Public Perceptions of West-side Forests: Improving Visual Impact Assessments and Designing Thinnings and Harvests for Scenic Integrity

Robert G. Ribe

Abstract

Perceptions of public forests' acceptability can be influenced by aesthetic qualities, at both broad and project levels, affecting managers' social license to act. Legal and methodological issues related to measuring and managing forest aesthetics in NEPA and NFMA decision-making are discussed. It is argued that conventional visual impact assessments—using descriptive pictorial qualities against a naturalistic scenery standard—have limitations as legal evidence, in addressing other popular aesthetic values, and helping public participation in planning processes. But such descriptive assessments do have merit: they are similarly perceived by diverse people, they describe landscape attributes that managers can manipulate, and they are strongly related to the public's broad-trust perceptions of forests' acceptability. Evidence-based guidelines are offered for the production of scenic quality in Pacific Northwest west-side forests. These guidelines are derived from extensive studies of forests and perceptions in the region, and estimate and interpolate average public perceptions of average forest conditions. They inform in-stand perceptions related to forest density measurements and regeneration harvest prescriptions, of percent and pattern of tree retention, and of retained down wood. Other guidelines related to percent and pattern of retention and harvest unit design apply to vista views of harvests. These guidelines can assist planners and managers in designing forest treatments, implementing wholesale forest plans to maintain broad-trust acceptability perceptions, more reliably meeting scenic integrity standards, and making more accurate visual impact assessments at regional and project scales.

Keywords: Forest visual impacts, scenery management, timber harvest design, social acceptability, public participation.

Introduction

Perhaps in an ideal world, public forest planners and managers would only need to make decisions to optimize the technical achievement of well-defined natural-science-based objectives. Recent experience suggests that it is also important to manage forests' social acceptability to avoid popular and antagonistic perceptions of forest plans and projects (Bengston 1994). This can help forestry professionals regain and maintain their "license" to plan and execute projects with professional discretion. This paper seeks to provide practical aesthetic theory and evidence-based guidance to forest planners in estimating visual impacts and keeping forestry projects from going past "tipping points" of acceptability.

Perceptions of "social acceptability" are often not the same as those that forest managers encounter in public meetings, hearings, or other legal contexts. They are more intuitive, emotional, and holistic (Hansis 1995; Wyatt et al. 2011). They are not primarily motivated

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to reflect the needs of a particular individual, community, corporation, or interest group. Such perceptions can be positive or negative, and become powerful when they are widely and deeply felt. They are not always formed according to criteria defined by elites, stakeholders, activists, or lawyers. A well-defined legal story usually lies behind forest management conflicts. But behind that story often lie aesthetic perceptions reinforced by political narratives, typically related to winners and losers, justice and trust in government (Tindall 2003). Together these can create adverse perceptions of forest management (Ford et al. 2009). Such shared perceptions can rely on cognitive simplifications of the complex world of forest policy and planning more than on the technical details of forest science, policy, litigation, or implementation (Shindler et al. 2002; Tindall 2003; Olsen et al. 2012).

Public agencies gain acceptance of forest management at two social scales. The first can be called "broad-trust acceptability", and encompasses regional or national populations and relates to many people's trust in an agency to serve public interests and take good care of forests. The second can be called "project-level acceptability" and is more focused on the details, trade-offs, and conflicts of interest that are manifest in "hot spot" projects, area plans, and the rules and policies that drive these. Gaining and maintaining license to manage land and harvest timber requires both kinds of acceptance. The spotted owl controversy involved a loss of broad-trust acceptability and regional/national loss of social license. Forest management projects or forest plan revisions held up by local opposition and legal/administrative challenges involve loss of project-level acceptability (Blahna and Yonts-Shepard 1989; Trosper 2003).

Social acceptance of forest management is driven by perceptions at both these scales (Shindler et al. 2002). Perceptions that drive broad-trust acceptability occur among members of the "general public" who are extensively interested in public forests because they serve generally understood values. These concerns are not typically intensely focused on particulars or places but are influenced by ideological or intuitive perceptions of public landscapes and by stories and social narratives found in news media and social networks (Allen et al. 2009; Clement and Cheng 2011). Perceptions that drive detailed project-level acceptability are mainly those of smaller numbers of activists and stakeholders focused on specific, conflicting agendas and values. Perceptions of power relationships and justice typically frame these perceptions because they are seen to weaken or strengthen these competing goals (Cheng and Mattor 2006; Daniels and Walker 1995). Technical, functional, and spatial details can matter much more in negotiating solutions that gain acceptance among conflicting parties.

Forest managers who design thinnings and harvests are familiar with these facts of political life. They are also aware of the general importance of aesthetic forest perceptions (Ribe 1989), but the role of aesthetics in decision-making is challenging (Shindler et al. 2002). They face at least three problems: (1) how to predict the aesthetic impact of forestry projects in advance for the various required environmental impact assessments; (2) how to go about managing the larger public forest landscape to maintain broad-trust acceptability; and (3) how to understand and communicate about forest aesthetics in local negotiations and public participation processes aimed at gaining project-level perceptions of acceptability across diverse constituencies. A basic, simplified discussion of practical aesthetics to address these problems is sketched below. Then, evidence-based recommendations are offered to aid forestry project design.

Practical Forest Aesthetics

The National Environmental Policy Act of 1969 (NEPA) promulgated a decision process that emphasizes scientific analysis (Bartlett 1986). The original NEPA process requires few and

inadequate opportunities for public participation, and these are constrained and located in the process so as to be unlikely to influence the design of alternatives or to yield useful and accountable perceptions of projects' acceptability (Hourdequin et al. 2012). Congress did, however, require assessments of visual impacts, while recognizing that this might fly against the science-based rationalism of the rest of the law. NEPA states: "…assure for all Americans… aesthetically…pleasing surroundings…and… develop methods and procedures…which will insure that presently unquantified environmental amenities and values may be given appropriate consideration in decision making…" The National Forest Management Act of 1976 affirmed this mandate with respect to forest landscapes: "…cuts… shaped and blended to the extent practicable with the natural terrain."

In principle, such visual impact assessment methods must pass evidentiary due process tests to avoid being deemed an inadmissibly arbitrary and capricious basis for public decisions (Tassinary et al. 2010). This arguably amounts to passing the same tests of reliability and validity applied to other scientific assessments required by NEPA (Palmer 2000; Palmer and Hoffman 2001). The U.S. Forest Service addressed this requirement for visual assessment methods (Smardon 1986) by adoption of the Visual Management System (VMS, USDA FS 1974), now modified as the Scenery Management System (USDA FS 1995). A pragmatic core approach to making purportedly reliable and valid visual assessments in these methods is to restrict forest aesthetics to formalistic descriptions of pictorial aesthetic qualities. These must conform to a normative standard of naturalistic scenery (Selman and Swanwick 2010; Sheppard 2001).

