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Visual Analysis of Forest Landscapes

S R J Sheppard, University of British Columbia, Vancouver, BC, Canada

Introduction

This article examines the broad concepts and methods underpinning the management of visual resources in forestry, and describes some of the key scientific methods of addressing the often difficult issue of aesthetics and public perceptions of forested landscapes. It draws on accumulated research knowledge on public perception (*see* **Landscape and Planning**: Perceptions of Forest Landscapes) and provides general concepts and methods employed in more specific procedures for managing landscape values under visual resource management (VRM) (*see* **Landscape and Planning**: Visual Resource Management Approaches) and other multiple-value forestry programs. The topic of visual analysis focuses on the main human perceptual sense of vision, rather than appreciation of other aesthetic values such as sound and smell, which can also be very important in their own right though typically less critical than visual values in forestry.

What is the purpose of visual analysis? There are a number of reasons to conduct visual analysis or to be aware of its methods and underlying theories:

1. It can provide support for rational VRM and broader forest management decision-making, supplying credible scientific data on human perceptions, scenic quality, and visual design that can be used on an equal basis with ecological, economic, or other social data.
2. It provides systematic support for project planning and design where aesthetic values are important
3. It can be used to monitor visual qualities and VRM performance (at the regional to project level), as part of social sustainability assessments and forest certification efforts.
4. It can provide an indicator or predictor of public perceptions about some forest management issues, which can be useful as background for developing effective public involvement strategies.
5. It can provide visual documentary evidence for monitoring visible conditions over time (e.g., vegetation growth, human uses, etc.) that are important to various sustainability values or management issues other than aesthetics.

The history of visual analysis as applied today in forestry can be traced back most clearly to the practice of landscape architecture in Great Britain, where deliberate design of larger-scale somewhat naturalistic landscapes for aesthetics began in the eighteenth century. Certain principles of landscape design and analysis were first systematically applied to forestry by Sylvia Crowe, an English landscape architect working for the Forestry Commission in the 1960s. Since then there has been a tradition of landscape architects developing visual analysis and management approaches in forestry, incorporating both design principles and a growing body of research on aesthetic responses to forest landscapes. Researchers, most notably R.B. Litton Jr., and other landscape architects in the USA, developed the field of visual analysis in the 1960s and 1970s. The introduction of the National Environmental Protection Act (NEPA) in 1969, which recognized the need to protect the rights of Americans to aesthetic enjoyment, and the 'clear-cut crisis' in the US National Forests, led to the implementation of a major program of VRM in the US Forest Service, adapting Litton's work. This in turn has led to development of visual analysis procedures and VRM programs in other regions and jurisdictions, such as British Columbia in Canada. Other systems of landscape assessment and visual analysis have developed somewhat independently in various parts of the world, though mostly in the more developed and affluent nations.

Visual Landscape Description and Inventory

This section reviews some basic principles of visual perception and landscape characteristics, which govern how observers see landscapes. It represents the first stage of visual analysis, which permits quantifiable, objective analysis that does not require much interpretation or argument. It is based on a review of documented observation and research, as well as landscape design principles.

Fundamental Visual Characteristics of Landscapes

The process of vision exerts various influences on visual perception of landscapes. Key aspects of the physiology of vision include: visual acuity and contrast, which enables detection, and recognition of landscape elements; the field-of-view (horizontal and vertical extent); and the nature of eye movement, which automatically records visual information from certain points within the field-of-view. Vision is affected by variables of light transmission within the visible spectrum.

Litton in his seminal work *Forest Landscape Description and Inventories* was the first to develop comprehensive principles for analyzing and inventorying the visual characteristics of larger-scale natural landscapes. This work has been supplemented since by many others, such as the US Forest Service series on National Forest Landscape Management. Such methods are based on definitions of certain visual elements, which can be used to describe objectively the perceptual characteristics of landscapes (**Figure 1**). These elements include:

- color, including hue, value (lightness–darkness), and chroma (saturation or brilliance)
- texture
- scale (in absolute terms, relative to landscape scale, or relative to human scale)
- form (comprising three-dimensional (3D) forms and two-dimensional (2D) shape)
- line/edges
- position in the landscape
- movement in the landscape.

These elements can be used to describe the visual characteristics of the landscape and its principal components: landform, vegetation, water bodies, human land uses and structures, and atmosphere. The combination of these components and visual elements forms the landscape patterns and spatial (3D) structure that we see. The elements can be measured through approaches such as color charts or specifications, photographic image analysis, and pixel counts applied to representative images of the landscape.

