formal contributions by two other members of the School of Forestry staff but pertaining to different aspects of forest management. For the sake of bibliographical completeness, they are shown below.


