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Biodiversity, Traditional Management Systems and Cultural Landscapes: Examples from the Boreal Forest of Canada

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Introduction

Many discussions implicitly or explicitly assume that biodiversity conservation is possible only within protected areas. Yet most of the world's biodiversity is in areas used by people. Hence, to conserve biodiversity, we need to understand how human cultures interact with landscapes and shape them into cultural landscapes. In fact, to a large extent, the world's biodiversity depends on maintaining patterns of resource use that facilitate the continued renewal of ecosystems. Many traditional systems of forest use do this, showing subtle understandings of how forest ecosystems work. The study of cultural landscapes and indigenous use of non-timber forest products (NTFPs) provides an arena in which discussions of biodiversity, traditional management systems and cultural landscapes can be brought together.

The use of many NTFPs is linked to the ecological processes of disturbance and succession. Various species of trees and shrubs are distributed in space and time relative to disturbance. For example, in the lands of the Anishnaabe (Ojibwa) people of Shoal lake, northwestern Ontario, fireweed (*Epilobium angustifolium* L.) occurs in the early years following a disturbance, ginseng (*Panax quinquefolius* L.) is found under mature forest canopies, while highbush cranberry (*Viburnum trilobum* L.) often occurs along riverbanks disturbed periodically by spring flooding. Fireweed and ginseng are utilized as medicinal plants while highbush cranberry is an edible berry (Davidson-Hunt and Berkes 2001). However, the dominant use of the forest in this geographic area has been large-scale timber production, a use that has made little allowance for these ecological processes that produce NTFPs.

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Can forests be managed sustainably -- in a way that permits these processes to continue, while at the same time providing for timber production and other services? In recent years there has been a shift in the idea of how forests should be managed. Instead of merely as a source of timber, forests may be viewed as providing a range of ecosystem goods and services. This shift is in part related to the understanding of how human activities can be made consistent with biodiversity and landscape conservation (Berkes 2004). In part it is related to such recent interdisciplinary, international efforts as the Millennium Ecosystem Assessment (MA 2005), UNDP's Equator Initiative program (http://www.undp.org/equatorinitiative), and *World Resources 2005* (UNDP/UNEP/World Bank/WRI 2005). These approaches aim for the integration of ecosystem management with human well-being, and recognize that the long-term health of forest ecosystems and livelihood needs are complementary, rather than opposing, goals.

In exploring the relationship between biodiversity conservation and cultural practices of land use in forest ecosystems, our objectives are to examine the significance of traditional knowledge and management systems and their implications for biodiversity conservation. We start with a section to provide context on indigenous systems of forest use. Then we turn to the detailed example of indigenous use of boreal forest ecosystems of northern Canada, discussing traditional practices and cultural landscapes that provide temporal and spatial biodiversity, and examining the mechanisms by which biodiversity can be conserved. We conclude by discussing broader definitions of conservation and integrated objectives for sustainable management that can accommodate livelihood needs of local people while protecting biodiversity.

Succession Management in Traditional Systems: Use of Fire

There exists a diversity of traditional practices that resemble contemporary scientific practices for ecosystem-based management. They include succession management, landscape patchiness management, resource rotation, and multiple species management (Berkes et al. 2000). Among these, succession management is a particularly common practice, often used in combination with the other practices. **Table 1** provides a sample of traditional ecosystem-based management systems that use fire as a way to clearing land and initiating ecological cycles that provide food and

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other materials. This practice is best known from systems of shifting cultivation (swidden or "slash-and-burn) from the humid tropics. But it is not only tropical agriculturalists who practice succession management by the use of fire.

Conventional wisdom used to hold that hunter-gatherers did not practice habitat management. Lewis's seminal work and cross-cultural comparative studies showed that many different groups in diverse geographic areas of the world practiced fire management. There were remarkable similarities in the functional strategies used by these groups in such diverse areas as the Pacific Northwest of the United States, Northern Alberta in the west-central boreal zone of Canada, and in Tasmania and the various parts of Australia (Lewis and Ferguson 1988).

Table 1 is restricted to examples from the Americas. They range from a classical study of Amazonian shifting cultivation (Denevan et al. 1984) and the *kumerachi* system of the temperate forests of northern Mexican highlands (Davidson-Hunt 2003a), to boreal forest examples. One of these is the Lewis and Ferguson (1988) study of habitat management of northern boreal hunters and the other, Davidson-Hunt's (2003b) work on Anishnaabe berry management that will be described in some detail in this paper.

