Aldo Leopold Wilderness Research Institute: Publication # 283
CITATION: Cole, David N. 1996. Ecological manipulation in wilderness--an emerging management dilemma. In: International Journal of Wilderness. 2(1): 15-19.

Ecological Manipulation in Wilderness—
An Emerging Management Dilemma

BY DAVID N. COLE

[*Editor's Note:* A U.S. wilderness leader's thoughts about the dilemma of whether to manipulate wilderness to maintain pristine conditions, or whether unmanipulated conditions are more desirable. *IJW* looks forward to providing a forum for David Cole's call for more ideas and debate. —John C. Hendee]

Abstract: The 1964 Wilderness Act contains at least three conflicting goals: preservation of natural or pristine conditions, avoidance of intentional ecological manipulation, and provision of opportunities for use. As anthropogenic disturbance of wilderness intensifies, managers must increasingly face the dilemma of choosing between the goals of restoring pristine conditions and avoiding conscious manipulation of ecosystems. At the crux of this dilemma are questions about the value of wilderness as a reference area or baseline and what wilderness should provide a reference to. Several compromise approaches with the potential for partial resolution of this dilemma are offered but more ideas and debate are needed.

PASSAGE IN THE UNITED STATES OF THE WILDERNESS ACT OF 1964 presented federal land managers with the challenge of maximizing a number of different wilderness values. Wilderness is important for at least three reasons. These wildlands are needed to protect examples of natural ecosystems and the diversity of life those ecosystems harbor (Noss 1991). They are also important as scientific reference areas or baselines—unmanipulated, pristine ecosystems that can be compared with the intentionally manipulated ecosystems that dominate most landscapes (Franklin 1987). Finally, wilderness is important for the recreational, spiritual, and other human values that derive from the use and existence of wilderness (Lucas 1973).

Conflicting Wilderness Goals and Management Dilemmas

These three sets of values are reflected in three different management goals established by the 1964 Wilderness Act. One goal is to preserve lands "in their natural condition" (Sec. 2a). Definitions of naturalness vary but the concept is most often equated with pristineness and defined by conditions that are similar to what would have existed in the absence of post–aboriginal humans (Wagner et al. 1995). In this paper I will refer to such conditions as "pristine," although this does not imply lack of influence by aboriginal humans or that future conditions should not diverge from the past as the natural processes of geologic, climate, and evolutionary change continue.

In Sec. 2c, wilderness is defined as "an area where the earth and its community of life are untrammeled by man."

Attempts to restore localized areas, such as denuded campsites, should generally not be controversial.

Untrammeled means uncontrolled, unconfined, not restrained. So a second goal—also related to the concept of naturalness—is to protect some lands from human control, from conscious, active, intentional manipulation. The third goal is to provide a variety of public benefits that derive from use of wilderness—"the public purposes of recreational, scenic, scientific, educational, conservation, and historical use" (Sec. 4b).

I believe the task of wilderness management is largely to optimize trade-offs between these three goals. Conflict between goals creates dilemmas that wilderness managers need to resolve. So far, most attention has been devoted to the dilemma arising from the conflict between use of wilderness, particularly for recreation, and preservation of natural conditions.

Burgeoning recreation use, particularly during the 1960s, made many aware of the impacts that recreationists can inflict on natural ecosystems, such as eroded trails and denuded campsites (e.g., Frissell and Duncan 1965). Managers had to decide whether to curtail beneficial uses—such as recreation—or allow those uses to adversely affect natural condi-

tions. This dilemma has typically been resolved by compromising both goals to some extent. Recreation is often restricted but still allowed (Lucas 1990), and wilderness ecosystems are impacted but not at the scale where their integrity or diversity is seriously affected (Cole 1990). In many wildernesses, "limits of acceptable change" (Stankey et al. 1985) have been established that formally define the tradeoff between recreation use and preservation goals. Other internal uses (e.g., scientific study and livestock grazing) are also typically restricted but not disallowed.

Manipulation of Vegetation, Genes, and Populations

Internal uses, however, are not the only threat to wilderness conditions. Wildernesses are also adversely affected by what goes on around them (Cole 1994). Wilderness boundaries are permeable to external influences that would ideally be kept out of wilderness (e.g., air pollution and exotic species) and at least somewhat impermeable to the natural flow of disturbance agents (e.g., fire) and wide-ranging species. As managers begin to deal with threats that are less easily controlled than internal use, new and complex questions arise. The evolution of fire management in wilderness provides an illustrative example.

