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Perceptions of forestry alternatives in the US Pacific Northwest: Information effects and acceptability distribution analysis ☆

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Abstract

Conflicts over timber harvesting and clearcutting versus wildlife conservation have instigated alternative silvicultural systems in the US Pacific Northwest. Major forest treatments can be the most controversial element of such systems. A public survey explored the social acceptability of 19 forest treatments that varied by forest age, level of green-tree retention, pattern of retention, and level of down wood. The survey presented respondents with photos of the treatments, explanatory narratives, and resource outputs related to human and wildlife needs. Respondents rated treatments for scenic beauty, service to human needs, service to wildlife needs, and overall acceptability. Acceptability distribution patterns were analysed for all forest treatments. These showed broad, passionate opposition to clearcutting, conflict over the acceptability of not managing forests, conflict over old growth harvests, conflict with some passionate opposition to 15% retention harvests, and unconflicted acceptance of young forest thinnings and 40% retention harvests. Modelling of these responses found that socially acceptable forestry attends to scenic beauty and serves wildlife needs, while also serving human needs but not at a high cost to these first two values.

Keywords: Forest management; Public perceptions; Timber harvests; Green-tree retention; New Forestry

1. Introduction

The success of land management programs often depends on adequate public acceptance in the face of conflicting interests and ideologies (Wondolleck, 1988). This effected by the causes and methods of change, the actors involved, the risks, context, available options, perceived viability, aesthetics, and trustworthy planning processes (Shindler, Brunson, & Stankey, 2002). While decision processes often revolve around points of law and gamesmanship among activists and interest groups, the viability and durability of management choices is also founded on understanding and gaining general public support, no matter how much choices may be technically justified, legally correct, settled among powerful agents, or supported by meritorious beneficiaries (Schneider & Ingram, 1997).

A common example of conflict in forest management involves choices involving timber harvesting versus forest preservation (Manning, Valliere, & Minteer, 1999; Shindler & Cramer, 1999), or between clearcutting and other harvest types (Bliss, 2000; Robson, Hawley, & Robinson, 2000). Recent efforts to address these conflicts have focused on "New Forestry" silvicultural systems (Franklin, 1989), which seek to provide harvests while also sustaining ecosystem functions. These retain various amounts and types of green trees and other "ecological legacies" within stands and across the landscape as timber harvests are implemented (Swanson & Franklin, 1992).

A seminal, prominent example of conflict over forest management and implementation of New Forestry is found

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in the public forests of the US Pacific Northwest (Carroll, 1995; Yaffee, 1994). There, issues of forest health, sustaining habitats, sustaining timber and other resource harvests, reducing fuel loads, and providing amenity values for urban populations are all in complex and lively play. The impact of timber harvesting on ecosystems is a focus of public contention (Brunson, Shindler, & Steel, 1997). An attempted resolution has been implemented via the Northwest Forest Plan, or NWFP (US Department of Agriculture & US Department of Interior, 1994). This plan favors silvicultural systems within certain areas that retain green trees, down wood, riparian forests, and other habitat features. Nevertheless, timber yields governed by the NWFP have been much lower than originally intended and often remain controversial, even when proposed within the plan's constraints (Charnley et al., 2006).

Perceptions of timber harvesting in the US Pacific Northwest have been largely conceived along a dichotomy between intensive harvesting versus forest preservation without appreciable management (Dietrich, 1992). Little is known about general public perceptions of timber harvests between these extremes. Popular perceptions may also be substantially based upon static views of forests (Kimmins, 1999), and little is known about perceptions if people see what nonclearcut forest treatments look like and are informed about the forest dynamics, resource values, and management rationales that justify them. If perceptions favor some silvicultural options this could suggest ways to produce wealth from timber harvests while not significantly diminishing general perceptions of ecological health and amenities that help recruit many wealth-producing people and businesses to the region (Niemi & Whitelaw, 1999).

2. Perceptions of forest management

Public perceptions of silvicultural systems that retain green trees and down wood, as per the NWFP, are potentially more favourable than those of plantation systems that entail clearcutting (Brunson & Shelby, 1992), but this is not certain (Gobster, 1996; Silvennoinen, Alho, Kolehmainen, & Pukkala, 2001). Most existing research findings about forest perceptions deal mainly with aesthetics, rather than perceptions of approval based upon multiple values, or the content of forests. They have also largely focused on conventional forest treatments (Clausen & Schroeder, 2004; Ribe, 1989). The study reported here focused on perceptions derived just from stand-level forest conditions, so only the same will be reviewed below.

A few studies of multi-dimensional perceptions of forests' acceptability have been conducted among the general public. These tend to investigate small samples of activists, interest group representatives, or people otherwise already engaged in local forestry issues. Common findings are that clearcuts and other very intensive harvests garner low acceptability while treatments employing green-tree retention garner higher approval (Brunson & Reiter, 1996; Burchfield, Miller, Allen, Schroeder, & Miller, 2003; Ribe, 1999). Predispositions derived from visual preferences tend to favor mature forests over young ones, and more natural or healthy appearing forests over plantations, obviously damaged, or managed ones (Anderson, 1981; Buhyoff, Leuschner, & Wellman, 1979; Carls, 1974; Hodgson & Thayer, 1980; Ribe, 1999). Forest treatments can gain approval if they are derived from public input, holistic scientific considerations, and attention to many, including environmental values (Shindler, List, & Steel, 1993), even among rural residents if environmental values are framed appropriately (McBeth & Foster, 1994).

Three recent studies have focused on acceptability perceptions of clearcuts versus other forest treatments or conditions that were informed by both photos and information. First, Kearney (2001) found that such perceptions of clearcut scenes can be increased if Michigan forest activists are informed that the cuts serve to create more ecologically valuable forests than those removed (as opposed to silvicultural or financial rationales), but the same information had no effect on perceptions of the post-clearcut regenerated forests.

Ford, Williams, Bishop, and Webb (2005) showed respondents simulated panoramas of clearcuts and other harvest types over time, together with information about their logging plans and resource value consequences. They found that perceptions of forests' acceptability vary depending on the environmental attitudes of their Tasmanian judges: Protectionist and nonaligned people find clearcuts unacceptable, selection harvests most acceptable, and generally prefer forests with more green-tree retention. Productionist people exhibited the reverse pattern with respect to all three of these characterizations. The information about the alternative harvest patterns had a slight affect on nonaligned judges' perceptions, but not on the others. The nonaligned judges seemed most affected by issues of logger safety and Eucalyptus regeneration such that selection harvests lost approval and a pattern of 30%, clumped, green-tree retention gained approval.

Burchfield et al. (2003) found that perceptions of harvests' acceptability—depicted on posters with resource outputs—varied insignificantly across a variety of Alaskan judges' interest group affiliations. Interviews found that judges' reasons varied, but all tended to find unharvested forests more acceptable, clearcuts least so, and the acceptability of six other intermediate harvests varied roughly with their intensity. The high level of agreement derived from how harvests sought to sustain natural systems, produce some on-the-ground benefits, balance tradeoffs, consider landscape context, and produce the appearance of natural complexity.

3. Methodological approach

In judging forest acceptability public respondents may often have limited desire or patience to consider multiple issues and complex information. Providing simple policy statements followed by approval ratings is subject to

wording effects, and can fail to ascertain important aspects of perceptions between people with different values, such as why people make their ratings, the contingencies behind their judgments, and the strength of their feelings. This study employed mixed methods (Miles & Huberman, 1994) seeking to reduce these difficulties. It descriptively analysed quantitatively estimated acceptability distributions, as described below. A closed-ended public survey (described in the Methods section) queried informed judgments, with staged, deliberative questions about multifaceted attributes of policy options, as suggested by Price and Neijens (1998). It aimed to identify important attributes and causes of perceptions that can be useful to decision makers in selecting silvicultural prescriptions for public lands.

The survey instrument was streamlined for general public respondents. However, its deliberative, time-consuming nature likely elicited responses mainly from people more interested in or attentive to forestry issues, who's political behaviour will most affect forest policy through voting and activism (Faulkenberry & Mason, 1978; Vasky & Donnelly, 1999). Informed responses from less-engaged or disinterested people tend to yield less meaningful results (Bishop, Tuchfarber, & Oldendick, 1986; Grant & Patterson, 1975). Informed survey responses from interested respondents may be more meaningful (Bright & Manfredo, 1995).

4. Acceptability distribution analysis

The key analysis of social acceptability in this study lay in interpreting acceptability distributions using a new method, borrowing from Davis, Hinich, and Ordeshook (1970). The nature of public perceptions of a policy choice, i.e. a forest treatment, can be diagnosed by three dimensions of the shape of its acceptability distribution. Each of these, defined below, can take on one of several forms, as illustrated in Fig. 1. These can combine in many ways:

1. The *Mean* of the distribution may correspond to a *positive*, *negative*, or *neutral* rating value, describing the central tendency of opinion regarding the policy.
2. The *Mode* of the distribution may be uni-modal, with one "hump" that may approximate a normal distribution, describing public *consensus*; or it may be *bi-modal*, with two "humps" (or more) describing *conflicted* public opinion. There may also be no clearly distinguishable "humps" in a acceptability distribution, with all ratings roughly equally represented, describing public *indifference* to a policy.
3. The *Mood* of the distribution may take on three descriptions: (1) A mode, or high point in the distribution, may be at or near the extreme positive end of the rating scale indicating public *exuberance* for a policy. (2) A mode may be at the extreme negative end of the rating scale indicating public *aversion*. (3) All modes may be sufficiently toward the centre of the range of ratings, exhibiting bell shapes with two tales and no preponderance of extreme ratings, describing *temperate* overall public opinion.

