Can we still see the wood for the trees? Landscape visualisation in forestry

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Can we still see the wood for the trees? Internationally, public demand for improved stewardship of forests has been an important driver of forest visualisation. Sophisticated technologies incorporating GIS, digital modelling and rendering are now widely used as part of community land use planning and forest management to show what forests might look like in the future, and to communicate information about the effects of policies.

In New Zealand, the Resource Management Act (RMA) requires assessment of environmental effects of significant changes in land use activity, including landscape and visual effects. Visualisation is an important tool in RMA processes, but there has been little research investment in forest visualisation in recent years, and visualisations have been largely undertaken using generic technologies.

Several factors may lead to visualisation becoming more prominent on the forestry agenda. First, consumers of forest products are demanding evidence of sustainable management practices – we have to be seen to be green. Second, as the plantings from the 1990s mature, many smaller forests in rural landscapes will become due for harvest. The resulting landscape change will be visible to tourists and the New Zealand public. Third, awareness of the consequences of climate change may yet stimulate significant new plantings as both adaption and mitigation measures, which could result in significant changes of landscape character in some regions.

Drawing upon information from a survey and workshop of professional key informants, this article reviews the past development and current status of forest visualisation in New Zealand, and identifies emerging problems and opportunities for landscape visualisations.

Forest harvesting

Forest visualisation

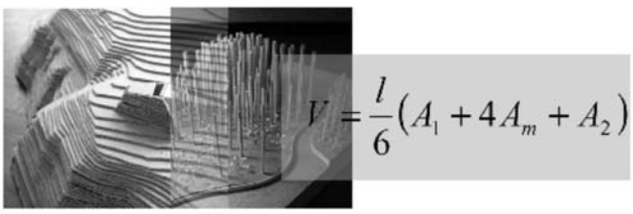
The adoption of environmental impact assessment protocols by governmental agencies in the United States and Europe in the late 1960s and early 1970s was an early catalyst for forest visualisation. These protocols required systematic assessment of the environmental effects of major projects, including visual effects, and in the United States were also applied to major land use changes on the government land controlled by the Bureau of Land Management, including the forests of the US Forest Service.

By the late 1970s forest visual assessment and management had become a major focus of professional and research activity (Elsner and Smardon, 1979). Federal funding supported development of social science based procedures for assessment of scenic quality, and visual forest management systems were developed for practical application. Similar trends occurred in forested parts of Europe, for example Finland and Switzerland, and to a lesser extent, the UK.

The next big change came with the emergence of digital technologies. The development of hardware and software for visualisation is a fascinating story in itself, but a good example is the Smart Forest System (Orland et al, 1994). Closer to New Zealand, Ian Bishop at the University of Melbourne has been a pioneer of visualisation and was a speaker at the Wellington workshop described below. His work shows how forest visualisation frequently cross-fertilises with other applications, such as power infrastructure, highways, and climate change adaption.

Forest visualisation has particular technical challenges relating to the scale of forests, their visual complexity, and long-term dynamics, but in common with other applications a main distinction is between 'looks like' and 'acts like' visualisation (Erwin, 2001). 'Looks like' provides accurate and authentic visual representations on screen or on paper of what a forest would look like to a viewer in the real landscape. It emphasises authenticity and

validity, which enables visualisations to be used in statutory decision making, for research into public perceptions, or for community consultation over forest management. 'Acts like' visualisation is quite different, and is usually aimed at communicating how a forest system functions, such as, its erosion status.



Comparing 'looks like' and 'acts like' visualisation

The emphasis of research on visualisation internationally is now extending from technical development, to improved understanding of the way digital visualisation technologies can be most effectively integrated within forest management systems and wider planning processes involving the public. This applies to both 'looks like' and 'acts like' visualisation, and typical questions now being asked are 'how can/does/should visual information influence forest decision making?'

