Do Landscape Assessments Need to Account for Environmental Attitudes and Demographics? Scenic Beauty Perceptions of Old-growth and Harvested Forests by Ecotopian Versus Timber Subcultures in the U.S. Pacific Northwest

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ABSTRACT Differences in informed scenic beauty perceptions, among 504 residents of Oregon, USA, were investigated to see how environmental attitudes, demographics, and old-growth versus harvested forests affected them. Scenic differences dominated explanation of perceptual differences. Attitudes accounted for small marginal differences in perceived scenic beauty if they instigated affects due to landscapes' scenic content. These affects reversed direction with changes in landscape type. Demographic attributes only related to very small differences in perceived beauty if they were strongly correlated with such affective attitudes. These relationships often reversed or became inoperative with coincident changes in landscapes, attitudes, or other demographic traits. Respondents disagreed about ugly more than beautiful landscapes. Forest protection attitudes were associated with younger people, regional newcomers, urban rather than rural residents, more education, and more income. Forest production attitudes were associated with the opposite traits. Differences in scenic beauty perceptions were associated only with respondents' ages, regional experience and residential locations. It is generally not worthwhile to account for viewers' traits in landscape assessments except when attitudes contend with the content of ugly scenery.

KEY WORDS: landscape assessment, visual quality, environmental attitudes, demographics, forest conflict

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Introduction

Aesthetic perceptions of landscapes arise from a variety of affects produced by different types and intensities of cognition (Ulrich, 1983; Nasar, 1983; Kaplan et al., 1989). Some affects can be minimally cognitive whereby compositional scenic attributes of a landscape and/or the denotative content of what is seen evokes an immediate aesthetic response (Wohlwill, 1976; Amadeo et al., 1989). Measuring landscape attributes like these enables "psychophysical" landscape assessment methods and research (Zube et al., 1982; Parsons and Daniel, 2002). Much evidence indicates that this class of affects dominates reliable explanations of aesthetic landscape perceptions (e.g. Ode et al., 2008; Franco et al., 2003; Real et al., 2000; Roth, 2006; Hagerhall, 2001; van den berg and Koole, 2006; Fenton, 1985). Other affects are more cognitive but still strongly related to what is seen in landscapes, such as their connotative content (Russell, 1988), or their affordances and information processing qualities (Kaplan and Kaplan, 1982). These qualities help explain common aesthetic preferences and found the "cognitive" or non-formalist paradigm of landscape assessments and research (Kaplan and Kaplan, 1989; Fenton, 1985; Herzog, 1992).

Another "behavioral" view of scenic landscape assessment derives from the fact that there is a great deal of descriptive theory and criticism seeking to understand and explain landscape aesthetics. This intuitively leads to the idea that people's aesthetic perceptions and judgments are, or ought to be, similarly constructed and as such constitute behaviors as much or more than simple perceptions. According to cognitive hierarchy theory (Rokeach, 1979), differences in people's base values, the way their base values assemble into coherent value orientations, and the attitudes formed by their value orientations all should produce different aesthetic judgments,

similar to how differences in other environmental judgments arise (Vaske and Donnelly, 1999). Accounting for these norms should join with what is seen in landscapes to produce more socially valid aesthetic assessments incorporating the values of landscape viewers (Lyons, 1983; Abello and Bernaldez, 1986; Winkel et al., 1969) and critical conceptual understandings of the qualities involved (Carlson, 1977; Lothian, 1999). Such assessments would account for differences in people's own aesthetic interpretations and emotional fulfillments, potentially derived from connotative interpretations, ideological norms, contextual understandings and associations, landscape familiarities, imputed motives of others, and ideas learned from one's culture or social reference groups.

While some researchers are seeking to integrate the psychophysical, cognitive and critical dimensions of landscape aesthetics (Fenton and Reser, 1988; Bourassa, 1990; Gobster, 1999; Uzzell, 1991; Ode et al., 2008), others have concentrated on the behavioral dimension. They search for systematic differences in landscape perceptions attributable to categorical differences in perceivers, and are reviewed below. These investigations have focused on whether people's demographic traits or attitudes are associated with significantly and consistently different aesthetic perceptions. People's categorical traits are measured as proxies for potentially shared cognitive affects and aesthetic norms because individual's landscape experiences are difficult to measure, and the nuances of these may be too anecdotal or complex to effectively account for shared public perceptions. Demographic traits are often the data about landscape viewers readily available to landscape assessors and decision makers.

Few studies have investigated the strength of viewers' demographic attributes versus the landscape attributes they see in predicting aesthetic perceptions (Stamps,

1995; Daniel, 2001). Few have identified whether demographic correlates of landscape perceptions are attributable to differences in knowledge, normative attitudes, or cultural differences in cognitive apprehension of landscapes (Macia, 1979; Balling and Faulk, 1982). Few have investigated whether demographic correlates of landscape perception change with landscapes' content or aesthetic valence (Dearden, 1984; Hagerhall, 2001). This study sought to help address these weaknesses. It investigated perceptions affected by a major conflict in which demographic, attitudinal and scenic differences are wide, potent, and interactive in affecting aesthetic perceptions.

Demographics and Landscape Aesthetics

Stamps (1999) provides a meta-analysis of 107 studies investigating how people's demographic and other traits explain differences in aesthetic perceptions, following an earlier, narrower review by Kaplan and Talbot (1988). He notes that such traits fail to explain differences in perceptions more often than they do. He also notes that different demographic groups' perceptions tend to be highly correlated, suggesting aesthetic perceptions largely transcend cultural or sociological differences. He identifies several demographic groups that show reasonably regular associations with marginally different aesthetic perceptions: designers, other land use experts, students, children, cultural minorities, genders, and special interest groups such as environmentalists. In what follows only studies after Stamps (1999) are reviewed.

More recent studies have, also found that people with different demographics agree about scenic quality much more than not, with no significant demographic correlates (Roth, 2006; Franco et al., 2003; Hagerhall, 2001). Other studies show that people with more eco-centric or environmentalist attitudes can exhibit significantly

different landscape perceptions than those with more anthropocentric or resource exploitive views (Bjerke, et al., 2006; van den berg and Koole, 2006; Kaltenborn and Bjerke, 2002; Ribe, 2002; Dearden, 1984; Strumse, 1996). Strumse (1996) found that land management knowledge is significantly associated with differences in aesthetic perceptions, as did Brush et al. (2000) as a major factor explaining differences in scenic perceptions. The land-management knowledgeable subjects in this latter study were mainly rural residents with lower aesthetic standards than mainly urban, amenity-seeking visitors. Such urban-versus-rural differences have also been found by van den Berg et al. (1998) and Strumse (1996). Another study by van den Berg and Koole (2006) found that rural respondents had different preferences for rural landscapes than urban residents, and also identified significant differences associated with age, wealth and farming background. When studying preferences for vegetation density in urban parks, Bjerke et al. (2006) found that house versus apartment dwellers had significantly different preferences, and also identified significant differences associated with age and educational attainment.

Research Program

This study undertook a three-way analysis of landscape perceptions, following Hagerhall (2001). Scenic beauty perceptions were investigated as a widely shared and valued landscape quality, but one that entails an immediate, primary aesthetic response that might be little affected by attitudinal or demographic differences. Information was therefore provided with study scenes to elicit differences to the extent they affect scenic beauty perceptions. The goal was to explore how differences in perceptions of visually identifiable scenic types correlate to differences in perceivers' attitudes, and how both these are associated with demographic traits (Real

et al., 2000; Fenton, 1985). The intent was to overcome the following three weaknesses common to many demographic perception studies reviewed above and by Stamps (1999).

First, aesthetic perceptions were analyzed here with a respondent sample systematically representing traits found in a regional population like that which landscape assessments need to be valid for. Many earlier studies have employed small samples, opportunity samples, or just pre-selected categories of people.

Second, many studies of respondent traits in relation to perceptual differences have been confounded by use of a diversity of scenes with various formal and denotative qualities and scenic beauty. This study sought to better isolate the effects of respondent traits by employing just two landscapes drawn from the same categorical type, each with internally homogeneous scenery very different from the other. Perceptions were compared across people's attitudes and demographic traits within each landscape before comparing perceptions between the two landscapes.

Third, unlike most previous studies, this study tested the interaction of scenic, ideological and demographic correlates in a social context where all three of these factors exhibit wide differences that are interrelated. Here, that context was a landscape controversy with strong and clearly related scenic, ideological and demographic features. This enabled an incisive test of their relative strength and interaction in affecting aesthetic perceptions.

The landscape types employed in this study were a very beautiful one and an ugly one to further investigate a finding by Ribe (2002), Strumse (1996) and Hagerhall (2001) among wildland and rural scenes. Namely, people with different traits tend to exhibit significantly different scenic beauty perceptions only among landscapes they find to be of low scenic value; while much more consensus is found

among high-beauty scenes. There is a need to compare which respondent traits are associated with different landscape perceptions within ugly and within scenic landscapes, and then between them.

A Landscape Conflict Case Study

This study employed the "spotted owl controversy" in the U.S. Pacific Northwest (Dietrich, 1992; Durbin, 1996). This conflict revolved around intensively harvested forest landscapes and scenic, unharvested, old-growth forests. People with different environmental attitudes might perceive these landscapes differently (Ribe and Matteson, 2002), and these behaviors might be correlated with their demographic traits.

The sociology of the spotted owl controversy has been extensively investigated and reported (e.g. Steel 1997, Yaffee, 1994; Carroll, 1995). No such studies have determined which demographic traits are associated with environmental attitudes and perceptions in the affected region, as was required for the study reported here. This question was therefore carefully investigated as part of the research described below. The existing studies do provide guidance by suggesting a broad outline as follows.

The region was historically dominated by an anthropocentric relationship with forests, sometimes called a "timber culture," entailing active management and harvest of forests to produce wealth and a way of life for timber-dependent local and regional economies (Brown and Harris, 1992). The people associated with this historic condition tend to be represented more in rural communities, to be older, and have lived in the region for a long time (Carroll 1995). More recently, the region has seen a large immigration of "ecotopian" people not dependent on forest products income

who seek a healthy and beautiful environment (Miller, 1990). Many tend to have a more eco-centric relationship to forests, entailing beliefs that unmanaged forests have value as ecosystems and that forests ought to produce wildlife, amenities and aesthetic context for quality of life (Bengston, 1994). They tend to be urban, younger, and relatively new to the Pacific Northwest (Miller, 1990). Their activism helped fuel the controversy, which produced major revisions to forestry policy and practices and traumatic economic change.

Postulates

Figure 1 illustrates the three-way study design to investigate the interaction of attitudes, demographics, and ugly versus beautiful landscapes in affecting aesthetic perceptions. Seven postulates were suggested by previous studies:

1. The Importance of Scenic Content Versus Demographics or Attitudes: Differences in aesthetic perceptions attributable to demographic or attitudinal traits will be smaller than those attributable to substantial differences in scenic content, i.e. between old-growth versus harvested forest landscapes.
2. The Importance of People's Traits in Relation to Scenic Beauty Levels: Differences in perceived scenic beauty associated with demographic and/or attitudinal differences will be smaller when people judge beautiful old-growth forests than ugly timber harvests.
3. Are their Really Two Oregons? There are substantially different subcultures within western Oregon to enable investigation of how demographic traits relate to environmental attitudes and forest perceptions.
4. Do Attitudes and Not Demographics Matter? People's environmental attitudes, which more directly reflect affective norms for evaluating landscapes, will be

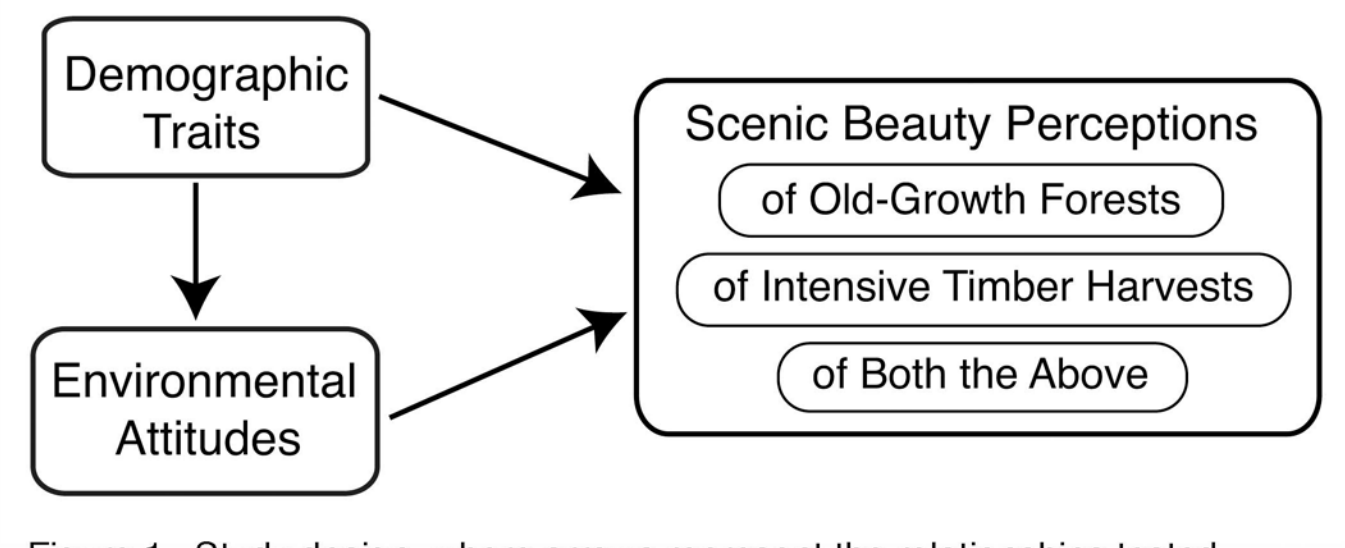


Figure 1. Study design, where arrows represent the relationships tested.

associated with larger differences in aesthetic perceptions than demographic traits, which are indirectly related to landscape affects.

