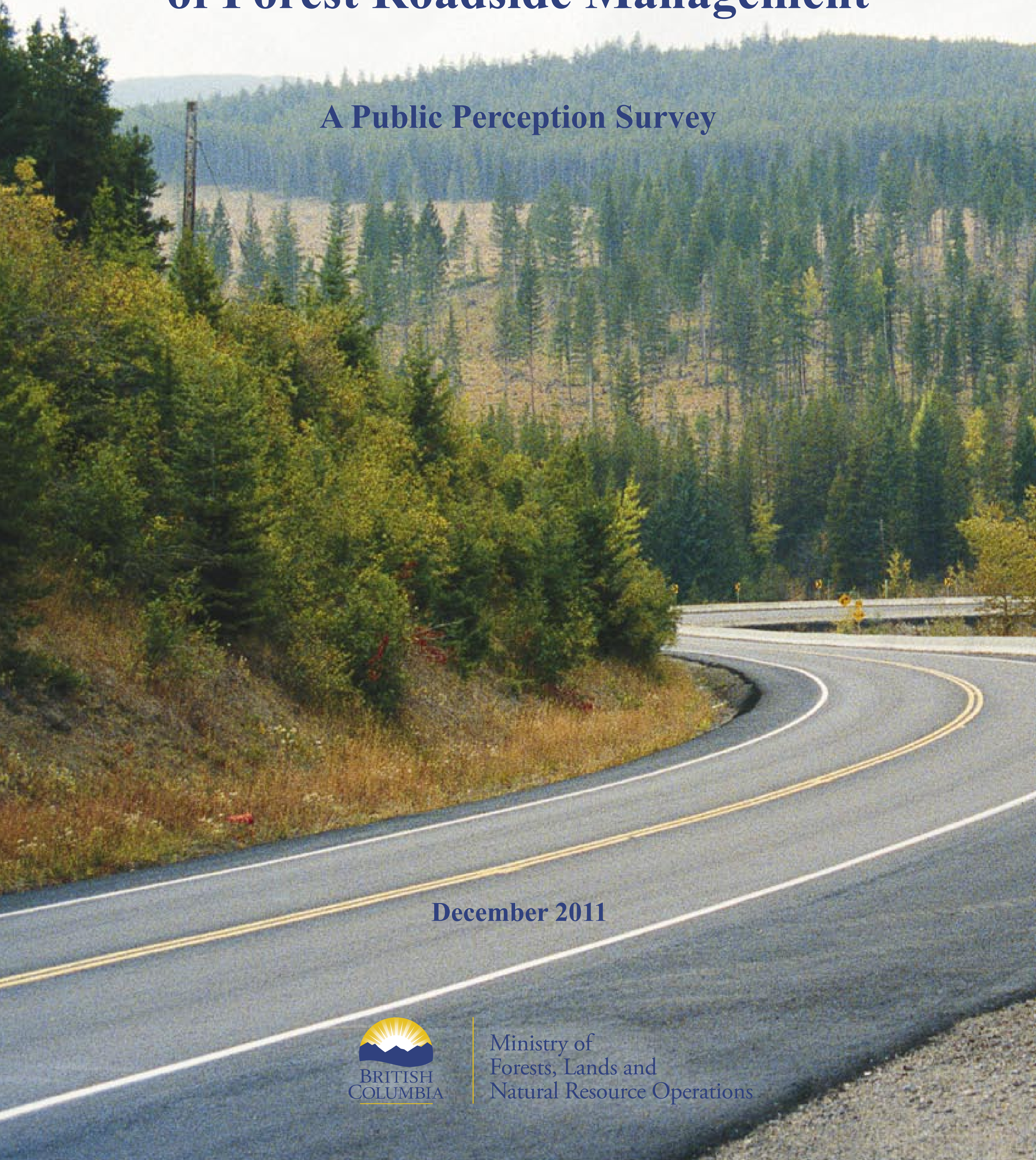
A First Look at the Visual Quality of Forest Roadside Management



A Public Perception Survey

December 2011

BRITISH COLUMBIA
Ministry of Forests, Lands and Natural Resource Operations

A First Look at the Visual Quality of Forest Roadside Management

A Public Perception Survey

December 2011

BRITISH COLUMBIA
The Best Place on Earth

Ministry of
Forests, Lands and
Natural Resource Operations

Library and Archives Canada Cataloguing in Publication Data

Marc, Jacques, 1956-
A first look at the visual quality of forest roadside management : a public perception survey/ Jacques Marc

Includes bibliographical references.
Available also on the Internet.
ISBN 978-0-7726-6539-3

1. Forest landscape management--British Columbia--Public opinion. 2. Forest landscape design--British Columbia--Public opinion. 3. Roadside improvement--British Columbia--Public opinion. 4. Silvicultural systems--British Columbia--Public opinion. I. British Columbia. Ministry of Forests, Lands and Natural Resource Operations II. Title.

SD389 M3 2011 719'.3309711 C2011-909066-X

Marc, Jacques, 1956-
A first look at the visual quality of forest roadside management [electronic resource] : a public perception survey / Jacques Marc

Includes bibliographical references.
Electronic monograph in PDF format.
Issued also in printed form.
ISBN 978-0-7726-6540-9

1. Forest landscape management--British Columbia--Public opinion. 2. Forest landscape design--British Columbia--Public opinion. 3. Roadside improvement--British Columbia--Public opinion. 4. Silvicultural systems--British Columbia--Public opinion. I. British Columbia. Ministry of Forests, Lands and Natural Resource Operations II. Title.

SD389 M3 2011 719'.3309711 C2011-909067-8

Citation:
British Columbia Ministry of Forests, Lands and Natural Resource Operations. 2011. A first look at the visual quality of forest roadside management: a public perception study. Resource Practices Branch, Victoria, B.C.

For further copies or information, contact:
B.C. Ministry of Forests, Lands and Natural Resource Operations
Resource Practices Branch
9th Floor, 727 Fisgard Street
Victoria, BC V8W 9C2
Phone (250) 387-8481
www.for.gov.bc.ca/hfp/values/visual/index.htm

Executive Summary

The Ministry of Forests, Lands and Natural Resource Operations has conducted research into the parameters influencing visual quality since 1989 and has developed a systematic approach for managing scenic landscapes in British Columbia. The visual management system presently in place is designed to address mid-ground (1–8 km) landscape-level views.

The Forest Practices Board conducted an audit of visual resource management in Campbell River Forest District in 2004 and released its report in May 2005. One of the Board's observations was that timber harvesting along the side of the highway creates a strong visual impact, and that the current system does not adequately address these close-up views. In addition, land use planning processes have made recommendations regarding foreground management for which there are no set criteria or standards.

Between January and April 2008, the Ministry of Forests, Lands and Natural Resource Operations conducted a survey of 694 individuals to determine public preferences for 60 roadside views of natural and harvested forest scenes. The objectives of the survey were (1) to establish public response to different methods of managing roadsides in logged areas, (2) to determine whether there is a single variable or combination of variables that can be used to predict public acceptance, and (3) to determine whether one or more site and stand variables can be used to predict Visual Quality Class.

Statistical analysis of the survey data produced the following key results:

- Silvicultural systems that retain some stand structure (Commercial Thinning, Single-tree Selection, etc.) were preferred over silvicultural systems that remove most or all of the trees (e.g., Clear Cut and Patch Cut).
- The quantity/volume of coarse woody debris was identified as the best single predictor of public acceptance rating (PAR) for clear cuts, while remaining stems was identified as the best single predictor of PAR for partial cuts. As the amount of wood waste and coarse woody debris increases in quantity, there is an associated decrease in PAR. As the percentage of stems, volume, and basal area removed increases, PAR decreases.
- The PAR for visible opening size was positive for 0.4 ha and smaller clear cut openings, and was positive for 0.8 ha and smaller for partial cut openings.
- The amount of coarse woody debris was also identified as the single best predictor of Visual Quality Class. Coarse woody debris in combination with stems was identified as the best two-variable predictor.
- Partial Cut openings that retain 66% stems/volume or more would be classed as Preservation, openings that retain between 25% and 30% would be classed as Retention or Partial Retention, and openings that retain 20% or less would be classed as Modification or Maximum Modification.

The study also sought to answer one additional question: what is the public response to the Silviculture Treatments for Ecosystem Management in the Sayward Forest (STEMS). The STEMS Control, Group Selection, and Commercial Thinning scenes received positive PAR. All other treatments received neutral or decreasing PAR.

Acknowledgements

I thank the numerous people who helped make this project possible:

- Gerrard Olivotto designed the initial data collection form and piloted the survey approach in May 2006 to pave the way for this study. He also peer reviewed the final draft version of this report.
- University of Victoria Co-op student Jamie Elbert administered the perception survey in seven communities, entered all the data, and carried out preliminary data analyses. She also employed Photoshop to remove distracting objects and features from the photographs used in the study.
- Amanda Nemec (International Statistics and Research Corp) carried out the statistical analysis on public perception survey data and summarized this aspect of the survey. Her work comprises the body of this report.
- Regional Visual Resource Specialists Luc Roberge, Lloyd Davies, and Peter Rennie assisted with site selection and data collection and subsequent peer review of the report.
- Zbigniew Olak photographed the STEMS sites.
- Many non-profit groups (see Appendix 6) participated in this survey and improved our understanding of roadside management.

Jacques Marc RFT
Visual Resource Management Officer
Resource Practices Branch
December 2011

Table of Contents

Tables

Figures

1.0 Introduction

The Ministry of Forests, Lands and Natural Resource Operations (MFLNRO) has conducted research into the parameters influencing visual quality since 1989 and has developed a systematic approach for managing scenic landscapes in British Columbia. The visual management system presently in place is designed primarily to address mid-ground (1–8 km) landscape-level views.

The BC Forest Practices Board conducted an audit of visual resource management in Campbell River Forest District in 2004 and released its report in May 2005. One of the Board's observations was that timber harvesting along the side of the highway creates a strong visual impact, and that the current system does not adequately address these close-up views.

In response to the Board's concerns, the Resource Practices Branch initiated a pilot project in 2006 to explore the public response to various roadside treatments. The goal of the pilot project was to identify issues and data information needs necessary to complete a more in-depth study.

A more comprehensive study was initiated in 2007. Photographs and field data were collected for 60 roadside openings during the 2007 field season. A public perception survey was conducted between January and April 2008, and analysis of the data was completed in the fall of 2008.

The broad objectives of the survey were to:

- determine the public response to different harvest practices in the foreground and along roadsides,
- determine if there is a single variable or combination of variables that can be used to predict public acceptance, and
- determine whether one or more site and stand variables can be used to predict Visual Quality Class (VQC).

Detailed objectives were to:

1. match the sample group with the socio-demographic statistics for British Columbia as closely as possible
2. determine the public acceptance rating (PAR) for each of the 60 images used in the study
3. determine PAR for each silvicultural treatment in the Sayward Forest STEMS project areas
4. examine trends in PAR relative to forest site and stand variables
5. determine PAR thresholds of acceptance
6. determine if there is a forest site or stand variable or combinations of variables that will predict PAR
7. derive PAR values that might predict Visual Quality Class
8. examine trends in VQC relative to forest site and stand variables
9. determine if there is a site or stand variable or combinations of variables that can be used to predict VQC for foreground landscapes

The report *The Public Response to Harvest Practices in British Columbia at the Landscape and Stand Level* examined the public response to the in-stand conditions of the research openings in phase 1 of the Silviculture Treatments for Ecosystem Management project in the Sayward Forest (STEMS). Images of both phase 1 and phase 2 of STEMS were included in this study to get an overall impression of how the public at large responded to these specific treatments.

2.0 Survey Methodology

This study involved a number of steps: taking photographs; collecting site and stand data; selecting, classifying, and editing photographs; choosing survey participants; administering the survey; analyzing the results; and determining public acceptance trends and thresholds.

2.1 Collection of Field Data and Site Photography

To complete this study, a minimum of 60 roadside samples was required, consisting of different silvicultural treatments and occurring in different locations throughout the province. A preliminary list of sampling sites was created by talking with regional and district staff of the Ministry of Forests, Lands and Natural Resource Operations. Follow-up field trips were made to suggested sites in the Southern Interior and Northern Interior Regions to sample the sites. In the Coast Forest Region, sites in the Sayward Forest STEMS project areas (I and II) were sampled, as were some sites used in the 2002 study *Predicting the Visual Impacts of Retention Cutting*.

During each site visit, several photographs were taken of the harvested openings as one would view them travelling along the highway. During photography, it was important to capture the length, breadth, and depth of each opening. Once the photography was completed, a data collection form (Appendix 1) was completed to document the site and stand variables associated with each opening image. Pre-harvest data were taken directly from opening information in the Reporting Silviculture Updates and Land Status Tracking System (RESULTS) or off site plans. Post-harvest site data were collected using various field instruments to measure parameters. In the case of partial cut stands, a mini post-harvest cruise was conducted to determine volume / stems / basal area remaining. Observational data, like colour of forest floor, were recorded using ocular assessments—that is, which colour was most predominant in the opening. Once all the data collection forms had been completed, the attribute information was entered on to an Excel spreadsheet for analysis purposes.

2.2 Selecting Photographs

Multiple photographs were taken of each of the sites sampled. For the purposes of the study, the best representative photograph was chosen. This was accomplished by choosing the photograph that had the best lighting and most closely represented the scene as the viewer would actually observe it outdoors.

Some of the images contained foreign objects or structures that would be distracting to the viewer. In these circumstances, the photographs were imported into Adobe Photoshop to edit the extraneous objects, such as power lines, from the photograph.

To choose the slide order for presentation, the number of slides ($N = 60$) was entered into an online randomizer (www.randomizer.org/). The randomizer subsequently produced a sequence for the slide show.

2.3 Selecting Participants

One of the challenges in public perception studies is ensuring an unbiased sample by soliciting participation from non-aligned groups or individuals. For this study, the objective was to sample approximately 80–90 people in each of seven communities across the province. Figure 1 shows the locations of communities chosen to represent the three forest regions and a variety of forest districts as well as rural and urban settings.

As an incentive, the MFLNRO offered to donate $10 per completed survey package to the organization or to the charity of its choice. In total, 694 respondents were recruited from various non-profit organizations in seven communities throughout British Columbia from January to April 2008.

The specific organizations that participated are identified in Appendix 6. Altogether, 50 groups comprising a total of 694 people participated in the survey (Table 1).

A list of non-profit organizations was developed for each community by targeting service and professional clubs, outdoor activity and hobby clubs, and seniors' centres. After initial contact with each group by phone, and a follow-up fax or email of a details sheet, the first 6–7 groups to confirm participation were selected to take part in the study.

Figure 1. *Map showing communities sampled.*

Table 1. *Number of sample groups (community organizations) and respondents*

Community	Number of groups	Number of respondents in group			
		Minimum	Maximum	Mean	Total
Abbotsford	7	7	28	13.6	95
Campbell River	6	8	19	13.2	79
Kamloops	7	8	24	16.7	117
Nelson	7	7	20	14.6	102
Prince George	6	8	20	14.0	84
Terrace, Kitimat	11	5	27	13.0	143
Williams Lake	6	4	25	12.3	74
All communities	50	4	28	13.9	694

2.4 Survey Delivery

To ensure consistency of delivery, a standardized introduction and speech was given. This ensured a professional and unbiased delivery of information regarding the survey intent and content. For consistency, the presentation electronics were set up in advance so that participants were greeted by a welcome screen. Before starting, a survey package (Appendix 2) and pen were handed out to each participant. The survey administrator then introduced herself and explained that the purpose of the study was to help the MFLNRO understand how residents of British Columbia respond to various forestry practices. In the case of this study, participants were told **"This survey seeks your preference about the visual quality of 60 forest roadside scenes throughout B.C."**

It was then explained that the survey consisted of two parts:

- Part One: After a practice session using the form, participants were asked to view and evaluate 60 colour slides, each showing a different roadside scene. Participants rated each scene using a 7-point Likert scale: Very Unacceptable (-3), Moderately Unacceptable (-2), Slightly Unacceptable (-1), Neutral (0), Slightly Acceptable (1), Moderately Acceptable (2), Very Acceptable (3).

- Part Two: After rating the roadside scenes, respondents were asked to provide basic demographic information: sex, age, education, occupation, income, and place of residence so that the survey population could be compared with the 2001 and 2006 census profiles for British Columbia and Canada.

The survey began with six practice slides shown in a standardized random order. These permitted participants to calibrate their rating system and ask questions before tackling the main slide show. No ratings or comments were collected from the practice slides.

Once the administrator was sure that the group was comfortable with the process, the main slide show was started. The slides were projected on a large screen in a darkened room. The number of each slide was present in the bottom right of each projection and was introduced with the changing of each slide. In addition, periodic reminders to check that they were in the correct row kept participants from getting ahead or falling behind. At the halfway point, participants were reminded of their objective in rating the photographs ("rate the landscape based on how much or how little you enjoy it as though it is real to you").

The slides were arranged in the same random order for each survey. Each of the slides was shown for 8–10 seconds, in order to allow for a Likert rating and a brief comment. To control for order effects, approximately every third group was presented with the slides reversed.

A space for comments was included on the evaluation form so respondents could make notes about what physical qualities they were reacting to in each photo.

Following the main presentation, a debriefing was offered to address any questions or concerns from the participants. In this segment, the procedure for the survey was fully explained and participant questions were answered. Participants were also invited to write down any general or overarching comments regarding what they had seen in the survey presentation.

2.5 Statistical Methods

A variety of techniques was used to analyze the public response to roadside data. See Appendix 3 for the complete write-up on the statistical methods used.

In brief, Chi-square tests were used to assess the differences between the survey population and the overall populations of British Columbia and Canada. Trends in PAR relative to site and stand variables were examined by plotting mean PAR by the various descriptor variables. Potential predictors of PAR were evaluated by fitting a multinomial model against site and stand variables. Thresholds for public acceptance were determined by fitting univariate non-linear regression models relating mean PAR to site and stand variables, and, for each model, calculating the critical level where public opinion was expected to change from positive to negative. Normal-theory discriminant analysis was applied to the 2006 *The Public Response to Harvest Practices in British Columbia at the Landscape and Stand Level* survey results to develop a rule for assigning VQC to 2010 data. Potential predictors of VQC were evaluated by fitting a multinomial model against silvicultural system, amount of coarse woody debris, and other site or stand variables.

3.0 Survey Results

3.1 Participant Profiles

Response rates exceeded 96% for all demographic questions except income, where the response rate fell to approximately 85%. Ninety-eight percent of the survey participants with known places of residence lived in British Columbia and 2% resided in another province or country (Table 2).

Figures 2–5 compare the sex, age, education, and occupation of survey respondents with the corresponding 2006 census profiles for British

Table 2. *Place of residence of survey respondents*

Place of residence	Number	Percentage
British Columbia	675	98.3
Other province	8	1.2
Other country	4	0.6
Responses	687	99.0
Non-responses	7	1.0
Total	694	100

Columbia and Canada.[1] The income distribution of the respondents is shown in Figure 6, where it is compared with the 2005 provincial and national income distributions.[2] Figure 7 shows the sample breakdown into urban (town, city, or large city) and rural dwellers, and the comparison with the provincial and national breakdowns in 2001.[3]

The male/female ratio of the survey sample was comparable to both British Columbia and Canada (Figure 2). However, other characteristics of the respondents differed significantly from the general populations of the province and country. Survey respondents were more likely to be older (Figure 3) and better educated (Figure 4), to have occupations in social sciences, education, or government (and less likely to be employed in sales and service) (Figure 5), and to have a higher annual income than the province or country as a whole (Figure 6). The proportion of respondents from urban areas was slightly higher than expected for both British Columbia and Canada (Figure 7).

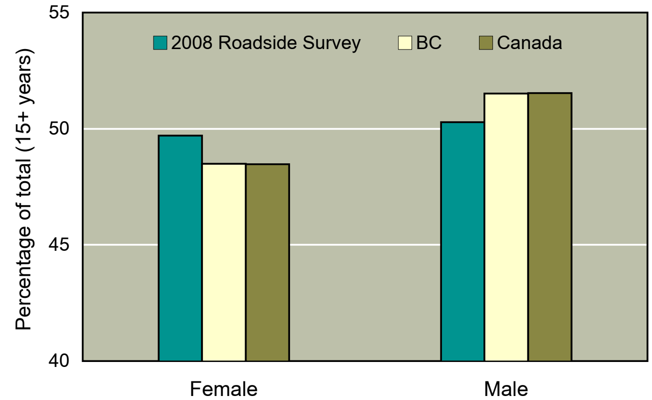


Figure 2. *Sex of survey respondents.*

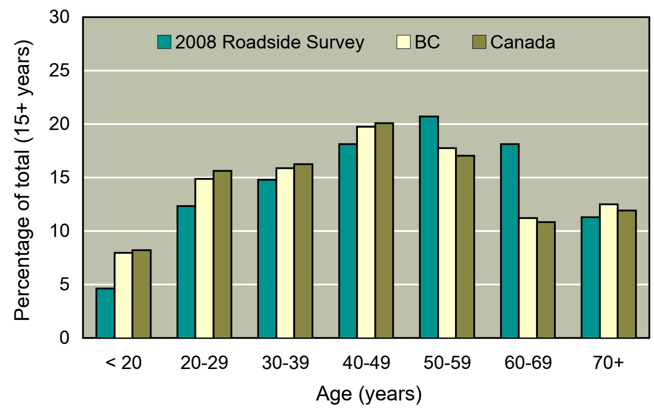


Figure 3. *Age of survey respondents.*

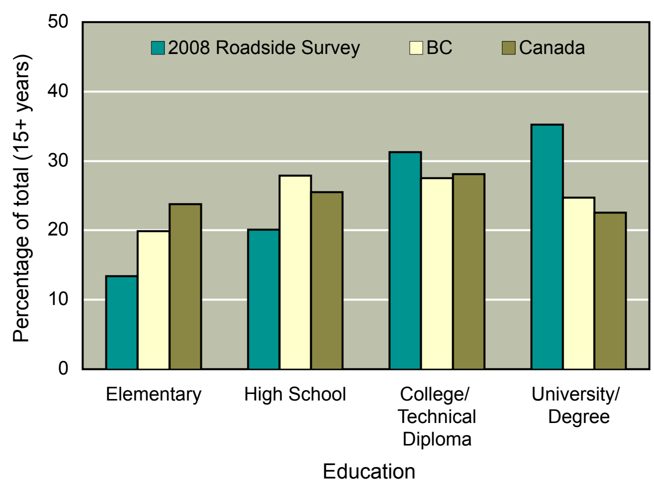


Figure 4. *Highest level of education attained by survey respondents 15 years or older.*

