

**Progress report to the Bureau of Land Management**

## **Iceberg Point Landscape Restoration Study**



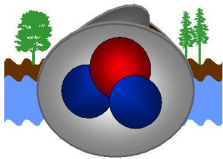
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**February 2006**

## **Progress Report**

### **Iceberg Point Landscape Restoration Study**

In January 2005 we presented descriptions of the plant communities and soils of Iceberg Point, and proposed an experimental framework for evaluating several alternative methods of restoring publicly valued, more diverse historical conditions (open meadows, high concentrations of native flowering plants, high butterfly diversity). The restoration methods we suggested for experimental use included mowing and hand clearing of trees and shrubs; small flashy fall fires; combined clearing and burning; and transplantation of native forbs. Our proposal drew upon clues to past landscapes and management practices found in current plant community composition (e.g. high concentrations of forage grasses that were popular with sheep farms 100 years ago), and evidence of pre-Contact burning by Coast Salish peoples (Spurbeck & Keenum 2003; Suttles 2005). BLM commissioned us to plan and implement the proposed experiment, in cooperation with BLM field staff.

The present report provides a detailed experimental design, sufficient for use in public consultations on Lopez Island. It also reports current preparatory research we are conducting on seed banks, soil chemistry, and soil response to different levels of heat flux from small, controlled fires.

#### Work completed in 2005

- Plant community maps attached to our January 2005 proposal have been corrected and further refined. We have also expanded our original plant lists based upon 12 days of additional observations in spring, summer and fall 2005. (Appendix Maps 1-2, and Text Appendix A).
- We have identified 48 ten-square-meter test plots on the landscape, with a view to monitoring a representative cross-section of plant communities and aspects for the evaluation of restoration methods. Plots were selected, mapped and photographed by Native American undergraduates in our science enrichment program in August 2005. (Appendix Maps 3-6).
- We collected 150 cc soil samples from each of the 48 ten-square-meter test plots in January 2006 for germination trials by students at Lopez School, to explore the nature of the seed bank within each test plot. At the time of this writing, seedlings are developing secondary leaves and will soon be positively identifiable.
- We have mapped and attempted an explanation of the occurrence at Iceberg Point of yampah (*Perideridia gairdneri*), a traditional Native American root food that is reportedly uncommon elsewhere in the San Juan Islands (Appendix Map 7).

- With the permission of neighboring landowners, we collected 100 cc soil samples along a EW and NS transects from Agate Beach south and west through the BLM property to Flint Beach, with the aim of determining the extent to which local soil chemistry reflects the highly varied bedrock geology of southwest Lopez. Intern Stephanie Blair is processing samples at Evergreen State College using an Atomic Absorption Spectrometer (AA), Inductively Coupled Plasma Spectrometer (ICP) and Ion Chromatograph (IC) for precise quantification of micronutrients.
- We have made arrangements with one of the neighboring private landowners for six small (three-meter-square) experimental April burns of mixed grass meadows that include camas (*Camassia quamash*). Soil samples collected before and after each burn will be assayed by AA/ICP, and heat flux will be measured during each fire by thermocouples buried at three depths below the ignition. Photographs and data can be used to plan larger burns and give Lopez residents visible examples of the results of controlled uses of fire.
- Preliminary positive local press coverage of this study in the February 22, 2006, issue of The Sounder, preparing residents for future public meetings organized by BLM staff on Lopez. We also routinely encounter curious Lopez residents when working on Iceberg Point, giving us frequent opportunities to talk about historical landscape change at Iceberg Point, and about the importance of public input in the planning and implementation of any experimental manipulations.
- We also referred to historical conditions and ongoing changes at Iceberg Point in a February 9, 2006 presentation we made at the Lopez Community Center under sponsorship of the Lopez Historical Society (“Landscape, Economy and Power”).

