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Identifying Landscape Values in Prince William Sound with Public Participation Geographic Information Systems (PPGIS)

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Abstract

This chapter describes the type and spatial distribution of landscape values Alaskans identify with Prince William Sound (PWS). Data was collected from two separate public participation geographic information systems (PPGIS) studies conducted in 1998 and 2000. The results indicate that Alaskans value PWS for multiple reasons, but of greatest importance are its scenic beauty, recreational opportunities, biological richness, and economic opportunities. The spatial distribution of values are shown in a series of "hotspot" maps that reveal the clustering of different values near prominent landscape features such as Columbia Bay and Montague Island, and near the PWS communities of Cordova, Valdez, Whittier, Tatitlek, and Chenega Bay. The greatest perceived risks to PWS values are associated with large scale industrial activity such as oil transport and commercial logging or mining. Alaskans are also concerned with tourism growth leading to shoreline development and increased cruise ship activity and appear willing to regulate some aspects of tourism activity to protect PWS values.

Lessons Learned

From the participatory mapping studies of Prince William Sound, we have learned that Alaskans intensely value the Sound for its biological bounty, economic and subsistence opportunities, and life sustaining qualities. The most widely acknowledged values are its scenic beauty and recreational opportunities that are internalized and nurtured through participation in a variety of nature-based activities. Alaskans are wary about further development of the tourism sector in PWS that would increase recreational access and use, especially cruise ships and shoreline development that have the potential to compromise more intimate experiences with the Sound. While it is clear that PWS is a special place with exceptional values, it is less clear how Alaskans can effectively protect the Sound with increased access and growth of the tourism sector. The "secret" places in PWS, the nooks and crannies of a mystical landscape, are no longer secret. In the study results described herein, Alaskans have taken the first important step in the development of a sustainable recreation strategy for the Sound by identifying those places that are collectively special and worthy of protection. The next step of establishing limits of change to preserve PWS values will prove much more challenging. Alaskans have always been opportunistic, exploiting the abundant natural resources of the state. Establishing access or use limits to protect PWS values appears contradictory to an Alaskan identity that has experienced relatively few limits. But the inexorable march to increase nature-based opportunities for those unfamiliar with the Sound will not abate. In the face of increasing use, non-action does not appear to be a viable alternative. The key lesson from this study is that Alaskans share a strong, shared foundation of values for PWS upon which to build a collaborative, regulatory, or incentive-based framework for preserving those values.

Introduction

Individuals fortunate enough to have visited Prince William Sound (PWS) recognize it as a very special place. Its scenic beauty, biological richness, and seemingly limitless nature-based recreation opportunities combine to make the Sound a mecca for outdoor enthusiasts. For Alaskans that live in or near PWS, their relationship to the Sound is characterized by multiple meanings embedded with a diversity of values.

In 1998 and 2000, two separate public participation geographic information systems studies (PPGIS) were completed in Alaska that asked residents to identify what they valued about the Sound. The purpose of 1998 study was to inform the Chugach National Forest Land and Resource Management Plan, a 10-15 year plan that guides management of the 5.5 million acre national forest that cradles the Sound. The purpose of the 2000 study was to assist NGOs to develop a conservation strategy for protection of the Sound by identifying conservation "hotspots" and to examine policy issues such as shoreline development, tourism activity, and cruise ship regulation in the Sound. The two PPGIS studies, in combination, provide a reasonably comprehensive view of *what* Alaskans value about the Sound and *where* they perceive these values.

Landscape values

What is a landscape value? In the process of "place-making", humans implicitly or explicitly associate meaning and values with space. The human value formation and expression process is complex and involves both "held" and "assigned" values. Held values tend to be quite general while assigned values are more specific (McIntyre, et al., 2008). Held values are ideas or principles that are important to people (Lockwood, 1999) that take the form of enduring beliefs about a specific mode of conduct or an end state of existence (Rokeach, 1973). For example, an individual may value, in general, more natural areas over built human environments. Assigned values express the importance of an object relative to one or more other objects (Brown, 1984). For example, an individual may prefer the relatively pristine landscape of Harriman Fiord in PWS to the more industrialized eastern reach of Port Valdez. Held values are believed to

influence assigned values through the subjective evaluation of objects (Brown, 1984, Lockwood 1999). A landscape value acknowledges this internal influence and is best described as a type of "relationship" value that bridges held and assigned values. In the process of associating meanings with a place, what is personally important to an individual becomes fused with conceptions of what appears important to the individual in the physical landscape.

In a PPGIS process, individuals call upon their tacit values in the process of assigning values to a landscape such as Prince William Sound. This landscape valuation process is an attempt to have the participant recall the memories created through transactional human-landscape relationships (Zube 1987) where humans are active participants in the landscape—thinking, feeling and acting—leading to the attribution of meaning and the valuing of specific landscapes and places. These meanings and values generally result from direct experience with the Sound, but some value expressions may be informed by a more primitive archetypal human experience with a similar landscape. While it is tempting to view landscape values as "assigned" values because these values are linked to place, the influence of held values based on life experiences should not be discounted, especially with individuals that have an intimate relationship with the landscape.