Ecologically speaking, what these succession management systems have in common is that they all involve ecological renewal cycles, and they all start with a disturbance event. The disturbance could be a natural fire, a pest infestation, a blowdown following a storm, or it could be a human-made fire or a patch of forest cut and cleared. A typical renewal cycle, also called the adaptive renewal cycle (Gunderson and Holling 2002), starts with an early succession phase of rapidly growing herbaceous plants. Gradually, bushy plants take over, shading out the grasses and other pioneer species. Larger trees gradually take over, leading to a climax phase. In the Denevan et al. (1984) example, the Bora people burned a forest patch and planted a succession of crops, from annuals and root crops to bananas to tree crops, mimicking natural succession. Some 30 years later, the patch had grown to look similar to the original forest but still yielded useful products for the Bora.

The adaptive renewal cycle does not stop at the climax phase. In some forest ecosystems, such as the boreal forest, a disturbance event is needed to release the nutrients and start the cycle over again. Frequent small disturbance events actually help with the ecosystem functioning; conversely, the prevention of small disturbances makes a forest ecosystem increasingly more

vulnerable to large and potentially disastrous disturbances. The classical example is the Yellowstone National Park in the United States -- a century of fire prevention eventually resulted in a giant fire in 1988 that burned down about half of the Park.

In resilient ecological systems, small disturbances precipitate the “release” phase that helps system renewal by leading to a “reorganization” phase in which the “memory” of the system enables ecological cycles to start over (Gunderson and Holling 2002). The memory can consist of pine cones in a boreal forest, for example, anything that helps the forest ecosystem to perpetuate itself; it could also include “social memory” of traditional practices such as those of the Bora or the Anishnaabe that help renew forest ecosystems.

Canada’s Boreal Forest Ecosystem and People

The boreal forest dominates large parts of North America and Eurasia. Canada's boreal region covers some 6 million km^2 or 58% of Canada's land mass. It forms a broad green belt across the centre of the country, from Newfoundland to the Yukon, bounded by the tundra to the north and temperate forests and prairies to the south. By some calculations, the boreal contains some 90 percent of the country's remaining large intact forests. Wetlands and an estimated 1.5 million lakes cover some 30 percent of the boreal zone. It receives year-round precipitation and contains some of the country’s largest river systems.

Canada's boreal region is home to more than four million people, including many First Nations communities. Indigenous peoples of the Boreal Forest include the Cree, the Anishnaabe (Ojibwa), both of which speak languages belonging to the Algonquian family, and the Dene (Athapascan) that include groups such as the Gwich’in. The boreal forest, with its wetlands, lakes and rivers, is a source of livelihoods for these groups. Boreal indigenous people have developed lifestyles and local economies that are based on hunting, fishing and gathering, with small-scale agriculture practiced only in limited areas.

The forest is a source of big game such as moose, and small game such as snowshoe hares. Wetlands produce ducks and geese, and lakes and rivers produce fish. Indigenous traditional economies used timber mainly for construction, firewood, and to make wood implements such as sleds, snowshoes and ice shovels. Berries and medicinal plants were the main NTFPs used (Marles

et al. 2000; Andre and Fehr 2001). Other NTFPs included household goods and crafts such as birch bark baskets, other woven containers and mats, and food items such as sugar from maple and other tree sap.

The use of the forest by Canadian indigenous people is probably not as well known internationally, for example, as the indigenous peoples of the Amazon. There is extensive information on land use and wildlife hunting in the Canadian boreal and some on forestry planning (Natcher and Hickey 2002), but the use of plants and NTFPs is relatively less studied. In this paper, we concentrate mainly on the use of berries as a way of illustrating the relationship of boreal indigenous peoples with the plant resources of their environment.

The discussion is based on the Anishnaabe of Shoal Lake (Iskatewizaagegan No. 39 Independent First Nation), a small community in northwestern Ontario straddling the Manitoba border. In the two sections that follow, first we discuss a traditional boreal forest management system of the Shoal Lake Anishnaabe that provides temporal biodiversity, and second, their notions of spatial biodiversity. We make cross-references to a second Anishnaabe community, Pikangikum First Nation, also in northwestern Ontario, and a Dene group, the Teetl'it Gwich'in of Fort McPherson, the Northwest Territories, who live near the Mackenzie Delta.