#### Yampah as a species of interest

One important result of our 2005 field observations was confirmation of a large, dense concentration of Gairdner’s yampah (*Perideridia gairdneri*), which Atkinson and Sharpe (1993, at 161) reported to be the largest population of this species in the San Juan Islands. See map, Appendix G. Kozloff (2005) identifies this population as *P. gairdneri borealis*; it is the northernmost representative of its genus on the Pacific Coast, and was highly prized as food by Coast Salish peoples. The distribution of yampah in our region—locally abundant in dense patches—may be an artifact of pre-Contact cultivation, like the cultivation of camas (Suttles 2005). Yampah would have been especially valuable to Coast Salish reef-net camps, which were located at Reef Net Cove (on the Iceberg Point property) and Watmough Bight (a nearby BLM property) according to the Samish elders interviewed by Suttles (1951). Besides being particularly sweet when eaten raw, yampah flowers at the end of the sockeye fishing season i.e. late August and September, making it easy to find at a time when other native plant foods are either unavailable, or not reliably identifiable.

We attempted to identify factors influencing the patchy distribution of yampah at Iceberg Point, by examining soil structure and soil chemistry in dense yampah patches (15-28 stems/m<sup>2</sup>) and adjacent patches with no yampah. Yampah was densest in mixed grass and scarce or absent in ground shaded by tall grass, shrubs or trees. Most yampah patches were characterized by deeper dark soils with much organic matter, while Iceberg Point soils as a whole tend to be shallow silty to sandy loams, with thin O and A layers. This pattern suggests that yampah patches are relics of pre-Contact cultivation practices; however, yampah was not densest, on average, in the darkest and greasiest (most humus and ash-rich) soils we encountered. Also, we noted that yampah is concentrated close to the main E-W trail on the property, which suggests that disturbance is an important factor as well. It is conceivable that human activity helps disrupt and “daylight” grassy patches adjacent to the trail, breaking the grass canopy that would otherwise shade out yampah.

More study of Iceberg Point’s yampah would be useful, to ensure the sustainable management of this species in future. In the mean time, special care should be exercised in fall clearing and burning, since yampah flowers and reproduces at that time.

### Seed bank study

In January 2006, we took 50 cc soil samples from each of the 48 test plots in order to ascertain the nature of the seed bank, i.e. which plant species are represented in the soil as viable seeds whether or not they actually emerged during our 2005 field season. Many species do not sprout annually, but only appear when conditions are favorable. Seeds can remain viable for decades; species that have not been observed for years may re-appear if conditions change. In a tall-grass patch or Douglas fir copse, for example, native flowers may re-appear after some disturbance of the canopy, such as fire or mowing, allows more light and heat to reach seeds in the soil. Germinating seeds from soil samples is one way of anticipating the results of clearing away tall grasses, shrubs, and trees.

Each 150 cc soil sample was broken up gently by hand. Roots, stems, and shoots were removed, leaving seeds, bulbs and corms in the sample, which was then spread out on a tray of sterile potting soil. Germination trays were then placed in the greenhouse at Lopez School, and maintained in natural daylight at about 65° F. Students at the school prepared the germination trays and have monitored seedling emergence for two months. Controls included two pots with potting soil but no sample, and two pots with seeds of a number of native forbs we collected in summer 2005 on South Lopez.



*Germination trays at Lopez School’s greenhouse Reveal Iceberg Point seed banks*

Secondary leaves are just beginning to form on many of the seedlings at this time. At their current rate of growth, we should be able to identify all seedlings fully by May. Broad categories can already be distinguished in many of the pots, however, and their distribution across different plant community types is instructive.

**Table 1. Preliminary identification of seed banks, by plant community**

<i>Test Plot Type</i>	<i>N</i>	<i>Grasses</i>	<i>Forbs</i>		<i>Rubus</i>	<i>Mean seedlings</i>	<i>Zero seedlings</i>
			<i>Plantain</i>	<i>Other*</i>			
Mixed Grass	12	8	28	30	0	5.5	0
Tall Grass	12	33	2	24	0	4.9	2
Shrub thicket	12	14	26	26	1	5.6	1
Fir copse	12	26	1	10	1	3.2	4
	48	81	57	90	2	4.6	4

\*Thistle, sheep sorrel, cress, figwort, hairy cats-ear, forget me not, dovefoot geranium, *Gallium*.