Litton also described various perceptual relationships which affect how we see the landscape. These relationships include: diurnal/seasonal aspects of temporal variation (such as lighting direction, shade/shadow, weather); viewing distance and scale effects; observer position (superior, normal, or inferior with respect to the landscape being viewed); and observer motion (determining the effective field-of-view and viewing sequence).

In any natural landscape situation, various landscape compositional types can be identified, as follows:

1. Fundamental/large-scale compositions or spatial configurations.
   - panoramic: offering wide, unobstructed views over a large area
   - feature: views dominated by a major landscape feature such as a mountain peak or waterfall (**Figure 2**)
   - enclosed: views confined by enclosing elements such as forest edge or hills
   - focal: views focused in a particular direction by the alignment of topographic or other landscape components, e.g., a view down a narrow valley or road corridor.
2. Supportive/small scale compositions.
   - canopied: views within a forest stand, with overhead closure

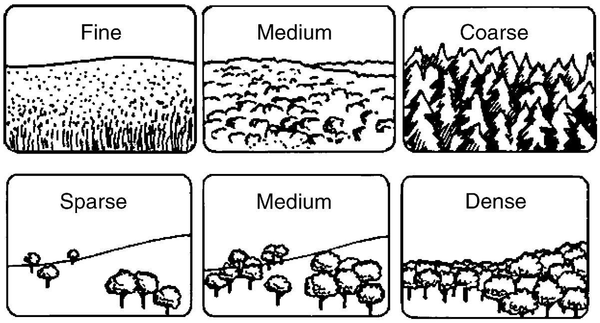

Figure 1 Example of a visual element texture that can be objectively described in the landscape. Graphic by Richard Alcina, reproduced with permission from Sheppard SRJ (1989) *Visual Simulation: A User's Guide for Architects, Engineers & Planners*. New York: Van Nostrand Reinhold).

Figure 2 Feature landscape with view dominated by a mountain peak.

- detailed: close-up views of small-scale landscape features, e.g., wild flowers.

Temporal landscape patterns can also affect landscape perceptions, sometimes dramatically. Ephemeral landscapes include views of short-lived or rapidly changing landscape features, such as fall color on trees or reflections in lakes. Change of landscapes over time are usually evaluated in terms of visual impact prediction for specific projects such as forest harvesting activities (see 'Visual Impact Assessment' below); here, there is a tendency to assess 'before and after' conditions, rather than the landscape dynamics of natural disturbance regimes, succession, or forest rotation cycles over time. The rise of landscape ecology has focused more attention on some visual descriptors of the results of natural disturbance events, in the form of a classification of landscape mosaics into patches, corridors, networks, matrix, etc. These can be quantified, but common landscape ecology metrics do not appear to be closely related to aesthetics.

Landscape Inventory Concepts

This section describes conventional approaches used to document and classify the existing ('baseline') landscape conditions.

Visual units Various organizational frameworks for mapping and classifying visual landscapes have been suggested, on a hierarchy of scales that can be related to physiographic regions, biogeoclimatic zones, forest types, the 'landscape' or watershed level, and stand level. However, these other landscape description systems cannot be expected to correspond closely with visual mapping, due to the integrative nature of the essentially visual experience: a visual landscape is defined by the totality of what is seen within the viewshed, not necessarily what it consists of in any one place.

Each of these landscape scales can be described in terms of geographic extent, boundaries/edges, landform, vegetation, water forms, and focal attractions/local features. This combination of landscape components defines what the US Forest Service calls the 'Characteristic landscape' and what in Europe is referred to as landscape character.

The visual unit level most closely approximates the scale of the forester's meaning of the word 'landscape,' although visual units can range from small valleys to very large basins. A visual unit represents a distinct area of recognizable unified character, often defined by spatial enclosure such as basins, valleys, watersheds, etc. Visual units have been mapped as the basic spatial units for visual assessment in many studies. Descriptors of visual characteristics of individual units, commonly used in many larger scale inventories, include:

- scale (extent)
- boundary definition
- spatial configuration/proportions
- landscape patterns
- unifying/detailed features
- other sense-of-place indicators that contribute to the unique character of each place.

Some visual landscape inventory systems also recognize landscape subdivisions at a subunit level, such as a particular hillside or other landform component (**Figure 3**).