1 Statistics Canada. 2007. 2006 community profiles. 2006 census.

2 Canada Revenue Agency. 2007. 2005 income statistics.

3 Statistics Canada. 2005. Censuses of population, 1851–2001. Population urban and rural, by province and territory.

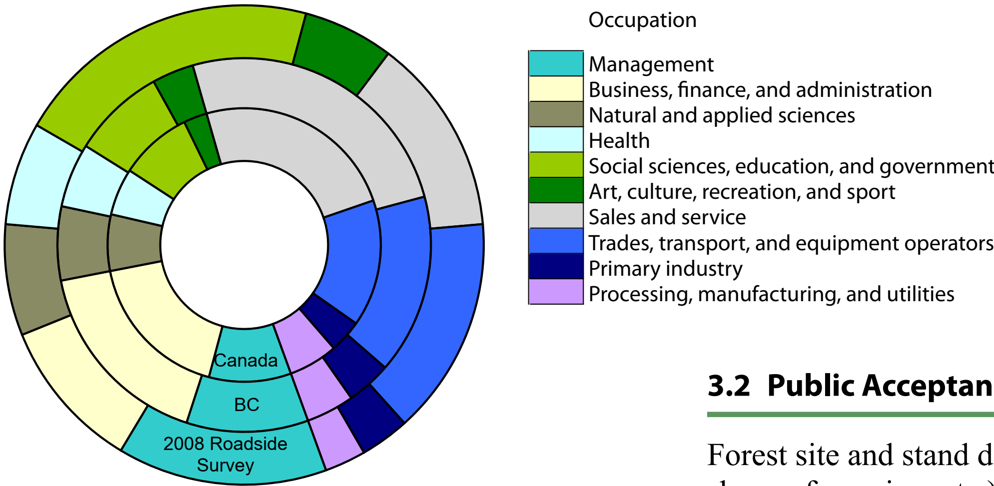


Figure 5. *Occupation of survey respondents.*

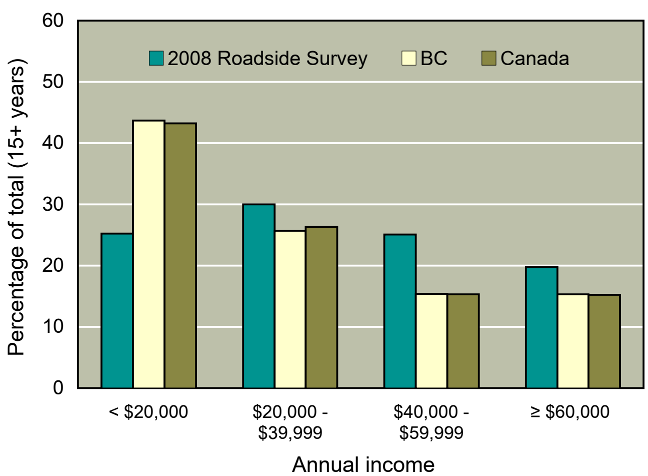


Figure 6. *Total personal annual income of survey respondents.*

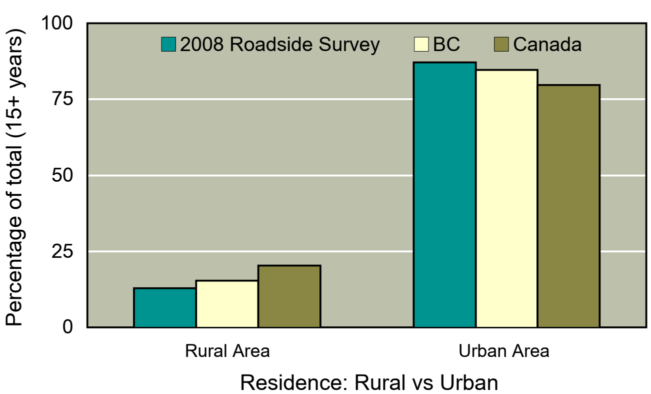


Figure 7. *Survey respondents from urban and rural areas.*

3.2 Public Acceptance Ratings

Forest site and stand data (silvicultural system, shape of opening, etc.), assigned VQC, mean PAR, and a ranking of the 60 roadside scenes from most acceptable (Rank 1: maximum mean PAR) to least acceptable (Rank 60: minimum mean PAR) are given in Appendix 4. Photographs of the landscapes and their PAR are presented in Appendix 7. Each slide was evaluated by at least 98.6% (684) of the 694 survey participants, with an overall response rate of 99.4% for all slides. The distribution of PAR is tabulated by slide in Appendix 5.

3.2.1 Slide order

Figure 8 illustrates the effect of slide order, where the absence of both a significant trend (p = 0.7812) and a zero offset (p = 0.3951) imply that reversal of slide order produced no significant change in mean PAR.

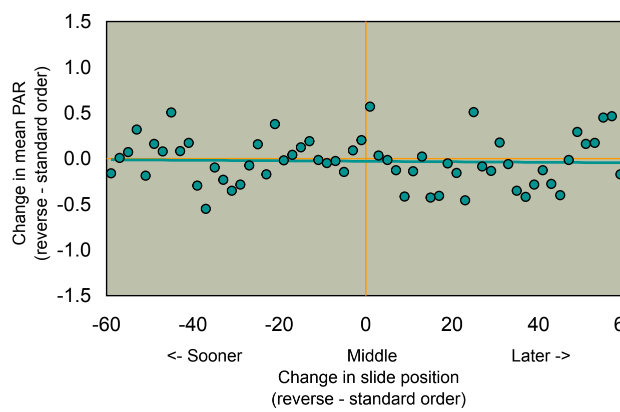


Figure 8. *Effect of viewing order: Change in mean public acceptance rating (PAR) versus change in slide position (reverse - standard order) with fitted trend line (heavy teal line).*

3.2.2 Response to STEMS series

Figure 9 shows the public response to STEMS research openings. The STEMS Control, Group Selection, and Commercial Thinning received positive ratings. All other treatments received decreasing PAR.

3.2.3 Trends in public acceptance ratings relative to site and stand variables

This section examines the PAR response to silvicultural system, colour of forest floor, amounts of coarse woody debris, presence or absence of a vista view, visible roads, visible site disturbance, and angle of view relative to the block. The trends in PAR relative to site and stand variables are illustrated in Figures 10–16.

In general, natural (Control) scenes and silvicultural methods that do not create large openings (Commercial Thinning, Single-tree Selection, etc.) were preferred over silvicultural systems that remove most or all of the trees, such as Clear Cut and Patch Cut (Figure10).

Mean PAR decreased from positive to negative across the colour sequence green–yellow–red-brown (Figure 11) with grey scenes receiving favourable ratings compared to grey-red and grey-brown scenes. Forest floor colour generally represents age of disturbance. The newer the disturbance, the lower the PAR. As the disturbance greens up, it becomes more acceptable.

As the amount of wood waste and coarse woody debris increased, there was an associated shift in the PAR distribution towards less favourable ratings (Figure 12).

The presence of a vista view was also associated

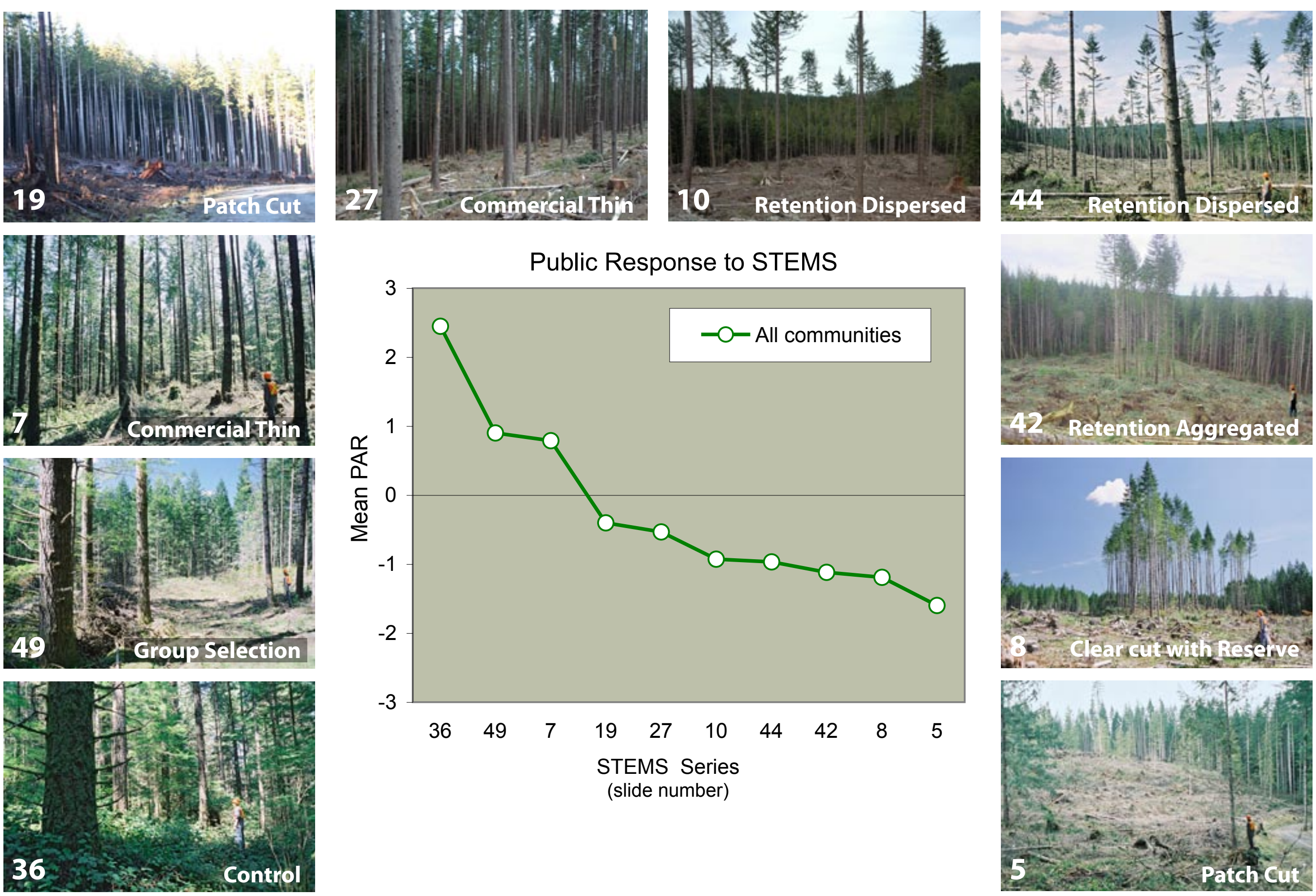


Figure 9. *Provincial response to STEMS research samples.*

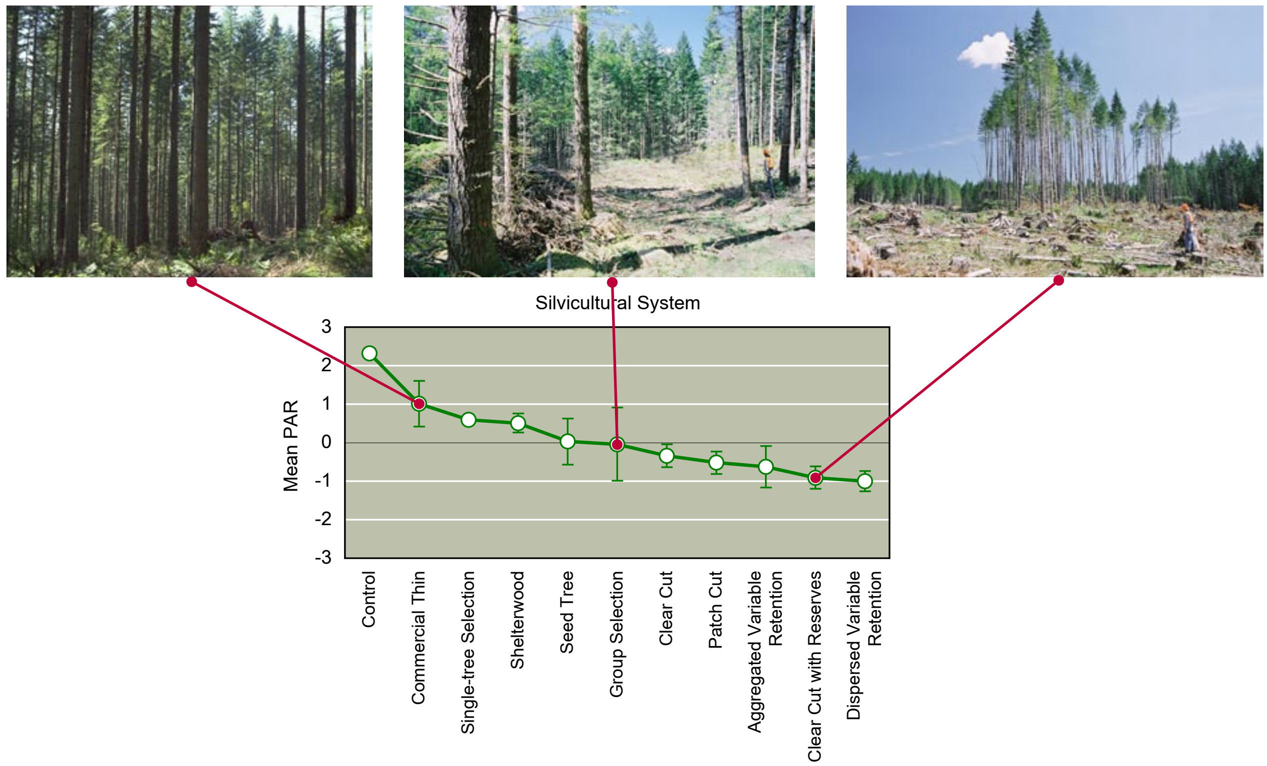


Figure 10. *Mean public acceptance rating (PAR) by silvicultural system. Each point is the average for one to 14 slides with error bars representing 1 standard error.*

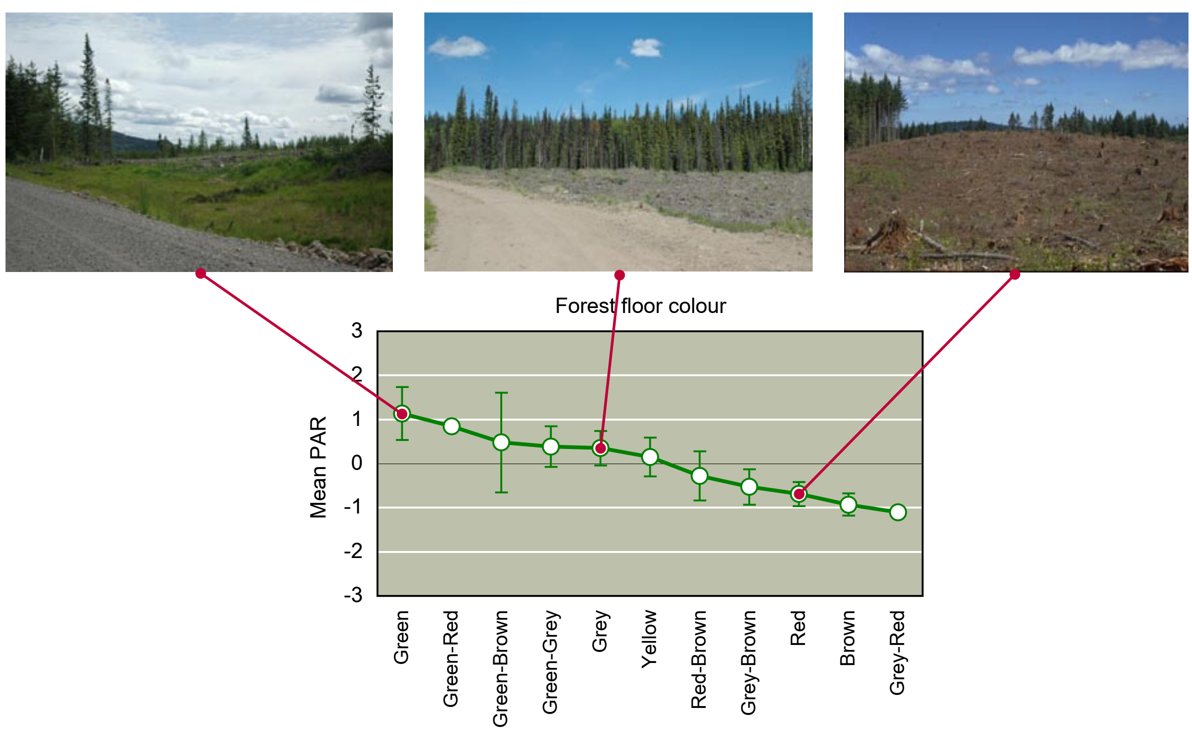


Figure 11. *Mean public acceptance rating (PAR) by forest floor colour. Each point is the average for one to 16 slides with error bars representing 1 standard error.*

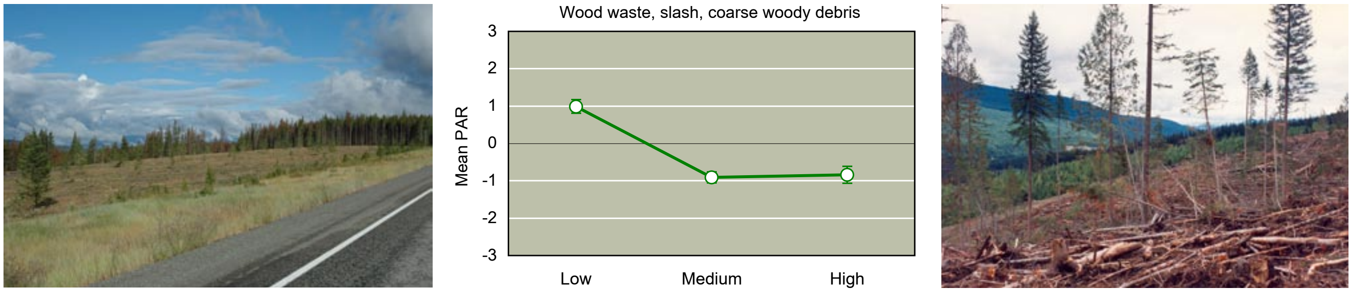


Figure 12. *Public acceptance rating (PAR) distributions for scenes with low (22 slides), medium (26 slides), or high (12 slides) accumulations of wood waste, slash, or coarse woody debris.*

with a shift from positive to negative PAR (Figure 13). Enclosed openings were preferred over openings that expose the broader viewscape. It is postulated that opening up the vista accentuates or increases opening size, which was found to negatively influence PAR.

The presence of visible roads within an opening saw the mean PAR rating drop by one full point or 14% (Figure 14). The analysis carried out to investigate the influence of increasing the amount of the road visible within a block was inconclusive, the result of too few samples ($N = 12$).

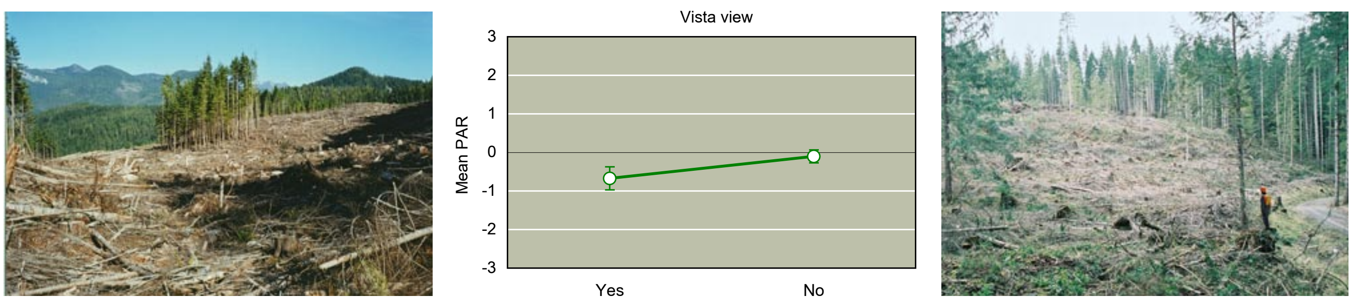


Figure 13. *Public acceptance rating (PAR) distributions for scenes with (10 slides) or without (50 slides) a vista view.*

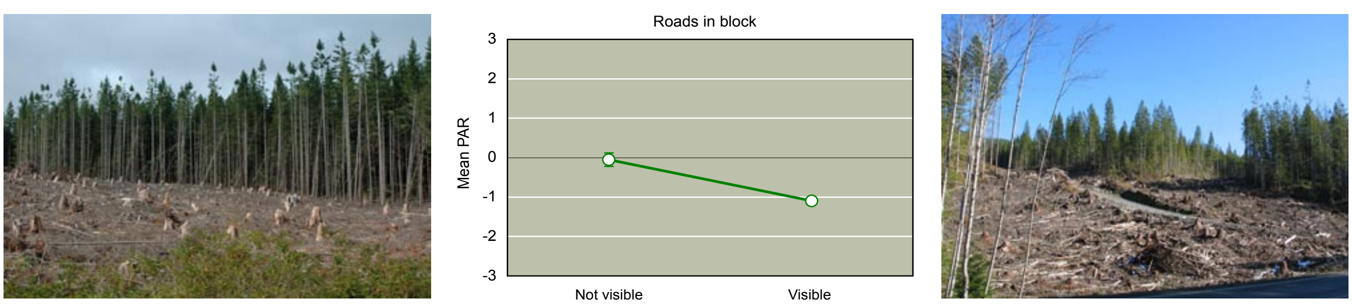


Figure 14. *Public acceptance rating (PAR) distributions for scenes without (48 slides) or with (12 slides) visible road(s).*

Visible site disturbance (Figure 15) was also associated with a shift from positive to negative PAR. As with the presence of roads, the analysis carried out to investigate the influence of increasing site disturbance was also inconclusive, the result of too few samples ($N = 8$).

Blocks viewed from below tended to be considered less acceptable than those viewed from above, while openings with a level or horizontal viewing angle were the most likely to be rated favourably (Figure 16). This is most likely because when an opening is viewed from above, it falls away from the viewer, thereby having less impact. An opening viewed from below would appear directly in your field of view, more obvious and rated less desirable.