Initially, of course, fire was considered to be an enemy, and everything possible was done to keep it from destroying wilderness. The strategy was to defend the wilderness perimeter, to keep the disturbance (i.e., fire) out. As it became increasingly clear that the real disturbance agent was not fire itself—but the suppression of fire—this strategy of defending the wilderness perimeter was simply turned around. Fire suppression was to be kept out of the wilderness. Natural ignitions were to be allowed to burn where possible (Parsons et al. 1986).

In many wildernesses, however, a policy allowing most natural ignitions to burn is not sufficient to restore natural conditions. Natural ignitions within wilderness may occur too infrequently. Many wildernesses are adapted to unusually frequent fires—the result of aboriginal burning (Arno 1985). Others are typically burned in fires that ignite outside wilderness, where they are suppressed these days. In many cases, fires are only allowed to burn when flammability is low; many fires are put out if they start during the time of year when they normally burn. In other cases, fire suppression has already resulted in such high fuel buildups that natural ignitions would result in fires that burn more catastrophically than is thought to have occurred in the past (Kilgore 1987). For all these reasons, it is becoming increasingly clear that restoration of pristine conditions and processes will usually require active intervention—human ignitions and perhaps some pre-burn manipulation of fuels and vegetation. But is conscious ecosystem manipulation desirable?

Restoration of natural fire is not the only management issue for which questions about the desirability of manipulation have surfaced. Exotic species have and are spreading across wilderness lands. The exotic disease, white pine blister rust, is decimating whitebark pine populations in the northern Rockies (Keane et al. 1994). Severe whitebark mortality could seriously affect grizzly bear populations, which depend on whitebark seeds for a significant proportion of their diet (Mattson et al. 1991). One way to compensate for this impact is to breed and plant rust-resistant whitebark pines (Hoff and Hagle 1990). Is this sort of manipulation of genes and populations desirable in wilderness?

The Dilemma of Ecological Manipulation

As we enter the 21st century, the foremost challenge facing wilderness managers is likely to be the dilemma posed by the conflict between the goal of preserving conditions as they would be in the absence of anthropogenic disturbance and the goal of avoiding conscious manipulation of wilderness ecosystems. Managers will increasingly be forced to decide which of the two aspects of naturalness—pristine conditions or unmanipulated conditions—should be given preeminence. They will have to determine whether or not it is desirable to intentionally manipulate ecosystems for the purpose of restoring more pristine conditions.

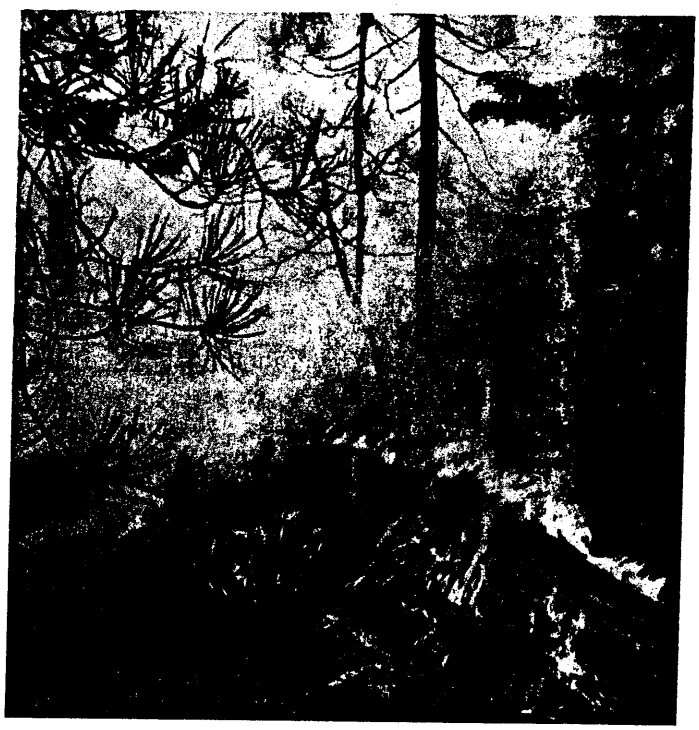
At the crux of this dilemma are questions about the value of wilderness as a reference area or baseline and what wilderness should provide a reference to. The ideal reference area would be wilderness that is both pristine and unmanipulated. Unfortunately, this is not an option, although the framers of the 1964 Wilderness Act and most scientists of the time probably failed to realize this.

