Brown bear (Ursus arctos) habitat and signs of use: Berners Bay, Alaska site survey - June 15-19, 2003

A SEAWEAD report by:
Bob Christensen &
Cheryl Van Dyke

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Abstract

The purpose of this project was to field test survey methods for rapid habitat assessment and signs of its use by brown bears (brown bear quick cruise[1]), and to provide conservation groups and management agencies high resolution[2] information relevant to bear habitat management in the Berners Bay estuary and near-shore uplands (Fig. 1). Berners Bay was an ideal place to perform a trial of the brown bear quick cruise (BBQC) because it enabled us to add new habitat variables to our existing test record, including: large mainland river location, the presence of black bears, and the presence of moose. Although SEAWEAD did not conduct this research with the intention of gathering data suitable for detailed analysis, we were able to survey critical seasonal feeding areas and traditional travel routes. The resultant data are relevant to an environmental assessment of a proposed road in the area. Funding and in-kind support were provided by Friends of Berners Bay, the Skaggs Foundation, Sierra Club Juneau Chapter, and the US Fish and Wildlife Service. Field crew support was provided by Ayme Johnson and Aaron Wells.

Introduction

Scientists and naturalists from Southeast Alaska Wilderness Exploration, Analysis and Discovery (SEAWEAD) surveyed bear habitat near the Antler and Lace Rivers in Berners Bay, Alaska June 15-19 2003.

Habitat is an area that possesses the resources necessary for an organism or population of organisms to carry out all or a portion of its life cycle (Meffe 1997). Resources include food, cover, flows of energy and nutrients, and other biotic and abiotic characteristics that comprise a healthy ecological system (Begon et al. 1996, Chiras et al. 2002). For bears, habitat resources are those that influence suitability for feeding, denning, travel, resting-bedding, and social interaction through the course of the year.

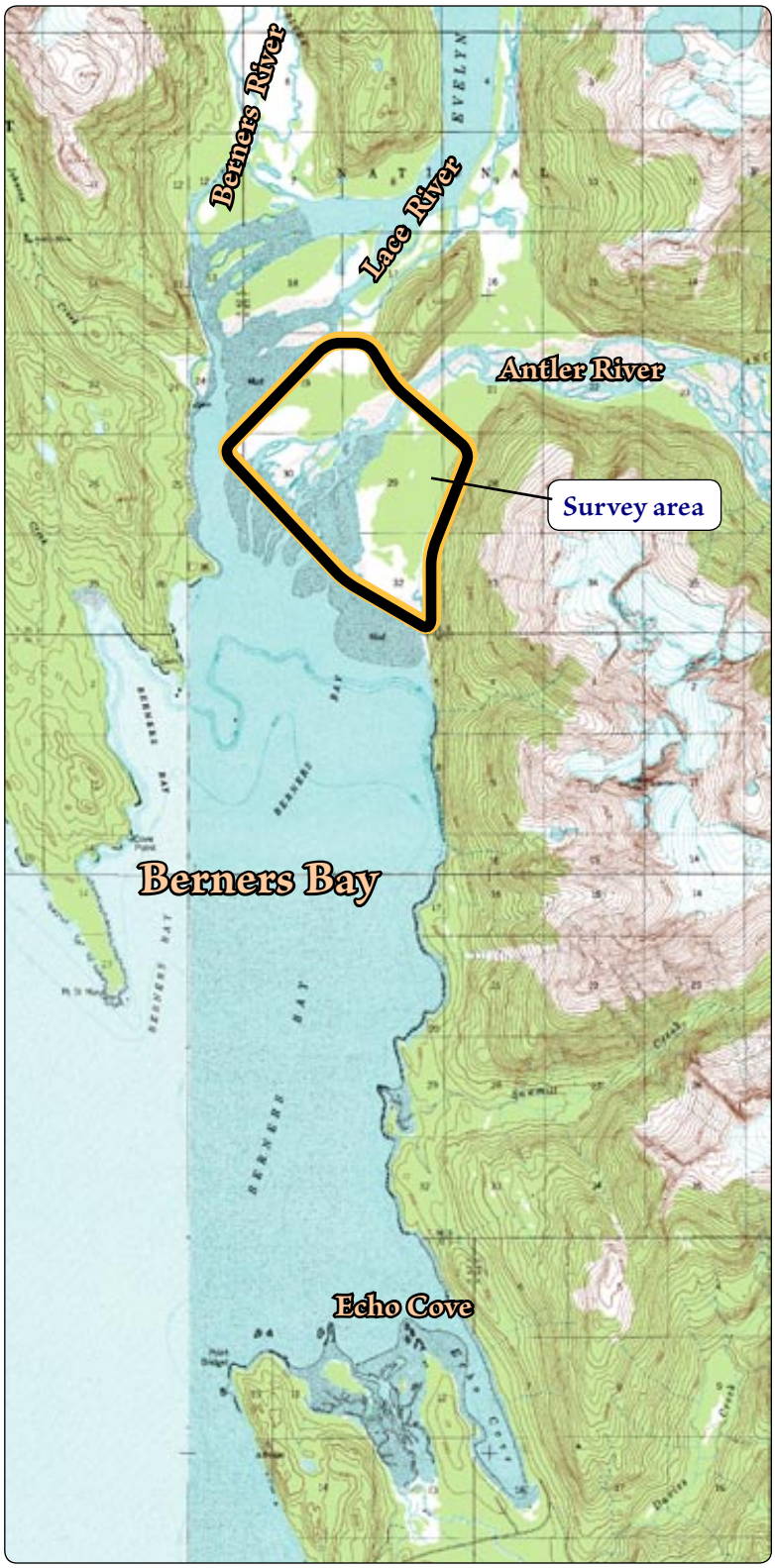


Figure 1. Survey area in the Berners Bay estuary and uplands.