5. Universality of Demographic Associations with Scenic Beauty Perceptions: Demographic traits will not be associated with aesthetic perceptions in "universal" ways that may be observed across regions and landscape types; but rather will be contingent upon local cultures as they relate to scenic differences.
6. Interaction of Landscapes and Attitudes: People with different value orientations will not only perceive landscapes differently, but the character of those differences will change with different landscape types, because new scenic content will instigate uniquely new affects in concert with each set of attitudes.
7. When and Why do Demographic Traits Matter? The way demographic traits associate with differences in aesthetic perceptions will tend to be contingent upon how traits are associated with environmental attitudes and upon the value of other demographic attributes in reinforcing such associations.

Survey Methods

A survey instrument was developed to measure three attributes of respondents: (1) protectionist versus productionist attitudes toward forest management, (2) demographic traits, and (3) perceptions of scenic beauty in photographs of old-growth and intensively harvested forests. Environmental attitudes toward forestry were queried by the three Likert scale questions listed in Table 1. These were previously validated as efficient at sorting respondents' dispositions toward forest management in the Pacific Northwest (Ribe and Matteson, 2002; Ribe, 2002). Another set of questions queried demographic attributes that have shown evidence of relations to aesthetic landscape perceptions (Stamps, 1999) and to environmental

Table 1. Cluster-analysis classification of respondents' environmental attitudes[a]

Proposition Cluster attribute	Productionists	Non-Aligned	Protectionists
I believe the northern spotted owl should be saved even at a high economic cost.			
Cluster mean value	-1.63	-0.36	1.02
Cluster standard deviation	0.52	0.93	0.92
I believe the northern spotted owl should be saved only if it can be done without eliminating jobs and significantly hurting the economies of communities.			
Cluster mean value	1.44	+0.74	-1.26
Cluster standard deviation	0.80	0.71	0.60
I believe the northern spotted owl should be saved only if it can be done without significantly hurting private property owners' rights and freedom of land use.			
Cluster mean value	1.63	+0.48	-1.19
Cluster standard deviation	0.50	0.77	0.77
Maximum cluster distances			
Prior to clustering	2.78	2.56	2.55
After clustering	3.48	3.23	3.22
Number of respondents	192	139	173

[a]To execute the clustering and produce the values in this table, the survey proposition responses were coded as follows; "strongly disagree" = -2, "disagree" = -1, "neutral or not sure" = 0, "agree" = +1, "strongly agree" = +2. The pre-clustering standard deviation of all this coded data was 1.32.

attitudes (Vaske et al. 2001, Manfredo and Zinn, 1996). These included categorical choice questions about educational attainment, gender, income, ethnicity, distance from home to nearest city bus stop, time of residence in Oregon, and the impact of timber harvest reductions on incomes. Numeric response questions asked for home zip code and year of birth.

While the above-described questions were identical in all survey instruments, photos were presented for rating in a printed mail survey or projected in front of groups where each member privately rated scenes on their own survey. In either modality, each respondent rated four photos of old-growth forests and four photos of intensive (15% green-tree retention) timber harvests, along with other forests not analyzed here. In the mail survey a short paragraph appeared below all four photos of each forest type. The paragraph described the attributes and management goals of the forest, and respondents made one rating of scenic beauty across all four photos. In the live-groups survey the descriptive paragraph was orally presented and respondents rated each photo one at a time. These ratings were later averaged. Respondents rated scene sets or scenes for scenic beauty on a numeric scale from -5 to +5. They were instructed that the scale ranged from "very ugly" (-5) to "very beautiful" (+5), with zero assigned to scenes they found neither beautiful nor ugly or were undecided about.

Each respondent rated one of two sets of four old-growth forest photos. These sets were randomly assigned to respondents in the mail survey and to groups in the live-group survey. The four old-growth photos within each set were drawn randomly from 38 representatively sampled photos within old-growth forests in western Oregon and Washington. There were four sets of intensive timber harvest photos that were also randomly assigned to mail respondents and live groups. The four photos within

each of these sets were drawn randomly from 96 representatively sampled photos within recent 15% retention timber harvests in western Oregon and Washington.

Mail surveys were delivered during 2004 to 724 holders of driver's licenses in the 18 western-most counties of Oregon most affected by the spotted owl controversy. Of these, 281 (39%) were returned, with nine too incomplete for use in this study. The distributions of demographic responses in these returned questionnaires were assessed to see if categories were under- or over-represented by more than 5% compared to 2000 population or 2003 employment census data within the region. All demographic categories met this test except for young adults, which were under-represented by 9%, and people who reported significant income impacts due to timber harvest reductions, which were under-represented by 7%.

A set of 12 over-sample, live-group survey sessions were conducted during 2006 and 2007 which corrected these sampling deficiencies without creating new ones. The survey instruments for these added the three questions in Table 2 to validate attitude classifications, as explained later, that had not been in the mail survey instrument. Headcounts at all 12 live-group survey sessions indicated that about 1/5 of attendees opted not to participate.

Five communities were identified with sustained adverse economic impacts due to timber harvest reductions (Charnley et al., 2006). Six live-group surveys were conducted in these at meetings of four service clubs, a chamber of commerce, and a hospital auxiliary. These yielded 113 respondents with 25% reporting “some” and 14% reporting “a lot” of lost income.

Six live-group surveys were conducted to sample young adults in two community college classes, a house party attended by young service and retail workers, a young business professionals club, a lower-division, general-education university class, and a

Table 2. Validity tests of respondent attitude classification

Test proposition	% Productionists	% Non-aligned	%Protectionists
Whenever people harvest forests they...			
Exercise their right to modify the environment to meet important human needs.	86	31	16
Upset the delicate balance of nature with potentially very bad consequences.	14	68	84
No response	0	1	0
If a sixty year old forest has always been left alone without any human management or intervention...			
It is a good thing because a forest that grows and changes by natural processes is a healthy forest.	16	46	85
It is a bad thing because forests need to be managed by people to grow well, to be as healthy as possible, and be safe from catastrophic wildfire.	82	48	15
No response	2	6	0
Whenever people must harvest forests they...			
Can do a good job and generate enough income to support communities while allowing nature to develop a new forest that wildlife and people will use.	55	39	14
Can do a good job of sustaining biological diversity first, while providing as many products and jobs as possible after meeting ecological goals.	45	59	86
No response	0	2	0

small, graduate-level university environmental design class. These yielded 119 respondents, with 72% less than 30 years old. The complete sample, combining the mail and live-group surveys, included 504 respondents.

Classification of Respondent Attitudes

Cluster analysis was used to classify all respondents into three subsets: those with (1) strongly resource-productionist attitudes, (2) strongly resource-protectionist attitudes, and (3) all others non-aligned with these first two groups. This was done with level-of-agreement responses to the three spotted owl propositions in Table 1.

The stepwise k-means clustering method of non-hierarchical estimate-minimization using standardized data was used (Forgy, 1965; SAS Institute, 1995). This clustered the respondents into those closest to each other in Euclidean space defined by their answers to the three propositions. K-means was the best method for this classification to an a-priori number of groups with the data type and structure in this study (Milligan, 1980). It succeeded in sorting to the expected three respondent types using all combinations of responses to the three spotted owl questions. The most efficient final clustering in Table 1 had mean response values the furthest apart and the smallest mean distance within clusters (Gengerelli, 1963). The distributions of responses differed substantially and in the expected ways between the two polar types of people across all three propositions, and the "leftover" non-aligned respondents had more widely distributed and more moderate views (Table 1).

This classification of respondent attitudes was validity checked by the three live-group survey questions in Table 2. The first was adapted from the New Environmental Paradigm (NEP) index (Dunlap and Van Liere, 1978) to refer to forestry. The second tested a strongly conflicted issue among attitudes toward

forestry (Tarrant et al., 2003), particularly in the study region (Ribe, 2006). The last question tested dispositions toward "ecosystem management" versus earlier forestry paradigms, but may be too nuanced to test basic environmental attitudes.

The response distributions to the first two questions in Table 2 confirmed the validity of the classification of respondents' environmental attitudes, consistent with Vaske et al. (2001). That for the first quasi-NEP question suggests that the non-aligned respondents lean toward the protectionists. The response distribution for the last question in Table 2 also confirms the classification of protectionist and non-aligned respondents, but suggests that some of the productionists are "buying in" to the ecosystem management paradigm, at least for now.

Analysis Methods

Each of the relationships depicted in Figure 1 was investigated first by stepwise regression to see how much variance in people's attitudes was significantly explained by their demographic traits, or how much their scenic beauty ratings were significantly explained by demographic traits or attitudes. In identifying the best model to report here, the criterion at each step was to enter the factor that most increased R^2 without reducing the model's $\underline{F}$ value. To join a model a factor had to not increase the model's standard error of estimate, and either be statistically significant at the 0.10 probability level and add at least 1% to the model's R^2, or be significant at $\underline{p} = 0.05$.

Each regression was followed by a factorial analysis of variance (ANOVA) or covariance (ANCOVA) testing the same data sets to search for interaction effects that elaborate the relationships estimated by each regression analysis. The best analysis

reported was that which contained the most statistically significant effects (at p=0.10) and only included variables that participated in at least one such effect.

In the analyses of how demographics relate to environmental attitudes, the dependent variable was defined as the degree of each respondent's disposition favoring forest protection, called "protectionism" here. This was measured by membership in the three attitudinal groups from the cluster analysis described above. Protectionists were assigned a value of 1.0, non-aligned respondents a value of 0.5, and productionists zero. In the analyses explaining scenic beauty perceptions, the dependent variable was each mail respondent's rating across the four scenes of a forest type or live group respondent's average rating across the four scenes of a forest type.

Among independent, demographic variables, bivariate indicator (dummy) variables were used to code for gender, ethnic membership by type, and income loss from timber harvest reductions ("a lot" or "some" versus "none"). Respondents selected from categorical choices in reporting their educational attainments. Reported education levels were coded to a two-value indicator variable by whether each respondent had at least a four-year college degree (value of 1) or not (value of 0). This method was found to best aid interpretation of results. Respondents selected from ten thousand dollar annual income ranges from $5,000 up to $75,000, or twenty five thousand dollar ranges from $75,000 to $200,000, or more than $200,000. These selections were coded by the value at the midpoint of each income range. Respondents' ages were computed as the difference between their reported year of birth and that of the survey. This age variable and that for income were continuous independent variables and therefore covariates in ANCOVAs.

Classification of respondents' primary residences as rural versus urban involved two steps: The primary key was their reported home zip code. If the area mapped for that zip code was entirely outside of any census metropolitan area populated by at least 50,000 people, respondents were classified as rural, and vice versa. When a zip code mapped areas both inside and outside such a city, a respondent was classified as rural if they reported that their home was more than a mile from the nearest city bus stop, and vice versa.

Respondents' ages proved to be overly correlated with reported years of residence in the region for inclusion in regressions and ANCOVAs. To remove this correlation and improve the conceptual validity of the regional experience variable, it was redefined: "Regional memory" took on two values measured by whether each respondent's time of residence in the region was more or less than half an estimated period of their remembered life's experience. This regional memory variable was found by subtracting ten years from respondent ages to remove roughly the period of pre-memory childhood. The remaining "memorable" time was then compared to a respondent's reported time of regional residence. If a respondent reported a five-year-increment regional-experience response category fully below half of their age minus ten years, they were coded as "less than half" of memory in the region, and vice versa. In applying this "fully below" categorical standard, care was taken not to miss-classify 18 and 19 year-old respondents who had spent most or all of their life in the region.

Results

The sections below first report associations between demographics and environmental attitudes. These results serve as a baseline for comparison in the subsequent sections

which cumulatively describe associations between demographics, attitudes and forest types in relation to scenic beauty ratings.