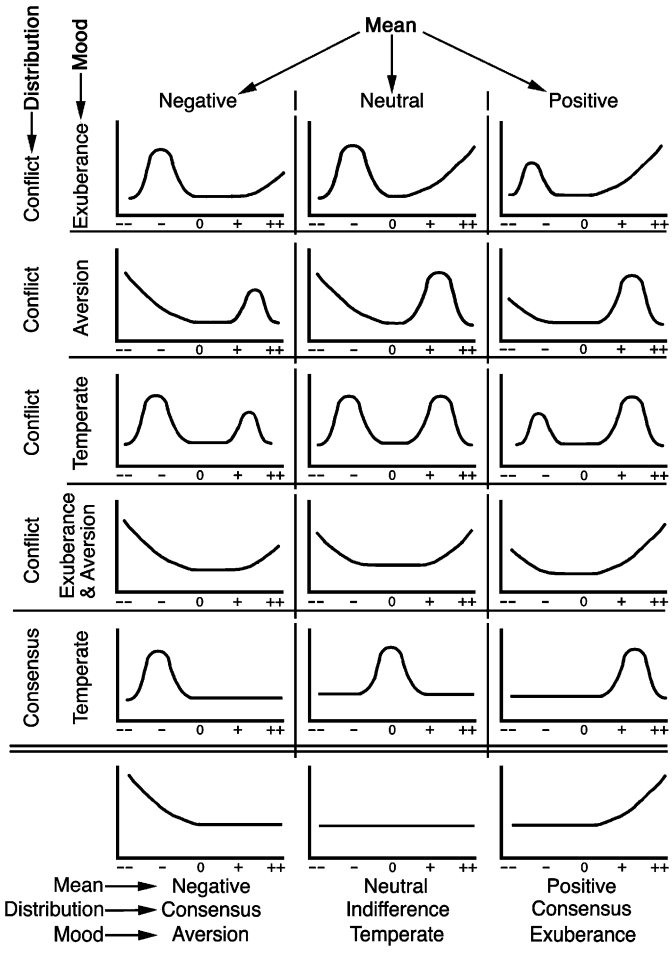

Fig. 1. Illustration of possible pure-case descriptions of acceptability distributions (not exceeding bi-modal distribution), combining means, distributions and moods. The vertical axis in every case measures the number or proportion of ratings rendered and the horizontal axis corresponds to a range of available rating values from very negative to very positive as indicated.

The description of the mode and mood of an acceptability distribution allows interpretation of how people with different attitudes contribute to overall public opinion. For example, one hump of a bi-modal distribution regarding clearcutting can reasonably be attributed to forest protectionists and the other to productionists. Further analysis of how differences in information about alternative policies relates to different acceptability distributions may aid interpretation of the interplay of attitudes and policy attributes in affecting public opinion.

5. Components of the public survey

This study chose to investigate acceptability perceptions of alternative forest treatments consistent with the complex forestry issues in play in the NWFP. Such perceptions need

to be cognisant of qualities, ideas, features and tradeoffs (Barnett, 1953), entailing both simple forest attributes and technical information about the treatments. This information needs to be perceived in a variety of forms representative of the ways that public perceptions can be affected (Kluckhohn & Strodtbeck, 1961). Accordingly, the survey for this study incorporated four types of stimuli (outlined below) relevant to effective public opinion research about forestry (Hansis, 1995; Tindall, 2003) and supported by social psychology theory (Bennett, 1993). The purpose here was to measure robust perceptions but not to investigate whether and how the different types of stimuli affect perceptions.

5.1. Visual affects

Judgments are often strongly influenced by emotional affects (Slovic, Finucane, Peters, & MacGregor, 2002), and visual affects are a major basis of environmental judgments (Ulrich, 1983), as are visual ideals (Greider & Garkovich, 1994). Scenic aesthetics are an established way of understanding social perceptions of forestry (Ribe, 1989), and are strongly correlated to acceptability perceptions (Ribe, 2002). Pictures of forest treatments, and aesthetic responses to them, should be included in public surveys about forests' acceptability, as was done in all the studies reviewed above.

5.2. Narrative information

Cognitive affects can arise from conceptual information (Tye, 1991), as mediated by metaphors by which a culture organizes and makes sense of experience (Lakoff & Johnson, 2003). These affects can be a durable, noncapricious basis for personal and shared environmental judgments (Petty & Cacioppo, 1981), and need not be rational (Zajonc, 1980). These affects can be stimulated by explicit or implicit narratives in relation to potent normative explanations and interpretations known as "frames" (Minsky, 1985). People may also perceive narratives via "scripts" (Schank, 1977) whereby other people's or agencys' choices and actions are related to one's own values. It is therefore useful to provide justificatory stories explaining forest treatment decisions. The metaphors, frames and scripts they entail tend to be a stable, important basis for perceptions (Converse, 1964; Iyengar, 1990) that can be marginally affected over time by information (Althaus, 1998).

Information effects upon perceptions of forests' acceptability have been suggested by earlier studies, whether people are mainly considering visual scenes (Brunson & Reiter, 1996; Isen, 1993; McCool, Benson, & Ashor, 1986; Tips & Savasdidara, 1986), are making more complex cognitive judgments (Kearney, Bradley, Kaplan, & Kaplan, 1999; Kimmins, 1999; Lyons, 1983; Vining, 1992), are perceiving simple information (Anderson, 1981; Brunson & Reiter, 1996), or are apprehending the values of change agents (Dearden, 1989; Lovrich & Pierce, 1986; Nelson, McDonough, & Holecek, 1989). Positively framed narratives describing management intentions and biological processes can elevate judgments of active forest management (Kearney, 2001; Ribe, 1999; Simpson, Rosenthal, Daniel, & White, 1976), but not always (Ford et al., 2005).

5.3. Value outputs

Value statements relating to what people want or are willing to exchange are an effective conceptual shorthand for the play of information upon people's judgments (Axelrod, 1994; Norman, 1975). "Resource value" statements are potentially more objective than the narrative affects introduced above, and account for most planning representations of the consequences of environmental change, as in environmental impact statements. Information describing such values can be expressed via "outputs" implying tradeoffs associated with forest conditions or changes (Tindall, 2003). Simple information that expresses value ideas can help people judge unfamiliar phenomena (Stern, Dietz, Kalof, & Guagnano, 1995), such as forest treatments, and increase the certainty and stability of their judgments (Davidson, Yantis, Norwood, & Montano, 1985). It is useful to ascertain the strength of people's reactions to value output information (Bright & Manfredo, 1995; Burchfield et al., 2003), as in the aversion and exuberance acceptability distribution patterns in Fig. 1.

5.4. Nature–human dichotomy

When the virtue of forest conditions and changes are at issue, perceptions often focus on the explicit or implied norms of interaction between people and nature (Carls, 1974; Hodgson & Thayer, 1980; Kearney et al., 1999), as mediated by perceived forest context and observers' preexisting expectations (Brunson, 1993; Greider & Garkovich, 1994). For example, Burchfield et al. (2003) found that information about forest value outputs stimulated careful assessments typically conceptualized as tradeoffs between natural and human needs. This conceptual division of values is therefore useful in public surveys investigating the acceptability of forestry.

6. Research goals

This study sought to discover and describe public acceptability distributions (as in Fig. 1) for a diverse set of alternative forest treatments applied to public forests of the US Pacific Northwest. The set of treatments varied systematically by the principal variables that define silvicultural prescriptions: The proportion of green trees retained, the pattern of those trees, the amount of down wood retained, and stand age (Franklin, Berg, Thornburgh, & Tappeiner, 1997; Vanha-Majamaa & Jalonen, 2001). Factors that tend most to explain perceptions of forest treatments' overall acceptability were explored. These were the treatments' silvicultural attributes,

perceived scenic beauty, service to human needs, and service to wildlife needs.

7. Methods

The methods were similar to those of Ford et al. (2005) except that forest treatments were only rated soon after logging at the lowest point of public perceptions (Sheppard, Harshaw, & McBride, 2001), rather than dynamically over the life of the effected forests. Some changes over time were mentioned in the narratives. The experimental design involved four steps: (1) A sample of forest treatments was developed representing combinations of the silvicultural dimensions under study. (2) Representative photographs were acquired for each treatment. (3) Narrative explanations and resource value outputs attributable to each forest treatment were estimated with expert help. (4) A public opinion questionnaire was constructed, administered and analysed.

7.1. Sample of forest treatments

The forest treatments studied needed to include many diverse combinations of four silvicultural variables: (1) forest age (young, mature, old-growth); (2) harvest intensity (light, moderate, clearcut, or no harvest); (3) retention pattern (dispersed, aggregated or no retention); and (4) down wood level (low or high). The set of study treatments was limited by three factors: First, hypothetical treatments were not studied because photographs were needed of actual examples. Second, the photographed treatments needed to be similarly recent to control the visual effects of time since harvest. Third, the treatments needed to be executed in well-controlled ways so that the photos would be validly illustrative. These criteria were satisfied by using 19 treatments (Table 1) from ongoing, large-scale silvicultural experiments or from recent timber harvests that had been executed within well-controlled silvicultural parameters.

