Using science to inform the place of forestry in the landscape

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In this paper, a brief review of the past history of commercial plantation establishment is compared with the situation now. It is suggested that barriers to strengthening the industry relate to domestic structural economics and public and political comprehension not just biological or technical productivity. A case is made that –

- New Zealand has 10 million hectares of economically underperforming rural land
- Returns on capital from plantation forests are on average higher than for much of our pastoral land. In terms of contribution to GDP, forestry per million hectares occupied has been producing between 161 per cent and 231 per cent that of pastoral agriculture
- Expansion in deployment of private capital in commercial plantation forestry is very much constrained by matters of public policy
- Science has already told us much about the role of forestry in the landscape, but it is science which integrates economics and enables full assessments of public and private benefits that is needed for change
- New policy instruments are needed which address questions of how to avoid penalising the provisions of ecosystems service, how to ensure economic consequences of ecological performance or non-performance is efficiently and fairly distributed to cost and revenue streams, and how to use evolving science to effectively and efficiently reintroduce native biodiversity and productive system resilience across our lowlands.

Background

Historically, commercial plantation forestry has been through numerous cycles of expansion, often related in some fashion to a crisis of policy or land management. Arguably this started at the very beginning of this country's plantation forest history with the recognition that our native forests were exhaustible.

The formation of the Forest Service in 1919 saw the first solid efforts to define and create what was appropriate in the landscapes and societies of the day. Aided by the years following the Great Depression and large tracts of land deemed wasteland not suitable for agriculture, the first plantations forged ahead. Successive employment constraints, the success of radiata in a variety of sites and recognition that forests of exotic species could be used to provide other services to society led to further expansions into new regions and on to threatened sand dunes and eroding eastern sedimentary hill country.

Those early initiatives were supplemented by the early calls for private investment into Perpetual Forests (later NZFP), and regional development strategies in the 1980s. In recent times it was only in the aftermath of the early 1990s log price spike, when agricultural land prices were relatively low and latterly in response to the Emissions Trading Scheme were new forests planted for a strictly commercial end. Over the bulk of that period, the operating environment for this industry has been one of relatively static or declining real log prices and increasing costs including land costs. As financial signals incentivised dairy conversion and government policy flagged a desire and preparedness to use forests as the cheapest offset solution to New Zealand's carbon intense economy, wastelands or steep lands were again edging into the spotlight as society's idea of where forests should rightly be.

Do we know our place?

With little recognition of the increasing costs of production, the attraction of lower cost steep lands for planting and achieving other objectives such as erosion control has been seen by some as a possible future for forestry. However, the production costs in these often back country forests, and recent rounds of well publicised debris flow associated with steep land areas over the last five years, has created a relatively high level of public disquiet about the value of commercial forests and forestry in the rural landscape.

The forests have grown, so too has a whole generation who have little recollection or knowledge of the extent of erosion arising from the previously forested steep lands subsequently cleared for pastoral development before re-afforestation occurred. Over the intervening years, the risks arising from increasing population and production development pressures on adjacent, apparently stable lowland areas have often been ignored. Regional plans produced under the RMA have recognised steep land erosion hazards from an erosion and water quality perspective, but district plans have not translated those hazards into risk recognition for development of flood plains.

Forestry has been seen to create reverse sensitivity to the arriving or intensifying lowland users, not the other way around. Past images of inundated farms and houses, aggraded river beds and destroyed infrastructure over wide ranging areas have been replaced by vivid images and equally colourful press coverage attributing localised modern day events to a broad based problem with forestry. So the question remains, if forestry cannot compete on good land, is not cost effective and a problem on the difficult land, what is the future for forestry in New Zealand?

The extreme of the private view as espoused in the Gisborne newspapers this year suggests that in at least some parts of the country, some New Zealanders still hold tightly to the notion that our pastoral enterprise must remain inviolate. That pastorally dominated landscapes are our backbone and remain our future as the best solution for New Zealand Inc.

This sense appears to be not without some official sanction given a recent document prepared for the Ministry for Primary Industries (2013). To be fair, this report looking at options for the future development of under-used Maori land, described long time horizons and the problem of negative cash flow until harvest as reasons why they had not considered forestry for Maori. What they had considered and documented however, was that the only appropriate land use on substantial areas of class VI and VII land was pastoral drystock agriculture. This is the same land that the long-standing Land Resource Inventory describes as unsuitable or severely constrained for pastoral use.

It would be easy to conclude therefore that as an industry, forestry had little future. It is caught between the pincer of dairy intensification and public opprobrium over the use of hill country.