Landscape visibility Beyond the broad organization of spatial and temporal landscape patterns,

Figure 3 Identification of landscape subunits (termed visual sensitivity units) using the British Columbia Ministry of Forests method. Image by Ken Fairhurst; courtesy of Greater Vancouver Regional District.

visual inventories often attempt to measure the visibility of specific areas, points, or objects in the landscape, as seen from certain viewing locations. This is often termed viewshed mapping or 'seen area' analysis. Clearly, visibility factors are critical in determining whether or not there can be a direct visual impact from forest operations or natural disturbances.

Visibility of landscapes depends upon the viewer location. Viewpoints are usually identified as certain use areas (e.g., recreational sites, residential areas, or other community gathering points) and travel routes. These can be specific points, often termed key observer points (KOPs), or linear travel sequences. Selection of appropriate viewpoints for analysis is often conducted with knowledge of relative observer concerns (see below). Observer position (elevation) makes a considerable difference in terms of what can be seen of a particular forest landscape.

Visibility is limited by topography, vegetative screening, man-made structures, atmospheric conditions, and, over long distances, by the curvature of the earth. Visibility can be described in terms of viewing distance, viewing angle (horizontal and vertical), and visual penetration (the extent to which observers can see through screens or filters of intervening objects, such as tree belts).

Techniques used to map visibility include linear map notation, cross-section analysis, manual mapping of visible areas from on-the-ground viewpoints, and computer viewshed analysis using 3D geographical information system (GIS) datasets. Whether these techniques take into account tree height in calculating and mapping visibility can make a difference in terms of accuracy in lowland landscapes or detailed, site-specific studies.

Visual Landscape Assessment

Visual landscape assessment goes beyond the relatively objective inventory of conditions, to evaluate and interpret forest landscapes for certain characteristics or qualities important to forest planning and management. These can involve prioritizing areas of the landscapes that are suitable for certain management regimes or actions, or identifying particular constraints, risks, or opportunities that are important to bear in mind in forest planning and design. Various methodologies for landscape assessment have been applied to large-scale landscapes. These are important as a possible framework for VRM decisions to predict aesthetic values and for modelling of future management outcomes.

In the interpretation process, there is the need to consider both the landscape characteristics described above (typically evaluated by trained experts), and the characteristics and concerns of observers. Both can be mapped and to some extent quantified. Both landscape and observer characteristics can be assessed by expert methods, public perception testing, or a mix of these methods.

In general, methods of visual analysis usually address one or more of the following major aspects of visual landscapes (although they may not be defined in these terms and often overlap within the assessment methodology):

- visual absorption capability
- viewer sensitivity
- visual quality
- landscape meanings.

Visual Absorption Capability

Visual absorption capability (VAC) is defined as a measure of the landscape's ability to absorb alteration and maintain its visual character. It expresses the likelihood that a landscape change will be noticeable, and serves as a general predictor of visual impact (**Figure 4**). It describes how well a landscape

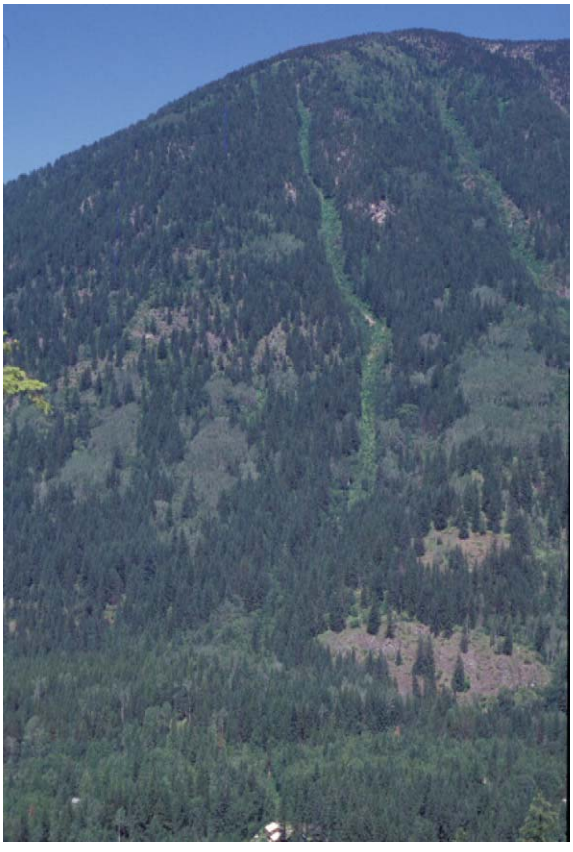

Figure 4 Landscape with moderate visual absorption capability due to strong vegetative patterns but steep terrain.

disturbance might fit in to the landscape. Typical indicators of VAC may include:

- slope (angle and screening)
- vegetation pattern (color, texture, orientation, uniformity)
- soil erosion potential
- soil color
- landform screening/surface variations
- vegetation screening
- aspect
- man-made features/urban clutter.