With the exception of the old-growth harvests, all the forest treatments were available from large-scale silvicultural experiments in western Washington and Oregon. These studies controlled for forest ages, retention percent and pattern, and down wood, and were conducted in a variety of conifer-dominated forests at various altitudes. They were the Demonstration of Ecosystem Management Options (DEMO) study (Aubry et al., 1999), the Long-Term Ecosystem Productivity (LTEP) study (Homann, Bormann, & Boyle, 2001), and the Young Stand Thinning and Diversity Study (YSTDS) (Beggs, Puettmann, & Tucker, 2005).[1] All were randomized block designs with harvest treatments replicated at various locations. Examples of unharvested old growth forests (Treatment 19) came from a DEMO study block that was not harvested. Old growth harvests (Treatments 17 and 18) came from two timber sales in the Umpqua National Forest of western Oregon.

Examples of high down wood conditions came from three post-treatment situations: (1) forests where high quantities of down wood had been intentionally left permanently on the ground; (2) forests that were photographed after trees were felled and the trunks removed but before all other harvesting debris was cleaned up; (3) areas of forest for which field measurements indicated the presence of large amounts of down wood (Ribe, 2005). All other forests not matching these three conditions represented low down wood conditions.

7.2. Photographic sampling

A sample of four photographs represented each forest treatment in the public survey (described later) so respondents could rate each treatment's scenic beauty as a factor that may contribute to overall acceptability perceptions. Large, unbiased samples of permanent monuments and photo directions within the forests served as photo points (Ribe, 2005). The sets of four photos representing each treatment were selected at random from these photos. Photos of the treated forests were made within 3 months after logging, at mid-day, with a 35 mm lens and the horizon in the same position.

7.3. Estimating resource value outputs

In addition to photographs, the survey instrument provided respondents with levels of expected resource value outputs for each forest treatment. Those included in the final instrument were constrained in six ways: (1) They needed to be clearly normative expressions of values, as opposed to characterizations of essentially factual forest conditions that might carry value connotations. This constraint helped distinguish narrative descriptions of the forest treatments in the survey from the resource values. (2) The output ratings needed to be specifically attributable to the operational differences among the forest treatments, as opposed to broad intentions, like "natural integrity," "multiple use," or "habitat protection." Such generic ideas

[1] The DEMO study provided examples of mature, untreated forests (Treatment 16 in Table 1), and harvests in mature forests retaining either 15% or 40% of green trees (Treatments 8–15). Harvests at each of these two retention levels were conducted either with dispersed (Treatments 8, 9, 12 and 13), or aggregated (Treatments 10, 11, 14 and 15) retention patterns. For the aggregated retention treatments, the percent retention was by area of the unit. For dispersed retention treatments, the percent retention was by basal area to match that of the corresponding, same-percentage, aggregated-retention treatment within the corresponding experimental block. The LTEP study provided more examples of mature, untreated forests (Treatment 16), clearcut treatments (Treatments 6–7), and one 40% basal area dispersed retention harvest with high down wood (50% by tree density, Treatment 13). The YSTDS study provided examples of young, untreated forests (Treatment 5), a heavy thin retaining a dispersed pattern of about 25% of stems (Treatments 1- and 2), and a light thin retaining about 50% of dispersed stems (Treatments 3- and 4).

Table 1
Forest treatments included in the study

Treatment number	Age class	Tree retention (%)	Tree retention pattern	Down wood level	Acronym
1	Young	25	Dispersed	Low	Y25DL
2	Young	25	Dispersed	High	Y25DH
3	Young	50	Dispersed	Low	Y50DL
4	Young	50	Dispersed	High	Y50DH
5	Young	100	NA	NA	YOUNG
6	Mature	0	NA	Low	CCL
7	Mature	0	NA	High	CCH
8	Mature	15	Dispersed	Low	M15DL
9	Mature	15	Dispersed	High	M15DH
10	Mature	15	Aggregated	Low	M15AL
11	Mature	15	Aggregated	High	M15AH
12	Mature	40	Dispersed	Low	M40DL
13	Mature	40	Dispersed	High	M40DH
14	Mature	40	Aggregated	Low	M40AL
15	Mature	40	Aggregated	High	M40AH
16	Mature	100	NA	NA	MATURE
17	Old-growth	15	Dispersed	Low	OG15DL
18	Old-growth	15	Aggregated	Low	OG15AL
19	Old-growth	100	NA	NA	OLD

NA = not applicable.

are vague or equally attributable to many forest treatments. (3) The values needed to be specifically attributable to physical attributes of the treatments that experts could reference in estimating output ratings. Hence, generic concepts like "recreation value," "cultural value," and "spiritual value" were excluded. (4) Scenic beauty was excluded because it was represented directly to the respondents by photos. (5) Values were excluded that cannot be meaningfully estimated within single forest areas, such as cumulative water-quality and fish impacts across watersheds, road network impacts, or landscape-level effects on large habitat ranges or ecosystem functions. (6) Broad value ideas too similar to, or tending to "lead the witness" about, respondents' acceptability judgments were excluded, such as the "viability" of the treatments.

A review of recent research documenting forestry values salient to the public in the region (Burchfield et al., 2003; Clausen & Schroeder, 2004; Shindler, Steel, & List, 1996) identified 12 candidate values of frequent concern that met the above six criteria: (1) old-growth habitat; (2) jobs, wealth-production and income; (3) wildfire risks; (4) forest habitat other than old-growth; (5) game habitat for deer and elk; (6) nontimber forest products (i.e. mushrooms, berries, etc.); (7) accelerated restoration of old-growth habitat conditions; (8) soil conservation and fertility; (9) logger safety; (10) production of or investment value in future timber harvests; (11) wildlife habitat on or near the ground; and (12) logging damage to leave-trees.

Two of these values were not included in the survey. First, the expert judges (described below) did not discriminate appreciable differences in soil conservation and fertility across the study treatments. Second, expert estimates of logging damage to trees proved strongly correlated to percent green tree retention so as to introduce multicollinearity errors in statistical analyses, and this was only cited once as a marginally important concern in the source studies.

7.4. Expert ratings of resource output values

Ratings of the resource output levels attributable to each forest treatment were needed for the survey instrument. These were developed from the opinions of nine expert silviculturist and forester judges from western Oregon, selected for their experience implementing and/or studying a wide variety of silvicultural options. They represented a range of employers, potential value biases, and areas of additional expertise.[2] The judges filled in a survey, rating the forest output values for each treatment on a five-point semantic differential scale from low to high. A few judges chose not to rate some values which they felt unqualified to judge.

All expert judges were provided with the same descriptions of the forest treatments and the same resource value definitions. These were written to reinforce the value selection criteria described above. The definitions were also written consistent with an instruction to make generic ratings as averages rather than in relation to any particular

[2]Three experts were silviculturists from the US Forest Service. One was a forest biologist from the US Bureau of Land Management. Two were forest research scientists from the US Forest Service. One was a silviculturist from private industry. One was a forester from private industry, and one was a forestry consultant to non-profit conservation organizations.

site or type of site, such as depicted in the photos of each treatment.[3]

The ratings used in the survey instrument were simply the average ratings across the experts, derived after converting the ordinal ratings to numbers. Average ratings that fell half-way between integer values were rounded in the direction of the rating(s) from the judges with the most expertise about the corresponding resource.

7.5. Output uncertainty bracketing ratings

Two additional sets of ratings were needed for analyzing uncertainty in the public survey results. These represented best and worst-case scenarios for the resource output values for each forest treatment. For every set of expert ratings unique to each forest treatment and value combination, the best-case scenario rating was computed according to the average deviation of all the judges' ratings made above their average value. When such values fell between integer values they were rounded up to the value furthest above the average rating to be conservatively generous in estimating the range of variability of the corresponding value output. The same rules were used in estimating the worst-case scenario values, except with deviations below average ratings and downward rounding.

7.6. Forest treatment explanations

The "foresters' decision explanation" narrative for each forest treatment was written with help from scientists and silviculturists collaborating in the DEMO, LTEP and YSTDS studies. Generically valid language was sought minimizing their uncertainties and disputes over details and nuances. The analysis of the survey responses was to emphasise how the information items within these narratives affected perceptions, so systematic differences in explanations corresponding to the various forest treatments was the main concern. The explanations made reference to forest attributes and changes identified in the literature as normatively meaningful to the public, whenever the consultants substantially agreed about how to do so.

Every forest treatment's explanation was assembled from a "kit of parts" common to all the treatments. Each was between 80 and 100 words and contained the same number of sentences about the same silvicultural dimensions in the same order. Exactly the same language describing any particular silvicultural dimension—such as forest age, percent retention, or down wood condition—was employed across all the applicable forest treatments. Consequently, each forest treatment's explanation was a unique assemblage of sentences and phrases also found in other forest treatments' explanations. This approach sought to control differences among these explanations, so that respondents' perceptions could be mainly attributed to differences in the silvicultural dimensions of the treatments.

7.7. Questions eliciting ratings

Each forest treatment was presented in the survey instrument on two facing pages. The format of these pages and the questions eliciting ratings were identical for all treatments. Only the photographs, foresters' decision explanations, and the resource output values varied among the forest treatments. The first question asked respondents to judge the balance of each foresters' decision. It only sought to force the respondents to fully read and comprehend each explanation.

The second question asked respondents to rate the beauty of each forest treatment, on a scale from -5 to $+5$, in light of both its photos and narrative explanation. It was intended to elicit ratings of informed aesthetic perceptions, but was placed early in the sequence to minimize the extent to which these scenic beauty ratings might load upon, and thereby be unduly correlated with, the last question's ratings of overall acceptability.