A place at the table

If the prognosis is poor for forestry, what is the situation for the current occupants of that land? An analysis of model farms financial data, derived from surveys run and managed by both MPI (2012) and Beef and Lamb NZ (2011), give a grim story. Over the last 10 years, drystock farm profitability on land that approximates Class VII, VI, or better has been very poor. Returns on capital have fluctuated around zero with a weighted average over the period of just 1.4 per cent.

Concurrently, farm capital inclusive of land values has ranged between $6,000 and $8,000 a hectare. Forestry, with disciplines strongly exercised by overseas investment capital, continues to try to meet expected returns of around eight per cent after tax. A similar hurdle applied to drystock pastoral land would see values more in the range of $1,300 a hectare.

Table 1: Hill country drystock farm model financials

	Range	10 yr average
Return on capital	-0.7% to + 3.5%	1.4%
Farm capital values per hectare on current returns	$6,000 to $8,000	$7,000
Farm capital values per hectare at 8 per cent equivalent return on investment	-$1,000 to $3,200	$1,300

Hargreaves et al (2010) noted that 'Although land prices had corrected somewhat there is still an underlying structural problem with farmland values as the New Zealand taxation system encourages farmers to accept low capitalisation rates in exchange for tax free capital gains'. Others, Aitken (2011) and Gawith (2010), have also noted this problem.

So does it matter? Forestry might be a big industry, the third biggest exporter in 2012, but if it cannot compete then it does not deserve a place at the table and we should move resources to those areas that can compete. The problem is that it is competing very efficiently. But few policy makers, politicians, media, the pubic and perhaps even this industry's own have fully recognised it. In failing to recognise this we risk losing an industry which is making an extremely important contribution to New Zealand's economic and environmental performance.

In the GDP league tables, forestry and forest products sit well down at about 30 per cent of the contribution from the combined pastoral agriculture and related food processing industries. But GDP does not necessarily reflect economic efficiency, and it is economic efficiency which has dogged New Zealand's capacity to perform and raise the standard of living of its citizens.

Comparing GPD against the land area occupied gives a surprising result, as shown in Table 2.

Table 2: Comparison of contribution to GDP per million hectares

Pastoral agriculture 12 million hectares	Forestry 1.7 million hectares
2009 – 0.75% GDP per million hectares	2009 – 1.24% GDP per million hectares
2010 – 0.74 % GDP per million hectares	2010 – 1.71% GDP per million hectares

Forestry has been contributing between 161 per cent and 231 per cent more to GDP per million hectares occupied than pastoral agriculture according to 2009 (Treasury) and 2010 (Infometrics, 2012) data. Furthermore, over the last decade forestry almost level-pegged with the pastoral sector in contribution to GDP growth, out-performed it in the two years 2009/10 and 'in 2009/ 2010 forestry was the third largest contributor to GDP growth behind wholesale trade and transport and Storage'. Harvesting at the levels that generate those contributions are still within the long run yield capability of the New Zealand estate if there were no new plantings.

The science challenge

In recent months in a new policy initiative to promote innovation and science, the government has established a set of science challenges covering a range of fields perceived as important to the future wellbeing of New Zealand. One recently announced science challenge has particular relevance to the theme of this paper. There has been much in the media in recent months dealing with pressing problems related to –

- The need to intensify agricultural production, particularly dairy
- The need for irrigation and how to pay for it
- The problems of declining water quality across most lowland environments
- RMA constraints on non-point source discharges of nitrogen, sediment and coliforms
- The failure of the ETS in the light of global market contraction and the criticism of the continued shielding of New Zealand's main emitters, including pastoral agriculture.

The government, clearly and rightly worried about looming environmental limits constraining increasing production from a finite land resource in an economy which remains heavily dependent upon primary industry, have sought to tackle the problem. The science challenge issued was – Research to enhance primary sector production and productivity while maintaining and improving our land and water quality for future generations.

The goal is laudable but it is hard not to get the impression that much of the thinking behind the challenge relates to the tangible problems facing the dairy industry. Based on the simple preceding analysis, is there another challenge? We have 10 million hectares of under–performing rural land. What are the impediments to raising the average return on capital, and achieving that with no adverse effects on the environment?

Start from here

Perhaps we start here. To do so is not necessarily about expensive ground-breaking research into genetics, pasture breeds and nutrient regimes, although that must undoubtedly continue. This challenge is simply about doing far better with what we already have before we also then gain more productivity, more intensity and more value. Part of the challenge has to be how to achieve a better marriage between the biological sciences, economics and the means to convey their implications to the public and policy makers. The problem highlighted so far is not one of constraints in biological or environmental systems, nor necessarily one of market constraint. It is one of structural economics and the policies which societies and their elected representatives choose to follow.

