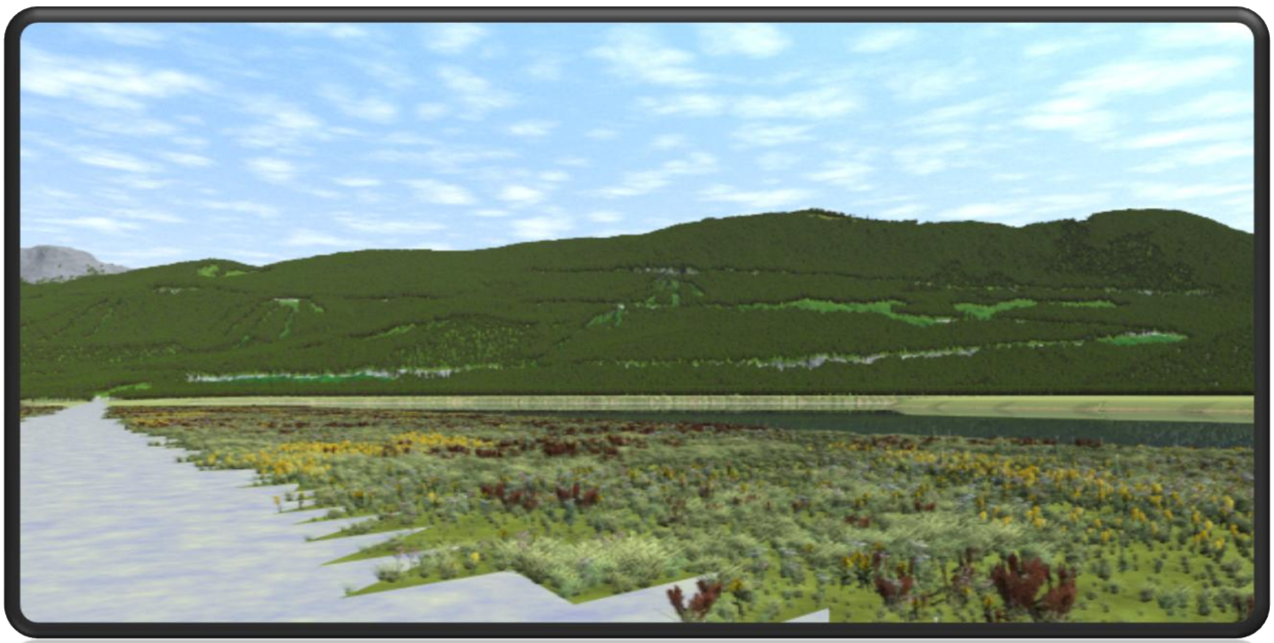
THE RELATIONSHIP OF LANDSCAPE VISUALIZATIONS TO PUBLIC PERCEPTIONS OF SUSTAINABLE FOREST MANAGEMENT PRACTICES



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INTRODUCTION

The management of forest resources has always been important to many aspects of human society. The most prominent of these resources in terms of human consumption is wood. It is incredibly versatile, having been used for cooking and/or heating fuel, structural timbers for homes, and as pulp for paper production. Regardless of its' end use, wood must first be harvested. This process can be a controversial one, as it affects many other resources valued by society. These generally include concerns over drinking water, fish habitat, wildlife habitat, recreational opportunities, etc.

One of the most fundamental forest values to the general public is, simply, the impression made by a tree covered landscape. In many places, timber harvesting is largely perceived negatively, often associated with destruction, detrimental environmental effects, and plain old ugliness. Human alterations have tended to be dominant on the landscape, acting as a visible reminder of a 'necessary evil'. However, this does not have to be the case. The aesthetic qualities of a forested landscape are being managed as a 'visual resource', alongside other previously mentioned objectives. It is important to demonstrate not only the proposed management plans and activities, but also the underlying data on which they are based. This can be a daunting task, especially given the amount of information for ecology, silviculture, wildlife management, harvesting method requirements, harvesting patterns, and especially the processes behind arriving at a given management scenario. Fortunately, as computer technology has improved, so have the means of conveying information to the general public about forest practices. Maps detailing management areas and the practices within can now be quickly and easily created to inform interested or concerned parties.

