Stewardship of Conserved Lands

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Abstract
Land that has been conserved for natural resource protection requires careful and ongoing management. There are many factors that can degrade protected lands. These include changes in native plant or animal communities caused by pests, pathogens, or invasive species; poaching, illegal resource harvesting, disturbance to plants and animals from intensive human use, malicious destruction of resources, and ecological changes in nearby landscapes. Every protected property, regardless of size, must have an explicit conservation goal, a management plan, stewardship consistent with the management plan, monitoring to determine if management goals are being achieved, and adaptive adjustment of management plans if goals are not being met or new threats to the integrity of the protected land emerge.

INTRODUCTION

Acquiring ownership of, or development rights to land is one of the most effective ways of conserving natural and cultural resources at local, regional, and national scales. Once acquired, protected land requires constant stewardship. Land protection is done for many reasons: to protect the fauna and flora of a site, to protect cultural resources, to ensure that ecosystem services are maintained, to allow sustainable use of natural resources of the site, and to afford public access for recreational purposes.[1,2] Land conservation occurs at multiple scales, in all ecosystems (terrestrial, aquatic, and marine), and is accomplished by many kinds of institutions and public agencies. National governments protect watersheds, forests, and rangelands for resource protection and in many cases, for sustainable resource harvesting. National governments also conserve large national park systems for the benefit of biota and present and future generations of citizens. Conservation occurs at smaller jurisdictions as well; for example, states, counties, and towns. Large nonprofit organizations, such as The Nature Conservancy and the Audubon Society in the United States, are very effective in protecting land, as are small nonprofit organizations such as local land trusts and conservancies. Regardless of the size of the conservation organization or the property preserved, all protected lands require ongoing management and stewardship.

The consequences of not stewarding protected lands can jeopardize the very resources that are meant to be preserved. Developing and implementing a management plan for protected land is one good way of cataloging and prioritizing stewardship responsibilities and we review steps in management planning here. Threats to protected lands can rapidly change; therefore, monitoring protected lands is an important part of the process. Finally, the technical knowledge within a conservation organization, the availability of staff and equipment, and funding for protected land management are frequently inadequate for the magnitude of the task, thus, innovative collaborations and efficient implementation of management plans are necessary.

Protected land stewardship is a challenging endeavor and has many components which will be reviewed here. Large government agencies or other organizations that own and manage large areas of protected lands typically have dedicated programs for stewardship activities. For example, the National Park Service (NPS) oversees a large and complex network of protected areas in the United States. Every park in the NPS system has a General Management Plan, which articulates the management needs of a park and how the park will meet those needs.[3] Furthermore, the NPS has a sophisticated program—the NPS Inventory and Monitoring Program—to systematically monitor environmental conditions in parks to know if management and stewardship activities are having the desired results and to be vigilant to new or unforeseen threats to the ecological integrity of a park.[4] Other conservation agencies that oversee large areas of land have similar programs such as the U.S. Fish and Wildlife Services,[5] U.S. Bureau of Land Management,[6] and U.S. Forest Service.[7] Small conservation organizations, such as local conservancies and land trusts, typically do not have dedicated staff or program resources for protected

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land stewardship, yet they own significant areas of land. In the United States, for example, there are 1700 different land trusts that control over 150,000 km^2 of land.[5] The focus of this article is to describe the conservation land stewardship process that would be followed by a small conservation organization.

LAND PROTECTION AND STEWARDSHIP

There are a variety of reasons to protect land and many stewardship strategies that can be used to meet conservation goals (Table 1). Conservation lands are typically protected by securing fee simple ownership, control over future development rights, or establishment of permitted and restricted uses of the land through zoning controls.[2] However a property is controlled, the development and implementation of an ongoing management plan for the protected property are essential. There are many threats to the ecological integrity of protected lands (Table 2, Fig. 1). Pests, pathogens, and invasive species can impact native fauna and flora of a site. Illegal poaching or harvesting natural resources can diminish the biota. Soil compaction, erosion, and vegetation disturbance in fragile ecosystems caused by motor vehicle riding (e.g., all-terrain vehicles, motorcycles) can result in serious environmental damage. Malicious acts, such as garbage dumping, littering, theft of cultural resources, and vandalism, can diminish the esthetic value of a site. A carefully designed management plan will be attentive to these threats. Protected land management should happen in a systematic manner (Fig. 2). The basic steps are discussed in detail in the coming sections.