Forbs are most numerous under mixed grass and shrubs, while grasses dominate under tall grass and firs. Dense fir boughs not only shade out competitors but also appear to prevent wind-blown seeds from reaching the soil surface. Firs in our test plots appear mainly to be 15-25 years of age, which does not rule out survival of seeds deposited on the soil prior to the trees' establishment. However, we also observed fungal growth in most of the soil samples collected under firs, suggesting that any older seed bank was relatively quickly decomposed. This implies that tracts cleared of firs will not produce native plants from seed banks, but instead will be re-seeded by the currently dominant species on Iceberg Point: non-native grasses and ubiquitous introduced forbs such as the plantains, *Plantago lanceolata* and *Plantago major*. Forb seeds are also relatively scarce under tall grass.

Forbs fare better under thickets composed mainly of snowberry and Nootka rose. However, plantains and other non-native species are dominant. Very few native grasses or forbs are present in these seed banks. Most of the native forbs we observed emerging from soil samples were growing from corms rather than seeds, moreover; for example, tiny Brodiaeas (*Brodiaea coronaria* or *Brodiaea hyacinthina*). It seems likely that rodent caching helps broadcast corms throughout the Iceberg landscape, even under shrub canopies where they may long lay dormant. We noted abundant voles, vole burrows and runways in mixed grass meadows in January 2006; burrow spoils were rich in tiny corms and bulbs of Liliaceae such as *Brodiaea*, *Allium* and *Camassia*.

#### Refinement of soil chemistry

Our original proposal (Barsh & Murphy 2005) included a preliminary survey of the nutrient chemistry of the soils underneath different Iceberg Point plant communities. Succession from meadows or grasslands to trees appeared to be a function of soil depth; no clear associations with nutrients were observed. We decided to revisit this issue using a different sampling strategy and more precise tools (Atomic Absorption Spectrometer, Inductively Coupled Plasma Spectrometer and Ion Chromatograph), as well as including micronutrients such as zinc and, manganese and copper. Intern Stephanie Blair will carry out the analyses at the Evergreen State College analytical chemistry laboratory.

South Lopez geology is unusually complex, with several thrust faults and sharply dipped imbricate bedrock series (the Lopez Structural Complex) including volcanic tuffs, plutonic tonalites, and meta-sedimentary rocks such as slate, chert and sandstone of Jurassic to Cretaceous age, with numerous exotic elements (Brandon, Cowan & Vance 1988). Basalt slices are reportedly rich in calcium, chromium, nickel and strontium while some pillow lavas are calcium-poor but rich in vanadium, and a large exotic igneous slice (from the Turtleback Complex) is poor in all of the foregoing elements but relatively rich in cobalt (ibid, 30, 69-73). South Lopez soils consist of varying proportions of glacial till and more recently decomposed bedrock. The resulting geochemical landscape should, in theory, be relatively uniform (the ubiquitous glacial till) with islands of different kinds of micronutrient richness (decomposing balds and areas into which they drain). We noted in our proposal (Barsh & Murphy 2005) that the highest concentrations of metallic nutrients are found where bedrock is in the process of decomposition by moss mats, a process that slowly builds up substrates for colonization by forbs and grasses.

Our previous soil survey found relatively small variation in pH between Iceberg plant communities, with the predictable exception of the moss mats, since mosses create acidic environments in order to decompose bedrock minerals for their use. Although pH can be easily measured in the field, and influences the biological availability of whatever micronutrients are present in soils, it is not a nutrient itself. A soil can have “good” pH but lack one or more important micronutrients such as zinc. Low variation in pH across the Iceberg Point landscape makes it necessary to measure traces of metallic ions such as copper and zinc directly, with a high degree of precision. Hence our decision to evaluate the range of micronutrient variation in soils across the geological variation in the South Lopez landscape, including but not limited to Iceberg Point.