One of the most powerful tools now available is software which enables near photo-realistic renderings of proposed harvesting blocks. The technologies involved in creating these visualisations are fairly complex, and largely outside the context of this paper. However, those that are relevant will be explained briefly, with references provided for further information. Regardless, the end result is part of a system which allows feedback, evaluation, and modification to harvesting areas within visually sensitive areas, before a single physical change to the landscape is made. In this way, the general public can be included in the management process to an extent, and a more favourable perception of forest practices can begin to be created. The focus of this paper is largely on developments within North America, as much of the timber harvesting land base is publically held. The land base of many other countries is largely privately owned, however, and so little direct public involvement tends to occur. As with nearly everything, there are associated benefits, and drawbacks/limitations which will also be discussed.

BACKGROUND

To discuss the current implementation and uses of forest visualization, it is important to understand the circumstances leading to its development. The primary factor was an opportunity to give professional foresters a means of interacting with, and disseminating information to the public, regarding management plan impacts. Drive for this new approach largely stemmed from increasing social awareness of environmental issues, and poor public perception of forestry practices. Initially, visualization techniques varied from scale models to manual manipulation of photographs. Building scale models can be time and labour intensive, as can manually creating transparencies/overlays for photographs, or altering negatives. Eventually, digital alteration of photographs became possible, leading to modern two and three dimensional modelling programs which enable the creation of near-photo realistic images or animations (Sheppard S. R., 2000). The driving force for these tools stems primarily from the entertainment industry, specifically special effects in movies. As big budget films are beginning to move towards more realistic simulations of fictional environments, there is a trickle-down effect occurring in other sectors as people become accustomed to the ease of creating eye-catching graphics.

In this modern world, the old phrase “a picture is worth a thousand words” is being followed to great effect as society continues to move in a direction where many things are ‘on-demand’. As a result, information needs to be presented in a concise, direct manner to ensure and maintain target attention. It has been noted that as the generations who have been raised with exposure to video games age, they will have become accustomed to both interacting with and manipulating virtual environments (Sheppard S. R., 2000). This could prove to be an especially powerful factor in current and future perceptions of timber harvesting practices, as members of these generations are reaching the age where they begin to concern themselves with the interactions and manipulation of their real environment.

Environmental management is currently undergoing changes, especially in regards to human interactions and manipulation. Since the 1990s, there has been a movement to develop forestry landscape planning that is based in ecological knowledge. The main premise was to shift towards sustainable alternatives from the then-dominant forestry practice of clear-cutting , a practice widely perceived to be an unsustainable approach to forest management on the Pacific coast (e.g, Clayoquot Sound). In Canada, the adoption of an ecology-based system was a mix of “the landscape ecological model with the visual design approach. This has resulted in a process that could be called ‘forest ecosystem design’” (Bell, 2001). Further changes have occurred, following the refinement of ecosystem analysis, where the natural processes and patterns of forests are considered at the landscape level, rather than on an individual stand basis. On the management side of things, this has translated as a shift in harvesting methods towards those which mimic or emulate natural disturbances (wind, insects, disease, fire, etc.) (Sheppard S. R., 2000), (Bell, 2001).

Of course, to ensure implementation of these measures, steps have to be taken at the political level. In 1992, the World Convention on Sustainable Development was signed, in Rio de Janeiro, Brazil. One important result of this event was the formation of several processes, the dominant one for the Northern temperate zone being the Montreal Process (Bell, 2001). They were intended to develop criteria and indicators (C&I) to evaluate sustainable forest management (SFM). Among other things, forest planners became required to include the public, usually in the form of local communities, in the planning process. This is clearly important when concerning the management of publically held lands. A further refinement of C&I in Canada came from the Canadian Council of Forest Ministers (CCFM), which includes in their system under Criterion 6: Society's Responsibility; a requirement to "(consult) with Aboriginals in forest management planning and in the development of policies and legislation related to forest management" (CCFM, 2005).