A Traditional Knowledge and Management System of the Shoal Lake Anishnaabe

The central portion of the Canadian boreal zone is a fire-driven forest ecosystem. It depends on periodic natural fires to renew itself, and there are a number of fire-dependent species, as one finds in other fire-dependent forest ecosystems around the world. In the past, the Shoal Lake Anishnaabe used fires to create disturbances in the forest canopy. This practice was banned in the first half of the 20th century as wasteful and dangerous. However, the Anishnaabe still use disturbance as a forest management tool, relying on naturally occurring fires and other kinds of disturbances such as clear-cutting that in some cases mimic the ecological effects of fire (Davidson-Hunt 2003b).

The cycle starts with 'forest,' called ***Nopoming*** in Anishinaabe (**Figure 1**). The elders use the word ***Ishkote*** refer to the action of burning. The first year or two following a fire is described as ***Ishkwaakite***, 'newly burned trees' (the English term in each case is a gloss of the Anishnaabe term).

At this stage, following a fire disturbance, herbaceous vegetation is absent or just beginning to emerge. What is present in abundance is standing dead wood suitable for firewood. ***Ishkote*** is used to refer to both those fires set by people and those that occur naturally. Historically, a fire could be set to clear an area for a planting, for example a garden on islands on Shoal Lake. In this case, ***Ishkote*** is used to convert ***Nopoming*** into ***Ishkwaakite*** and then into ***Gitigaan,*** meaning planting or gardening. Some of the islands in the region, those with deep, loamy soils and with a mixed hardwood forest cover, are known as ***Gitigaan Minis***, 'gardening islands.'

Once a garden is established by clearing the standing dead wood, it is burnt each spring to prepare it for planting. The process of burning and planting eventually leads to an area that was free of roots and easily planted. When it is no longer utilized as a garden, the annual burning would stop but the long-term imprint of the cultural modification could remain for more than 50 years. **Figure 2** shows the soil profile for two sites on one of these gardening islands, Potato Island. The control site in the forested area has A and B soil horizons. The site that corresponds to the planted area does not have a B horizon, resulting in a soil profile signature for the site due to the process of working the soil for gardening. There is also a noticeable impact of gardening on soil chemistry and on the mix of plant species found at the site (Roberts 2005).

When a fire occurred on sandy or rocky sites with little soil, these sites were not used for gardening. In these places, ***Ishkwaakite*** changed to ***Oshkwaakite,*** 'older burnt trees.' The standing dead wood could be harvested for firewood. In such areas, three to five years after the disturbance, a blueberry heath would develop. Several years after the establishment of the blueberry heath, bush honeysuckle (*Diervilla lonicera*) would begin to shade out the blueberry plants. In order to prevent this from occurring, some people burned the blueberry heath every couple of years to renew the blueberry plants and control succession. This led, over time, to a ***Miiniikaa***, a 'blueberry patch.' If the blueberry patch was not burned, then succession would proceed and the patch would revert back to forest.

The elders described a similar cycle for a logging disturbance, also shown in Figure 1. In this case, the stage that followed logging was described as ***Gaagiidazhigiishkaakweyag,*** 'there the trees were cut down'. A blueberry heath would be established following a clear-cut that occurred on sandy soils. However, this appears to be dependent on post-harvest site preparation. Some methods of silviculture lead to a full and productive blueberry heath. Others result in a patchy heath with

poor production. Elders suggested that the timing of the cycle was similar to that which followed forest fires. A blueberry patch established itself three to five years after a clear-cut and lasted for another three to five years.

We have also documented the use of fire to control vegetation underneath oak trees (probably to help fertilize and protect oak trees); on points and high areas (probably to help visibility for hunting); and to keep campsites free of brush (as elders note, this allows the wind to blow and reduce mosquito nuisance). The diversity of uses of fire documented here has something in common: the Anishnaabe used disturbance in a variety of ways to maintain habitats in early stages of succession. The actual practices in the use of disturbance no doubt varied with the indigenous group and the type of boreal forest ecosystem. Management for berries seems to be common in many parts of the boreal forest. Others have documented additional practices. For example, Lewis and Ferguson (1988) have shown that, in addition to creating and maintaining blueberry patches, fire has been used to maintain grassy areas along rivers and wetlands to provide fodder in spring for ungulates and other species, to clear trails, and to renew dead patches of forest.