Visual assessments based upon naturalistic form, line, color, scale, contrast, etc., were assumed to have intuitive "face validity" (Litton 1972; Wohlwill 1976). This is the first-impression, 'primary aesthetic quality' of forest landscapes (Ingarden 1973). These have been assumed to be reasonably reliable if made systematically by trained experts (i.e., landscape architects) using standard procedures (Litton 1968; Smardon 1986). Reliance on such experts also has the advantage of producing assessments related to the form of landscapes managers can actually control. It also has the advantage of avoiding assessments based on hearsay public opinion "driven" by various value agendas, which can define their own aesthetic qualities (Parsons and Daniel 2002). These might range into diverse, "special", and potentially contentious or contradictory ad-hoc conceptions and perceptions of aesthetic value different than those specified by NEPA. NEPA was crafted to avoid creating an intractably irresolute political process and to keep pure judgments and decision authority in the hands of objective experts and officials with democratically vested authority (Bartlett 1986).

NEPA-compliant methods of assessing the aesthetic impacts of forest management, i.e., the SMS, have been legally accepted as "best available professional practice." This is because (1) they have been formally adopted by agencies; (2) some sanctioned method is required and the institutional cost of changing those methods would be prohibitively high even if they were found legally invalid; (3) lawyers and judges instinctively avoid contesting aesthetic measurements as a risky, cost-ineffective "can of worms"; and (4) demonstrably valid and reliable, widely-applicable alternatives, not requiring slow and expensive methods, have not been proposed. Nevertheless, the reliability and validity of SMS scenic impact assessment methods have not been demonstrated (Palmer 2000), and they have remained essentially unchanged for more than 30 years, while hundreds of scientific studies of landscape perception have been published.

Studies of visual-aesthetic perceptions of landscapes frequently confirm that public perceptions of scenic aesthetics can be predicted by descriptive formalistic or cognitive sense-making attributes of landscape scenery (Ode et

al. 2008; Ryan 2005). The exact degree of these relations varies in different landscape settings, cultural contexts, and with different research methods (Stamps 1999). Other studies confirm that perceived naturalism is a powerful, positive aesthetic value among most people everywhere, perhaps in "hard-wired" ways (Ulrich 1979), with psychological health benefits (Thompson 2011; Grinde and Patil 2009).

An advantage of expert visual impact assessments using naturalistic, pictorial standards is that this simple, face-valid concept of aesthetic quality is strongly related to public perceptions of broad-trust acceptability (Carvalho-Ribeiro and Lovett 2011). Ribe (2002) showed that perceptions of scenic beauty versus acceptability were strongly correlated among large samples of people with diverse environmental attitudes in the Pacific Northwest (fig. 1). This is consistent with other findings from the region (BCMF 1996; Kearney 2001; Kearney et al. 2011). Ribe (2006) also found that scenic beauty was the third-strongest predictor of informed perceptions of forests' overall acceptability (behind perceived habitat quality and economic value) in the same region (fig. 2). This is similar to other regional findings (Bradley and Kearney 2007; BCMF 2006; Brunson and Shelby 1992). The formalistic, pictorial naturalistic aesthetics specified by NEPA can therefore serve as a guidepost, among other considerations, in designing forest management plans and projects aimed at maintaining broad-trust acceptability.

Predicting Scenic Impacts of Forestry Projects

The problem remains of how visual assessments can be made more valid and reliable. When it comes to forests of the west-side Pacific Northwest, empirical evidence is available to serve as one major basis for more accurate visual impact assessments. Appropriately designed research can offer a strong contribution to legally

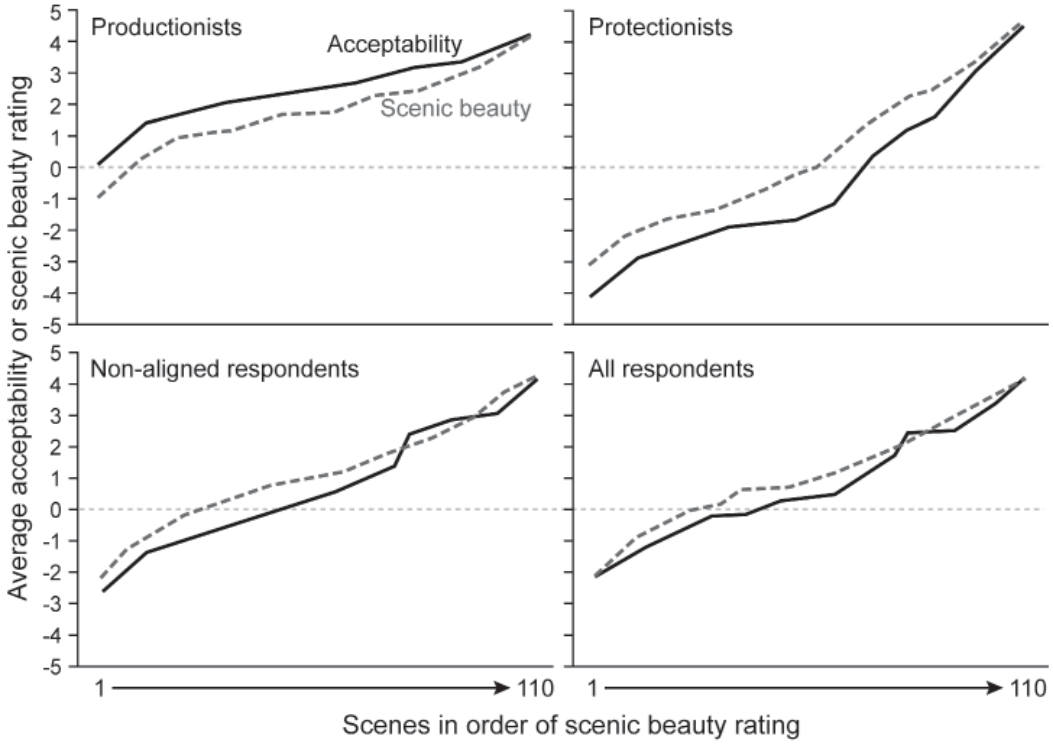

Figure 1—The relationship between uninformed acceptability ratings of 110 photos of west-side forests and uninformed scenic beauty ratings of the same photos among people with different environmental attitudes. Adapted from Ribe (2002).

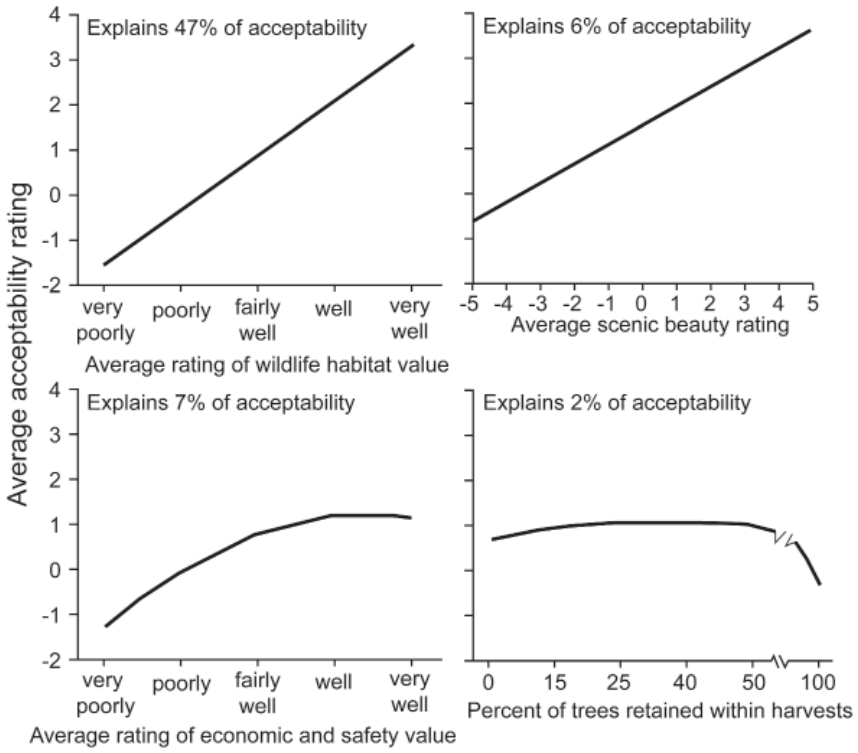

Figure 2—The relative strength and functional form of perceptions of information and of photos' beauty as these were associated with average overall acceptability perceptions of forest treatments in west-side forests. Adapted from Ribe (2006).

valid and reliable visual assessments of forest changes, using methods explained in detail by Tassinary et al. (2010).