For the rest of this paper, I show examples of some of the research developments of recent years undertaken as part of the Future Forests Research environment theme programme and elsewhere, which have potential to help in solving the second challenge. The examples used are neither solutions nor advocacy in their own right. Their purpose is to illustrate how, with the developments in these areas of science, we can begin to better understand the implications of our current status quo approaches. If we want to achieve fundamental changes and improvement in our primary sector economic, social and environmental performance, we may need to question some of the current culturally anchored assumptions by which we operate.

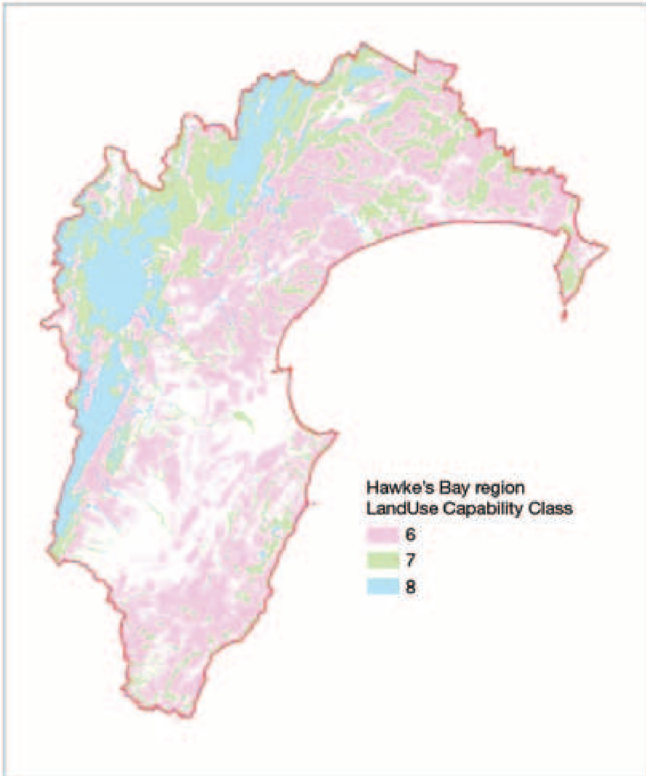

Figure 1: Land Use Class VI,VII & VIII Hawke's Bay

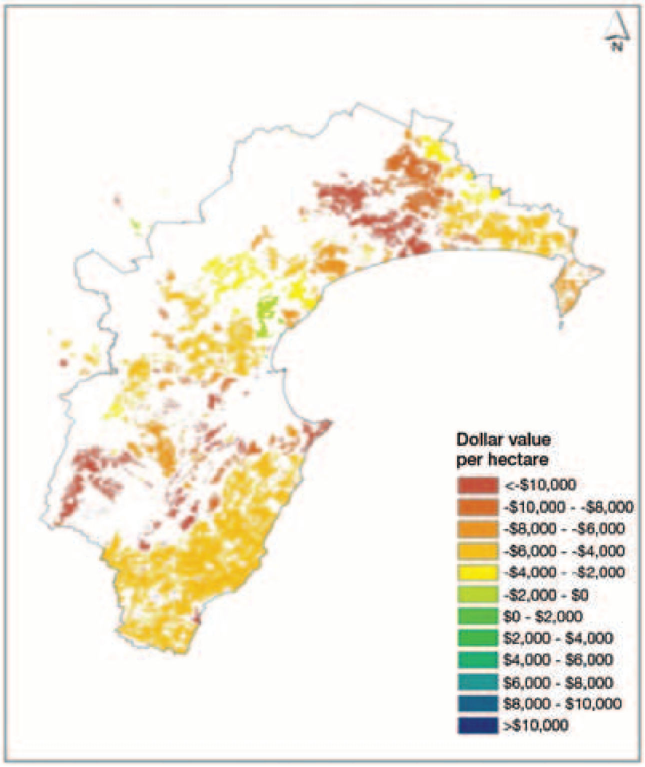

Figure 2: Forestry viability at eight per cent discount

Recent development of a framework for spatial economic evaluation as part of the Future Forests

Research programme has enabled some sense of the effect of this structural economic distortion to be evaluated. The model Forest Investment Finder currently provides coverage for class VI and VII land. This land, subject to other filtering constraints such as conservation land, steepness and climate, is able to determine the land expectation value of land which might be available for forestry. The model incorporates site specific productivity, projected grade out-turns, infrastructure build and operational costs. It finally applies discounted cashflow analysis to determine land expectation value, and subtracts from that land values as derived from Quotable Value NZ to indicate the probable viability of forest growing on such sites.