Spatial Biodiversity and Shoal Lake Anishnaabe Boreal Forest Knowledge

Many plant species important to the Anishinaabe people occur across a variety of boreal forest habitats. In the four kinds of habitats (called Ecosites in the Ontario Ecological Land Classification system) investigated by Ruta (2002), there were plants that were named and utilized by the Anishinaabe. Some of these species were specialists and only occupied a narrow range of habitats. Others were generalists found in most of the habitats. While the generalists were widely distributed, they were often found at greater abundance in a narrower range of habitats (Ruta 2002).

After documenting the distribution and abundance of important plant species within four habitat types, a workshop was held with Shoal Lake Anishnaabe elders to discuss whether these findings could suggest that some habitats were more important than others. Could the diversity of habitat types at a landscape scale be shifted in a direction that would maximize habitats that generate local values? The context of this question was the ongoing discussions on the forest management policy of the Province of Ontario. There has been the suggestion that productive forest lands should be intensively managed as plantations for a single value (timber), while conserving other lands as

protected areas. Such as shift in forest management practice would change the abundance of different types of habitats at the landscape scale, and their distribution across the landscape. This was the issue being posed to the elders.

To approach the larger question, elders were asked whether some plants were more important than others, with the related understanding that this may indicate that some habitats are more important to keep on the landscape at higher abundance. This question generated a rich discussion regarding the relationship between forest management and biodiversity, and led to an articulation of the principles that the elders began to formulate. The basic principle from Shoal Lake Anishnaabe elders is that some plants are not more important than others, and there should not be an effort to protect some species and not other species. Rather, what is important is the protection of the full suite of biodiversity. Habitats at the landscape scale, as well as plants at the scale of sites, should be maintained through forest management practices.

As we probed this question further during a series of workshops, we came to the following understanding. In the Anishinaabe perspective, the Creator placed the people in Iskatewizaagegan (Shoal Lake) and provided everything that the people would need for their survival in that place. In return, the Anishinaabe hold the responsibility to maintain these gifts that were given to them. Practices that harm these gifts can lead to consequences for an individual or the individual's family. At the landscape scale, there is a basic duty upon the Anishinaabe not to influence abundance or distribution of habitats. In a workshop with elders in Pikangikum, the same principle emerged and was concisely translated into English as: "as was, as is".

At a site-specific scale, there is another argument for maintaining the full suite of biodiversity. There exists a general body of knowledge about plants that can be referred to as survival knowledge that is widely distributed through the Anishinaabe population. However, there is another body of knowledge – in this case, specialized knowledge -- that is accessed during the healing process. A healer may receive a vision during a dream in which a plant, or other being, offers itself for the healing process. A healer does not know ahead of time what that plant might be; it might even be a plant that the healer has never used before. One must hold an attitude of humility for the mysteries of nature, as one never knows the real value of a plant ahead of time. Given that the Creator provided everything that the Anishinaabe need to survive, there must be a reason for the existence of every plant, animal and other beings (Davidson-Hunt 2005).

The Shoal Lake Anishnaabe principle of maintaining the full suite of biodiversity is similar to scientific views on multifunctional landscape management, but it is from a different angle. Rather than tying biodiversity to known functional properties of a habitat or species, the Anishinaabe principle considers that every habitat and species has a reason to be there, known or unknown, and for that reason biodiversity should be maintained into the future.

Conserving Biodiversity in Cultural Landscapes

Anishinaabe principles and practices contradict much of the current forest management strategies. Anishinaabe people seem to manage diversity at both the site scale and the landscape scale, to obtain multiple values at both. By contrast, much of current scientific management aims to obtain a single dominant value from a given landscape. For example, protected areas are managed to maximize conservation, while forest lands are maximized for timber production. Neither appears to be doing a particularly good job of conserving biodiversity.