In order for these parties to be properly involved in forest planning, information needs to be presented in a clear yet comprehensive manner. This is where visualizations become a valuable tool. Community involvement varies greatly depending on their changing economic and social situations, acceptance of forestry practices, and level of knowledge. For forest planners, this means attempting to manage the land base in the best way possible by balancing the three fundamental SFM objectives: environmental, social, and economic. As different management possibilities arise, it is important to be able to demonstrate which one(s) has/have the best potential.

As mentioned previously, visualisations are primarily used to convey the information behind forest management decisions to those unfamiliar with the complex balancing act that is sustainable forest management. Specifically, near photo-realistic visualizations – as observed by concerned public audiences – may lead to “better understanding and appreciation of the intentions and motivations behind proposed management actions, though there is a risk of misinterpretation of the visualizations or misplaced belief in the underlying models” (Meitner, et al., 2005).

The management activities being represented usually occur in a timed sequence, over the practically accessible areas of the land base. For instance, harvesting of immediately adjacent areas usually cannot occur until previously harvested areas have reached a level of visually effective regeneration. Therefore, it is necessary that the underlying quantitative data can be projected or manipulated to show the desired and/or future outcomes. One of the most comprehensive attempts was made by the Collaborative for Advanced Landscape Planning (CALP) at the University of British Columbia (UBC) to use commonly available software programs to meet this challenge. These programs included: “FORECAST (an ecosystem-based, stand-level, forest growth simulator), FPS-ATLAS (a forest-level harvest simulation model), and SIMFOR (a decision support tool designed to help managers and researchers evaluate the impacts of forest harvesting scenarios against landscape and habitat indicators)” (Meitner, et al., 2005). Using their own proprietary visualization system, outputs from all of the programs were combined and sent to a rendering program, which created the final images and animations. A graphic representation of the program relationships is shown in Figure 1.

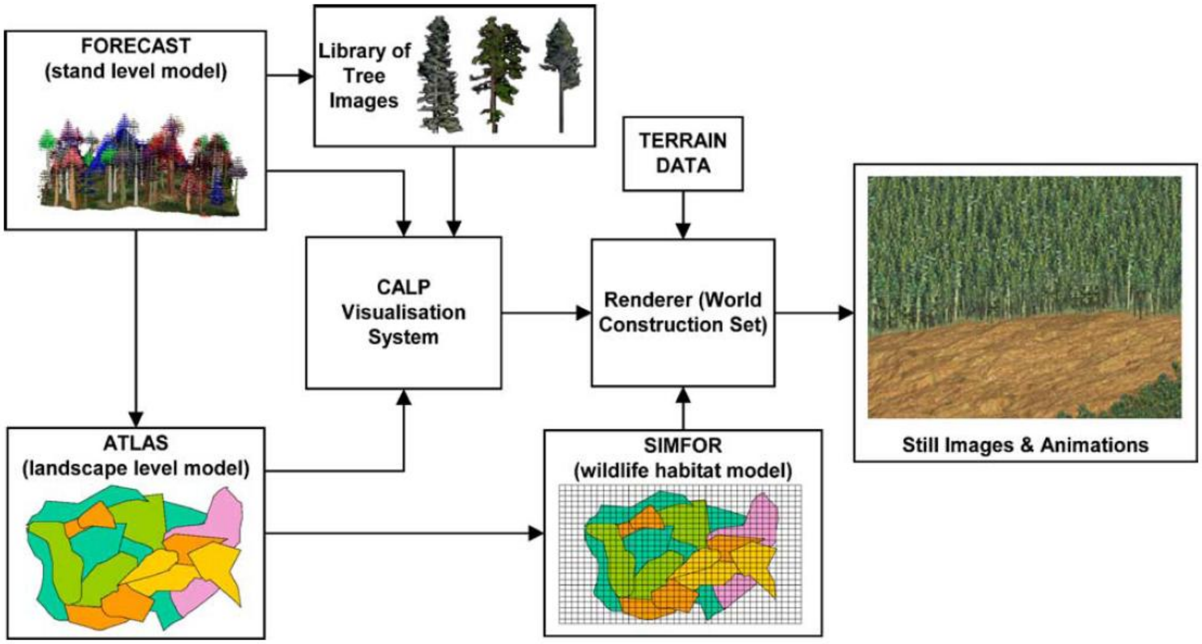

FIGURE 1: Flow chart showing the overall visualization process used. (Meitner, et al., 2005)