[1]The brown bear quick cruise (BBQC) terminology follows work done by Kirchoff et al for Sitka black-tailed deer.

[2] Resolution in this context derives from the ratio of information to area, e.g. more information per unit area = higher resolution.

View of the Berners Bay estuary and surrounding beach meadow habitat from our base-camp on the Antler River.

Existing data relevant to brown bear habitat assessments in the Berners Bay area are maintained primarily by the USFS, the Alaska Department of Fish and Game (ADFG) and the United States Fish and Wildlife Service (USFWS). Sources reviewed for this project included: USFS Digital Elevation Model (DEM), the USFS "Existing Vegetation" polygon layer, USFWS National Wetlands Inventory (NWI) polygon layer, the ADFG anadromous streams layer, and the USFS channel type layer.

The resolution of the data listed above is often inadequate for management decisions directed at small spatial extents. Although the information can effectively guide the researcher's and/or manager's initial approach it is too coarse to accurately predict the effects of conservation and development activities at fine scales (such as assessing the potential impacts from road building, logging and mining). The BBQC methods build on existing data by providing high resolution details that are relevant to bear habitat quality (food and cover values). The high resolution habitat data is collected along with perennial bear sign information to provide a detailed picture of where the high values habitats are located and how they are accessed by bears.

Methods

Our surveys at Berners Bay focused on describing habitat values associated with bear food and cover resources, and mapping perennial bear sign (trails, sign trees and bedding areas). Protocols were adapted from those used by the U.S. Forest Service and Bureau of Land Management (Hibler and O'Dell 1998, USDA and USDI 1999). A complete description of methods is included in Appendix 1.

Aaron Wells surveying a lush herbaceous meadow point.

Control points were established in representative plant community types. These points were surveyed to ground-truth photo-interpretation of covertypes and to add high resolution food and cover attributes. Fine scale topography was delineated by identifying areas as either river bed, flood plain, terrace or slope and noting the elevation of each feature at control points.

Three types of perennial bear sign were documented, including: trail networks, sign trees, and bedding areas. Perennial bear sign data were collected in four phases:

- Pre-field review to identify potential focal areas for field surveys;
- Intuitive controlled survey to navigate between focal areas;
- Investigative survey to map brown bear trail networks, sign trees, and beds at the focal areas; and
- Transect survey to systematically survey areas with very high or very low bear sign densities.

Ephemeral signs (e.g. scat, signs of digging, hair on brush, and active beds) were used to corroborate indications about bear use from perennial sign and habitat mapping. For example, if researchers were unsure whether a trail was primarily used by bear or moose then consistent observations of bear hair on brush might be used to designate it as primarily a bear trail.

All field data were collected with a GPS receiver capable of relatively accurate (.1-10 meter) measurements below dense canopy. Receivers stored point, line, and polygon shape files. Data were downloaded to a laptop computer on a daily basis for storage and initial processing. Data were analyzed with ArcView^{tm} 8.3 GIS software.

Results

Habitat & Bear Movements

The highest concentrations of trails and most of the heavily worn trails appeared to be associated directly with food and cover resources, and/or connectivity between resources - especially near the lush beach meadows and among the gappy forest patches on the east side of the Lace River (Fig. 2).

Fine-scaled landform features also appeared to influence bear movements in the Berners Bay near-shore uplands. Of particular interest were *pseudo* barriers to lateral movement. Valley walls, river banks, and terrace features tended to focus up-valley/down-valley perennial bear travel routes. In essence, these landforms funneled traffic parallel to their structure. In Figure 3 the travel corridors at 1, 2, 4, & 5 are each good examples of this phenomena.

There were also several trails with low to moderate vegetation wear that appeared to be up-valley/down-valley travel corridors. We hypothesize that the lack of funneling landform structures and nearby food resources result in relatively less use and that these trails act primarily as conduits between higher value resources and/or as marginal pathways for less dominant