Public Participation GIS

What is PPGIS? The term "public participation geographic information systems" (PPGIS) was conceived in 1996 at the meeting of the National Center for Geographic Information and Analysis (NCGIA). The concept describes the process of using GIS technologies to produce local knowledge with the goal of empowering marginalized populations. Since the 1990s, the range of PPGIS applications has been extensive, ranging from community and neighborhood planning to mapping traditional ecological knowledge of indigenous people (see Sieber, 2006; Brown, 2005; and Sawicki and Peterman, 2002 for a review of PPGIS applications and methods).

When designing, implementing, and presenting a PPGIS project, it is important to define what is meant by "public" and "participation" (Schlossberg and Shuford, 2005). The domain of public can range from decision makers to affected individuals to the random public while the domain of participation can range from simply informing the public to providing citizen control

over the decision process. In the two Alaska PPGIS studies presented herein, the public consisted of random samples of Alaska residents, the majority of which were "affected individuals". The participatory process in the Chugach National Forest is best characterized as "consultation" by the U.S. Forest Service in the forest planning process while the PWS study is best characterized as a supplemental forest planning information collection process sponsored by an NGO to inform coastal policy in the Sound.

In a PPGIS, a high degree of variability in spatial responses is to be expected, and there will be misperceptions, if not errors in the public identification of attributes on the landscape. And yet, there is an expectation that despite limitations in individual knowledge, the aggregated public responses will exhibit some degree of collective, spatial consistency. The analogy of Surowiecki's (2004) "wisdom of crowds" may be appropriate in observing that that a diverse collection of independently-deciding individuals in the PPGIS process can produce collective spatial information that is superior to individual responses in isolation, and may even rival the knowledge of experts in a field of study. At the very least, PPGIS data can serve as a "check and balance" on expert knowledge which is the traditional source of knowledge informing public lands management (Brown et al., 2004).

Integrating Landscape Values and PPGIS

The two Alaska PPGIS studies reported herein were some of the earliest efforts to incorporate participatory GIS technology for public lands planning. The studies were guided by several principles and assumptions: 1) the public has significant place-based knowledge and values that are essential to an inclusive and effective planning process, 2) the values of the general public that comprise "the silent majority" are seldom explicit in a public planning process, and 3) methods can be developed to measure the place-based information from the general public in a systematic and unbiased way. An implicit, normative assumption of the PPGIS approach is that public land management *should* be guided by public values for the region.

In determining how the general public can most effectively contribute to the planning process, the selection of the spatial attributes to be identified in the PPGIS is a significant

challenge. The spatial attributes to be measured should be general enough to accommodate multiple levels of geographic familiarity with the study region and provide a full range of human values ranging from use values (both consumptive and non-consumptive) to non-use, more abstract values. The spatial measures should be specific enough to provide guidance for allocating and managing lands for a variety of purposes. At the time of the two PPGIS studies, there were relatively few typologies of values developed for public lands (e.g., see Bengston and Xu, 1995) and none that had been developed for use in spatial data collection. The set of 13 landscape values developed and operationalized for the Chugach National Forest PPGIS was adapted from a forest values typology proposed by Rolston and Coufal (1991). The actual definitions used in the two PPGIS studies appear in Table 1. The validity of the value typology was subsequently assessed by Brown and Reed (2000) with the conclusion that the 13 values appear to represent identifiable value domains that resist grouping into higher order constructs.

A final, important question is why have the public identify landscape values in the PPGIS rather than landscape uses or activities? The answer is that values are logically and even predictably connected to landscape uses, but values provide public land management agencies with more appropriate information for long-range planning. Arguably, public lands and waters should not be managed for specific public uses indefinitely but rather managed for more general public values which can be achieved through a variety of uses. In other words, land uses and activities are more volatile, short-term conceptions of a public good while values are a more stable, enduring conception of the public good. Furthermore, a focus on the measurement of uses or activities would exclude individuals that value public lands but do not directly use them.

The remainder of the chapter presents the specific methods used to collect the landscape values in the two PPGIS studies and the key findings. The analysis is guided by the following questions: 1) what are the most important landscape values in the Prince William Sound and how are they distributed, and 2) how does proximity and familiarity with the Sound influence the distribution of values. The chapter concludes with a discussion of some survey findings from the Prince William Sound study that provide context for the landscape value results.

Methods

Data collection

Chugach National Forest Study. The Chugach NF study was initiated in 1998 with a mail survey of Alaskan residents using Dillman's (1978) total design method. The sampling methodology consisted of randomly selecting individuals from households in 12 communities (Anchorage, Cooper Landing, Cordova, Girdwood, Hope/Sunrise, Kenai, Moose Pass, Seward, Soldotna, Sterling, Valdez, and Whittier) in close proximity to the forest. Additionally, a statewide random sample of Alaskan households was selected for inclusion in the study to compare with households in close proximity to the forest. The names of the communities, sampling rates, and response rates appear in Table 2.