Site Assessment and Baseline Inventory

An essential first step in conservation land management is a site (the parcel) and landscape (what is around it) survey to inventory current conditions and catalog important habitats. The purpose of the site assessment is to evaluate the presence and condition of important natural resources and to identify threats to the focal resources and the ecosystem as a whole. Target resources can be species, habitats, rivers, landforms, viewscapes, farms, cultural resources, groundwater, or ecosystem services and ecological processes.[8,9] Site assessment can be a complex activity and require personnel familiar with local ecological conditions. Assessment involves field survey and consolidation of relevant geospatial information such as data from Geographic Information Systems (wetlands, rare species occurrences, land use, soils, landform, etc.), digital imagery, and the results of previous reconnaissance of the area if available. The initial site assessment establishes a baseline condition for easement monitoring and tracking changes in the condition of the property. Landscape analysis provides a regional context for conservation and provides insight in gains and losses of dispersal corridors, up-watershed threats that would jeopardize site-level habitats or species, and land use changes on nearby properties that might enhance or diminish the conservation value of a particular parcel.[10] There is a growing number of protocols that have been advanced to perform a baseline inventory.[11,12]

Development of Management Goals and Plan

Development of management goals is an essential step and the goals of the management plan will reflect the values of

Table 1 Examples of common conservation goals and management activities that achieve them

Goal	Management and stewardship actions
Preserve biodiversity	Protect large tracts of land. Connect separate refuges with corridors. Increase the size of refuges. Enforce policies against poaching wildlife or harvesting plants. Ensure adjacent land uses are not a source of invasive species, pests, or pathogens. Monitor for invasive species, pests, and pathogens. Monitor population levels of key or indicator species of plants and animals.
Preserve cultural resources	Protect sites or regions of interest; limit public access to sensitive sites.
Preserve ecosystem services	Ensure that conservation land boundaries encompass whole watersheds, maintain diversity of habitats, and allow public access and nondestructive forms of recreation so that patrons can benefit from esthetic values.
Preserve aesthetic or recreational values	Provide trails and interpretive services for public access; encourage hiking, hunting, and fishing if appropriate for the site; manage viewscapes and soundscapes to preserve natural conditions.
Ensure sustainable resource use	If a site permits, allow controlled harvest of sustainable resources, such as wood products, game and fish, plants, fruits, berries, and fungi.
Agricultural preservation	Obtain development rights and easements to working lands and waters to ensure they will remain in agricultural land use.

Table 2 Examples of common threats to resources on conserved lands

Resource	Threat
Biodiversity	Habitat destruction, poaching; illegal harvest of plants or animals; spread of invasive species, pests, and pathogens; loss of fitness due to small population sizes; illegal motor vehicle access in sensitive habitats.
Cultural resources	Vandalism, theft, and alteration of landscape context (e.g., viewscapes, soundscapes).
Ecosystem services	Groundwater withdrawal outside refuge, habitat destruction on borders of refuge, and high-impact land uses outside refuge in watershed.
Aesthetic or recreational values	Trespassing, illegal motor vehicle access, dumping, degradation of natural viewscapes or soundscapes.