3.2.4 Acceptance thresholds

The relationship between mean PAR and visible opening size (ha) for clear cuts (i.e., logging methods CC, CC with Res, VrA, PC, or GS, which remove most of the trees; $n = 31$ slides) and partial cuts (CT, SS, ST, SW, VrD; $n = 16$ slides)[4] are illustrated in Figure 17 (visible

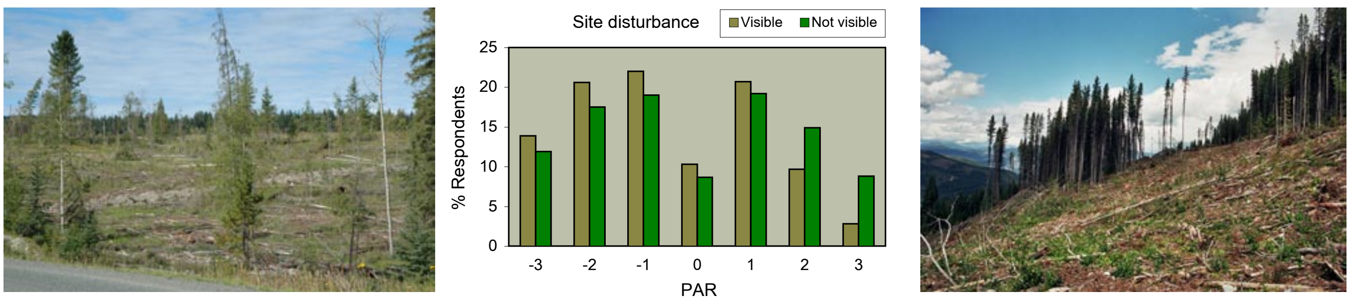


Figure 15. *Public acceptance rating (PAR) distributions for scenes with (8 slides) or without (52 slides) visible site disturbance.*

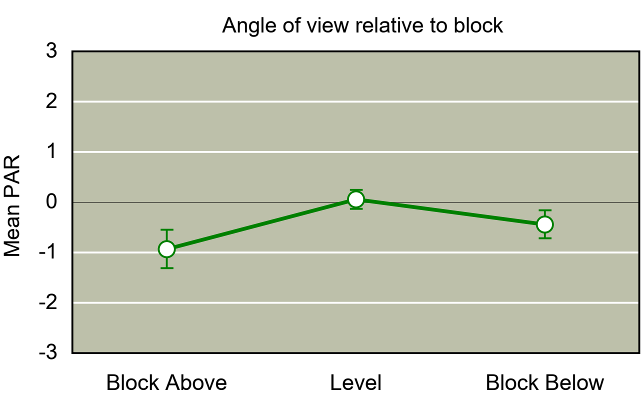
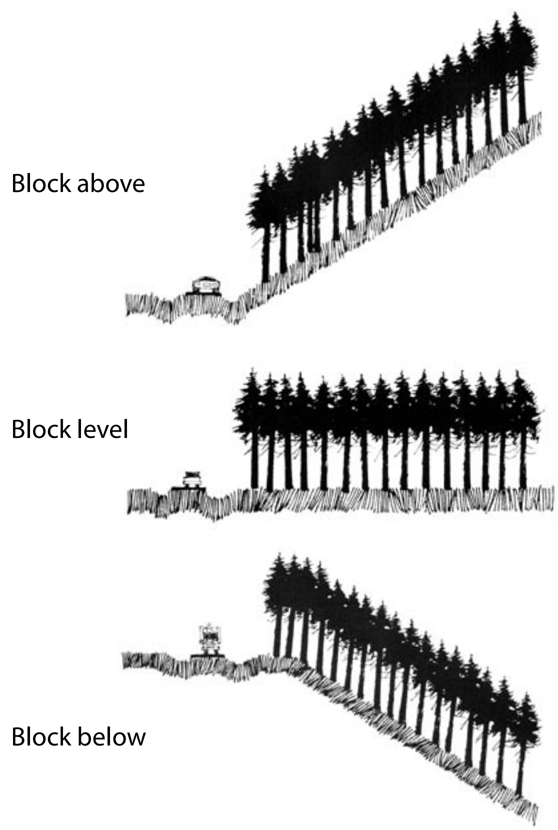


Figure 16. *Public acceptance rating (PAR) distributions for scenes viewed from above (10 slides), level with (39 slides), or below (11 slides) block.*



4 Silvicultural system abbreviations: Clear Cut (CC), Clear Cut with Reserve (CC with Res), Variable Retention Aggregated (VrA), Patch Cut (PC), Group Selection (GS), Commercial Thin (CT), Single-tree Selection (SS), Seed Tree (ST), Shelterwood (SW), Variable Retention Dispersed (VrD).

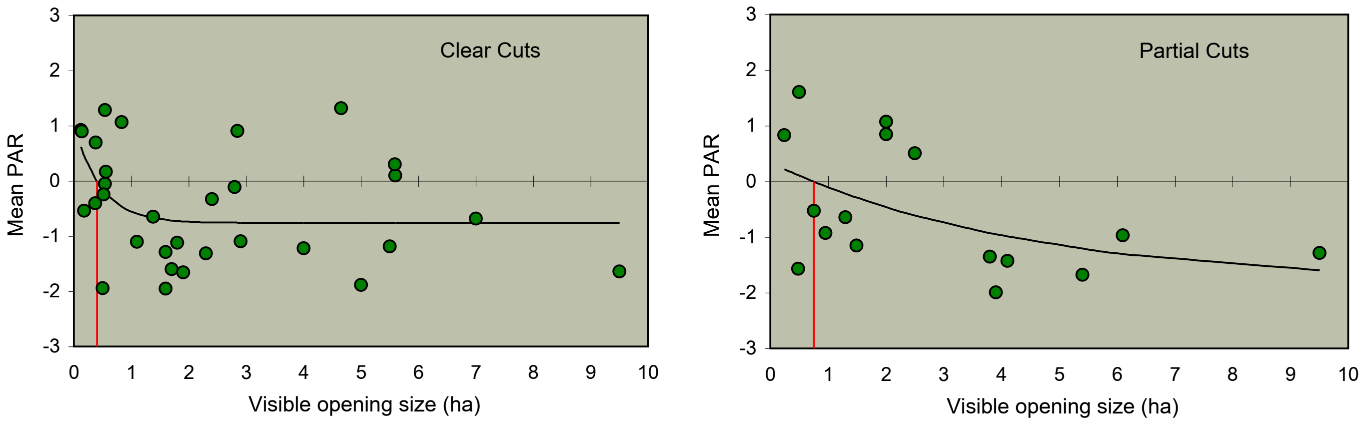


Figure 17. *Relationship between mean public acceptance rating (PAR) and visible opening size for clear cuts (left panel) and partial cuts (right panel). Equations of fitted curves and threshold for acceptance (red vertical lines) are given in Table 4.*

opening size was not available for 13 samples). Fitted models for the two samples and for both samples combined are summarized in Table 3, where the estimated thresholds for public acceptance (ignoring other factors such as amount of coarse woody debris) were calculated to be a visible opening size of 0.4 ha for clear cuts, 0.8 ha for partial cuts, and 0.4 ha for the combined sample. Clear cuts with retained patches of trees (CC with Res or VrA; $n = 9$ slides) tended to receive a lower PAR than those without patches (Figure 18); however, owing to the small sample size and large variability, patches were found to have no significant effect on the fitted relationship between mean PAR and visible opening size ($p = 0.5860$).

The relationship between mean PAR and the dimensions of the opening are illustrated in Figure 19. Opening length (left panel) appears to have had little effect on mean PAR, while there was a noticeable downward trend with increasing depth (right panel). Parameter estimates for the fitted depth model are given in Table 5, from which an acceptance threshold of 63 m was calculated.

Table 3. *Fitted models relating mean public acceptance rating (PAR) to visible opening size (ha): clear cuts, partial cuts, and both types of logging combined*

Mean PAR = a + b × e $^{-\text{visible opening size}/c}$

Clear cuts (n = 31) (CC, CC with Res, VrA, PC, GS)				
Parameter	**Estimate**	**Std. err.**	***t* value**	**Prob > |*t*|**
a	-0.76	0.24	-3.09	0.0045
b	1.79	1.07	1.68	0.1038
c	0.46	0.44	1.04	0.3069
Threshold for acceptance = **0.4 ha**				
Partial cuts (*n* = 16) (CT, SS, ST, SW, VrD)				
Parameter	**Estimate**	**Std. err.**	***t* value**	**Prob > |*t*|**
a	-1.84	2.09	-0.88	0.3962
b	2.18	1.82	1.19	0.2535
c	4.38	8.83	0.50	0.6282
Threshold for acceptance = **0.8 ha**				
Mix of clear cuts and partial cuts (*n* = 47)				
Parameter	**Estimate**	**Std. err.**	***t* value**	**Prob > |*t*|**
a	-0.78	0.21	-3.79	0.0005
b	1.84	0.93	1.99	0.0530
c	0.51	0.41	1.25	0.2165
Threshold for acceptance = **0.4 ha**				

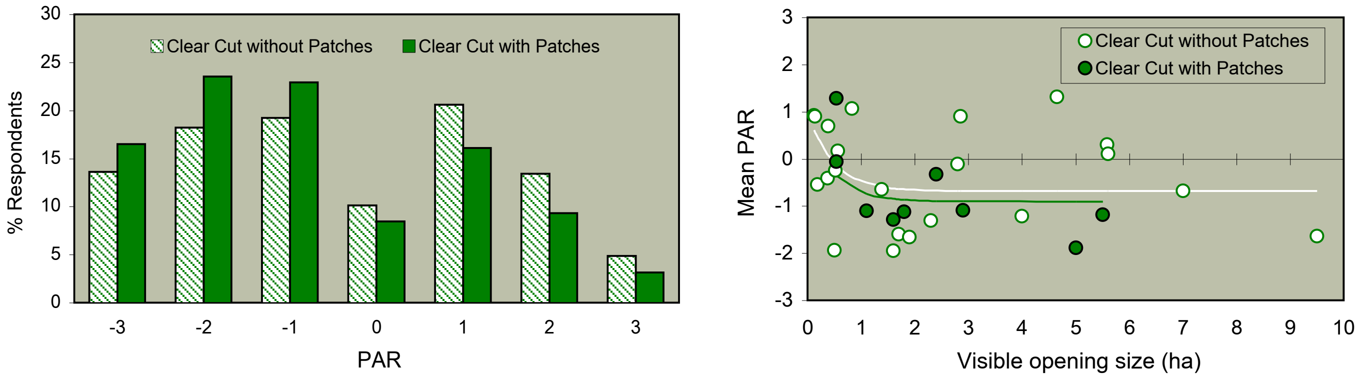


Figure 18. *Comparison of public acceptance rating of clear cuts with (9 slides) and without (22 slides) retained patches of trees: public acceptance rating (PAR) distribution (left panel) and relationship with visible opening size (right).*

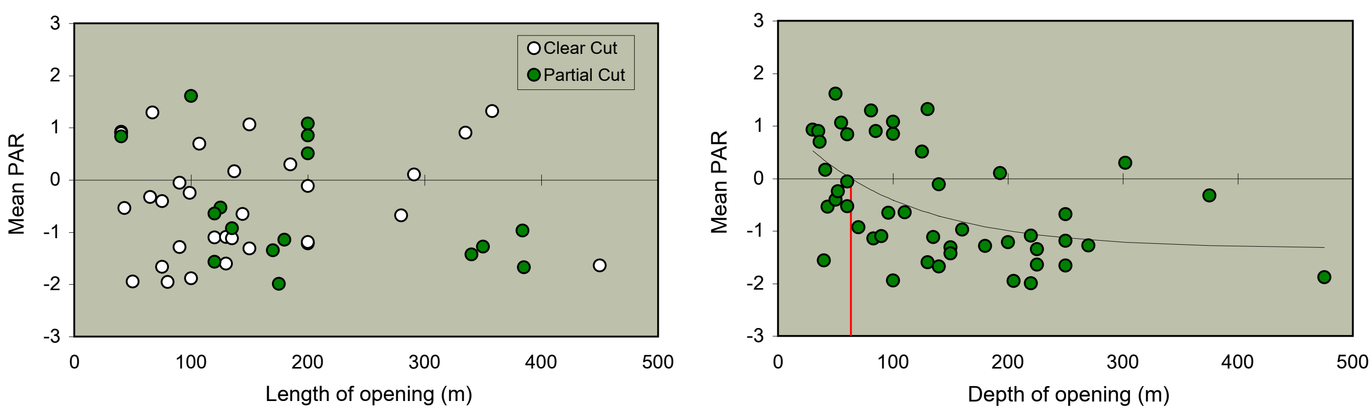


Figure 19. *Mean public acceptance rating (PAR) by length (left panel) and depth (right) of opening. The equation of the fitted depth curve and derived threshold for acceptance (red vertical line) are given in Table 5.*

Table 4. *Fitted model relating mean public acceptance rating (PAR) to depth of opening*

Mean PAR = a + b × e^-depth/100^ ($\text{Mean PAR} = a + b \times e^{-\text{depth}/100}$)
Clear cuts and partial cuts (*n* = 47)

Parameter	Estimate	Std. err.	*t* value	Prob > |*t*|
a	-1.33	0.24	-5.45	< 0.0001
b	2.51	0.61	4.11	0.0002
Threshold for acceptance = **63 m**				

Figure 20 shows that mean PAR tended to decrease as the percentage of stems, basal area, or volume removed increased. Estimated intercepts and slopes for the fitted trend lines are given in Table 5. Based on these results, which are similar for all three variables, mean PAR is estimated to decrease by approximately 0.04 for every 1% of stems, basal area, or volume removed, with the threshold for acceptance occurring around the two thirds (67–70%) level. PAR decreases as the percentage of stems, volume, and basal area removed increases. The threshold for acceptance occurs at about 70% removal.

Mean PAR for individual scenes are subject to considerable variability (Figures 17–20); therefore, fitted models and derived thresholds presented here (Tables 4 and 5), which are based on small samples and ignore the confounding effects of other factors, should be adopted with caution.

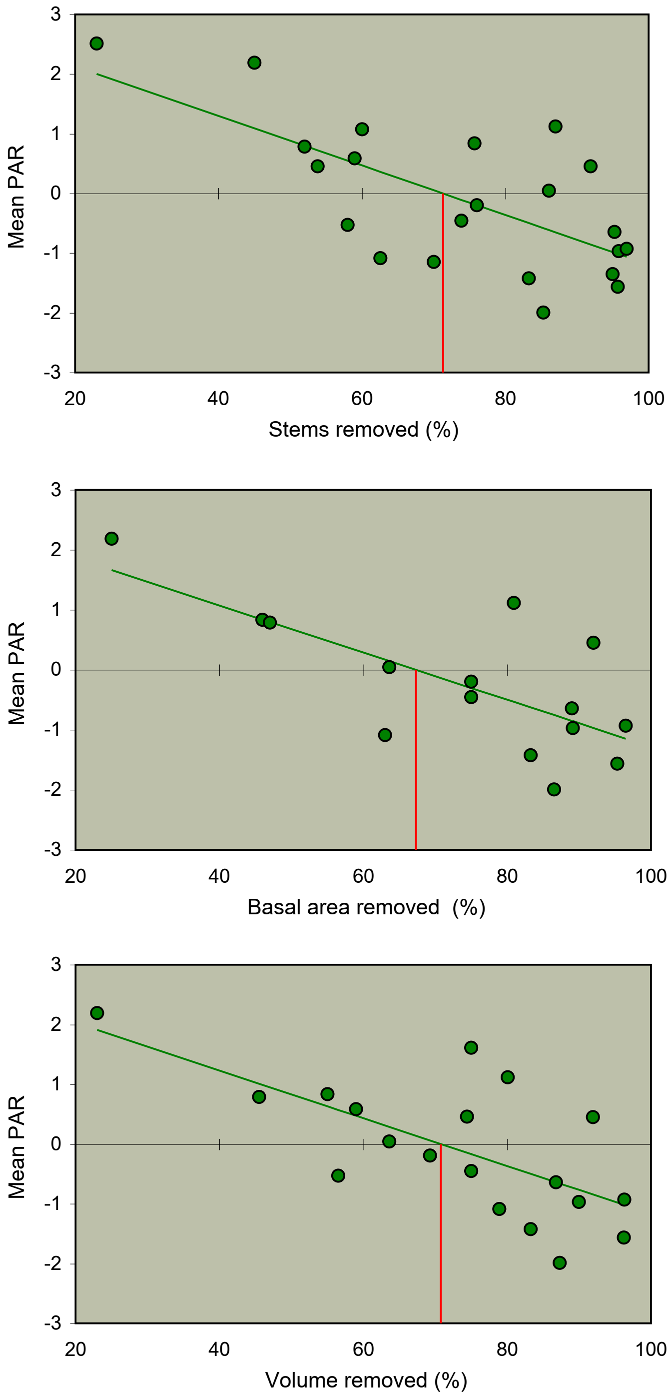


Figure 20. *Mean public acceptance rating (PAR) by stems removed (top panel), basal area removed (middle), and volume removed (bottom). The equations of the fitted lines and thresholds for acceptance (red vertical lines) are given in Table 4.*

Table 5. *Fitted models relating mean public acceptance rating (PAR) to stems removed (%), basal area removed (%), and volume removed (%)*

Parameter	Estimate	Std. err.	*t* value	Prob > |*t*|
Mean PAR = a + b × stems removed (%)				
Scenes with retained trees (*n* = 22)				
a	2.95	0.76	3.91	0.0009
b	-0.04	0.01	-4.18	0.0005
Threshold for acceptance = **71%** stems removed				
Mean PAR = a + b × basal area removed (%)				
Scenes with retained trees (*n* = 15)				
a	2.65	0.82	3.24	0.0065
b	-0.04	0.01	-3.68	0.0028
Threshold for acceptance = **67%** basal area removed				
Mean PAR = a + b × volume removed (%)				
Scenes with retained trees (*n* = 19)				
a	2.83	0.81	3.51	0.0027
b	-0.04	0.01	-3.74	0.0016
Threshold for acceptance = **71%** volume removed				

3.2.5 Predictors of public acceptance rating

Nine site variables[5] were considered as candidate predictors of PAR for clear cuts (n = 31 slides): forest floor colour, low/medium/high level of coarse woody debris (wood waste, slash), presence/absence of a vista view, presence/absence of visible road(s), presence/absence of visible site disturbance, visible size of opening, depth and length of opening, and shape of cut. Coarse woody debris was identified as the single best predictor. Addition of the remaining variables resulted in the identification of a model that included all nine predictors as the best overall model.

Six variables, in addition to the nine variables listed above for clear cuts, were evaluated as potential predictors of PAR for partial cuts

5 Patch size was missing for 24 of the 31 clear cuts and was dropped from the analysis.

(n = 27 slides): silvicultural system, residual stand structure, stems remaining after harvest (% of pre-harvest), remaining basal area (%), remaining volume (%), and average diameter at breast height of remaining trees. Remaining stems was identified as the single best predictor of PAR for partial cuts. Coarse woody debris, presence/absence of visible disturbance, residual stand structure, and forest floor colour, in combination with remaining stems, were also selected as significant predictors of PAR.

3.3 Visual Quality Classes

In order to determine a potential Visual Quality Class for each roadside scene, discriminant analysis was carried out on the 2006 survey VQC and PAR data relating to mid-ground landscapes. This produced a range of mean PAR that would predict each VQC (Table 6). Roadside scenes in the 2008 study were classified by comparing their mean PAR to these intervals and were assigned a VQC (Appendix 4). For example, Slide 1 has mean PAR = 0.45, which falls into the interval 0 – 0.93, and therefore was assigned VQC = Partial Retention. Once this had been completed, the trends in VQC were evaluated relative to site and stand variables.

Table 6. *Predicted membership probabilities for Visual Quality Class (VQC) based on mean public acceptance rating (PAR) from the 2006 study*

	Mean PAR limits for VQC	
Predicted VQC	**Minimum**	**Maximum**
Preservation	1.78	3.00
Retention	0.94	1.77
Partial Retention	0.00	0.93
Modification	-0.92	-0.01
Maximum Modification	-3.00	-0.93

3.3.1 Trends in Visual Quality Class relative to site and stand variables

Figures 21–26 illustrate how the VQC distribution of scenes varied with forest floor colour, amount of coarse woody debris, presence or absence of a vista view, visible roads, or visible site disturbance, and viewing angle relative to the block. There was a noticeable decrease in the proportion of scenes classified as Preservation or Retention (with a corresponding increase in the proportion classified as Modification or Maximum Modification) across the forest floor colour sequence green–yellow–red-brown (Figure 21). The VQC distribution showed a similar shift away from Preservation/Retention as the amount of coarse woody debris increased (Figure 22). A vista view (Figure 23), visible roads (Figure 24), visible site disturbance (Figure 25), and a viewing angle above or below the block (Figure 26) also appeared to be associated with a decreasing likelihood of a Preservation/Retention classification, although sample sizes were too small to be certain that the shift was real.

Variations across VQC in visible opening size, length and depth of opening, and percentage of stems remaining are illustrated in Figures 27–30. There was considerable overlap of the classes with respect to visible opening size, length of opening, and remaining stems except for scenes classified as Maximum Modification, which tended to have visible opening sizes exceeding 2.8 ha (Figure 27) and openings longer than 184 m (136 m for clear cuts; 207 m for partial cuts; Figure 28), and scenes classified as Preservation, which tended to have at least 57% of the stems remaining after harvest (Figure 30). Opening depth (Figure 29) showed the most obvious variation across VQC. Approximate ranges in opening depth for Retention, Partial Retention, Modification, and Maximum Modification were, respectively: 1–91 m, 92–109 m, 110–152 m, and ≥ 153 m for all silvicultural systems combined; and 1–95 m, 96–118 m, 119–167 m, and ≥ 168 m for clear cuts. The corresponding ranges were

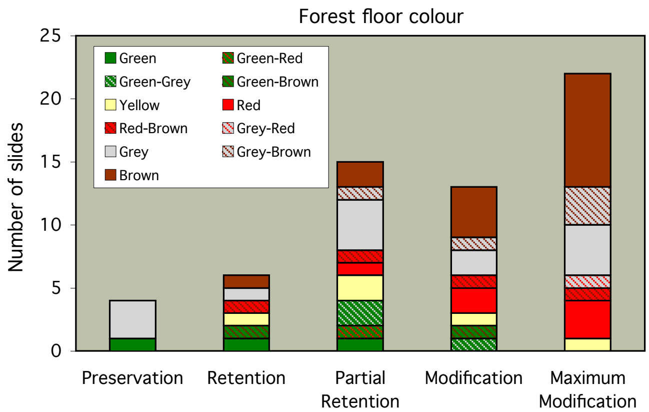


Figure 21. *Visual Quality Class distribution by forest floor colour.*

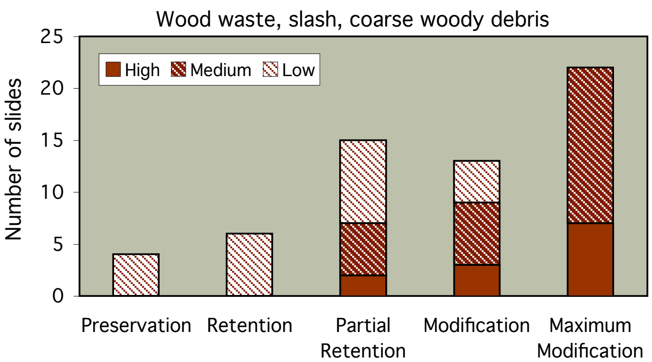


Figure 22. *Visual Quality Class distribution by level of wood waste, slash, and coarse woody debris.*

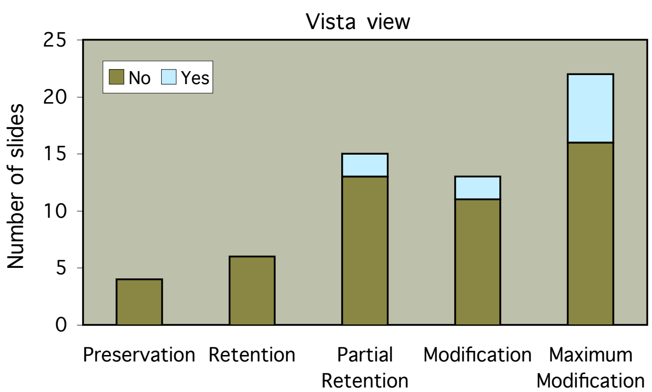


Figure 23. *Visual Quality Class distribution for scenes with and without a vista view.*