Associations Between Demographics and Attitudes

The best stepwise regression model employing demographic factors to explain respondents' forest protectionism is in Table 3. Six demographic attributes significantly explained 30% of variance in protectionism. Age was positively related to protectionism and contributed 17% to its explanation. Residential location contributed 7% more to explaining protectionism whereby urban residents tended to be more protectionist. Regional memory explained an additional 3% of protectionism whereby respondents with less adult experience in the Pacific Northwest tended to be more protectionist. More lost income due to timber harvest reductions, less annual income, and less education were also statistically significant in this model and negatively related to respondents' protectionism, but each contributed very little (1%) to further explanation of variance in protectionism.

The gender and ethnicity variables were not statistically significant in the best regression model (Table 3), nor in the corresponding best ANCOVA model (Table 4). Ethnicity variables were not statistically significant in any tested ANCOVA to predict protectionism (at p=0.10). Gender only bore a statistically significant relation (at p=0.05) to respondents' protectionism as a main effect in a simple, two-way ANOVA with no other variables in the model. In this case, women were a bit more likely to be protectionists. If any other independent variable(s) were added to this model, gender ceased to be a significant factor (even at p=0.10), as the other variables more strongly accounted for variance in protectionism. Respondents' lost income from timber harvest reductions was not statistically significant (at p=0.10) in any ANCOVA tested

Table 3. Regression analysis using respondents' demographic attributes to explain their degree of forest protectionism

Parameter	Estimate	Stand. error	Stand. coeff.	t value	Prob.
Intercept	0.84	0.07	0.84	11.30	<0.001
Age	-0.006	0.001	-0.25	-5.84	<0.001
Location[a]	0.17	0.04	0.20	4.54	<0.001
Income	0.15	0.03	0.17	4.33	<0.001
Lost income[a]	-0.12	-0.04	-0.12	-2.98	0.003
Regional memory[a]	-0.12	0.04	-0.13	-3.07	0.002
Education[a]	0.08	0.03	0.09	2.31	0.02

Regression statistics:	Degr. freedom	R^2	Adjusted R^2	F-test	Prob.
	6/461	0.30	0.29	33.17	<0.001

Stepwise explanation of variance in degree of forest protectionism:

Step	Parameter	Added R^2	Cumulative R^2	simple r[b]
1	Age	0.17	0.17	-0.41
2	Location[a]	0.07	0.24	0.40
3	Regional memory[a]	0.03	0.27	-0.30
4	Income	0.01	0.28	-0.18
5	Lost income[a]	0.01	0.29	-0.22
6	Education	0.01	0.30	0.14

[a]Location values are rural = 0 and urban = 1; regional memory values are less than half experience = 0 and more than half experience = 1; lost income (from timber harvest reductions) values are none = 0 and some or a lot = 1; and education values are less than college degree = 0 and at least college degree = 1.

[b]These values are not stepwise but simple Pearson correlations with protectionism.

Table 4. ANCOVA of demographic attributes on respondents' degree of forest protectionism.[a]

Source	D.f.	Mean square	F-ratio	Prob.	Power
Location[b]	1	0.70	5.63	0.02	0.66
Income	2	0.54	4.38	0.01	0.76
Regional memory[b]	1	0.06	0.47	0.49	0.10
Education	1	0.0004	0.004	0.95	0.05
Age	1	0.67	5.44	0.02	0.64
Income X memory	2	0.32	2.60	0.07	0.51
Income X memory X age	2	0.35	2.82	0.06	0.54
Location X income X education	2	0.99	8.02	<0.001	0.97
Location X income X education X age	2	1.48	11.90	<0.001	0.99
Location X income X education X age X memory	2	0.39	3.12	0.04	0.59
Error	413	0.12			

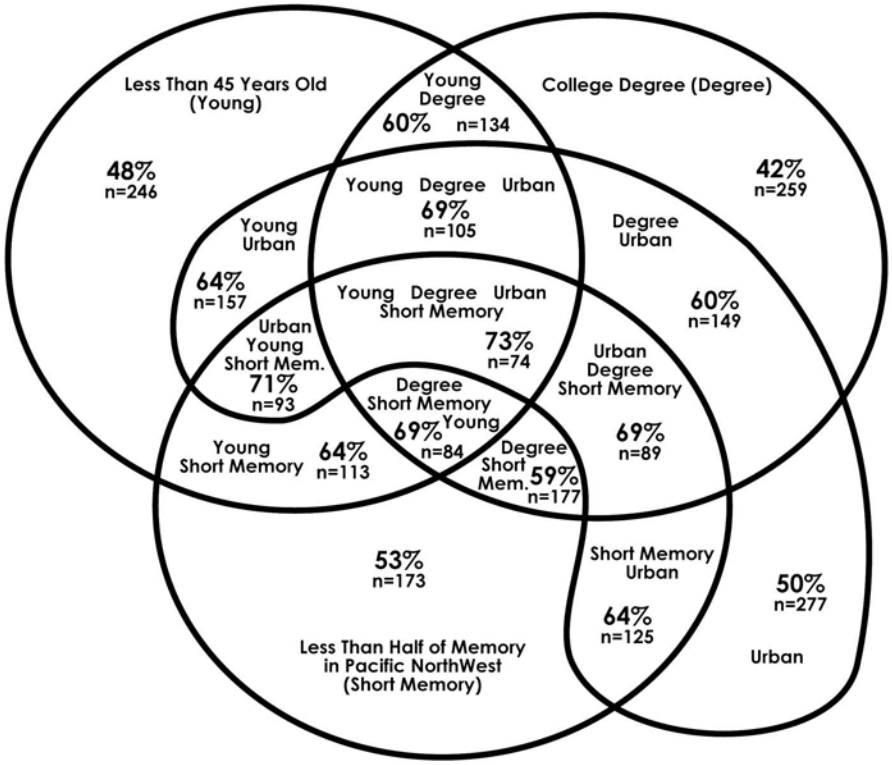
[a]Only statistically significant main effects, main effects for variables that participate in statistically significant interaction effects, and statistically significant interaction effects, all at $p = 0.10$, are listed.

[b]Location values are rural = 0 and urban = 1; regional memory values are less than half experience = 0 and more than half experience = 1, and education values are less than college degree = 0 and at least college degree = 1.

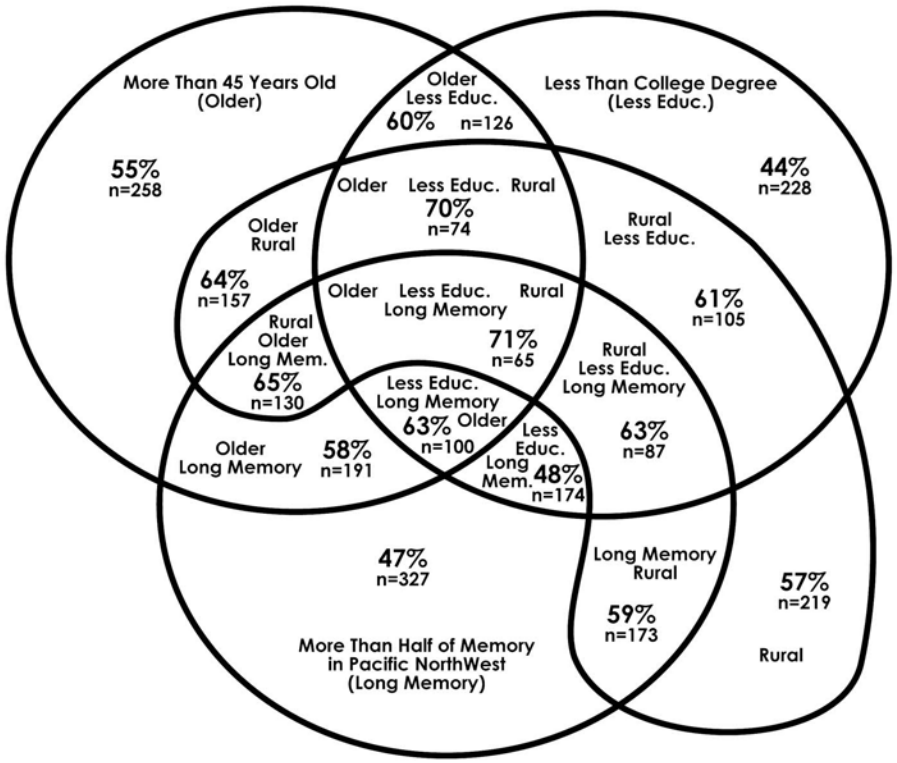
with any combination of independent variables; but in all such tests it was always negatively associated with protectionism, as expected and as in the regression analysis in Table 3. This was not for lack of variance in lost income, as 14% of respondents reported lost income due to timber harvest reductions (5% reporting "a lot" and 9% "some").

The best ANCOVA for explaining demographic factors in relation to protectionism (Table 4) has five independent variables involved in statistically significant effects. Location, age and income had significant main effects in relation to protectionism. These three variables join with education and regional memory to participate in statistically significant, cumulative interaction effects. Their relationships to protectionism are contingent on the value of all four other variables, such that the three simple, main effects are likely to be misleading.

The interaction effect that includes all five independent variables is statistically significant, and this relatively improbable result is the most interesting feature of Table 4. All five demographic attributes tend to be conjointly associated with peoples' protectionism, each with effects that are contingent on the value of all four other factors. These interactions were explored by inspecting various mean-value bar charts. Of the five interactive factors, income was among the least correlated with protectionism (Table 3) and had the weakest and most complex contingent relations with the other four factors in effecting protectionism. The contingent relationships effecting protectionism involving the other four factors were found to always be the same whereby they simply reinforce each other. This is depicted in the four-dimensional Venn diagrams in Figure 2. These show how the interactive variables tend to be marginally additive in cumulatively predicting attitudes in both directions along the protectionism scale. To the extent that such environmental attitudes may



Percent of Respondent Subsets That Were Forest Protectionists by Combinations of Four Demographic Attributes



Percent of Respondent Subsets That Were Forest Productionists by Combinations of Four Demographic Attributes

Figure 2. Four-dimensional Venn diagrams illustrating the most robust ANCOVA interaction effect in Table 4. The same demographic traits cumulatively increase the likelihood that a respondent's attitudes favored either forest protection (top) or forest production (bottom). (Respondent ages were a continuous variable in this and all other ANCOVA analyses and are split here for illustrative purposes near their median value, and likewise in Figures 4-7.)

be associated with differences in scenic beauty perceptions, any of these demographic traits are candidates for associations with such perceptions.

Associations Between Attitudes and Scenic Beauty

Respondents' forest protectionism categories were always significantly associated with scenic beauty ratings in regression models, whether just among old-growth forest scenes or just among intensive timber harvest scenes (Table 5), or both these forest types together (Table 6). Increased protectionism explains 5% of increases in scenic beauty ratings of old-growth scenes, 22% of decreases in scenic beauty among intensive harvest scenes, and 1% of decreases in scenic beauty among both these scene types together.

The ANOVA exploring how scenic beauty ratings relate to both forest protectionism and forest scene types identified a statistically significant interaction effect between these factors (Table 6), as illustrated in Figure 3. Among old-growth forest scenes, scenic beauty ratings increase with respondents' protectionism. But, the reverse applies among intensive timber harvest scenes, where increased protectionism produces lower scenic beauty ratings. No ANOVAs were conducted within each of the scene types because there was just one independent variable.

Associations Between Demographics and Scenic Beauty Among Old-Growth Scenes

Among old-growth forest scenes, the only demographic trait that significantly explained scenic beauty ratings, via any regression model, was respondents' ages, whereby increases in age explain only 2% of decreases in scenic beauty ratings (top of Table 7).

