RECREATION IN WHITEBARK PINE ECOSYSTEMS: DEMAND, PROBLEMS, AND MANAGEMENT STRATEGIES

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ABSTRACT

Whitebark pine ecosystems are an important element of many of the most spectacular high-elevation landscapes in the western United States. They occupy upper subalpine and timberline zones in the prime recreation lands of the Cascades, the Sierra Nevada, and the Northern Rocky Mountains. This paper explores the nature of the recreational opportunities that the whitebark pine ecosystem provides and the demand for those opportunities. Important management problems are described, as are strategies for minimizing problems and optimizing recreational opportunities.

Dispersed backcountry recreation is particularly important in whitebark pine ecosystems. Maintenance of natural-appearing landscapes is a critical management objective with this type of recreational use. The principal management challenges are to (1) provide opportunities to enjoy the landscape but concentrate and contain use wherever it regularly occurs, (2) design transportation systems and facilities to blend with the surroundings, (3) strive to improve site rehabilitation techniques, and (4) minimize the obtrusiveness of other forest uses.

RECREATION DEMAND AND OPPORTUNITIES

Most whitebark pine ecosystems are remote and inaccessible by road (Arno and Hammerly 1984). Consequently, the most common recreational activities are dispersed backcountry pursuits, such as backpacking, horsepacking, hike-in fishing, photography, nature study, and contemplation. A large proportion of these ecosystems—probably well over one-half—is protected as Wilderness, under the authority of the Wilderness Act, which expressly prohibits mechanized equipment, such as four-wheeled vehicles, motorcycles, snowmobiles, and even mountain bikes. This limits the range of recreation activities in most places.

Demand for outdoor recreation is great in whitebark pine ecosystems. The Cascades and Sierra Nevada are close to the population centers of the Pacific Coast, and the Northern Rocky Mountains are an important vacation destination. Wilderness acreage in these areas is abundant and large numbers of wilderness visitors are attracted to whitebark pine ecosystems. Eight of the 10 most heavily used wilderness areas in the United States have substantial amounts of whitebark pine (fig. 1). Within these wilderness areas, visitors are frequently attracted to these high-elevation forests. Visitors commonly hike or ride through lower elevations up to the higher elevation forests and meadows that are their primary destination. This tendency can be illustrated using data collected in the most popular portion of the Eagle Cap Wilderness, in the Wallowa Mountains of northeastern Oregon. In that area, about one-third of the landscape consists of whitebark pine forests, associated subalpine meadows, and spruce-fir forests in which whitebark pine is a component. However, 46 percent of the trail miles and 78 percent of the campsites are located in these ecosystem types (Cole 1977). Most wilderness visitors want to spend most of their time in these places.

The reasons why wilderness visitors are particularly attracted to whitebark pine ecosystems have not been studied. Four attributes of these ecosystems that likely attract large numbers of dispersed recreationists are esthetics, diversity, ease of hiking and camping, and good fishing. These landscapes are highly esthetic. Views of rugged peaks are often spectacular. At these elevations the peaks look close and the open stand structure provides more frequent vistas than the denser forests of lower elevations. Stunted whitebark pines and sunbleached snags are highly attractive, particularly silhouetted or bathed in late evening's alpenglow.

Whitebark pine landscapes are also unusually diverse. Meadows and rock outcrops are frequently as abundant as the forests and invite exploration. Creeks babbling through the meadows and the wildflowers that fill the meadows add to the diversity and interest of these areas. So do glacial features, such as cirque lakes and waterfalls, that cascade over glacially carved steps. The relatively open and highly diverse landscape invites cross-country travel and dispersed camping. It is relatively easy to hike off trail and to find attractive campsites away from heavily trafficked places.

Finally, the fact that whitebark pine ecosystems frequently occupy glacially carved landscapes means that cirque lakes are common features. These lakes attract visitors both as an esthetic and logical destination area and because they frequently offer good fishing. Fishing is an important wilderness activity for many visitors. In many wilderness areas, more than one-half of all visitors spend some time fishing (Lucas 1980). Fishing quality is