In both cases, there is a tendency to "freeze" or fix the ecosystem in a particular configuration to manage for the dominant value (Holling and Meffe 1996). In the Anishnaabe system, a disturbance is created or welcomed as the necessary force to drive renewal cycles and give rise to both spatial and temporal diversity. That is, the landscape is allowed to be dynamic so that it generates values (Creator's gifts), rather than trying to control the ecosystem to generate a particular value. This idea is pervasive among the indigenous peoples of boreal forest. For example, the Gwich'in say, "the Creator made this land for us"; resources such as berries are sacred gifts that are part of the spiritual connection of the Gwich'in to their land (Parlee et al. 2005).

The Anishnaabe landscape is multifunctional; it produces all that is needed by the people, as long as biodiversity is maintained throughout the landscape. This does not mean that Anishinaabe people do not undertake practices that change the landscape; however, it does mean that such practices are in line with natural processes (such as succession) and help maintain spatial and temporal diversity at both the landscape and the site level. Similarly, when the Gwich'in people say, they "take care of the land", they are referring to the practice of visiting and maintaining the trails and berry patches so that they do not become grown over with invasive species such as willows (Parlee et al. 2005).

How do Anishnaabe and other indigenous principles of diversity protection get translated into practice? Are there specific mechanisms by which biodiversity is conserved and created in these multifunctional, dynamic, cultural landscapes? There seem to be at least three possible mechanisms in the case of Anishnaabe fire and other kinds of disturbance management:

The first is the conserving and enhancing biodiversity by the maintenance of all successional stages. Each stage in succession represents a unique community of plants, animals and human uses. A land use regime that maintains forest patches at different successional stages therefore helps maintain biodiversity. At the same time, such a pattern of land use contributes to the continued renewal of ecosystems by conserving system memory for renewal and reorganization (Berkes and Folke 2002).

The second is the creation of patches, gaps and mosaics; these are well known in landscape ecology as ways in which biodiversity may be enhanced in a given area. Another way of stating this is that low and intermediate levels of disturbance often increase biodiversity as compared to non-disturbed areas. Not only boreal NTFP harvesters but also boreal hunters know this mechanism well and use it effectively, for example, through the creation of meadows and yards (e.g., moose yards) by the use of fire (Lewis and Ferguson 1988).

The third is the creation of edges (ecotones). Edges exist in nature but new edges can also be created by disturbance. Boundaries between ecological zones are characterized by high diversity, both ecologically and culturally (Turner et al. 2003). Overlaps, mixing and diversity of plant and animal species and human cultures make for dynamic landscapes (Boyd 1999).

A fourth mechanism, not observed in Anishnaabe cultural landscapes but elsewhere (Boyd 1999), is the conservation and enhancement of vertical diversity. Resource use can help create structural complexity with layers of tree, shrub and ground vegetation. For example, some of the indigenous inspired alternatives to clear-cutting being practiced in British Columbia involve the maintenance of species and age diversity of forest as well as its architecture (Pinkerton 1998).

In summary, the practice of Anishnaabe site-specific burning, in combination with landscape scale natural fires, would increase the temporal diversity of the boreal forest. The combined outcome is a landscape that is diverse spatially; within that spatial diversity, there are habitats at different temporal stages that increase the overall landscape biodiversity. It is possible that this pattern may help fire-proof the landscape. The large patches of young vegetation from natural fires,

as well as the ribbons of green along the rivers and patches of green scattered throughout, would provide fire-breaks. Frequent small fires would reduce the fuel load on the forest floor, an example of small disturbances staving off a Yellowstone National Park kind of catastrophic disturbance (Gunderson and Holling 2002). More generally, in ecosystems in which the natural rate of decomposition is slow (as in the boreal forest), fires would speed up nutrient cycling, help increase biological productivity, and maintains ecosystem resilience by lubricating adaptive renewal cycles.

Conclusions: Toward Integrated Objectives of Biodiversity Conservation and Livelihoods

Human activities modify ecosystems. "Pristine areas" are not as pristine as the purists think, and "wilderness" is largely a myth, even in apparently untouched tropical forests (Gómez-Pompa and Kaus 1992). In many areas, human activities have caused the degradation of ecosystems and loss of biodiversity. But this is not necessarily the case everywhere. Even in heavily populated biodiversity "hot spots" such as the Western Ghats, India, researchers have found high levels of biodiversity, comparable to protected areas, in sacred groves and in multispecies plantations (Bhagwat et al. 2005). As these authors observe, sacred groves maintained by tradition and the multifunctional cultural landscapes produced by centuries-old systems of plantation, can be as important as formal protected areas in conservation strategies. As the Anishnaabe example shows, there are habitats that emerge from the activities of people on the land.

