

# What can forest engineering do for forestry in New Zealand?\*

Dr. Rien Visser<sup>1</sup>

I recently had the opportunity to enjoy a 4 month sabbatical at the School of Forestry, Canterbury University. On various occasions I was confronted with the question - "what is a forest engineer?" This was not just from students contemplating joining the program, but also from current students intrigued by future employment opportunities. In addition, the Institute for Professional Engineers NZ (IPENZ) panel, evaluating all the engineering programs at Canterbury University, was seeking (and found!) justification for having an accredited forest engineering program.

Historically the 'Forest Engineer' was typically the person in charge of all engineering and operational aspects within a forestry company - a quite senior position. Duties could include designing and laying out roads and or railroad networks, supervising the construction of bridges and buildings, earth work projects including development of quarries, surveying land boundaries, as well as modification of mechanized equipment to serve in the rugged forest environment. You could say the forest engineer's heyday was back at the end of the 19th Century when large tracts of forest land were being opened up, wire rope had just been invented, motorized equipment came on the scene, and the demand for timber seemed insatiable.

Most forested areas in developed countries are now well networked with roading infrastructure, GPS and GIS allows most people to accurately engage in map / surveying work and nearly all forestry equipment is bought 'off the shelf' from equipment dealers, with modifications for specific needs served by 'clip-on' attachments. Bridges construction is left up to the civil engineers, and designing sawmills done by mechanical and industrial systems engineers.

So this begs the question, what is the role of a specialist 'modern' forest engineer? What differentiates a forest engineer from a 'forester' (with a Forest Science degree), or from a civil engineer? And perhaps more importantly, considering New Zealand does not really seem to have many active roles and or people designated as forest engineers, do we really need them in a modern forest industry?

To suggest that forest engineering is simply the interface between forestry and engineering would be an

<sup>x</sup> Note: This is also a Refereed Paper.

<sup>1</sup> Rien Visser is a New Zealander who in addition to his Engineering degree from Canterbury, he has a Masters of Engineering from the University of California, Davis and a Doctorate in Forest Engineering from Austria. His experience includes 4 years with the NZ Logging Industry Research Organization. He has been working at Virginia Tech in the USA since 2000 as an Associate Professor in the Department of Forestry.



Figure 1: 'Yarder on rails'; prior to common availability of bulldozers to make roads and trucks to transport timber, forest engineers designed extraordinary harvesting systems to extract timber in steeper terrain.

over simplification. Their real strength is in their analytical ability and problem solving skills, based on core engineering principles, coupled with a strong understanding of complex operational and management systems within the forest industry. Table 1 shows a simple list of typical 'tasks' a forest engineer should thrive on. It should be noted that forestry students also receive a good grounding in many forest operational aspects.

To answer the question "what can Forest Engineers do for NZ forestry?", I think it is appropriate to review recent costly failures within the NZ industry. Selling deficient structural timber is perhaps the most recent example - albeit manifesting itself mainly within one company. However there have been common problems that have impacted many or most companies. Examples include



Figure 2: New machines, such as the walking harvester Plus-Tech shown here, is an innovative design to overcome problems with rough terrain. Although the machine is functional; its cost-effectiveness is far from proven.

contracting out harvest planning without being able to define expected planning standards, setting up key-supplier type programs on a cost-plus basis, failure to understand logging cost drivers in a free-market system, adopting new measurement technologies without fully understanding implementation or opportunity costs (e.g. log making using electronic calipers, on-site log grading using sonics). All have artificially and unnecessarily raised the average cost of harvesting. All of these issues have a common theme; they all fall well within the definition of what we expect a forest engineer to do.

Back in the early 1990's forestry companies still directly employed a staff with a comprehensive range of skills. Recognizing that a forest engineer could find many opportunities and make valuable contributions, many companies actively supported the initiation of a forest engineering program. New Zealand has been running a Forest Engineering program at Canterbury and Lincoln Universities since 1991. Set up at a time when forestry was booming, it was based on civil and mechanical engineering courses, along with the appropriate forestry courses, to make an acceptable program. The program was quickly accredited by the IPENZ, giving the program a high level of credibility.

The out-sourcing craze that swept the industry at the end of the 90's (another mistake - but this time clearly a business management problem) meant the freshly graduating forest engineers struggled to find a 'home'. Overall, the 'new' industry has failed to embrace the specific role of a forest engineer. Some larger consultants retained the services of forest engineers, but most logging contractors are simply still too small to afford the luxury of an in-house engineering specialist.

So forest engineers typically compete with foresters for a job, or many have found their skills welcome in the broad and currently thriving field of civil engineering. This is perhaps not bad for the individual - but I would suggest it has been disastrous for the forest industry as a



Figure 3: Harvester on-board computers can capture large quantities of data: but can we effectively use this information to out-perform the rugged dependability of feller-bunchers?

whole considering the example industry wide 'problems' listed above.

It's a 'free world' and we can't force forest engineers on the industry. It's the old adage that you first need to admit that you have a problem before you realize the need to seek help. The industry needs to learn to recognize forest engineering problems and understand what forest engineers can do for them. Perhaps this article goes a small way towards that goal.

Table 1: Defining the role of a forest engineer using examples.

#### Specific Forest Engineering skills

- Mechanics of machines (design, improvements, attachments)
- Harvesting systems (options, evaluation, optimization, costing)
- Operational management (system design, time studies & evaluation concepts)
- Forest roads / infra-structure design (roads, bridges specifications, costs)
- Forest operations' impacts (stand damage, regeneration impacts)
- Due diligence on new technologies (data capture, analyses, system implementation)
- Bio-energy (biomass production, storage, conversion)
- International forestry (practices in other countries, comparisons)
- People / workforce management (safety, ergonomics, safety systems)
- Surveying (boundaries, roads, stands, buildings etc)
- Transportation (logistics, networks, optimization)
- Value recovery (wood quality, conversion, optimization)
- Strategic, tactical and operational harvest planning
- Forest Certification (SFI, FSC, ISO etc)
- Forest watershed management (impacts of harvesting, stream crossing design)
- Contract management (economics, legal aspects)