Research cannot set the normative standards for visual impact assessment. These are socially defined and expressed through democratic due process of law and administrative procedures, i.e., NEPA and the SMS. But research can measure perceptions against these legally specified aesthetic concepts and standards. Representative samples of people's aesthetic perceptions can be elicited for well-sampled forest scenes. Ratings of legally appropriate scenic qualities can be statistically related to forest attributes depicted in the photographs. Such ratings of photographs correspond closely to perceptions in the field (Trent et al. 1987).

To understand how research can inform visual impact assessments of public forests, readers who are not landscape architects first need to understand the basics of SMS scenic standards. The SMS divides national forest landscapes into sub-areas where different desired "scenic integrity level" standards are applied (USDA FS 1995). These are based upon the beauty of each area's natural scenery, how visible the area is (hidden or seen at greater distances), how many people view it, whether what they are likely to be doing there is more sensitive to scenic quality, and how much aesthetic value local residents and recreators place upon each area. These integrity levels are conceptually defined and range from "very low" to "very high."

A critical problem with making admissibly valid and reliable visual assessments lies in predicting which scenic integrity level a thinning or harvest will conform to after it is finished. If a landscape architect is actively involved in designing a project, they can shape the cut unit as seen in a vista view to minimize visual impact and affect the scenic integrity level it should achieve. But a shortage of landscape architects may mean that this task is only performed for more sensitive projects. When silviculturists, engineers, and biologists design projects, they have no qualifications to make visual impact assessments, and landscape architects or outdoor recreation planners may be expected to provide post-hoc, conjectural visual

impact assessments. If these assessments are only made for in-stand views, none of these design or non-design professionals may have a clear enough idea what the forest landscape will look like after logging operations. It may be impractical to control the visual consequences of logging operations to the degree needed to predict final scenic integrity levels using SMS procedures with high confidence, either soon after logging or over the long term.

When extensive programs of forestry projects are planned, in specific or as-yet-unspecified locations (e.g., as the product of a forest plan or long-term timber sale program), there is typically little basis for valid and reliable descriptive assessments of "ungrounded and un-designed" projects using SMS methods. This wholesale decision-making is where full EIS assessments are most often required and where strong visual impact assessments are most needed and potentially subject to scrutiny.

Research can assist in improving visual impact assessments in both these situations. It can't explain the full variability in perceived impacts as a consequence of the detailed or accidental forest scenery produced by each and every forestry project. But it can inform reliable and valid predictions of average perceived visual impacts by an average member of the public in relation to scenic integrity standards. This can be done in relation to attributes of forest structure that managers intentionally manipulate in their prescriptions.

Practical Extra-NEPA Planning-process Aesthetics

Pro-forma NEPA- and NFMA-based decision processes have encountered political and legal challenges. Successful appeals have created precedents, case law, rules, and statutes that can be demanding of decision-makers and contradictory or confounding. These have empowered stakeholder and activist groups more than NEPA and similar organic planning laws arguably intended. One solution forest management agencies are pursuing is to engage in more intensive and meaningful public participation (Arnstein 1969) that promotes collaborative learning and collective decision-making (Daniels and Walker 1996). These aim to negotiate decision design and the trade-offs needed to arrive at a solution acceptable among multiple interests. This approach seems to be headed for effective use (e.g., Gordon et al. 2012) and codification in the "new forest planning rule" for national forests (USDA FS 2011).

Aesthetics' role in this emerging new forest planning process will be potentially important and interesting. Some brief speculative comments are offered here. There are many kinds of aesthetic experiences and qualities that might become salient or powerful in participatory planning. Philosophers and aesthetic theorists make very weak and subtle distinctions between aesthetic perceptions that occur in a passionate cognitive mode versus dispassionate claims of intrinsic or inherent value (Santayana 1896; Richards 2001; Kiester 1997). Forest planning activists tend to have passionate values based upon strong aesthetic experiences and consequent long-standing forest affections (Buijs 2009; Brown and Raymond 2007). These typically motivate their participatory agendas. Examples are perceptions of the beauty of a river basin rich in healthy salmon habitat; the pleasing social and economic vitality of a rural town supported by a strong timber industry; the harmonious ecology of an old-growth forest; or the sublime historical process by which resource development has over time inexorably, powerfully, and exploitatively lifted untold numbers of people into the middle class and provided them with greater freedom. Such aesthetic perceptions underlie spoken or unspoken claims of transcendent, intrinsic values that ought to be preserved in and of themselves as wonderful, ingenious, and vulnerable (sui-generis).

Obviously, such strong aesthetic perceptions behind claims of intrinsic value can be in

conflict. Indeed, they form a powerful basis for social conflicts that block forest decision-making and enliven attempts at participatory planning. Assessing and pursuing these kinds of aesthetic qualities in forests is quite different from the much safer, broadly shared (common-denominator) goal of producing as much naturalistic, formalistic pictorial landscape as possible, as Congress has directed. Many planning participants are embarrassed to voice aesthetic concerns. They seem "too religious", outside the technical aspects of decision-making that civil democratic discourse emphasizes, or divorced from the most relevant social narratives of who has power, gets what, and pays the price in political decision-making. Claims of intrinsic aesthetic value are vulnerable to the retort: "So what exactly do we decide to do to satisfy your aesthetic needs and all the other competing intrinsic (aesthetic) values?" Conventional visual impact management arguably avoids this problem by focusing on "superficial" appearances that are subject to manipulation in the landscape rather than in people's minds.

Naturalistic pictorial aesthetics may not be a major player in many public participation negotiations, as they can be too narrow and irrelevant to the most salient values in a conflict. Obvious exceptions will occur when important economic values flow from local exceptional visual aesthetic resources. But care should be taken not to sacrifice naturalistic pictorial visual landscape qualities when negotiating collectively acceptable solutions. This can put broad-trust acceptability perceptions at risk. Pictorial qualities may not be "at the table", but they still matter.