Typically, the steeper the slope and the more uniform the surface patterns, the harder it is to design a forest intervention that will be unnoticeable or acceptable to the public. VAC evaluation is usually conducted by visual resource experts, and is intended to help locate and/or design forestry activities to fit the landscape character.

Viewer Sensitivity

Classically, viewer sensitivity levels have been defined as a measure of people's concern for the scenic quality of the landscape. While this can be obtained directly from or verified by community representatives, in most cases viewer sensitivity is assessed based on a set of assumptions about what viewers are likely to care about. It embraces the concepts of landscape visibility (how the landscape is viewed) and viewer concern (how much viewers care about the visual characteristics of the landscape). The key indicators usually used include a few quantifiable and mappable factors:

- type of viewer: recreation users, sightseers/visitors, and residents are commonly considered to be the most concerned
- number of viewers (use volumes)
- visibility and viewing distance from key observer points: foreground and middleground views are most sensitive
- viewing duration and frequency
- other viewing conditions, e.g., roadside screening, direction of view, view angle, etc.
- land designation/policy indicators, e.g., parks, wilderness area, scenic area, scenic highway corridor, designated urban viewshed.

Mapping procedures for viewer sensitivity include composite viewshed mapping from viewing areas and division of visible areas into distance zones (foreground, middleground, and background).

In essence, this part of the assessment weights those areas that are seen most closely and most often by people with a high expected concern for aesthetics in that area. Landscapes that are more seldom seen, or seen mainly by workers, for example, are typically considered to be less sensitive to human disturbance (on visual grounds). While this tends to work in practice, this often-adopted policy has been criticized as representing an 'out of sight, out of mind' approach, and may also raise issues of social justice. It is generally understood that it is best to verify expert assumptions on viewer sensitivity with real perception data from a sample of the affected public.

Visual Quality

Visual quality has been defined in various ways by different researchers and practitioners, but it is often used in forest management as the overall dimension for aesthetics. It is sometimes referred to as scenic beauty, aesthetic value, or a measure of visual preference, factors that approach the landscape as a source of aesthetic enjoyment. It is sometimes directly addressed by forest policies and management practices, though often in a vague manner.

Classically, VRM approaches recognize that landscapes with the greatest visual variety or diversity have the greatest potential for high scenic value (**Figure 5**), using indicators such as slope, rock form, vegetation pattern, and water forms (*see* **Landscape and Planning**: Perceptions of Forest Landscapes). Research and practice have found that such features can create visual interest and draw people's attention. The landscape can therefore be mapped by experts in terms of its level of distinctiveness within a regional landscape character type. This usually assumes a typical observer in a first-encounter viewing situation. Some systems have developed methodologies that recognize a broader range of indicators of visual quality, such as vividness, variety, intactness (freedom from obvious human-made changes), and overall visual unity or harmony of the parts.

Figure 5 Landscape with high visual variety and distinctiveness.

Relatively few studies have attempted to assess the effects of natural disturbance on visual quality. Some scientists believe that cultural forces in Western nations have led to forest landscape preferences (and assessment approaches) that favor a static, visual mode of landscape experience, and an aversion to the death of trees and the 'messiness' which results from rapid landscape change.

In North America and some other countries, human influences on the forested landscape have until recently been viewed as positive features only where they represent limited, traditional (usually pastoral or historic) features of largely rural cultures. Most human interventions in landscape assessment approaches are treated as negative 'visual intrusions' by default. The largely expert-based US Forest Service Visual Management System in 1974, for example, equated departure from natural-appearing conditions with reduced visual quality, on the assumption that the public visiting the US National Forests held an expectation of a naturally appearing landscape character. Western research on human perception of timber harvesting does provide support for these assumptions: visual preferences generally decrease as the perceived degree of disruption (i.e., sudden change, perceived destruction, and 'messiness') increases, and people tend to prefer smaller-scale clear felling or plantations, for example, over larger changes. Expert evaluations of existing visual condition (EVC) attempt to map and quantify the apparent naturalness of or level of human disturbance in the landscape, as a contribution to overall visual quality at a given time.