The sampling frame used was a database produced by the State of Alaska of all individuals in Alaska who had applied to the state to receive a permanent fund dividend (PFD) in 1997. Sampling was limited to one individual per household. An introductory letter announcing the intent of the survey was sent to each selected household prior to the actual mailing of the questionnaire with a cover letter. A follow-up reminder postcard was sent approximately 10 days after the questionnaire. The questionnaire and cover letter were accompanied by a Forest Service-printed Chugach NF map that recipients were to use to complete part of the questionnaire. Inserted in the map was a single page of sticker dots and definitions for the 13 landscape values (see Table 1 for the value definitions).

Participants were instructed to unfold the map of the Chugach NF and to find the 4 sticker dots associated with each of the 13 landscape values. Each sticker dot was printed with a unique pneumonic code representing the associated landscape value (e.g., "A" for aesthetic/scenic value). They were instructed to place the sticker dots "directly on the map over those locations on the forest that you feel best represent those values." Participants were further instructed that it was not necessary to have visited the forest location where they placed their dots because some values were related to use while others were not.

Prince William Sound Study. The Prince William Sound study was initiated in November, 2000 using similar methods to the Chugach NF study. Questionnaires were mailed to

randomly selected households in the PWS communities of Cordova, Valdez, Whittier; the villages of Tatitlek and Chenega Bay; the city of Anchorage; and a random statewide sample of Alaskan residents. There were three rounds of mailing: 1) the initial survey packet with cover letter and map, 2) a follow-up reminder postcard, and 3) a second survey with cover letter and map. The survey sample was randomly drawn from the State of Alaska's year 2000 Permanent Fund Dividend (PFD) database. The communities, sampling rates, and response rates appear in Table 2.

The mapping instructions were nearly identical to those used in the Chugach NF study. The only differences between the two studies in the mapping activity were as follows: 1) the map used in the PWS study was greyscale rather than color, 2) the PWS study contained three sticker dots for each landscape value rather than four, and 3) the PWS study had three stickers allocated to the mapping of "special places".

To provide context for the value mapping activity, the PWS study contained a series of survey questions that asked opinions about potential threats to PWS values such as oil transport, shoreline development, increased small tour operator activity, and large cruise ships. These questions were measured on a five-point Likert scale ranging from "No impact" to "Very large impact".

Data analysis

*GIS data preparation***.** The sticker dots representing the 13 landscape values from the two studies were digitized into a GIS as point features. The landscape value codes and additional attributes relating to respondent characteristics (e.g., community of residence) where joined to the points.

To combine the two GIS data sets, an Alaska coastline coverage was buffered by 10 kilometers to capture near shore points. This coverage was combined with a GIS coverage that included the entire marine area of the Sound. The end result was a study area polygon that included all the waters and islands of PWS extending inland along the coast for 10 kilometers.

Data summary. To describe the general distribution of the landscape values within the study area, the number of landscape value points were summed and ranked for each value and

the nearest neighbour R statistic was calculated. The R statistic is a global measure of the point distribution and tests the hypothesis that each point distribution is completely spatially random (CSR) in the study area. The R statistic is a ratio of observed distances between points to the expected distances between points if the points were randomly distributed. The R scale ranges from R = 0 (completely clustered) to R = 1 (random) to R = 2.149 (completely dispersed). From the R statistic, a standardized z score is computed to test the hypothesis that the point distribution deviates from randomness, either toward clustering or uniformity. Z scores greater than ±1.96 (95% confidence level) lead to rejection of the null hypothesis of random point distribution.

Data visualization. "Hotspot" maps of the point distributions for the 13 landscape values were generated using kernel density estimation techniques in ArcGIS Spatial Analyst®. To generate the kernel density map, a circular neighbourhood area of 3000 meters was defined around each landscape value and a smoothly curved surface was fitted over each point. The surface value is highest at the point location and diminishes reaching 0 at the edge of the neighbourhood area. Each kernel density map is a raster data layer with a grid resolution of 500 m that shows how the intensity of a landscape value changes over the PWS study area. Kernel density maps were also generated for all combined landscape values for each of the three PWS communities of Cordova, Valdez, and Whittier, as well as Anchorage.

Results

The overall survey response rate for the two studies was about 31 percent with a total of 13, 895 landscape value points identified in the study area. The PWS communities of Cordova, Valdez, and Whittier were sampled in both studies. In the Chugach NF study, these communities had response rates of about 32, 26, and 33 percent and 40, 36, and 45 percent respectively in the PWS study (see Table 2). Respondent characteristics were similar for the two studies with more male respondents (62 percent), middle-aged (mean 47 years), long-time Alaska residents (mean 26 years), with about 8 percent Alaska Native.

The frequency, rank, and nearest neighbour statistic (R) for the 13 landscape values appear in Table 3. Not surprisingly, the most frequently mapped value in the two studies was

aesthetic/scenic value followed by recreation value. The least frequently mapped landscape values were intrinsic, spiritual, and cultural values. The hypothesis of completely spatially random (CSR) was rejected for each landscape value. The spatial distribution of the landscape values ranged from the most highly clustered value of cultural (R=.60) to the most highly dispersed values of biological, life sustaining, spiritual, and future value (R=.76).