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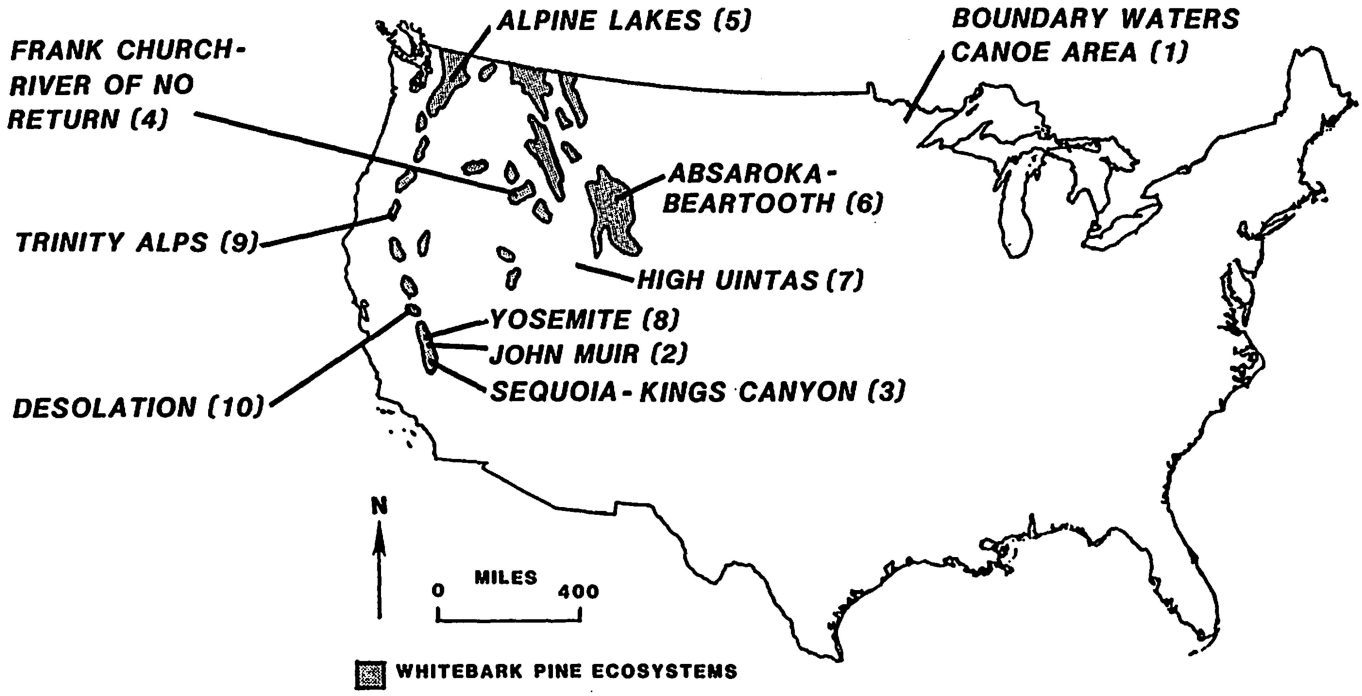

Figure 1—Eight of the ten most heavily-used wilderness areas in the country are in places with whitebark pine ecosystems. Numbers in parentheses are the rank of each wilderness area in terms of amount of use.

often an important consideration when selecting a wilderness destination and goes a long way toward explaining the popularity of whitebark pine ecosystems.

While backpacking, horsepacking, hiking, and fishing are probably the most common recreational opportunities that whitebark pine ecosystems provide, other types of recreation also are pursued. In the few places where roads access whitebark pine forests, scenic driving, picnicking, and roadside camping occur. The Tuolumne Meadows-Tioga Pass area in Yosemite National Park is a good example of a popular place offering this style of recreation. Snowmobiling and off-road-vehicle driving are well-established in some places and mountain biking is growing greatly in popularity. Demand for these experiences is high, again because of esthetics, diversity, and fishing. However, these opportunities are limited by road access and are not as unique to these ecosystems as is backcountry recreation. Finally, downhill and cross-country skiing occur in whitebark pine forests, but are not especially common there.

One theme common to all of these recreational pursuits is the importance of scenic quality and a landscape that has not been greatly altered by man. This latter concern is explicit in wilderness, where the Wilderness Act (P.L. 88-577) directs management to preserve wilderness such that it "appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable." Scenic qualities and an environment that contrasts with civilization are important motivations for visiting wilderness (Lucas 1985; Stankey and Schreyer 1987). I would hypothesize that these motivations are also important to recreationists outside wilderness and more important in whitebark pine ecosystems than in most other ecosystems.

A major management concern, then, should be to minimize the evidence of human use. This means minimizing the impacts caused by recreational use and sensitive design of transportation routes and facilities to accommodate recreational use. It also means minimizing the obtrusiveness of other forest uses, such as timber harvesting, grazing, and mining.

COMMON MANAGEMENT PROBLEMS

The most common problems that recreation managers face in whitebark pine ecosystems are resource degradation and crowding as a result of intensive recreational use. Trail and campsite degradation, packstock impacts, development of user-created trails around lakeshores, litter, and loss of solitude are all significant problems in many places (Washburne and Cole 1983). These problems are not unique to whitebark pine ecosystems, but they may be particularly pronounced due to the popularity of those landscapes.