Local people have incentives to conserve biodiversity when their livelihoods depend on multitude of products and values produced by biodiversity. This is the case for many rural peoples o the world whose livelihoods depend on NTFPs. It is also the case for the indigenous groups of Canada's boreal forest ecosystems who obtain much of their protein from hunting and who use NTFPs such as medicinal plants and berries. Hence, biodiversity conservation strategies that work in the long-term need to take into account those who use the products of the ecosystem in which they live and who are active agents in producing cultural landscapes.

Recent approaches such as the Millennium Ecosystem Assessment (MA 2005) and *World Resources 2005* (UNDP/UNEP/World Bank/WRI 2005) promote the integration of ecosystem management with human well-being. They recognize that biodiversity conservation and livelihood

needs are, or should be, complementary goals. But these two objectives are not necessarily congruent in a given situation and they rarely coexist as equals.

More common are situations in which one objective or the other dominates (Brown 2002). For example, involving local communities in conservation is often used as a means of making conservation measures less likely to meet local resistance. But the ultimate objective is one of conservation. Conversely, protecting the productivity of a resource may be used as a means to enhance local livelihoods and development options, but the main objective remains development. Management approaches that explicitly have more than one objective are far less common than those that have one primary objective.

The Millennium Ecosystem Assessment terms this multiple objectives approach, "integrated responses". They are those responses that explicitly and purposely state that their objectives address more than one ecosystem service(s) and human well-being simultaneously. Integrated responses may be seen as a way of moving from problem-solving in simple systems to problem-solving in complex adaptive systems (Berkes 2004). As appropriate to that task, integrated responses tend to involve networks and partnerships of various levels of government, the private sector and civil society. In cases such as the management of boreal forest ecosystems, effective integrated responses need to take into account traditional knowledge systems and alternate ways of understanding and interacting with forest ecosystems.

Learning from traditional management systems, such as those of the Anishnaabe, is important for broadening conservation objectives and approaches. The use of local and traditional ecological knowledge is an effective mechanism for the empowerment of indigenous communities for joint decision-making. The lens of cultural landscapes provides a mechanism to understand how multiple objectives (timber production, NTFPs, protected areas, tourism) are central to sustainable forest management in landscapes that conserve heritage values and support the livelihood needs of local people. Developing a broader, cross-cultural, pluralistic definition of conservation is a major challenge. As pointed out by the UNDP/UNEP/World Bank/WRI (2005) document, our definition of conservation has been elitist. Accommodating livelihood needs and recognizing local and traditional knowledge built over centuries to deal with cultural landscapes is one way to build more inclusive, robust constituencies for conservation.

