

IS NEW ZEALAND READY FOR STEEP COUNTRY LOGGING?

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ABSTRACT

Over the next decade New Zealand expects to approach an annual timber harvest of 3.6 million cubic metres per year from its steep country plantations. Its steep country logging problems will rise dramatically as well.

In the late sixties the U.S. Forest Service faced an increase in difficulties with the logging of their steep country regions. Their problems arose partly from environmental concerns, partly from economic considerations. Because of these problems, they felt compelled to train over 500 logging specialists and institute better harvest planning into the management of their forests.

This paper discusses the U.S. Forest Service Logging Specialist training programme. Based upon comparisons of annual timber production it suggests that New Zealand should consider its own programme. The comparisons show that New Zealand would need over one hundred trained logging specialists by 1993.

INTRODUCTION

If one asks if New Zealand is ready to harvest large volumes of timber from steep country, the unqualified answer to this question is, of course, no. With little recent experience in steep country logging, few cable haulers, a limited pool of trained people, and few short-wheelbased trucks this answer is expected. It is equally obvious how the answer could change: machines will be purchased and loggers will be trained as the needs arise.

However, given the loggers and equipment, the answer to our question will remain no. The reasons are more subtle. They go beyond questions of physical capability to questions about the ability to harvest properly - i.e. to log steep terrain at low cost and with little damage.

New Zealand will soon have steep country logging problems. This is obvious: in the next decade, the Forest Service anticipates over 15 million cubic metres (N.Z.F.S., 1980) of softwood to be cable logged

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from its steep country regions. The extent of these problems is not obvious, and will not be until this substantial increase in logging begins. New Zealand forest managers can, however, gain some insight into their future from a look north, to the Pacific Northwest (P.N.W.) of the United States, and its recent logging history.

Steep country logging in the P.N.W. is an established tradition. All through this century they have harvested old-growth stands on difficult terrain. One could say they have always had the men and machines for the job, and yet, approximately 15 years ago, the United States Forest Service, for several reasons, found themselves with a near-desperate need for enough logging technology and knowledgeable people to continue harvesting. Put simply, they encountered a steep country logging problem, which by now they have largely solved. Their solution came through training. The extent of their effort is most impressive and should be of interest.

#### A LOOK NORTH, FIFTEEN YEARS AGO

In the early sixties, the U.S. Forest Service found themselves with large stands of valuable, yet economically inaccessible, timber in their Western Region - Washington, Oregon, Idaho, Montana, and northern California. The accelerated pace of logging in the late forties and fifties had brought them deep into old growth forests, up slopes, into rugged steep terrain. High quality saw timber and plywood peelers remained, but, the cost of road construction and maintenance, the low production of cable hauling machines extracting over short spans in steep, rugged country, and, the high cost of transport over long, winding roads were consuming all the revenue. These economic facts, plus the rising tide of environmental concerns (often stimulated by the poor logging practices brought on by the difficult conditions) caused the U.S. Forest Service to consider blocking large segments of these roadless areas out of their productive land base. The timber was there, but, the value was not; the cost of harvesting and transport threatened to render it economically worthless.

In the Western Region during the sixties, there were many logging contractors that could physically accomplish the task of removing timber from the steep terrain. The U.S. Forest Service had come to rely upon them to deliver their annual cut. Most loggers, hungry for wood, brought their equipment and logging methods up from the gentler slopes of the foothills. They had tractors to carve out roads and highlead cable systems to yard logs over short spans. The logs reached the mills, but, the cost and damage of dense road systems became more obvious as time went on.

Other methods were proposed: the long reach balloon logging system was introduced in 1966, some helicopter experiments began soon after, and a number of long span skylines began to reappear. The skylines showed most promise. The reasons were related to increased production rates and a consequential reduction in harvesting cost, but, perhaps most obviously, the longer spans were most attractive --- when a systems' reach is doubled, the accessible area quadruples, the number of landings are reduced proportionally, and road density diminishes as well.

In the mid-sixties, skylines were not common in the United States. They were familiar to some loggers from the history books and had been used to harvest timber in steep terrain all over the world ---

in the European Alps, in Norway, in North America, in Japan, in the U.S.S.R., and in New Zealand as well. The earliest systems appeared in the late 1800's soon after the inventions of wire rope and the single drum steam donkey. Literally hundreds of different systems have operated over the last century, each with some unique arrangement of spar poles, anchors, and cables, worked through different carriage and hauler designs. The Cable Logging Systems Handbook (Studier; Binkley, 1978), published first by the U.S. Forest Service, shows several dozen cable/spar pole/anchor arrangements, at least 20 different carriages, and mentions over 60 haulers. Each of these systems had worked and several had been substantially improved by advances in hauler designs. In 1966, the logger was left to decide which worked best, or, as often happened, ignore them and proceed with business as usual.