Two studies have evaluated the susceptibility of whitebark pine ecosystems to recreational impact. In the Eagle Cap Wilderness, campsite impacts in whitebark pine forests were pronounced. The undergrowth vegetation, primarily grouse whortleberry (*Vaccinium scoparium*), is quite fragile; the mean vegetation loss on the central part of campsites was 94 percent. This compares, for example, with neighboring sedge (*Carex nigricans*) meadows where the mean vegetation loss on campsites was only 40 percent (Cole 1981).

Dale (1973) studied trails in whitebark pine, lodgepole pine, and spruce-fir forests of the Lee Metcalf Wilderness, in the Madison Range in southwestern Montana. Trails in whitebark pine forest were not particularly deep, but they tended to be unusually wide, particularly when subjected to heavy use. Factors that might contribute to wider trails here include (1) rocky soils that tend to cause users to spread out, (2) sandy soils that are readily displaced laterally, and (3) open vegetation that makes walking side-by-side easier. Generally, the suitability of whitebark pine forests for trails appears to be good to moderate, while suitability for campsites is moderate to poor.

Two problems that are particularly pronounced in whitebark pine ecosystems are the impacts associated with the collection of fuelwood for campfires and widespread proliferation of user-created trails and campsites. Collecting and burning wood in campfires is a common practice in most wilderness areas. In popular places this practice leads to large areas denuded of all downed wood and extensive damage to standing trees, both dead and alive. Damage to trees, from broken off lower branches to felled saplings and hacked snags, presents obvious evidence of human impact. A forest floor totally devoid of downed wood also looks unnatural to many visitors. In addition to these esthetic impacts, there are undoubtedly ecological changes that result from this practice. Recent research suggests that removal of large woody residue on and in the soil may have serious consequences. Large decaying wood plays an important and irreplaceable role in the ecosystem—for example, in water and nutrient conservation and as a substrate for biological activity (Franklin and others 1981; Harvey and others 1979).

These problems are likely to occur wherever fuelwood consumption rates exceed the rate at which downed woody material is produced. Problems are particularly likely in whitebark pine forests because productivity is relatively low and consumption is often high, due to the popularity of these places as destination areas. In a few study areas in the Sierra Nevada, for example, Davilla (1978) found that whitebark pine wood litter production was very low compared with that of lodgepole pine and mountain hemlock. This led him to recommend that fuelwood never be collected in forests where the dominant tree is whitebark pine. In many national parks campfires are prohibited at higher elevations; however, campfires are seldom prohibited in wilderness areas administered by the Forest Service, U.S. Department of Agriculture (Washburne and Cole 1983). While it is very common to discourage the use of campfires (and encourage visitors to use stoves), it is uncommon to differentiate among ecosystems in terms of their productivity and therefore the importance of not having a campfire (Cole in press).

Another problem that is particularly pronounced but not unique to whitebark pine forests is the proliferation of campsites and user-created trail systems in popular destination areas. Proliferation reflects heavy use, ease of cross-country travel, and the large number of potential campsites in these ecosystems. For example, all campsites were inventoried in a 325-acre area around two popular lakes in the Eagle Cap Wilderness. More than 200 campsites were found (fig. 2). Virtually every site around Mirror Lake with the potential for camping showed some evidence of use. Also, the fact that recreational use in the area was spread over a very large number of sites did not mean that impact on these sites was negligible. More than half the campsites had experienced a moderate to great loss of vegetation (Cole 1982). In addition to all these campsites, numerous informal trails branched off from the constructed trails to other campsites and to circle the lakes. Created by users, many of these trails are poorly located and prone to erosion.

Impact problems are exacerbated by the difficulty of rehabilitating damaged recreation sites in whitebark pine forests. Rehabilitation is required wherever excessive or inappropriate use has occurred or whenever management objectives change. Much of the current rehabilitation work in wilderness is focused on campsites close to lakeshores. In the past, few wilderness areas had specific objectives about appropriate campsite locations; today objectives frequently stress maintaining lakeshores in as natural a condition as possible. It is also common to rehabilitate braided trails and trails that have been relocated either because they were inadequately constructed or poorly located.