Our first soil survey sampled across plant community types, while our most recent (February 2006) soil survey samples across geological variation holding plant community types constant (mixed grass meadows). All structural geological elements identified by Brandon, Cowan & Vance (1988) were included in 10 samples (100 cc each). The range of micronutrient variation observed within this set of samples will help us identify which micronutrients are likely to be limiting factors in the growth of different groups of plants. Results should be available by April. See Appendix F (sampling map).

#### Experimental spring burns

An important issue raised during discussions of this study with BLM staff was the visual impact of burns on public enjoyment of the Iceberg Point Landscape. At the same time, we were anxious to learn as much as possible about the management and results of fire in the south Lopez landscape before igniting any fires at Iceberg Point. The scientific literature on North American fire ecology is vast but highly specialized, mainly focusing on the large public forests managed by USFS in the Rocky Mountain and Basin regions, and Great Plains grasslands. The behavior and effects of fire in the Puget Sound lowland is poorly studied, least of all in the relatively arid rain shadow landscapes of the San Juan Islands.

The extant literature contains little information on the relationship between heat flux and changes in soil chemistry, furthermore. Differences in fuel loads, humidity and wind speed (among other factors) determine the peak temperature and duration of a fire, altering the total amount of heat passing through different layers of the soil, and thereby influencing which seeds, corms, rootlets and soil fungi survive. Manipulating heat flux is an important but very poorly understood tool for controlling the chemical and biological consequences of a fire.

We have accordingly planned six small (3 m<sup>2</sup>) experimental fires in April 2006 on two privately owned tracts within 1 km of the BLM property, to study fire effects on the specific chemistry of soils like those found at Iceberg Point. The experimental site shares the surficial and bedrock geology, and mixed grass type of plant community found along the south shore of Iceberg Point. Each burn will be confined behind a 30 cm-high barrier built of fire-retardant material, which will be wetted prior to ignition. Thermocouples on meter-long steel probes will be inserted at an angle from the edge of each burn site so that we can monitor temperatures at 5, 10 and 20 cm below the soil surface at the center of the ignition. Plant community descriptions and photographs will be taken of each site before, and 4 and 8 weeks after burning. Soil samples will be collected from each site before and after immediately after burning at 1, 5, and 10 cm below the center of the ignition for the analysis of major and micronutrients. Half of each plot will be re-seeded after burning with native forbs. Depending on the results, we may later attempt to determine the upper temperature limits of seeds and bulbs of particular native species, by in vitro heating and germination experiments with students at Lopez School.

Data and photographs from these six small burns will be available to share with Lopez residents before any fall burns are approved for Iceberg Point. Residents will have a concrete basis for visualizing and understanding the nature and effects of the proposed burns at Iceberg Point, and to make informed judgments about the acceptability of fire as a management tool.

#### Proposed burning and clearing design

Assuming that BLM decides to proceed with experimental clearing and burning at Iceberg Point, we recommend clustering the most proximate and botanically similar plots and designating up to three treatments and at least one control within each of the clusters

(as shown on Appendix Maps 5-6). This will provide a reasonable level of comparability within and between types of treatments, controlling for possible effects of variations over the entire landscape in factors such as slope, aspect, drainage, and soil chemistry.