Many U.S. Forest Service managers recognised quickly that skyline systems can work well. In most steep country logging conditions they out-perform the simpler highlead system, if their set-up is planned and properly laid out. (See Note 1). Generally, a proper skyline operation will always minimise the cost and environmental damage to steep country logging.

In the late sixties, several things changed the U.S. Forest Service policy towards forest harvesting and the role it would play in planning harvesting activities. First, Forest Service managers recognised that they could no longer depend upon their logging contractors to use the latest and best logging technology and methods. Put most simply, the loggers' incentives did not always coincide with those of the land manager. Second, they recognised that their organisation lacked the expertise to decide and dictate which logging methods should be used, and where. Finally, and perhaps most importantly, the U.S. Congress passed the national Environmental Policy Act of 1969, which instructed all federal agencies to introduce a systematic, interdisciplinary approach in their planning and decision making.

In 1969, the U.S. Forest Service began immediately an internal programme designed to train eventually a large number of "logging specialists" --- employees equipped to plan and make decisions about the harvest and transport of their forest resource. They began also to fund more research into steep country logging techniques and to co-sponsor a series of Skyline Symposia to transfer the results of training and research to the logging industry at large.

I believe it worthwhile to review the past decade of the U.S. Forest Service activities for the benefit of the New Zealand forest industry. New Zealand will soon enter its first decade of extensive steep country logging; a decade that could see an early end to steep

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Note 1: The author does not intend to make a sweeping condemnation of highlead logging. They are not always less productive and more costly; in some cases the opposite is true. Many variables affect production and overall cost. For some comprehensive studies, see Dykstra (1975), Wellburn in the 3rd Skyline Logging Symposium (1976), and Nagy in the 4th Skyline Logging Symposium (1980).

country logging in the midst of costly mistakes, leaving many of its exotic forests economically inaccessible, or, a decade used to build an infrastructure of knowledgeable logging planners, loggers, and equipment prepared to deal with the future. The U.S. Forest Service continues to harvest its steep country forests. New Zealand has yet to find out if it can.

#### A LOOK NORTH, TODAY

Each year, through the beauracracic machinery of the U.S. Department of Agriculture and Congress, the Forest Service is handed an "allowable cut". Most recently this figure has been approximately 30 million cubic metres for their Western Regions; it was nearly the same in 1970. The Forest Service endeavours to sell this volume to logging contractors or mill owners, who are then responsible for all stages of felling, harvesting, and transport. The Forest Service\* does not own or operate logging or milling operations. However, they do plan and locate timber access roads and harvest units, and specify the harvesting systems to be used and details about their layout.

In 1969, the U.S. Forest Service did not specify the harvesting systems or layout; the Congressional requirements for cut were met by merely outlining the timber to be harvested. As mentioned earlier, the systems then were predominately highlead and tractor. Very little skyline yarding was done, certainly less than a few percent of the volume.

By 1978, the picture had changed considerably. Donald Studier, a Forest Service Logging Specialist, presented Table 1 in a report to the Northwest Skyline Symposium (Skyline Logging Symposium, 1980). In the same report he estimated that 200 cable haulers were at work in Oregon/Washington, 140 in Idaho/Montana, and 60 in northern California. All were operating on Forest Service sales that were designed, laid out, and periodically inspected by U.S. Forest Service logging specialists.

The transition from solely highlead extraction to this mixture of highlead, skyline, and some helicopter logging took approximately one decade. Many loggers, particularly those originally content with their highlead methods, will not remember it as a pleasant period. The Forest Service forced the transition. It was not easy, since, in the beginning, they knew little about skyline logging. Their logging planners, by and large, learned all they knew about skylines, harvest planning, and layout through special, Forest Service sponsored, training programmes. By policy, plans, and recommendations alone, they brought an entire industry around to pursue a new technology.

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\* The U.S.F.S. is a heirarchy organised much the same as the N.Z.F.S.: they are structured downward from a Head Office in Washington, D.C., through Regional Offices, Forest Offices, to District Offices. Their Western Regions employs approximately 16,000 people.

