Wilderness Management and Restoration in High Use Areas of Olympic National Park, Washington, U.S.A.

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Abstract—The attraction of Olympic National Park's natural diversity and wilderness integrity along with its proximity to the heavily populated greater Seattle metropolis have made it one of the most visited wilderness areas in the United States. More traditional management actions such as education, monitoring, visitor use limits, designated sites, and campfire restrictions have been implemented along with an intensive wilderness revegetation and rehabilitation program to address unacceptable impacts to wilderness resources and character that have resulted from high use. This combination of actions has proven extremely successful in restoring and preserving Olympic's wilderness qualities.

Olympic National Park, both a World Heritage Site and a Biosphere Reserve, is an exceptional international treasure of natural diversity and wilderness integrity. Its 914,818 acres (370,227 ha) contain mountainous peaks draped with over 250 glaciers, remote subalpine meadows and lakes, some of the last remaining old growth temperate rainforest in the world, and a stretch of wild Pacific Ocean coastline. The Park's wilderness values are recognized as one of its greatest assets:

> Olympic's wilderness values are superlative. As our technology races ahead, our need for the special peace and renewal of the human spirit that undeveloped, unspoiled wild lands can offer us increases proportionately. Thus, Olympic's rich, unique wilderness qualities emerge as among the most precious of the Park's resources. (Olympic National Park Master Plan, October 1976)

In 1988, 50 years after Park designation, the United States Congress designated 95 percent of the Park (876,669 acres) as the "Olympic Wilderness," to be managed under the Wilderness Act of 1964. This additional layer of law directs that the area will be administered in a manner that will preserve its wilderness character for its present and future use and for enjoyment as wilderness.

In: Watson, Alan E.; Aplet, Greg H.; Hendee, John C., comps. 1998. Personal, societal, and ecological values of wilderness: Sixth World Wilderness Congress proceedings on research, management, and allocation, volume I; 1997 October; Bangalore, India. Proc. RMRS-P-4. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

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Impacts to Olympic Wilderness Qualities

Olympic's wild character has drawn a multitude of visitors over the past 25 years. Overnight use in the Park's backcountry increased in the 1970's, then after a decline in the 1980's reached all-time highs in the 1990's for 5 successive years. In 1995, overnight backcountry visitation was 20,000 parties, 55,000 visitors, and 124,000 visitor use nights (visitor use nights = the total of the number of nights all visitors stay). The highest proportion of use occurs during July and August (49 percent), with rainy weather and snow conditions discouraging hiking in the off-season on all but the wilderness coast and lowland trails.

In general, use trends in the Olympic Wilderness are a result of its proximity to the greater Puget Sound metropolis that extends from Bellingham near the Canadian border, through Seattle and Tacoma, to Olympia, the State's capital. About 57 percent of Olympic's overnight wilderness use originates from this area, 76 percent from all of western Washington. The recent rise in use is probably attributable to the increasing growth in the Puget Sound area population, which has grown by 500,000 in the past 10 years to 2.7 million people. Proportionately, Friday and Saturday nights receive the greatest overnight stays (40 percent), when most Puget Sound residents take their work weekends.

Olympic National Park has approximately 600 miles of trails to facilitate access within the wilderness, and over 1,300 established campsites are located along this maintained trail system. The vast majority of visitors (98.3 percent) remain within the maintained trail corridor, with the highest use concentrated in those river valleys with the most dramatic scenery, subalpine lake basins, and the most easily reached camp areas along the wilderness coast. Large groups, usually organized scout, church, or youth groups, tend to visit the already popular locations.

Concentrated use can have significant effects on wilderness character by compromising the aesthetics of the natural environment and by damaging resources and altering ecosystem processes. The cumulative impacts from the high use of the 1970's and the increasing use in the 1990's have resulted in unacceptable changes that run counter to the Wilderness Act. Those of greatest concern in the Olympic Wilderness are campfire-related impacts and trail and campsite deterioration. By first understanding the nature and cause of the impacts, effective management actions can then be determined.

Campfire Impacts

In many high-use areas in Olympic National Park, campfires have resulted in a variety of unacceptable impacts.

Changes in soil chemistry as a result of fires alter species composition, though in bare-ground campsite areas this has usually not been a concern. The more difficult impacts to address have occurred as a result of firewood gathering. The search for firewood has caused soil compaction and vegetative impacts. The removal of dead and down wood is of special concern in areas where soil has been lost and soil replenishment cannot or is slow to occur, such as areas at or above timberline. In some camp areas where collection has exhausted the firewood supply, live trees and shrubs have been taken, resulting in impacts on the plant community and wilderness aesthetics.