The corresponding ANCOVA (bottom of Table 7) identifies the same main effect between age and scenic beauty ratings as in the regression model (top of Table 7). It

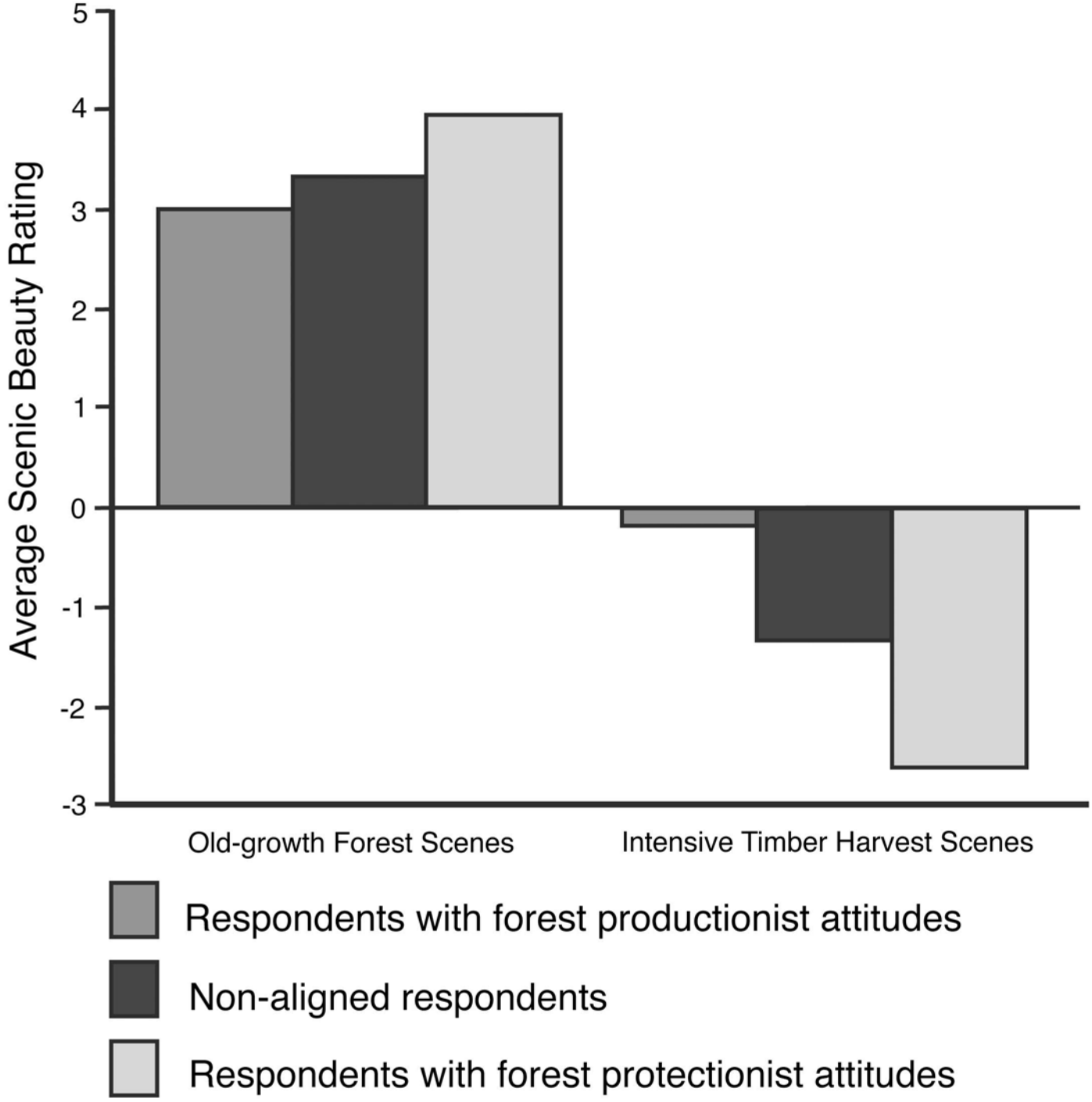


Figure 3. Mean value bar chart for the significant ANOVA interaction effect (from Table 6) between environmental attitudes and forest type in explaining scenic beauty ratings.

Table 5. Regression analyses using respondents' degree of forest protectionism to explain their scenic beauty ratings within different scene sets.

Within old-growth forest scenes:

Parameter	Estimate	Stand. error	Stand. coeff.	t value	Prob.
Intercept	2.98	0.11	2.98	26.25	<0.001
Protectionism[a]	0.91	0.18	0.23	5.17	<0.001

Regression statistics:	Degr. freedom	R^2	Adjusted R^2	F-test	Prob.
	1/495	0.051	0.049	26.77	<0.001

Within intensive timber harvest scenes:

Parameter	Estimate	Stand. error	Stand. coeff.	t value	Prob.
Intercept	-0.18	0.13	-0.18	-1.33	0.18
Protectionism[a]	-2.43	0.21	-0.47	-11.76	<0.001

Regression statistics:	Degr. freedom	R^2	Adjusted R^2	F-test	Prob.
	1/496	0.218	0.216	138.20	<0.001

[a] Protectionism values: productionists = 0, non-aligned = 0.5 and protectionists = 1.

Table 6. Regression and ANOVA analyses using respondents' degree of forest protectionism and the type of forest rated to explain scenic beauty ratings among both old-growth forest and intensive timber harvest scenes.

Regression analysis:

Parameter	Estimate	Stand. error	Stand. coeff.	t value	Prob.
Intercept	-0.98	0.11	-0.98	-8.74	<0.001
Forest type[a]	4.77	0.12	0.77	38.55	<0.001
Protectionism[b]	-0.76	0.15	-0.10	-5.22	<0.001

Regression statistics:	Degr. freedom	R^2	Adjusted R^2	F-test	Prob.
	1/991	0.604	0.603	756.14	<0.001

Stepwise explanation of variance in scenic beauty ratings:

Step	Parameter	Added R^2	Cumulative R^2
1	Forest type[a]	0.59	0.59
2	Protectionism[b]	0.01	0.60

ANOVA of scene type rated and respondents' forest protectionism on scenic beauty ratings.[c]

Source	D.f.	Mean square	F-ratio	Prob.	Power
Forest type[a]	1	1077.42	326.34	<0.001	1.0
Protectionism[b]	1	103.14	31.24	<0.001	1.0
Forest type X Protectionism	1	499.58	151.32	<0.001	1.0
Error	991	3.30			

[a] Indicator variable with intensive harvest = 0, and old-growth forest = 1.

[b] Protectionism values: productionists = 0, non-aligned = 0.5 and protectionists = 1.

[c] Only statistically significant main effects, main effects for variables that participate in statistically significant interaction effects, and statistically significant interaction effects, all at p = 0.10, are listed.

also identified a significant three-way interaction effect between age, residential location and regional memory in explaining old-growth scenic beauty ratings. The corresponding regression analysis (top of Table 7) suggests that this three-way interaction only describes a very small, marginal explanation of variance in scenic beauty ratings. It is illustrated at the top of Figure 4, where respondents' ages are graphed not as the continuous variable in the ANCOVA but split near the sample median. This graph shows that among old-growth scenes, older people tended to render significantly lower scenic beauty ratings than younger people, consistent with the regression results (top of Table 7). It further shows that neither residential location nor regional memory had any effect upon old-growth scenic beauty ratings among younger people, while these factors did matter in interesting ways among older respondents. Older respondents with less than half their memory in the Pacific Northwest tend to rate the same beauty for old-growth scenes irrespective of whether they live in urban or rural areas. But, if they have more than half their memory in the region, rural residents tended to rate less scenic beauty in old-growth scenes than rural respondents with less than half their memory in the region. The reverse applied to older, urban respondents with more than half memory in the region. They rated more beauty in old-growth scenes than did older, urban respondents with less regional memory.

Associations Between Demographics and Scenic Beauty Among Intensive Timber Harvest Scenes

Among intensive timber harvest scenes, the best regression model employing demographic attributes to explain scenic beauty ratings identified three significant factors (top of Table 8). These were the same factors identified in the ANCOVA above

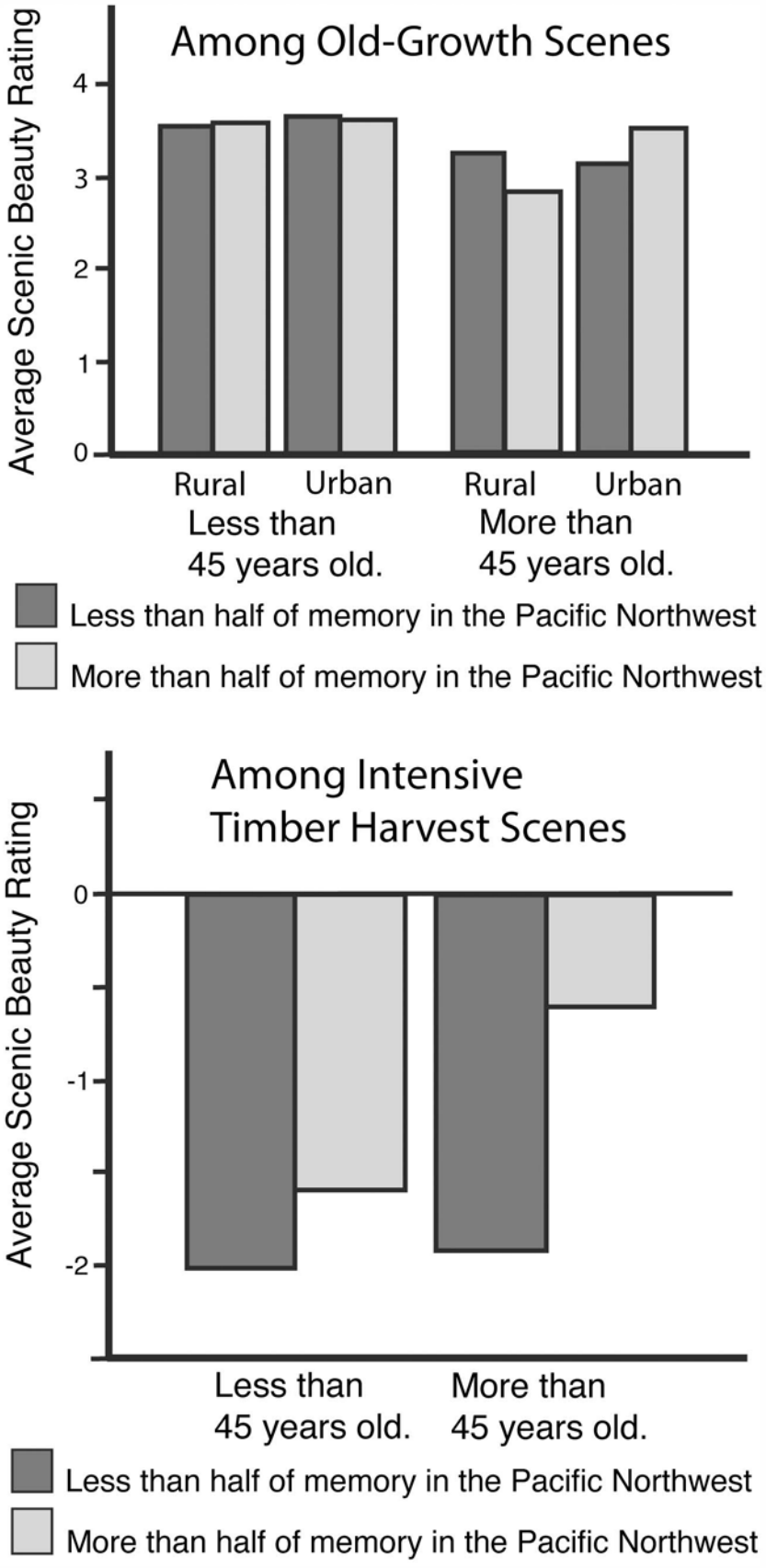


Figure 4. Mean value bar charts for significant ANCOVA interaction effects where demographic traits explain scenic beauty ratings among old growth forests (top, from Table 7) and intensive timber harvests (bottom, from Table 8).

Table 7. Regression and ANCOVA analyses using respondents' demographic attributes to explain their scenic beauty ratings just within old-growth forest scenes.

Regression analysis within old-growth scenes:

Parameter	Estimate	Stand. error	Stand. coeff.	t value	Prob.
Intercept	4.09	0.20	4.09	20.26	<0.001
Age	-0.015	0.004	-0.16	-3.58	<0.001

Regression statistics:	Degr. freedom	R^2	Adjusted R^2	F-test	Prob.
	1/495	0.025	0.023	12.82	<0.001

ANCOVA of respondents' demographic attributes on their scenic beauty ratings within old-growth scenes:[b]

Source	D.f.	Mean square	F-ratio	Prob.	Power
Age	1	10.18	3.88	0.04	0.49
Location[a]	1	2.76	1.05	0.30	0.17
Regional memory[a]	1	2.07	0.79	0.37	0.18
Age X location X memory	1	8.80	3.36	0.07	0.43
Error	465	2.62			

[a] Location values are rural = 0 and urban = 1; regional memory values are less than half experience = 0 and more than half experience =1.

[b]Only statistically significant main effects, main effects for variables that participate in statistically significant interaction effects, and statistically significant interaction effects, all at p = 0.10, are listed.

Table 8. Regression and ANCOVA analyses using respondents' demographic attributes to predict scenic beauty ratings just within intensive timber harvest scenes.

Regression model within intensive timber harvest scenes:

Parameter	Estimate	Stand. error	Stand. coeff.	t value	Prob.
Intercept	-1.97	0.36	-1.97	-5.55	<0.001
Age	0.014	0.006	0.11	2.37	0.02
Location[a]	-0.75	0.21	-0.17	-3.51	<0.001
Regional memory[a]	0.68	0.21	0.15	3.25	0.001

Regression statistics:	Degr. freedom	R^2	Adjusted R^2	F-test	Prob.
	3/497	0.094	0.089	17.12	<0.001

Stepwise explanation of variance in scenic beauty ratings:

Step	Parameter	Added R^2	Cumulative R^2
1	Location[a]	0.06	0.06
2	Regional memory[a]	0.02	0.08
3	Age	0.01	0.09

ANCOVA of demographic attributes on respondents' scenic beauty ratings within intensive timber harvest scenes:[b]

Source	D.f.	Mean square	F-ratio	Prob.	Power
Age	1	0.81	0.19	0.66	0.07
Location[a]	1	19.87	4.63	0.03	0.57
Regional memory[a]	1	1.96	0.46	0.50	0.10
Age X memory	1	15.78	3.68	0.05	0.47
Error	466	4.29			

[a] Location values are rural = 0 and urban = 1; regional memory values are less than half experience = 0 and more than half experience =1.