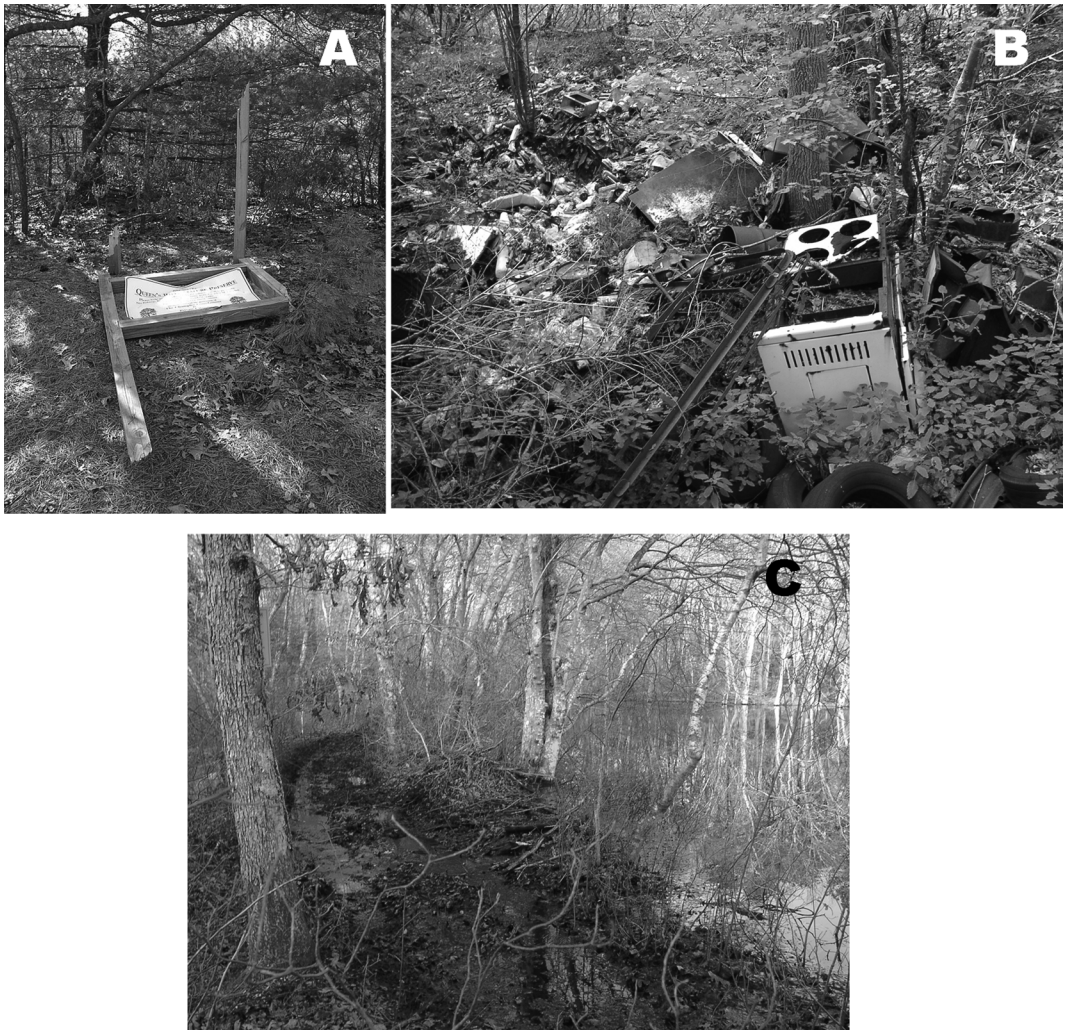

Fig. 1 Examples of threats to protected lands: (**A**) Vandalism (destruction of signage); (**B**) illegal dumping of refuse; (**C**) all terrain vehicle track damage to wetland habitat.
Source: Photo courtesy, The Rhode Island Chapter of The Nature Conservancy.

the conservation institution and the purpose for acquiring the conservation land.[13] Common management goals include stewarding the land for water (ground and/or surface) protection, conservation of biodiversity, forestry, farming, esthetic values, fish and wildlife management, and recreation (hiking, paddling, fishing, hunting, etc.). Management goals of one property can affect the viability of nearby conservation properties owned by others; hence there is a need for coordinated management when protected lands are in a mosaic of small parcels managed by different institutions. It is important that a management plan establish a basis or rationale for prioritizing resources

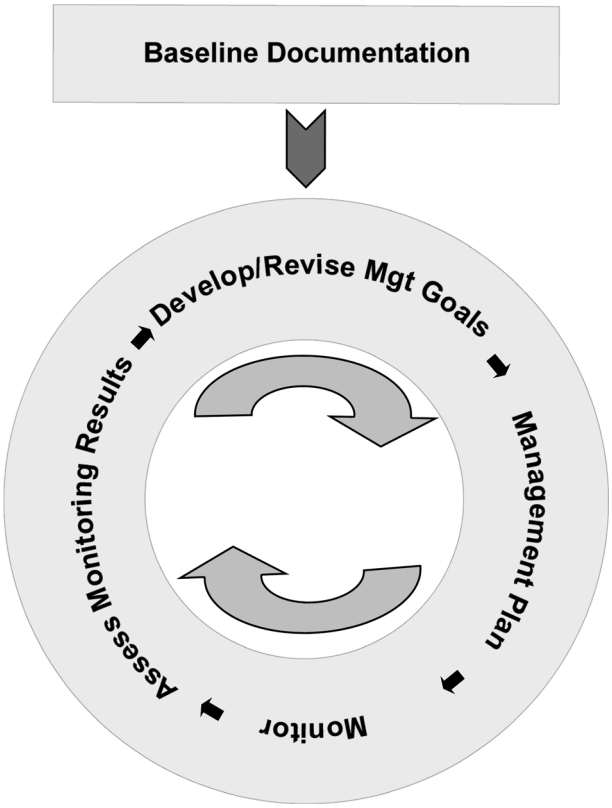

Fig. 2 Management cycle of protected lands: Steps involved in managing protected lands.

and stewardship actions, so that scarce resources are applied over time can still achieve large, long-term goals. Once goals for a property are established, a management plan can be developed and clear measures of success must be identified. These measures are the basis for ongoing monitoring and are the indicators of success or failure of the management plan.