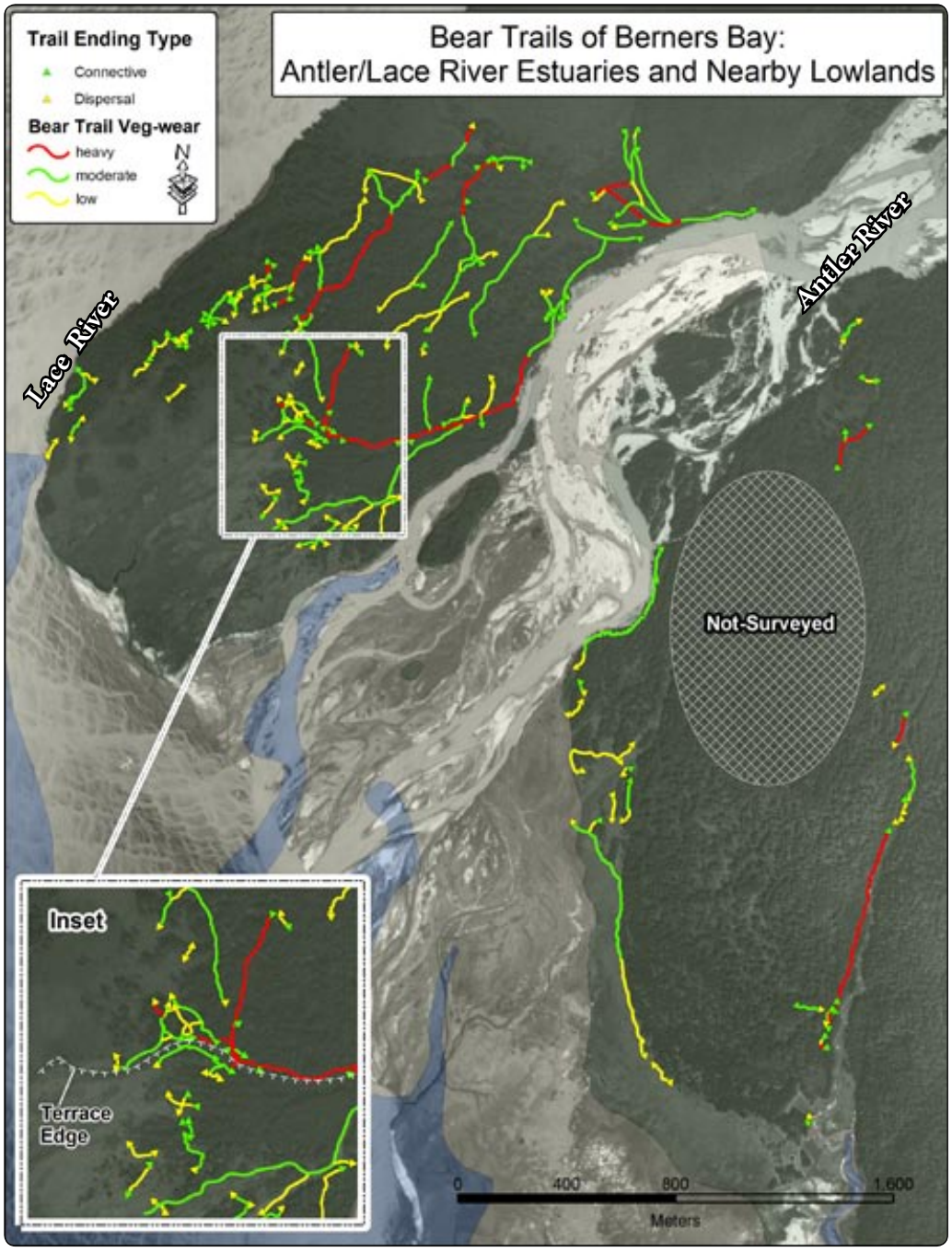


Fig. 2. Trails: Red lines indicate high vegetation wear (potentially higher use levels) green for moderate vegetation wear, and yellow for low vegetation wear. Green trail endings (little arrows at the end of trails) mean the trail keeps going, yellow arrows indicate that the trail disapeared and it was probably a bear dispersal area. Trail dispersal points often indicate locations of high value food resources. Bears tend to "fan out" in plant communities that are rich in food because the food is broadly distributed and bears need lots of personal space. The inset highlights the funnelling effect of terraces on travel and the dispersal effect lush meadows have on trail patterns.

individuals.

Overall there were six primary travel corridors identified: 1) At the base of "Sugarloaf Mountain" between the west bank of the Antler River and the southeastern-most extent of the base of the mountain, 2) Along the west side of the Antler River terrace margin, 3) The longitudinal core of the lowlands between the Antler River and the Lace River, 4) Along the east bank of the tidal portions of the Antler River, 5) Along the base of the eastern valley wall, and 6) Running laterally along the meadow-forest fringe on both sides of the Antler River (Fig. 3).

The primary travel corridors (with the exception of 6) likely serve as the most popular travel routes for bears as they move from den emergence in the surrounding mountains to the lushest spring grazing habitats found in the watershed. These routes also likely see increases in traffic as bears move from the lowland meadows to highland grazing or salmon foraging in mid-summer, and then again in the Fall as the bears return for roots in the meadows and berries, especially devil's club, in the gappy forest understory.

Habitat, Food & Cover

Because bear access to salmon in the sample area was nearly non-existent (generally too deep and silty), we focused on plant communities and how they provided food and cover for bears. It is possible that some foraging of carcasses occurs in