In more obviously developed and culturally modified regions, there is no baseline of a natural landscape that can readily be used in visual analysis, and a richer set of issues and influences on aesthetic values needs to be considered. In some countries with long cultural histories of landscape manipulation, for example in Europe and China, formal views of aesthetic quality have arisen from art appreciation, landscape design, and other cultural or religious movements, which recognize human modifications or transformations of natural landscapes as closer to the ideal (**Figure 6**). These beliefs can lead both to an expert view of appropriate or higher-quality scenery, and popular appreciation of certain landscape characteristics. These values can be applied to forests by means of landscape assessments or appraisals by experts, which identify the important aspects of both natural features and landscape heritage to be protected.

Other approaches to assessing visual quality have relied exclusively or partly on soliciting people's opinions on different landscapes or landscape conditions. This can take various forms, from direct judgments about levels of scenic beauty to general questions on preference (like/dislike). Public perceptions can also be gathered on one or many of the factors described in the expert assessments, such as viewer sensitivity. Such methods can be used to verify the criteria and results of experts, though this practice is still rare. Methods have not generally been well documented, and range from very loose public participation exercises to rigorously controlled psychological experiments. One of the few methods of measuring and predicting public perceptions that has been formalized and documented is the Scenic Beauty Estimation method developed by Terry Daniel of University of Arizona, which associates people's stated scenic beauty judgments with physical features of forested landscapes, such as stand density or openness of views. A variety of methods are available to collect public perception information: workshops, stand-alone surveys with images to be rated (e.g., photo-questionnaires), public meetings where surveys are administered, user-selected field photography exercises, etc.; certain methods may not be equally suitable for all cultural contexts.

Figure 6 Wychwood Forest, Oxfordshire, UK: an example of a pastoral landscape with relic woodlands which hold substantial cultural meaning to local residents.

Landscape Meanings

While it is generally believed that visual quality of forested landscapes can be associated closely with human preference, it is also understood that many other factors beyond a concern with aesthetics or beauty are invoked by the look of the forest. These other meanings that the forest landscape may have for people may be confirmed, suggested, or exaggerated by certain visual characteristics. With indigenous cultural groups in North America and elsewhere, visual quality can be difficult to separate from other cultural, spiritual, and use values of the land and forests.

Assessment of public observer factors needs to take into account the particular sociocultural context, drawing on cultural traditions, use areas, documented public preferences in the area, past project experience, etc. There are many possible influences on human perceptions of landscape and their appreciation of it (*see* **Landscape and Planning**: Perceptions of Forest Landscapes). Both instinctive and cultural factors may exert an influence. Factors that may need to be taken into account in evaluating landscape meanings for forested areas include: familiarity and level of knowledge of observers with local conditions; the ability of the landscape to offer further information for viewers, e.g., through following a path or attaining a prospect over the surrounding landscape; and the relationship of the viewer to forestry activities (e.g., logger versus environmentalist). Theories such as information processing of landscape scenes and prospect-refuge theory underpin some of these kinds of analysis. Simply because a given forest landscape is not particularly scenic or unusual does not preclude strongly held local values for that landscape and how it appears to be managed. There is considerable literature documenting the values in the ordinary local landscape.

Methods of evaluating landscape meanings from observers include the range of public perception gathering techniques discussed above plus anthropological and sociological methods such as oral history documentation and cognitive mapping of community areas.

Visual Impact Assessment

Visual impact assessment has the purpose of supporting project level decisions and design activities, for consideration alongside assessments of other ecological and social impacts. Expert impact assessments normally determine whether and to what extent the proposed activity would be visible (using techniques such as viewshed mapping), and then describing and evaluating the expected landscape changes (**Figure 7**). Often, visual simulations (or landscape visualizations) are used to assist the process by depicting the expected visual condition of the landscape (*see* **Landscape and Planning**: The Role of Visualization in Forest Planning). Many of the same issues addressed in the overall landscape assessment described in the preceding section also apply to the more particular assessment of project visual impacts.

Visual impact assessment is based on the same general principles and procedures as other resource impact assessments, derived from international and regional environmental impact assessment guidelines codified for example in the National Environmental