It may not be a waste of time to seek and propose specially crafted conceptions of aesthetic quality that cut across or transcend participants' competing, intrinsic aesthetic affections. Some of the ecological aesthetic ideas behind ecosystem management can be of this kind. These can seek to appreciate how active resource management can aesthetically resonate with the function of natural systems in ways most people perceive as intrinsically good (Gobster 1999; Carvalho-Ribeiro and Lovett 2011). Within a public participation process, it may be possible to promote shared aesthetic perceptions of the quality of the participation process itself. This might be a means to promote a sense of common purpose, and of the "intrinsic" value of an agreement that to some extent supersedes its privately perceived aesthetic inadequacies. But don't expect such internal process aesthetic perceptions to be shared outside the group.

Evidence-Based Aesthetic Decision Assistance for Pacific Northwest Forestry

This section provides evidence-based aesthetic decision guidance to forest planners regarding the density and structure of managed forests, particularly in the Pacific Northwest. The aims are (1) to help keep forest projects from going past "tipping points" of broad-trust acceptability perceptions that can jeopardize forest managers' social license; and (2) to more accurately predict average visual impacts of forestry projects that use the "standard" logging procedures used in the research studies from which the findings came. These impacts can be improved to some unverified extent by use of aesthetic forestry techniques, such as those advocated by Klessig (2002), the University of New Hampshire Cooperative Extension (1993), and others.

"Broad-trust tipping point" guidelines are offered based upon where source studies estimated that scenic integrity tends to be perceived to cross from low to moderate level. The aim is not to suggest that all public forestry projects should follow these guidelines. Biological and economic goals will sometimes necessitate otherwise. Instead, the suggestion is that if a preponderance of projects seen in the landscape meet or exceed the guidelines, then broad-trust acceptability perceptions should be maintained. The focus is on the author's studies of perceptions of west-side forests of Oregon and Washington. Only the

most useful results of these studies are extracted and sketched. Refer to the original publications for details of methods and all findings.

In-Stand Views

Several studies are reviewed here that investigated the production of scenic beauty against measures of forest structure and types of forest treatments, including unmanaged forests. These studies investigated only treatments in forests at least 40 years old, and only the scenery found within six months after treatments. Improvements do occur in scenic beauty in the early "green-up" years after regeneration harvests, but these are not as appreciable to the general public as might be hoped for (Kearney et al. 2011).

Mean changes in average scenic beauty perceptions attributable to different forest treatments were measured via public surveys where many groups of respondents rated numerous matching forest photographs of pre- and post-treatment conditions (Ribe 2005a). The resulting aesthetic changes are shown in fig. 3, without regard to differences in the initial scenic beauty of the pre-treatment forests. The resulting sequence of magnitudes of scenic change is similar to that found by Bradley and Kearney (2007). More intense treatments tend to produce greater reductions in scenic beauty, particularly if one accounts for the extent of open clearcut areas produced within harvest units, such as in aggregated retention harvest patterns.

Density Management and Scenic Beauty

Ribe (2009) found that the density and basal area of mature forests' structure are significantly related to average in-stand perceptions of scenic beauty. These results, described below, were derived from large samples of photographs of diverse pre- and post-treatment forests as rated by a large sample of residents of western Washington and Oregon.

A best-fit polynomial regression function (fig. 4) relating forests' density to scenic beauty estimated on an interval scale (Ribe 1988) was graphed against U.S. Forest Service Scenery

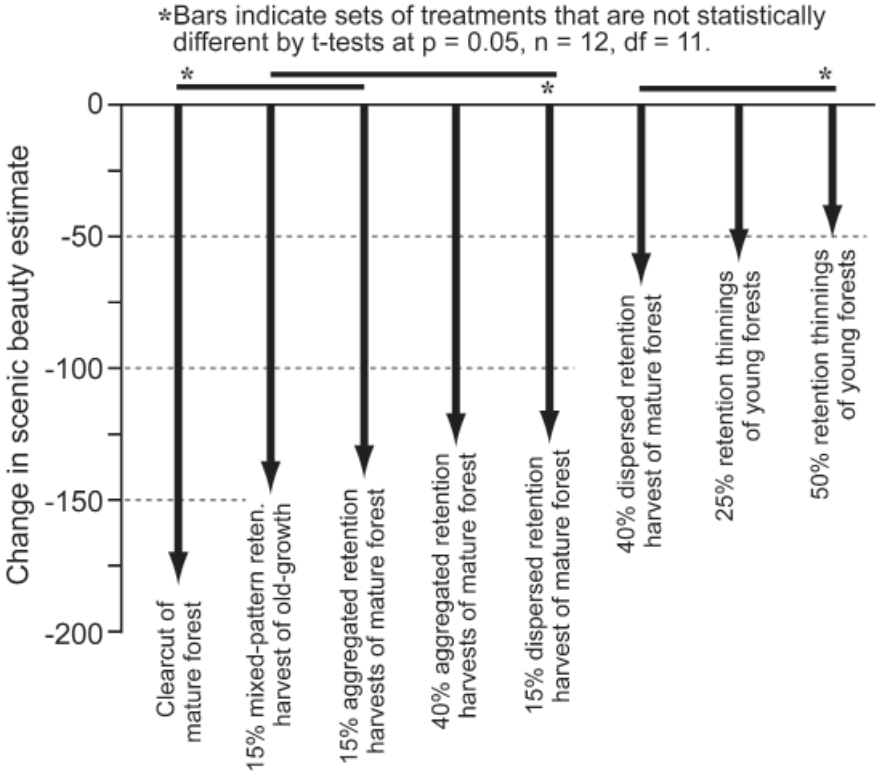

Figure 3—Comparisons of changes in average perceived scenic beauty ratings attributable to different forest treatments. From Ribe (2005b).

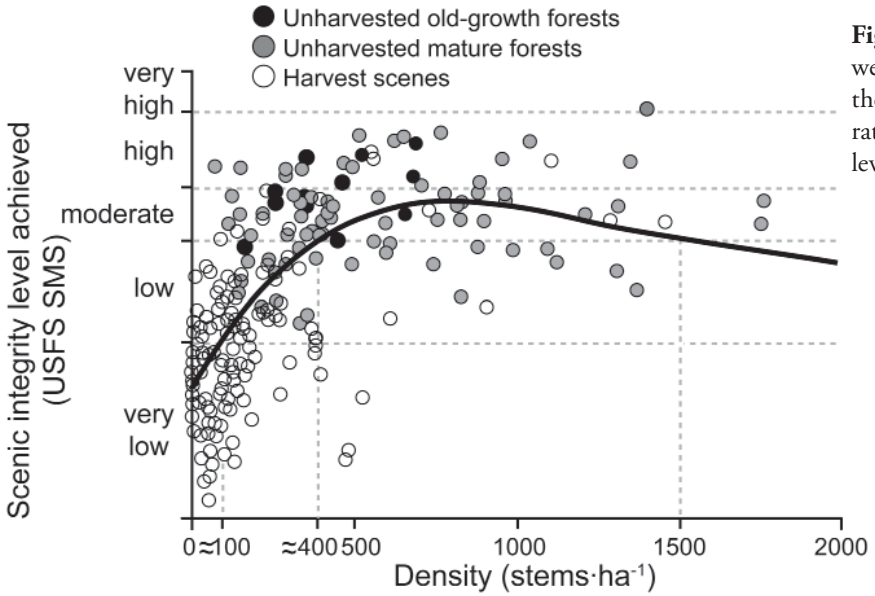

Figure 4—The relationship between west-side forests' stem density and their average in-stand scenic beauty ratings interpreted by scenic integrity levels. Adapted from Ribe (2009).