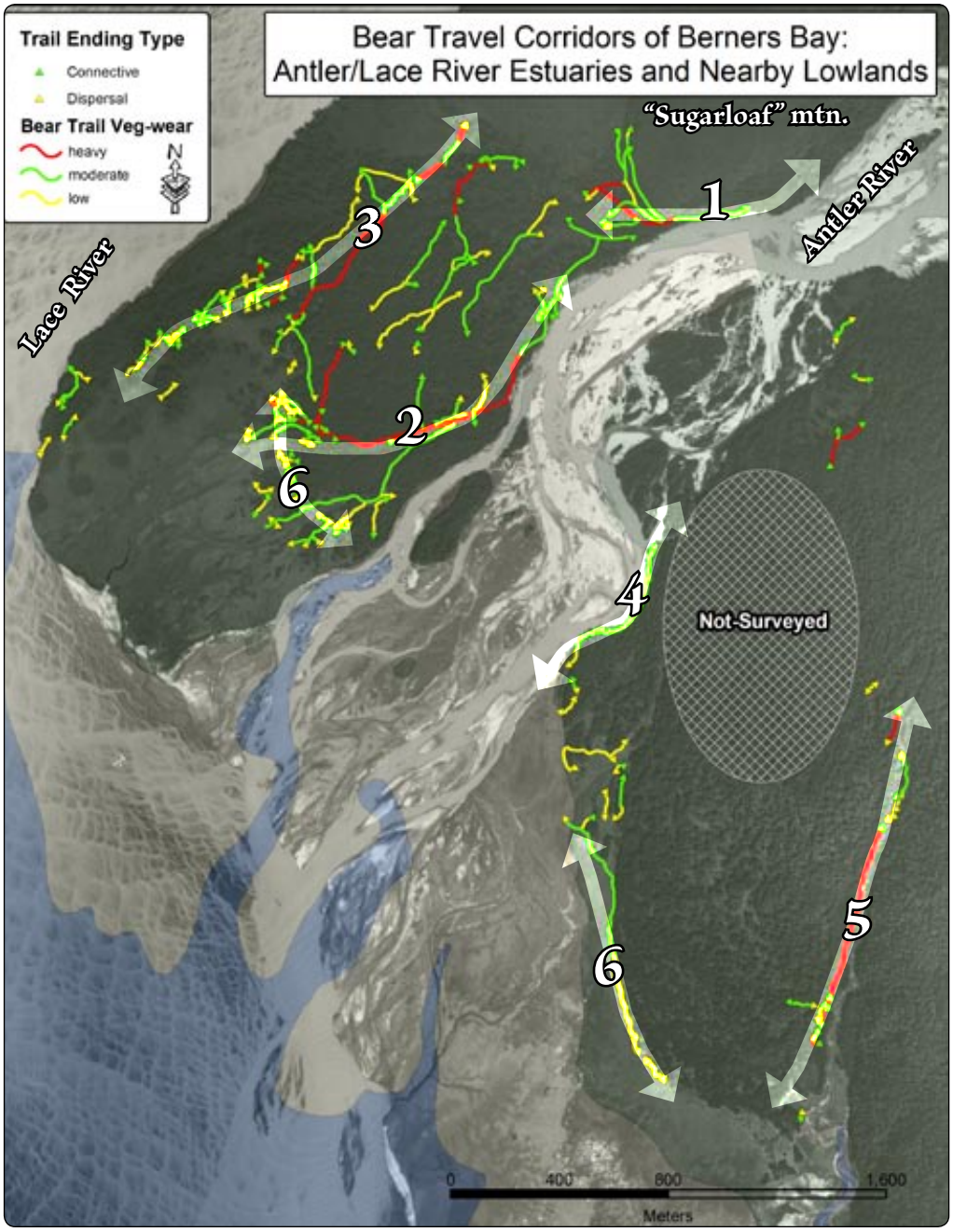


Fig. 3. Primary travel corridors: 1, 2, 4, & 5 demonstrate how landforms such as valley walls, river banks and terrace features "funnel" bear traffic.

Left: Moderate veg-wear "hot-feet" style trail along meadow-forest interface. This trail is located in east travel corridor 6 above.

Right: Moderate veg-wear on an upriver/downriver bear trail. This trail connects from the south to the heavy veg-wear trail in travel corridor 2 above.

late summer, especially on the Lace River side, but we saw no evidence (fish bones) of this activity in any of our surveys.

Roots and grazing: Roots appeared to be a considerable spring and fall food source in the Berners Bay meadows (probably the primary low elevation food source in the watershed - other than salmon). The lush herb meadows, which are quite extensive, hold a variety of roots, including: lupine, various umbel species, shooting star, rice root, and others. Lush herb meadows often occurred near the spruce or cottonwood forest fringes, conveniently close to cover and bedding areas. Contents of scats containing roots were difficult to ID down to species, though it is worth noting that root matter comprised the greatest proportion of scats observed. In this case the ephemeral sign (signs of digging) were very informative as to which plants were the target species. Grazing opportunities, especially on umbel species, were also relatively high in the lush meadows.

Sedge and Grass: One of the primary sources of high quality spring foods for bears is Lyngbye's sedge – *Carex*

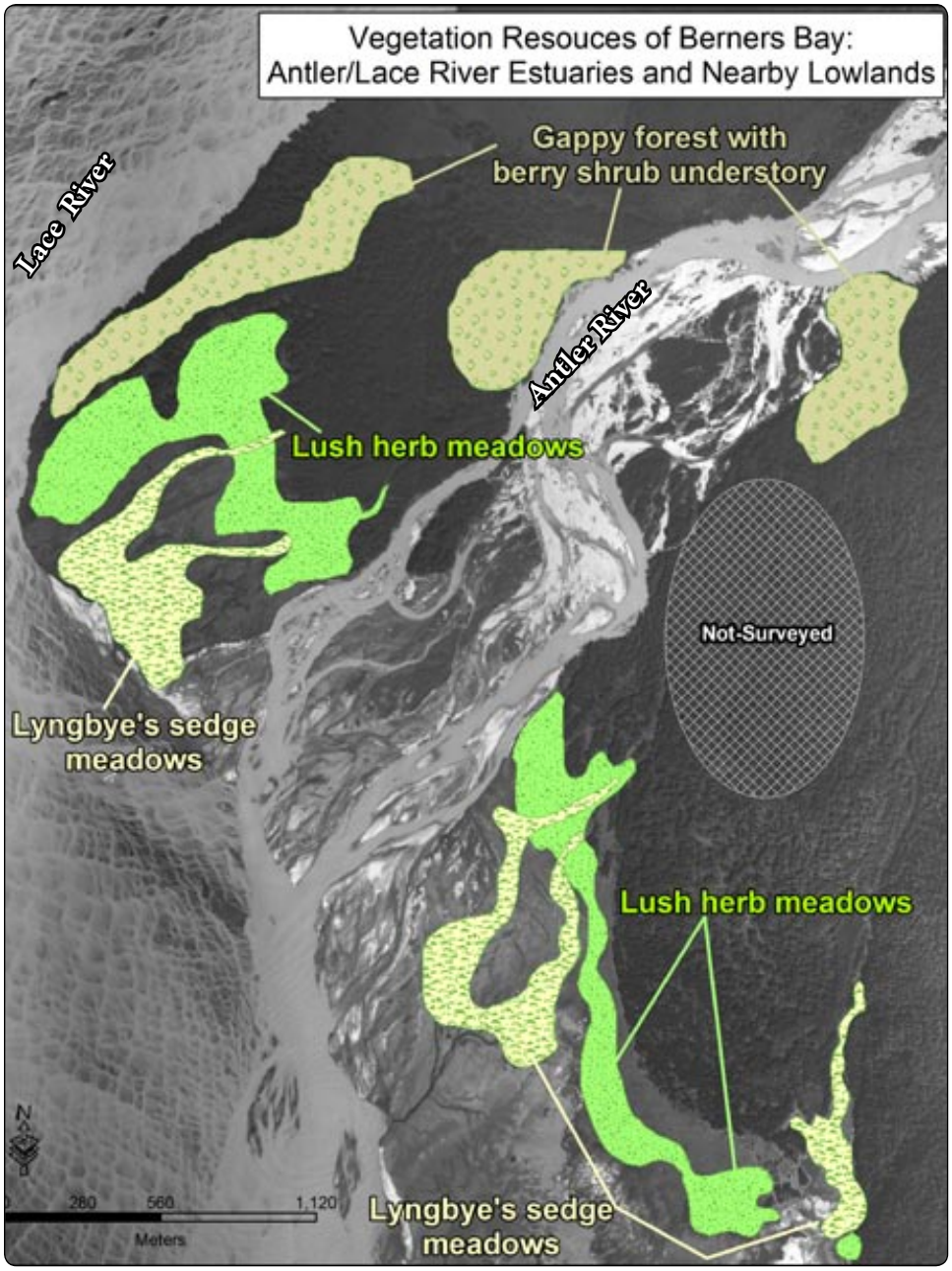
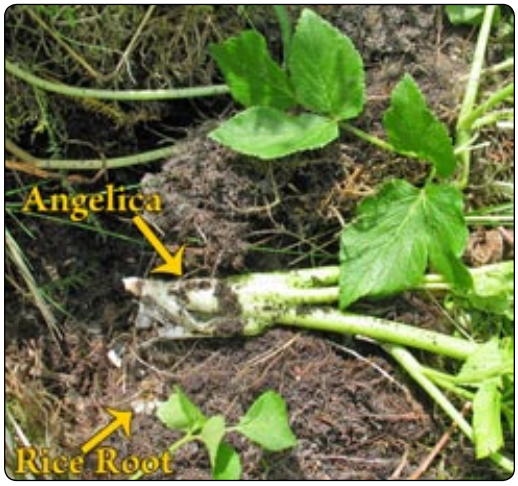