The combination of these programs was used as it allowed the focus to be on known territory, i.e. “forest management within a sub regional context in British Columbia” (Meitner, et al., 2005). The CALP system was found to be useful for presenting three groups of static outputs:

1. Strategic overview. Generally illustrate a viewpoint >200m elevation, and at a large distance from the subject matter.
2. Spatial pattern/arrangement view. Usually between 1 and 200m elevation, and the distances tend to be optimized to allow accurate, scale portrayal of pattern.
3. “Sense of place”. These visualizations are usually eye-level elevation, close to the subject matter, and include foreground features and perspective distortion.

Examples of the previously mentioned groups are represented in Figure 2, on the following page.

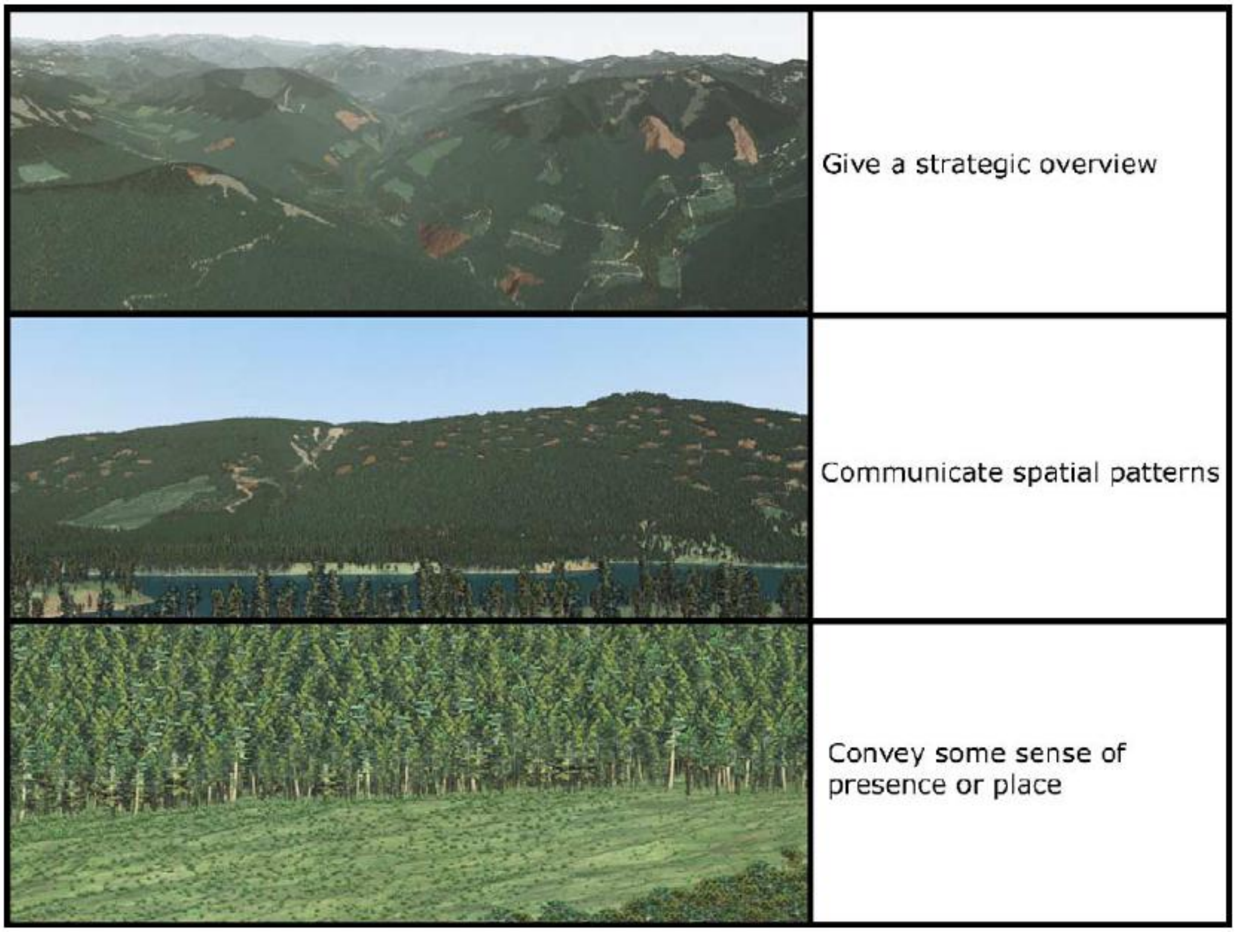

FIGURE 2: Examples of three distinct types of environmental visualization outputs based on camera position. (Meitner, et al., 2005)

Of course, what good is developing a system if it is not fully tested? The CALP team wanted to look into the use of this technology as a means to both inform the public, and obtain public evaluation/feedback of proposed management scenarios. This feedback could then be used in an iterative process between management professionals and the public, which would allow for the development of a solution based on the wants and needs of both parties. Some 'field' tests of the CALP system have been held in public forums, the context of which were "interdisciplinary research projects aimed at sustainable forest management" (Meitner, et al., 2005). Pending completion of the analysis and interpretation of research findings from these trial runs, it is possible to remark on some preliminary findings. In the simplest case, the presentations were largely one-sided, intended merely to present information. The landscape visualizations presented appealed to the attendees, and "91% stated that (the LVs) were either "very helpful" or "moderately helpful" on a five point scale, when asked to evaluate various aspects of the decision-making process they were involved in" (Meitner, et al., 2005). When presented with still images and animations, most of the participants wondered why the still images were used, and they expressed desire to be able to interact with the visualizations to choose their own viewpoints and angles. The researchers felt that it is also important for the audience to be able to see the scenario results progress over time. This is where good base data and the means to accurately extrapolate it come into play. Further explanation to the audience of the workings of the growth and yield models, and the changing patterns of management activities (i.e. ensuring visually adjacent green-up occurs before logging adjacent blocks) were also needed.