[b]Only statistically significant main effects, main effects for variables that participate in statistically significant interaction effects, and statistically significant interaction effects, all at p = 0.10, are listed.

for demographics related to old-growth scenic beauty. Here, rural (not urban) residential location explained 6% of increase in scenic beauty ratings, more regional memory explained 2% of such increases, and more age added 1%, yielding a total R^2 of 9%.

The corresponding ANCOVA (bottom of Table 8) identified only residential location as a significant main effect, and the other two factors from the regression model as significant only via an interaction effect between them (bottom of Figure 4). There, younger people tended to rate harvest scenes with significantly lower scenic beauty than older respondents. In addition, more memory in the Pacific Northwest increased scenic beauty ratings of harvest scenes much more among older than younger people.

Associations Between Demographics and Scenic Beauty Among Old-Growth and Timber Harvest Scenes

The best regression model employing demographic attributes to explain scenic beauty ratings among both old-growth forest and intensive timber harvest scenes identified three significant factors (top of Table 9). Old-growth scenes as opposed to harvests explained 59% of positive variance in scenic beauty ratings. Respondents' rural as opposed to urban residential location and whether they had at least half their memorable experience in the Pacific Northwest were both significantly associated with decreased scenic beauty ratings, but these only added 1% to explanation of variance, bringing the total R^2 to 60%.

The corresponding ANCOVA (bottom of Table 9) identified two significant main effects (forest type and regional memory) and these combined with respondents' ages and residential location in five significant interaction effects. The most meaningful of

Table 9. Regression and ANCOVA analyses using respondents' demographic attributes to explain their scenic beauty ratings within both old-growth and intensive harvest scenes.

Regression analysis within intensive timber harvest scenes:

Parameter	Estimate	Stand. error	Stand. coeff.	t value	Prob.
Intercept	-1.39	0.15	-1.39	-8.99	<0.001
Forest type[a]	4.76	0.12	0.77	38.30	<0.001
Location[b]	-0.31	0.13	-0.05	-2.37	0.02
Regional memory[b]	0.34	0.14	0.05	2.52	0.01

Regression statistics:	Degr. freedom	R^2	Adjusted R^2	F-test	Prob.
	3/994	0.60	0.60	494.37	<0.001

Stepwise regression explanation of variance in scenic beauty ratings:

Step	Parameter	Added R^2	Cumulative R^2
1	Forest type[a]	0.593	0.593
2	Regional memory[b]	0.004	0.597
3.	Location[b]	0.002	0.599

ANCOVA of respondents' demographic attributes on their scenic beauty ratings within within both old-growth forest and intensive timber harvest scenes:[c]

Source	D.f.	Mean square	F-ratio	Prob.	Power
Forest type[a]	1	77.69	21.77	<0.001	0.99
Age	1	3.89	1.09	0.30	0.17
Location[b]	1	4.88	1.37	0.25	0.28
Regional memory[b]	1	33.30	9.33	0.002	0.88
Forest type X location	1	11.17	3.13	0.04	0.59
Regional memory X location	1	21.38	5.99	0.003	0.89
Forest type X age	1	19.05	5.34	0.02	0.63
Forest type X location X age	1	11.51	3.23	0.04	0.61
Reg. memory X location X age	1	22.06	6.18	0.002	0.90
Error	971	3.57			

[a] Indicator variable with intensive harvest = 0, and old-growth forest =1.

[b] Location values are rural = 0 and urban = 1; regional memory values are less than half experience = 0 and more than half experience =1.

[c] Only statistically significant main effects, main effects for variables that participate in statistically significant interaction effects, and statistically significant interaction effects, all at p = 0.10, are listed.

these are the two involving the most factors illustrated in Figure 5. The three-way interaction at the top of Figure 5 shows that younger respondents rated more scenic beauty in old growth scenes than older respondents, but this difference reverses for intensive harvest scenes. It also shows that there was no difference between rural versus urban respondents' ratings among old-growth scenes, but urban respondents rated much lower beauty than rural respondents among harvest scenes. The three-way interaction at the bottom of Figure 5 shows that scenic beauty ratings across both forest types were unaffected by residential location or regional memory among younger respondents, but there was a difference among older respondents. There, more regional memory reduced beauty ratings among rural residents but increased it among urban residents.

A comparison of the results explaining old-growth scenic beauty ratings (Table 7 and top of Figure 4) to those explaining intensive timber harvest ratings (Table 8 and bottom of Figure 4) reveals three instructive differences: First, demographic attributes significantly explained much more variation in scenic beauty ratings among timber harvest scenes than among old-growth forest scenes. Second, the directional effect of age reversed between these scene types. Older respondents rated less beauty than younger ones for old-growth scenes; while older respondents rated more scenic beauty in harvest scenes than did younger respondents. Third, among older, rural respondents, the directional effect of regional memory also reverses. Those with a greater part of life's memory in the region rated lower scenic beauty for old-growth scenes. The reverse was true among ratings of intensive timber harvest scenes, where a greater part of regional memory produced higher scenic beauty ratings.

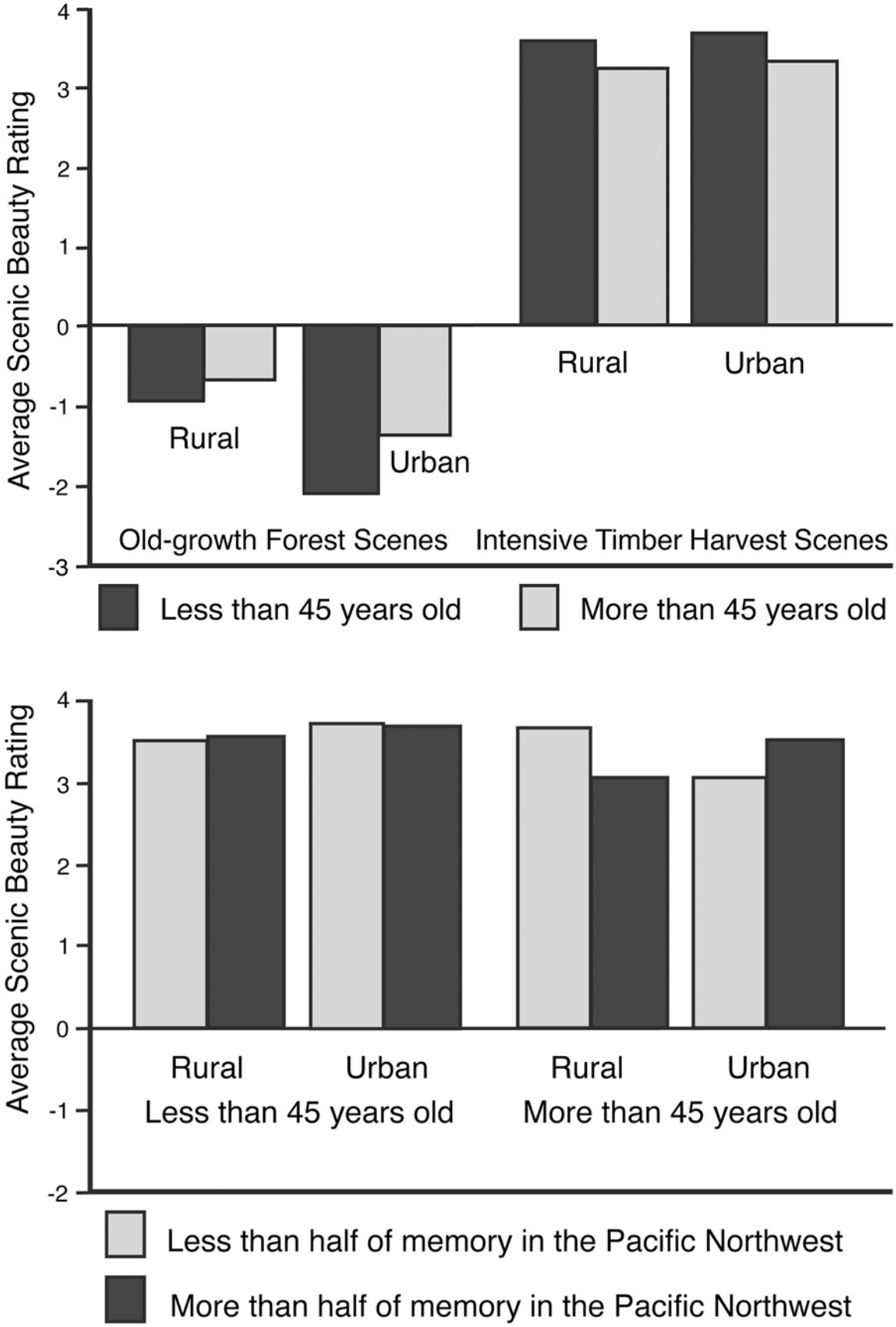


Figure 5. Mean value bar chart for two different significant ANCOVA interaction effects (from Table 9) when demographic traits explain scenic beauty ratings among all forest scenes.

Associations Between Scenic Beauty Ratings and Demographics and Attitudes Among Old-Growth Scenes

Among old-growth forest scenes, the best stepwise regression model employing respondents' demographic attributes and degree of forest protectionism to explain scenic beauty ratings is at the top of Table 10. Only two factors proved significantly associated with scenic beauty. The first was forest protectionism, which was associated with increased scenic beauty and explained 5% of variance in scenic beauty ratings. The second was respondents' ages, which were associated with decreased scenic beauty and explained 1% more variance in scenic beauty ratings.

The corresponding ANCOVA (bottom of Table 10) also identified forest protectionism as significantly associated with scenic beauty via a simple, main effect. Age did not exhibit such a main effect, but did participate in two significant interaction effects. The simplest was with forest protectionism and is illustrated in Figure 6. There, among both productionists and protectionists, younger respondents tended to see more scenic beauty in old growth scenes than older respondents; but there was no significant difference in scenic beauty ratings by age among non-aligned respondents. The second significant interaction effect involving respondents' ages was with residential location and regional memory. This proved to be very similar to that involving the same three variables identified across both forest types and explained above with respect to Table 9 and illustrated at the bottom of Figure 5.

Associations Between Scenic Beauty Ratings and Demographics and Attitudes Among Harvest Scenes

Among intensive timber harvest scenes, the best stepwise regression model employing demographic attributes and forest protectionism to explain scenic beauty ratings is at

Table 10. Regression and ANCOVA analyses using respondents' demographic attributes and degree of forest protectionism to explain their scenic beauty ratings just within old-growth scenes.

Regression analysis within old-growth scenes:

Parameter	Estimate	Stand. error	Stand. coeff.	t value	Prob.
Intercept	3.40	0.26	3.40	13.04	<0.001
Protectionism[a]	0.78	0.19	0.19	4.11	<0.001
Age	-0.01	0.004	-0.09	-1.79	0.07

Regression statistics:	Degr. freedom	R^2	Adjusted R^2	F-test	Prob.
	2/496	0.06	0.05	15.05	<0.001

Stepwise regression explanation of variance in scenic beauty ratings:

Step	Parameter	Added R^2	Cumulative R^2
1	Protectionism[a]	0.05	0.05
2	Age	0.01	0.06

ANCOVA of respondents' demographic attributes and degree of forest protectionism on their scenic beauty ratings within old-growth scenes:[b]

Source	D.f.	Mean square	F-ratio	Prob.	Power
Protectionism[a]	2	7.10	2.75	0.06	0.53
Age	1	3.45	1.33	0.25	0.20
Location[c]	1	4.07	1.57	0.21	0.23
Regional memory[c]	1	0.46	0.18	0.68	0.07
Protectionism X Age	2	9.10	3.52	0.03	0.65
Age X location X memory	1	12.32	4.76	0.03	0.58
Error	433	2.59			

[a] Protectionism values: productionists = 0, non-aligned = 0.5 and protectionists = 1.

[b] Only statistically significant main effects, main effects for variables that participate in statistically significant interaction effects, and statistically significant interaction effects, all at p = 0.10, are listed.

[c] Location values are rural = 0 and urban = 1; regional memory values are less than half experience = 0 and more than half experience =1.