The third and fourth questions sought to make the process of comprehending and evaluating each forest treatment's 10 resource value outputs more cognitively manageable by splitting them. The third question queried about the five more anthropocentric resource value outputs (jobs and income, investment value, logger safety, non-timber products, and wildfire risk reduction). It asked respondents' to rate how well each forest treatment serves all these economic and safety needs together. The fourth question queried the five more ecocentric values (ground habitat, arboreal habitat, deer and elk habitat, old-growth habitat, and old growth restoration). It asked how well each treatment serves wildlife needs. This division sought to make every respondent comprehend and attend to both humanistic and naturalistic values, even if their attitudes might dispose them to emphasise one of these types (Gagnon-Thompson & Barton, 1994).

The last question elicited the main synthetic judgment of each forest treatment. It sought a rating of overall acceptability, on a scale from -5 to $+5$, considering everything previously presented and rated about each treatment. It also emphasised that this judgment was to be made with respect to public, not private, forests.

7.8. Allocation of forest treatments among survey versions

Pretests of draft surveys indicated that mail surveys needed to be limited to six forest treatments to be completed in an average of 10 min to promote adequate response rates. This entailed creating four survey versions to incorporate all 19 forest treatments. The allocation of forest treatments to survey versions was not random. It assigned a variety of forest treatments to each survey

[3]These instructions read as follows: "Your ratings should seek to reflect the relative, average output of the values if each forest treatment were widely employed throughout the Douglas Fir zone of Oregon and Washington. That is, you are to average across all the site-by-site variation that will effect the actual results of each treatment."

version, so that all respondents could make ratings across a full spectrum. Every survey version included the untreated old-growth forest and one of the other two untreated forests. Every version also included either a clearcut or a 15% retention treatment to represent maximum intensity harvests. To the extent possible, the remaining three forest treatments in every survey version included at least two retention levels, both young and mature forest ages, both retention patterns, and both down wood levels. Every survey version included the same ranges of all the forest output values and silvicultural attributes, to allow estimation of a single regression model across them. Forest treatments were ordered randomly within survey versions.

7.9. Questions regarding general silvicultural practices

Another problem was identified in survey pretests. Many respondents desired to express opinions about, and make judgments based upon, factors that did not vary at all, or in any systematic way, with the silvicultural dimensions of the 19 forest treatments being studied. The respondents' need to address these issues was satisfied by up-front questions. These allowed respondents to rate the acceptability of general silvicultural practices relevant to how all the forest treatments may be executed. These questions queried logging practices that pretests most frequently identified as of concern, such as logging near streams, replanting trees, the use of pesticides or herbicides, helicopter yarding, other yarding methods, snag creation, and use of fire. These questions served to cognitively "clear-away" these issues so the respondents could more freely focus on the factors that varied among the forest treatments in the subsequent survey pages. Responses to these up-front questions were not analysed in this study.

7.10. Mail survey sampling

Surveys were sent to a sample of 832 randomly selected holders of driver's licences and state identification cards in the 18 western-most counties of Oregon, apportioned to the counties by population. Survey versions were assigned randomly such that 208 copies of each version were mailed. About 108 were returned due to unknown forwarding addresses or deceased addressees. A letter encouraging a response was sent 14 days later to all members of the initial mailing. All who had not yet returned a survey 31 days after the initial mailing were sent another survey copy with a second, encouraging letter. At the end, 272 respondents returned a survey, for a 38% response rate. All four survey versions had response rates between 65 and 71.

7.11. Regression analysis

A regression model was estimated to explain ratings of treatments' overall acceptability predicted from respondents' ratings of economic-safety value, wildlife value, scenic beauty, or any of the treatments' silvicultural dimensions found in the narrative explanations.[4] This estimation was across all ratings of treatments by all respondents, by combining data from the four survey versions. This yielded 1633 cases, after those with missing values were removed.

Multicollinearity errors were expected in estimating this model due to "natural" correlations among independent variables. Consequently, variable pairs correlated by more than $r = 0.60$ were excluded. To further avoid such errors, specifications with a standard error of any estimated coefficient that exceeded 10% of the corresponding coefficient were excluded, and the best specification was found by stepwise regression. The criterion at each step was to enter the factor that most increased R^2 without reducing the model's F value. To stay in a model an added factor had to be statistically significant at the 0.10 probability level, add at least 1% to the model's R^2, and not increase the model's standard error of estimate.

7.12. Estimating acceptability distributions

Distributions of overall acceptability ratings for forest treatments were needed to describe the nature of controversy about them, as in Fig. 1. The raw ratings distributions were only suggestive of diagnostic shapes due to small sample sizes. The treatments' acceptability distributions were therefore statistically estimated from the survey data. Eleven different regression models were employed, corresponding to each of the 11 rating values (-5 to $+5$) used to rate overall acceptability. Each of these models predicted the proportion (probability) of all acceptability ratings that would take on its corresponding rating value, given the set of forest treatment attributes presented in the survey. These estimated proportions were then graphed to depict each forest treatment's predicted rating distribution among interested western Oregonians.

Each of these models was estimated across the same 1633 forest appraisals used in the earlier model estimated to predict treatments' average acceptability ratings across all rating values. This large number of cases was used to employ the full variation in forest outputs and silvicultural parameters that evidently contribute to respondents' choice of each subject rating value. For each forest appraisal data point—by one respondent for one forest treatment—the value of the dependant variable was the proportion of all respondents' ratings of the corresponding forest treatment that took on the subject rating value. The independent variables were the attributes of the treatment, and each

[4]The numeric rating values for scenic beauty and overall acceptability were analysed without recoding. The semantic differential rating values for economic-safety and wildlife value were coded as ordinal integers from -2, for "serves needs very poorly," to $+2$, for "serves needs very well." "Don't know" responses, no answer, and double answers were coded as missing values. The three forest age classes, the two down wood levels, and the two retention patterns were all coded as separate indicator variables.

Table 2
Regression analysis explaining ratings of the overall acceptability of forest treatments[a]

Parameter[b]	Estimate	Standard error	*t*-value	Prob.
Intercept	0.38	0.16	2.35	0.019
Wildlife value	1.22	0.05	24.37	<0.001
Economic and safety value	0.61	0.05	11.49	<0.001
(Econ. & safety value)^2	−0.21	0.03	−6.25	<0.001
Scenic beauty	0.42	0.02	19.16	<0.001
Percent retention	0.02	0.01	3.24	0.001
(Percent retention)^2	−0.0003	0.00006	−4.93	<0.001

Regression statistics: degrees of freedom	R^2	Adjusted R^2	*F*-test	Prob.
6/1631	0.62	0.61	434.43	<0.001

Stepwise regression explanation of variance in overall acceptability ratings

Step	Parameter	Added R^2	Cumulative R^2
1	Wildlife value	0.47	0.47
2	Scenic beauty	0.06	0.53
3	Economic and safety quadratic	0.07	0.60
4	Percent retention quadratic	0.02	0.62

[a]Regression was estimated across all ratings of overall acceptability across all treatments and respondents.
[b]Independent variables are each respondent's own ratings of wildlife value, economic and safety value and scenic beauty, and the percent of green-tree retention described in each forest treatment's explanation.

respondent's own ratings of scenic beauty, economic-safety value, and wildlife value. The mathematical form of these model estimations was restricted to that found earlier to predict treatments' average acceptability ratings. Only the values of the parameters were re-estimated for each of these new, rating-value-specific models.

7.13. Estimation errors in acceptability distributions

The graph of the estimated rating distribution for each forest treatment was to be inspected against the diagnostic shapes in Fig. 1. This interpretation was aided by graphing error ranges around each point there. Two types of errors were estimated. The first "resource output uncertainty error" was attributable to the potential variation in resource value outputs produced by each treatment.[5] The second "total error" added the standard error of the regression model involved to the first resource output uncertainty error.[6]

[5]Resource output uncertainty errors were estimated by inserting the bracketing resource output values (derived from the expert judges) into the same regression equations used to estimate each point on all graphs in Figs. 3–5. This was done separately for errors above and below each point because bracketing output values often differed for best- versus worse-case scenarios. The ratings of economic-safety and wildlife needs included in these error-estimation regressions had to be estimated from the bracketing resource output values, which were not presented to the respondents. This was done with special regression models just for this purpose, optimized using the same methods employed to derive the model in Table 2.

[6]This standard error calculation summed both the error of the overall acceptability regression used at each rating value and the impact of the errors of the special economic-safety and wildlife regressions used as described above in footnote 5.

8. Results

The best model for explaining forest treatments' average overall acceptability ratings explained 62% of variance and included four factors (Table 2). Average ratings of wildlife value and scenic beauty were positively and linearly related to overall acceptability. Economic-safety value and percent green-tree retention took on quadratic specifications as shown in Fig. 2. Average wildlife value was the most influential factor, as measured by stepwise contribution to R^2. Average ratings of economic-safety and scenic beauty were next-most and equally influential. Percent green-tree retention was the least influential but significant factor.

The estimated acceptability distributions of overall acceptability ratings for treatments of young forests are in Fig. 3, for mature forests in Fig. 4, and old-growth in Fig. 5. Each acceptability distribution is labelled with a diagnosis of its social acceptability pattern (as in Fig. 1). The mood and mode were determined by visual inspection. Distributions with mean values of more than +0.40 were identified as positive, those of less than −0.40 were negative, and those in-between were neutral.[7]

9. Discussion

The results of this study are derived from people who responded to a thought-intensive, time-consuming survey

[7]Each graph in Figs. 3–5 is also labeled with each forest treatment's mean overall acceptability rating as computed from the estimated acceptability distribution there. The same mean ratings are also used in Table 3 to list forest treatments' order of social acceptability.