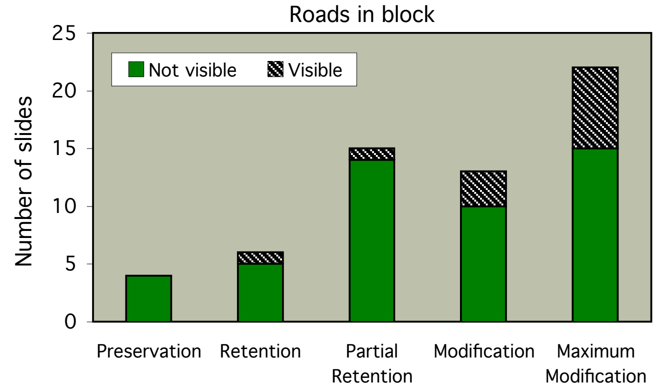


Figure 24. *Visual Quality Class distribution for scenes with and without visible roads.*

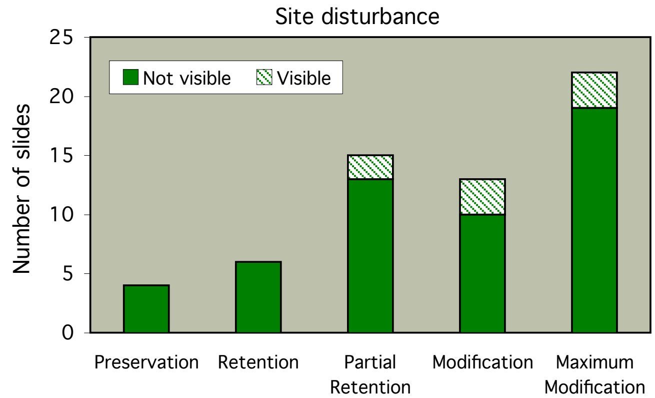


Figure 25. *Visual Quality Class distribution for scenes with and without visible site disturbance.*

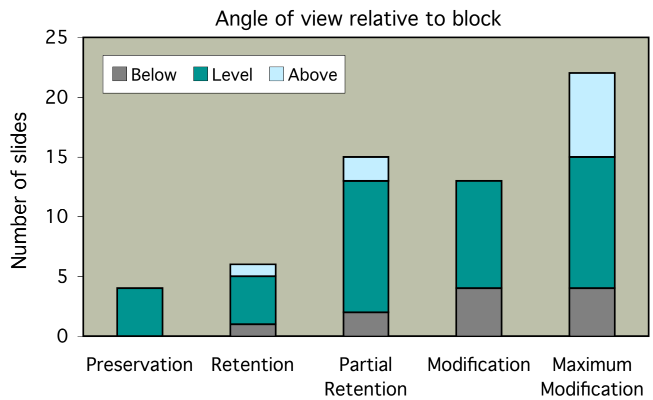


Figure 26. *Visual Quality Class distribution for scenes viewed from above, level, or below.*

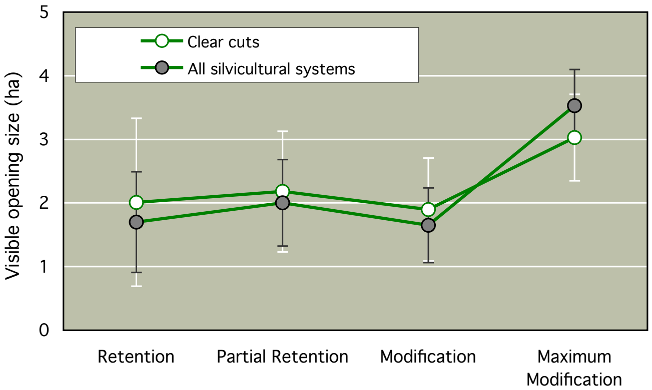


Figure 27. *Visible opening size by Visual Quality Class: clear cuts (n = 31 slides) and all silvicultural systems (n = 47 slides). Each point is the mean for n = 3–13 (clear cuts) or n = 5–21 (all silvicultural systems) slides with error bars representing 1 standard error.*

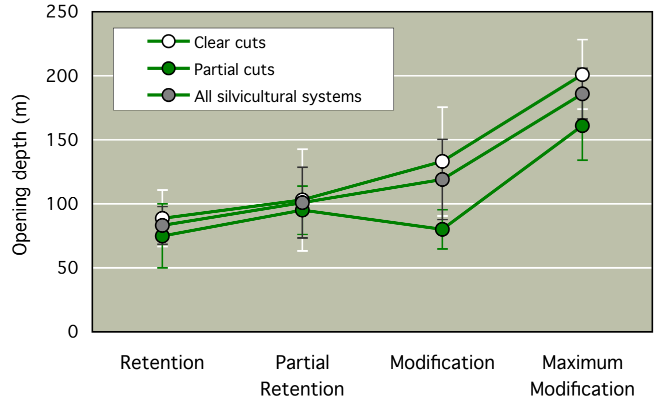


Figure 29. *Opening depth by Visual Quality Class: clear cuts (n = 31 slides), partial cuts (n = 16 slides), and all silvicultural systems (n = 47 slides). Each point is the mean for n = 3–13 (clear cuts), n = 2–8 (partial cuts), or n = 5–21 (all silvicultural systems) slides with error bars representing 1 standard error.*

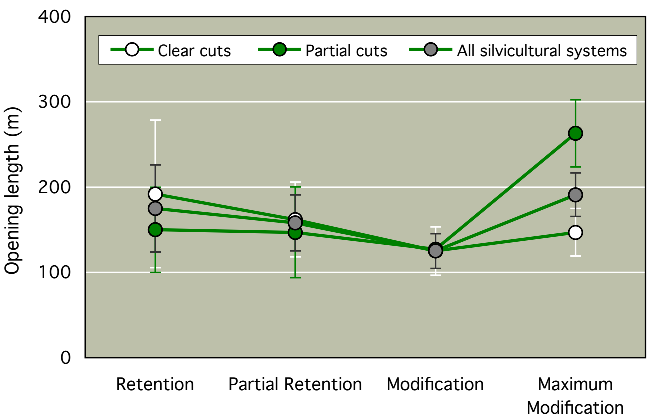


Figure 28. *Opening length by Visual Quality Class: clear cuts (n = 31 slides), partial cuts (n = 16 slides), and all silvicultural systems (n = 47 slides). Each point is the mean for n = 3–13 (clear cuts), n = 2–8 (partial cuts), or n = 5–21 (all silvicultural systems).*

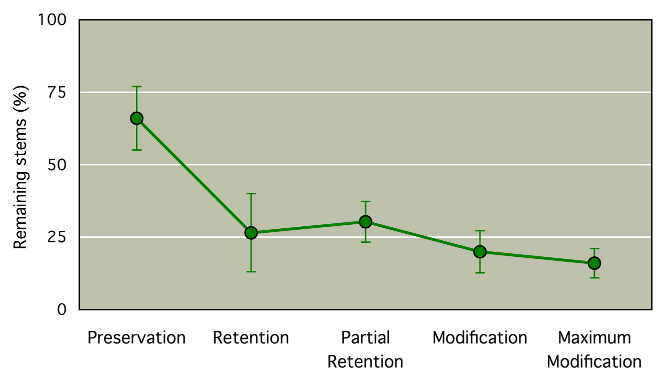


Figure 30. *Remaining stems by Visual Quality Class for partial cuts (n = 22 slides). Each point is the mean for 2 to 7 slides with error bars representing 1 standard error.*

ill-defined for partial cuts except for scenes with openings exceeding 129 m in depth, which tended to be classified as Maximum Modification.

3.3.2 Predictors of Visual Quality Class

Fifteen site variables were evaluated as predictors of VQC: forest floor colour, amount of coarse woody debris, presence/absence of a vista view, presence/absence of visible road(s), presence/absence of visible site disturbance, visible size of opening, depth and length of opening, shape of cut, silvicultural system, residual stand structure, remaining stems (%), remaining basal area (%), remaining volume (%), and average diameter at breast height of remaining trees. Amount of coarse woody debris (*n* = 60 slides) was identified as the single best predictor of VQC, and the models that combined amount of coarse woody debris with stems, volume, or basal area remaining were identified as the best two-variable models (despite the > 50% reduction in sample size due to missing data from clear cuts, patch cuts, and aggregated retention cuts). The addition of a third predictor did not produce a significant improvement in fit. Parameter estimates for the two-variable model based on stems remaining are given in Table 7. Replacing stems remaining (n = 25) with volume (n = 23) or basal area (n = 19) remaining resulted in similar parameter estimates with slightly larger standard errors due to smaller sample sizes; therefore, the model that included stems remaining was adopted as the final model.

Table 7. *Estimated model (Equation 2) parameters for predicting Visual Quality Class*

Predictor	Level	Parameter	Estimate	Std. err.	t value	Prob ≥ |t|
Intercept	Maximum Modification	α_{MM}	1.6452	0.8892	1.85	0.0808
	Modification	α_{M}	3.5517	1.1100	3.20	0.0050
	Partial Retention	α_{PR}	6.2634	1.5843	3.95	0.0009
	Retention	α_{R}	8.1329	2.0799	3.91	0.0010
	Preservation	α_{P}				
Level of waste wood, slash, coarse woody debris	Low	β_1	-4.5501	1.5402	-2.95	0.0085
	Medium	β_2	-1.7186	1.0150	-1.69	0.1077
	High		0			
Remaining stems (%)		β_3	-0.06737	0.02481	-2.72	0.0142

4.0 Survey Conclusions

The following conclusions are based on the statistical analyses of the data collected.

Objectives	Conclusions
Match the sample group with the socio-demographic statistics for British Columbia as closely as possible	The population in this study was found on average to be older and better educated, to have occupations in social sciences, education, or government, and to have a higher annual income than the province or country as a whole. The proportion of respondents from urban areas was slightly higher than expected. Only the male/female ratio of the survey sample was comparable to both British Columbia and Canada. Based on the findings of previous studies, it is anticipated that the sample group would rate altered forest landscapes slightly lower in acceptance than the general population of British Columbia.
Determine the public acceptance rating for each of the 60 photographs used in the study	The PAR for the 60 roadside scenes used in the study are presented in Appendix 5 and are ordered by PAR, with Rank 1 being most acceptable and Rank 60 being least acceptable.
Determine PAR for each silvicultural treatment in the Sayward Forest STEMS project areas	The STEMS Control, Group Selection, and Commercial Thinning scenes received positive PAR. All other treatments received neutral or decreasing PAR.

Continued on the next page

Objectives	Conclusions
Examine trends in PAR relative to site and stand variables	• Silvicultural systems that retain some stand structure (Commercial Thinning, Single-tree Selection, etc.) are preferred over silvicultural systems that remove most or all of the trees (e.g., Clear Cut and Patch Cut). This corroborates how the public viewed silvicultural systems in the 2006 study, *The Public Response to Harvest Practices in British Columbia at the Landscape and Stand Level*. • Forest floor colour generally represents age of disturbance and displays greater amount of ground vegetation. New openings generally received lower PAR. • As the amount of wood waste and coarse woody debris increases in quantity, there is an associated decrease in PAR. • Roadside openings that open up vista views received lower PAR than openings that did not open up vista views. • Openings that do not contain visible roads receive higher PAR than openings that contain visible roads. • Openings that contain site disturbances were preferred less than openings without site disturbances. • Openings viewed from above were found to be more acceptable than openings viewed from below. • As visible opening size increases, there is a decrease in PAR. • Shallow opening depth receives higher PAR than deep openings. • Opening length did not yield conclusive results, likely due to the media used for the survey. • As the percentage of stems, volume, and basal area removed increases, PAR decreases. This was found to be very consistent with how the public responds to perspective landscapes.
Determine PAR thresholds of acceptance—that is, at what point does PAR move from like to dislike?	• The PAR threshold for visible opening size is 0.4 ha for clear cuts, 0.8 ha for partial cuts, and 0.4 ha for clear cut–partial cut mix. • The PAR threshold for opening depth is 63 m. • The PAR threshold for partial cuts is 71% stems or volume removed and 67% for basal area removed.
Determine if there is a site or stand variable or combinations of variables that will predict PAR	• The quantity/volume of coarse woody debris is identified as the best single predictor of PAR for clear cuts. • Remaining stems is identified as the best single predictor of PAR for partial cuts.
Derive PAR values that might predict VQC	Comparative analysis of 2006 PAR and VQC data determined that: • Preservation (P) is predicted by PAR +3.0 to +1.78 • Retention (R) is predicted by PAR +1.77 to +0.94 • Partial Retention (PR) is predicted by PAR +0.93 to 0 • Modification (M) is predicted by PAR -0.01 to -0.92 • Maximum Modification (MM) is predicted by PAR -0.93 to -3.0

Continued on the next page

Objectives	Conclusions
Examine trends in VQC relative to site and stand variables	• A primarily green forest floor is more likely to achieve P, R, and PR. Openings in which the forest floor colour is yellow, red, or brown are more likely to be classed as M and MM. • Openings that contain little or no wood waste, slash, and coarse woody debris are likely to achieve P, R, PR; if they contain moderate to high levels of slash, they are likely to achieve M and MM. • Openings that do not open up vista views are likely to achieve P, R, PR, and if they open up a vista view, they are more likely to be classed as M and MM. • Openings containing no visible roads are more likely to be classed as P, R, and PR; if they contain visible roads, the VQC likely achieved is M and MM. • Openings containing no visible site disturbance are more likely to be classed as P, R, and PR; if they contain visible site disturbance, the VQC likely achieved is M and MM. • Openings viewed from above or level are likely to be classed as P, R, and PR, while openings viewed from below are likely to be classed as M and MM. • Clear cut openings with a visible size of 2 ha or smaller are most likely to achieve R, PR, or M. Clear cut openings greater than 2 ha are most likely to achieve MM. • Clear cut openings that are 136 m or greater in length are likely to be classified as M or MM. Clear cut opening depths: – 1–95 m predicts Retention – 96–118 m predicts Partial Retention – 119–167 m predicts Modification – >168 m predicts Maximum Modification Partial cut openings that retain: – 66% or more stems/volume would be classed as Preservation – around 30% would be classed as Partial Retention – 20% or less would be classed as M and MM
Determine if there is a site and stand variable or combination of variables that can be used to predict VQC for foreground landscapes	• Amount of coarse woody debris was identified as the single best predictor of VQC. • Coarse woody debris in combination with stems was identified as the best two-variable predictor. • The addition of a third variable did not improve the predictability.

5.0 Discussion

This study provides us with a better understanding of how the public responds to roadside harvesting activities. Specifically, it provides us with a better understanding as to how the public responds to the presence or absence of various forest attributes in roadside scenes.

5.1 Understanding the Results

Some of the key findings from this study are as follows:

1. Silvicultural systems that retain some stand structure are preferred over silvicultural systems that remove most or all of the trees.
2. As the percentage of stems, volume, and basal area removed increases, PAR decreases.
3. Small openings are preferred over larger openings.
4. The public dislikes high levels of visible slash/coarse woody debris.
5. Openings with visible roads and/or site disturbance receive lower PAR.
6. A green forest floor is much more accepted than red, brown, or grey.
7. Openings viewed from above or on the level are more preferred than openings viewed from below.
8. Roadside openings that open up vista views receive lower PAR.

What does all this mean? This information provides a foundation on which to develop Best Management Practices for roadside harvesting. To that end, images that produced favourable PAR contained the following attributes:

- low levels of slash/coarse woody debris in opening
- 30% or more stems, volume, or basal area retained within opening
- opening size 0.4 ha or smaller for clear cuts or 0.8 ha or smaller for partial cuts
- opening length 136 m or less
- opening depth 75 m or less
- no visible roads and/or site disturbance in block
- opening does not open a vista view

5.2 Study Limitations

The fundamental limitation of any public perception study is that the results depend on many variables—for example, the question asked, the photos selected, the classification scheme, the attributes analyzed, the statistical analysis employed, and the representativeness of the sample population.

In this study, the following instructions were given to participants:

> During the survey we will show you photographs of different forested roadside scenes. The photos are taken close up to represent landscapes that you might see travelling along a highway in B.C. Please rate each of the scenes on a scale from –3 (Very Unacceptable) to +3 (Very Acceptable). The midpoint is 0. For the purpose of this survey, visual quality can be considered the attractiveness of the scenery as it would affect your enjoyment of it.

There may be terms in the instructions that were not completely understood or that may mean different things to different people.

The photographs used in this study were taken of harvested openings as you would see them travelling along the highway or a side road. During photography, every effort was made to capture the visible length, breadth, and depth of each opening.

It should be noted that the minimal effect of the length of an opening on mean PAR may be attributed to the limitation of using static photographs in the survey as opposed to showing a video taken from a moving vehicle in real time. Duration of view is postulated to be a significant factor affecting public acceptance of roadside harvesting. At slower speeds, the duration of view is relatively long and may negatively affect viewer acceptance. This variable needs further investigation in future studies.

Attribute data were collected at the time each photograph was taken. It may be that not all predictor attributes were recognized and collected.

This study examined harvesting activities occurring in the foreground along roads and highways. Some caution must be exercised in trying to apply the results in other foreground settings, such as along rivers and lake shores. However, it is likely that the public would show similar preference trends in these viewing contexts.

Despite the best efforts of researchers, the make-up of the respondent sample differed slightly from the general population of British Columbia. The population in this study was found on average to be older and better educated, to have occupations in social sciences, education, or government, and to have a higher annual income than the province or country as a whole. Based on the findings of previous studies, it is anticipated that a sample group such as this would rate altered forest landscapes slightly lower in acceptance than the general population of British Columbia.

5.3 Future Work

This body of research provides a first look at how the public responds to roadside treatments. The next step will be to apply the results of this study and develop Best Management Practices that will assist forest planners and field practitioners in designing activities along the roadsides that will minimize visual impact. The results of this study will also help formulate the definitions of Visual Quality Class as they apply to roadside and foreground settings.

Over time, specific forest site variables such as length, depth, shape of openings, angle of view, and duration of view may be explored further in new roadside studies.

Although the Best Management Practices that will come out of this study might be useful in other foreground settings, such as along rivers and lake shores, specific public perception studies of foreground harvesting activities in those settings will be required to capture the setting as well as the harvesting.

This study did not examine the public response to replanting and subsequent green-up of the harvested roadside areas. This may be something that could be explored in a future study.

6.0 Glossary

Chi-square test: any statistical hypothesis test in which the sampling distribution of the test statistic is a Chi-square distribution when the null hypothesis is true, or any in which this is asymptotically true, meaning that the sampling distribution (if the null hypothesis is true) can be made to approximate a Chi-square distribution as closely as desired by making the sample size large enough.

clear cut (CC): a silvicultural system that removes the entire stand of trees in a single harvesting operation from an area that is one hectare or greater, and at least two tree-heights in width, and is designed to manage the area as an even-aged stand.

discriminant analysis: a technique for classifying a set of observations into predefined classes. The purpose is to determine the class of an observation based on a set of variables known as predictors or input variables. The model is built based on a set of observations for which the classes are known.

foreground: the part of a scene (visible terrain) that is nearest to and directly in front of the observer.

multinomial model: a regression model that generalizes logistic regression by allowing more than two discrete outcomes; that is, a model used to predict the probabilities of the different possible outcomes of a categorically dependent variable, given a set of independent variables.

public acceptance rating (PAR): a measure of the public's "acceptance" of visual quality in this study.

regression analysis: includes any techniques for modelling and analyzing several variables when the focus is on the relationship between a dependent variable and one or more independent variables. More specifically, regression analysis helps us understand how the typical value of the dependent variable changes when any one of the independent variables is varied while the other independent variables are held fixed.

STEMS: Silviculture Treatments for Ecosystem Management in the Sayward Forest.

viewshed: a physiographic area composed of land, water, biotic, and cultural elements that may be viewed and mapped from one or more viewpoints and that has inherent scenic qualities and/or aesthetic values as determined by those who view it.

Visual Landscape Inventory: the identification, classification, and recording of the location and quality of visual resources.

Visual Quality: the character, condition, and quality of a scenic landscape or other visual resource and how it is perceived, preferred, or otherwise valued by the public.

Visual Quality Class (VQC): a classification that refers to the character and/or condition of the visual resource and is described using the same terminology as Visual Quality Objectives.

Visual Quality Objective (VQO): a resource management objective established under the *Government Action Regulation* that reflects the desired level of visual quality (category of alteration) based on the physical characteristics and social concern for the area. The five visual quality classes are defined as follows:

- **Preservation (P):** consisting of an altered forest landscape in which the alteration, when assessed from a significant public viewpoint, is very small in scale and not easily distinguishable from the pre-harvest landscape;
- **Retention (R):** consisting of an altered forest landscape in which the alteration, when assessed from a significant public viewpoint, is (1) difficult to see, (2) small in scale, and (3) natural in appearance;
- **Partial Retention (PR):** consisting of an altered forest landscape in which the alteration, when assessed from a significant public viewpoint, is (1) easy to see, (2) small to medium in scale, and (3) natural and not rectilinear or geometric in shape;
- **Modification (M):** consisting of an altered forest landscape in which the alteration, when assessed from a significant public viewpoint, (1) is very easy to see, and (2) is:
  (a) large in scale and natural in appearance, or
  (b) small to medium in scale but with some angular characteristics;
- **Maximum Modification (MM):** consisting of an altered forest landscape in which the alteration, when assessed from a significant public viewpoint, (1) is very easy to see, and (2) is:
  (a) very large in scale,
  (b) rectilinear and geometric in shape, or
  (c) both.

Visual Resource: the quality of the environment as perceived through the visual sense only.

Visual Resource Management: the identification, assessment, design, and manipulation of the visual features or values of a landscape, and the consideration of these values in the integrated management of provincial forest and rangelands.

7.0 References

British Columbia Ministry of Forests. 1996. Clear cutting and visual quality: a public perception study. Range, Recreation and For. Pract. Br., Victoria, B.C.

_______. 1997. Visual impacts of partial cutting. For. Pract. Br., Victoria, B.C.

_______. 2002. Predicting the visual impacts of retention cutting. For. Pract. Br., Victoria, B.C.

British Columbia Ministry of Forests and Range. 2006. The public response to harvest practices in British Columbia at the landscape and stand level. For. Pract. Br., Victoria, B.C.

De Montigny, L. 2004. Silviculture treatments for ecosystem management in the Sayward (STEMS): Establishment report for STEMS 1, Snowden Demonstration Forest, B.C. Ministry of Forests, Research Branch, Victoria, B.C. Tech. Rep. 17.

Nemec, A. 2009. Provincial public perception survey: statistical summary and analysis of results. Unpublished report.

Olivotto, G. 2006. Draft roadside forest management: a public perception survey. B.C. Ministry of Forests and Range, Forest Practices Branch, Victoria, B.C. Unpublished manuscript.

Swanson, J. 2005. Site Plan A19232 CP 96 Elk Bay STEMS2. International Forest Products, Campbell River, B.C.

U.S. Department of Agriculture. 1974. National forest landscape management. Vol. 2, Chapter 5: Timber. U.S. Dep. Agriculture, Forest Service, Washington, D.C.