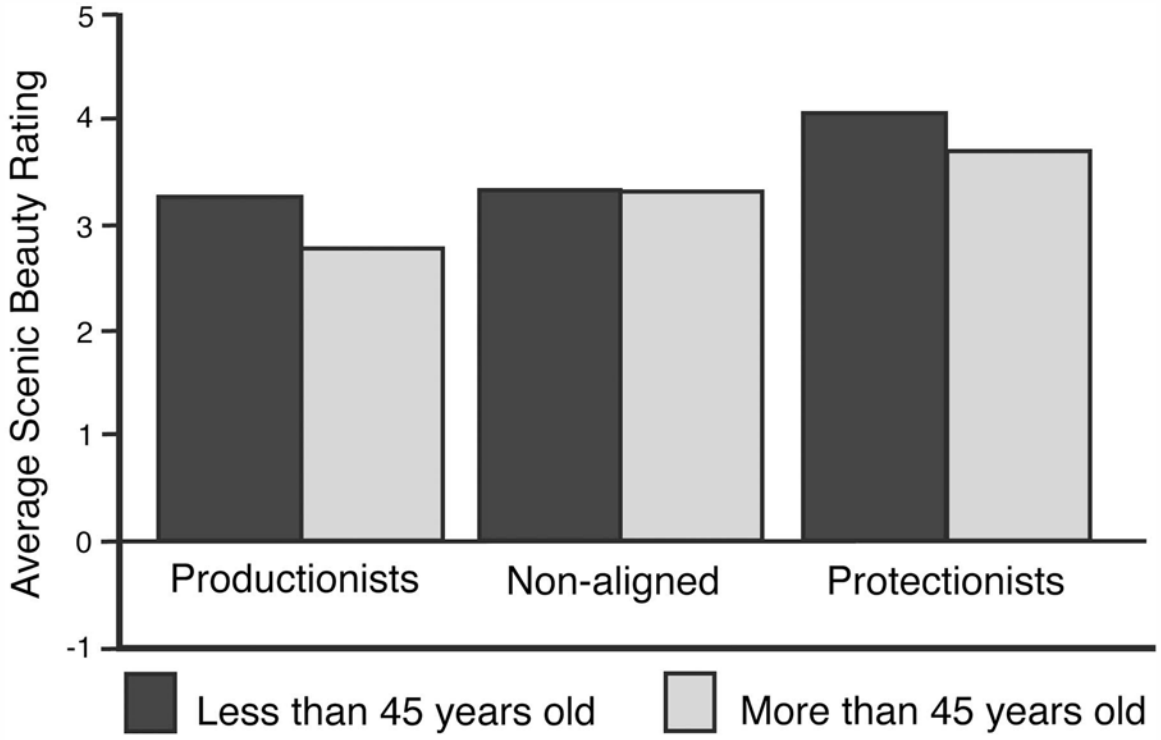


Figure 6. Mean value bar chart for a significant ANCOVA interaction effect (from Table 10) where demographic traits and environmental attitudes together explain scenic beauty ratings just among old growth forest scenes.

the top of Table 11. Two factors proved significantly associated with scenic beauty. The first was forest protectionism, which was associated with decreased scenic beauty and explained 22% of variance in ratings. The second was regional memory, which was associated with increased scenic beauty and explained 1% more variance in scenic beauty ratings.

The corresponding ANCOVA (bottom of Table 11) also identified forest protectionism as significantly associated with scenic beauty via a main effect. Regional memory did not participate in any significant effects. The simplest significant interaction effect involved residential location and protectionism (top of Figure 7). There, residential location was not associated with differences in beauty ratings of harvest scenes among protectionists; but, among productionists and non-aligned respondents, rural residents saw more scenic beauty in harvest scenes.

This significant two-way interaction effect is elaborated, to be more fully informative and less misleading, by the addition of respondents' ages in a significant, three-way interaction effect (bottom of Table 11 and bottom of Figure 7). There, among protectionists, there actually is a difference between rural and urban residents' scenic beauty ratings (contrary to the two-way interaction described above) once their ages are accounted for. Among older protectionists, urban respondents rated less beauty in harvest scenes than rural ones, and the reverse is true among younger protectionists. Among non-aligned respondents, rural residents saw more beauty than urban residents but only if they were younger. Among productionists, this difference is more pronounced among younger respondents.

Associations Between Scenic Beauty Ratings and All Other Factors

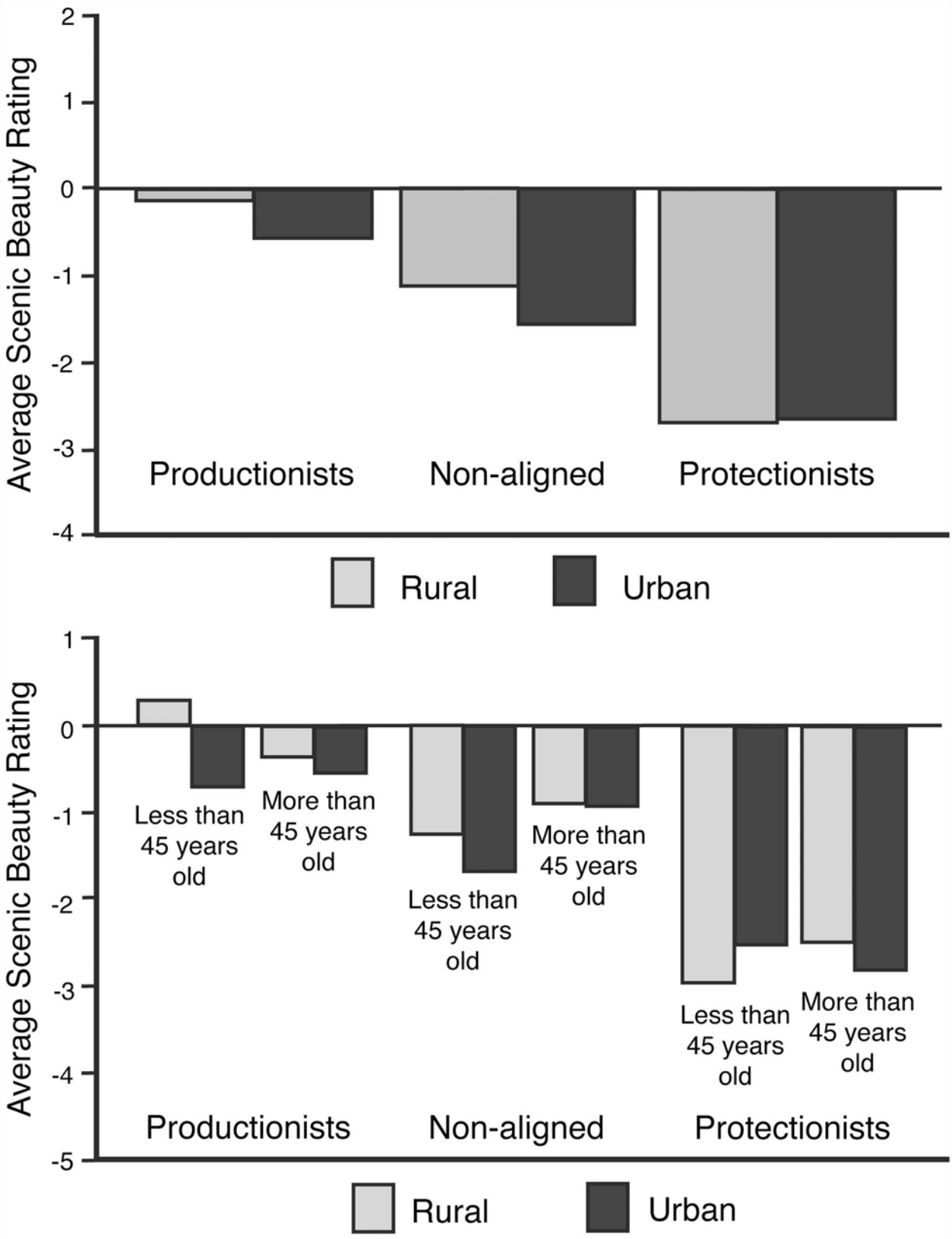


Figure 7. Mean value bar chart for two cumulative, significant ANCOVA interaction effects (from Table 11) where both demographic traits and environmental attitudes explain scenic beauty ratings just among timber harvest scenes.

Table 11. Regression and ANCOVA analyses using respondents' demographic attributes and degree of forest protectionism to explain their scenic beauty ratings just within intensive timber harvest scenes.

Regression analysis within intensive timber harvest scenes:

Parameter	Estimate	Stand. error	Stand. coeff.	t value	Prob.
Intercept	-0.47	0.21	-0.47	-2.31	0.02
Protectionism[a]	-2.31	0.22	-0.44	-10.71	<0.001
Regional memory[b]	0.37	0.19	0.08	1.90	0.06

Regression statistics:	Degr. freedom	R^2	Adjusted R^2	F-test	Prob.
	2/493	0.23	0.22	71.40	<0.001

Stepwise regression explanation of variance in scenic beauty ratings:

Step	Parameter	Added R^2	Cumulative R^2
1	Protectionism[a]	0.22	0.22
2	Regional memory[b]	0.01	0.23

ANCOVA of respondents' demographic attributes and degree of forest protectionism on their scenic beauty ratings within intensive timber harvest scenes:[c]

Source	D.f.	Mean square	F-ratio	Prob.	Power
Protectionism[a]	2	14.31	3.94	0.02	0.71
Age	1	0.98	0.27	0.60	0.08
Location[b]	1	4.54	1.25	0.26	0.19
Protectionism X Location	2	13.81	3.80	0.02	0.69
Protectionism X location X age	2	11.08	3.05	0.05	0.58
Error	434	3.64			

[a] Protectionism values: productionists = 0, non-aligned = 0.5 and protectionists = 1.

[b] Location values are rural = 0 and urban = 1; regional memory values are less than half experience = 0 and more than half experience =1.

[c] Only statistically significant main effects, main effects for variables that participate in statistically significant interaction effects, and statistically significant interaction effects, all at p = 0.10, are listed.

Table 12 describes the best stepwise regression for explaining scenic beauty ratings among both old-growth and intensive harvest scenes together and making potential use of all available demographic and attitudinal factors. As in the regressions reported above, ethnicity, income and gender were not significant factors, nor were income impacts from harvest reductions. From the remaining potential factors, only three proved significant in this comprehensive model of scenic beauty ratings. Scene type significantly explained 59% of variance in scenic beauty ratings, with old-growth more beautiful than harvest scenes. Protectionism significantly explained an additional 1% of variance, with protectionists seeing less beauty than productionists. Regional memory contributes negligibly to R^2.

The ANCOVA for comprehensively explaining scenic beauty ratings (Table 13) reveals more complexity of influences affecting scenic beauty perceptions than the regression model in Table 12. It employs scene type and respondents' protectionism, residential location, and ages as significant factors in interaction effects, including one involving all four of these factors. (None of these factors exhibit significant main effects.) Inspection of various interaction mean bar charts for this four-way effect mostly revealed the same effects already identified in Figures 4-7.

Discussion

The results of all regression analyses (Tables 5, 12, and top of Tables 6-11) are summarized in Figure 8 comparing the contribution of combinations of factor types in explaining differences in scenic beauty perceptions. The results of all ANCOVA and ANOVA models (bottom of Tables 6-11 and Table 13) are summarized in Figure 9, showing the most robust and significant ways that all significant factors explained

Scenic beauty explained by:	Within old-growth scenes only	Within harvest scenes only	Among both old-growth and harvest scenes
Demographics only	2.5% (From Table 7)	9% (From Table 8)	1% (From Table 9)
Attitudes only	5% (From Table 5)	22% (From Table 5)	1% (From Table 6)
Demographics (with attitudes)	1% (From Table 10)	1% (From Table 11)	0% (From Table 12)
Attitudes (with demographics)	5% (From Table 10)	22% (From Table 11)	1% (From Table 12)
Attitudes and demographics	6% (From Table 10)	23% (From Table 11)	1% (From Table 12)
Scene type only (old-growth vs. harvested)	Not applicable	Not applicable	59% (From Tables 6 and 12)
Demographics, attitudes and scene type	Not applicable	Not applicable	60% (From Table 12)

Figure 8. Summary chart arraying how much explanation of variance in scenic beauty ratings was achieved by categories of respondent attributes (left column) by types of forest scenes (top row).

Table 12. Regression analysis using respondents' demographic attributes and their degree of forest protectionism to explain their scenic beauty ratings among both old-growth forest and intensive timber harvest scenes.

Parameter	Estimate	Stand. error	Stand. coeff.	t value	Prob.
Intercept	-1.18	0.16	-1.18	-7.50	<0.001
Forest type[a]	4.77	0.12	0.77	38.60	<0.001
Protectionism[b]	-0.68	0.15	-0.09	-4.47	<0.001
Regional memory[c]	0.27	0.14	0.04	1.93	0.05

Regression statistics:	Degr. freedom	R^2	Adjusted R^2	F-test	Prob.
	3/994	0.605	0.604	506.28	<0.001

Stepwise explanation of variance in scenic beauty ratings:

Step	Parameter	Added R^2	Cumulative R^2
1	Forest type[a]	0.59	0.59
2	Protectionism[b]	0.01	0.60
3	Regional memory[c]	0.005	0.605

[a] Indicator variable with intensive harvest = 0, and old-growth forest = 1.