Management System integrity levels (USDA FS 1995). On average, forests with 400 to 1500 stems >5 cm·ha^{-1} tend to achieve the highest perceptions of scenic beauty, with the peak at about 750 stems·ha^{-1}. Very low, potentially adverse, aesthetic perceptions will tend to result from in-stand views of forests with less than 100 stems·ha^{-1}. The "broad-trust tipping point" threshold is about 400 stems >5 cm·ha^{-1}.

A best-fit polynomial regression function relating forests' basal area (BA) to in-stand scenic beauty perceptions (fig. 5) suggests that, on average, forests with 120 to 170 m^2·ha^{-1} BA will tend to achieve very high scenic integrity characteristic of the most beautiful old-growth forests. Forests with more than 170 m^2·ha^{-1} BA will tend to achieve high scenic integrity, likely due to the inclusion of larger trees within dense forests with broad diameter distributions; while those with 50 to 120 m^2·ha^{-1} BA will also tend to achieve high scenic integrity, likely due to moderate densities of mainly moderately large trees. Very low, potentially adverse, aesthetic perceptions will tend to result from in-stand

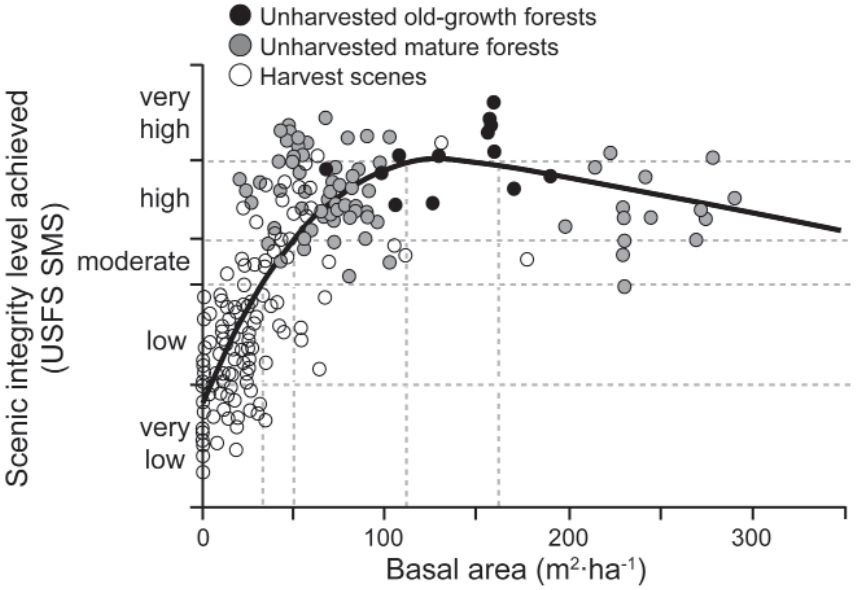

Figure 5—The relationship between west side forests' basal area and their average in-stand scenic beauty ratings interpreted by scenic integrity levels. Adapted from Ribe (2009).

views of forests with less than about 30 $m^2 \cdot ha^{-1}$ BA. The "broad-trust tipping point" threshold is about 50 $m^2 \cdot ha^{-1}$ BA.

For regeneration harvests seen from within, the relation between post-treatment retention levels and scenic integrity levels also accounted for levels of down wood (fig. 6) (Ribe 2009). Harvests with 40 percent dispersed retention and low down wood can achieve, on average, as much scenic integrity as pre-harvest forests. Other 40 percent retention harvests will tend to produce more marginal, moderate to low scenic integrity. Harvests with 15 percent aggregated retention and high down wood will tend to produce very low scenic integrity, comparable to clearcuts. Other 15 percent retention harvests can be expected, on average, to produce low scenic integrity. Ribe (2006) found that informed acceptability perceptions (as opposed to uninformed scenic beauty) were not significantly affected by high down wood levels. This suggests that public education should improve broad-trust perceptions of forests with high down wood in spite of their low scenic quality.

The same study (Ribe 2009) statistically interpolated average scenic integrity levels other than those produced at the 15 percent and 40 percent levels photographed and presented to respondents. This model has high margins of error (fig. 7). The key finding there is not so much the exact average scenic integrity level predicted for any retention level, but the interaction of favoring dispersed retention patterns and low residual down wood in producing scenic beauty, particularly at moderate (15–70 percent) retention levels. The broad-trust harvest retention levels are at about 15 percent for dispersed tree patterns with low down wood; about 30 percent in aggregated patterns with low down wood; about 35 percent in dispersed patterns with high down wood; and about 55 percent in aggregated patterns with high down wood.

Scenic Beauty of Harvests in Vista Views

Perception of scenic beauty in vista views (fig. 8) appears to be related to the design of the shape of harvest units rather than down wood (Ribe 2005b). These results suggest that aggregated-retention harvests will tend to produce low to very low scenic integrity, similar to clearcuts, irrespective of retention level. Dispersed retention patterns are more effective at mitigating scenic impacts in vista views than harvest shapes. At 15 percent retention, dispersed as opposed to aggregated retention patterns will tend to produce low, rather than very low, average scenic integrity. At 40 or 75 percent

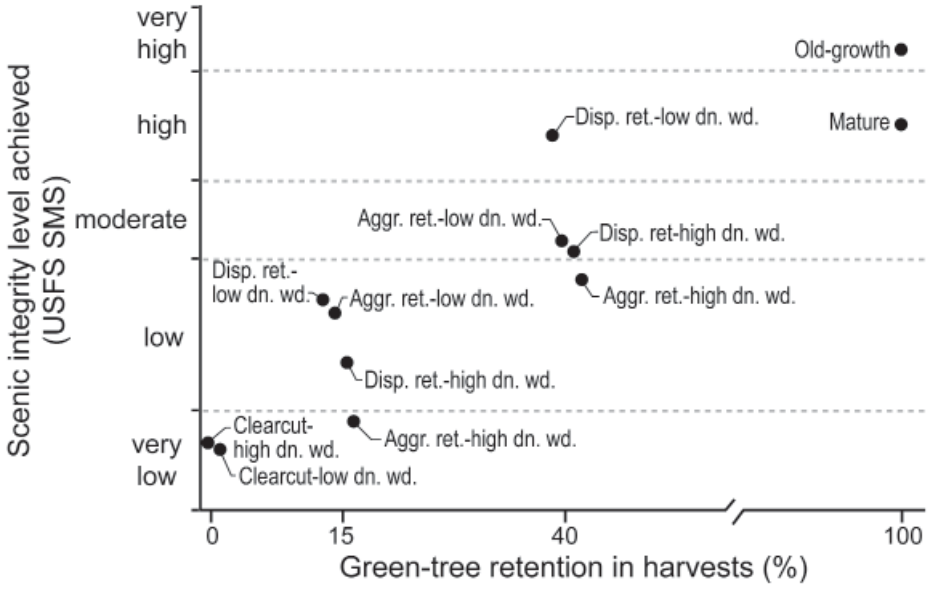

Figure 6—The relationship between west side forest regeneration harvests' variable tree retention levels and patterns, as well as down wood levels, and their average in-stand scenic beauty ratings interpreted by scenic integrity levels. Adapted from Ribe (2009).