We recommend the following kinds of treatments, drawing on our January 2005 proposal to BLM and the results of our subsequent research:

<i>Plant Communities</i>	<i>Number of plots, by treatments</i>				<i>Total plots</i>
	<i>Spring cut</i>	<i>Spring cut and burn</i>	<i>Spring cut, Fall burn</i>	<i>None</i>	
Mixed grass	3	3	3	3	12
Tall grass	3	3	3	3	12
Shrub thickets	4	0	4	4	12
Fir copses	4	0	4	4	12
<i>Opuntia</i> patches	0	0	0	2	2
Rocky balds	0	0	0	2	2
Splash zones	0	0	0	2	2
					54

A burn-only treatment option has been omitted for practical reasons. Suppression of fire has resulted in significant fuel accumulation even in grassy meadowland at Iceberg Point. Fuel loads are probably greater than they were when Coast Salish people burned the landscape frequently in patches. The potential heat flux is greater, as well as the risk of wildfire. To keep experimental fires manageable, we recommend cutting burn plots in spring so that fuel can be re-distributed or removed as appropriate, prior to ignition. This approach also provides for a tighter experimental design, in which all treatment plots are cleared, a sub-sample of plots are burned, and the sub-sample (in turn) is divided between Spring burning and Fall burning.

Spring cut (or mow): Shrubs and trees will be taken down to ground level by hand using a combination of brush-cutters, loppers, pruning saws and chainsaws as appropriate to the thickness of the limbs. Mixed grass and tall grass plots will be cleared down to 3-4 cm height using a gas-powered mower. Care will be taken to avoid disturbance of plants outside the test plots, and to minimize ground disturbance within each plot. Cleared areas will be loosely circular to mimic natural plant-community edges. Debris will be removed and disposed of off-site. Optimum timing is April-May, after camas has bloomed and the tall non-native grasses are beginning to overshadow native grasses and the later-blooming forbs. An on-site inspection for flowering native forbs should be made before mowing to minimize any adverse impact on the species most in need of promotion.

Spring and Fall burn: Plots in this treatment group will be cut or mowed in Spring and either ignited in May, or in late September to October after the flowering of yampah. Some dried debris from clearing may be left on these plots to achieve heat flux targets. Loosely circular plots will be cordoned with loose, wet hay to serve as a firebreak, and at least two persons will standby with backpack sprayers to keep the firebreak wet and respond to any breach. Fires will be managed to be fast, flashy and relatively cool. In theory they should break down taller grass mounds and sterilize at least some shallow roots and seeds, as well as liberating inorganic nutrients. Fires should not be hot enough to sterilize all seeds and bulbs, nor to volatilize key nutrients. Burn sites will be doused thoroughly with water immediately after flames recede, to minimize the possibility of blowing embers or root fires. These treatments should suppress grasses, shrubs, and firs more effectively than cutting alone, and should result in a greater increase in nutrients in the soil and surface water. However, we do not yet have a basis for predicting how the timing of the fires will affect the mix of native and non-native forbs in re-growth. Some guidance in this respect will be provided by the experimental spring burns planned for April 2006, described above.

Based on the results of the experimental small burns in April 2006, we will decide whether treated plots should be re-seeded with a mix of seeds collected from local native forbs such as *Camassia spp* or *Fritillaria lanceolata*. Our recent observations of cleared areas at Iceberg Point, burnt patches of San Juan National Historical Park, and the seed bank revealed by our germination experiments at Lopez School, incline us to predict that the re-growth will be dominated by non-native grasses and forbs unless we re-introduce some vigorous locally adapted native forbs. To this end, we propose to collect seed from Iceberg Point throughout the 2006 growing season, being careful to collect no more than ten percent of the seeds of any native species from any portion of the landscape.

Control plots include sensitive plant communities such as *Opuntia* patches that appear to be stable at present, but should be monitored to confirm this. Controls will be visited in spring and fall for photography and plant descriptions. We are particularly concerned about the impacts of increased human activity on moss- and lichen-covered balds. While mapping of the BLM property last year, we frequently saw recently bared patches of bedrock from which mosses had apparently been extirpated by pedestrians or bicycles. While this is not the focus of our study, we plan to continue monitoring two patches of moss near the Monument (=heavy traffic) and a smaller and more isolated bald (little or no traffic).