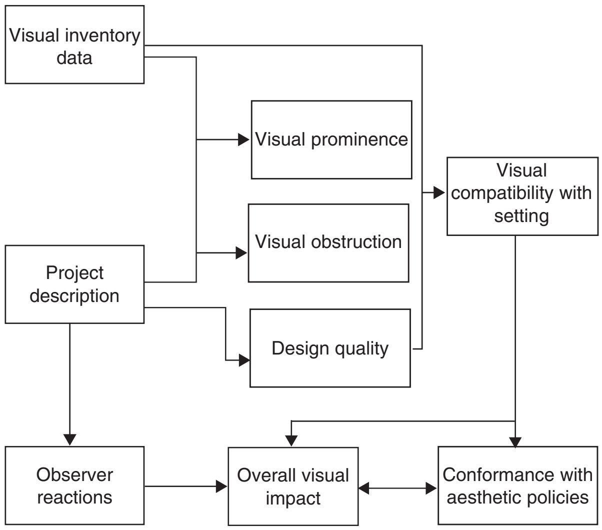

Figure 7 Example of criteria used in the process of visual impact assessment for proposed management activities. Reproduced with permission from Sheppard SRJ (1989) *Visual Simulation: A User's Guide for Architects, Engineers & Planners*. New York: Van Nostrand Reinhold.

Protection Act in the USA and World Bank policies. Typically, visual impact assessments contain a baseline assessment, description of visual aspects of the project, assessment of expected visual effects (magnitude and significance), review of compliance with visual quality objectives (VQOs) and policies, mitigations required or desired, and assessment of any residual visual impact. Visual impact can be considered positive or negative/adverse, with impacts described in terms of type, severity, significance or otherwise. Mitigation methods identify visual characteristics that can be modified through the redesign process to achieve a lower or more compatible level of visual impact.

A variety of criteria have been used for assessing the visual impact of forest management activities. Most commonly these address the prominence or visual dominance of the activity relative to the surrounding landscape (**Figures 8** and **9**), and comparison with the desired objectives established through a visual analysis (VRM) process. Thus, a proposed timber harvesting operation might be assessed in terms of the expected visual condition relative to the VQO established for the area. Less visibly contrasting management actions, such as dispersed partial cutting, are more likely to meet a given objective or maximum dominance level than a more contrasting technique such as clear-cutting (**Figure 10**). However, other criteria may be important, such as view blockage, design quality, or other indicators of visual compatibility with the local landscape. Some agencies have developed structured and comprehensive

Figure 8 Harvesting approaches using a geometric pattern of removal tend to be visually dominant. Photograph by P Picard, Collaborative for Advanced Landscape Planning (CALP).

methods of assessing visual impacts, such as rating visible landscape modifications in terms of strong to weak visual contrasts in form, line, color, and texture of the landscape. Some visual impact assessment systems also evaluate harvesting plans on criteria of design (e.g., 'Does it exhibit elements of good visual design?'), and scale (e.g., 'What portion of the visual landscape do existing alterations and proposed operations represent in perspective view?') These criteria can sometimes be quantified through image measurements or professional scoring. However, some research suggests the more numeric systems may suffer in terms of reliability between raters.

Again, public perception information can be used in assessing visual impacts of forestry. People can be asked to judge the visual impact level or acceptability directly, or they can be asked to indicate the criteria important to them for evaluating visual impact, which can avoid bias due to direct 'voting' for an alternative preferred for a variety of aesthetic and other reasons. Public perception data are useful for verifying effects on local or public values, but consistent data should not be expected for all individuals. The view of a cut block or plantation may be a symbol or trigger for many other emotional or cognitive responses, which originate in other sources of information beyond the landscape itself, e.g., cultural background, recent news events, etc. In recent years, a movement headed by Gobster has advocated the improved understanding of ecological processes as a basis for a more informed landscape preference: the 'ecological aesthetic.' The experience of community forests and pre-industrial-scale forestry traditions in many countries suggests that increased activity by local forest managers working inside the community, demonstrating care for the local landscape (sometimes termed 'visible stewardship'), may lead to higher community acceptance of timber harvesting than would reduced or concealed forest management activity. This suggests that visual impact assessments should consider the informational process by which landscape changes are planned, presented, and implemented.

Nonetheless, in Western countries, public reaction to change in the forest setting often demonstrates a negative association with large-scale or rapid landscape disturbance. It is possible to predict the severity of visual impact by examining the proposed project approach to particular practices likely to trigger public concerns, such as perceived waste of resources when slash and snags remain on site (**Figure 11**) or where there are ineffective and wind-prone buffer strips between the viewer and the activity.

Visual impact assessment needs to consider the time elapsed since the activity took place. In general, the longer the time from the disturbance, the lower the visual impact. Vegetation succession tends to reduce visual contrasts, and at some point people may no longer recognize the area as disturbed by humans. Active management areas, once regenerated, may have higher scenic value to people. Perception studies conducted in British Columbia, for example, found a significant threshold, termed Visually Effective Green-up, with tree heights of 3 to 8 meters in clear-cuts.