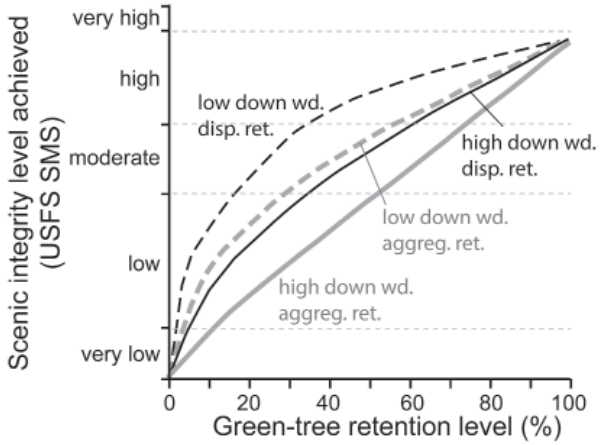

Figure 7—An estimated general statistically interpolated model of perceived scenic integrity levels in relation to a continuum of regeneration harvests' tree retention levels, sorted by retention pattern and down wood level. Adapted from Ribe (2009).

retention, dispersed patterns will tend to produce high to very-high scenic integrity, instead of the low to very low integrity levels associated with aggregated patterns. The "broad-trust tipping point" is 25 percent retention for dispersed retention harvests, irrespective of unit design. All aggregated retention harvests, including traditional clearcuts, fall below the "broad-trust tipping point" of scenic integrity. This perception is unlikely to be significantly mitigated by public education (Bliss 2000; Hansis 1995). However, Ribe (2006) found that informed acceptability perceptions of 15 percent dispersed retention harvests were substantially higher, albeit still a bit negative, than for clearcuts. This suggests that where ecological or economic goals call for cutover areas within cutblocks, if a few trees are left standing there (and remain so until greenup), then informed public observers may see these as evidence of visible forest stewardship, even if they otherwise see such areas as ugly.

Guidance for Predicting Average Visual Impacts of Forestry Project Designs

Standard SMS practice prescribes that if a forestry project will produce a visual change that conforms to the "expected or desired" standard at its location, then it is assessed as having a "low" visual impact. If it is predicted to fall one integrity level short of the local standard, it is assessed as a "high" impact. If it is expected to produce a visual change more than one level below the local standard it is assessed as having a "very high" impact. If projects may exceed the standard they are typically assessed as a "very low" impact. Average, evidence-based, estimated scenic integrity and visual impact levels achieved by forest and harvest structures described above are summarized in table 1. The SMS-derived visual impact of these designs will depend on the scenic integrity level standard set for the corresponding area of landscape, as described earlier.

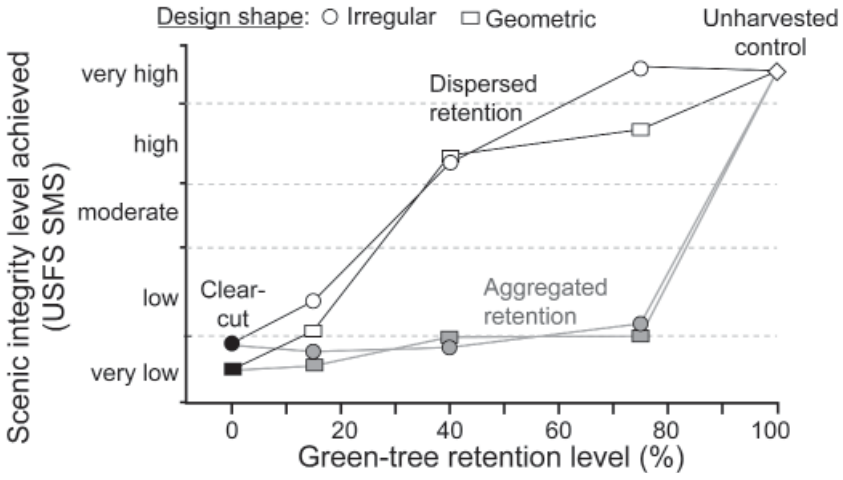

Figure 8—The relationship between average, vista-view scenic beauty ratings of forests and regeneration harvests interpreted by scenic integrity levels, as sorted by retention level, retention pattern, and harvest unit shape-type. Adapted from Ribe (2005a).

Table 1—Summary of evidence-based guidelines for estimating scenic integrity levels achieved by different forest conditions and regeneration harvest prescriptions; followed by a guide to corresponding visual impacts as related to project site scenic integrity standards. These can be used to predict expected average perceived integrity levels for the average west-side forest in assessments of multiple harvests in forest plans or for single, not-visually-controlled harvests. Levels can be improved when specific projects are designed or contextually assessed by landscape architects.

Designing Forests to Meet Scenic Integrity Standards If one or more of these criteria are met, then the integrity level in the left column is estimated to be met for an average forest seen by an average member of the public.					**Predicting Estimated Average Visual Impacts** Estimated visual impact resulting if a project area's scenic integrity standard is a column header and the forest meets criteria in a row in the left matrix.				
	In-stand Views			**Vista Views**	**Scenic Integrity Standard**				
Scenic integrity level achieved	**Forest density (stems >5 cm·ha^{-1})**	**Basal area (m^2·ha^{-1})**	**Forest type or harvest design**	**Forest type or harvest design**	**Very low**	**Low**	**Moderate**	**High**	**Very high**
Very high	700-1000	120-170	Old-growth forest	75-100% disp ret 95-100% agg ret	very low	very low	very low	very low	low
High	700-1000	50-120 or >170	Mature forest or: 40-100% disp ret, low dn wd; 60-100% disp ret, high dn wd; 60-100% agg ret, low dn wd; 75-100% agg ret, high dn wd	35-75% disp ret; 90-95% agg ret	very low	very low	very low	low	high
Moderate	400-700 or 1000-1500	30-50	20-40% disp ret, low dn wd; 35-60% disp ret, high dn wd; 30-60% agg ret, low dn wd; 55-75% agg ret, high dn wd	25-35% disp ret; 85-90% agg ret	very low	very low	low	high	very high
Low	100-400 or >1500	15-30	2-20% disp ret, low dn wd; 5-35% disp ret, high dn wd; 3-30% agg ret, low dn wd; 10-55% agg ret, high dn wd	15-25% disp ret, rectilinear shape; 0-25% disp ret, designed shape; 40-85% agg ret, any shape	very low	low	high	very high	very high
Very low	<100	0-15	0-2% disp ret, low dn wd; 0-5% disp ret, high dn wd; 0-3% agg ret, low dn wd; 0-10% agg ret, high dn wd	0-15% disp ret, rectilinear shape; 0-40% agg ret, any shape (designed shape might help 0-15%)	low	high	very high	very high	very high

Discussion

Designing forest treatments and regeneration harvests is always complex and fraught with conflicting goals and trade-offs. These goals are rooted in social values often instigated by aesthetic experiences and fundamentally understood by aesthetic sensibilities (Grob1995). The search for good forestry decisions can be understood as a search for "elegant" solutions that optimally achieve and express physical, biological, perceptual, and social functions. In a sense, such decisions can aesthetically transcend particular technical goals, biological criteria, or narrowly conceived social and aesthetic values. This is arguably a goal of ecosystem management, but this paradigm could be more explicitly attentive to broadly conceived aesthetics as they affect public perceptions (Lessard 1998). Forests that express ecological health by emulating ecological processes and attributes might gain public approval (Olsen et al. 2012), even when not of high scenic quality, by virtue of exhibiting "visible stewardship" (Sheppard 2001) to gain perceptions of their "ecological aesthetic" quality (Gobster 1999).