OTHER CONSIDERATIONS

Regardless of the accuracy or completeness of the data used, the end product is still an image or animation which is intended to portray an existing and/or future landscape. An editorial from one of the journals used for this paper as a reference (Bishop & Lange, 2001) summarized some of the concerns about the tools used for landscape modeling and visualizations. A main theme was the level of realism in the simulated landscapes as compared to reality itself. Some of the questions raised were: "what is real, how do we display reality, how do people respond to simulated environments, how does this raise the possibility of new planning paradigms, what questions can visual simulation effectively address, what distortions of the planning process might be introduced by heavy use of simulation, and what other information needs to accompany visual representations?" (Bishop & Lange, 2001).

Other articles mentioned in the editorial concern themselves with the possibility of aesthetic aspects 'competing' with productivity and ecological issues. Some parties put forward integrated approaches, while others try for categorizations that would account for the multiple functions of the landscape. Yet others raise the point that "in the developed world, both increasing bio-centric (green philosophy) and social construction views of the landscape will reduce the importance of formal aesthetic considerations" (Bishop & Lange, 2001). There is a general trend that even with the tools available, it is hard to tell which aspects need to be measured, modeled, and simulated. The end goal is difficult to see, especially as landscape visualization embraces multiple disciplines which are subject to changes in the norms and values of society.

Part of the challenge involved is largely due to the fact that there is little framework or guidance in place to regulate the creation and use of landscape visualizations. There exists the strong possibility that misrepresentation of existing, predicted, or potential environmental data could occur. Some research has been undertaken to test "the levels of inaccuracy in experimental simulated images compared with the real landscapes, and some have found bias in responses to some media compared with those arising from the real landscape" (Sheppard S. R., 2000). These findings reveal that there may be inherent problems with some of the media being produced, but there has not been much time for research into finding patterns or examining the potential influences of data, technology, and the simulation process used.