Ideally, all plots excepts controls should be cleared or mowed in April-May 2006, and the burn sub-sample (a total of 24 plots) should be burned in May and October 2006. The process of public engagement and formal BLM decision-making may delay the onset of all or part of the experiment. We recommend that the shrub and fir plots be cleared in 2006 if possible, even if the full experimental design cannot be implemented until Spring 2007. There is considerable local public interest in seeing some action taken against rose and fir encroachment at Iceberg Point. One option is a Fall 2006 clearing of shrubs and trees, followed by further clearing and burning of the same plots in Spring and Fall 2007.

This would provide public momentum as well as useful data, without compromising our larger experimental design.

### Species of concern

Two rare plants are reported on the BLM property, *Polemonium pulcherrimum* and *Oxytropis campestris* var. *gracilis* (Kozloff 2005). We observed *P. pulcherrimum* on the large rocky bald where the survey monument is located. No experimental activity is proposed on any balds, although we plan to monitor two patches of *Cladina spp* (reindeer moss) by photographing them periodically from existing trails that circle balds. We have not yet observed any examples of *O. campestris* on the property, and understand that this species has only been reported to the east of our test plots.

The property hosts unusually large concentrations of the cactus *Opuntia fragilis*, as noted in our previous report (Barsh & Murphy 2005), and Gairdner's yampah, as noted above. We plan to monitor two patches of cactus photographing them periodically from existing trails, to learn whether they are suffering from human disturbance.

Yampah occurs in one of our proposed test plots, TG-SW3 (see Appendix C), so we have designated this plot as a "control"—that is, routine photographic monitoring but no treatment or disturbance. Yampah also occurs about 50 feet from two other proposed test plots, FC-SE9 and FC-SE10. Proposed treatment of these two plots (cutting firs, and combined cutting and flashy burning) will be carefully contained, and carried out without moving people or equipment over the nearby yampah patches. We recommend that other BLM activities likewise avoid the yampah population that we have mapped, until we are better able to determine its significance, and its sensitivity to disturbance.



*Gairdner's yampah at Iceberg Point (September 2005; R. Barsh photo)*

Recent interest in reported Island Marble butterfly subspecies (*Euchloe ausonides insulanus*) in meadows at San Juan National Historical Park raises the possibility that the same rare subspecies exists in similar habitats on south Lopez. Unfortunately, very little is known about this animal, which had not been observed for a century. They have been reported feeding on *Brassica campestris*, a widespread non-native mustard; the historical hosts are presumed to be native mustards such as *Arabis hirsuta*. *Brassica capestris* and *Arabis hirsute* occur on Lopez, but a 2005 USFWS survey did not find the Island Marble on Iceberg Point or elsewhere on South Lopez (Ted Thomas 2006, personal comm.).

The native hosts of the butterfly are very small and relatively scarce today in the archipelago. The non-native host is very abundant in disturbed areas. This suggests that disturbance may actually benefit the survival of the butterfly unless it is of such a nature that it kills them outright. Clearing and burning may kill caterpillars and pupae that lack the mobility of adults. We will therefore make a visual examination of each test plot for host plants, caterpillars and pupae. If caterpillars or pupae are observed, we will identify them, and if they are either *Euchloe spp*, or cannot be identified confidently, we will not disturb that test plot, but report the occurrence to USFWS and WDFW.



An adult  
"Island Marble" butterfly  
(James Miskelly photo)

As we suggested above, voles (*Microtus spp*) may play an important role in the diffusion and redistribution of native plants, through the aeration of soils and caching of seeds, bulbs and corms. Voles are locally abundant at Iceberg Point, usually associated with mixed grass communities that are relatively rich in forbs. Historical vole predators are either absent from south Lopez (e.g. wolves) or presumably reduced in numbers (e.g. raptors and the weasels, *Mustela spp*). The impact of frequent fires on vole communities could be positive (promoting the growth of preferred food plants) or negative (destruction of voles, vole caches and vole burrows). Until we know more about the contributions of voles to the maintenance of native plants at Iceberg Point, and more about the response of vole communities to fires, a precautionary approach should be taken. Experimental fires should avoid vole burrows or runways. At the same time, vole colonization of burnt plots

should be carefully noted and monitored, particular as a possible vector of recolonization of these plots by native forbs.