A series of maps show the spatial distribution of the landscape values in Figures 1-3. There are few areas in PWS that are not valued for its scenery, however, aesthetic values cluster in the areas near Columbia Bay (highest concentration), Cordova, Port Wells extending into College Fiord, Port Valdez, and various islands such as Montague, Knight, and Naked Islands (see Figure 1a). As with many of the mapped landscape values, there was significant placement of aesthetic values in the center of PWS which are interpreted as "whole Sound" values. Recreation value had a similar distribution to aesthetic value but with higher clusters of values located in the two primary PWS access points of Whittier and Valdez (see Figure 1b).

Biological and life sustaining value were among the most spatially dispersed values in PWS (see Figure 1c and 1f). These values had the highest concentration of points placed to represent the whole Sound (note the significant concentration in the center of the Sound). In contrast, economic value clustered around 5 areas—the communities of Cordova, Valdez, and Whittier, as well as Esther Island and Main Bay where salmon hatcheries are located (see Figure 1d). Esther Island and Main Bay are also frequented by tour operators. Subsistence value is somewhat more distributed than economic value with key concentrations located near Cordova (e.g., Hawkins Island) and the native villages of Tatitlek and Chenega Bay (Figure 1e).

The landscape values of historic and cultural indicate distinct spatial clusters (Figure 2b and 2f). Cultural values are located near the communities of Cordova/Eyak, Tatitlek, and the locations of the historic and present Chenega villages. The original Chugach Aluttiq village on Chenega Island was destroyed by the Good Friday Earthquake tsunami in 1964. The present village of Chenega Bay was relocated southward to Evans Island in 1982. Historic values are located in the same areas identified for cultural value, but also include additional areas known for World War II history such as the port of Whittier and Hinchinbrook Island. A significant number of respondents also indentified historical places associated with the 1989 Exxon Valdez

oil spill such as Bligh Reef, where the tanker ran aground, and McPherson Bay on Naked Island where the Exxon Valdez was towed for shelter following the spill.

The more abstract and intangible landscape values of intrinsic (Figure 2d), spiritual (Figure 2e), and future value (not shown) are distributed throughout the Sound. Intrinsic value is predominantly viewed as a whole Sound value while spiritual values reflect both Alaska Native spirituality around the Alaska Native villages of Tatitlik, Chenega Bay, and Eyak, as well as highly scenic places such as Esther and Culross Islands. The spatial distribution of future value is similar to intrinsic value but with greater intensity of points and a significant whole Sound cluster.

The distribution of landscape values for the PWS communities generally reflects the spatial proximity of the respondent community. For example, the landscape values for Cordova (Figure 3a), Valdez (Figure3b), and Whittier (Figure 3c) tend to concentrate along the coast within 20 to 30 kilometers of the community. The spatial distribution of landscape values for Anchorage residents (Figure 3d) are more dispersed throughout the Sound, although the highest concentration is near Whittier, the closest access point for Anchorage residents. The distribution of responses by all respondents from all communities surveyed (Figure 3e) reveals that despite the relative remoteness of the Sound, there are few places in the Sound that don't hold significant value to the residents of Alaska.

Finally, the PWS study provided an opportunity for respondents to indicate "special places" for any reason. In addition to the special places located near one's community, respondents chose to emphasize highly scenic and more remote locations such as Columbia Bay, Culross Passage, Blackstone Bay, Harriman Fiord, and Naked Island (see Figure 3f).

Discussion

The maps from this PPGIS study reveal there are no empty places in the Sound without significant value. Alaskans know the Sound intimately and value the Sound for many reasons, but of greatest importance are its scenic beauty, recreational opportunities, biological richness, and economic opportunities. Subsistence values are especially important to residents of Cordova/Eyak and the villages of Tatitlek and Chenega Bay. These values are strengthened

through participating in outdoor activities in the Sound, the most common being recreational fishing, using the Alaska Marine Highway, subsistence gathering, and touring/sightseeing in private boats. There is a natural tendency for PWS residents to reflect higher landscape value intensities in proximity to their communities and in areas that have access (Brown et al., 2002).

Prince William Sound is the ideal mirror to reflect the complexity of Alaskan identity that has been forged with living in a challenging but inspirational northern environment. Alaskans perceive themselves as more resourceful, risk-taking, independent, and seekers-of-wilderness than outsiders. They hold a strong utilitarian and controlling view of nature but also view themselves as more connected to the forces of nature (Brown and Alessa, 2003). In Prince William Sound, Alaskans are reminded that resource development in a biologically rich, but ecologically sensitive marine environment can have serious consequences. Having experienced the trauma of the Exxon Valdez oil spill, Alaskans now confront new threats to the values of the Sound in the form of tourism activity and development. With improved access through Whittier and increased tourism activity, their special places may become less special. For example, upon receiving the invitation to participate in the study, one Prince William Sound resident wrote back, “I don’t give away secrets.”