Testing this capability in the Hawke's Bay region, selected because of a large proportion of better class VI land, it is clearly demonstrated that forestry viability as we have come to understand is not good. Little or no land could be expected to be commercially viable in this region.

Using data from the farm models that reflect much of the land in this region, farm capital values were imputed for a return equivalent to the eight per cent that might be expected from investment analysts. The implications are significant. There are substantial areas, as shown in Figure 3, which would be capable of supporting an economic case for forestry. Much of this land is class VI where with cheaper roading and harvesting, local processing and roading infrastructure with an export port servicing the region, the potential is strong.

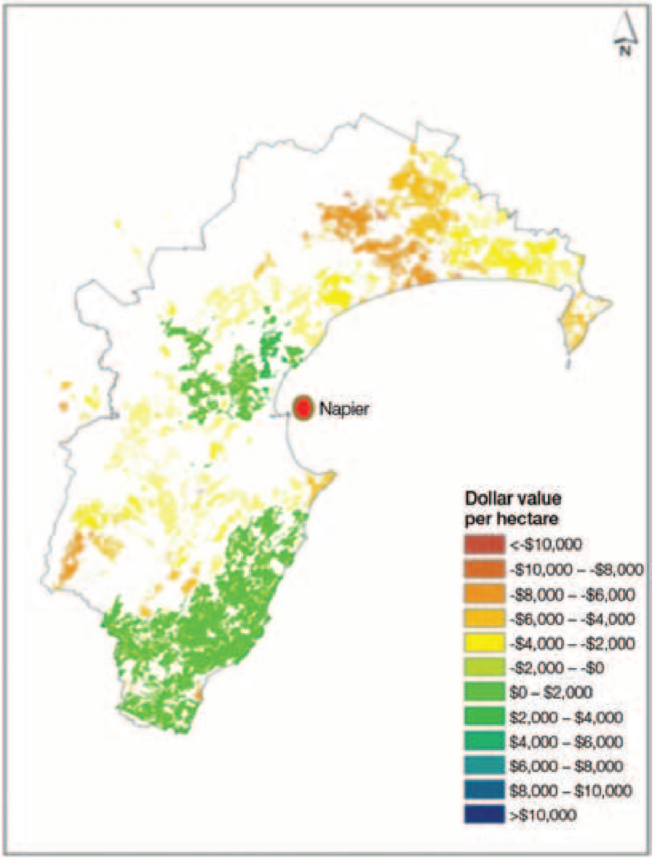

Figure 3: Forestry on imputed farm land values

Sensitivity analysis using the model confirms the normal understanding among foresters that land value is one of the greatest influences on the viability of new forests. This analysis illustrates that point and that in many cases, when operating to the same normal commercial returns, forestry would be more profitable than the current land use and based on the preceding analysis, capable of contributing more to GDP than the current use.

It looking beyond timber

If one significant impediment to a viable forest industry is a structural economic problem, how else are the ramifications of that represented across the landscape. The modelling framework, under the same set of base assumptions in the Gisborne region, is able to demonstrate what might be economically rational when other services are priced into the model.

As in Hawke's Bay, at current rural land values and a timber only regime, no land is going to meet commercial forestry hurdle rates. At a very modest $10 a tonne carbon dioxide equivalent, the added potential is only about four per cent of the available land area clustered inland and around the Gisborne port hinterland. Looking again at what happens if current land use was operating to the same commercial strictures as the forest industry would like, we see a