Fig. 4. The high value plant resource areas are indicated in this figure.

Left: Older (last season) signs of digging next to a creosote "chew-toy" in a rice-root/cow parsnip meadow.

Right: Close up view of spring diggings. Rice root and/or Angelica could have been the target root food in this scene. These were the most common roots noted as targets in the lush herb meadows during the spring 2003 surveys.



lyngbye. Lyngbye's sedge occurs in wetter habitats in the upper intertidal zones of estuaries (low marsh zones). In Berners Bay the primary areas of highly concentrated Lyngbye's sedge occurred in the tidal sloughs that penetrated the beach meadows, a limited extent of the low marsh flats near the seaward margins of the estuary meadows (mostly on the west side of the Antler River), and a relatively rich patch on the eastern extreme of the estuary/ beach area - along the largest of the tidal sloughs in the area. Not surprisingly, we found the highest concentrations of scats comprised of sedge in these areas.

Berries: Some patches of strawberries and nagoon berries were noted in upper extents of the drier lush meadows. These crops do not tend to be very dependable sources of food in general because of sporadic productivity and high energy costs for gathering. Still, they are obviously a prized resource when available. The forested habitats in our survey area were primarily first generation closed canopy conifer stands. Shrub layers in much of the area were almost nonexistent. Some of the more mature stands, or stands that had evolved from deciduous forests, had significant canopy gaps and shrubby under-story layers – mostly salmon berry, blueberry, devils club, currant, cranberry and elderberry. These areas likely provide important sources of food in the summer and early fall.

Mammals: In Berners Bay we documented no signs of bears feeding on or excavating for mammals. There are certainly some small mammals available in the Berners Bay area, as elsewhere in the region, but we have rarely seen signs of brown bears targeting small mammals with nearly the vigor their grizzly bear cousins are noted to exhibit. Older moose, winterkills, or young of the year could provide a significant food source for bears but we documented no signs of this activity in the survey area. Based on observations of bear and moose hair in brush it does not appear that use by these species overlaps much here.

Gappy forest covertype with lush under-story shrub layer.

Cover: It is important to place food resources within the context of cover resources. Bears, especially mature animals, tend to avoid open exposure where possible. Opportunities to "duck under cover", or to rest in relative hiding from other bears, people, and the occasional southeast Alaska scorching sun considerably affect bear habitat use patterns. This means that food resources near to cover resources tend to be highly valued by bears and food resources that occur in very exposed circumstances tend to be avoided. A prime example of this effect was reflected in the signs of use in the Berners Bay Lyngbye's sedge meadows. Although there were large patches of sedge in the low marsh flats of the estuary these areas did not appear to be much utilized. However, the Lyngbye's sedge habitat along the tidal sloughs were relatively heavily grazed (see photos below). A similar effect was noted in the use patterns observed in the lush meadow habitat. Lush meadows nearer the forest edge were more highly utilized than

Left: Lyngbye's sedge along the margins of a slough. Note the trampling just past Cheryl. Bears feeding in these areas benefit from the relatively high cover values and lush food sources.

Right: Sedge meadows in the low marsh zone near the beach. Distance to cover may explain the absence of grazing sign encountered here.

those well away from forest cover.

Within cover areas, bed site selection is often associated with fine-scale structural features such as large trees, stumps and steep banks. In the Berners Bay survey area the large spruce trees in the small patches of gappy forests were often selected as bedding sites. Although these areas did not occur extensively near spring grazing opportunities we still found the greatest concentration of bedding areas in these habitats. Beds were also scattered along the spruce forest fringe just inside of the lush meadow edge. Here again they were most often associated with the largest trees in the area, especially along the eastern margins of the survey area where the gappy forest covertype extended into the lush meadow complex.