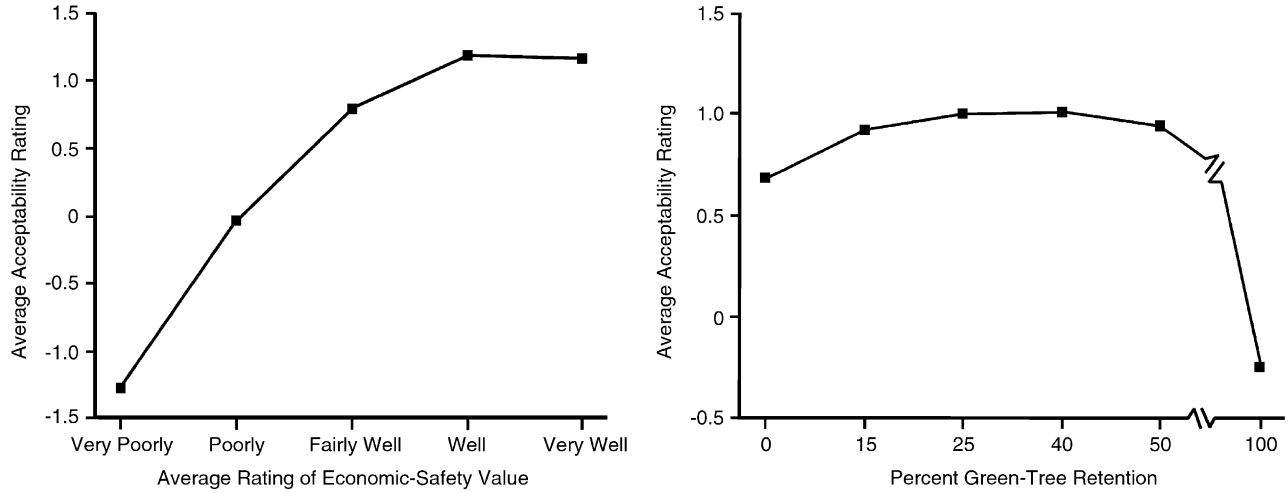

Fig. 2. The nonlinear relationships by which perceived economic-safety value or observed percentages of green tree retention effected average overall acceptability ratings.

likely containing unfamiliar information. The results should be interpreted as representing the views of western Oregon "interested" in forestry and more likely to engage policy debates about forest plans. The remainder of the population may be largely split somehow between those minimally engaged in forestry issues or those with some concern about forests but preferring to form opinions by reference to nontechnical affects, such as scenic aesthetics or generic political frames and scripts.

9.1. Ranking the acceptability of forest treatments

The order of average acceptability for the forest treatments in Table 3 is interesting. They fell into a surprisingly "clean" order, with similar treatments falling together on the list so as to indicate the following descending order of social acceptability: (1) light thinnings; (2) harvests that retain 40% green trees; (3) unmanaged mature and old growth forests; (4) heavy thinnings and unmanaged young forests; (5) harvests that retain 15% green trees; and (6) clearcuts.

9.2. Patterns of public opinion about unpopular forest treatments

Public perceptions of forest management in the US Pacific Northwest remain conflicted. Nine of the 19 forest treatments in Figs. 3–5 exhibit conflicted acceptability distributions. Not surprisingly, all the treatments involving old growth forests are conflicted, whether harvested or not. Old growth harvests show evidence of particularly adverse disapproval from forest protectionists, producing negative mean overall acceptability ratings (Fig. 5, Treatments 17 and 18). Unmanaged old growth forests show evidence of strong conflict (Fig. 5, Treatment 19). The essence of this conflict is perhaps best revealed by the fact that the other two no-harvest treatments of young and mature forests are similarly conflicted (Fig. 3, Treatment 5 and Fig. 4, Treatment 16). People who believe it is only acceptable to actively manage forests and those who believe it is acceptable to leave forests alone and unmanaged are both well-represented among the public interested in forestry issues. The protectionists evidently outnumber the productionists inasmuch as all three of these untreated forests had more positive ratings than negative ones and hence had positive mean overall acceptability ratings.

By contrast, there is much less conflict about clearcuts. Instead, there is substantial consensus that such forest treatments, with much or little down wood, are adversely unacceptable (Fig. 4, Treatments 6 and 7). The movement away from clearcutting in the standards and guidelines of the Northwest Forest Plan (US Department of Agriculture and US Department of Interior, 1994) is clearly justified by broadly held public perceptions.

The NWFP proscribes clearcutting and requires at least 15% green-tree retention, and many harvests now implement this minimum level. The social acceptability of these harvests is not decisively indicated by the results of this study. Such forest treatments also exhibit adversely negative acceptability distributions (Fig. 4, Treatments 8–11), albeit much less than clearcuts, and consequently still have negative average acceptability ratings. These 15% retention harvests do garner support from productionists making for conflict about their acceptability. This is true irrespective of the age of the harvested forest or the pattern of retention (Fig. 4, Treatments 8–11 and Fig. 5, Treatments 17 and 18).

9.3. Patterns of public opinion about popular forest treatments

There is positive consensus about some forest treatments, albeit without exuberance. All young forest thinnings enjoy such support, whether heavy or light, and

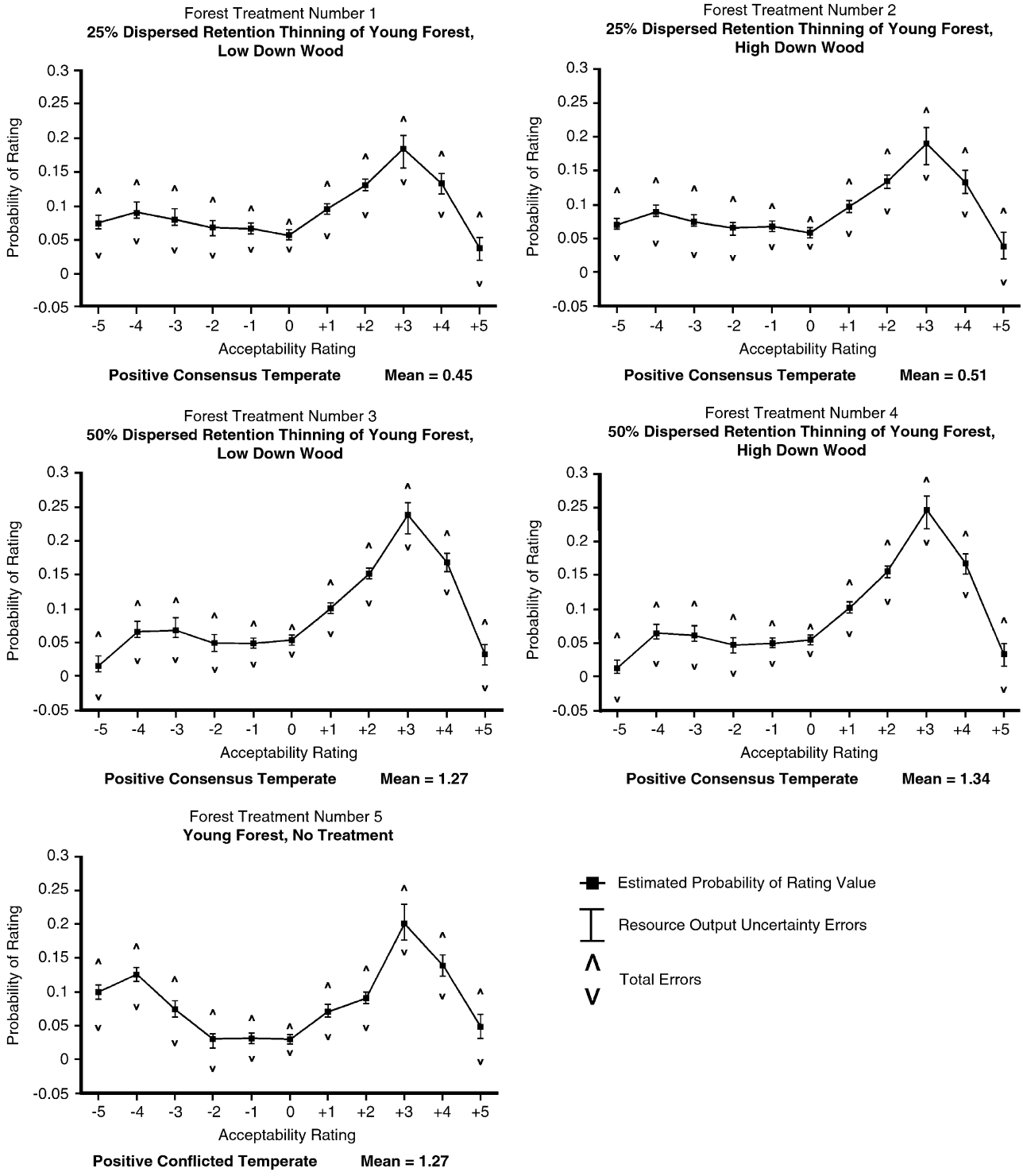

Fig. 3. The estimated acceptability distributions for treatments of young forests.

whether they retain much down wood or little (Fig. 3, Treatments 1–4). Harvests of mature forests that retain 40% green trees also enjoy consensus-positive, temperate support, whether the retained trees are clumped or dispersed, and whether they retain much or little down (Fig. 4, Treatments 12–15). The light thinnings and 40% retention harvests have essentially identical acceptability distributions and similarly high mean overall acceptability ratings. This is evidence of a consensus that moderate stem removal, i.e. retaining 40–50% green trees, is a broadly acceptable forest management. Heavy thinnings have the same kind of acceptability distribution but with significantly lower mean ratings as a consequence of fewer positive ratings (Fig. 3, Treatments 1 and 2),