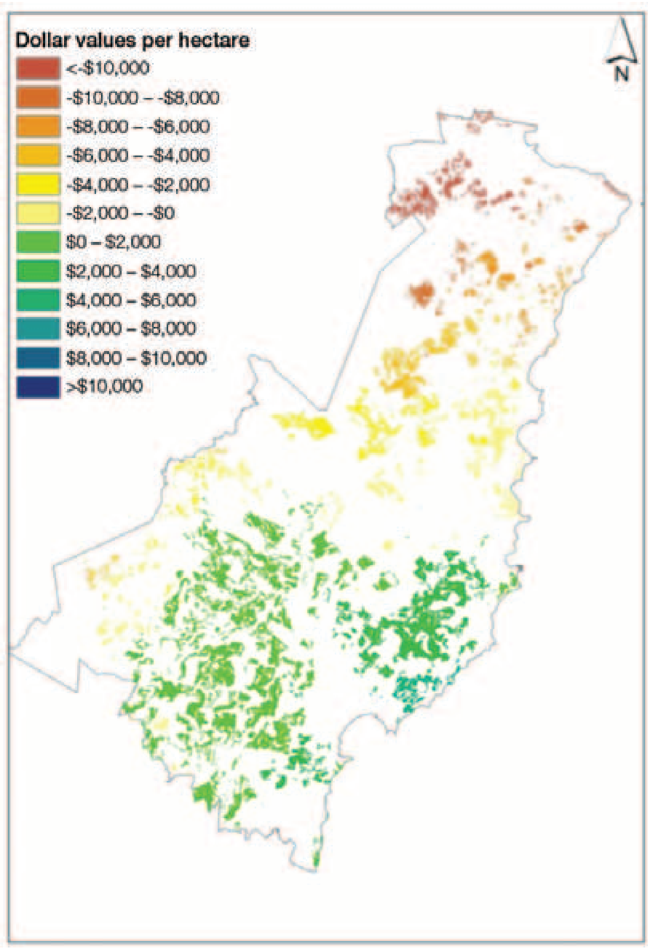

Figure 4: Forestry on imputed farm land values plus $10 a tonne carbon equivalent

potentially viable land bank rise substantially to 21 per cent of the class VI and VII pool. Add in the modest $10 a tonne carbon dioxide equivalent as in Figure 4, and the proportion rises 64 per cent or 139,000 hectares of eroding hill country land in this region, still in a rational radius of the export port.

Whether the ETS has failed, whether carbon mitigating technologies will outstrip economic and world energy demand or whether a European recovery added to Asian growth will at some point outstrip the available means of carbon offsets causing a significant increase in the price of carbon, is a different discussion. What is clear is that if a carbon intensive economy such as New Zealand's needed to hedge its future carbon liabilities, it could potentially be achieved at relatively little economic cost to the tax payer or carbon emitter if land was valued at its true commercial worth. If the reverse applies, carbon mitigation may be much more expensive for the general taxpayer and may be much more dependent on technologies of unknown cost and viability not yet well integrated into our economy.

Other science and values in the landscape

We know science has for some time been providing insight into other main services from forestry. Carbon sequestration, being directly related to biological growth and a market price is relatively easy to model. But what about other fundamental ecosystem services? How are we progressing with them? We have already known that, on average, commercial forest estates are providing water at a quality not too dissimilar to natural forest.

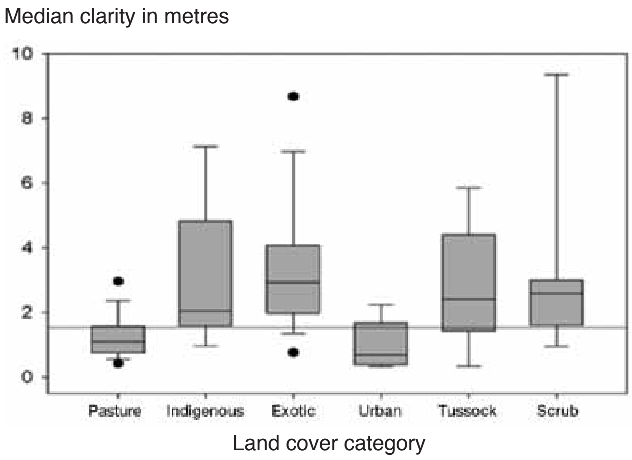

Figure 5: Water quality by land use

Modelling capability developed by Landcare Research (NZ Empirical Erosion Model NZEEM – Landcare Research, 2005) is able to redistribute the sediment load in rivers over the contributing landscape according to the primary land covers, soil types and rainfall. Combining this capability with those of Forest Investment Finder, an economic value on avoided erosion, and an account of the higher sediment yields during the post- harvest window of exposure, it has been possible to provide a first basis for deciphering where forests might most effectively be established to avoid, economic cost to the public purse and the implicit costs of erosion to the wider public (Barry et al. 2012).

The scenarios, run at normal forest discount rates of eight per cent and at current rural land values for Gisborne, indicate again that not many forests would be planted without some level of public input as has happened previously in the East Coast Forestry Project. Even at reduced land values and a modest carbon value as before, only a proportion of the total erosion-susceptible land bank would provide any hope of private net benefit, the rest remaining unplanted and susceptible to erosion. But these are class VI to VIII and mainly VII lands that the farm models, if imputed to return eight per cent, would need farm capital values as low as $350 a hectare. This is land which has some of the highest rates of erosion in the world.

If the land reflected its true commercial worth, the models, as shown in Figure 7, indicate that if the avoided costs of erosion in perpetuity are priced into the scenario, the sum of public benefits and private benefits, often negative toward the northern part of the region, still result in overall net benefit which would be almost universally positive, sometimes substantially so.