The foregoing discussion has been couched in terms of predicting visual impacts from future forestry activity. However, visual impact assessment is also necessary for monitoring and assessing visual conditions after the management activity (e.g., post-harvesting assessments) and on a regular basis as part of certification or adaptive management programs.

Conclusions and New Directions

Visual analysis has evolved over the last few decades into a suite of approaches that can be used to describe objectively and even quantify many aspects of the appearance of forest landscapes. The analysis and prediction of public responses to landscape conditions is much more complicated and uncertain, although in certain cultures (notably younger Western nations with a strong image of the natural landscape), research and forestry practice have revealed strong patterns of preference for certain levels and types of forest management practice. In these conditions, prescribed forms of visual analysis leading to VRM programs have proved fairly robust

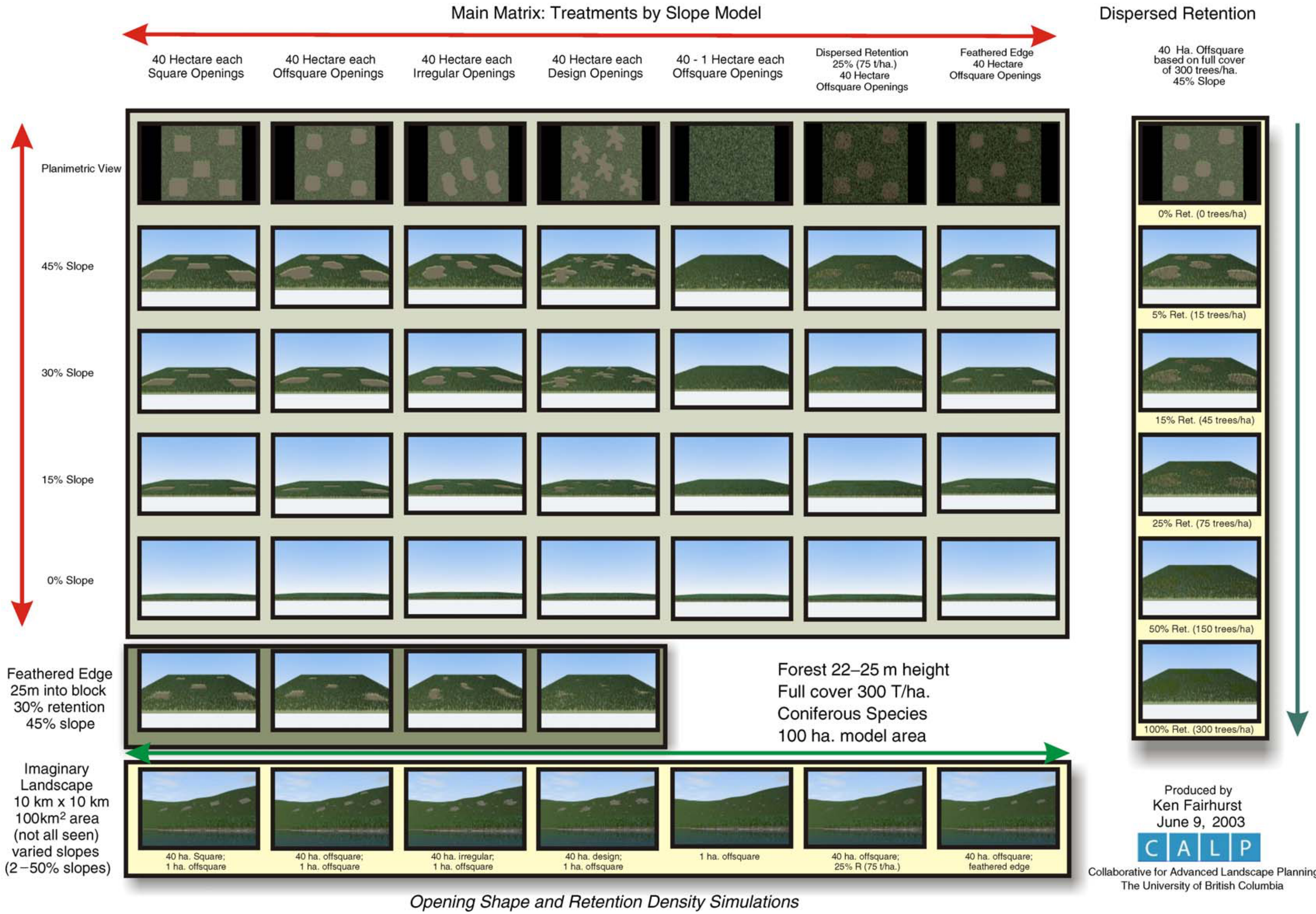

Figure 9 Controlled landscape visualizations of hypothetical forest harvesting treatments, showing differing levels of visual dominance with different design approaches. (Figure by Ken Fairhurst, CALP, reproduced with permission from British Columbia Ministry of Forests.)