We can have wilderness that is close to pristine, although it would still be somewhat altered by anthropogenic disturbance. However, to compensate for anthropogenic disturbance and to re-create more pristine conditions, managers would have to actively manipulate wilderness ecosystems. Eventually, given the pervasiveness of human influence, aggressive pursuit of this approach would result in the manipulation of all wilderness ecosystems. At that point, ironically, all wilderness ecosystems would be artificial constructs to some extent—conscious reconstructions of what humans think is natural (Graber 1995).

Manipulated wilderness would be useful as a reference for comparison with highly altered landscapes (e.g., managed forests and agricultural systems). Its value for this purpose would be determined largely by the skill managers bring to the definition of pristine conditions and the implementation of prescriptions that re-create these conditions. However, it would be impossible to evaluate the success of these prescriptions and adjust management accordingly. All wildlands would be consciously constructed artifacts, so there would no longer be any examples of unmanipulated ecosystems to serve as reference areas. Ecosystem manipulations in wilderness would become experiments without controls.

Alternatively, we can have wilderness that is unmanipulated but substantially disturbed. Taking this approach,

managers would actively attempt to keep direct anthropogenic disturbances (e.g., exotic species and fire suppression) out of wilderness, but they would avoid active ecosystem manipulation within wilderness. The result would be wilderness ecosystems that diverge, perhaps substantially, from their projected pristine state. These wildernesses would be useful as reference areas for comparison to manipulated ecosystems, both within and outside of wilderness. They would provide controls for interventions within wilderness and provide scientists with a place to monitor the dynamics of unrestrained ecosystems. Many, however, would be poor examples of pristine ecosystems.



Periodic disturbance by fire is critical to the natural fucntion of wilderness ecosystems. Restoration of natural fire regimes may require human ignitions and preburn fuel manipulation.

Management Options: Pristine, Unmanipulated, or a Combination?

My argument, in short, is that the goal of naturalness implies the desirability of wilderness ecosystems that are both pristine and unmanipulated, but these ecosystem states are to some extent mutually exclusive. So what are 21st century wilderness managers to do? I believe that some compromise between pristine and unmanipulated conditions is the best approach. The extreme of doing everything possible to approximate pristine conditions cannot be afforded over the large acreages required, even if this approach was deemed desirable. As Vale (1987) points out, such intensive manipulation, because it would require conspicuous human presence, would also conflict with recreation use goals. The extreme of no intervention anywhere—while inexpensive in the short-term—seems equally undesirable because the integrity of many wilderness ecosystems will inexorably degrade in the face of increased human disturbance.

Acceptable Restorations

One compromise option is to distinguish, either generally or on a case-by-case basis, between acceptable restorations and interventions that are too manipulative. Criteria useful in evaluating the acceptability of a restoration might include, 1) characteristics of the disturbance (e.g., areal extent, persistence, etc.), 2) characteristics of what is being restored (e.g., its rarity, vulnerability, irreplacability, etc.), and 3) characteristics of the intervention itself (e.g., its complexity, likely side effects, etc.). It might be decided, for example, that campsite restorations and chemical treatment of exotics within localized areas are generally acceptable because they only affect small sites that are not particularly unique, and they are unlikely to have far-reaching and unpredictable side effects.

This approach holds promise for distinguishing between controversial and noncontroversial restorations. It is less useful for making decisions about the appropriateness of controversial restorations. The problem is that characteristics that make a restoration beneficial in terms of increasing naturalness also make a restoration risky in terms of having widespread, unpredictable, and perhaps unnatural effects on highly valued or rare ecosystem components.

One potential outcome of this approach is that all wilderness ecosystems eventually become manipulated to a moderate degree. This approach to compromise is analogous to that taken, with some success, to resolve the use vs. preservation dilemma. When applied to the dilemma of pristine vs. unmanipulated conditions, this approach has a major drawback. Wilderness lands would not provide good examples of either pristine conditions or unmanipulated conditions. Where controversial restorations are considered, a zoning approach to compromise might be preferable.