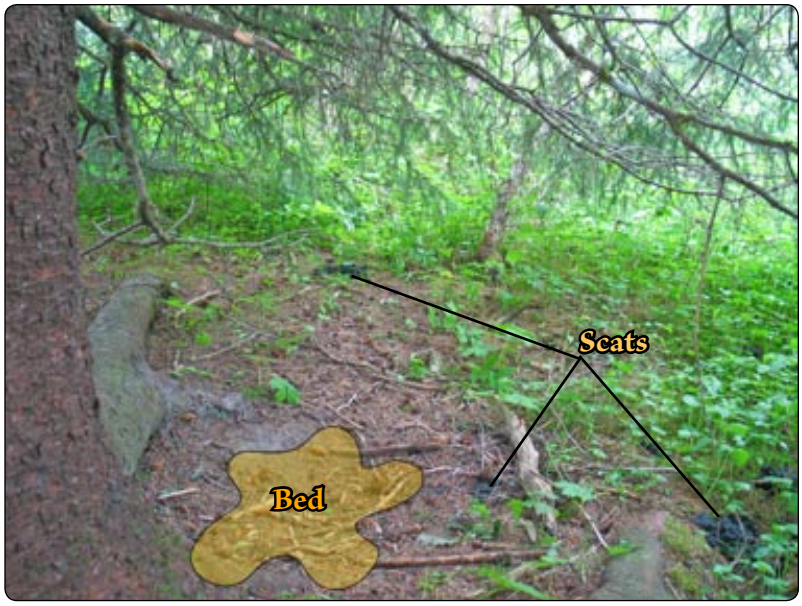


Fig. 4. This is an active bedding area at the fringe of the gappy forest that interfingers with the lush meadows on the east side of the survey area. It was common to find bedding areas associated with structural features such as large trees.

Denning sites: It is rare for brown bears to den at low elevations. Occasionally black bears are found denning at low elevations under downed logs, in caves or under tree hollows. Because the forest in the survey area is a first generation stand, opportunities for low elevation denning were scarce.

Discussion

Perennial signs can be an excellent source of information to draw generalizations about bear habitat use, especially when considered with high resolution habitat information. Perennial sign data are particularly useful in describing long-term patterns of use because they are the result of many years, sometimes generations, of repetitive patterns of activity. We believe these long term patterns are exceptionally relevant to assessing the potential impacts of development activities to habitat quality.

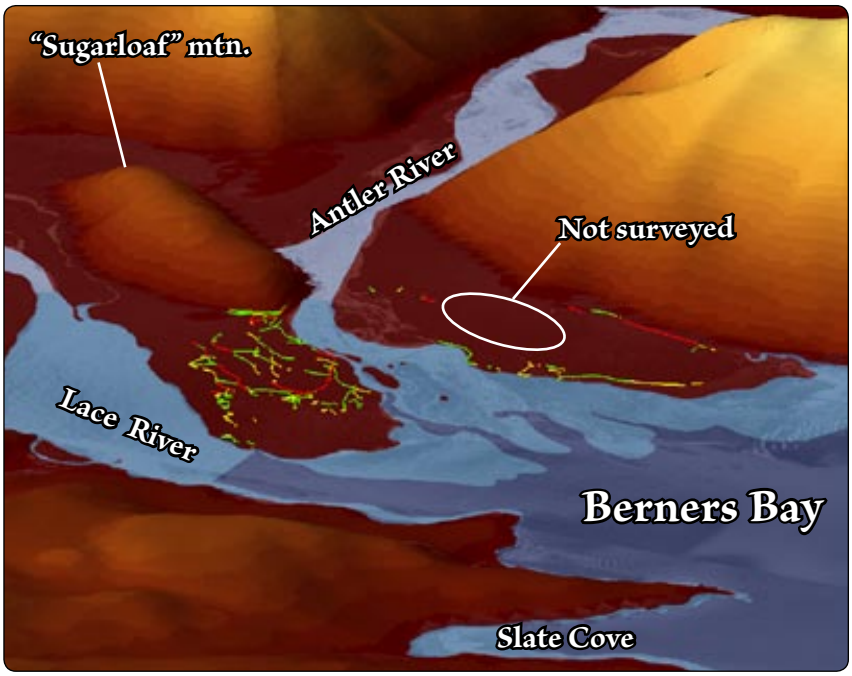


Fig. 5. 3 dimensional-oblique view of survey area bear trails.

Within the context of the survey area it was clear that the primary travel corridors and the highest trail densities were associated with food and cover resources, or connectivity between resources (Figs. 5, 6, & 7). For example, the disparity between trail density documented on the east side and west side of the Antler River is likely do to the east side having lower quality and less total cover for herbaceous meadow and gappy forest habitats. These kinds of data are instructive when considering potential impacts to habitat.

Ecological Context - Greater watershed scale

The focal area for our habitat and sign surveys centered on the Antler and Lace River estuary, uplift beach meadows, and nearby forests. Within the context of the Berners, Lace, Antler and Gielke 'greater watershed' the survey area is uniquely rich in spring food resources. The alluvial terraces, floodplains, and estuary areas between the Antler and Lace river mouths are home to the lushest and most expansive low elevation herbaceous and sedge meadows in the area. According to the National Wetlands Inventory (NWI) database the survey area contains 100% of the estuarine emergent vegetation in the 350 square mile greater waterhsed. This wetland type is the only habitat likely to support Lyngbye's sedge meadow (an exceptionally rich source of early season proteins). Approximately 30-50% of the low elevation palustrine emergent vegetation suitable for grazing in the greater watershed also occurs in the survey area. These two classes comprise the bulk of the low elevation grazing opportunities in the greater watershed context. These already exceptional resource values are further amplified by their near shore location and southwesterly aspect; making them the richest and earliest available plant food resources in the greater watershed. Access to this area is likely critical to maintaining the existing carrying capacity of bears in the area.