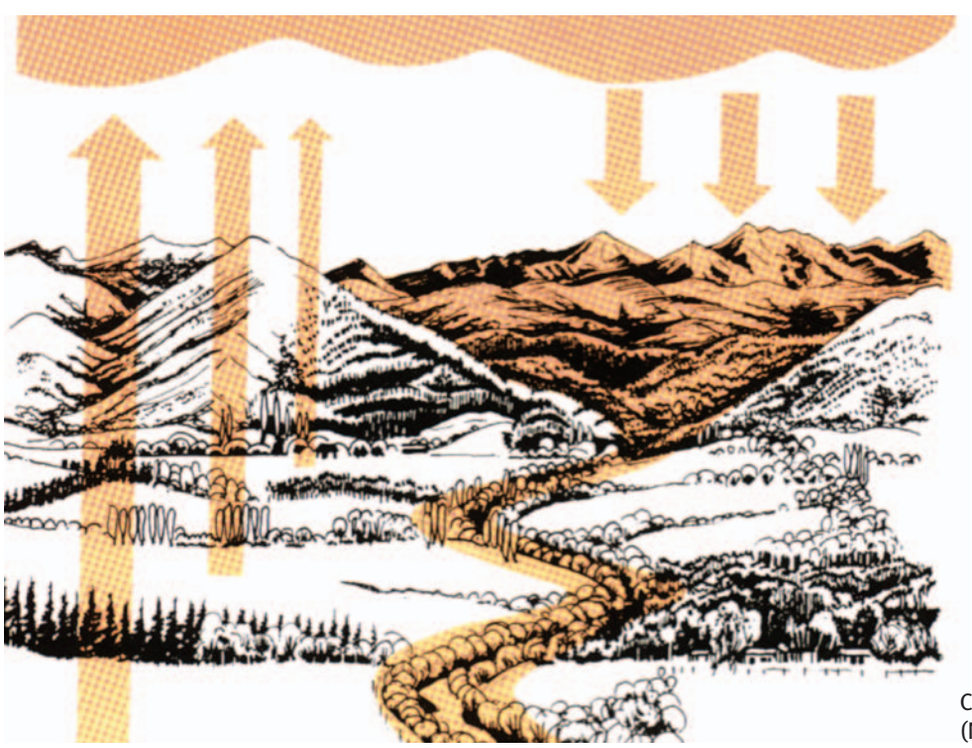
NZ forests in the landscape

There have been three main phases of visualisation in New Zealand –

- The design-based landscape approach that emerged in the latter years of the NZFS
- A period of hybrid digital modelling and rendering of land use change in the 1990s
- Contemporary use of generic digital technologies.

Early interest in forest visualisation paralleled the environmental movement of the 1960s and 1970s, and was associated with the growth of the landscape architecture profession, whose design thinking influenced forest design and management within the NZFS. The text *Creative Forestry* (Anstey et al, 1983) combines 'looks like' and 'acts like' visualisation in evocative hand graphics, applied to the multiple objective and mixed indigenous and exotic forest estate that characterised New Zealand at that time.

The 'landscape' approach continued during the corporatisation of the Forest Service and establishment of the Ministry of Forestry, for example in the publication *On the Edge* (MoF 1991). But as the production forest estate was privatised, the momentum fell away, and activity narrowed to focus on meeting the requirements of the RMA which varied geographically according to the status of forestry in different district plans. Public good research funding in the 1990s supported some 'looks like' visualisation, as stimuli for research into stakeholder and community attitudes (Fairweather and Swaffield, 1995, 1996; Hock et al, 1995). However, as the1990s planting boom faded, funding agency interest in enhanced visualisation based techniques declined, and technical development moved towards a small number of consultancies involved in RMA related assessments using generic



Creative Forestry
(NZFS Wellington 1983)

visualisation techniques. New demands have now emerged, including the need to demonstrate effective environmental management procedures as part of individual forest certification schemes such as the FSC.

Survey and workshop structure and participation

The current status of forest visualisation in New Zealand was investigated in two stages. First, in June 2010, an email survey was undertaken of professional key informants – people in the forest industry or related sectors likely to have had some involvement in visualisation. A short open-ended questionnaire was distributed to members of two professional organisations – the NZ Institute of Foresters and the NZ Institute of Landscape Architects – and to a range of contacts in universities, councils, Crown Research Institutes and a GIS user group. A total of 41 responses were received, of whom 27 were involved in the field in some way.

The survey was followed up in February 2011 with a one-day workshop in Wellington, which involved around 30 participants from a range of relevant sectors, including those surveyed in 2010. The workshop involved presentations on the current 'state of the art' (Ian Bishop), group discussions on several themes, and a plenary session. The next section summarises the findings of the survey and workshop. A detailed report of the survey questionnaire findings is available from Scion.

Profile and activity

The main finding from the survey and workshop is the diversity of New Zealand experience and application. Forest visualisation is used to evaluate and minimise adverse effects on landscape from forest establishment and during harvesting, and to aid change, including the provision of environmental services. The spatial scope includes individual trees and coupes, area management, and broad views of forests in their landscape setting. It extends beyond visual 'looks like' images to include representations of the outcomes of processes and effects of planted trees.

The workshop revealed contrasts between the experience, concerns and research needs of forest planners, and those responsible for the actual visualisation. The planners were concerned with application, needed to know how to represent forest change, and are motivated by outcomes – wanting to know how to use visualisation to make better decisions. The 'techies' were interested in upgraded technology, needed more information on what to represent, and are motivated by the outputs – the actual visualisations.

The main challenge is to help a move in focus from 'looks like' to 'acts like', with greater emphasis on systems and dynamic modelling and its representation. This includes empowering a wider range of participants, and the survey and workshop identified a number of inter-related challenges and opportunities. These include questions of both technology and application.