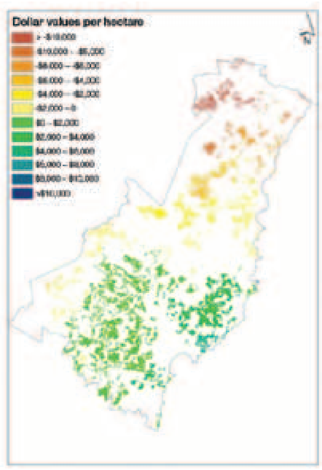

Figure 6: Privately viable forest land at eight per cent imputed farm value.

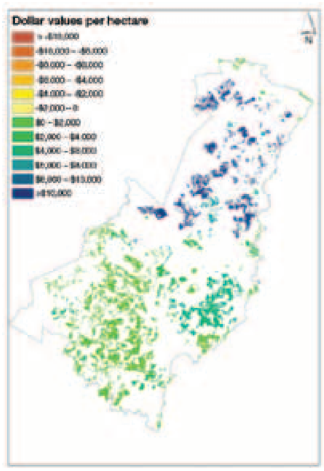

Figure 7: Public benefit from avoided erosion Gisborne Region

In reality, timber production from radiata clear fell systems may never be appropriate nor viable for some of these areas. With some land true commercial worth approximating zero, and very high environmental costs, these models are getting us to the point where we really can evaluate what we should accept as appropriate land management into the future and where the true costs and benefits should fall.

The results of this and the earlier scenario related to carbon also provide insight into other forestry options, previously not easily assessable. Radiata pine may well be a good species for occupying a site and accumulating biomass very quickly. This is desirable if a prime objective is a timber harvest with other co-benefits provided as an aside. As already noted however, concerns have been raised whether radiata is necessarily the right species for all situations.

Currently, the productivity surfaces for other species such as eucalypts, cypress and redwood are not installed into this economic framework. However, the surfaces exist and that capability will come shortly. Similarly, there is no technical barrier to including higher land classes, their existing value profiles and existing forests.

Perhaps at the right price, and in the right place, land could be planted at scale with these other species and the costs of establishment covered by carbon value sequestered or other services provisioned and subsequently sunk. Future decisions about the forest use, whether for timber yield or public good, could be left unencumbered for future generations to decide. The options and values then may be very different from today and the economic evaluation markedly different with discounting no longer a relevant component.

Equally with expanded coverage, the model framework could be used to assess among other things –

- Costs and benefits of regulation at a regional or district scale
- Spheres of economic influence such as employment and economic flows
- Effect of disease
- Any forest related co-benefit to which costs and revenue streams or proxies for them can be allocated.

Freshwater biodiversity

The benefits of forests to water quality are generally well known, but have only relatively recently been able to acquire some spatial dimension as is the case for aquatic biodiversity. The Freshwater Environments NZ (FENZ), is already a powerful method to help in landscape scale planning for aquatic biodiversity. It also has application in practical forest management as shown in Figure 8, despite limitations in its NIWA based rivers classification system which remains tied to a coarse scaled terrain model.

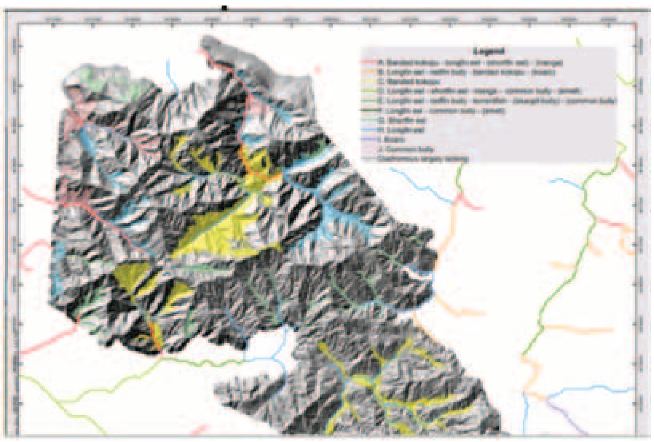

Figure 8: FENZ predicting fish species association in a plantation forest

For forestry, there is of course a double edged sword. In the case of FENZ, if plantations are correlated in some circumstances with providing improved habitat opportunities for freshwater biodiversity, what will that mean? Will forest owners be penalised, required not only to protect the specific habitats within their forest but also to buffer or offset the effects of adjacent or downstream land use or intensification?

Alternatively, will those whose activities that leave stream habitats in a state less than their natural potential, be required to avoid, remedy or mitigate to ensure the natural habitat capacity of those waterways can be retained or regained? Implemented in one direction, the costs of the forester will rise, and their competitiveness be further eroded. Implemented the other, the service consumer will pay. Their business will either have to become more efficient to neutralise their cost increases, or their land values will drop to absorb the long term costs of avoidance or mitigation. Which will it be? The track record for forest owners under the RMA has not been good and the challenge to change that trend under the foreshadowed water reforms will be significant.