8.0 Appendices

Appendix 1
Roadside Opening Data Collection Form

Appendix 2
Public Perception Survey Form

Appendix 3
Statistical methods

Appendix 4
Site data, Visual Quality Class, and public acceptance rating (mean and rank) for 60 roadside scenes

Appendix 5
Public acceptance rating distributions for 60 roadside scenes

Appendix 6
List of non-profit organizations that participated in the study

Appendix 7
Photographs used in roadside perception study

Appendix 1 Roadside Opening Data Collection Form

Forest District _______________________________ Site ID No ____________________
Surveyor ___________________________________ Survey Date ___________________
Block Location: GPS Northing ________________ GPS Westing __________________
Highway/FSR Name _________________________ BEC designation _______________

Preharvest Stand Data

Licensee______________ Opening no. _________ Geographic Location ___________________________

Area (ha) ______________ Avg Slope in block % _________ Old growth ☐ or Second-growth ☐

Volume (ha) ______________ Basal Area (ha) _______________ Stems/ha ________________________

Avg. dbh (cm) _____________ Avg ht. (m) _________

Postharvest Stand Data

Year logged _______ Years since harvest_______

Harvest Method: Cable ☐ Feller-Buncher ☐ Feller-Processor ☐ Skidder ☐ Hoechuck ☐

Silv System: Clear Cut ☐ Patch Cut ☐ Group Selection ☐ Single Tree ☐ VR Dispersed ☐
VR Aggregated ☐ Sanitation Cut ☐ Shelterwood ☐ Seed Tree ☐ Commercial Thin ☐

Retention: Evenly Dispersed ☐ Randomly Dispersed ☐ Aggregated single patch ☐
Aggregated multiple patches ☐ Hybrid (Single trees and patches) ☐

Site data from Harvest Unit

View direction to block from road: Focal ☐ Perpendicular (90 degrees) ☐ Obtuse Angle ☐
Vertical view angle to block: Above ☐ Below ☐ Level ☐ ______ %
Shape of cut: Square ☐ Rectangular ☐ Elliptical ☐ Semi-circle ☐ Organic ☐ Curvilinear ☐
Residual Stand Structure: Single Storey ☐ or Multilayered ☐
Seen opening size (ha) ____________ Length (m) ______________ Depth (m) ___________________
Avg dbh (cm) ______________ Avg ht. (m) _________________ Avg tree vol (m^3) ________________
Avg Stems/ha ________________ Stems Removed ______________ % Stems Remaining ___________
BA Remaining (m^2/ha) _________ BA Removed _____________ % BA Remaining ________________
Vol Remaining (m^3/ha) __________ Vol Removed _____________ % Vol Remaining _______________

View Canopy ☐ or Trunk ☐

Roads in block: Visible ☐ Not Visible ☐ Proportion of View ________%
Site disturb: Visible ☐ Not Visible☐ Proportion of View ________ %

Colour of forest floor: Green ☐ Yellow ☐ Red ☐ Brown ☐ Grey ☐

Does harvest area open up a vista view? Yes ☐ or No ☐

Is backdrop natural or has it been harvested? ___________________________

Quantity/Volume of waste/coarse woody debris Low ☐ Moderate ☐ High ☐

Appendix 2 Public Perception Survey Form

Group: ________________________

Location: ________________________

Date: ________________________

B.C. Forest Service Photograph Survey

The intent of this survey is to help the Forest Service understand the public response to the visual quality of different forested scenes. The survey results will be used to incorporate public preferences in future visual resource management policy.

During the survey we will show you photographs of different forested roadside scenes. The photos are taken close up to represent landscapes that you might see travelling along a highway in B.C. Please rate each of the scenes on a scale from –3 (Very Unacceptable) to +3 (Very Acceptable). The midpoint is 0.

To start we will view six slides to assist you to understand the visual rating format. These six slides will not be part of the formal survey data. After viewing and discussing these six slides, another sixty slides will be shown that make up the survey.

FOR THE PURPOSE OF THIS SURVEY, VISUAL QUALITY CAN BE CONSIDERED THE ATTRACTIVENESS OF THE SCENERY AS IT WOULD AFFECT YOUR ENJOYMENT OF IT.

Calibration Slides

Slide #	Very Unacceptable			Neutral			Very Acceptable	COMMENTS
Pract 1	-3	-2	-1	0	+1	+2	+3	
Pract 2	-3	-2	-1	0	+1	+2	+3	
Pract 3	-3	-2	-1	0	+1	+2	+3	
Pract 4	-3	-2	-1	0	+1	+2	+3	
Pract 5	-3	-2	-1	0	+1	+2	+3	
Pract 6	-3	-2	-1	0	+1	+2	+3	

The Survey

For each slide, please rate how acceptable or unacceptable you find the visual quality. Assume that you are viewing the scene from your automobile travelling along a highway in B.C. Rate each of the scenes on a scale from –3 (Very Unacceptable) to +3 (Very Acceptable). The midpoint is 0. Circle your rating.

Next to each line there is a blank space for comments to describe what influenced your rating. Repeating words or phrases is okay, and if nothing comes to mind then just leave the space blank.

FOR THE PURPOSE OF THIS SURVEY, VISUAL QUALITY CAN BE CONSIDERED THE ATTRACTIVENESS OF THE SCENERY AS IT WOULD AFFECT YOUR ENJOYMENT OF IT.

Slide #	Very Unacceptable			Neutral			Very Acceptable	COMMENTS
1	-3	-2	-1	0	+1	+2	+3	
2	-3	-2	-1	0	+1	+2	+3	
3	-3	-2	-1	0	+1	+2	+3	
4	-3	-2	-1	0	+1	+2	+3	
5	-3	-2	-1	0	+1	+2	+3	
6	-3	-2	-1	0	+1	+2	+3	
7	-3	-2	-1	0	+1	+2	+3	
8	-3	-2	-1	0	+1	+2	+3	
9	-3	-2	-1	0	+1	+2	+3	
10	-3	-2	-1	0	+1	+2	+3	
60	-3	-2	-1	0	+1	+2	+3	

Demographic Information

Please take a few minutes to fill out this page. We need this information so that we can compare responses from different groups. All answers will be kept confidential and anonymous.

What is your Age?

☐ Less than 20 ☐ 20–29 ☐ 30–39 ☐ 40–49 ☐ 50–59 ☐ 60–69 ☐ 70 Plus

Are you?

☐ Male ☐ Female

What is the highest level of education that you have attained?

Check the highest level.

☐ Less than High School Graduation
☐ High School Graduation Certificate
☐ Trades Certificate
☐ College (grad or not)
☐ University – certificate, diploma, and no degree
☐ University – Bachelor's or higher

Place of Residence?

☐ British Columbia
☐ Other Canadian Province
☐ Outside Canada

Where do you live?

☐ Rural Area	less than 2500 people
☐ Town	2500 – 24,999
☐ City	25,000 – 249,999
☐ Large City	250,000 or more people

What is your occupation?

☐ Management
☐ Business, Finance, and Administration
☐ Natural and Applied Sciences
☐ Health
☐ Social Sciences, Education, and Government
☐ Art, Culture, Recreation, and Sport
☐ Sales and Service
☐ Trades, Transport, and Equipment Operators
☐ Primary Industry
☐ Processing, Manufacturing, and Utilities
☐ Other:____

What is your total annual income? *not combined marital (Optional)

☐ Less than $20,000
☐ $20,000 to $39,999
☐ $40,000 to $59,999
☐ $60, 000 +

Thank you for taking time to participate in this survey.

Appendix 3 Statistical Methods

1 Respondent Profiles

The distribution of the survey sample (number and percentage of respondents) by sex, age, education, occupation, income, and place of residence (urban or rural) was compared graphically with the corresponding demographic profiles for British Columbia and Canada. Chi-square tests, where all respondents were assumed to be drawn independently from a common population (i.e., ignoring differences between communities and between groups within communities), were used to assess the statistical significance of differences between the survey population and the overall populations of British Columbia and Canada.

2 Public Acceptance Ratings

Public acceptance rating (PAR) was summarized for each slide by tabulating the number and percentage of respondents (all communities and groups combined) who rated the scene as Very Unacceptable, Moderately Unacceptable, etc. (i.e., PAR = -3, -2, -1, 0, 1, 2, 3). The distribution of scores was plotted separately for the 60 scenes, which were ranked from most to least acceptable based on mean PAR. Correlation of site and stand factors was examined by plotting mean PAR by silvicultural system, visible opening size, length and depth of opening, amount of waste wood (slash, coarse woody debris), and other descriptive variables.

3 Predictors of Public Acceptance Ratings

Silvicultural system; cutblock shape; visible area; length and depth of opening; remaining percentage of stems, basal area, and volume; amount of coarse woody debris; forest floor colour; and other potential predictors of PAR were evaluated by fitting a (cumulative logistic) multinomial model:

$$p\,(PAR_{ij}\ \pounds\ \mathrm{k} \mid \mathrm{x}_i, \mathrm{e}_j) = \frac{e^{\,a_k + bx_i + e_j}}{1 + e^{\,a_k + bx_i + e_j}}$$

The dependent variable *PARij* is the rating assigned by Person *j* to Slide *i*; $\{x_i\}$ is a set of one or more continuous (e.g., % stems remaining) or discrete (e.g., silvicultural system) predictor variables[6] that describe the site or stand shown in Slide *i*; ε_j is a random effect associated with Person *j* (i.e., the combined effect of various factors that determined whether an individual tended to rate scenes lower or higher than the population as a whole); and $p(PAR_{ik} \le k|x_i, \varepsilon_j)$ is the predicted cumulative probability[7] that the assigned PAR is no greater than k = -3, -2, -1, 0, 1, 2, where $p(PAR_{ik} \le 3|x_i, \varepsilon_j) = 1$. Ratings were assumed to be independent across slides for each person, and the random effects $\{\varepsilon_j\}$ were assumed to be independent and identically distributed normal random variables with mean 0 and variance σ^2. The unknown model parameters α_k (k = -3, -2, -1, 0, 1, 2), β, and σ^2 were estimated by maximizing the residual pseudo-likelihood function.

Model 1 was fitted separately for clear cuts (n = 31) and partial cuts (n = 27), with predictors $\{x_i\}$ added or dropped in a stepwise fashion based on the associated *F* tests. Demographic factors (sex, age, etc.) were assumed to be incorporated into the random effects and were not explicitly evaluated as predictors of PAR.

---

6 If x_i is a class variable (with m + 1 classes represented by m dummy variables) or there are multiple predictors $\{x_{i1}, x_{i2},\ldots, x_{im}\}$ associated with Slide *i*, then βx_i in Model 1 is replaced with $\beta_1 x_{i1} + \beta_2 x_{i2} + \ldots + \beta_m x_{im}$

7 Individual probabilities are obtained by subtraction:

$$p\,(PAR_{ik} = -3|x_i, \varepsilon_j) = p\,(PAR_{ik} \le -3|x_i, \varepsilon_j)$$

$$p\,(PAR_{ik} = k|x_i, \varepsilon_j) = p\,(PAR_{ik} \le k|x_i, \varepsilon_j) - p\,(PAR_{ik} \le k - 1|x_i, \varepsilon_j) \quad k = -2, -1, 0, 1, 2$$

$$p\,(PAR_{ik} = 3|x_i, \varepsilon_j) = 1 - p\,(PAR_{ik} = 2|x_i, \varepsilon_j)$$

Thresholds for public acceptance were determined by fitting univariate non-linear regression models relating mean PAR to visible size (Table 3), length, and depth of opening; and percentage of remaining stems, basal area, and volume; and, for each model, calculating the critical level where public opinion was expected to change from positive to negative (i.e., the value where expected mean PAR = 0).

To investigate whether slide order affected the ratings, the difference in mean PAR for respondents who viewed the slides in standard order and those who viewed the slides in reverse order was plotted against the change in slide position,[8] and the results were tested for a statistically significant trend or offset from zero.

4 Visual Quality Class

Normal-theory discriminant analysis (with a pooled variance estimate) was applied to a separate sample of 65 scenes,[9] which were assigned a Visual Quality Class (VQC) by a group of professional foresters and were independently rated for public acceptance in a 2003 survey of 714 British Columbians.[10] The results were used to develop a rule for assigning VQC based on average PAR. The rule was then used to classify the 60 roadside scenes as Maximum Modification (VQC = MM), Modification (M), Partial Retention (PR), Retention (R), or Preservation (P).

5 Predictors of Visual Quality Class

Silvicultural system, amount of coarse woody debris, and other site or stand variables were evaluated as candidate predictors of VQC by fitting a multinomial model:

$$p(VQC_i \text{ £ } k \mid \mathrm{x}_i) = \frac{e^{a_k + bx_i}}{1 + e^{a_k + bx_i}}$$

where the dependent variable VQC_i is the VQC assigned to Slide *i* by the method described above; k = 1, 2, 3, 4 correspond to the classes MM, M, PR, and R, respectively[11]; and x_i is one or more predictor variable(s)[12] describing the scene in Slide *i*. The model parameters α_k (k = 1, 2, 3, 4) and β were estimated by maximizing the likelihood function, with predictors $\{x_i\}$ added or dropped in a stepwise fashion based on the associated *F* tests.

All data summaries and analyses were performed with Statistical Analysis Software (SAS). Models 1 and 2 were fitted with PROC GLIMMIX; PROC NLIN (REG) was used to fit the non-linear (linear) regression models for calculating acceptance thresholds (and for assessing the effect of slide order); and PROC DISCRIM was used to assign a VQC to the roadside scenes.

8 Slide position = slide number (60 – slide number + 1) for groups that viewed slides in standard (reverse) order.

9 One scene (Slide 36) was previously identified as an outlier and was omitted from the discriminant analysis.

10 British Columbia Ministry of Forests and Range. 2006. The public response to harvest practices in British Columbia at the landscape and stand level. Forest Practices Branch, Victoria, B.C.

11 Probabilities for individual VQC can be obtained by subtraction (see footnote 7).

12 Class variables and models with more than one predictor are represented as described in footnote 6.

Appendix 4 Site data, Visual Quality Class (VQC), and public acceptance rating (PAR)(mean and rank) for 60 roadside scenes

Slide	District	Location	Silvi-cultural System	Opening Shape	Residual Stand Structure	Visible Size of Opening (ha)	Opening Length (m)	Opening Depth (m)	Post-harvest dbh (cm)	Patch Size (ha)	Post-harvest sph (%)	Post-harvest BA (%)	Post-harvest volume (%)	CWD	Roads	Disturb-ance	Colour	Vista View	Vertical View Angle	VQC	Mean PAR	Rank
1	DOS	Haggart Creek	ST	-	SS				35.6		8.1	8	8.1	M	NV	NV	Y	N	B	PR	0.45	21
2	DKA	Logan Lake Hwy	CC	E	None	2.8	200	140						L	NV	NV	GB	Y	L -5%	M	-0.11	27
3	DHW	Camp Creek	SW	U	SS				32.9		46.2		25.6	M	NV	NV	B	N	L	PR	0.46	20
4	DCR	Big Tree Creek FSR	VrA	E	SS	2.9	130	220						M	NV	NV	GB	Y	B -18%	MM	-1.09	41
5	DCR	Black Dog Main	PC	S	None	1.7	130	130	27.3					M	NV	NV	G	N	A 10%	MM	-1.60	53
6	DSI	Highway #1	VrD	O	M	1.49	180	83			30			M	NV	NV	R	N	L	MM	-1.15	44
7	DCR	Black Dog Main	CT	O	M				27.3		48	53	54.5	H	NV	NV	GnG	N	L	PR	0.79	16
8	DCR	Black Dog Main	CC with Res	R	SS	5.5	200	250		0.3				M	NV	NV	GB	N	L	MM	-1.19	45
9	DCR	East Amor FSR	VrA	C	M	2.4	65	375						M	0.05	NV	Y	N	B -8%	M	-0.33	30
10	DCR	BR Stems 2	VrD	R	SS	0.95	135	70	30.1		3.1	3.49	3.7	H	NV	NV	RB	N	B	M	-0.93	38
11	DRM	Spillmacheen FSR 19K N	SW	U	M	2	200	100			40			L	NV	NV	B	N	L	R	1.08	9
12	DCA	HWY #3	VrD	U	SS				35.2		24	25	30.7	L	NV	0.1	B	N	L	M	-0.19	28
13	DKA	Louis Creek	CC with Res	I	SS	0.54	90	60	35.3	0.003	13.2	24.1	28.9	H	NV	0.2	B	N	L	M	-0.05	26
14	DCR	Highway 19	CC	S	None	2.3	150	150						H	0.02	NV	G	N	A 5%	MM	-1.31	49
15	DNR	Capitol Forest	CC	C	None	4	200	200						M	NV	NV	R	N	L	MM	-1.21	46
16	DSQ	Soo Valley	ST	E	SS	2.5	200	125	32.3					L	0.1	NV	R	N	L	PR	0.51	19
17	DVA	Kluskus KL 79.4	PC	R	None	0.56	137	41						M	NV	NV	RB	N	A 2%	PR	0.17	23
18	DAB	HWY 3B	CC with Res	E	M	1.1	120	90	31.4	0.06		18.7	18.4	M	NV	NV	GR	N	L	MM	-1.10	42
19	DCR	STEMS 2	PC	R	None	0.37	75	50						L	0.3	NV	B	N	L	M	-0.40	31
20	DHW	Moose Creek	VrD	E	M	4.1	340	150	35		16.7	16.7	16.7	H	0.05	NV	RB	Y	L	MM	-1.42	51
21	DCR	Johnstone Strait	VrD	SC	SS	0.48	120	40	41.8		4.3	4.7	3.8	H	NV	NV	G	N	L	MM	-1.56	52
22	DKA	Logan Lake Hwy	CC	R	None	4.65	358	130						L	NV	NV	Y	N	B -2%	R	1.32	6
23	DVA	Blue Mtn FSR	CC	R	None	5.6	291	193						H	NV	0.05	Gn	N	L	PR	0.10	24
24	DCR	Highway 19	ST	R	SS	3.8	170	225	40		5			M	NV	NV	B	N	A 8%	MM	-1.35	50
25	DPG	Blackwater Road	CC	R	None	0.83	150	55						L	NV	NV	RB	N	L	R	1.07	10
26	DAB	Slocan	ST	C	M	1.3	120	110	50.3		4.8	11	13.2	M	NV	NV	R	N	B	M	-0.64	35
27	DCR	STEMS 2	CT	R	SS	0.75	125	60	30.6		42		43.5	H	NV	NV	GnG	N	B	M	-0.53	33
28	DCA	Hwy #3	VrD	-	SS				29		37.4	37	21.1	H	V	0.12	R	N	L	MM	-1.09	40
29	DHW	HWY #16	ST	-	M				35.6		77			L	NV	NV	G	N	L	P	2.51	1
30	DSQ	Mamquam FSR	SW	-	SS				48		13.9	36.4	36.4	M	NV	NV	B	N	L	PR	0.04	25
31	DSI	Mt Prevost Road 5KL	VrD	-	M	2	200	100	20					L	NV	NV	GnR	Y	B -5%	PR	0.85	14
32	DCR	Highway 19	CC	C	SS	9.5	450	225						M	0.02	0.035	B	N	A 10%	MM	-1.64	54
33	DVA	Lucas 500	PC	T	None	0.52	99	52						L	NV	NV	G	N	L	M	-0.24	29
34	DSQ	HWY 99	CT	R	M	0.5	100	50	27.4				25	L	0.05	NV	GnB	N	L	R	1.61	5
35	DCR	Highway 19	CC	R	None	1.9	75	250						M	NV	0.02	B	N	B 2%	MM	-1.66	55
36	DCR	Black Dog Main	Control	-	M						100	100	100	L	NV	NV	G	N	L	P	2.45	2
37	DVA	Holy Cross FSR	CC	T	None	5.59	185	302						L	NV	NV	G	N	L	PR	0.30	22
38	DNR	Capitol Forest	PC	S	None	0.18	43	43						M	NV	NV	R	N	L	M	-0.54	34
39	DOS	Cold Stream Creek	SW	R	SS				42.1		26.1	25	25	M	NV	NV	B	Y	L	M	-0.45	32
40	DNR	Capitol Forest	GS	R	None	0.12	40	30	61					L	NV	NV	G	N	L	PR	0.92	11
41	DCR	Newcastle Road	CC with Res	O	M	1.6	90	180	46	0.2				M	NV	NV	B	Y	B -8%	MM	-1.29	48
42	DCR	Black Dog main	VrA	R	SS	1.8	135	135	27.8	0.05				H	NV	NV	GB	N	L	MM	-1.12	43
43	DCR	Ucona Road	VrA	R	SS	5	100	475		0.1				M	NV	NV	B	Y	L	MM	-1.88	57
44	DCR	Branch 2000	VrD	C	SS	6.1	384	160	38.2		4.2	10.9	10	H	NV	NV	G	Y	B -10%	MM	-0.97	39
45	DVA	Blue Mtn FSR	CC	R	None	7	280	250						M	NV	0.02	G	N	L	M	-0.68	37
46	DVA	Lucas 500 KL 42	CC	R	None	2.85	335	85						L	NV	NV	G	Y	A10	PR	0.91	12
47	DCR	Highway 19	ST	E	SS	9.5	350	270						M	0.04	NV	Y	Y	L	MM	-1.28	47
48	DCR	Highway 19	VrD	O	SS	5.4	385	140						M	0.05	NV	B	N	A 10%	MM	-1.67	56
49	DCR	Black Dog Main	GS	R	None	0.14	40	35	28.5					L	NV	NV	GnG	N	L	PR	0.90	13
50	DND	Binta 22KL	CC	O	None	0.38	107	36						L	NV	0.02	G	N	L	PR	0.70	17
51	DOS	South Kelowna	SW	R	SS	0.24	40	60	29.4		24.3	54	45	L	NV	NV	GB	N	L	PR	0.84	15
52	DNR	Capitol Forest	Control	-	M						100	100	100	L	NV	NV	Gn	N	L	P	2.19	4
53	DCR	Stems 2	GS	S	None	0.5	50	100						M	NV	NV	B	N	A15%	MM	-1.94	58
54	DNR	Capitol Forest	CT	-	SS				56.6		55	75	77	L	NV	NV	G	N	L	P	2.19	3
55	DCR	Oyster River M/L	VrD	R	M	3.9	175	220	46.6		14.7	13.5	12.7	H	NV	NV	B	N	A 25%	MM	-1.99	60
56	DNR	Capitol Forest	SW	-	SS				59.2		13	19.1	19.9	L	NV	NV	Gn	N	A	R	1.12	8
57	DRM	Lamb Creek FSR	SS	-	SS				26.8		41		41	M	NV	NV	Y	N	L	PR	0.59	18
58	DAB	Highway #6	VrA	-	SS	0.54	67	81		0.1				L	NV	NV	G	N	L	R	1.29	7
59	DCR	Highway #19	CC	S	None	1.6	80	205						M	0.05	NV	B	N	L	MM	-1.95	59
60	DKA	Lac Le Jeune Road	CC	R	None	1.38	144	96						M	0.05	NV	GnB	N	L	M	-0.65	36

Note: The codes used in this table are set out on the Roadside Opening Data Collection Form. See Appendix 1.