Without assistance, trails and campsites in whitebark pine ecosystems will require decades—if not centuries—to recover. For example, campsites in a lodgepole pine-whitebark pine forest around heavily impacted Bullfrog Lake in Kings Canyon National Park were closed to overnight use in 1961. After 17 years of closure, soil compaction levels had returned to near-natural levels. Litter depth and volume, however, remained substantially below those found in undisturbed forest. Tree damage, vegetation loss, and user-created trails remained pronounced, although recovery had begun. Tree mutilations were often covered over with new growth and some of the trails were being recolonized (Parsons 1979; Parsons and DeBenedetti 1979).

Attempts to assist site rehabilitation in these ecosystems are challenging. It is difficult to effectively close sites to use, and without effective closure sites are not likely to recover (Cole and Ranz 1983). Even where assistance has been effective in establishing an initial plant cover on damaged sites, recolonization of the entire site may be slow. For example, the success of transplanting was followed over a period of 5 years on two campsites in the Eagle Cap Wilderness. Mean vegetation cover on these two sites increased from 6.3 and 10.8 percent in 1979 to 7.3 and 12.3 percent in 1984. This compares with a mean vegetation cover of about 60 percent on undisturbed sites. Most of this increase was a result of the original transplanting of plugs. While most transplants survived, they had not spread and did not contribute much to a gain in vegetation cover (Cole 1986).

A final problem is disposal of human waste. Toilet facilities are seldom provided in whitebark pine ecosystems because use frequently is dispersed and facilities often are considered inappropriate. Where heavy overnight use occurs, camping areas can be littered with feces and toilet paper. In addition to being an esthetic problem, this can pose a health hazard. It is difficult to clearly demonstrate a cause-and-effect relationship between inadequate disposal of human waste and disease;

Figure 2—The distribution and degree of vegetation loss on campsites around Mirror and Moccasin Lakes in the Eagle Cap Wilderness, OR.

however, there is some evidence that *Giardia* spp. are more abundant in surface waters of frequently used recreational areas (Suk and others 1987). *Giardia* contamination is now a common problem in whitebark pine ecosystems.

MANAGEMENT STRATEGIES

Maintaining a natural-appearing landscape is the key to recreation management in whitebark pine ecosystems. Recreationists visiting these places expect to see little evidence of human use and impact. Characteristics of whitebark pine forests that make this difficult are inherently low productivity and low resilience. Once damage occurs, recovery takes a long time. Given the popularity of these places with backcountry recreationists, this low resilience means that management must be especially proactive. Management must strive to avoid problems rather than deal with them after they have occurred.

Four challenges face managers of whitebark pine ecosystems seeking to optimize recreational opportunities. First, it is important to concentrate and contain recreational use wherever it regularly occurs. Extremely low recovery rates make it imperative to minimize the number of places that are disturbed by recreational use. This is accomplished by confining as much use as possible to established trails and campsites. Overlooks should be designed to contain use and, if necessary, managers should harden heavily trafficked surfaces. Wilderness visitors should be encouraged to stay on constructed trails and use well-established or even officially designated campsites. Where packstock use is allowed, facilities for concentrating impact in small areas (for example, hitchrails or corrals) should be provided. The consequence of not pursuing this strategy is proliferation of impacts—a mistake that will require decades and centuries to correct.

Second, transportation systems and facilities can increase recreational opportunities in these ecosystems. Scenic byways and overlooks can add greatly to the enjoyment of motorized recreationists. Well-constructed trails, hitchrails, and toilets can add to the enjoyment of backcountry recreationists. Sensitive design is important, however. Cut slopes visible for miles—whether along roads or trails—are intrusive and detract from the natural environment. The challenge is to make certain that transportation systems and facilities blend into the natural-appearing landscape. This is particularly true inside wilderness, where the general philosophy is to provide facilities for purposes of safety and resource protection, but not visitor convenience.

The third challenge is to improve our ability to rehabilitate damaged sites. More experimentation with rehabilitation methods is needed. Rehabilitation efforts need to be documented and monitored; successes and failures need to be communicated to others. One example of a step in the right direction is a new rehabilitation program begun in whitebark pine and other ecosystems in Yosemite National Park. Experiments with seeding, nursery propagation, transplanting, and a variety of cultural treatments are under way. A controlled trampling experiment was conducted to evaluate the resistance of individual plant species and plant communities to trampling. Rehabilitation success is being monitored and results are being published in reports (Hadley and Moritsch 1988). Similar efforts are needed elsewhere.

The fourth challenge is to minimize the obtrusiveness of forest uses other than recreation. Timber harvesting, domestic livestock grazing, and mining are uses that can leave obvious disturbances on the landscape and detract

from the esthetics of these places. Where these uses occur, every effort should be made to separate these uses from recreational uses. Buffer strips along trails and roads can screen places where disturbance is evident. Trails can also be rerouted away from these places. Grazing can be limited to times and places where recreational use is low.