However, the evolving capability to develop spatially explicit habitat specific rules for the management of riparian and rare fish habitats has real potential application for informing how, what and where forests might be managed in the landscape at the stream side and landscape level. The power of these methods can only improve if wide adoption leads to broad based investment in improvement. Linked with other spatial surfaces and economic flows, new services such as avoided erosion or the provision of a habitat service may well become valuable tradeable rights. Will New Zealand policy makers be up to the task and will we reward the provisioner or the polluter?

As part of its recent research effort, Scion (Ballie and Heaphy, 2011) has been looking at what is needed to provide good and representative water monitoring across the full cycle of forest activity. Data recorded and within the framework should ensure the industry's performance within a wider landscape can be advocated while also dovetailing into developing national data (Ballie et al, 2013).

Terrestrial biodiversity

For New Zealand with its high levels of endemic, threatened and declining species, possibly one of the toughest challenges is to understand more about our terrestrial biodiversity to arrest further decline. Many factors including localised habitat conditions, climate, predator concentrations and landscape problems of connectivity all confound precise understanding.

As foresters we have well understood that while incapable of replacing tall native forest, our commercial plantations provide important habitat for some important species in New Zealand. Commercial forest estates have, admittedly, often by historical good luck rather than intentional management, provided protection, buffering and connectivity for native ecosystems. They now find themselves faced with costly and difficult mechanisms to protect for society what has already been naturally protected. These costs incurred under RMA processes reflect efforts to describe, inventory and protect what is important under very broad and generalised concepts of what makes ecosystems tick. Knowing reliably and predictably what is out there is traditionally expensive information to acquire at a business level in fragmented landscapes.

Two other areas of current research promise real benefits. Recent work has been looking at the plausibility of relating remotely sensed LiDAR metrics of forest structure to within forest biodiversity. An aside to that research has been to establish that the plants collected within the plantation sites represent 8.3 per cent of the total described flora of New Zealand. A credible 18.3 per cent of all New Zealand birds has been found. Invertebrate representation in plantations remains an unknown proportion as they are still far from comprehensively described in New Zealand. The real interest is that, if sound relationships can be established, then the potential exists to use extensive remote sensing at the landscape scale to indicate biodiversity.

Table 3: Animals and plants in New Zealand plantations

Taxonomic group	Native species (number)	Exotic species (number)	Percentage of total described
Plants	195	75	8.3%
Birds	15	11	18.3%
Beetles	?	?	469 Species total

Add repeatable surveys, time and stand structure modelling and we may soon be able to answer questions about –

- How best and when plantations contribute to biodiversity?
- Are levels of forest biodiversity permanently retained in the estate albeit in a state of flux according to the development and spatial arrangement of the forests stands?
- Do coupes sizes have much relevance to a plantation's performance in provisioning native biodiversity?
- Can we understand the interactions between native forest patches, corridors and planted forests in our ecologically fragmented and largely pastoral lowland landscape?

At the detailed scale, the costs and difficulties of quantifying and describing biodiversity at anything but a localised scale would cause most to pale. New frontiers being embarked upon at Landcare Research Ltd could revolutionise this task. The project has already sampled plantation forests in the Wairau Valley. The project examines biodiversity change, above and below ground, across multiple components of biodiversity. It will therefore enable comparisons between plantation forests, natural forests, grassland, pasture and vineyards. In just a few years, as DNA testing becomes routine and cheap, simple soil samples gathered for a site for an estate and repeated could provide a detailed inventory of all the biodiversity for the areas in question. With that data, modelling at levels of complexity currently beyond comprehension, including direct estimates of ecosystem service metrics such as nitrogen and carbon cycling, may become routine.

For foresters, the opportunity will exist to use this information to be ecologically benign while remaining commercially successful, as we currently aim to be. For New Zealand, the challenge will be –

- How to avoid penalising the provisioners
- How to ensure economic consequences of ecological performance or non-performance is efficiently and fairly distributed to cost and revenue streams
- How to use this evolving science to effectively and efficiently reintroduce native biodiversity and ecosystems and productive system resilience across our lowlands.

Hazardous landscapes

All is not always rosy, and as already noted, radiata plantations under current management regimes have demonstrated a susceptibility to debris flow during high intensity storms when located on highly erodible soils immediately after clearfell. While plantation related property damage has occurred from these storm events, over the last five years, far more examples occurred that had nothing to do with plantations. Nevertheless, while the public seem to accept such events under other land use as bad luck, their tolerance of destructive events from commercial forests is practically nil.