Implementation of Management Plan

Management plans can vary in complexity; simple management plans for conservation lands may require little activity beyond periodic monitoring. Other stewardship activities, however, could require considerable work, expertise, and investment in personnel, supplies, equipment, and time in the field. Examples of expensive and complex management tasks include habitat restoration, creating and maintaining trail systems, forest management (selective cutting to maintain the age and target species composition of the forest), and removal or control of invasive species.[14,15] The implementation of a management plan can be a challenge for conservation organizations. Large land owners do not always have the staff or resources to manage extensive properties. Similarly, small, local conservation organizations, such as land trusts, rarely have the technical wherewithal or financial ability to take on complex management activities. Partnerships and collaborative projects are one way to perform complex stewardship tasks.

Monitoring

Vigilant monitoring is required of conservation properties and the land surrounding them. Easements must be monitored on a regular basis to ensure that fee owners are managing properties in a manner that is consistent with the easement that is held by the conservation organization. Violations in easements will have legal and policy ramifications which will need to be addressed.

All properties must be visited on a regular basis to protect against adverse possession claims and to identify inappropriate human activities occurring on or near them. Vandalism, dumping, erosion caused by motor vehicles, illegal hunting, and wood cutting are, unfortunately, common on conservation lands (Fig. 1). Monitoring for disturbances such as these is relatively straightforward for small properties but requires constant attention. Monitoring over large, expansive conservation lands can be logistically difficult, especially if access is difficult.[16] Ecological monitoring must be done on and around conservation lands to ensure that invasive plants and animals have not become established, pests or pathogens are not present, stewardship activities are yielding desired outcomes, target species are still present, and ecosystem health remains high. Regional changes in the creation of impervious surfaces, which increase storm water runoff, water withdrawal in the watershed, land use conversion, and habitat fragmentation can degrade the condition and viability inside conservation lands.

Synthesis, Reflection, and Adaptive Stewardship

Monitoring provides the data from which decisions about the efficacy of the management plan can be made. A careful analysis of monitoring data determines if the management plan is working and the ecological condition of the property is changing. If the desired results are not occurring, the management plan should be modified to meet the conservation goals of the property. This is a critical step and follows the logic of the adaptive management paradigm.[17] New, unanticipated stewardship challenges can emerge rapidly. Management plans must be dynamic documents and capable of changing as knowledge or needs require.

CONCLUSIONS

Acquiring land is an effective way to protect natural resources and careful stewardship of conserved lands ensures that the condition of the natural resources is preserved. Stewardship is an ongoing process and a long-term commitment. Many factors can diminish the value of

protected land and these must be monitored, and when present, mitigated. The process of protected land management has a number of steps and begins with a careful resource inventory of the protected property and establishment of a suite of management goals that will direct stewardship activities. Ongoing monitoring to ensure that management goals are being met is an essential component of the process.

Large land owners, such as U.S. NPS or U.S. Forest Service, have very complex management programs to ensure that the property in their care retains the environmental and cultural resources the lands were obtained to protect. Small land owners, such as land trusts and local conservancies, frequently do not have dedicated staff resources, knowledge, or budgets to steward their land, but innovative partnerships are one way the resources of many institutions can be leveraged to achieve effective land stewardship even by small land owners. One model is the Rhode Island Conservation Stewardship Collaborative (RICSC),[18] an alliance of federal, state, municipal, and nonprofit conservation organizations who partner to (from its mission statement) "*… advance long-term protection and stewardship of terrestrial, aquatic, coastal, estuarine, and marine areas in Rhode Island that have been conserved by fee, easement, or other means*." The RICSC tackles systemic, state-wide, impediments to good conservation land stewardship and provides training materials, protocols, and technical capacity to assist conservation land owners in their stewardship challenges.

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