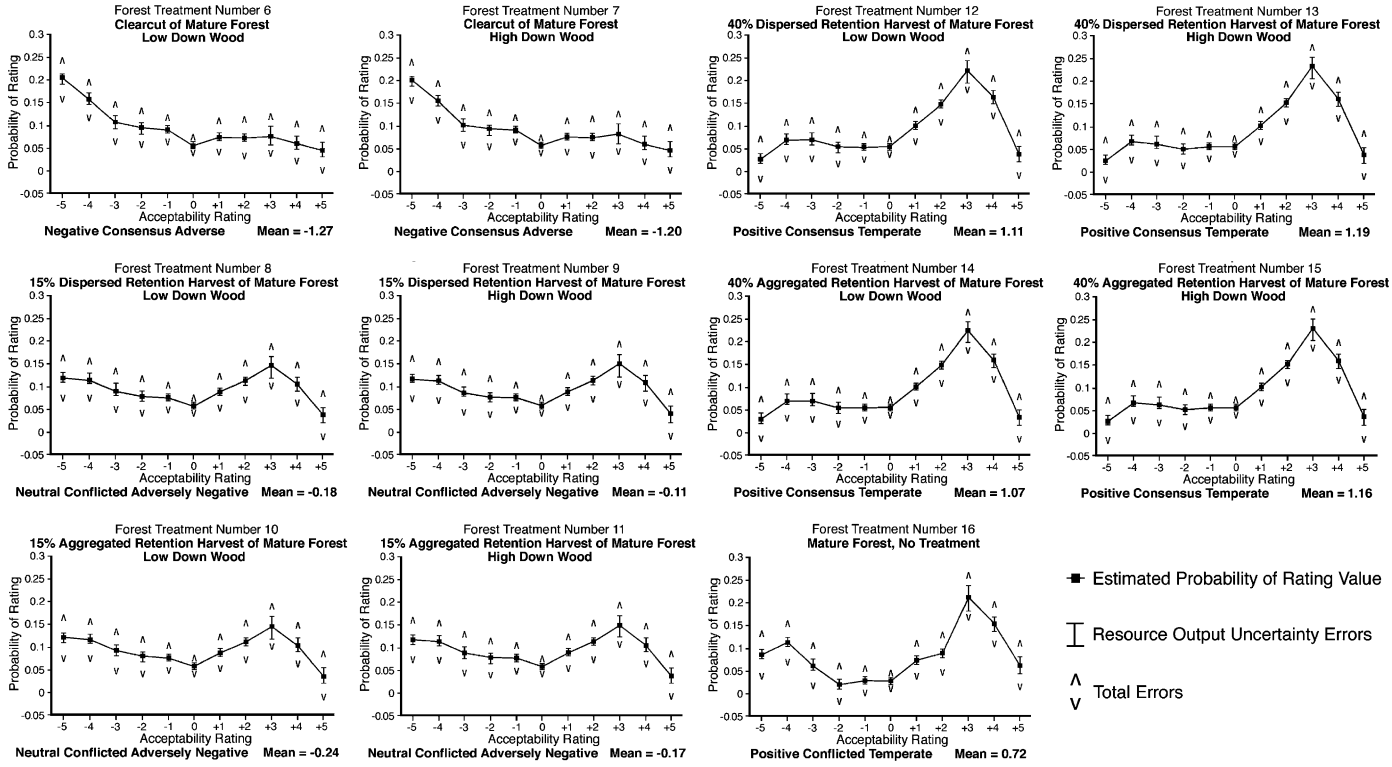

Fig. 4. The estimated acceptability distributions for treatments of mature forests.

such that there is public consensus that these treatments are OK.

9.4. Diagnostic uncertainties

All the comparative perceptions described above hold true irrespective of technical details regarding how much of one resource value or another each forest treatment might reasonably produce. This is evident by inspection of all the (smaller) resource output uncertainty errors graphed in Figs. 3–5. These are small enough as to inappreciably affect the shape of the estimated acceptability distributions or mean ratings there. The results of this study cannot easily be dismissed by claims that respondents were provided poor or misleading information about the value outputs of the forest treatments. The results might change some if a different resource value output set were presented to respondents or if narratives were substantially rewritten to strongly favor some treatments. Further research could test for such effects. The total errors, including statistical estimation errors, graphed in Figs. 3–5 are small enough that the acceptability distribution curves there retain their diagnostic shapes within such bounds.

9.5. What forest values does the public want?

Both perceived wildlife and economic-safety values are positively related to average perceptions of forest treatments' overall acceptability (Table 2). This finding seems incongruous in light of the conflicted acceptability distributions in Figs. 3–5, which suggest that many people favor one of these values over the other. There are at least two, potentially complementary, explanations. First, many respondents see merit in both human and wildlife values, even as they favor one more than the other, so that treatments with at least some of both value types will garner higher acceptability ratings than those heavily favoring just one type. Second, moderate respondents may favor forest treatments they perceive to be adequately balanced, with limited trade-offs, so that they give low overall acceptability ratings to treatments that have clearly low (unbalanced) levels of some values. These explanations suggest that both human and wildlife needs are important, and socially acceptable forest treatments need to be perceived as producing at least an appreciable amount of both. This general finding favoring balance is not surprising, and is consistent with other studies (Burchfield et al., 2003; Shindler, Steel, & List, 1996).

The results suggest new, nuanced findings about balancing values in socially acceptable forest treatments. Scenic beauty is important in tipping the balance favourably (Table 2). Wildlife needs are a bit more important than human needs in two ways: First, perceived wildlife value more strongly affects average overall acceptability ratings than perceived economic-safety value (Table 2). Second, the shape of the curve in the left-hand graph in Fig. 2 indicates that forest treatments that do not serve human needs at all tend to be unacceptable; but those that

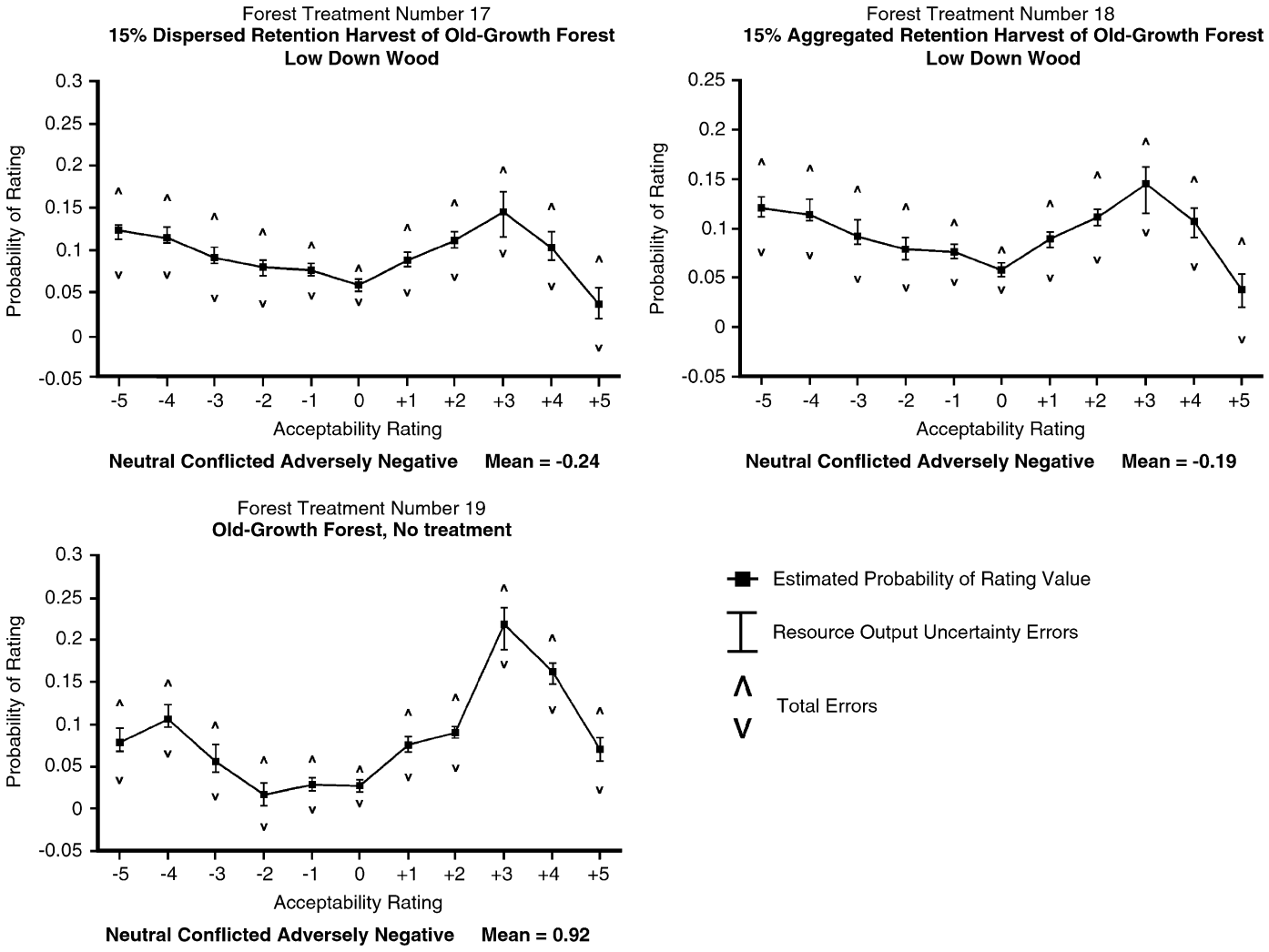

Fig. 5. The estimated acceptability distributions for treatments of old-growth forests.

favor human needs a lot gain little or no additional average overall acceptability by doing so. Forest treatments that "go the extra mile" to serve economic and safety needs at a high perceived cost to wildlife needs gain very little social acceptance by virtue of that "mile". Finally, retaining more green trees in harvests is effective in garnering general social acceptance but only up to a point. There is evidently a point of diminishing acceptability returns as one approaches retaining all trees (Fig. 2), as unmanaged forests garner opposition from productionists. (The survey narratives about unmanaged forests implied that this might be a long-term treatment.)