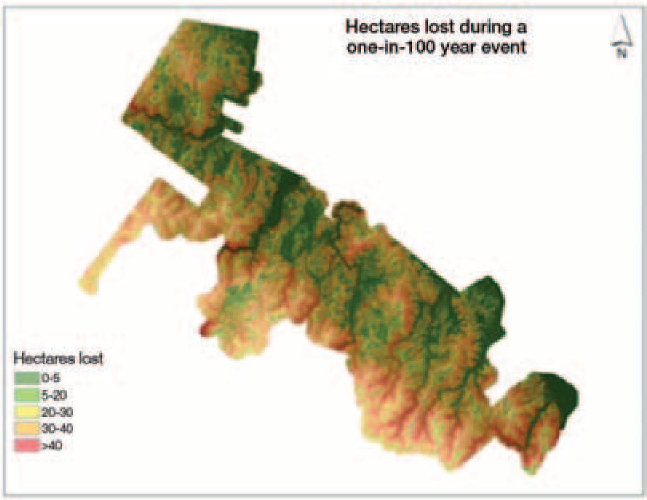

Figure 9: Forest erosion hazard map

Identifying hazardous zones is currently the field of those with specialist technical skills or left to the indications and relatively broad categorisations of small-scale erosion maps. Neither of these are necessarily easy to apply to a landscape already hidden under trees.

Recent work (Harrison et al, 2012b) has started to provide new options here. Using LiDAR and long standing data from the Pakuratahi catchment in Hawke's Bay, spatial regression models have been developed for predicting shallow landslide erosion susceptibility under woody and non-woody vegetation cover at varying storm return period intensities. This model is undergoing validation and expansion to extend its cover on to new soil types not currently represented.

Even at this stage it is showing real promise to help more accurate recognition of hazardous locations and a means to demonstrate the holding capacity of forested versus deforested landscapes. If successful, under final development it is to be hoped that foresters identify hazardous areas as well as –

- Identify the storm intensities and return periods at which a hazard is likely to become significant
- Expect councils to respond by attempting to regulate forests and by recognising the implicit hazards identified by these surfaces and regulating inappropriate development in downstream locations
- See this, combined with spatial calculation of 'Melton's ratios' to indicate the hazard from landslide and if landslides occur, the propensity of the receiving catchment to carry destructive debris flows
- Inform where other species may be sited or techniques employed to reduce the hazard.

Concurrent research by Landcare Research Ltd into the soil holding potential of other native and exotic species continues to add knowledge to the potential options that may end up at the land manager's disposal (Philips and Marden, 2011).

Next steps – big problems

The preceding examples have sought to illustrate how current and new science is evolving to enable better understanding. Importantly, they show better means to demonstrate and communicate how our land use fits, or does not fit,within the current biophysical and socio-economic operating environment. All the examples clarify important parts of the jigsaw of forest and general land management. Some have clearly illustrated that problems can be more than just physical and biological.

The problem with the advances to date is that we remain relatively constrained by our technologies and data structures to investigating at the level of one or a few semi-dynamic dimensions. We can see that –

- To survive economically we need to increase productivity and market values at rates significantly above those of competitors to beat land inflation
- Current economic settings may not support the industry but what are the correct ones, what are the consequences of change and how do they flow through the economy to affect all New Zealanders?
- Urgent new planting is needed if the industry is to sustain a permanently increased harvest and the security for processing to use it. But do we need more, where could or should it occur and what are the consequences of not planting, to industry and to New Zealand Inc?
- On many fronts, forestry has provided ecosystem services at no or low cost to wider society and that continued or expanded provision may cease. Where will the costs of future provision fall if it occurs at all?
- Do we need different forestry models distinct from, but not replacing, the current commercial framework to achieve different publicly sought objectives in other areas?

These are all complex biophysical, social and economic questions which extend across regions, terrains and communities. What are the answers and the solutions and what actually works best for all? In other words how do we get the best mix of private, public and national benefits, the from the finite but currently poorly performing land resource available in New Zealand?

Imagine a future point, where a code or DNA sequence can be allocated against all the elements in a landscape. A code which describes all the inputs, outputs and traits that could be expected from the land in terms of requirements for environmental, economic and social performance. Imagine if that DNA could be allowed to combine and recombine within the dynamics of the constantly changing physical environment and evolving strong survivable solutions within that environment. Imagine if societies could be interactively involved with those solutions to see and understand those that best met their social, economic and environmental wellbeing.

Watch this space. It may not be coming to a town near you, but it is coming and represents pushing the boundaries in multi-dimensional problem solving research at Scion. It is research which may have direct application from solving complex logistics and estate problems to landscape scale land management.

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