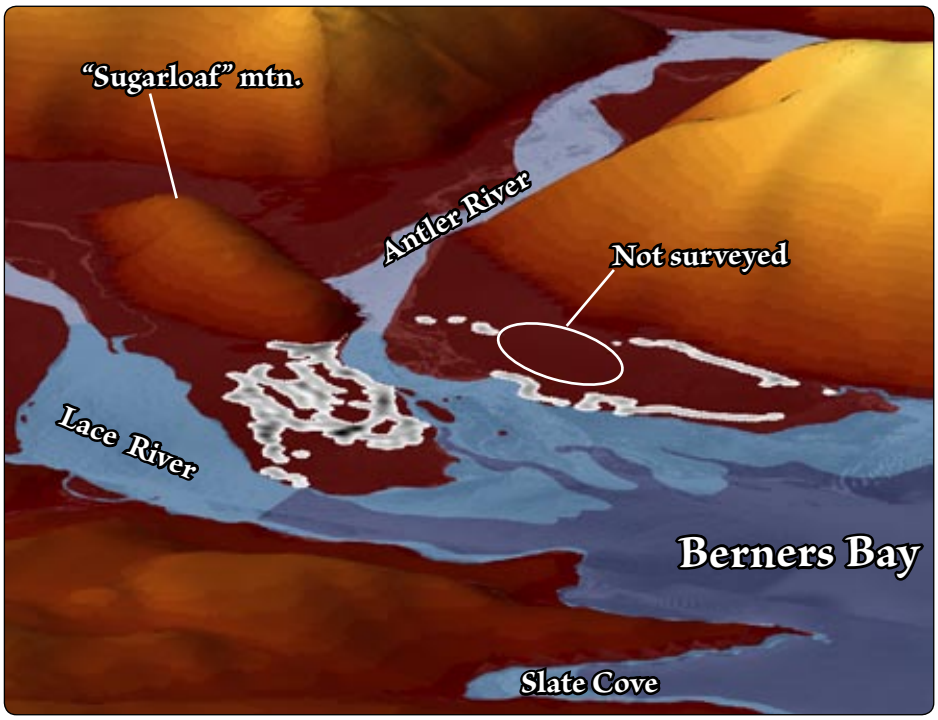
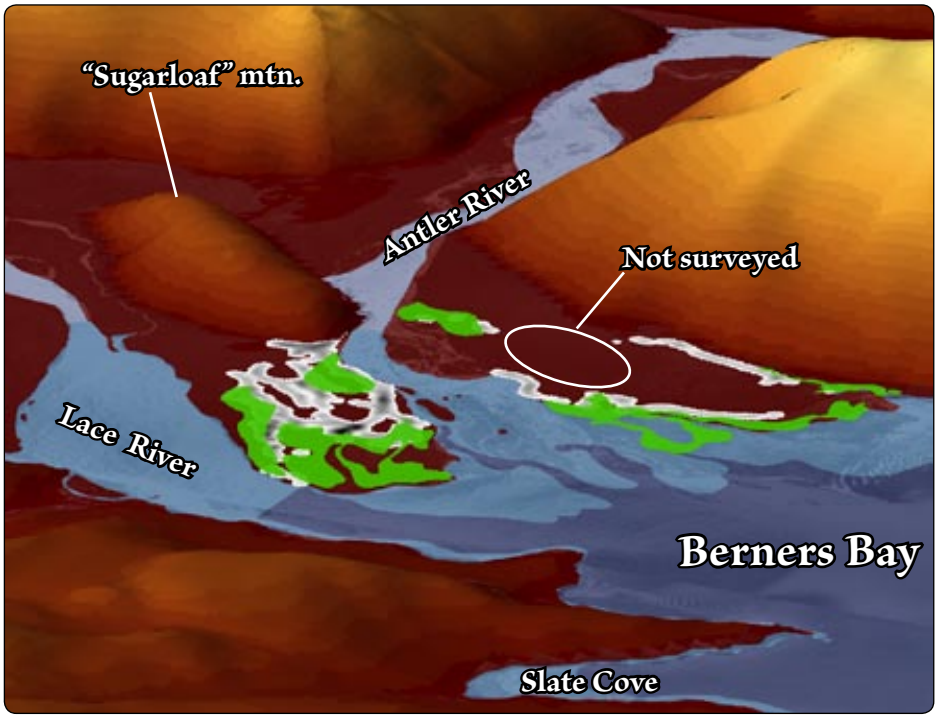


Fig. 6. Above is the product of a trail density calculation conducted via Arcview[tm] spatial analyst that provides a simple but effective representation of traditional bear travel patterns. Darker shades of gray represent higher trail density; typically at travel route "confluences".

Fig. 7. In the figure below I shaded the high quality plant resources in an green hue and overlayed them on the trail density map.



Proposed Road Corridor

The construction of roads into brown bear habitat has been demonstrated to impact bear populations through direct mortality of bears through legal hunting, defense of life and property kills, illegal killing, and fragmenting the habitat into smaller, more isolated parcels (Knight 1980, Peek et al. 1987, McLellan and Shackleton 1989, McLellan et al. 1999, Mattson 1990, Schoen et. al. 1994, Suring et al. 1998, Titus and Beier 1991, Mace et. al. 1996).