The challenge for forest managers is to design forest treatments that express visible stewardship and also public education programs that broaden public appreciation of ecological aesthetics among more people. If agency claims of ecological aesthetic value, as opposed to scenic value, are to gain legal validity, they have to be similarly perceived by at least a majority of the relevant public. Meanwhile, naturalistic scenic aesthetics are already similarly perceived by most people (McCool et al. 1986; Magill 1992), and are required by law and established visual impact assessment standards and methods.

The best approach seems to be the simultaneous pursuit of a mix of forests with naturalistic scenic quality and ecological aesthetic qualities (especially both at once), along with education programs seeking to increase appreciation of the latter. Over time, the socially acceptable "recipe" of these two aesthetic types may shift toward more ecological aesthetics, but the public's desire for naturalistic scenic quality is powerful, indeed likely hard-wired, and will not go away (Parsons and Daniel 2002; Thompson 2011). Managers should attend to the creation of ecological features like micro-habitats for insects, amphibians, and fungi, forests that serve as refugia or riparian or interior habitats, key habitat elements for wide-ranging sensitive vertebrate species, or the stabilization and enrichment of soil. These efforts should also pay attention to locally applicable scenic integrity standards and favor project designs, whenever possible, that tend to achieve these in the ways described above. Where scenic integrity standards are less constraining on forest attributes, projects should often, and whenever possible, seek to avoid crossing the scenic "tipping points" described above to maintain broad-trust public license to manage forests.

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Literature Cited

Allen, S.D.; Wickwar, D.A.; Clark, F.P.; Dow, R.R.; Potts, R.; Snyder, S.A. 2009. Values, beliefs, and attitudes technical guide for Forest Service land and resource management, planning, and decision-making. Gen. Tech. Rep. PNW-GTR-788. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 112 p.

Arnstein, S. 1969. A ladder of citizen participation. American Institute of Planners Journal. 35: 216–224.

Aubry, K.B.; Halpern, C.B.; Peterson C.E. 2009. Variable-retention harvests in the Pacific Northwest: A review of short-term findings from the DEMO study. Forest Ecology and Management. 258: 398–408.

Bartlett, R.V. 1986. Rationality and the logic of the National Environmental Policy Act. Environmental Professional. 8: 105–111.

Bengston, D.N. 1994. Changing forest values and ecosystem management. Society and Natural Resources. 7: 515–533.

Blahna, D.J.; Yonts-Shepard, S. 1989. Public involvement in resources planning: toward bridging the gap between policy and implementation. Society and Natural Resources. 2: 209–227.

Bliss, J.C. 2000. Public perceptions of clearcutting. Journal of Forestry 98(12): 4–9.

Bradley, G.R.; Kearney, A.R. 2007. Public and professional responses to the visual effects of timber harvesting: different ways of seeing. Western Journal of Applied Forestry. 22: 42–54.

British Columbia Ministry of Forests [BCMF]. 1996. Clearcutting and visual quality: a public perception study. Victoria, BC, Canada: British Columbia Ministry of Forests. Recreation Section, Range, Recreation and Forest Practices Branch.

British Columbia Ministry of Forests [BCMF]. 2006. The public response to harvest practices in British Columbia at the landscape and stand level. Victoria, BC, Canada: British Columbia Ministry of Forests. Recreation Section, Range, Recreation and Forest Practices Branch.

Brown, G.; Raymond, C. 2007. The relationship between place attachment and landscape values: toward mapping place attachment. Applied Geography. 27: 89–111.

Brunson, M.W.; Shelby, B. 1992. Assessing recreational and scenic quality: How does New Forestry rate? Journal of Forestry. 90: 37–41.

Buijs, A.E. 2009. Lay people's images of nature: comprehensive frameworks of values, beliefs, and value orientations. Society and Natural Resources. 22: 417–432.

Carvaho-Ribeiro, S.M.; Lovett, A. 2011. Is an attractive forest also considered well managed? Public preferences for forest cover and stand structure across a rural/urban gradient in northern Portugal. Forest Policy and Economics. 13: 46–54.

Cheng A.S.; Mattor, K.M. 2006. Why won't they come? Stakeholder perspectives on collaborative national forest planning by participation level. Environmental Management. 38: 545–61.

Clement, J.M.; Cheng, A.S. 2011. Using analyses of public value orientations, attitudes and preferences to inform national forest planning in Colorado and Wyoming. Applied Geography. 31: 393–400.

Daniels, S.E.; Walker, G.B. 1995. Managing local environmental conflict amidst national controversy. International Journal of Conflict Management. 6: 290–311.

Daniels, S.E.; Walker, G.B. 1996. Collaborative learning: improving public deliberation in ecosystem-based management. Environmental Impact Assessment Review. 16: 71–102.

Ford, R.M.; Williams, K.J.H.; Bishop, I.D.; Webb, T. 2009. A value basis for the social acceptability of clearfelling in Tasmania, Australia. Landscape and Urban Planning. 90: 196–206.

Gobster, P.H. 1999. An ecological aesthetic for forest landscape management. Landscape Journal. 18: 54–64.

Gordon, R.; Mallon, A.; Maier, C. [et al.] 2012. Building a citizen-agency partnership among diverse interests: The Colville National Forest and Northeast Washington Forestry Coalition experience. Res. Pap. PNW-RP-588. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 22 p.

Grinde, B.; Patil, G.G. 2009. Biophilia: does visual contact with nature impact on health and well-being? International Journal of Environmental Research and Public Health. 6: 2322–2343.

Grob, A. 1995. A structural model of environmental attitudes and behavior. Journal of Environmental Psychology. 15: 209–220.

Hansis, R. 1995. The social acceptability of clearcutting in the Pacific Northwest. Human Organization. 54: 95–101.

Hourdequin, M.; Landres, P.; Hanson, M.J. [et al.] 2012. Ethical implications of democratic theory for U.S. public participation in environmental impact assessment. Environmental Impact Assessment Review 35: 37–44.

Ingarden, R. 1973. Aesthetic experience and aesthetic object. In: Lipman, M., ed., Contemporary esthetics. Boston, MA: Allyn and Bacon: 274–297.

Kearney A.R. 2001. Effects of an informational intervention on public reactions to clear-cutting. Society and Natural Resources. 14: 777–790.

Kearney, A.R.; Tilt, J.R.; Bradley, G.R. 2011. The effects of forest regeneration on preferences for forest treatments among foresters, environmentalists, and the general public. Journal of Forestry. 108: 215–229.

Kiester, A.R. 1997. Aesthetics of biodiversity. Human Ecology Review. 3: 151–157.