### Suggestions for public meetings

Lopez is a small community that often feels marginalized when federal, state, and even county-level decisions are made affecting the island. Residents regard Iceberg Point as culturally significant. They use it heavily year-round, while tourists are more likely to use Odlin County Park and Spencer Spit State Park on the north end of Lopez. Our team encountered and spoke with residents on every occasion that we visited Iceberg Point, in all seasons and weather: adults, adults with children and many teenagers. Older residents were aware of the problem of fir-rose encroachment on the meadows, and delighted that a plan was developing to preserve and restore meadowland. Many younger residents were surprised to learn how much the landscape has changed in little more than 25 years. This makes it particularly important that Lopez residents feel included fully in all management decision and research, and that local people, especially youth, be employed in research as well as the hard work of clearing, mowing, and containing fires.

Lopez Community Center can be booked for a modest fee, but the Grange and the Lopez Library are cozier and less formal venues. Politicians tend to speak at the Center, while informal local gatherings are organized at the Grange or Library. Informality and sincerity are valued highly; food is appreciated and tends to draw a larger crowd. Videos and slideshows are very popular. Above all, however, Lopezians want straight talk; they do not much trust outsiders, even from the other islands. There does appear to be a very positive perception of BLM at the present time, which should be carefully nourished, and will be profoundly affected by the way in which management decisions for Iceberg Point are made.

Getting the word out can be the biggest hurdle on Lopez. Each of the three larger islands in San Juan County has a newspaper, but the Lopez paper (the Islands' Weekly) is the thinnest. Notice of any meetings should be printed in all three papers for at least two or three weeks in advance; a feature story would be easy to arrange and tends to increase public turnout considerably. Lopezians pay close attention to public notice boards at the ferry terminal, grocery stores, and the library: a colorful poster would be worth the effort. Identifying a well-known local moderator for the meeting would also be appropriate, and may incline more residents to attend and speak up. It would also be useful to involve the resident County Councilman, currently a person with a background in land stewardship.

We expect that the following questions will be uppermost in people's minds:

- What is BLM trying to achieve at Iceberg Point?
- Does BLM know what it's doing?

- How will local people be involved?

It is important for Lopezians to trust that BLM will try to achieve a landscape that continues to hold cultural value to Lopezians. This means maintaining access and current kinds of uses (and not encouraging tourism); preserving or increasing open vistas, spring flowers, birds and butterflies; continuing to have a personal presence on the island, which has already made a significant difference in public perceptions of BLM; sharing data and decisions on a regular basis; acknowledging that the decisions to be made are cultural and involve values as well as science; and asking for people's advice and help.

We suggest that the focus of a public meeting this spring should be: (1) what we know about the ecological changes taking place at Iceberg Point; (2) how we are trying to develop and test management tools such as clearing and burning at Iceberg Point, instead of simply importing theories or methods from elsewhere; (3) clarifying which decisions must be made on the basis of values rather than science alone, *e.g.* the relative importance of the open vistas and floristic diversity of Iceberg Point; and (4) how students and adults can get more directly involved in research, decision-making, and implementation.

The most difficult task, we believe, is clarifying the boundary between values and science. There has not been a "natural" ecosystem at Iceberg Point for centuries; people have been using the landscape and, until very recently, intervening actively in succession processes. Apart from the protection of scarce or endangered species where mandated by law, BLM has considerable flexibility to balance species richness, habitat diversity, and a variety of human uses. Whatever the goals are chosen, scientific research tied to adaptive management will help achieve them. But among all of the technically feasible outcomes, people rather than science must make the choice.

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We gratefully acknowledge the continued collegial support of Nick Teague, BLM liaison on Lopez; and Jill Rain, science teacher at Lopez School, and her students.