Interwilderness Zoning

One zoning option is to actively manipulate some wildernesses to approximate pristine conditions, while leaving other wildernesses essentially unmanipulated. This approach might optimize the value of wilderness as a baseline because some areas could serve as examples of pristine conditions while others could serve as examples of unmanipulated conditions. The knowledge obtained from studies of unmanipulated wilderness could allow for adaptive management of the more intensively manipulated wildernesses.

Botkin (1990), who argues the need for these two types of designated wilderness, also points out that the need for intervention decreases as wilderness size increases. Larger wildernesses are more effectively buffered from surrounding influences and more capable of functioning independent of surrounding lands. Therefore, unmanipulated wildernesses would probably be selected from the larger wildernesses in the country.

The Selway-Bitterroot Wilderness in Idaho, for example, is one of the larg-

est wildernesses in the country at 1,337,681 acres. It has a policy of allowing most natural ignitions to burn, but has not yet been intensively manipulated. Brown et al. (1994) estimate that the annual area burned by natural ignitions in a portion of the Selway-Bitterroot is about 60% of the annual area burned prior to settlement. More of the area could be burned and conditions might be closer to pristine if a program of fuel reduction and management ignitions was instituted, but these manipulations would compromise the value of the Selway-Bitterroot as an unmanipulated reference area. Since the Selway-Bitterroot remains relatively pristine even without active manipulation it might be a good candidate to remain unmanipulated.

Avoiding manipulation is not even a realistic option in small wilderness areas such as the 13,660-acre Big Gum Swamp in Florida. Here, fires historically burned through pine/wiregrass ecosystems every 3 to 5 years (Christensen 1978). Natural ignitions were infrequent but fire frequency was high because fires burned unencumbered over huge areas. Today, developed lands surround this small wilderness so fires never burn into the wilderness. Consequently, the only feasible source of frequent fire is management ignition. Without frequent fire, vegetation composition and structure change quickly and dramatically across the entire wilderness, fuels build up greatly, and the potential for catastrophic fire increases. Since little semblance of pristine conditions is possible without intervention, this small wilderness is a likely candidate for intentional manipulation. In fact, management ignitions have been used to burn most of the land in this wilderness in the past several years.

Intrawilderness Zoning

Another zoning option would be to manipulate some portions of a wilderness while leaving other portions unmanipulated. Manipulations might be confined to the most profoundly altered parts of the wilderness or perhaps to the wilderness periphery. With this approach, decisions would be made during management planning for individual wildernesses. This avoids the problems inherent to interwilderness zoning, where regional or national planning is required.

Conclusions

In the near future, management action (or inaction) will increasingly exert a significant influence on the long-term value of wilderness. Managers may continue to allow wilderness conditions to diverge from a pristine state by electing not to pursue active manipulation. Or they may compromise our future ability to monitor the effects of human actions by intentionally manipulating the last of our wildlands. Neither option is attractive. Clearly there is need for active restoration in wilderness management, but its extent and magnitude needs to be more intensely debated. The first step is recognition that there is a conflict between the goals of pristine and unmanipulated conditions. The primary purpose of this paper has been to increase awareness of this emerging dilemma. Once this conflict is recognized, the pros and cons of alternative approaches needs to be described. Then, decisions need to be made about where and when manipulation is desirable and whether there is any value to a zoning approach. Until these decisions are made (and even after they are made) it is important to approach wilderness restoration with more humility than hubris. For restoration to be successful, managers must specify desirable (i.e., natural) conditions. This is no simple task, judging from the minimal progress made in defining desired conditions during the 30 years since passage of the 1964 Wilderness Act. However, this task is much simpler than prescribing and implementing the interventions that will bring about desired changes in ecosystems, without causing undesirable and unanticipated changes elsewhere. As Frank Egler (1977) observed, "Ecosystems are not only more complex than we think, but more complex than we can think." With this in mind, we should be cautious about consciously manipulating the last of our wildlands—even if manipulation is the only way to restore natural conditions. **IJW**

David N. Cole is a research biologist with the Aldo Leopold Wilderness Research Institute, Missoula, Montana 59807, USA. Telephone: (406) 542-4199.

Acknowledgments
Some of the ideas in this paper are presented more clearly because of the constructive criticism of David Parsons.