A CONCLUDING REMARK

A final challenge I might mention is the challenge I experienced in trying to write this paper. Information on recreational opportunities and problems in specific ecosystem types is sorely lacking. Consequently I had few concepts or data to work with and no precedent to follow or even build upon. Biologists seem to have conveniently ignored recreation management, preferring to concentrate on management of more tangible commodities. Recreation managers and researchers too frequently ignore the unique opportunities and constraints that each ecosystem presents. Better cooperation between these two groups is needed to effectively manage whitebark pine and other ecosystems.

REFERENCES

Arno, Stephen F.; Hammerly, Ramona P. 1984. Timberline—mountain and arctic forest frontiers. Seattle, WA: The Mountaineers. 304 p.

Cole, David N. 1977. Man's impact on wilderness vegetation: an example from Eagle Cap Wilderness, northeastern Oregon. Eugene, OR: University of Oregon. 307 p. Dissertation.

Cole, David N. 1981. Vegetational changes associated with recreational use and fire suppression in the Eagle Cap Wilderness, Oregon: some management implications. Biological Conservation. 20(4): 247-270.

Cole, David N. 1982. Controlling the spread of campsites at popular wilderness destinations. Journal of Soil and Water Conservation. 37(5): 291-295.

Cole, David N. 1986. Ecological changes on campsites in the Eagle Cap Wilderness, 1979 to 1984. Res. Pap. INT-368. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 15 p.

Cole, David N. [In press]. Low-impact recreational practices for wilderness and backcountry. Gen. Tech. Rep. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station.

Cole, David N.; Ranz, Beth. 1983. Temporary campsite closures in the Selway-Bitterroot Wilderness. Journal of Forestry. 81(11): 729-732.

Dale, Donn Richard. 1973. Effects of trail-use under forests in the Madison Range, Montana. Bozeman, MT: Montana State University. 96 p. Thesis.

Davilla, Bill. 1978. Firewood production, use and availability in the High Sierra. In: Stanley, J. T., Jr.; Harvey, H. T.; Hartesveldt, R. J., eds. A report on the wilderness impact study: the effects of human recreational activities on wilderness ecosystems with special emphasis on Sierra Club wilderness outings in the Sierra Nevada. San Francisco, CA: Sierra Club, Outing Committee: 94-128.

Franklin, Jerry F.; Cromack, Kermit, Jr.; Denison, William; [and others]. 1981. Ecological characteristics of old-growth Douglas-fir forests. Gen. Tech. Rep. PNW-181. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station. 48 p.

Hadley, Richard L.; Moritsch, Barbara J. 1988. Subalpine and montane revegetation in Yosemite. Park Science. 8(4): 20-21.

Harvey, A. E.; Jurgensen, M. F.; Larsen, M. J. 1979. Role of forest fuels in the biology and management of soil. Gen. Tech. Rep. INT-65. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 8 p.

Lucas, Robert C. 1980. Use patterns and visitor characteristics, attitudes, and preferences in nine wilderness and other roadless areas. Res. Pap. INT-253. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 89 p.

Lucas, Robert C. 1985. Visitor characteristics, attitudes, and use patterns in the Bob Marshall Wilderness complex, 1970-82. Res. Pap. INT-345. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 32 p.

Parsons, David J. 1979. The recovery of Bullfrog Lake. Fremontia. 7(2): 9-13.

Parsons, David J.; DeBenedetti, Stephen H. 1979. Wilderness protection in the High Sierra: effects of a 15-year closure. In: Linn, R. M., ed. Proceedings of the first conference on scientific research in the national parks; 1976 November 9-12; New Orleans, LA. Transactions and Proceedings Series No. 5 Washington, DC: U.S. Department of the Interior, National Park Service: 1313-1318.

Stankey, George H.; Schreyer, Richard. 1987. Attitudes toward wilderness and factors affecting visitor behavior: a state-of-knowledge review. In: Lucas, Robert C., comp. Proceedings—national wilderness research conference: issues, state-of-knowledge, future directions; 1985 July 23-26; Fort Collins, CO. Gen. Tech. Rep. INT-220. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 246-293.

Suk, Thomas J.; Sorenson, Stephen K.; Dileanis, Peter D. 1987. The relation between human presence and occurrence of *Giardia* cysts in streams in the Sierra Nevada, California. Journal of Freshwater Ecology. 4: 71-75.

Washburne, Randel F.; Cole, David N. 1983. Problems and practices in wilderness management: a survey of wilderness managers. Res. Pap. INT-304. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 56 p.