The desire to limit activity in perceived special places notwithstanding, identifying the type and location of values in Prince William Sound through PPGIS was not an easy task for some residents. A few appeared to reject the premise that values in the Sound could be parsed and mapped with individual landscape values. One resident commented, “the whole place fills all of these values and it is all a special place” while another stated, “you can't just put a dot on a spot when the whole of the sound is interrelated and interdependent for all the values listed.” For residents that did accept the basic premise of the PPGIS mapping activity, a few still found the task difficult, “...this is impossible. I would need many more stickers for each value” while another commented, “it is difficult to categorize and prioritize PWS. Its value is unmeasurable in our lifetime.” The majority of respondents, however, were able to identify their values and special places for the Sound.

The results of several survey questions that followed the mapping activity in the PWS study provide context for the mapping results, especially if the values identified are to be

protected in the future. Despite the ecological disaster resulting from the 1989 Exxon Valdez oil spill, Alaskans perceive the Sound to be in relatively good ecological condition and want it to remain that way. They believe shoreline development should be limited and targeted to protecting the marine environment and enhancing primitive recreation opportunities. Resort development and floating lodges are viewed as incompatible with existing values for the Sound.

Growth in the tourism sector related to Prince William Sound is small compared to tourism growth from cruise ship activity in Southeast Alaska. And yet, PWS residents expressed awareness of the potential for significant growth in marine-based tourism in Prince William Sound. PWS residents appear open to small, incremental growth in cruise ship activity but all communities oppose a large increase in cruise ship numbers. Residents of the community of Cordova were most negative about cruise ship activity while the community of Valdez appears to be the most welcoming community to locate future cruise ship activity.

Even more likely than a large increase in cruise ship activity in Prince William Sound is an increase in the number and scope of smaller tour boat operators in the Sound. PWS residents believe that tour boat operators will need to be regulated to protect the Sound; regulation is not a conclusion easily reached as it appears inconsistent with the independent Alaskan ethos. In addition to controlling air and water discharges, residents believe that all aspects of tour boats operations may require regulation in the next 10-15 years. Study respondents were deeply concerned about keeping the waters of PWS clean and are willing to regulate boats that serve the tourism sector.

Future conservation strategies for Prince William Sound should be mindful of the elements that pose the greatest risk to the marine environment. When asked to evaluate activities with the greatest potential impact to PWS, the largest potential impacts were related to industrial activity in the Sound: oil spills, mining, and logging activity (see Figure 4). Respondents were concerned about the potential catastrophic nature of these large-scale activities. Of less concern to respondents, but arguably more probable, are impacts associated with tourism growth in PWS. Large cruise ships and shoreline development were evaluated as having between medium and large potential impact on the Sound. Because of the incremental but cumulative nature of

increased tourism activity, a defensible conservation strategy would be to establish thresholds of acceptable change in the Sound, as has been done for some terrestrial wilderness areas.

Prince William Sound has ecologically survived, though perhaps not fully recovered, from a major oil spill. Significant changes in the oil transportation system were made to decrease the probability of a similar disaster. While vigilance in this area is of paramount importance, the giant lurking beneath the surface is the potential for industrial tourism and its associated impacts on the marine environment and PWS residents' quality of life. It would be prudent for the PWS communities, state and federal interests, interest groups, and visitors to the Sound to engage in a comprehensive, proactive planning process that seeks to protect the current values in the Sound. Without a serious dialogue about the limits of acceptable change in the Sound, incremental changes may overwhelm the very attributes of the Sound that make it so special to its residents and visitors.

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Table 1. Value definitions used in the Chugach National Forest (CNF) and Prince William Sound (PWS) questionnaires.

Aesthetic value— CNF: I value the forest because I enjoy the forest scenery, sights, sounds, smells, etc. PWS: I value Prince William Sound for its scenery—its mountains, glaciers, forests, tidelands, bays, and islands.

Economic value— CNF: I value the forest because it provides timber, fisheries, minerals, or tourism opportunities such as outfitting and guiding. PWS: I value Prince William Sound because it provides economic opportunities in industries such as fisheries, tourism, timber, minerals, or oil transport.

Recreation value— CNF: I value the forest because it provides a place for my favorite outdoor recreation activities. PWS: I value Prince William Sound because it provides a place for outdoor recreation activities.

Life Sustaining value— CNF: I value the forest because it helps produce, preserve, clean, and renew air, soil, and water. PWS: I value Prince William Sound because it is a place that helps produce, preserve, clean, and renew air, soil, and water.

Learning value— CNF: I value the forest because we can learn about the environment through scientific observation or experimentation. PWS: I value Prince William Sound because we can learn about the environment from it through scientific observation or experimentation.

Biological diversity value—CNF: I value the forest because it provides a variety of fish, wildlife, plant life, etc. PWS: I value Prince William Sound because it provides a variety of marine life, plants, waterfowl and places for them to live.

Spiritual value— CNF: I value the forest because it is a sacred, religious, or spiritually special place to me or because I feel reverence and respect for nature there. PWS: I value Prince William Sound because it is a sacred, religious, or spiritually special place to me or because I feel reverence and respect for nature there.

Intrinsic value— CNF: I value the forest in and of itself for its existence, no matter what I or others think about the forest. PWS: I value Prince William Sound in and of itself for its existence, no matter what I or others think about it or how we use it.