TABLE 1 : TOTAL HARVEST FOR U.S.F.S. - WESTERN REGIONS  
CUBIC METRE\* PRODUCTION BY LOGGING SYSTEM

	Volume (Million m <sup>3</sup> )	Percent by System			
		Skyline	Highlead	Tractor	Helicopter
Oregon/Wash.	19.3	36	24	37	3
Idaho/Mont.	8.1	20	5	70	5
N. California	5.6	27	33	37	3
<b>TOTAL</b>	<b>33.0</b>	<b>31</b>	<b>21</b>	<b>45</b>	<b>3</b>

Source : Donald Studier, U.S.F.S., reporting to Northwest Skyline Symposium, (Garland, 1980)

\* Note : Studiers' boardfoot - Scribner scale volumes were converted to cubic metre volumes using the conversion,

$$\text{CUBIC METRE LOG SCALE} = (4.3) \text{ MBF SCRIBNER LOG SCALE}$$

See Conversion Factors for the P.N.W. Forest Industry, Hartmen, et.al., Institute of Forest Resources, University of Washington, Seattle, Washington, 98195.

#### THE TRANSITION PERIOD : TRAINING THE LOGGING SPECIALIST

##### Forest Engineering Education in the U.S.

A university-educated logging specialist is known in the United States as a forest engineer or logging engineer. Generally, he or she is a forester who has specialised in harvesting. The U.S. Forest Service began their programme to train logging specialists against this traditional background of education, and therefore, it is appropriate to review briefly the situation they encountered.

In 1974, 50 institutions were recognised as meeting the Society of American Foresters' standards for professional forestry instruction. Of these, only seven offered programmes in logging or harvesting. Forestry schools the world over share this lack of attention to harvesting; the U.S. is no exception (nor is New Zealand). It seems that many believe that if enough attention is paid to the traditional subjects of forestry --- inventory and appraisal, management, protection, processing, marketing, and the likes --- the harvesting problems will go away. When it comes to harvesting, foresters often turn their backs and hope the loggers will accomplish the messy business at least cost and with minimal damage. When one considers the total cost of harvesting as a percentage of the total cost of bringing wood from the nursery to the market, the slight attention paid to harvesting by educational institutions and research organisations has always seemed irrational, if not ludicrous.

In 1975 a study sponsored by the National Academy of Sciences/National Research Council documented the situation in the United States (Boyd et.al., 1977). Tables 2 and 3 are from that report. This distribution of effort had existed for decades, and, with few exceptions, it is much the same today.

TABLE 2 : RESEARCH ACTIVITY IN FORESTRY FOR  
THE PUBLIC SECTOR, 1974

Research Programme	Scientist man-years
Forest engineering systems	20
Inventory and appraisal of forestry resource	70
Timber management	355
Forest protection	316
Processing and marketing	298
Forest watersheds, soils, and pollution	153
Forest range, wildlife, and fisheries	83
Forest reservation and aesthetics	42
Alternate land uses	22
Technical assistance	2
Total forestry	1,361
Total programme in agriculture and forestry	10,611

Source : U.S.D.A., 1974.

TABLE 3 : GRADUATES OF FORESTRY SCHOOLS BY  
ACADEMIC DEGREE, 1974

Graduates and major discipline	B.S.	M.S.	Ph.D
	-----Number-----		
Graduates	3,969	691	142
	-----Percent-----		
Major discipline :			
Forestry	59.2	54.1	54.9
Wildlife	14.6	20.0	12.0
Products	5.4	6.7	14.8
Recreation	11.7	7.1	2.8
Other categories	9.1	12.1	15.5
	100.0	100.0	100.0
Specialty :			
Forest engineering	2.0	1.3	.7

Source : Personal communication, Richard Vasey, associate professor at Virginia Polytechnic Institute and State University, Blacksburg, compiler of the annual summaries for all schools reporting to the Society of American Foresters.

Of the seven U.S. forestry schools offering a harvesting programme, two of the strongest are in the Pacific Northwest at the University of Washington and Oregon State University. Their departments of forest engineering were initiated during the railroad logging days of the early 1900's and today they grant nearly half the total degrees on the subject.

The forest engineering programmes of these institutions has always been strong in quality but inadequate in number of graduates. This became apparent to the U.S. Forest Service in the early 1970's. When they made their policy decision to establish a cadre of logging specialists, they found few who qualified among their foresters or engineers. Eventually they recognised the need to educate their own.

#### Forest Service Education of Logging Specialists

In January of 1969, Oregon State University, with co-sponsorship from the University of Washington and the Forest Service, held the first of what would become a series of Skyline Logging Symposia (1969). There were 28 speakers: 17 from industry, 3 from academia, 8 from the U.S. Forest Service. Most speakers talked about the

economic and environmental needs for better planning, design, and layout of harvest areas. There were over 600 attendees for three days of lecturing. Most of the attendees recognised that the steep country logging industry was on the verge of change.