Titus and Beier (1991) demonstrated a significant correlation between cumulative miles of road construction and increased bear mortality on northeastern Chichagof Island in southeast Alaska. In a study conducted in Denali National Park, brown bear densities were higher in the back country than within 600 m of the road (Yost & Wright 2001). Research in the lower-48 suggests that grizzly bears are negatively affected by habitat fragmentation induced by roads. Avoidance of high quality habitat near roads or development may decrease the overall health of bears and cause an increase in mortality (Gibeau et al. 2002). In Yellowstone Park, grizzly bears avoided areas within 500 m of roads (Mattson et al. 1992). Kasworm and Manley (1990) documented an 80% decline in grizzly bear habitat use within 1 km of roads open to motorized vehicles in Montana. Mace and Waller (1998) also documented bear avoidance of roads. Grizzly bears in the Rocky Mountains showed a significant reduction in use of areas within 100 m of forest roads and showed a quantifiable reduction in use of areas within 250 m of the same roads. During a 25-year study of brown bears in southern Norway, researchers recorded a significant reduction in bear observations with increased road density (Elgmork 1978). Many of these results are independent of traffic volume, indicating that even logging roads with little traffic can have a negative effect on bears (McLellan & Shackleton 1988).

In light of the unique habitat qualities available in the survey area and substantial scientific evidence supporting the incompatibility of roads in important bear habitats, further consideration must be given to the potential impacts the proposed road route through Berners Bay would have on brown bears.

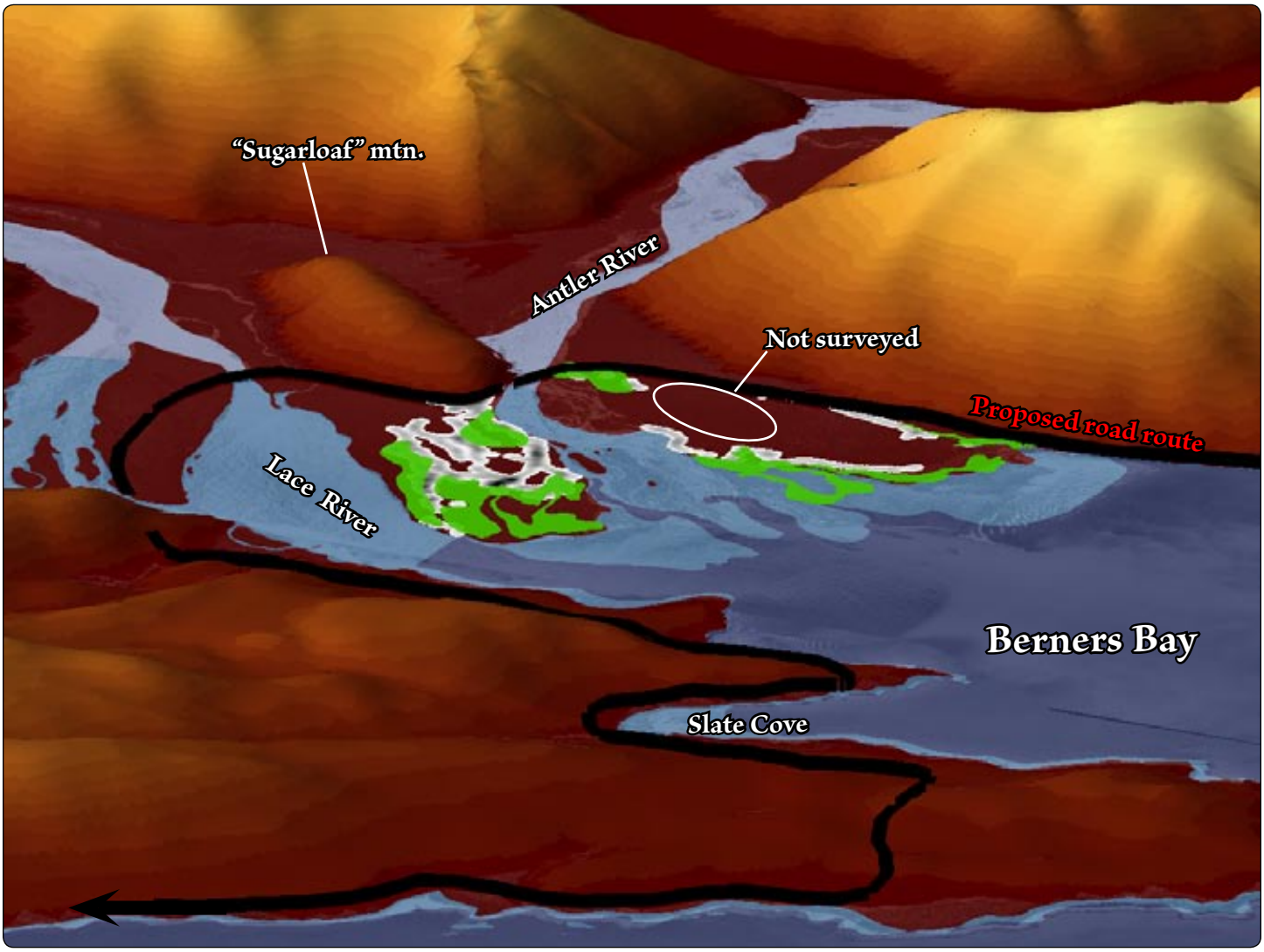


Fig. 8. Trail density, high value resources and the proposed Berners Bay road route.

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Appendix 1: Research Proposal

Brown Bear (Ursus arctos) Habitat Values and Signs of Use in Southeast Alaska: A high resolution approach to multiple-scale information needs

(Includes methods used in the Berners Bay Report - pages 17-22)

Prepared by:
Bob Christensen &
Cheryl Van Dyke

2004

**If the appendix is not attached you can download it at www.seawead.org/berners/berners_appendix1.pdf.*