Figure 10 Examples of partial cut (left) and a square clear-cut (right) as seen in winter. Photographs by Paul Picard, CALP.

Figure 11 Foreground view of landscape showing 'messy' waste material from a logging operation.

(*see* **Landscape and Planning**: Visual Resource Management Approaches). Here, visual analysis can provide a credible basis for policy objectives and design.

The applicability of such methods in other cultures has yet to be comprehensively established. There are as yet no accepted universal standards for aesthetic enjoyment of forest landscapes, and much more work needs to be done on the analysis of landscape meanings and sense of place, as part of defining social sustainability. In the meantime, there seems to be small risk in a careful, detailed attempt by experts to survey and describe landscape conditions, so long as the spiritual, cultural, and historic aspects of the landscape are given full weight, and expert evaluations are compared to and integrated with the knowledge and priorities of local people and other concerned users. The evolving role of other factors such as information, education, and economic necessity in determining public preferences must also be acknowledged. Expert-driven visual analysis should always begin with objective inventory and description before attempting more judgmental evaluations and interpretations, which should be grounded in the local landscape conditions and cultural context.

There do appear to be many places in the world where forestry is conducted without a sensitivity to visual concerns, and many would draw parallels between this experiential deficiency and the long-term unsustainability of the associated forest practices. The interactions between ecological values and aesthetic values require much more study. Time will tell whether emerging concepts in Western countries, such as an ecological aesthetic and visible stewardship, are able to transform how the public views forest management activities; it is interesting to speculate whether such movements will take Western nations back towards the more holistic views of landscape and human use observed in many indigenous cultures. Certainly, more research is needed on the effects of information of various kinds on people's preferences for forest landscapes.

We can expect increased use of visual monitoring methods to track data on both general forest conditions and aesthetic qualities: inexpensive systems of key observer points or 'landscape control points' need to be set up to provide long-term, systematic measurement and documentation of landscape change in perspective view through standard photography, to augment remote sensing data. Such systems, and visual analysis in general, should not be seen as relevant to just 'front-country' situations, in places most visible from current human-use areas: even remote landscapes are being increasingly used for recreation and tourism, and the internet provides the mechanism to broadcast imagery from anywhere in the world to a concerned public that is likely to judge forestry by its appearance.

See also: **Landscape and Planning**: Perceptions of Forest Landscapes; Perceptions of Nature by Indigenous Communities; The Role of Visualization in Forest Planning; Visual Resource Management Approaches. **Recreation**: Inventory, Monitoring and Management.

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Visual Resource Management Approaches

S Bell, Edinburgh College of Art, Edinburgh, UK

Background and History

The issue of visual resource management in forestry largely came to prominence after World War II, as the increasing network of highways and mass car ownership enabled large numbers of people to explore the countryside or natural landscapes of North America, Europe, and other developed countries. This period also coincided with greatly increased forestry activity such as afforestation programs in Britain, Ireland, and New Zealand and with increasing levels of timber harvest in the USA, Canada, and Scandinavia, especially on public lands. By the mid-1960s public concerns over the appearance of both newly planted forests and logging operations had increased, prompting agencies such as the British Forestry Commission and the US Forest Service to look for ways in which to safeguard the landscape. The models developed in Britain and the USA followed different routes, partly due to the scale of the forests and forest operations but also reflecting the type of forestry.

The US Model

In the USA logging took place (and still mainly takes place, at least in the National Forest System) in extensive natural forests, where the visual impact of sudden changes to the scenery, occurring over a large-scale landscape, can be very great. While the impact of an individual cutblock could have a negative visual effect, the cumulative impact over large areas was often considered to be greater still. This prompted the development of an approach to suit the scale of the landscape, the extent of the forest, and the need to try to control the rate of landscape change and its degree of impact, an approach that is generally referred to as 'visual resource management' or VRM. This approach aimed to manage the level of impact of logging on the natural scenery, especially as seen from key viewpoints, and this led to a highly developed visual management system intended to prioritize areas within large tracts for different levels of scenic protection (described below in more detail).

The UK Model

In Britain, the program of afforestation led to significant landscape change but each new planting project was relatively self-contained and there was