At this first symposium, U.S. Forest Service top management met with academics and revealed plans for two training programmes designed to satisfy their perceived need for logging specialists. One would be called the Advanced Logging Systems Training programme; the other, the Forest Engineering Institute. Both were to be funded by the U.S. Forest Service. Both exist today and still are very important to their Timber Sale Layout and Harvesting programme.

#### The Advanced Logging Systems Training Programme

This programme began in mid-1969 when five people, all experienced in either Road Construction or Timber Sale Layout, were seconded to the U.S. Forest Service Engineering Research Station in Seattle. They were expected to spend two years with researchers there while studying at the University of Washington towards a graduate degree in engineering or forestry. The plan was to educate a nucleus of logging specialists to staff their Regional Offices and some of the larger Forest Offices. In time, these people would then train and supervise a larger organisation of logging specialists that would eventually extend to every District Office.

The goals and structure of this programme was the subject of another Symposium paper, presented in 1976, by John Sessions (Skyline Logging Symposium, 1976). He outlined the course as it is now offered at Oregon State University. Students follow a full academic year in subjects related to harvesting (e.g. photogrammetry, economics, surveying, logging methods). They become familiar also with an extensive range of computer-based planning tools, most of which were developed by the U.S. Forest Service. A second year in this programme emphasises practical experience where the student receives on-the-job training, under an experienced planner, in the U.S. Forest Service or industry.

An evaluation of this programme was completed in May, 1981 (Nordwall, 1981). By that date, 38 employees had completed the two year course; ten others were currently enrolled. Thirty of the graduates were still with the U.S. Forest Service. Most of them run training seminars, advise, and supervise the larger organisation of on-the-ground planners who are trained by the Forest Engineering Institute.

#### The Forest Engineering Institute

By 1973, thirteen logging specialists had graduated from the Advanced Programme and were located in Regional or Forest offices, busy structuring the U.S. Forest Service plan to improve its steep country logging. Another Skyline Logging Symposium (2nd) was held in January 1974. Nineteen speakers discussed the advancements in skyline logging operations, equipment, and planning; again, over 600 attended. The Forest Service's promotional programme was in place. It was time to fill their organisation with trained people who could implement the programme on the ground. The Forest Engineering Institute was formed to fill this need.

The Institute began with a ten week, 40 hours per week, training



programme of lectures and practice in on-the-ground, harvest unit planning and layout. The Institute, on the Oregon State University campus, now offers two to four ten-week sessions per year. Nearly 600 trainees have graduated from this course since it began in 1974; 476 were U.S. Forest Service employees, others were from state or private industry, four were from New Zealand.

#### SUMMARY

In the context of forestry, when one crosses the equator from the P.N.W. of the U.S. to New Zealand, one crosses a cultural boundary as well. A large part of P.N.W. forestry is still dominated by old-growth timber. For decades, industry has harvested large logs, with cable equipment, from steep terrain. They have faced many logging problems, and by now have trained the people, and developed and promoted the technology to deal with these problems.

New Zealand, by contrast, is a tree-growing country: your recent experience and expertise is in establishment, tending, and protection. Today, New Zealand has very few steep country logging problems. Tomorrow promises a change. By the early 1990's many of New Zealand's steep country "new crops" will mature. These are plantations, not "old growth". The roads and landings do serve a continuous establishment and tending purpose. However, if these forests are to contribute to New Zealand's annual cut, current problems will suddenly pale in the light of the increased number of harvesting and transport problems.

In this brief article I allude to the large effort put forth by the U.S. Forest Service, as a forested-land owner, to build the infrastructure which has helped them remain competitive as a timber supplier. I have indicated only the magnitude of their effort - research, symposiums, and over 500 trained specialists in less than a decade. More details on this effort lies in the literature cited.

The most comprehensive summary of the logging specialist training programme is the evaluation by Paul R. Nordwall (1981). His review outlines the training objectives, the approach, cost, successes and failures of the programme. The training cost has stabilised near 1/2-million U.S. dollars per year, excluding salaries, and, Nordwall concludes that the programme is successful and necessary. His report projects a five-year plan for ten Advanced Programme graduates and 100 Forest Engineering Institute trainees per year.

In 1980 the U.S. Forest Service managed a harvest of near 17 million cubic metres by skyline and/or highlead logging methods. They employed 500 logging specialists for the task --- 30 specialists for every million cubic metres of annual harvest. By 1993, a decade from now, New Zealand expects to harvest 3.6 million cubic metres of timber per year from their steep country regions (N.Z.F.S., 1980). Should the New Zealand Forest Service structure an organisation of 108 harvest planners, and, begin now to train 10 to 12 logging specialists per year to implement it? The history of one forested-land owner would suggest that they do.

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