The concluding point of Sheppard's paper is that there needs to be a knowledge and/or guidance based framework to support and constrain the "crystal-ball gazers", especially as technology is continually advancing. Previously in his paper, he raises the point that one of the main arguments against such a framework is that "we lack much of the knowledge to prepare defensible guidelines for visualization preparers, especially in the area of sufficient realism for particular simulation purposes" (Sheppard S. R., 2000).

It is apparent that some of these other considerations can involve other branches of science, such as the likelihood of needing to use psychology to explore how people respond to simulated environments. These added steps, while likely to result in valuable insight and solutions, can require time and patience. It should be noted that much of the work done so far has been in regards of the scientific aspects, with little application or follow up occurring on the implementation/practicing professional side. In the past, public participation with regards to natural resource management has unfortunately "often had limited value" (Sheppard S. R., 2005). Conventional methods of involving the public, such as invitations for the public to comment on reports, or attend open-house sessions usually lead to low participation and satisfaction levels in regards to planning involvement. The usual approach often leads to a standoff between the harvesting industry and environmental groups. In situations where participation has helped to result in accordance between parties, the process may be limited, resulting in the public being left out of the implementation decisions. This generally leads to stakeholders claiming that the final decision-making is biased (Sheppard S. R., 2005).

BENEFITS AND DRAWBACKS

There are numerous benefits and positive aspects of the relationship between landscape visualizations (LVs) and public perceptions of sustainable forestry management practices (SFM). Generally, LVs are created via cost-effective computer techniques to represent environmental data which would normally be represented by 'abstract' statistics. Resource managers themselves can literally see the limitations and assumptions made in their models. In terms of the general public, visualisations "appear to influence the participant's level of interest in the discussions, and tend to hold their attention" (Meitner, et al., 2005), and can convey lots of information in a short time period. An interactive aspect is provided to the audience, which facilitates better spatial understanding of the underlying data. Many experts tend to be involved in the creation of LVs due to base data requirements, which ensures completeness of representation and allows more opportunity for in-depth explanations during the presentation of SFM options. These goals are difficult to reach with statistical and information-heavy presentations. Several fundamental SFM requirements are met, including the consideration of visual resources, as well as consulting the general public and/or First Nations groups. Finally, more software is becoming available at decreasing prices, which enables people with moderate computer skills to create near realistic LVs. The end result will likely be that management companies or consulting firms will not have to rely on specialized in-house employees, or contracting the work out to other firms. Producing LVs will become both cheaper and easier, further increasing their appeal as a decision support tool.

While many benefits have been mentioned throughout this paper, there are also some drawbacks and limitations to consider. The primary limiting factor is data availability. High quality biophysical data may not exist, or be provided promptly enough to support the computer applications involved in creating LVs, especially in a system as complex as that developed by CALP (Sheppard S. R., 2000). If the required data does exist, it can be difficult to reliably extrapolate into future conditions, which is further complicated by natural occurrences such as fire, disease, wind events, insect infestations, etc. (Sheppard S. R., 2000) (Bell, 2001). The production of LVs can still be a time consuming process, requiring lots of expert input. Given the large range of variables in perception, and the lack of visual landscape data, it is still possible for any two preparers (with the same base data and software) to produce highly varied visualizations (Sheppard S. R., 2000). Once the LVs have been created, there are still a number of potential obstacles in the public consultation process ahead. For instance, it is possible for clients (such as a private harvesting company) to be an intermediary between the visualization preparer (e.g. a consulting company), and withhold LVs from being displayed to the public, as they feel they would be unfavourable to the proposed project(s). This has been documented, as found in (Sheppard S. R., 2000). Furthermore, the validity of a presentation can be compromised by a number of factors, which include an inherent emphasis on the visible aspects of management scenarios, dependency on selected (near) realistic images, and the (potentially biased) narrative (Meitner, et al., 2005).