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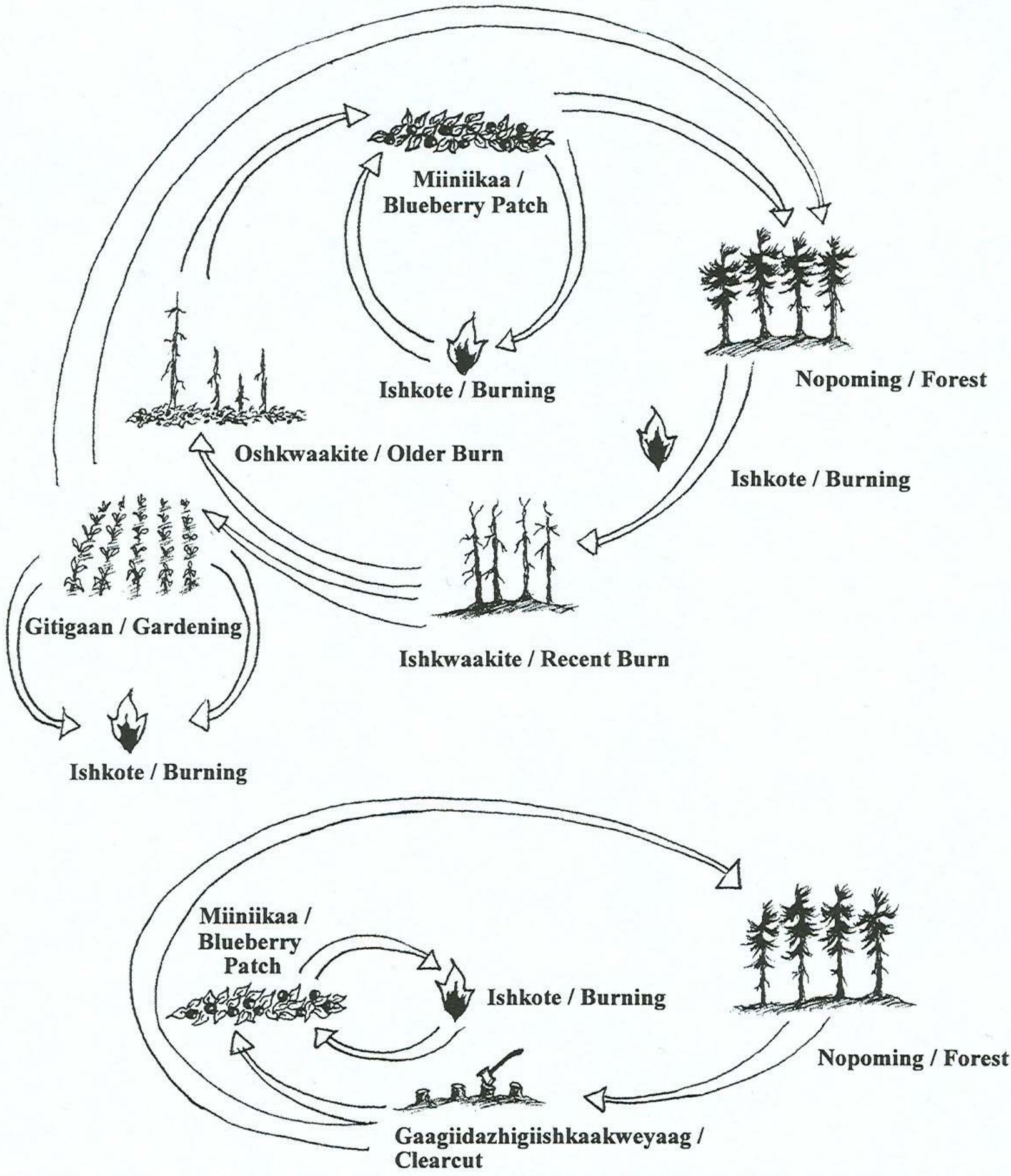
Table 1. Examples of the use of fire for succession management in the Americas.