Historic value— CNF: I value the forest because it has places and things of natural and human history that matter to me, others, or the nation. PWS: I value Prince William Sound because it has places and things of natural and human history that matter to me, others, or the nation.

Future value— CNF: I value the forest because it allows future generations to know and experience the forest as it is now. PWS: I value Prince William Sound because it allows future generations to know and experience the Sound as it is now.

Subsistence value— CNF: I value the forest because it provides necessary food and supplies to sustain my life. PWS: I value Prince William Sound because it provides necessary food and supplies to sustain people's lives.

Therapeutic value— I value the forest because it makes me feel better, physically and/or mentally. PWS: I value Prince William Sound because it makes people feel better, physically and/or mentally.

Cultural value— I value the forest because it is a place for me to continue and pass down the wisdom and knowledge, traditions, and way of life of my ancestors. PWS: I value Prince William Sound because it is a place for people to continue and pass down the wisdom and knowledge, traditions, and way of life of ancestors.

Table 2. List of communities sampled and the survey response rate for Chugach National Forest Study (1998) and the Prince William Sound study (2000).

	Chugach National Forest Study (1998)		Prince William Sound Study (2000)	
Community	Households Sampled[1]	Survey Response Rate (%)	Households Sampled[1]	Survey Response Rate (%)
Anchorage	281	29.7	386	23.3
Cooper Landing	148	43.9	-	-
Cordova	250	31.7	418	40.4
Girdwood	229	34.9	-	-
Hope	75	36.9	-	-
Kenai	265	27.4	-	-
Moose Pass	92	43.9	-	-
Seward	243	30.9	-	-
Soldotna	259	32.4	-	-
Sterling	239	36.4	-	-
Valdez	253	26.0	420	36.4
Whittier	113	22.5	68	45.1
Tatitlek/Chenega Bay	-	-	42	11.9
Other Alaska	319	21.0	381	20.7
Overall Response		30.8		31.0

[1] Only includes surveys that were presumed delivered

Table 3. Frequency, rank, and nearest neighbour ratio of mapped landscape values in Prince William Sound (combined Chugach NF and PWS datasets).

Landscape Value	Frequency	Rank	Nearest Neighbor (R)
Aesthetic/scenic	1662	1	.66
Recreation	1464	2	.65
Economic	1163	4	.65
Biological	1280	3	.76
Life sustaining	1007	7	.76
Learning	729	8	.70
Intrinsic	643	11	.75
Subsistence	1131	5	.67
Spiritual	633	12	.76
C*ultural*	626	13	.60
Historical	724	9	.66
Therapeutic	719	10	.74
Future	1017	6	.76
Special Places*	1088	N/A	.63

Figure 1. Spatial distribution of six landscape values hotspots: (a) Aesthetic (b)Recreation (c) Biological (d) Economic (e) Subsistence (f) Life sustaining.