If all goes according to plan, and feedback is given by the public on the proposed management scenarios, the intended result is an 'iterative loop'. The general idea is that management professionals and the public can work together to develop a result that is in the best interests of both sides. The reality, however, is that the process can be long and drawn out. Eventually, a decision will have to be made that may not be entirely favourable to all parties involved. Shortening this process is not aided by the fact that there has been little practical application outside of the academic context. In somewhere like British Columbia, this is likely due to private companies attempting to manage public lands while trying to make the most of an already small profit margin, and simply being unable to spare the time and expense involved with public consultation processes. Finally, "the volume of documented evidence in the scientific literature on the effect of visualizations on actual planning decisions is very small" (Sheppard S. R., 2000).

FUTURE POTENTIAL AND RECOMMENDATIONS

Continued development of both the technological capabilities, as well as research into key aspects of the 'iterative loop' process will be important for the use of landscape visualizations as a decision support tool. With the continued implementation of SFM practices and guidelines, the C&I on which they are based should also be accounted for in the participatory processes (Sheppard S. R., 2005). As results of the initial round(s) of practical testing and implementation of public involvement during landscape planning become available, they will provide a valuable basis for refining the process.

A common set of rules and guidelines for the creation of landscape visualizations should be developed by the research/scientific community working in partnership with practicing management professionals. The approach taken would ideally be one where scientific experience guides the land base managers to create LVs in a simple 'experiment' format. Feedback from public forum presentations could be gathered and analysed by a collection of interdisciplinary researchers. Both professional parties would be able to use their major strengths while establishing and developing their roles, and creating a larger, more comprehensive iterative loop process that would still involve the general public.

A further advantage of having the experimental phase performed by scientists is that parties such as timber harvesting companies (who are required to present management options, yet are more widely perceived to have biases and vested interests) will not be testing the waters entirely on their own. As discussed in the "Other Considerations" section, care must be taken to ensure the public consultation phase goes as smoothly as possible, otherwise trust can be lost, and the process can be seen in an unfavourable light. This would be both undesirable and counter-productive, and so the bulk of guideline development is best left to those who can view it as an experiment where bias and experimental error are minimized. Distributing the responsibilities in this way allows the management professionals to concentrate on following the implementation of the complex regulations and requirements of SFM practices, as well as how to use their pre-existing decision support tools (growth and yield, harvest patterns, etc.).

While this approach may seem complicated initially, it would eventually result in the development of at least a 'basic' code of ethics, or standards of practice that countries can adopt into their respective policies governing sustainable forest and/or visual resources management.

After a set of guidelines have been developed and implemented, landscape visualization results would likely become more 'standardised'. Streamlined implementation of technological advancements would be possible, as some of the new computer software or hardware would be designed to capitalize on ease of integration with a broadly-used framework. Currently, some proposed advancements include provisions to use existing video game technology to allow for more interactive landscape renderings that are designed to enhance realism and immersion via sounds, changing atmospheric effects, day/night/weather, etc. Trying to continually play 'catch-up' with implementing technology as it comes available would be unwise – the best approach would be to lay a solid foundation on which to prepare for the future.

CONCLUSION

Landscape visualizations will play a key role in communicating forest management decisions -and the information on which those decisions are based- to various parties in the years to come. It will, however, be important that the process has a solid base from which to adapt to both the changes in the technology it draws upon, and the management goals for which it is intended to communicate. Many steps in this direction have been taken, mostly as research projects designed to discover the limitations and biases which exist in the process of developing landscape visualisations as a means of conveying forest management information to the public. The full results of these preliminary 'experiments' have yet to be fully analysed and implemented. Multiple disciplines are involved, but there are many researchers working towards the common goal of developing a system that will work properly, and that can be implemented as easily as possible.

With the shift to sustainable forest management largely due to increased environmental awareness, and a desire to manage the land base responsibly, it would then be irresponsible not to provide information to the public about the conditions leading to management decisions. Once the process for creating landscape visualizations is standardized and even regulated, they will be a valuable tool in regards to public perceptions on forest management practices.

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