[b] Protectionism values: productionists = 0, non-aligned = 0.5 and protectionists = 1.

[c] Regional memory values are less than half experience = 0 and more than half experience = 1.

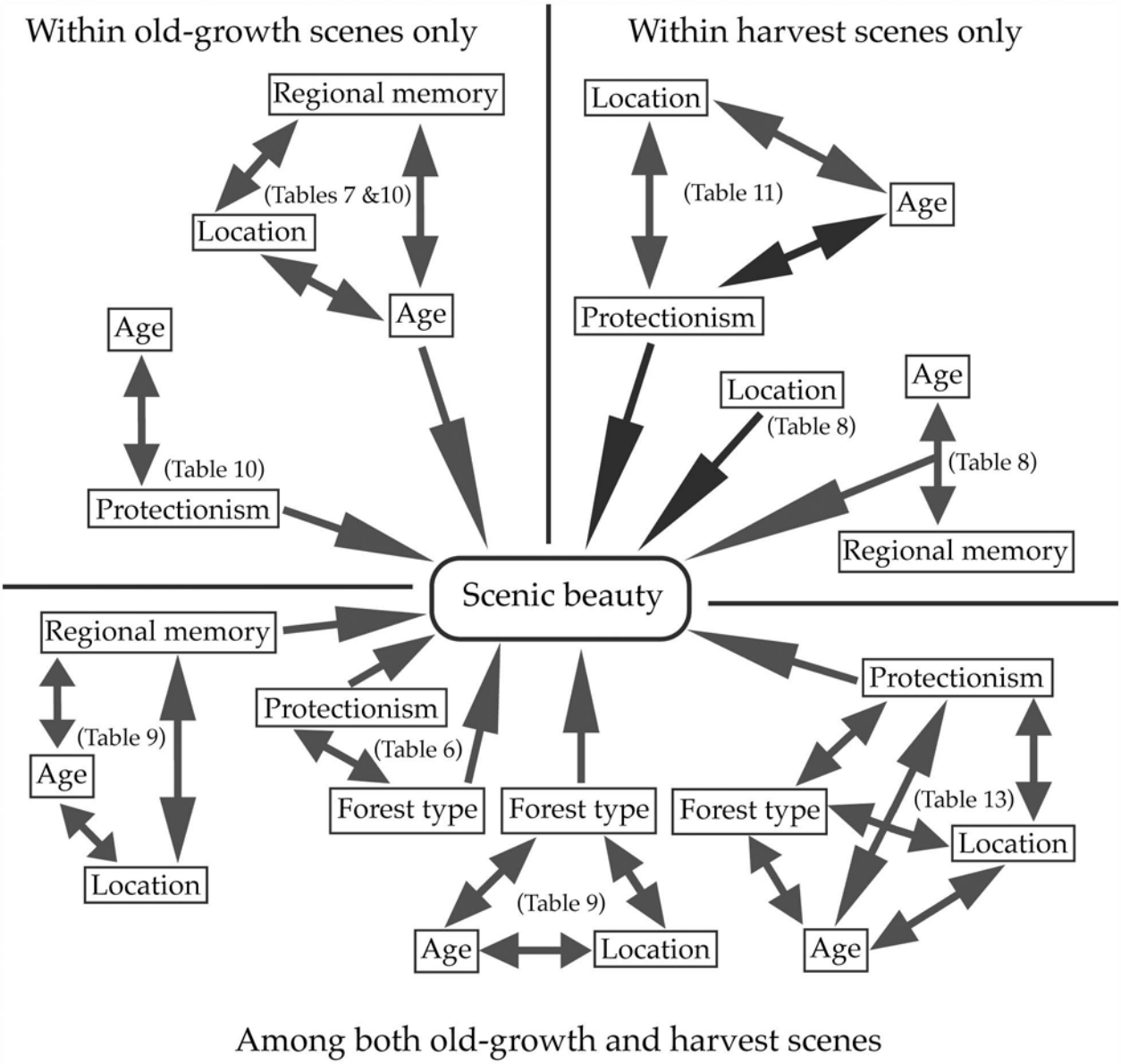


Figure 9. Summary of the most robust and significant interaction effects by which all significant factors participated in all study ANOVAs and ANCOVAs explaining scenic beauty ratings. (Arrows pointing to scenic beauty come from traits within interaction effects that also bore significant simple, direct effects upon scenic beauty. When arrows come from an interaction arrow then only the interaction effect was significant and none of its participating traits bore a significant simple, direct effect upon scenic beauty.)

variance in scenic beauty. The results in these and other figures are discussed below by study postulate.

1. The Importance of Scenic Content Versus Demographics or Attitudes

Strong differences in the scenic and denotative content of scenes, such as old-growth versus harvested forests, are much more influential in explaining differences in people's scenic beauty perceptions than their personal traits. This is illustrated in the right-hand column of Figure 8 where scene type explained 59% of variance in scenic beauty perceptions while the most that attitudes or demographics, or both, explained was 1%. Diverse people tend to agree about major differences in scenic beauty and their personal traits only account for very small, marginal differences. Only among relatively homogeneous scenes within one landscape type, i.e. old-growth forests or timber harvests, can attitudes or demographic traits account for significant differences in scenic beauty perceptions, and more so attitudes among ugly scenes (Table 8). When considering less homogeneous scenery, attempts to use only people's traits to account for differences in scenic beauty perceptions may identify false relationships due to how such traits co-vary with differences in scenic content, and which will likely disappear once scenic content is accounted for.

2. The Importance of People's Traits in Relation to Scenic Beauty Levels

Demographic traits or attitudes tend to account for differences in scenic beauty perceptions much more among ugly than beautiful scenes, consistent with previous studies (Ribe, 2002; Strumse, 1996; Hagerhall, 2001). This is illustrated in Figure 8 by comparing the values by row between the left-hand and center columns. In all but one case, the capacity of attitudes or demographics to explain differences in scenic beauty is substantially higher among timber harvests than old-growth forests. People

Table 13. ANCOVA of respondents' demographic attributes and degree of forest protectionism on scenic beauty ratings among both old-growth forest and intensive timber harvest scenes.[a]

Source	D.f.	Mean square	F-ratio	Prob.	Power
Location[b]	1	1.80	0.55	0.46	0.11
Forest type[c]	1	2.16	0.66	0.42	0.12
Protectionism[d]	1	10.04	3.09	0.08	0.40
Age	1	2.11	0.65	0.42	0.12
Forest type X protectionism	1	11.58	3.56	0.06	0.45
Forest type X location	1	16.01	4.92	0.03	0.59
Forest type X protectionism X location	1	13.81	4.25	0.04	0.53
Forest type X age X location	1	15.81	4.86	0.03	0.59
Forest type X age X location X protectionism	1	15.89	4.89	0.03	0.59
Error	963	3.25			

[a] Only statistically significant main effects, main effects for variables that participate in statistically significant interaction effects, and statistically significant interaction effects, all at $p = 0.10$, are listed.

[b] Indicator variable with rural = 0 and urban =1.

[c] Indicator variable with intensive harvest = 0, and old-growth forest = 1.

[d] Protectionism values: productionists = 0, non-aligned = 0.5 and protectionists = 1.

tend to agree about high levels of scenic beauty while their traits are more associated with differences in perceived ugliness.

3. Are Their Really Two Oregons?

Miller (1990) reported that there are "two Oregons" with respect to the forest products economy. This condition has been distilled in this study to a contrast between the "timber culture" and the "ecotopian" culture at the extremes. The survey sample in this study was drawn from Oregon and confirms and elaborates this characterization 15 years after Miller's report. There are many residents of this state that fall in the middle and are non-aligned with either extreme, but there is also a distinct dichotomy between people with value orientations and consequent attitudes favoring forest production versus forest protection (Table 1). The demographic traits that cumulatively identify people most likely to belong to either of these distinct value orientations (Table 3) entail geographic, lifestyle and experiential differences strong enough to reasonably be characterized as different subcultures. The forest production "timber culture" tends to consist of people who have spent a large proportion of their life's experience in the Pacific Northwest, and who live in rural communities, are less educated, lower-income, and older; whereby the more of these traits people have the more likely they are to belong to this subculture (Table 4 and Figure 9). The forest protection "ecotopian" culture tends to consist of people who have spent a lesser proportion of their life's experience in the Pacific Northwest, and who live in cities, are more educated, higher-income, and younger; whereby the more of these traits people have the more likely they are to belong to this subculture. This cultural dichotomy, and the simple, cumulative way that demographic traits are associated with it proved a propitious opportunity to investigate the relationship

between subcultural attitudes and aesthetic landscape perceptions. In fact, demographic traits associated with these attitudes that are arguably the least consistent with subcultural membership, namely income and education, were the ones not significantly associated with differences in scenic beauty perceptions.

4. Do Attitudes and Not Demographics Matter?

The evidence informing Postulate 1 above indicates that people's attitudes or demographic traits should only be significantly associated with meaningful differences in aesthetic perceptions when comparing among relatively homogeneous landscapes. In such instances, i.e. just within old-growth forest or timber harvest scenes, environmental attitudes proved to be more potent than demographic traits in explaining scenic beauty perceptions. In the two left-hand columns in Figure 8, for old-growth forests only and timber harvests only, the explanation of variance in scenic beauty by attitudes is consistently and substantially stronger than that by demographics, whether these factor categories are tested by themselves or together with the other. Normative attitudes that can connote emotional perceptions of landscapes, consistent with the emotional content of aesthetic perceptions, are more useful predictors of small differences in aesthetic perceptions of scenically similar landscapes.

This finding is reinforced by the fact that only the three demographic factors most directly correlated with attitudes (Table 3) were statistically significant in explaining variance in scenic beauty by regression or ANCOVA analyses (Tables 7-13). Other demographic traits (income, education, and lost income from harvest reductions) were significantly related to environmental attitudes (Tables 3-4), but were not significantly related to scenic beauty. Not all demographic traits associated

with environmental attitudes should be expected, ipso-facto, to be associated with differences in aesthetic perceptions.

5. Universality of Demographic Associations with Scenic Beauty Perceptions

The only demographic attributes that proved to be significantly associated with small differences in scenic beauty perceptions (Figure 9) were among those associated with environmental attitudes (Figure 2). Demographic traits not related to these subcultural attributes were never systematically related to scenic beauty in the most robust statistical tests. This evidence strongly suggests that demographic traits that are most likely to be associated with different aesthetic perceptions are those that are correlated with local, cultural or subcultural differences. Relationships found in other studies between demographic traits and different aesthetic sensibilities are unlikely to reflect more universal or fundamental psychological attributes of perceptions. They are contingent on local differences in cultural attitudes that affect aesthetic perceptions, and how these happen to instigate affects when seeing the local landscapes at issue.

This study found evidence that hints at one possible reliable association between a demographic trait and aesthetic perceptions. In the mean-value bars that correspond to different age groups but with the same other demographic attributes (while judging the same type of scenes) in Figures 4-7, older respondents tend to exhibit ratings closer to zero, i.e. less beautiful or less ugly, than younger people. Occasionally such differences are very small, and the rule may not apply in cases where mean ratings are very close to zero, i.e. for scenes that are seen as lacking appreciable beauty or ugliness (as with rural productionists in Figure 7). A clear exception is urban protectionists in both graphs in Figure 7. The weight of evidence

in these ANCOVA mean-value bar charts suggests that aesthetic perceptions might moderate with age. This is, however, weak and indirect evidence, suggesting that this phenomenon needs further research.

6. Interaction of Landscapes and Attitudes

The ways in which different environmental attitudes are associated with different scenic beauty perceptions can change substantially with changes in the type or aesthetic valence of landscape. This is clearly shown in Figure 3. When observing old-growth forests, people with forest protectionist attitudes tend to see a bit more scenic beauty than those with productionist attitudes, consistent with the results for Postulate 4 above. But, this relation does not apply to all forests. When observing harvested forests, the relationship reverses and people with forest protectionist attitudes tend to see substantially less scenic beauty than those with productionist attitudes. Once a relationship is found between aesthetic perceptions and environmental attitudes, consistent with membership in different subcultures, one can not assume that it applies to all landscapes. Such relationships are contingent upon landscape type according to how the different attitudes find expression or associations in the form and content of landscapes.