9.6. Perceptions of silvicultural parameters

Two technical attributes of New Forestry treatments—green-tree retention and forest age—substantially affect informed acceptability perceptions, while the others—retention pattern and down wood levels—do not. The proportion of green trees retained with thinnings and harvests is most influential. Retaining 40–50% is optimal in garnering social acceptability. Twenty five percent green-tree retention in young forest thinnings is a bit less acceptable. The only treatments with negative overall acceptability perceptions were the clearcuts and all the 15% retention harvests (Figs. 3 and 4), including 15% retention treatments of old growth (Fig. 5).

10. Conclusions

In interpreting these results bear in mind that this study investigated social perceptions that were well informed in a number of cognitive and technical ways. Many public perceptions affecting the social acceptability of forest treatments are not so well informed or multidimensional, such as those among the people indisposed to respond to this study's mail survey. These are often aesthetic perceptions. Down wood and green-tree retention patterns are likely to be important in affecting perceptions of forests' scenic beauty. Further research is needed.

Any public forest management programme will encounter objections and likely legal challenges, but some variety

Table 3
Average evaluation ratings for forest treatments in descending order of overall acceptability

Treatment number	Acronym[a]	Economic-safety needs[b]	Wildlife needs[b]	Overall acceptability[c]
4	Y50DH	−0.18	+0.38	+1.34
3	Y50DL	+0.56	−0.07	+1.27
13	M40DH	+0.06	+0.35	+1.19
15	M40AH	+0.45	+0.59	+1.16
12	M40DL	+0.27	+0.31	+1.11
14	M40AL	+0.69	+0.17	+1.07
19	OLD	−0.46	+1.11	+0.92
16	MATURE	−0.51	+0.64	+0.72
2	Y25DH	+0.45	+0.05	+0.51
1	Y25DL	+0.61	−0.11	+0.45
5	YOUNG	−0.93	−0.79	+0.41
18	OG15AL	+1.10	−0.11	+0.19
9	M15DH	+0.78	−0.48	−0.11
11	M15AH	+0.77	−0.26	−0.17
8	M15DL	+0.92	−0.73	−0.18
10	M15AL	+1.15	−0.65	−0.24
17	OG15DL	+1.14	−0.76	−0.24
7	CCH	+1.21	−0.74	−1.20
6	CCL	+1.15	−0.80	−1.27

[a]See Table 1 for key to acronyms.
[b]Average of observed semantic differential ratings coded as follows: Serves needs very poorly = −2; serves needs poorly = −1; serves needs fairly well = 0; serves needs well = +1; serves needs very well = +2.
[c]Mean ratings for the estimated acceptability distributions in Figs. 3–5.

of New Forestry can found an amicable programme in the Pacific Northwest. A major obstacle is a basic conflict regarding whether unmanaged forests are acceptable, i.e. healthy. This conflict runs deep (Brunson, Shindler, & Steel, 1997; Greider & Garkovich, 1994; Raphael, 1994) and may be best mitigated by a circumspect social dialogue informed by research.

This study indicates consensus is more likely regarding managed forests. There, attending to aesthetics is important while balancing human and wildlife needs. Retaining about half the trees in harvests and thinnings is perceived to support these ends. Clearcuts, and to a lesser extent 15% retention harvests, suffer aesthetically and seem to overpursue human needs, whether in mature or old-growth forests.

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References

Althaus, S. L. (1998). Information effects in collective preferences. *American Political Science Review*, *92*, 545–558.

Anderson, L. M. (1981). Land use designations effect perceptions of scenic beauty in forest landscapes. *Forest Science*, *27*, 392–400.

Aubry, K. B., Amaranthus, M. P., Halpern, C. B., White, J. D., Woodard, B. L., Peterson, C. E., et al. (1999). Evaluating the effects of varying levels and patterns of green-tree retention: Experimental design of the DEMO study [Special issue]. *Northwest Science*, *73*, 12–26.

Axelrod, L. J. (1994). Balancing personal needs with environmental preservation: Identifying the values that guide decisions in ecological dilemmas. *Journal of Social Issues*, *50*, 85–104.

Barnett, H. G. (1953). *Innovation: The basis of culture change*. New York: McGraw-Hill.

Beggs, L. R., Puettmann, K. J., & Tucker, G. F. (2005). Vegetation response to alternative thinning treatments in young Douglas-fir stands. In C. E. Peterson, & D. A. Maguire (Eds.), *Balancing ecosystem values: Innovative experiments for sustainable forestry*. General technical report PNW-635 (pp. 243–248). USDA Forest Service, Portland, OR.

Bennett, J. W. (1993). *Human ecology as human behavior*. New Brunswick, NJ: Transation.

Bishop, G. F., Tuchfarber, A. J., & Oldendick, R. W. (1986). Opinions on fictitious issues: The pressure to answer survey questions. *Public Opinion Quarterly*, *50*, 240–250.

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

Bright, A. D., & Manfredo, M. J. (1995). The quality of attitudinal information regarding natural resource issues: The role of attitude-strength, importance and information. *Society and Natural Resources*, *8*, 399–414.

Brunson, M. W. (1993). "Socially acceptable" forestry: What does it imply for ecosystem management? *Western Journal of Applied Forestry*, *8*, 116–119.

Brunson, M. W., & Reiter, D. K. (1996). Effects of ecological information on judgments about scenic impacts of timber harvests. *Journal of Environmental Management*, *46*, 31–41.

Brunson, M. W., & Shelby, B. (1992). Assessing recreational and scenic quality: How does New Forestry rate? *Journal of Forestry*, *90*(7), 37–41.

Brunson, M. W., Shindler, B., & Steel, B. S. (1997). Consensus and dissension among rural and urban publics concerning forest management in the Pacific Northwest. In B. Steel (Ed.), *Public lands management in the west: Citizens, interest groups, and values* (pp. 83–94). Westport, CT: Praeger.

Buhyoff, G. J., Leuschner, W. A., & Wellman, J. D. (1979). Aesthetic impacts of southern pine beetle damage. *Journal of Environmental Management*, *8*, 261–267.

Burchfield, J. A., Miller, J. M., Allen, S., Schroeder, R. F., & Miller, T. (2003). *Social implications of alternatives to clearcutting on the Tongass National Forest: An exploratory study of residents' responses to alternative silvicultural treatments at Hanus Bay, Alaska*. General technical report PNW-575, USDA Forest Service, Portland, OR.

Carls, E. G. (1974). The effects of people and man-induced conditions on preferences for outdoor recreation landscapes. *Journal of Leisure Research*, *6*, 113–124.

Carroll, M. (1995). *Community and the northwestern logger: Communities and changes in the era of the spotted owl*. Boulder, CO: Westview Press.

Charnley, S., Donoghue, E., Stuart, C., Dillingham, C., Buttolph, L., Kay, W., McLain, R., Moseley, C., & Phillips, R. (2006). *Northwest forest plan the first ten years: Socioeconomic monitoring results, vol. 1: Key*

findings. General technical report PNW-649. USDA Forest Service, Portland, OR.

Clausen, D. L., & Schroeder, R. F. (2004). *Social acceptability of alternatives to clearcutting: Discussion and literature review with emphasis on southeast Alaska*. General technical report PNW-594, USDA Forest Service, Portland, OR.

Converse, P. (1964). The nature of belief systems in mass publics. In D. Apter (Ed.), *Ideology and discontent* (pp. 206–261). New York: Free Press.

Davidson, A. R., Yantis, S., Norwood, M., & Montano, D. E. (1985). Amount of information about the attitude object and attitude-behavior consistency. *Journal of Personality and Social Psychology*, *49*, 1184–1198.

Davis, O. A., Hinich, M. J., & Ordeshook, P. C. (1970). An expository development of a mathematical model of the electoral process. *American Political Science Review*, *64*, 426–448.

Dearden, P. (1989). Societal landscape preferences: A pyramid of influences. In P. Dearden, & B. Sadler (Eds.), *Landscape evaluation: Approaches and applications* (pp. 41–63). *Western geographical series*: Vol. 25. Victoria, BC.

Dietrich, W. (1992). *The final forest: The battle for the last great trees of the Pacific Northwest*. New York: Penguin.

Faulkenberry, G. D., & Mason, R. (1978). Characteristics of nonopinion and no opinion response groups. *Public Opinion Quarterly*, *42*, 533–543.

Ford, R., Williams, K., Bishop, I., & Webb, T. (2005). *Social acceptability of forest management systems: Project overview*. Melbourne, Australia: University of Melbourne.