Appendix 5 Public acceptance rating (PAR) distributions for 60 roadside scenes

(Slides are listed in order of decreasing mean PAR)

		PAR (number of respondents)								PAR (percentage of respondents)								Mean PAR
Rank	Slide	-3	-2	-1	0	1	2	3	Total	-3	-2	-1	0	1	2	3	Total	
1	29	4	4	4	4	40	185	451	692	1	1	1	1	6	27	65	100	2.51
2	36	8	5	4	13	41	172	447	690	1	1	1	2	6	25	65	100	2.45
3	54	7	10	10	22	64	231	343	687	1	1	1	3	9	34	50	100	2.19
4	52	4	9	11	22	81	221	343	691	1	1	2	3	12	32	50	100	2.19
5	34	4	12	44	41	152	267	166	686	1	2	6	6	22	39	24	100	1.61
6	22	13	23	50	72	164	223	144	689	2	3	7	10	24	32	21	100	1.32
7	58	4	15	40	93	203	233	100	688	1	2	6	14	30	34	15	100	1.29
8	56	10	22	72	70	207	209	97	687	1	3	10	10	30	30	14	100	1.12
9	11	9	31	79	58	203	221	89	690	1	4	11	8	29	32	13	100	1.08
10	25	6	30	71	74	213	211	82	687	1	4	10	11	31	31	12	100	1.07
11	40	11	39	75	68	238	191	68	690	2	6	11	10	34	28	10	100	0.92
12	46	8	39	86	75	226	177	77	688	1	6	13	11	33	26	11	100	0.91
13	49	5	40	83	86	218	197	63	692	1	6	12	12	32	28	9	100	0.90
14	31	10	32	90	85	242	167	66	692	1	5	13	12	35	24	10	100	0.85
15	51	5	29	100	67	264	184	39	688	1	4	15	10	38	27	6	100	0.84
16	7	12	57	83	68	224	172	68	684	2	8	12	10	33	25	10	100	0.79
17	50	14	43	92	104	235	146	59	693	2	6	13	15	34	21	9	100	0.70
18	57	11	44	129	78	239	155	36	692	2	6	19	11	35	22	5	100	0.59
19	16	16	56	116	76	250	154	24	692	2	8	17	11	36	22	3	100	0.51
20	3	22	59	138	71	201	158	40	689	3	9	20	10	29	23	6	100	0.46
21	1	18	57	130	85	222	143	34	689	3	8	19	12	32	21	5	100	0.45
22	37	18	72	150	78	218	125	29	690	3	10	22	11	32	18	4	100	0.30
23	17	29	79	158	82	191	122	28	689	4	11	23	12	28	18	4	100	0.17
24	23	26	81	160	103	201	95	27	693	4	12	23	15	29	14	4	100	0.10
25	30	27	99	167	82	182	113	23	693	4	14	24	12	26	16	3	100	0.04
26	13	29	100	181	84	185	87	24	690	4	14	26	12	27	13	3	100	-0.05
27	2	73	112	126	70	150	125	31	687	11	16	18	10	22	18	5	100	-0.11
28	12	47	100	181	82	187	80	14	691	7	14	26	12	27	12	2	100	-0.19
29	33	48	118	170	99	153	78	24	690	7	17	25	14	22	11	3	100	-0.24
30	9	52	132	183	61	159	78	21	686	8	19	27	9	23	11	3	100	-0.33
31	19	62	124	193	77	146	65	24	691	9	18	28	11	21	9	3	100	-0.40
32	39	60	130	198	73	152	67	13	693	9	19	29	11	22	10	2	100	-0.45
33	27	54	151	197	77	136	64	11	690	8	22	29	11	20	9	2	100	-0.53
34	38	36	137	239	84	150	40	6	692	5	20	35	12	22	6	1	100	-0.54
35	26	70	161	196	63	134	58	11	693	10	23	28	9	19	8	2	100	-0.64
36	60	52	171	196	95	114	54	8	690	8	25	28	14	17	8	1	100	-0.65
37	45	85	159	177	69	134	49	17	690	12	23	26	10	19	7	2	100	-0.68
38	10	94	173	217	53	93	48	7	685	14	25	32	8	14	7	1	100	-0.93
39	44	98	191	192	61	105	35	8	690	14	28	28	9	15	5	1	100	-0.97
40	28	109	204	191	54	94	35	4	691	16	30	28	8	14	5	1	100	-1.09
41	4	138	202	155	49	83	47	15	689	20	29	22	7	12	7	2	100	-1.09
42	18	96	205	217	58	84	23	8	691	14	30	31	8	12	3	1	100	-1.10
43	42	103	207	206	57	88	26	5	692	15	30	30	8	13	4	1	100	-1.12
44	6	103	213	205	57	77	29	5	689	15	31	30	8	11	4	1	100	-1.15
45	8	145	189	179	48	89	31	8	689	21	27	26	7	13	4	1	100	-1.19
46	15	184	177	130	61	92	32	14	690	27	26	19	9	13	5	2	100	-1.21
47	47	141	208	189	51	66	26	9	690	20	30	27	7	10	4	1	100	-1.28
48	41	161	218	145	41	82	34	9	690	23	32	21	6	12	5	1	100	-1.29
49	14	133	214	201	58	60	19	8	693	19	31	29	8	9	3	1	100	-1.31
50	24	123	246	188	47	55	25	5	689	18	36	27	7	8	4	1	100	-1.35
51	20	142	245	176	45	65	15	4	692	21	35	25	7	9	2	1	100	-1.42
52	21	174	243	159	51	51	13	2	693	25	35	23	7	7	2	0	100	-1.56
53	5	201	232	140	40	51	16	8	688	29	34	20	6	7	2	1	100	-1.60
54	32	251	195	114	36	62	27	4	689	36	28	17	5	9	4	1	100	-1.64
55	35	205	253	120	40	47	16	7	688	30	37	17	6	7	2	1	100	-1.66
56	48	228	220	140	34	46	16	9	693	33	32	20	5	7	2	1	100	-1.67
57	43	294	194	116	34	28	19	6	691	43	28	17	5	4	3	1	100	-1.88
58	53	322	187	93	31	37	13	9	692	47	27	13	4	5	2	1	100	-1.94
59	59	284	231	95	31	30	13	4	688	41	34	14	5	4	2	1	100	-1.95
60	55	323	192	99	24	29	15	7	689	47	28	14	3	4	2	1	100	-1.99

Appendix 6 List of non-profit organizations that participated in the study

Abbotsford

- Amnesty International Campus Club
- Communitas Supportive Care
- Habitat for Humanity
- MSA Golden K
- Panthers Key Club
- Poets Potpourri Society
- Toastmasters

Nelson

- Fire and Rescue Services
- Kiwanis Club
- Rod and Gun Club
- Nelson & District Youth Centre

Campbell River

- Association for Community Living
- Campbell River Dragon Boat Society
- North Island Employment Foundations Society
- Rod and Gun Club
- Sierra Quadra Club
- West Coast Prostate Awareness Society

Williams Lake

- Thompson River University Campus Christian Ministries
- Cariboo Friendship Society
- Central Interior Community Services Co-op
- Chamber of Commerce
- Desniqi Services Society
- 139 Children's Fundraising Society

Prince George

- Carrier Sekani Tribal Council
- Hadih House
- Kinsmen Club
- Blackburn Community Association
- Active Support Against Poverty
- Evangelical Free Church

Terrace/Kitimat

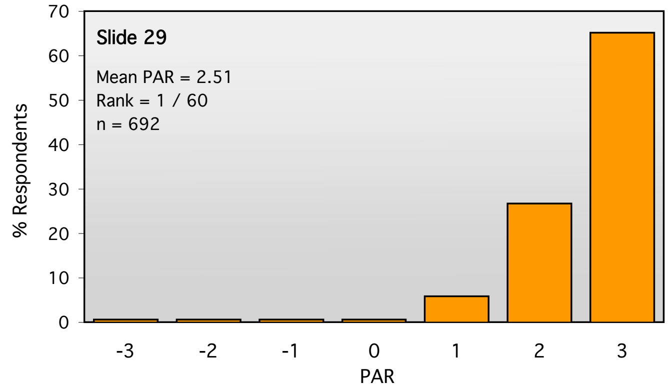
- Greater Terrace Beautification Society
- Coast Mountain Crawlers 4WD Association
- Zion Baptist Church
- Evangelical Church
- Lakelse Watershed Society
- Ministry of Forests and Range
- Terrace Hiking Club
- TORCA Mountain Biking Club

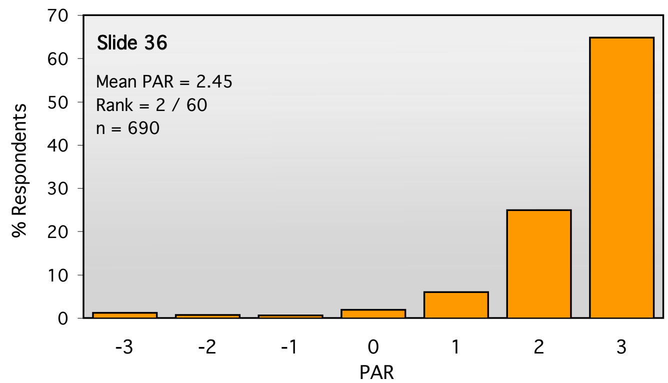
Kamloops

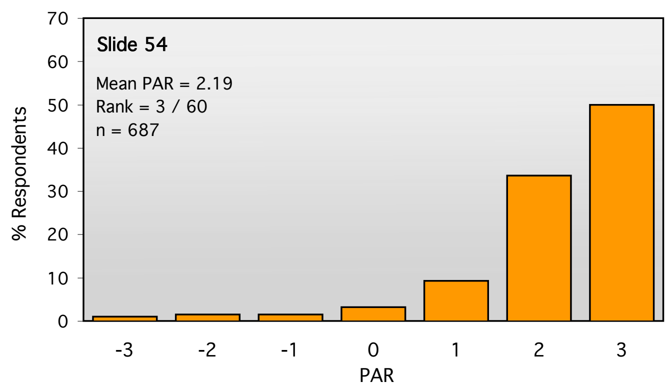
- Kiwanis Club of Downtown
- North Shore Community Centre
- New Life Mission
- Chamber of Commerce
- United Way of Thompson, Nicola, Cariboo
- Habitat for Humanity
- Sage Brush Working, Herding, and Obedience Club
- Nechako Elementary School Public Advisory Committee
- Snow Valley Nordic Ski Club
- United Church

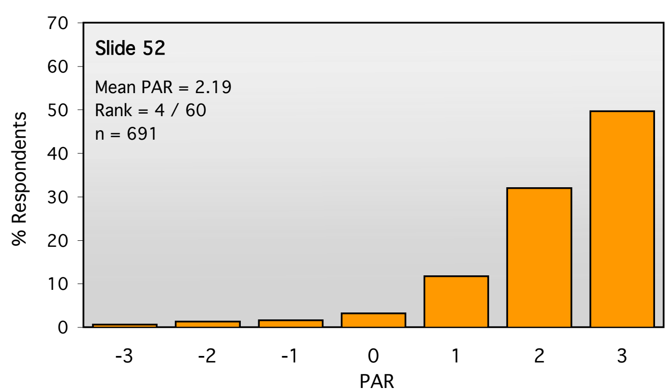
Appendix 7 Photographs used in roadside perception study

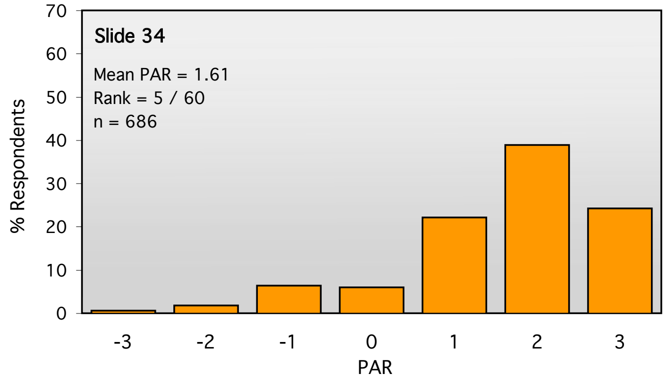
Slides in order of decreasing mean PAR

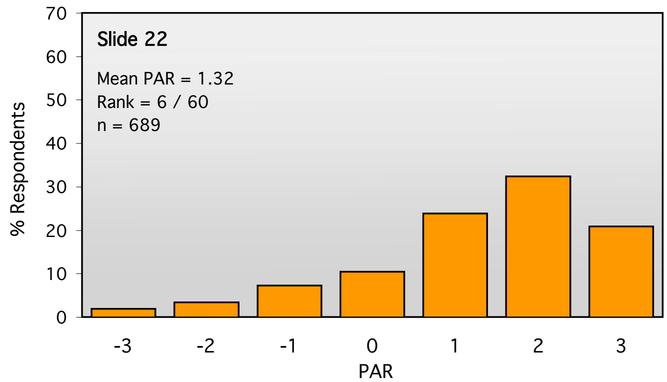



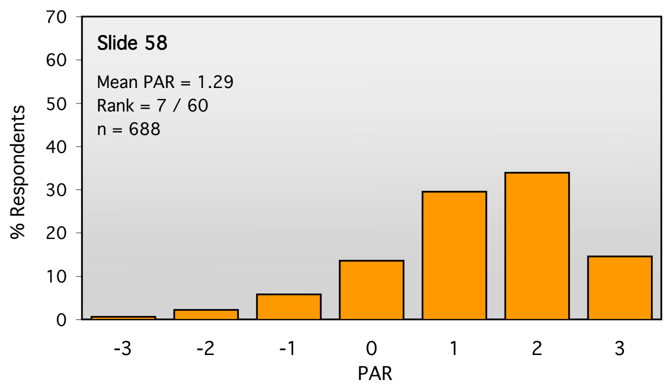



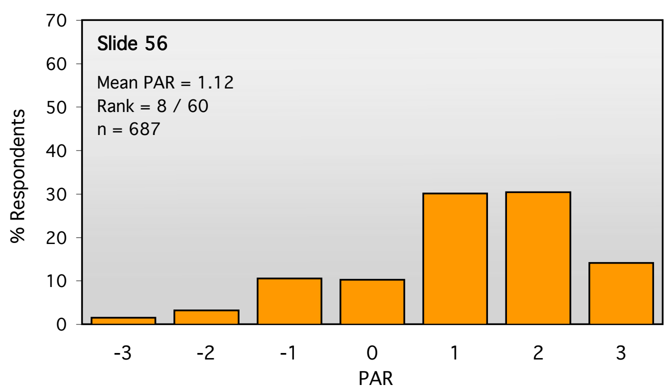



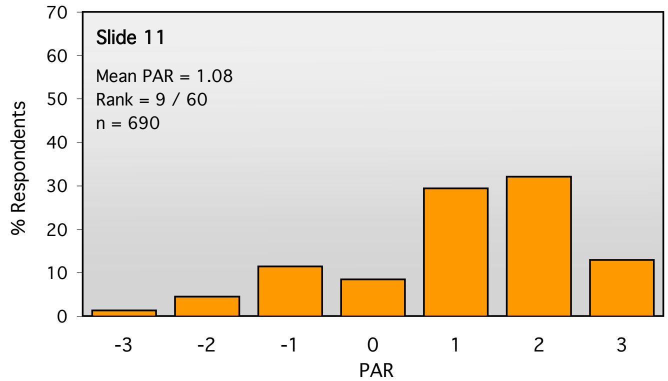



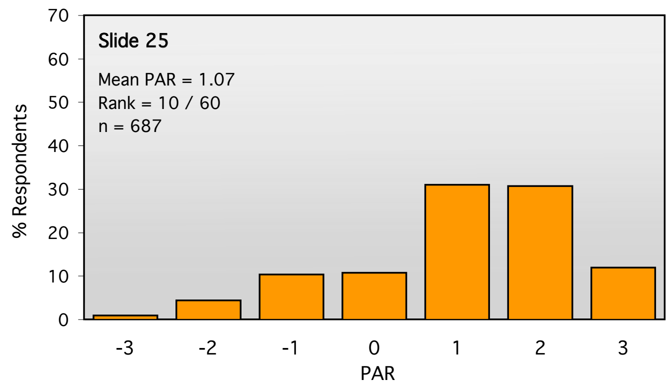

Slide 34
Mean PAR = 1.61
Rank = 5 / 60
n = 686
% Respondents
70
60
50
40
30
20
10
0
-3
-2
-1
0
1
2
3
PAR

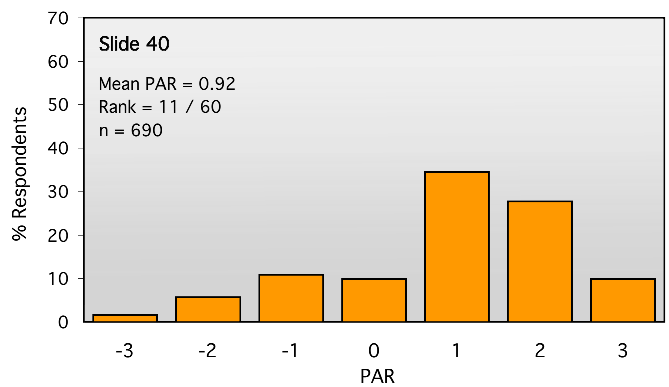

Slide 22
Mean PAR = 1.32
Rank = 6 / 60
n = 689
% Respondents
70
60
50
40
30
20
10
0
-3
-2
-1
0
1
2
3
PAR

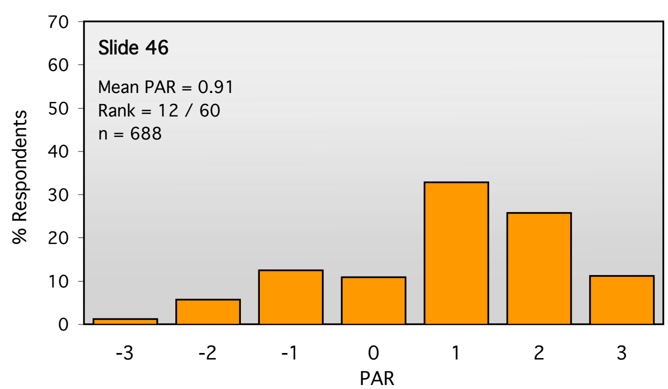

Slide 58
Mean PAR = 1.29
Rank = 7 / 60
n = 688
% Respondents
70
60
50
40
30
20
10
0
-3
-2
-1
0
1
2
3
PAR

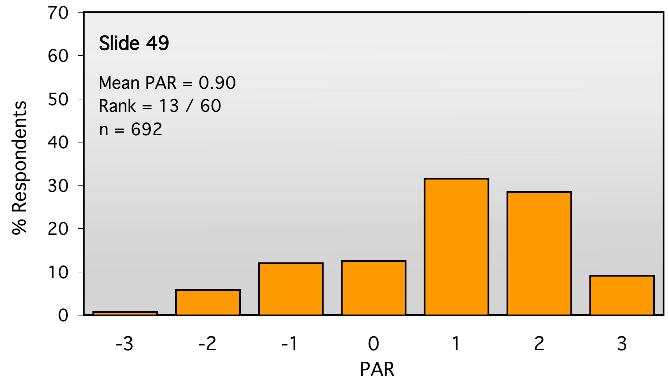

Slide 56
Mean PAR = 1.12
Rank = 8 / 60
n = 687
% Respondents
70
60
50
40
30
20
10
0
-3
-2
-1
0
1
2
3
PAR

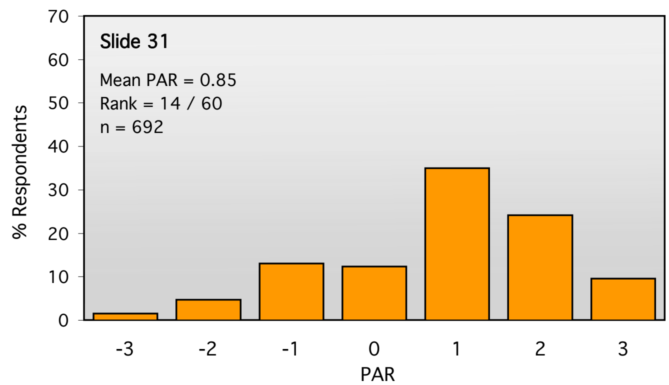

Slide 11
Mean PAR = 1.08
Rank = 9 / 60
n = 690
% Respondents
70
60
50
40
30
20
10
0
-3
-2
-1
0
1
2
3
PAR

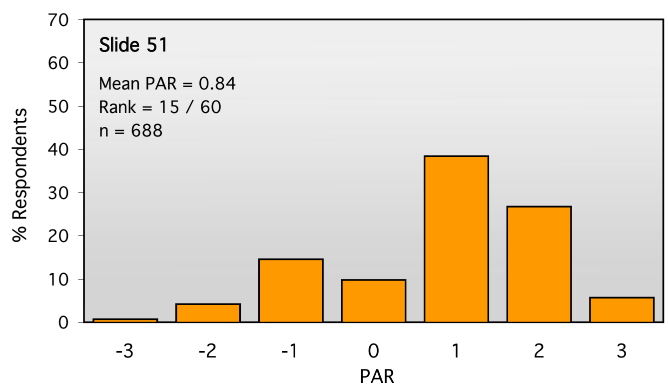

Slide 25
Mean PAR = 1.07
Rank = 10 / 60
n = 687
% Respondents
70
60
50
40
30
20
10
0
-3
-2
-1
0
1
2
3
PAR

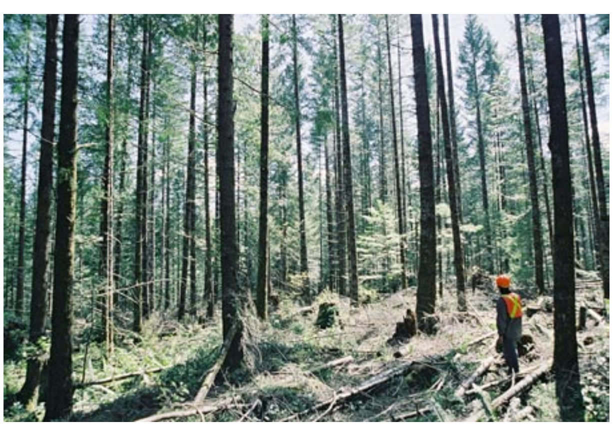

Slide 40
Mean PAR = 0.92
Rank = 11 / 60
n = 690
% Respondents
70
60
50
40
30
20
10
0
-3
-2
-1
0
1
2
3
PAR

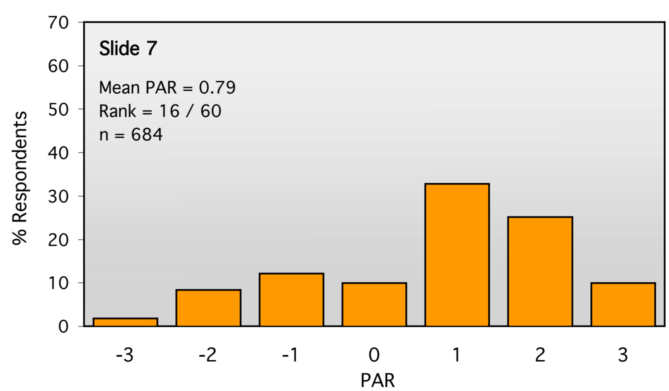

Slide 46
Mean PAR = 0.91
Rank = 12 / 60
n = 688
% Respondents
70
60
50
40
30
20
10
0
-3
-2
-1
0
1
2
3
PAR