Trail and Campsite Deterioration

The most obvious visitor-related impact within the wilderness has been vegetation and soil loss through facility development and use. Most of the maintained trail system was constructed in the 1920's and 1930's. Though enabling access for enjoyment and use, trail construction resulted in hundreds of miles of vegetation loss. The ongoing impacts that occur on trails, such as soil erosion, trail widening and braiding, are often overlooked when wilderness impacts are considered, but cumulatively they can result in significant soil and vegetation loss. Water flowing down trails, for example, can carry off tremendous amounts of soil, carving deeply eroded trenches.

Hikers tend to use the more easily traversed trail shoulders when the main trail tread becomes difficult to travel. This can happen for a variety of reasons. It is not uncommon for lingering snow to obscure trail segments, although the adjacent vegetated ground has melted off. Frequent water flow on Olympic trails results in erosion of the fine materials, leaving behind larger cobbles that make hiking more difficult. Unstable banks upslope of the trail may be undercut by active erosion creating hills of soil in the trail tread. In some areas, especially in the rainforest valleys, water is not able to run off the trail thus creating muddy stretches. Hiking on trail edges to avoid these obstacles has doubled and even tripled the trail width in some places, or created parallel trails. A 2 ft widening of segments along a major trail can easily result in thousands of square feet of unacceptable bare ground.

With the exception of the maintained trail system, historical use patterns, rather than management decisions, have directed the location and number of the majority of existing facilities within Olympic. Social trails (trails accessing water, view points, campsites) usually developed directly from repeated visitor travel across vegetated areas. This has most commonly occurred in campsite areas where a network has formed as visitors seek their own routes from camp areas to other points of interest or need. It is more common than not to find numerous trails between two locations where one would serve.

The majority of campsites in Olympic also developed from visitor use rather than through management planning, which has resulted in a proliferation of marginal and oversized sites. Visitors usually select flat, attractive spots, often immediately adjacent to lakes or rivers, that do not protect soils, vegetation, water quality, or the experience of other visitors. In most of these campsites, soil erosion has resulted in the loss of fine soils and in the exposure of tree roots, making sites uneven and uncampable. Poor drainage due to soil compaction and soil type results in wet, uninviting sites. Visitors seeking flat, campable ground migrate to the vegetated edges of sites which, in turn, results in campsite expansion.

Management Actions to Restore Olympic Wilderness Qualities

The restoration of wilderness resources and the visitor's wilderness experience is critical in ensuring that the direction provided by Congress through the Wilderness Act is adhered to in managing the Olympic Wilderness. A combination of management actions has been adopted and has proven tremendously successful in addressing Olympic's wilderness impacts. The more conventional actions, such as education, monitoring, visitor use limits, designated sites, and campfire restrictions, instituted in many protected areas are being implemented in Olympic. In addition, an intensive wilderness revegetation and rehabilitation program has been developed that has enabled wilderness resources and character to be restored and maintained at acceptable levels, even within high-use areas.

Education

Education is unquestionably the most important management strategy for ensuring both the short-term and long-term protection of wilderness. The successful prevention of deterioration and compromise of wilderness resources and character is incumbent on visitors' understanding and adopting wilderness values, ethics, and Leave-No-Trace techniques. To achieve this objective at Olympic, wilderness education is directed to hikers both during and prior to their visit.

Educational opportunities have been enhanced by expanding the number of visitors contacted before they enter the wilderness. A Wilderness Information Center (WIC) has been created adjacent to the Park's main visitor center, providing a centralized location for wilderness inquiries. Volunteer and paid staff provide trip planning information, updated trail conditions, safety tips, and minimum impact suggestions, both over the counter and by phone. Key resource concerns are described to the visitor, dependent on their hiking destination. Funding for the WIC comes from wilderness fees.

A Wilderness Trip Planner brochure has been developed to provide background material for visit preparation. The leaflet highlights information that will increase visitor safety and reduce wilderness impacts.

Onsite education has been extremely successful in preventing wilderness degradation. Coverage of high-use areas ensures that the majority of visitors receive a wilderness protection message. Limited funding does not allow paid personnel to staff all such areas, so volunteers trained through the Park's wilderness training program supplement the coverage.

Monitoring

In order to prevent further impacts and restore wilderness conditions, a systematized program to assess those

conditions is necessary. Long-term ecological monitoring (LTEM) is being established in Olympic National Park to monitor the condition of key natural resources. Objectives include understanding how components of Olympic's ecosystems change over time, providing an early warning of human-caused changes that may require management intervention, and providing a benchmark for assessing the health of more altered landscapes.

In addition, Olympic National Park has developed an ongoing monitoring program that is specifically directed at detecting and measuring the impacts on wilderness resources and character from visitor use. Campsite-related impacts, such as the amount of bare ground, organic soil, root exposure, and mutilated trees, are determined and compared to Olympic's wilderness standards. Campsites are mapped and photographed to more effectively relocate them and recognize changes over time. Visitor use levels are determined through daily logs kept by ranger staff documenting visitor numbers and individual site use. The use and resource impact data are used to determine appropriate management actions and to prioritize sites for restoration activities.