REFERENCES

Arno, S.F. 1985. Ecological effects and management implications of Indian fires. In *Proc. of symposium and workshop on wilderness fire.* USDA Forest Service, Intermountain Forest and Range Experiment Station, General Technical Report INT-182:81–86.

Botkin, D. B. 1990. *Discordant Harmonies.* New York: Oxford University Press.

Brown, J. K., Arno, S. F., Barrett, S.W., and J. P. Menakis. 1994. Comparing the prescribed natural fire program with presettlement fires in the Selway-Bitterroot Wilderness. *Int. J. Wildland Fire,* 4:157–168.

Christensen, N. L. 1978. Fire regimes in southeastern ecosystems. In *Fire regimes and ecosystem properties—proc. of the conference.* USDA Forest Service, General Technical Report WO-26:112–136.

Cole, D. N. 1990. Ecological impacts of wilderness recreation and their management. In *Wilderness Management,* Hendee, et. al. Golden, Colo.: North American Press.

Cole, D. N. 1994. The wilderness threats matrix: a framework for assessing impacts. USDA Forest Service, Research Paper INT-475.

Egler, F. 1977. *The Nature of Vegetation: Its Management and Mismanagement.* Norfolk, Conn.: Aton Forest.

Franklin, J. F. 1987. Scientific use of wilderness. In *Proc.—National Wilderness Research Conference: issues, state-of-knowledge, future directions.* R. C. Lucas, ed. USDA Forest Service, Intermountain Research Station, General Technical Report INT-220:42–46.

Frissell, S. S., and D. P. Duncan. 1965. Campsite preference and deterioration in the Quetico-Superior canoe country. *J. For.,* 63:256–260.

Graber, D. M. 1995. Resolute biocentrism: the dilemma of wilderness in national parks. In *Reinventing nature? responses to postmodern deconstruction.* M. E. Soul and G. Lease, eds. Washington D.C.: Island Press, 123–135.

Hoff, R., and S. Hagle. 1990. Diseases of whitebark pine with special emphasis on white pine blister rust. In *Proc.—symposium on whitebark pine ecosystems.* USDA Forest Service, Intermountain Research Station, General Technical Report INT-270:179–190.

(continued on page 19)

REFERENCES (continued from page 18)

Keane, R. E., Morgan, P., and J. P. Menakis. 1994. Landscape assessment of the decline of whitebark pine (Pinus albicaulis) in the Bob Marshall Wilderness Complex, Montana, USA. *Northwest Sci.*, 68:213–229.

Kilgore, B. M. 1987. The role of fire in wilderness: a state-of-knowledge review. In *Proc.—National Wilderness Research Conference: issues, state-of-knowledge, future directions.* R. C. Lucas, ed. USDA Forest Service, Intermountain Research Station, General Technical Report INT-220:70–103.

Lucas, R. C. 1973. Wilderness: a management framework. *J. Soil and Water Conserv.*, 28:150–154.

———. 1990. Wilderness recreation management: a general overview. In *Wilderness Management.* Hendee, et al. Golden, Colo.: North American Press.

Mattson, D. J., Blanchard, B. M., and R. R. Knight. 1991. Food habits of Yellowstone grizzly bears, 1977–1987. *Can. J. Zool.*, 9:1,619–1,629.

Noss, R. F. 1991. Sustainability and wilderness. *Conserv. Biol.*, 5:120–122.

Parsons, D. J., Graber, D. M., Agee, J. K., and J. W. van Wagtendonk. 1986. Natural fire management in national parks. *Envir. Manage.*, 10:21–24.

Stankey, G. H., Cole, D. N., Lucas, R. C., Petersen, M. E., and S. S. Frissell. 1985. The limits of acceptable change (LAC) system for wilderness planning. USDA Forest Service, Intermountain Forest and Range Experiment Station, General Technical Report INT-176.

Vale, T. R. 1987. Vegetation change and park purposes in the high elevations of Yosemite National Park, California. *Annual Assoc. Amer. Geogr.*, 77:1–18.

Wagner, F. H., Foresta, R., Gill, R. B., McCullough, D. R., Pelton, M. R., Porter, W. F., and H. Salwasser. 1995. *Wildlife Policies in the U.S. National Parks.* Washington, D.C.: Island Press.