Franklin, J. F. (1989). Toward a new forestry. *American Forests*, *95*(11), 37–44.

Franklin, J. F., Berg, D. R., Thornburgh, D. A., & Tappeiner, J. C. (1997). Alternative silvicultural approaches to timber harvesting: Variable retention harvest systems. In K. A. Kohm, & J. F. Franklin (Eds.), *Creating a forestry for the 21st century: The science of ecosystem management* (pp. 111–139). Washington, DC: Island Press.

Gagnon-Thompson, S. C., & Barton, M. A. (1994). Ecocentric and anthropocentric attitudes toward the environment. *Journal of Environmental Psychology*, *14*, 149–157.

Gobster, P. H. (1996). Forest aesthetics, biodiversity, and the perceived appropriateness of ecosystem management practices. In M. W. Brunson, L. E. Kruger, C. B. Tyler, & S. A. Schroeder (Eds.), *Defining social acceptability in ecosystem management: A workshop proceedings* (pp. 77–97). General technical Report PNW-669, USDA Forest Service, Portland, OR.

Grant, L. V., & Patterson, J. W. (1975). Non-attitudes: The measurement problem and its consequences. *Political Methodology*, *2*, 455–481.

Greider, T., & Garkovich, L. (1994). Landscapes: The social construction of nature and environment. *Rural Sociology*, *59*, 1–24.

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

Hodgson, R. W., & Thayer, R. L. (1980). Implied human influence reduces landscape beauty. *Landscape Planning*, *7*, 171–179.

Homann, P. S., Bormann, B. T., & Boyle, J. R. (2001). Detecting treatment differences in soil carbon and nitrogen resulting from forest manipulations. *Soil Science Society of America Journal*, *65*, 463–469.

Isen, A. M. (1993). Positive affect and decision making. In M. Lewis, & J. M. Haviland (Eds.), *Handbook of emotions* (pp. 417–435). New York: Guilford.

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., Bradley, G., Kaplan, R., & Kaplan, S. (1999). Stakeholder perspectives on appropriate forest management in the Pacific Northwest. *Forest Science*, *45*, 62–73.

Kimmins, J. P. (1999). Biodiversity, beauty and the ''beast'': Are beautiful forests sustainable, are sustainable forests beautiful, and is ''small'' always ecologically desirable? *Forestry Chronicle*, *75*, 955–958.

Kluckhohn, F. R., & Strodtbeck, F. L. (1961). *Variations in value orientations*. Westbrook, CO: Greenwood Press.

Lakoff, G., & Johnson, M. (2003). *Metaphors we live by*. Chicago: University of Chicago Press.

Lovrich, N. P., & Pierce, J. C. (1986). The good guys and bad guys in natural resource politics: Content and structure of perceptions of interests among general and attentive publics. *Social Science Journal*, *23*, 309–326.

Lyons, E. (1983). Demographic correlates of landscape preference. *Environment and Behavior*, *15*, 487–511.

Manning, R., Valliere, W., & Minteer, B. (1999). Values, ethics, and attitudes toward national forest management: An empirical study. *Society and Natural Resources*, *12*, 421–436.

McBeth, M. K., & Foster, R. H. (1994). Rural environmental attitudes. *Environmental Management*, *18*, 401–411.

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.

Miles, M., & Huberman, M. (1994). *Qualitative data analysis: An expanded sourcebook*. Thousand Oaks, CA: Sage.

Minsky, M. (1985). *The society of mind*. New York: Simon & Schuster.

Nelson, C. M., McDonough, M. H., & Holecek, D. F. (1989). Beliefs, attitude and political behavior of forest recreationists toward timber management in Michigan. In M. Lee, & P. Brown (Eds.), *Recreation and park management: Papers from the first national symposium on social science in resource management* (pp. 135–149). Corvallis, OR: Oregon State University.

Niemi, E., & Whitelaw, E. (1999). *Assessing tradeoffs in forest management*. General technical report PNW-403, USDA Forest Service, Portland, OR.

Norman, R. (1975). Affective-cognitive consistency, attitudes, conformity, and behavior. *Journal of Personality and Social Psychology*, *32*, 83–91.

Petty, R. E., & Cacioppo, J. T. (1981). *Attitudes and persuasion: Classic and contemporary approaches*. Dubuque, IA: William Brown.

Price, V., & Neijens, P. (1998). Deliberative polls: Toward improved measures of ''informed'' public opinion. *International Journal of Public Opinion Research*, *10*, 145–176.

Raphael, R. (1994). *More tree talk: The people, politics, and economics of timber*. Washington, DC: Island Press.

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

Ribe, R. G. (1999). Regeneration harvests versus clearcuts: Public views of the acceptability and aesthetics of Northwest Forest Plan harvests [Special issue]. *Northwest Science*, *73*, 102–117.

Ribe, R. G. (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. G. (2005). Comparing changes in scenic beauty produced by green-tree retention harvests, thinnings and clearcuts: Evidence from three Pacific Northwest experiments. In C. E. Peterson, D. A. Maguire (Eds.), *Balancing ecosystem values: Innovative experiments for sustainable forestry* (pp. 137–145). General Technical Report PNW-635, USDA Forest Service, Portland, OR.

Robson, M., Hawley, A., & Robinson, D. (2000). Comparing the social values of forest-dependent, provincial and national publics for socially sustainable forest management. *Forestry Chronicle*, *76*, 615–622.

Schank, R. (1977). *Scripts, plans, goals and understanding*. New York: Lawrence Erlbaum.

Schneider, A. L., & Ingram, H. (1997). *Policy design for democracy*. Lawrence, KS: University of Kansas Press.

Sheppard, S. R. J., Harshaw, H. W., & McBride, J. R. (2001). Priorities for reconciling sustainability and aesthetics in forest landscape management. In S. R. J. Sheppard, & H. W. Harshaw (Eds.), *Forests and landscapes: Linking ecology, sustainability and aesthetics* (pp. 263–288). New York: CABI Publishing.

Shindler, B. A., Brunson, M., & Stankey, G. H. (2002). *Social acceptability of forest conditions and management practices: A problem analysis*. General Technical Report PNW-537, USDA Forest Service, Portland, OR.

Shindler, B., & Cramer, L. A. (1999). Shifting public values for forest management: Making sense of wicked problems. *Western Journal of Applied Forestry*, *14*, 28–34.

Shindler, B., List, P., & Steel, B. S. (1993). Managing federal forests: Public attitudes in Oregon and nationwide. *Journal of Forestry*, *91*(7), 36–42.

Shindler, B., Steel, B. S., & List, P. (1996). Public judgments of adaptive management: A response from forest communities. *Journal of Forestry*, *94*(6), 8–12.

Silvennoinen, H., Alho, J., Kolehmainen, O., & Pukkala, T. (2001). Prediction models of landscape preferences at the forest stand level. *Landscape and Urban Planning*, *56*, 11–20.

Simpson, C. J., Rosenthal, T. L., Daniel, T. C., & White, G. M. (1976). Social-influence variations in evaluating managed and unmanaged forest areas. *Journal of Applied Psychology*, *61*, 759–763.

Slovic, P., Finucane, M., Peters, E., & MacGregor, D. (2002). The affect heuristic. In T. Gilovich, D. Griffin, & D. Kahneman (Eds.), *Heuristics and biases: The psychology of intuitive judgment* (pp. 397–420). Cambridge, UK: Cambridge University Press.

Stern, P. C., Dietz, T., Kalof, L., & Guagnano, G. A. (1995). Values, beliefs and proenvironmental action: Attitude formation toward emergent attitude objects. *Journal of Applied Social Psychology*, *25*, 1611–1636.

Swanson, F. J., & Franklin, J. F. (1992). New forestry principles from ecosystem analysis of Pacific Northwest forests. *Ecological Applications*, *2*, 262–274.

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

Tips, W. E. J., & Savasdidara, T. (1986). The influence of environmental background of subjects on their landscape preference evaluations. *Landscape and Urban Planning*, *13*, 125–133.

Tye, M. (1991). *The imagery of debate*. Boston: MIT Press.

Ulrich, R. S. (1983). Aesthetic and affective response to natural environment. In I. Altman, & J. F. Wohlwill (Eds.), *Human behavior and environment*, Vol. 6 (pp. 85–125). New York: Plenum Press.

US Department of Agriculture & US Department of Interior. (1994). *Record of decision for amendments to Forest Service and Bureau of Land Management planning documents within the range of the Northern Spotted Owl: Standards and guidelines for management of habitat for late-successional and old-growth forest related species within the range of the Northern Spotted Owl*. Portland, OR: Interagency Supplemental Environmental Impact Statement Team.

Vanha-Majamaa, I., & Jalonen, J. (2001). Green tree retention in Fennoscandian forestry. *Scandinavian Journal of Forest Research Supplement*, *3*, 79–90.

Vaske, J. J., & Donnelly, M. P. (1999). A value-attitude-behavior model predicting wildland preservation voting intentions. *Society and Natural Resources*, *12*, 523–537.

Vining, J. (1992). Environmental emotions and decisions: A comparison of the responses and expectations of forest managers, an environmental group, and the public. *Environment and Behavior*, *24*, 3–34.

Wondolleck, J. (1988). *Public lands conflict and resolution: Managing national forest disputes*. New York: Plenum Press.

Yaffee, S. L. (1994). *The wisdom of the spotted owl: Policy lessons for a new century*. Washington, DC: Island Press.

Zajonc, R. B. (1980). Feeling and thinking: Preferences need no inferences. *American Psychologist*, *35*, 151–175.