Visitor Use Limits

The most attractive of Olympic Wilderness sites accessed by trail have often been deluged with visitors. Even with other management actions in place, resources and the wilderness experience will continue to be affected unless visitor use levels are lowered. Thus far, use restrictions have focused on overnight rather than day visitors. Throughout the Park, overnight party size is limited to 12 visitors and, in those areas where stock are allowed, eight horses, mules, or llamas.

In some National Park Service wilderness areas, overnight quotas have been put into effect for all zones, limiting visitor use camping numbers throughout the wilderness. At Olympic, only specific areas identified as receiving too much use (based on wilderness plan guidelines) have overnight quotas. For example, one lake basin containing nine sites is restricted to 30 people per night, but the sites along the 8 mile trail accessing the area are not within the quota zone. Olympic's determination of actual quota numbers is based on the capacity of the area to sustain use while maintaining established wilderness conditions. Often, they are developed from the number of campsites that are deemed appropriate to keep within the area. Reservations for the quota areas may be made 30 days in advance for up to half the quota number. This allows visitors that plan ahead the assurance of receiving a site, but still provides an opportunity for visitors arriving at the Park without reservations to have some chance to camp in the most popular locales. Requiring more than 30 day advance reservations results in visitors making plans they are less likely to keep.

Designated Sites

Though Olympic's campsites developed and proliferated through visitor use rather than management selection, sites are now being reexamined to determine if each meets wilderness standards. Sites are evaluated based on distance from the main trail, other sites, water, and the likelihood that the site will not expand through vegetation loss and soil erosion. Unacceptable sites are closed, and those that meet guidelines are designated for use. Visitors are required to use designated sites along the trail corridor. This controls the development of new sites and helps make possible the restoration of closed areas. In the low-use cross-country zones, visitors are asked to camp on snow, rock, or resilient vegetation and to avoid camping on sites showing previous impacts where repetitive use would damage vegetation and potentially cause new site development.

Campfire Restrictions

In the 1970's, it was determined that campfire impacts to subalpine areas of the wilderness were too great to allow the building of open fires. "Stoves only" zones were established above the montane plant community in elevations with few or no trees. This more than 25 year closure has resulted in a significant decline in visitor-related impacts in subalpine areas. Probably the most popular backpacking destination in Washington State is located along Olympic National Park's wilderness coast. Though located at sea level, within the forest, with large piles of driftwood available and a use quota in place, it was determined that the campfire-related impacts were too severe. The area was closed to open fires in 1997, which has resulted in less trampling, soil compaction, and vegetation loss. In turn, this has protected revegetation efforts carried out in this area. Efficient and lightweight backpacking stoves have enabled most visitors to adapt to this change, but those still desiring the opportunity to build campfires can hike to alternative locations.

Rehabilitation and Revegetation

Site and trail rehabilitation and revegetation have proven to be one of the most successful methods for restoring high-use sites in the Olympic Wilderness. The combination of site upgrade and revegetation with the more conventional management actions discussed previously has been highly effective in maintaining restored wilderness conditions as well. The objectives of the rehabilitation and revegetation program are to upgrade facilities selected for retention to encourage visitor use and limit the area of visitor impact, and to restore the original native plant community as closely as possible on denuded sites and trails targeted for closure.

Olympic's revegetation program begins with the development of a detailed plan for the area based on monitoring data. An area map is drawn locating main trails, social trails, all sites, and other existing facilities such as toilets, bear cables (to hang food in trees away from bears), and ranger stations. Each trail and site is measured for length or area and given a code number. A determination is made of which trails and campsites will be retained for use and which will be closed to allow restoration. A specific prescription is then developed for each.

Campsites and trails are selected for retention based on use needs and whether wilderness values can be restored elsewhere by keeping them. Those remaining open are upgraded in a way that encourages visitors to contain their activities within trail and site boundaries.

Along main corridors where trails have widened or become braided, rocks and branches are placed on the trail shoulders to keep visitors on the main trail tread. If damage is severe enough, revegetation is done prior to placement. In some cases, where lingering snow has obscured the main trail and a parallel trail has developed in the early melt-off area, a more effective solution has sometimes been to upgrade the newly formed parallel trail and block and revegetate the former main trail. On trails where erosion has resulted in the loss of fine materials, rock or wood check dams are constructed to slow water flow and erosion and even allow soil buildup. Where check dams have been constructed along widened sections, large rocks placed on both sides of the check dam channel use. In time, vegetation begins to grow around the rocks, reducing the width of impacted tread. In substantially widened trail sections where bank undercutting has occurred, the construction of "planter boxes" has proved to be an effective rehabilitation technique. A rock wall is constructed, backfilled with rock and soil, and planted with vegetation. Bank erosion is halted and the trail restored to within standard. Sloping trails with flowing water can usually be improved by diverting water away using water bars (wood or rock used to form a ditch to carry water). Muddy, flat trails widened by visitors avoiding wet sections may be upgraded by placement of short wooden bridges called puncheon. Construction of turnpikes, using gravel from dry creek beds or uprooted trees that are placed between rock or wood borders, is also effective in bringing trail width back to standard.