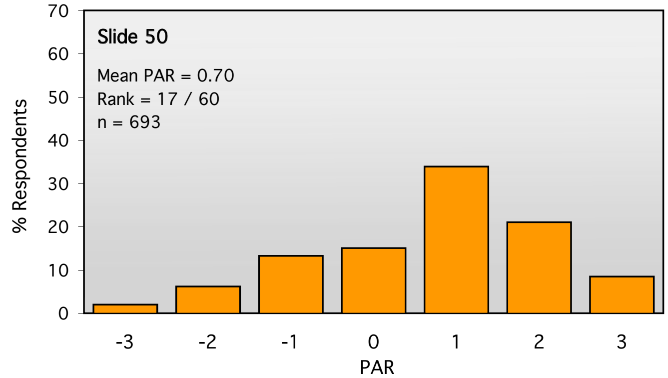

Slide 49
Mean PAR = 0.90
Rank = 13 / 60
n = 692
% Respondents
0
10
20
30
40
50
60
70
-3
-2
-1
0
1
2
3
PAR

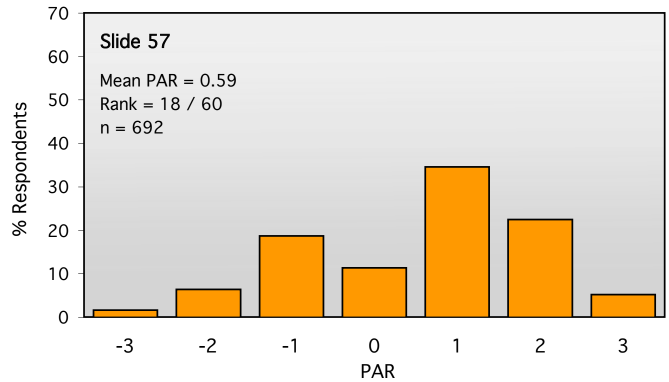

Slide 31
Mean PAR = 0.85
Rank = 14 / 60
n = 692
% Respondents
0
10
20
30
40
50
60
70
-3
-2
-1
0
1
2
3
PAR

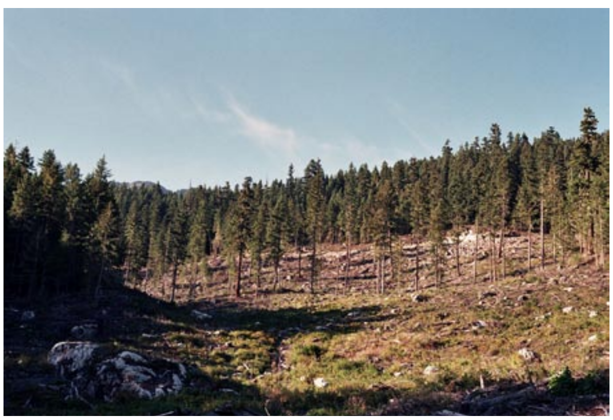

Slide 51
Mean PAR = 0.84
Rank = 15 / 60
n = 688
% Respondents
0
10
20
30
40
50
60
70
-3
-2
-1
0
1
2
3
PAR

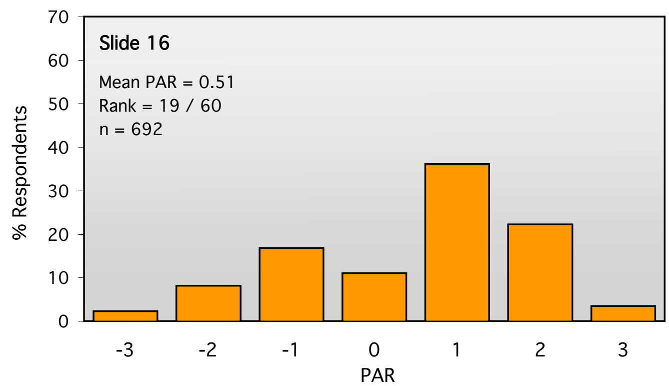


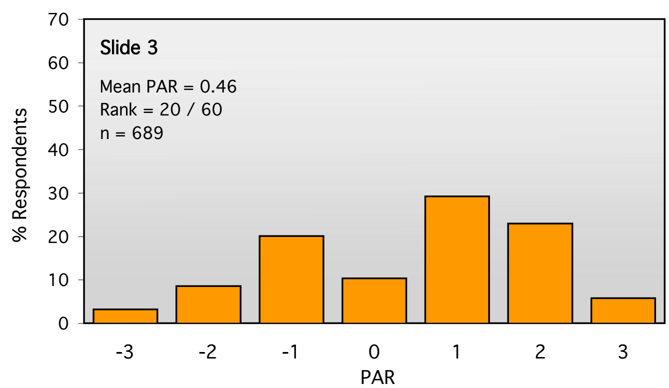

Slide 7
Mean PAR = 0.79
Rank = 16 / 60
n = 684
% Respondents
0
10
20
30
40
50
60
70
-3
-2
-1
0
1
2
3
PAR

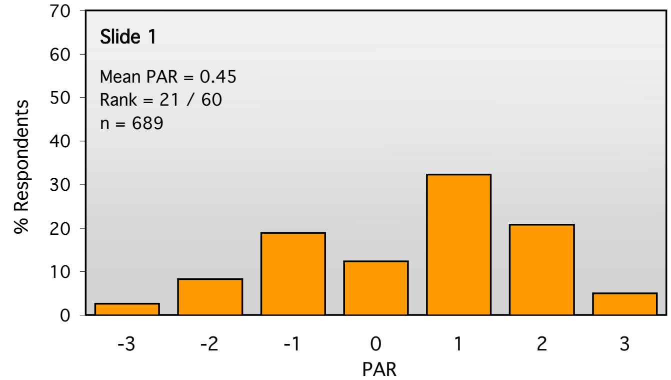

Slide 50
Mean PAR = 0.70
Rank = 17 / 60
n = 693
% Respondents
70
60
50
40
30
20
10
0
-3
-2
-1
0
1
2
3
PAR

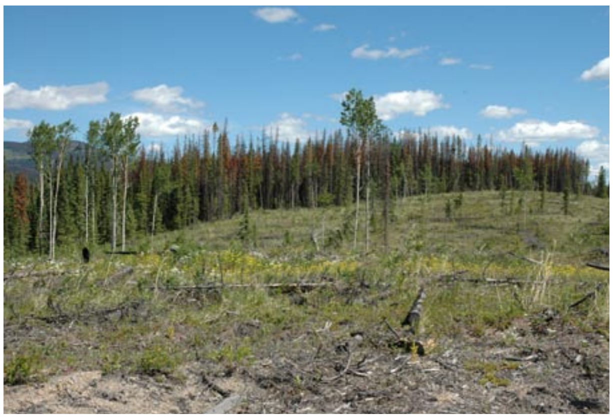

Slide 57
Mean PAR = 0.59
Rank = 18 / 60
n = 692
% Respondents
70
60
50
40
30
20
10
0
-3
-2
-1
0
1
2
3
PAR

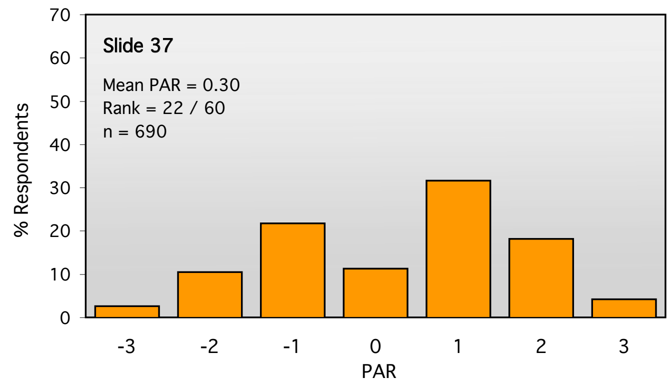


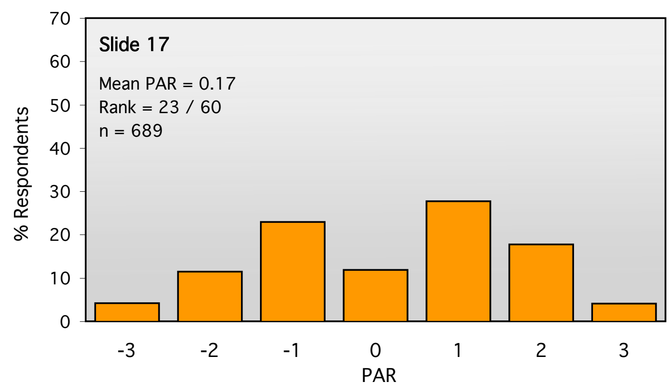

Slide 16
Mean PAR = 0.51
Rank = 19 / 60
n = 692
% Respondents
70
60
50
40
30
20
10
0
-3
-2
-1
0
1
2
3
PAR

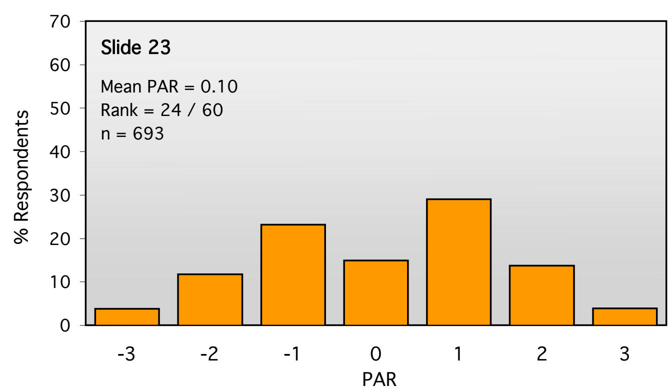

Slide 3
Mean PAR = 0.46
Rank = 20 / 60
n = 689
% Respondents
70
60
50
40
30
20
10
0
-3
-2
-1
0
1
2
3
PAR

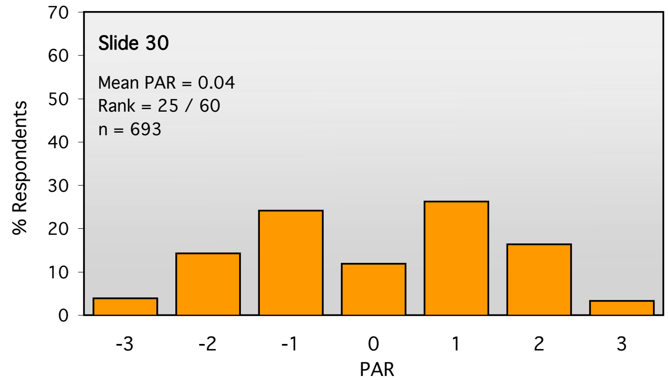

Slide 1
Mean PAR = 0.45
Rank = 21 / 60
n = 689
% Respondents
70
60
50
40
30
20
10
0
-3
-2
-1
0
1
2
3
PAR

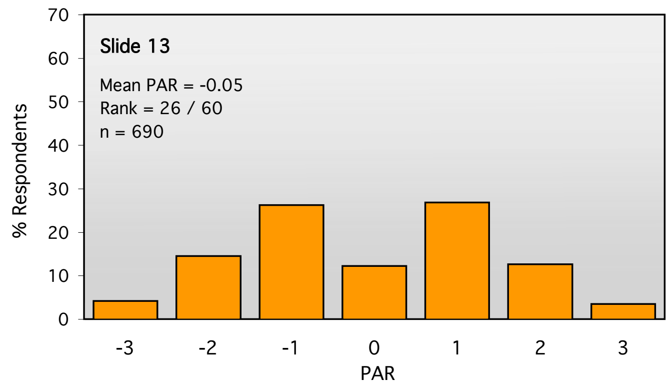


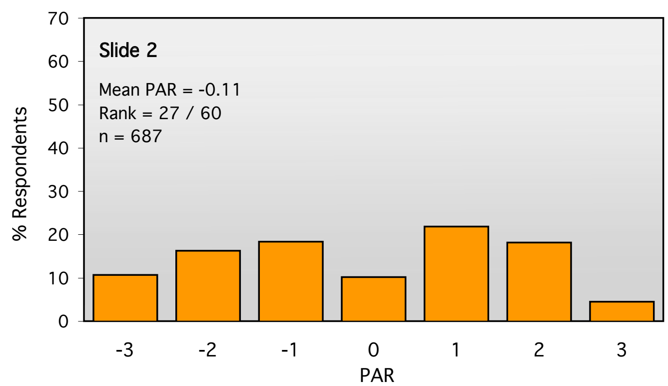

Slide 37
Mean PAR = 0.30
Rank = 22 / 60
n = 690
% Respondents
70
60
50
40
30
20
10
0
-3
-2
-1
0
1
2
3
PAR

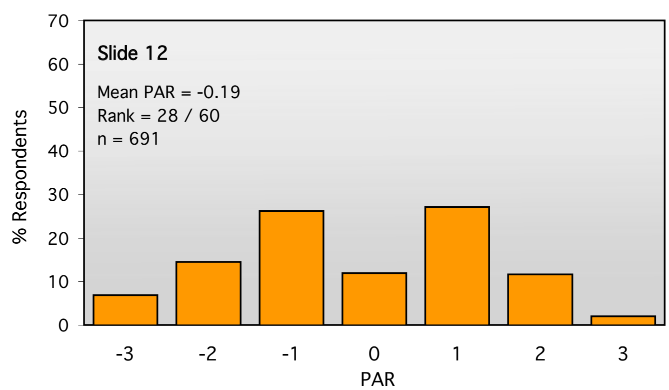

Slide 17
Mean PAR = 0.17
Rank = 23 / 60
n = 689
% Respondents
70
60
50
40
30
20
10
0
-3
-2
-1
0
1
2
3
PAR

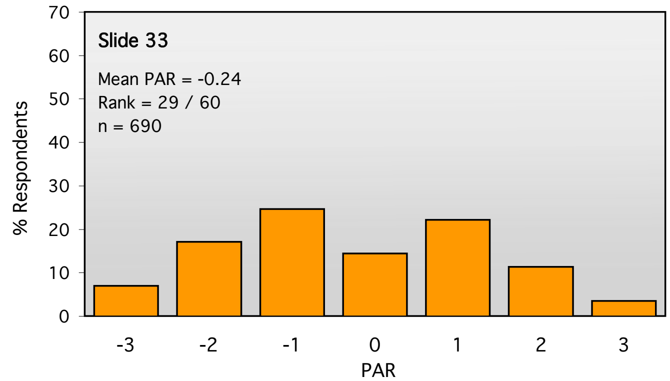

Slide 23
Mean PAR = 0.10
Rank = 24 / 60
n = 693
% Respondents
70
60
50
40
30
20
10
0
-3
-2
-1
0
1
2
3
PAR

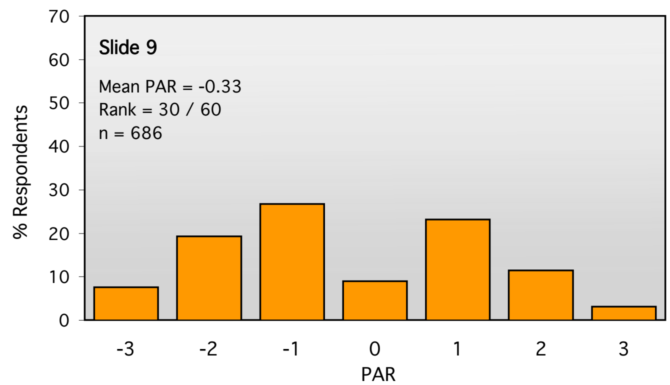

Slide 30
Mean PAR = 0.04
Rank = 25 / 60
n = 693
% Respondents
PAR

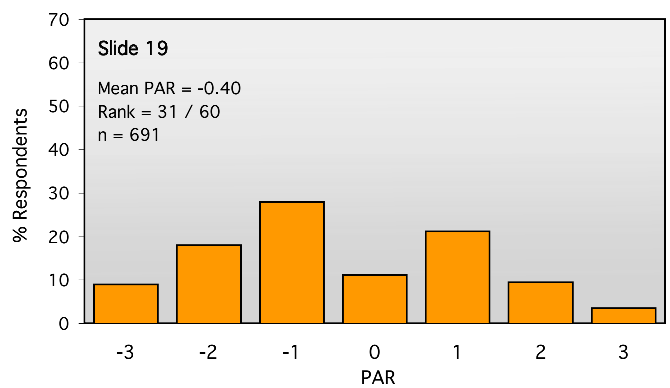

Slide 13
Mean PAR = -0.05
Rank = 26 / 60
n = 690
% Respondents
PAR

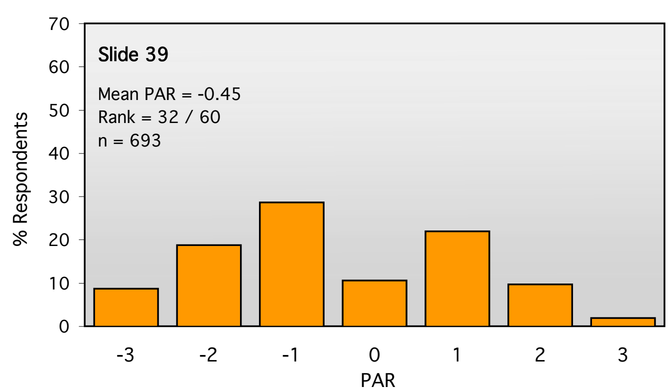

Slide 2
Mean PAR = -0.11
Rank = 27 / 60
n = 687
% Respondents
PAR

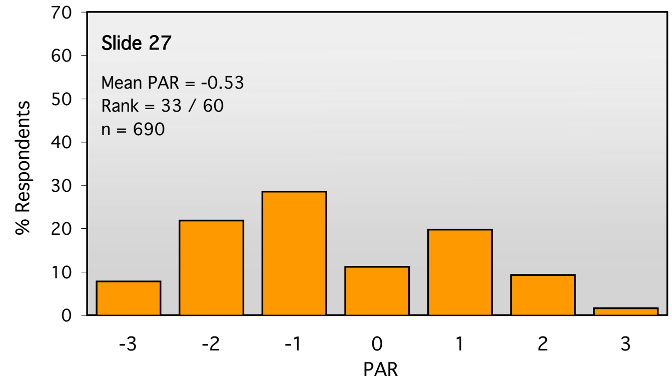

Slide 12
Mean PAR = -0.19
Rank = 28 / 60
n = 691
% Respondents
PAR

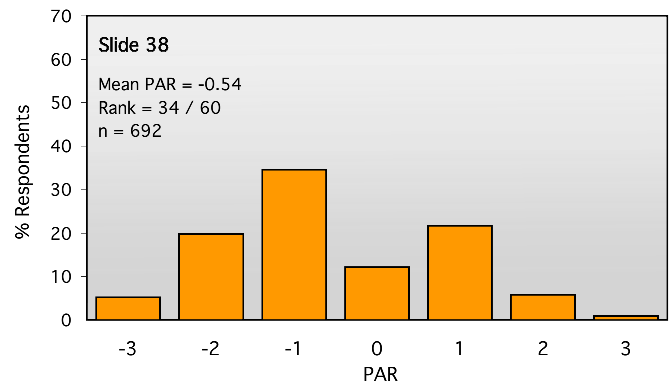

Slide 33
Mean PAR = -0.24
Rank = 29 / 60
n = 690
% Respondents
70
60
50
40
30
20
10
0
-3
-2
-1
0
1
2
3
PAR

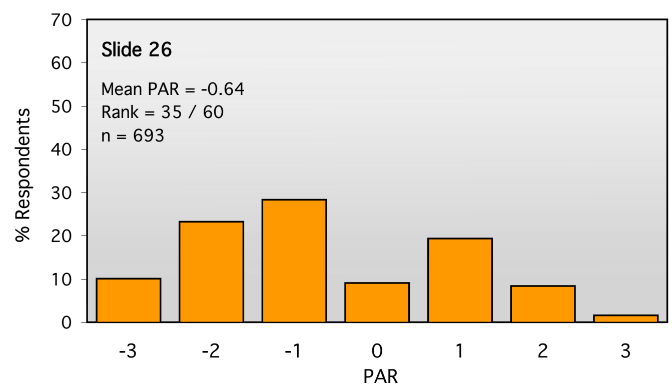

Slide 9
Mean PAR = -0.33
Rank = 30 / 60
n = 686
% Respondents
70
60
50
40
30
20
10
0
-3
-2
-1
0
1
2
3
PAR

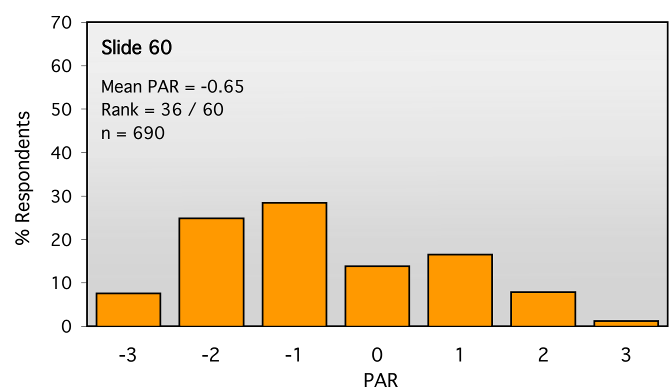

Slide 19
Mean PAR = -0.40
Rank = 31 / 60
n = 691
% Respondents
70
60
50
40
30
20
10
0
-3
-2
-1
0
1
2
3
PAR

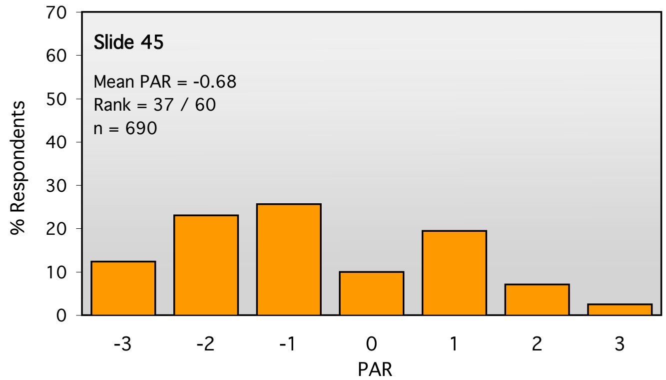

Slide 39
Mean PAR = -0.45
Rank = 32 / 60
n = 693
% Respondents
70
60
50
40
30
20
10
0
-3
-2
-1
0
1
2
3
PAR

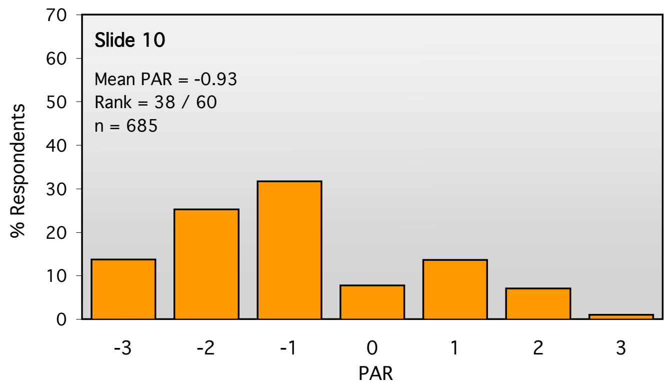

Slide 27
Mean PAR = -0.53
Rank = 33 / 60
n = 690
% Respondents
0
10
20
30
40
50
60
70
-3
-2
-1
0
1
2
3
PAR