Technology

The limited size of the New Zealand market means that software is largely sourced overseas, which requires adaption to New Zealand needs. Local data availability, cost and compatibility emerged as a consistent challenge for forest visualisation, particularly the high resolution data required for quality visualisations. Public sector reform in the 1980s resulted in a fragmentation of environmental databases and commercialisation of some of these. It created a situation with complex copyright and intellectual property relationships, different data management systems in many territorial local authorities, and varied standards. There is also a need to generate locally specific landscape models, for example of New Zealand plant species and textures which also adds costs and complexity.

In selecting and developing local applications, there is a need to determine the most appropriate balance between different modelling parameters, such as realism in representation versus ease of interaction. Interactive capabilities encourage wider ownership of processes and the decisions they generate, but the high costs can require trade-offs against authenticity. Some modellers are pursuing greater authenticity, such as by creation of immersive environments. Others focus on enabling greater interaction, for example making different scenarios easy to adjust. Ian Bishop uses panoramic displays as a compromise between stills and full animation. These technical questions are closely linked the need for managing user's expectations, which are the result of other familiar uses of visualisations such as gaming and television.

Application

Workshop participants agreed that visualisation is an important part of a wider public conversation to shape and inform policy and management, and techniques such as alternative futures modelling and scenarios that use visualisation can stimulate debate. However, lack of strategic thinking about landscape in the public realm and the reactive approach that has dominated the RMA regime creates significant tensions.

Policy development can be enhanced by interactive modelling which enables exploration and experimentation, but the inherent uncertainty

Visualisation of two alternative futures under climate change.

in modelling cumulative and extensive landscape results can conflict with the assessment of environmental effects for particular projects. The Environment Court requires accuracy and certainty above all else, which tends to narrow the focus on 'looks like' representations.

Another problem arises in managing relationships between property rights and public policy. The RMA in effect creates a landscape commons – visual effects are recognised as part of a wider public interest in the environment, expressed in policy and managed by plan rules and resource consent processes. Visualisation can help land owners and communities understand the significance of individual property changes for the wider landscape context. However, there are multiple scales involved including felling coupe, ecosystem, property title, forest, catchment, landscape, district and region. The significance of change and the sensitivity of the public to change varies according to the scale and context.

This means that both the visualisation techniques and their use in evaluation must be fit for purpose. An emerging approach to managing across scales is the alternative futures process now increasingly used internationally. This combines a number of different landscape based models into a systematic process of exploration and deliberation over development pathways.

The workshop discussions emphasised the importance of scoping and feasibility to clarify the purpose of a visualisation study, such as the relative importance of accuracy versus interaction and flexibility, and to ensure the right match of technology and application.

This in turn highlights the importance of the skills and knowledge of users of visualisation. There was a clear gap between those who understand the technology and its potentials and limitations, and those who are clients for visualisation, and who are most interested in its contribution to wider planning and decision-making processes.

Research questions and industry needs

Several potential research questions emerged from the discussion. They relate to both technology and application and include –

- How does the distance of the viewer from the forest being modelled influence the way they perceive the effects of change?
- What is the relationship between realism and decisions and what level of authenticity and detail is needed in order for visualisations to be helpful in making informed decisions? What is just sufficient, and indeed, can there be too much?
- How can social and economic and ecological information and values be most effectively represented?
- How can visualisation of forests contribute to government indicator and monitoring

programmes, to the district and regional planning process, and to industry based certification?

It is also clear that there is a wide range of awareness and levels of competency in specifying, and using visualisation technology and procedures. There is also a need and scope for both individual professional development and greater collaboration and sharing of knowledge and expertise.

Seeing the wood for the trees

Forest visualisation is a lot more than coffee table scenes. 'Looks like' visualisation has an important role in the implementation of the RMA, and can potentially contribute to wider involvement of communities and customers with forest management and marketing of products. Digital technologies now allow very high levels of realism in forest representations, but this can come at a high cost, and still face significant problems of data accessibility and quality. People are willing to challenge the validity and achievability of visualised landscapes, with exposure to quality representations in the media and entertainment industry creating increasing discernment.

There are also significant challenges in matching the appropriate level and type of visualisation to the particular need and application. This highlights the importance of 'acts like' visualisation techniques to help decision-makers, stakeholders and wider communities understand and make informed decisions about changes to the forest estate. A challenge is for forester managers to see the opportunity offered by digital technology to communicate a richer and more complete understanding of change to communities and stakeholders who have traditionally focused on the 'looks like' approach.

Acknowledgments

The survey and workshop were undertaken as part of a wider programme of research into Protecting and Enhancing the Environment through Forests (CO4X0806).

Further reading

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