Logs, and sometimes rocks, are used to delineate campsite borders, making site boundaries more clear, thus reducing campsite expansion. In areas where subtle delineation is not effective, very large barrier logs are pulled into place using hand-powered come-alongs. This discourages travel and camping in the site's closed perimeters. Sites are backfilled with soil or gravel to enhance drainage and campability, diminishing campsite sprawl. Rocks are placed within the site to be used for propping packs or as cooking or sitting surfaces to discourage travel into vegetated areas as hikers seek such amenities, reducing social trail development.

Logs are also strategically placed in sites and trails identified for closure. This creates barriers to discourage access. Rocks are dug in like "icebergs" in the center of closed areas that backpackers might otherwise find attractive for setting their tents. Dead wood is buried vertically to create the illusion of snags for the same purpose. Reducing traffic ensures a greater chance for plant recovery.

In many areas targeted for closure, natural recovery may successfully occur if vegetation has not been damaged too seriously and trampling is minimized. The majority of closed sites and trails in high-use areas have suffered significant enough damage; however, that recovery may take long periods and visitors will continue to be attracted to use the sites, making restoration impossible. Subalpine areas are especially slow to recover. Olympic's dominant subalpine species tend to be the woody shrubs such as heather and huckleberry that break easily, resulting in vegetation loss after moderate trampling. The growing season is extremely short in the high country with only a few summer months available for regrowth. Soils lost through erosion are not replenished since little duff or litter accumulates at or above treeline. Active revegetation is often required in high-use areas, especially the high country, to ensure that restoration occurs.

Revegetation efforts begin with the gathering of seeds and cuttings. Source materials are collected onsite in order to protect the plant community's genetic integrity. Species are targeted that will restore the original species composition as closely as possible. The plants are propagated in the Park greenhouse using a misting bench with bottom heat and specifically formulated rooting soil mixtures. Transplanting, ongoing watering, and feeding with fish fertilizer nurtures growth. Paperwork is done to track all plant treatments. Annually about 20,000 to 30,000 plants are propagated for Olympic Wilderness restoration projects.

Areas targeted for revegetation are prepared by thoroughly scarifying or breaking up compacted soil. Additives such as peat moss may be mixed in with the remaining onsite soils to help enhance plant growth in areas where soil has been lost to erosion.

Plants are packaged in cardboard boxes and transported to the project locations. The quantity of plants to be ferried onsite requires the use of motorized equipment. Helicopters are used in the high country, and for coastal projects sea transport is provided by the United States Coast Guard or the adjoining National Marine Sanctuary. The transplants are planted into the prepared beds, usually in the fall prior to plant dormancy. Watering, often the key to survival, occurs immediately after planting and then regularly until the fall rainy season arrives. Excelsior, aspen shavings that come in rolls, is placed over the revegetation areas to moderate the soil microclimate, protecting the plants from extremes in temperature. The material also serves as a mulch, enhancing the soil condition, and on steep slopes is used to check soil erosion. Plant survival has been extremely high.

Signs are placed to mark the specific areas closed for revegetation. A resource management sign is placed at the trailhead to explain the revegetation project and to identify with a map the campsites and trails that are open for use.

Little National Park Service money has been available for restoration work. Volunteers have provided a substantial amount of labor. In 1997, over 100 volunteers donated 4,000 hours of work to Olympic's wilderness restoration program. The majority of volunteers were recruited from the Puget Sound area, but a number of them came from throughout the United States to contribute to the project. Some volunteers worked for a day or two, others full-time for 5 months. Their contribution has ensured that the restoration program has been an extremely productive and cost-effective management tool.

Future Preservation of the Olympic Wilderness

The rainforests, glacier-covered peaks, and rugged coastline of Olympic National Park's exceptional wilderness is likely to attract increasing numbers of visitors in the future. Management actions such as education, monitoring, area use quotas, designated sites, and campfire restrictions have been highly successful in restoring and preserving wilderness qualities in high-use areas, when coupled with an aggressive rehabilitation and revegetation program. Continuing this management approach should ensure that the integrity of the Olympic Wilderness will be preserved so that future generations have the opportunity to use and enjoy a remnant of wild, primeval America.