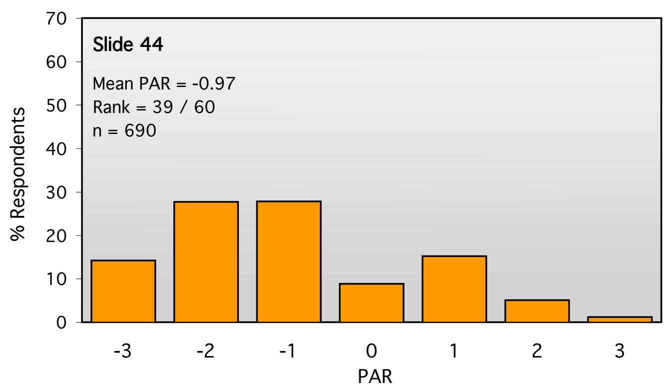

Slide 38
Mean PAR = -0.54
Rank = 34 / 60
n = 692
% Respondents
0
10
20
30
40
50
60
70
-3
-2
-1
0
1
2
3
PAR

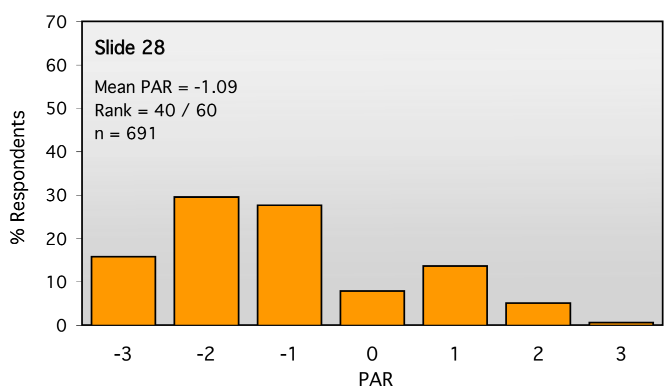

Slide 26
Mean PAR = -0.64
Rank = 35 / 60
n = 693
% Respondents
0
10
20
30
40
50
60
70
-3
-2
-1
0
1
2
3
PAR

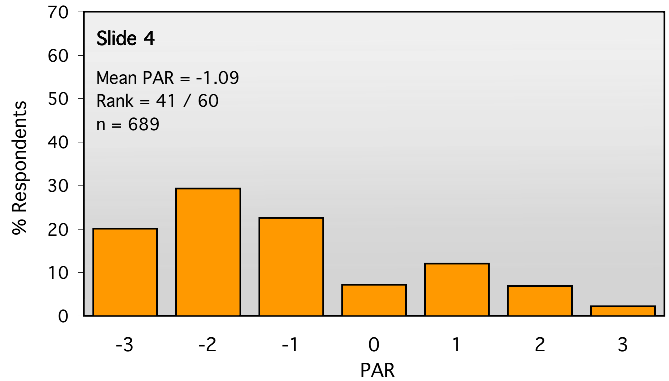

Slide 60
Mean PAR = -0.65
Rank = 36 / 60
n = 690
% Respondents
0
10
20
30
40
50
60
70
-3
-2
-1
0
1
2
3
PAR

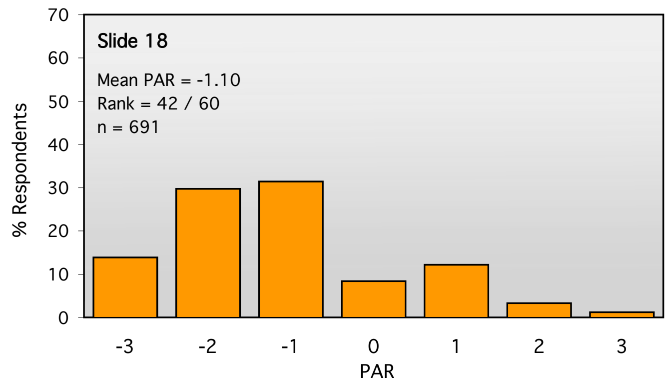

Slide 45
Mean PAR = -0.68
Rank = 37 / 60
n = 690
% Respondents
0 10 20 30 40 50 60 70
-3 -2 -1 0 1 2 3
PAR

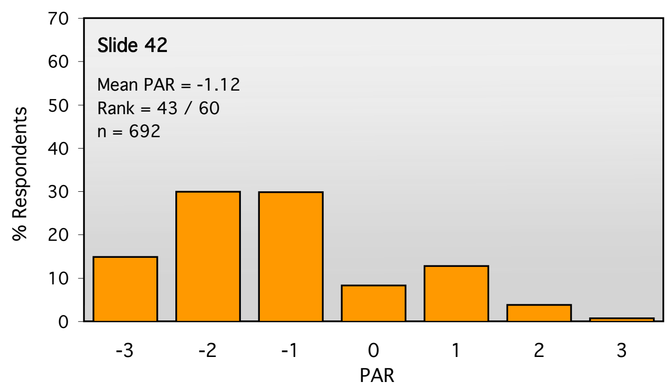

Slide 10
Mean PAR = -0.93
Rank = 38 / 60
n = 685
% Respondents
0 10 20 30 40 50 60 70
-3 -2 -1 0 1 2 3
PAR

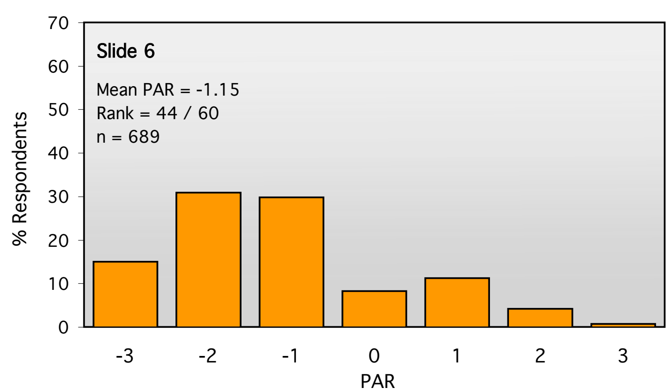

Slide 44
Mean PAR = -0.97
Rank = 39 / 60
n = 690
% Respondents
0 10 20 30 40 50 60 70
-3 -2 -1 0 1 2 3
PAR

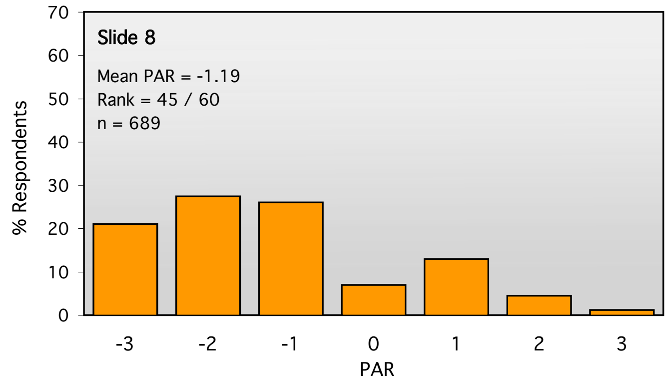

Slide 28
Mean PAR = -1.09
Rank = 40 / 60
n = 691
% Respondents
0 10 20 30 40 50 60 70
-3 -2 -1 0 1 2 3
PAR

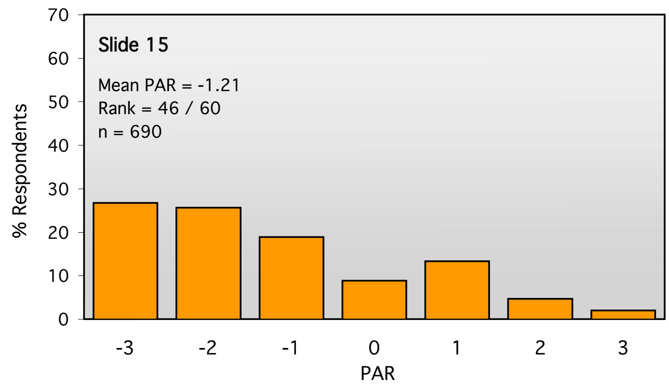

Slide 4
Mean PAR = -1.09
Rank = 41 / 60
n = 689
% Respondents
0
10
20
30
40
50
60
70
-3
-2
-1
0
1
2
3
PAR

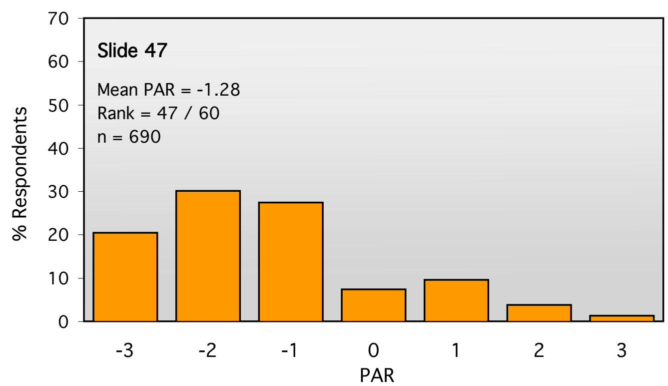

Slide 18
Mean PAR = -1.10
Rank = 42 / 60
n = 691
% Respondents
0
10
20
30
40
50
60
70
-3
-2
-1
0
1
2
3
PAR

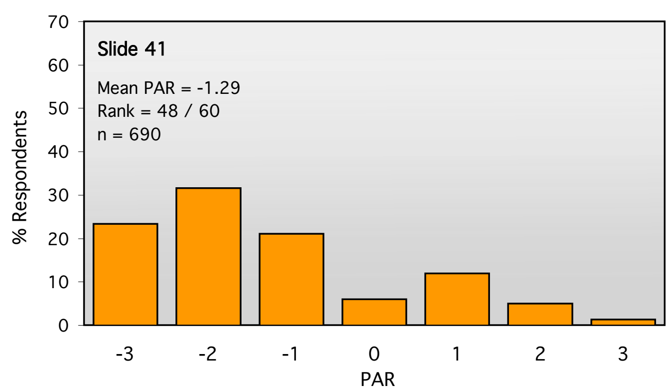

Slide 42
Mean PAR = -1.12
Rank = 43 / 60
n = 692
% Respondents
0
10
20
30
40
50
60
70
-3
-2
-1
0
1
2
3
PAR

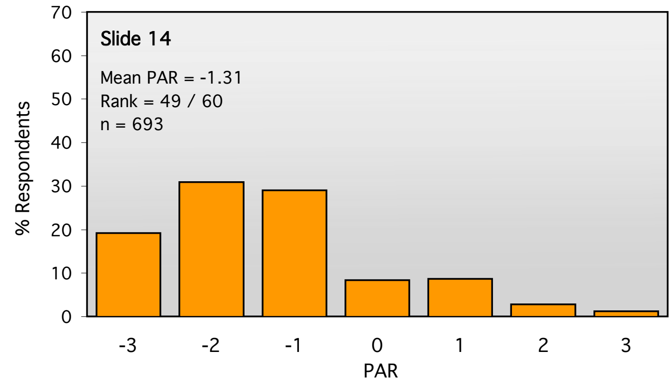

Slide 6
Mean PAR = -1.15
Rank = 44 / 60
n = 689
% Respondents
0
10
20
30
40
50
60
70
-3
-2
-1
0
1
2
3
PAR

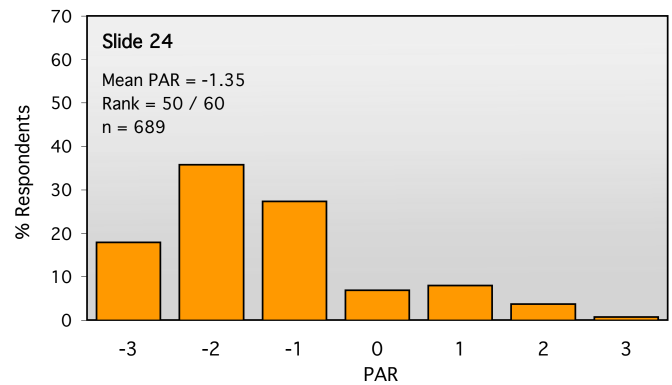

Slide 8
Mean PAR = -1.19
Rank = 45 / 60
n = 689
% Respondents
0
10
20
30
40
50
60
70
-3
-2
-1
0
1
2
3
PAR

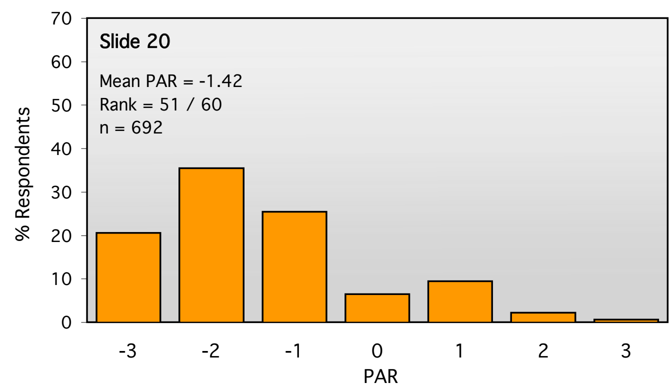

Slide 15
Mean PAR = -1.21
Rank = 46 / 60
n = 690
% Respondents
0
10
20
30
40
50
60
70
-3
-2
-1
0
1
2
3
PAR

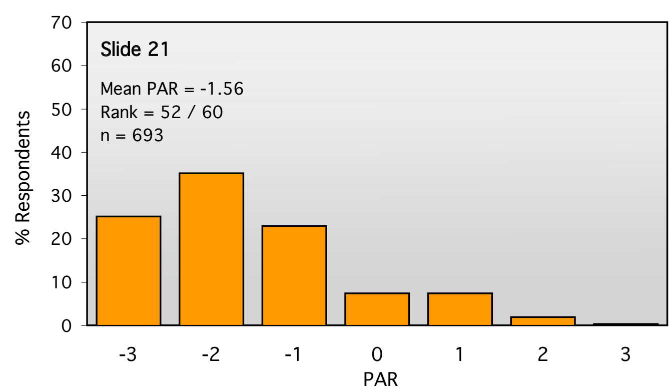

Slide 47
Mean PAR = -1.28
Rank = 47 / 60
n = 690
% Respondents
0
10
20
30
40
50
60
70
-3
-2
-1
0
1
2
3
PAR

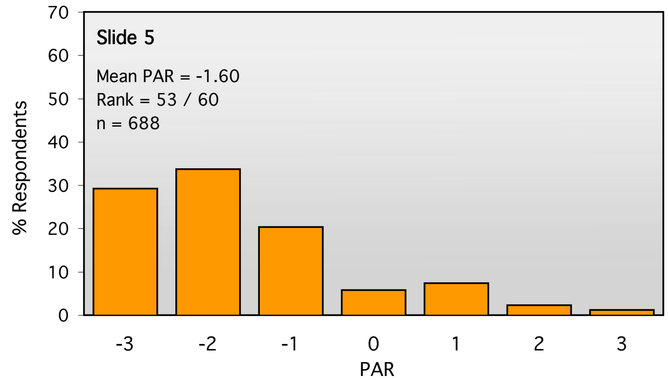

Slide 41
Mean PAR = -1.29
Rank = 48 / 60
n = 690
% Respondents
0
10
20
30
40
50
60
70
-3
-2
-1
0
1
2
3
PAR

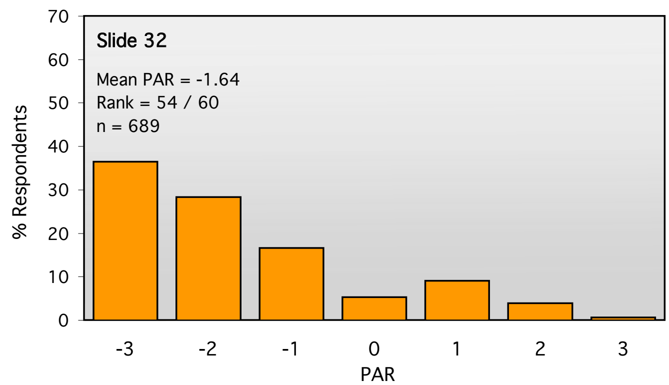

Slide 14
Mean PAR = -1.31
Rank = 49 / 60
n = 693
% Respondents
70
60
50
40
30
20
10
0
-3
-2
-1
0
1
2
3
PAR

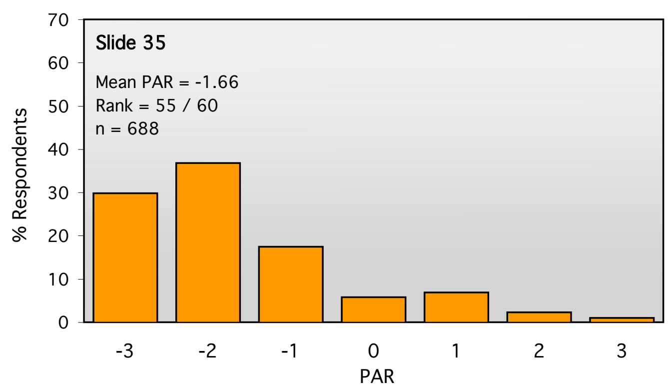

Slide 24
Mean PAR = -1.35
Rank = 50 / 60
n = 689
% Respondents
70
60
50
40
30
20
10
0
-3
-2
-1
0
1
2
3
PAR

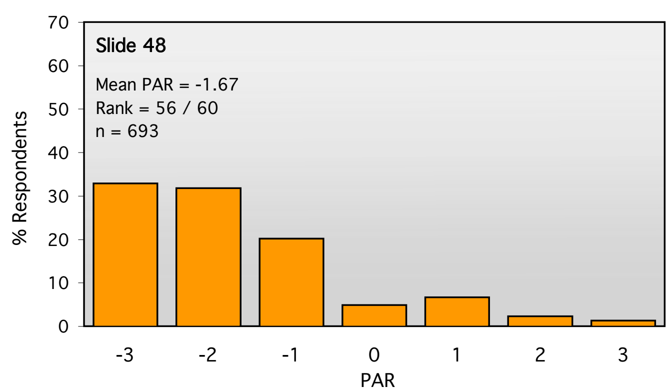

Slide 20
Mean PAR = -1.42
Rank = 51 / 60
n = 692
% Respondents
70
60
50
40
30
20
10
0
-3
-2
-1
0
1
2
3
PAR

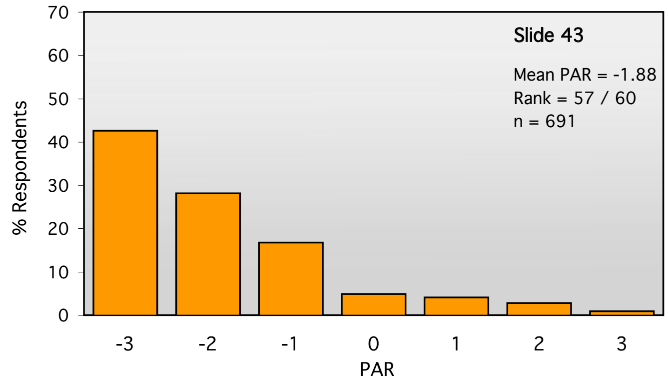

Slide 21
Mean PAR = -1.56
Rank = 52 / 60
n = 693
% Respondents
70
60
50
40
30
20
10
0
-3
-2
-1
0
1
2
3
PAR

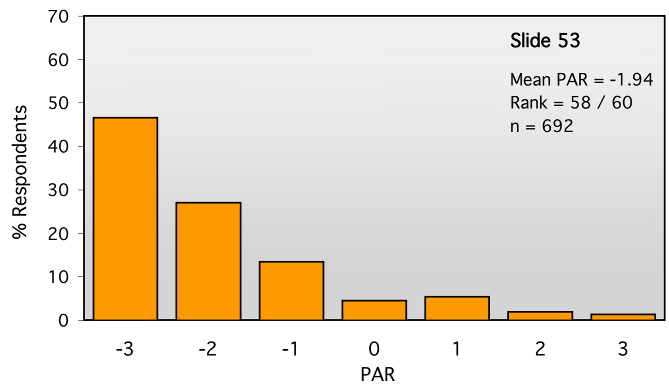

Slide 5
Mean PAR = -1.60
Rank = 53 / 60
n = 688
% Respondents
70
60
50
40
30
20
10
0
-3
-2
-1
0
1
2
3
PAR

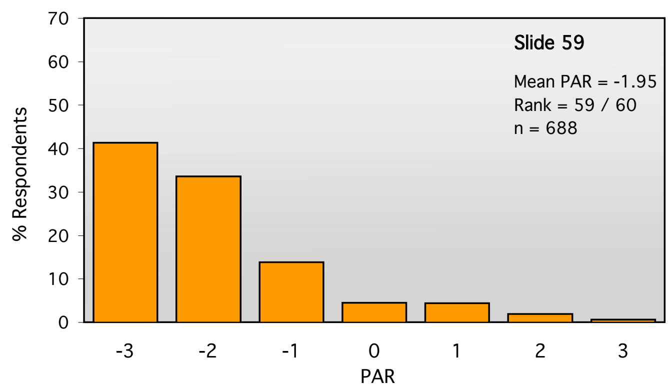

Slide 32
Mean PAR = -1.64
Rank = 54 / 60
n = 689
% Respondents
70
60
50
40
30
20
10
0
-3
-2
-1
0
1
2
3
PAR

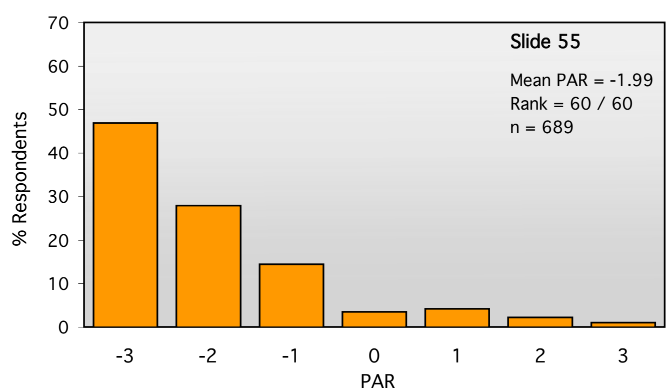

Slide 35
Mean PAR = -1.66
Rank = 55 / 60
n = 688
% Respondents
70
60
50
40
30
20
10
0
-3
-2
-1
0
1
2
3
PAR


Slide 48
Mean PAR = -1.67
Rank = 56 / 60
n = 693
% Respondents
70
60
50
40
30
20
10
0
-3
-2
-1
0
1
2
3
PAR


Slide 43
Mean PAR = -1.88
Rank = 57 / 60
n = 691
% Respondents
70
60
50
40
30
20
10
0
-3
-2
-1
0
1
2
3
PAR


Slide 53
Mean PAR = -1.94
Rank = 58 / 60
n = 692
% Respondents
70
60
50
40
30
20
10
0
-3
-2
-1
0
1
2
3
PAR


Slide 59
Mean PAR = -1.95
Rank = 59 / 60
n = 688
% Respondents
70
60
50
40
30
20
10
0
-3
-2
-1
0
1
2
3
PAR


Slide 55
Mean PAR = -1.99
Rank = 60 / 60
n = 689
% Respondents
70
60
50
40
30
20
10
0
-3
-2
-1
0
1
2
3
PAR