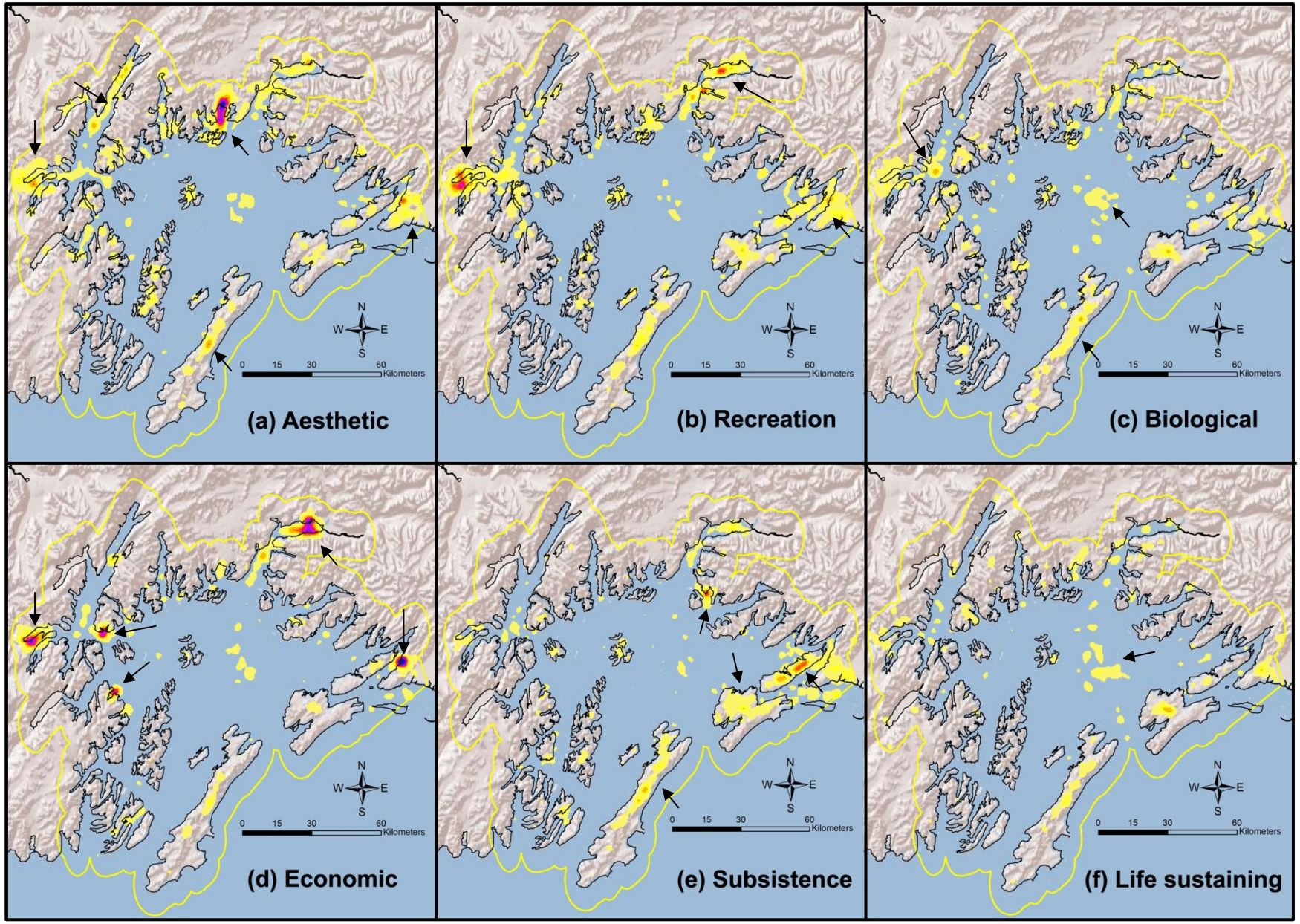

Figure 2. Spatial distribution of six landscape values hotspots: (a) Learning (b) Historical (c) Therapeutic (d) Intrinsic (e) Spiritual (f) Cultural.