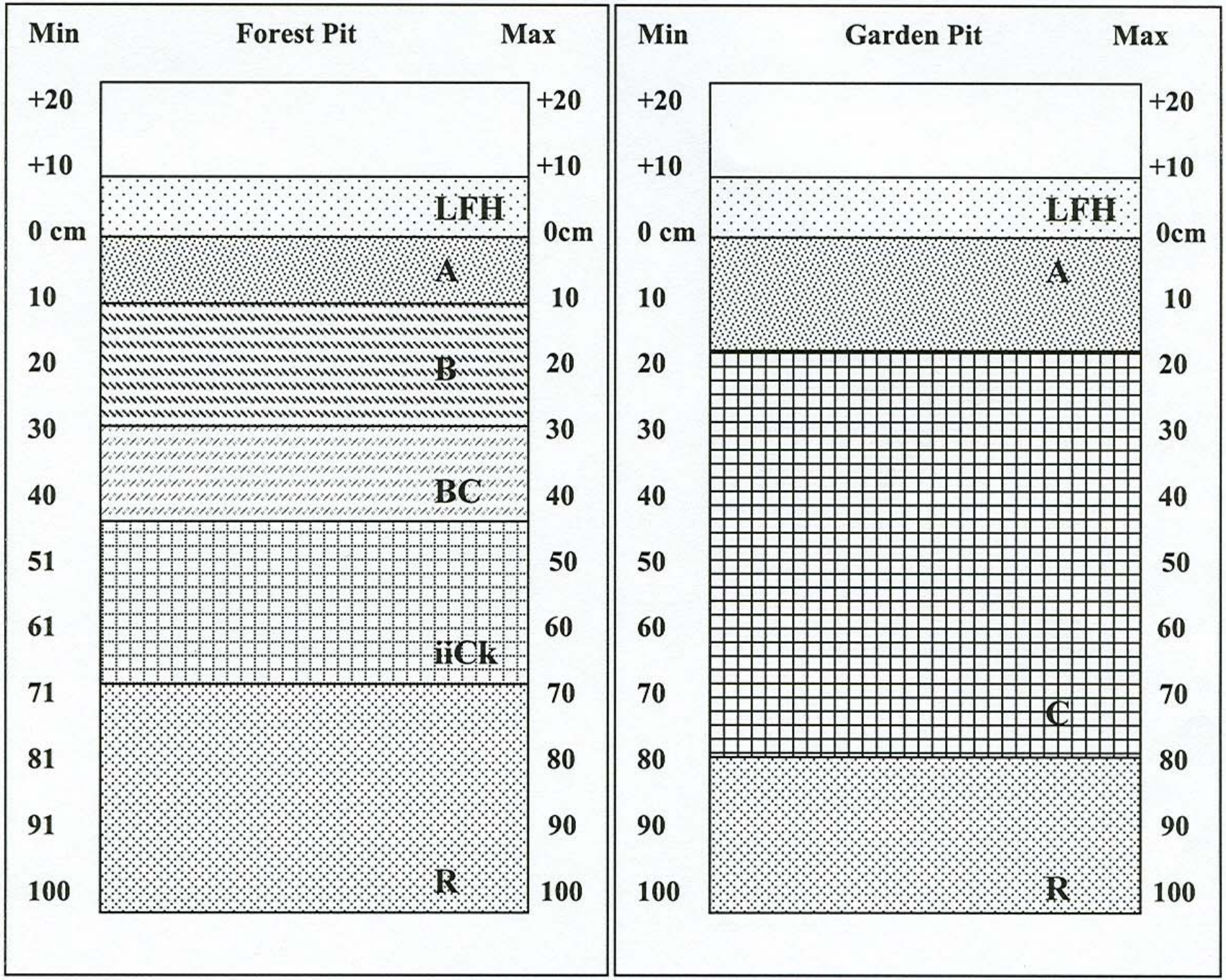
Society/area	**Description**	**Reference**
Bora, Peru Amazon	Multi-stage, multi-crop tropical shifting cultivation system	Denevan et al. 1984
Ralamuli, Northern Mexico	*Kumerachi:* oak-pine forest management for corn and beans cultivated in patches	Davidson-Hunt 2003a
Prairie Region, Canada	Anishnaabe burning of aspen parkland and riverbanks to expand prairie habitat for bison	Davidson-Hunt 2003a
Northern interior British Columbia, Canada	Burning of patches to maintain production of berries, mainly mountain huckleberry and lowbush blueberry	Johnson 1999
Southern coastal British Columbia, Canada	Burning of garry oak savannah landscape to prepare habitat for root crops, mainly camas	Turner 1999
Northern Alberta, Canada	Boreal forest burning to produce yards, corridors, mosaics, and habitat attractive for wildlife	Lewis and Ferguson 1988
Northwest Ontario, Canada	Boreal forest burning for berry production and small-scale cultivation	Davidson-Hunt 2003b

Figure Captions

Figure 1. An Anishinaabe perception of forest succession following disturbance. The top cycle refers to fire as disturbance. The bottom cycle refers to foresty clearcuts as disturbance. See text.

Figure 2. A comparison of soil pit profiles from a garden island located on Shoal Lake, Ontario. The forest pit serves as the control, with distinct A and B soil horizons. The garden pit shows a soil profile signature for the site due to the process of working the soil for gardening.


Miiniikaa /
Blueberry Patch
Ishkote / Burning
Nopoming / Forest
Oshkwaakite / Older Burn
Ishkote / Burning
Gitigaan / Gardening
Ishkwaakite / Recent Burn
Ishkote / Burning
Miiniikaa /
Blueberry
Patch
Ishkote / Burning
Nopoming / Forest
Gaagiidazhigiishkaakweyaag /
Clearcut


Min
Forest Pit
Max
+20
+10
0 cm
10
20
30
40
51
61
71
81
91
100
LFH
A
B
BC
iiCk
R
Min
Garden Pit
Max
+20
+10
0 cm
10
20
30
40
50
60
70
80
90
100
LFH
A
C
R