Klessig, L. 2002. Woodland visions: appreciating and managing forests for scenic beauty. University of Wisconsin Extension. Available at: http://woodlandinfo.org/sites/woodlandinfo.org/files/pdf/UWEX/G3762.pdf

Lessard, G. 1998. An adaptive approach to planning and decision-making. Landscape and Urban Planning. 40: 81–87.

Litton, R.B. 1968. Forest landscape description and inventories. Res. Pap. PSW-49. Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. 64 p.

Litton, R.B. 1972. Aesthetic dimensions of the landscape. In: Krutilla, J.V., ed., Natural environments: studies in theoretical and applied analysis. Baltimore, MD: Johns Hopkins University Press: 262–291.

Magill, A.W. 1992. Managed and natural landscapes: What do people like? Res. Pap. PSW-213. Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. 28 p.

McCool, S.F.; Benson, R.E.; Ashor, J.L. 1986. How the public perceives the visual effects of timber harvesting: an evaluation of interest group preferences. Environmental Management 10: 385–391.

Ode, A.; Tveit, M.S.; Fry, G. 2008. Capturing landscape visual character using indicators: touching base with landscape aesthetic theory. Landscape Research. 33: 89–117.

Olsen, C.S.; Mallon, A.L.; Shindler, B.A. 2012. Public acceptance of disturbance-based forest management: factors influencing support. ISRN Forestry Article ID 594067. 10 p.

Palmer, J.E. 2000. Reliability of rating visible landscape qualities. Landscape Journal. 19: 166–178.

Palmer, J.F.; Hoffman, R.E. 2001. Rating reliability and representation validity in scenic landscape assessments. Landscape and Urban Planning. 54: 149–161.

Parsons, R.; Daniel, T.C. 2002. Good looking: in defense of scenic landscape aesthetics. Landscape and Urban Planning. 60: 43–56.

Ribe, R.G. 1988. Getting the scenic beauty estimation method to a ratio scale: a simple revision to assess positive and negative landscapes. In: Lawrence, D.; Habe, R.; Hacker, A. [et al.], eds. People's needs/planet management: paths to coexistence. EDRA 19/1988. Oklahoma City, OK: Environmental Design Research Association: 41–47.

Ribe, R. 1989. The aesthetics of forestry: What has empirical preference research taught us. Environmental Management. 13: 55–74.

Ribe, R. 2002. Is scenic beauty a proxy for acceptable management? The influence of environmental attitudes on landscape perceptions. Environment and Behavior. 34: 757–780.

Ribe, R. 2005a. Comparing changes in scenic beauty produced by green-tree retention harvests, thinnings and clearcuts: Evidence from three Pacific Northwest experiments. In: Peterson, C.E.; Maguire, D.A., eds. Balancing ecosystem values: innovative experiments for sustainable forestry. Gen. Tech. Rep. PNW-635. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station: 137–146.

Ribe, R. 2005b. Perceptions of green-tree retention timber harvests in vista views: How much do cut level, pattern and design matter? Landscape and Urban Planning. 73: 277–293.

Ribe, R. 2006. Perceptions of forestry alternatives in the U.S. Pacific Northwest: Information effects and acceptability distribution analysis. Journal of Environmental Psychology 26: 100–115.

Ribe, R. 2009. In-stand scenic beauty of variable retention harvests and mature forests in the U.S. Pacific Northwest: The effects of basal area, density, retention pattern and down wood. Journal of Environmental Management. 91: 245–260.

Richards, R. 2001. A new aesthetic for environmental awareness: chaos theory, the beauty of nature, and our broader humanistic identity. Journal of Humanistic Psychology. 41: 59–95.

Ryan, R.L. 2005. Social science to improve fuels management: a synthesis of research on aesthetics and fuels management. Gen. Tech. Rep. NC-261. Saint Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 64 p.

Santayana, G. 1896. The sense of beauty. New York: Scribner.

Selman, P.H.; Swanwick, C.A. 2010. On the meaning of natural beauty in landscape legislation. Landscape Research. 35: 3–26.

Sheppard, S.R.J. 2001. Beyond visual resource management: Emerging theories of an ecological aesthetic and visible stewardship. In: Sheppard, S.R.J.; Harshaw, H.W., eds. Forests and landscapes: linking ecology, sustainability, and aesthetics. IUFRO Research Series No. 6. Wallingford, UK: CABI Publishing: 149–172. Chapter 11.

Shindler, B.A.; Brunson, M.; Stankey, G.H. 2002. Social acceptability of forest conditions and management practices: A problem analysis. Gen. Tech. Rep. PNW-537. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 68 p.

Smardon, R.C. 1986. Historical evolution of visual resource management within three federal agencies. Journal of Environmental Management. 22: 301–317.

Stamps, A.E. 1999. Demographic effects in environmental aesthetics: a meta-analysis. Journal of Planning Literature. 14: 155–175.

Tassinary, L.G.; Jourdan, D.; Parsons, R. 2010. Equal protection and aesthetic zoning: a possible crack and a preemptive repair. The Urban Lawyer. 42: 375–394.

Thompson, C.W. 2011. Linking landscape and health: the recurring theme. Landscape and Urban Planning. 99: 187–195.

Tindall, D.B. 2003. Social values and the contingent nature of public opinion and attitudes about forests. The Forestry Chronicle. 79: 692–705.

Trent, R.B.; Neumann, E.; Kvashny, A. 1987. Presentation mode and question format artifacts in visual assessment research. Landscape and Urban Planning. 14: 235–235.

Trosper, R.L. 2003. Policy transformations in the US forest sector, 1970–2000: implications for sustainable use and resilience. In: Berkes, F.; Colding, J.; Folke, C., eds. Navigating social–ecological systems: building resilience for complexity and change. Cambridge, UK: Cambridge University Press: 328–351.

Ulrich, R.S. 1979. Visual landscapes and psychological wellbeing. Landscape Research. 4: 17–23.

University of New Hampshire Cooperative Extension, Northeast Regional Agricultural Engineering Service. 1993. A guide to logging aesthetics: practical tips for loggers, foresters, and landowners. Ithaca, NY: PALS Publishing.

U.S. Department of Agriculture, Forest Service [USDA FS]. 1974. National forest landscape management. Vol. 2, Ch. l (The visual management system). Agricultural Handbook 462. Washington, DC.

U.S. Department of Agriculture, Forest Service [USDA FS]. 1995. Landscape aesthetics: a handbook for scenery management. Agricultural Handbook 701. Washington, DC.

U.S. Department of Agriculture, Forest Service [USDA FS]. 2011. Draft programmatic environmental impact statement: National Forest System land management planning. Washington, DC.

Wohlwill, J.F. 1976. Environmental aesthetics: the environment as a source of affect. In: Altman, I.; Wohlwill, J.F., eds. Human behavior and environment, Volume 1. New York: Plenum Press: 37–86.

Wyatt, S.; Rousseau, M.; Nadeau, S. [et al.] 2011. Social concerns, risk and the acceptability of forest vegetation management alternatives: insights for managers. The Forestry Chronicle. 87: 274–289.

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Ribe, Robert G. 2013. Public perceptions of west-side forests: improving visual impact assessments and designing thinnings and harvests for scenic integrity. In: Anderson, Paul D.; Ronnenberg, Kathryn L., eds. Density management for the 21st century: west side story. Gen. Tech. Rep. PNW-GTR-880. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station: 22–37.