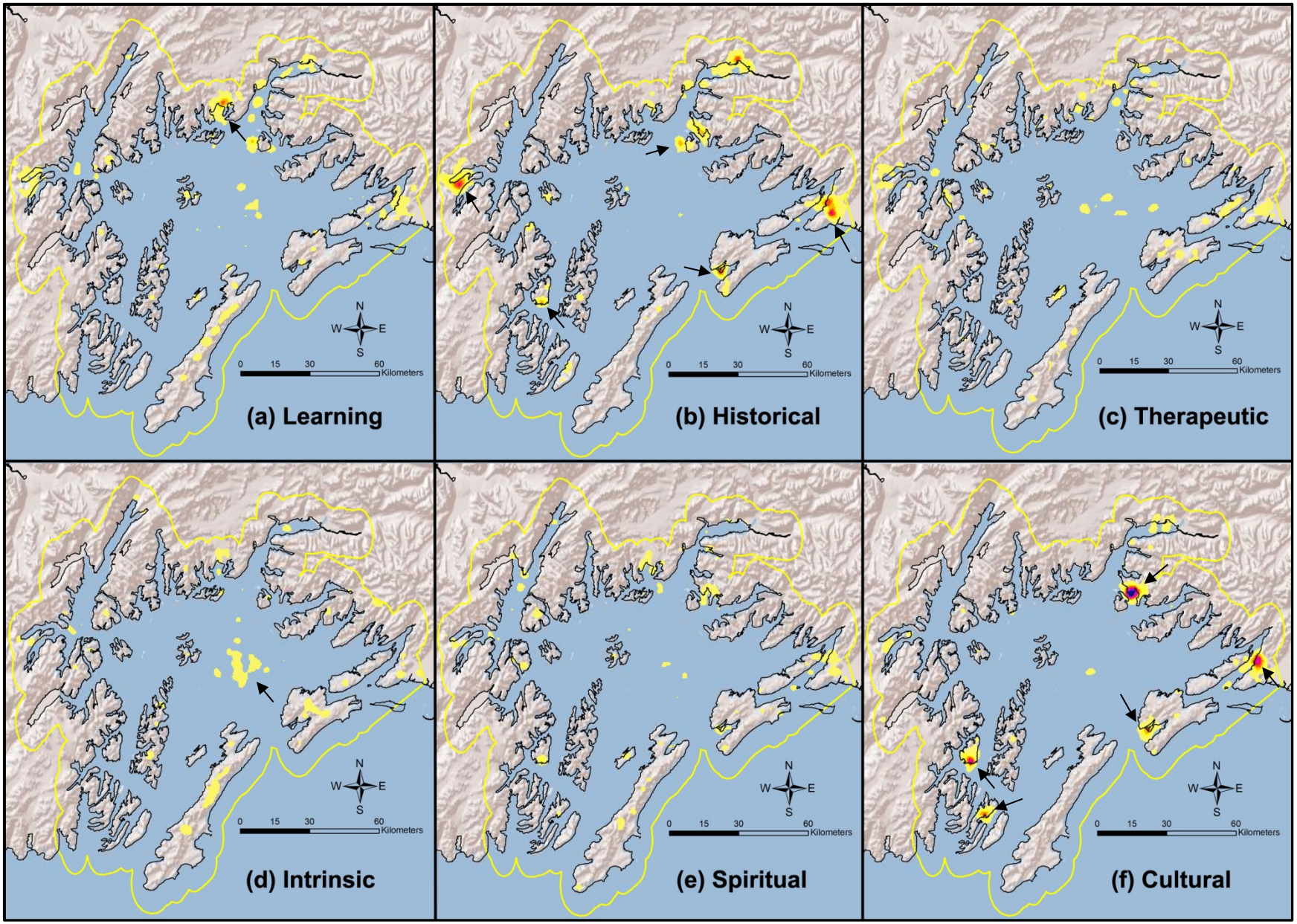

Figure 3. Spatial distribution of all landscape values by community: (a) Cordova (b) Valdez (c) Whittier (d) Anchorage (e) all values in all communities and (e) special places.

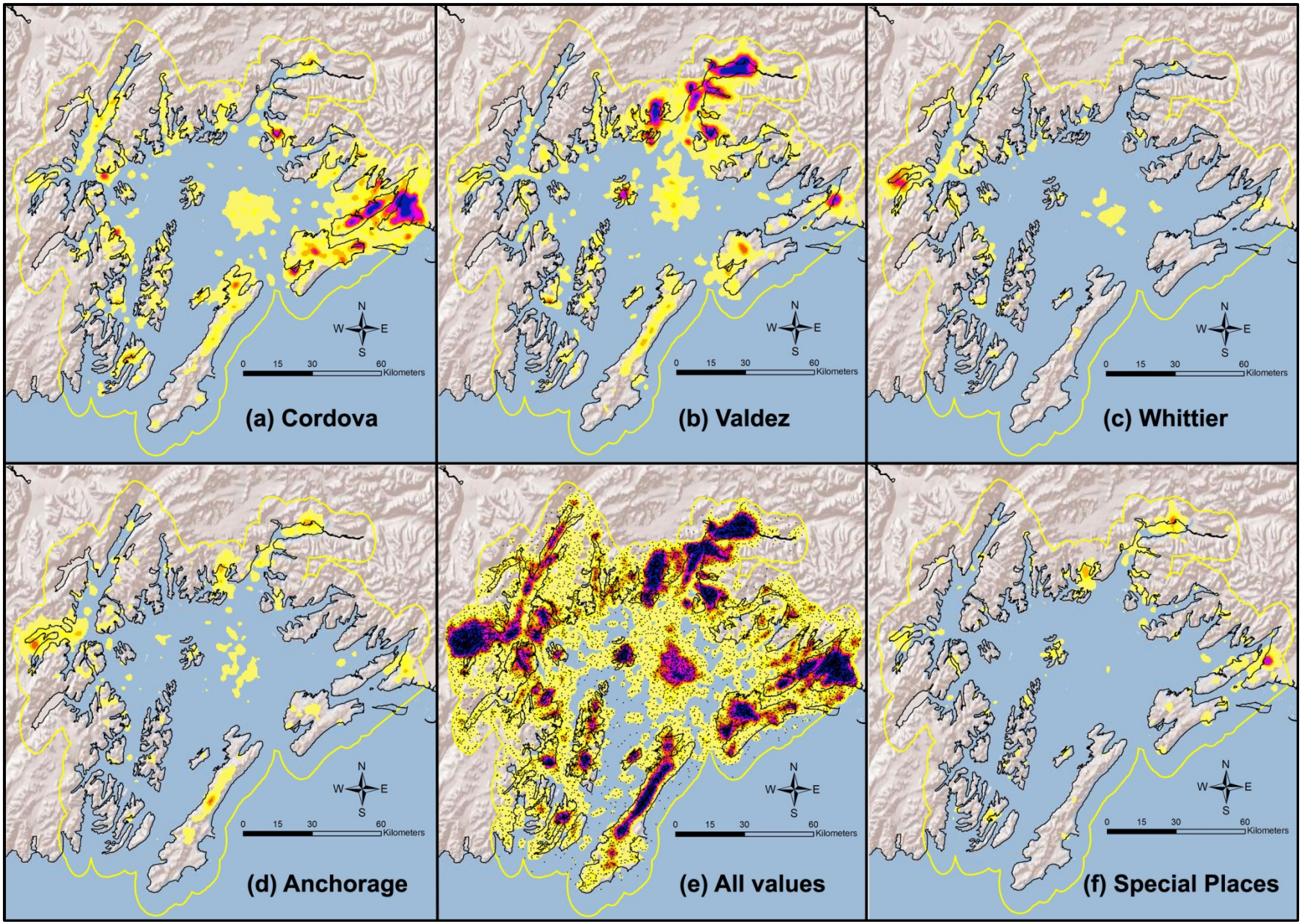

Figure 4. Alaskans perceptions of future potential impacts to Prince William Sound. Mean scores on 1 to 5 scale where 1=No impact, 2=small impact, 3=medium impact, 4=large impact, 5=very large impact. Activities with a mean value above 3.5 are perceived to have potentially large, negative impacts on the Sound.