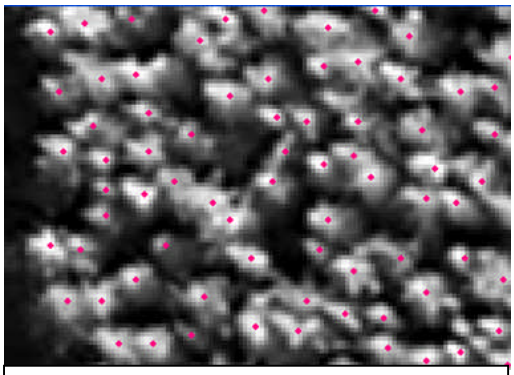
Forestry Software Solutions

A Scion Impact Statement 2007

Software development has been a major means of technology transfer at Scion for several decades. This has seen scientific modelling processes delivered as standard tools on the computers of most forestry companies in New Zealand and Australia.

When yesterday's forester went to perform a stocktake in his forest he was likely to be armed with a compass and tape measure. Today's forester is more likely to be armed with a mobile computer equipped with GPS, in fact he can complete half the job in his office by running tree recognition software over satellite imagery, as shown right.



Tree counting from space using tree recognition software

New Zealand is recognised internationally as a leader in plantation forestry and Scion has provided the underpinning science that helped develop that reputation. It has played a pivotal role in effecting the changing nature of forestry, taking it from a hunch-based decision making approach to a scientific process. Business decisions such as what genotypes to plant, the optimal time to prune or harvest, and the likely value of the harvest are based on reliable data and proven models that take into account the natural variation that occurs in forest growth.

Electronic data capture in the field

A key aspect of Scion's contribution to precise forest management has been it's investment in software development. For over forty years Scion has packaged its scientific data and knowledge into software that has been used throughout the industry for data management and to support decision making. As an example of the impact of Scion's software, foresters throughout New Zealand and Australia typically talk of "MARVLing" their stands; MARVL was a forest assessment software tool developed in the 1980s, and has since been superseded by more modern tools, but the name and concepts are still in common use. One forestry consulting firm even features "MARVL" on the number-plates of their vehicles.

Software developed at Scion is used in almost every forestry company in New Zealand, and accompanying manuals are to be found on nearly every bookshelf. In a recent industry review conducted by Alphametrik[1] forestry companies considered that the value these systems have added to their businesses over the last five years exceeded $80 million. The review surveyed

[1] Value of Forest Management Research: A survey of industry Andres Katz 5 March 2007.

fifteen major forest owners, representing 52% of New Zealand's plantation forest area.

Defects due to branching

Although New Zealand plantation forests are dominated by a monoculture of radiata pine, there is a surprising level of variation in the form and quality of trees, even within a single stand. Factors influencing this variation include genetics, aspect, altitude, soil type, climate, exposure to wind, as well as silvicultural practises such as how a stand is planted, thinned or pruned. Characteristics that determine the quality of the resulting timber include wood stiffness, which affects suitability for structural applications, the occurrence of branching, which affects the suitability for appearance products such as furniture and veneer, and less visible properties such as cell wall structure which affects the likelihood of lumber to twist or distort as it dries. With log prices varying from $128/tonne to $45/tonne depending on such qualities, accurate prediction of quality and quantity is critical to forest owners in making decisions impacting on the value realisation of their forests.

Forest growth data has been collected and managed at Scion since the 1920s, and during the 1980s this data was used to develop a series of sophisticated models of forest growth and behaviour under various conditions. Many of these models are still in use, and new ones continue to be developed. These models have been integrated into decision support applications which predict the likely yield and quality of logs under various tending regimes. Economic models were also incorporated in these systems so that forest managers could assess the economic impact (costs and returns) of the various management options.

In parallel to the development of decision support software, Scion has also been active in the development of forest management software. In the late 1980s when control of the NZ Forest Service estate was taken over by the new SOE: "Forestry Corporation of New Zealand", Scion was commissioned to develop database systems to maintain the operational information required for the management of this asset. The resulting system was used for nearly ten years until the Corporation was sold to Fletcher Challenge. This period also saw the emergence of geographical information systems (GIS) enabling stand and operational history to be displayed in a spatial context. This database application provided the foundations for a range of forest management systems that have since been developed and are now used by the majority of forestry companies in New Zealand, and increasingly in Australia.

Once, forests were simply a source of wood, now they are also a means to stabilise land, improve air and water quality and sequester carbon. Increasingly they are a tangible asset used to underpin significant investments both by the public and the corporates. According to the Alphametrik review, companies reported that the software systems produced at Scion led to: higher allocations of their global forest investment funds to New Zealand, smaller risk premiums in their discount rates thereby improving the value of their forestry investments, and it allowed them to be less conservative in their cash flow projections. It also assisted them in identifying management regimes with improved cost / benefit ratios.

A new structure for software development

Up until 2002, software developers were scattered throughout Scion, working within the science groups with Government funding to focus on the specific software needs of each group. This left developers and their applications to work largely in isolation. At this time Scion gathered the developers into a single business unit, branded as ATLAS Technology, and broadened their focus from supporting science units to supporting the industry. Their aim was to develop a new generation of software tools, based on the experience of the earlier systems, but now within an integrated architecture so that products relating to different stages in the forestry value chain

were able to communicate with one another. The other significant change was that the funding was primarily sought from industry, and as a consequence industry became much more involved in the development process. This ensured that new product development was focussed on the needs of the industry, yet being based within Scion; the team also maintained an active link with its FRST funded scientific roots, enabling new scientific developments to be incorporated into the software.

The new suite of ATLAS products has been widely adopted throughout New Zealand and Australia, generating nearly $8 million in commercial sales over the past five years. It has provided better efficiency for clients, because as the products communicate together better, so too do the people using them. A classical example is that forest growers and harvesting groups are now sharing a common system, and those divisions that historically worked independently are now much more aware of the activities of the other group. This increases the value of the data they collect, and reduces the incidence of errors because both groups have better information. In the Alphametrik review, industry estimated that the value of improved efficiencies is worth approximately $7 million p/a.

The ATLAS systems have also played a major role in the currently dynamic forest ownership arena, since there has been a heavy emphasis on due diligence by potential owners, and these systems have provided the accurate descriptions of both the current estates, and their potential for income generation. This in turn has provided confidence in the industry when significant decisions can be based on sound data and processes.

The ATLAS systems grew out of an intimate association of Scions' science teams with the forestry industry and were funded through Government and industry investment. ATLAS is now a fully commercial business providing and supporting market critical software systems, but most importantly it provides a vital interface between the high risk science funded by FRST and the sector, ensuring that value can be created and captured.