The contingent relationship between environmental attitudes and forest types in affecting scenic beauty perceptions carries through weakly to the demographic traits that are associated with the relevant attitudes. Attitudes seem to mediate between demographic traits and aesthetic perceptions. For example, respondents' ages tended always to participate in significant ANCOVA interaction effects (Figure 9), and their ages were also significantly determinant of their degree of forest protectionism (Table 3 and Figure 2). Consequently, because older respondents tend to be have more

productionist value orientations they exhibit the corresponding landscape-type contingent tendency to see old growth forests as less beautiful and timber harvests as more beautiful (Figure 4, top of Figure 5 and Figure 6). Because residential location participates in 5 of 7 significant interaction effects (Figure 9) and rural residents tend to have more productionist value orientations (Figure 2), they tend to exhibit the corresponding differences in scenic beauty perceptions by forest type, but with the contingency that they are older (top of Figure 4 and bottom of figure 5), are productionists (Figures 6 and 7), and more so if they are judging old-growth forests (top of Figure 4 and top of Figure 5). Regional memory participated in 3 of 7 ANCOVA interaction effects (Figure 9), and respondents with more than half their memory in the Pacific Northwest tended to be productionists (Figure 2). They exhibit the expected switch in relative scenic standards between old-growth versus harvested forests, particularly if they are older (Figure 4). These findings for the above three demographic traits apply in reverse for younger, urban and short-term regional residents.

7. When and Why do Demographic Traits Matter?

The three demographic traits (age, residential location and regional memory) that participated in statistically significant interaction effects in explaining variance in scenic beauty perceptions (Figure 9) were among those that did likewise in explaining variance in environmental attitudes (Table 4 and Figure 2). The same can be said for the demographic traits that were significant as simple direct effects in explaining scenic beauty or as significant factors in regressions that explained variance in scenic beauty (Tables 7-13 as compared to Table 3). This finding occurred from a larger pool of tested demographic traits in explaining both scenic beauty perceptions and

attitudes toward forest management. This suggests that only demographic traits that are associated with value orientations germane to the connotative content of the landscapes at issue will also be associated with different scenic beauty perceptions.

There were, however, demographic traits that were associated with forest protection attitudes that were never significantly associated with differences in scenic beauty perceptions. These were income, education level, and lost income due to timber harvest reductions. These were the three factors least directly correlated with protectionist or productionist attitudes, while the three factors noted above as significant in explaining scenic beauty were the most correlated with these attitudes (Table 3).

To the extent that demographic traits might predict small differences in scenic beauty perceptions among homogeneous scenery, they often do so cumulatively, whereby one trait's capacity to do so is contingent on one or more other traits in complex ways. For example, residential location explains more difference in scenic beauty perceptions among older respondents than young ones (top of Figure 4 and bottom of Figure 5); and regional memory similarly tends to explain more difference in scenic beauty perceptions among older people (bottom of Figure 4). These compound effects illustrate how a demographic trait may be related to aesthetic perceptions only if the value of one or more other demographic traits is just right. Such contingencies can also reverse the direction of such a relationship (right half, bottom of Figure 5). Here, such contingencies (Figure 9) nevertheless always worked in directions consistent with how demographic traits relate to environmental attitudes (Figure 2), while accounting for how attitudes relate to landscape types' scenic content, as described above for Postulate 6. These complex attitude and landscape dependent contingencies make demographic traits unreliable in landscape

assessments, unless identified by public survey researched for each local application.

Summary

The key findings are summarized, point-by-point, below by postulate number:

1. The Importance of Scenic Content Versus Demographics or Attitudes

- Substantial differences in scenic content, i.e. old-growth versus harvested forests, are much more important in explaining differences in scenic beauty perceptions than differences in people's attitudes or demographic traits, such that accounting for people's traits in scenic assessments is not cost effective.
- Differences in environmental attitudes, by themselves, tend to explain significant differences in aesthetic perceptions, but when combined with scenic differences offer much less explanatory power.
- Differences in demographic traits explain only very small differences in aesthetic perceptions, and when combined with attitudinal and/or scenic differences offer negligible explanatory power.
- Attitudes, and demographic traits to a lesser extent, are more associated with differences in scenic beauty perceptions when comparing among more homogeneous alternative landscapes.

2. The Importance of People's Traits in Relation to Scenic Beauty Levels

- People tend to agree more in their aesthetic perceptions of more beautiful landscapes, i.e. old-growth forests, than aesthetic perceptions of uglier landscapes, i.e. intensive timber harvests.
- Differences in environmental attitudes are more useful in partially explaining differences in aesthetic perceptions among uglier landscapes than among beautiful ones.

- Differences in demographic traits are more useful in partially explaining small differences in aesthetic perceptions among uglier landscapes than among beautiful ones.

3. Are Their Really Two Oregons?

- Western Oregon's population does exhibit environmental attitudes toward forestry that arguably reflect two different subcultures at the end points of a spectrum of opposing value orientations there.
- Western Oregon's "timber culture" tends to consist of people who have many or all of these traits: most of life's experience in the Pacific Northwest, rural residence, older, less educated and lower-income.
- Western Oregon's "ecotopian" subculture tends to consist of people with many or all of these traits: less experience in the Pacific Northwest, urban residence, younger, more educated and higher-income.
- Demographic traits most arguably consistent with subcultural membership, i.e. regional memory, residential location and age, are much more likely to be related to differences in aesthetic perception than traits less clearly identifiable with subcultures, i.e. income and education.

4. Do Attitudes and Not Demographics Matter?

- Environmental attitudes tend to be more powerful in explaining differences in scenic beauty perceptions than differences in people's demographic traits.
- Only demographic traits <u>most directly</u> related to attitudes relevant to the normative, connotative scenic content of landscapes can reliably be expected to relate to differences in scenic beauty perceptions.

- Not all demographic traits related to relevant attitudes and connotative scenic content will ipso-facto be related to differences in scenic beauty perceptions. (See second point under Postulate 7.)

5. Universality of Demographic Associations with Scenic Beauty Perceptions

- Demographic traits associated with differences in aesthetic perceptions tend to be highly contingent. They depend on which traits are associated with local subcultures and environmental attitudes and how those, in turn, associate with culturally relevant connotative differences in scenic content.
- However, this study did find evidence that people's age might exhibit a "universal" relation to aesthetic perceptions in that older people tend to make more moderated aesthetic judgments, i.e. they see a bit less beauty in old-growth forests and a bit less ugliness in timber harvests than do younger people.

6. Interaction of Landscapes and Attitudes

- Associations between demographic traits or attitudes and differences in aesthetic perceptions can be highly contingent, in validity or direction, upon the type of landscape being perceived and people's attitudes. (Such associations reversed between old-growth versus timber harvest landscapes.)
- Any demonstrated relationship between aesthetic perceptions and environmental attitudes can not be assumed to apply to all landscapes because the affective scenic content that couples with particular attitudes will vary among landscape types.
- People with attitudes favoring environmental protection tend to have <u>slightly</u> higher aesthetic perceptions of natural appearing landscapes than those favoring environmental production.

- People with attitudes favoring environmental production tend to have higher aesthetic perceptions of visibly exploited landscapes, i.e. harvested forests, than those favoring environmental protection.
- The direction of associations between demographic traits and differences in aesthetic perceptions of a landscape type are contingent upon particular cultural attitudes that mediate between demographic traits and aesthetic perceptions. (In this study reversible associations involved age, regional experience and rural versus urban residency and reversed between productionists and protectionists, and between old-growth and harvested forests.)

7. When and Why do Demographic Traits Matter?

- The demographic traits likely to be associated with differences in people's scenic beauty perceptions are only those also related to germane environmental attitudes.
- Not all demographic traits associated with environmental attitudes are likely to be associated with differences in aesthetic perceptions; but rather only traits most strongly associated with attitudes germane to the connotative content of the landscapes involved.
- Demographic traits tend to be cumulatively associated with differences in aesthetic perceptions in a manner consistent with how they are cumulatively associated with relevant environmental attitudes.
- The contingencies by which demographic traits associate with aesthetic perceptions tend to mimic the contingencies by which the same traits tend to associate with relevant environmental attitudes.

- Demographic traits' associations with differences in perceived scenic beauty tend to be mult-contingent and therefore an unreliable basis for landscape assessments, unless these are researched in every case.

Conclusions

Western Oregon, with its forest management conflicts, proved a good testing ground for how subcultures, with their opposing value orientations and attitudes, perceive forests' scenic beauty. Four demographic traits proved to be cumulatively predictive of likely membership in these subcultures, providing fertile ground for investigating their relationship to scenic beauty perceptions. Members of the "timber culture" tended to be older, rural, long-time regional residents, less educated, with lower incomes, while members of the "ecotopian" culture were the reverse. The results of this study inform whether and how demographic and attitudinal traits are associated with differences in scenic beauty perceptions, and need to be replicated in other regions with different subcultures, landscapes, demographics and environmental attitudes.

Evidence from this study does not support understanding aesthetic perceptions primarily as behaviors or as cognitively constructed judgments, at least with respect to appreciable differences in informed scenic beauty. Denotative or compositional scenic content dominates such scenic beauty perceptions, even among people with different cultural or demographic traits. Public perceptions of scenery should first be viewed as prima facie perceptions, like other basic "input" perceptions that subsequently effect people's more cognitively constructed judgments and behaviors. Only under special and fluid circumstances, and only at the margin, can value

orientations and demographic traits be considered influential upon scenic beauty perceptions, as described below.

Evidence here suggests that the valence and general magnitude of informed scenic beauty perceptions is determined by what is seen, and interpersonal traits tend to affect only marginal changes in the magnitude of such experiences. When substantial differences in scenic beauty are at issue, managers and researchers need not worry about modifying assessments of scenic quality according to the demographics or attitudes of affected publics. The same applies when evaluating small differences among alternative highly beautiful landscapes. Demographics and especially public attitudes come into small but significant play only when evaluating small scenic differences among landscapes alternatives that are homogeneously of moderate or low scenic beauty. Even then, accounting for how interpersonal differences relate to differences in perceptions is quite complex.

Evidence here indicates that there are not likely to be universal demographic correlates with aesthetic perceptions. Instead, this study offers some potentially reliable explanatory rules by which such correlations can be expected to occur in each landscape assessment situation.

Small interpersonal differences in scenic beauty perceptions mainly arise from differences in environmental attitudes and these must also affectively resonate with connotative differences in scenic content, consistent with the emotion-instigating nature of aesthetic experience. Environmental attitudes directly influence such experiences and are therefore more potent and reliable predictors of interpersonal differences in scenic beauty perceptions than demographic traits. A general rule indicated here is that people with attitudes favoring environmental protection tend to see a bit more beauty in natural appearing landscapes, while those favoring

environmental production tend to see a bit more beauty in landscapes exhibiting evidence of exploitation. More specific, broadly-reliable rules relating environmental attitudes to differences in scenic beauty perceptions are elusive. Such relations derive from each local and peculiar nexus between subcultural attitudes and differences in connotative scenic content. These may prove to occur in many but not all contexts. Not all locally observed differences in attitudes will be associated with differences in scenic beauty perceptions, and those that are will likely vary by region and subject landscape.

Reliable associations between demographic traits and small differences in scenic beauty perceptions are even more elusive because these relationships are mediated by both attitudes and the connotative scenic content of landscapes. Findings of significant relationships between demographic traits and differences in aesthetic perceptions should not be considered broadly valid or transferable to other regions, cultures or landscapes. (This study suggests one possible exception whereby aesthetic perceptions may be moderated in older people.) Such relationships are highly contingent. Evidence here indicates that only demographic traits that happen to be strongly correlated with environmental attitudes, and particularly attitudes derived from local subcultures, might reliably predict differences in scenic beauty perceptions. In this study only a few traits from among many tested were significantly related to attitudes and only those few that were most correlated with attitudes were significantly related to aesthetic perceptions. Not all demographic traits related to scenically relevant environmental attitudes will be related to differences in aesthetic perceptions. The attitudes must also instigate emotional affects upon perceiving germane connotative landscape content. Furthermore, the

direction of aesthetic affects associated with different attitudes, or with correlated demographic traits, can easily reverse with changes in landscape type or content.

Furthermore, significant associations between demographic traits and different beauty perceptions can be contingent upon the value of other demographic traits. Demographic traits may need to cumulatively reinforce each other before becoming indicators of environmental attitudes, and may often need to do likewise in relation to differences in connotative scenic content before they become significant in relation to aesthetic perceptions. Significant associations found between demographic traits and different aesthetic perceptions are therefore most likely anecdotal. They are contingent upon the landscapes involved, their relation to local attitudes and subcultures, and other demographic traits in the subject population.

These findings explain why associations between demographic traits and aesthetic landscape perceptions are inconsistent in the past studies cited earlier and by Stamps (1999). The weight of evidence suggests it is not generally worthwhile to account for viewers' traits in scenic assessments because their relation to perceptions is weak and unreliable, except when attitudes contend with scenic content, particularly ugly content. Relationships from previous studies recurred: People with different traits agree about landscape perceptions much more than not. Perceptions can differ with age and between urban versus rural residents. Environmentalists or those favoring resource production have different aesthetic standards. People disagree more, on the margin, about the ugliness of landscapes than their beauty.

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