

Living on the Edge: Ecological and Cultural Edges as Sources of Diversity for Social–Ecological Resilience

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A well-known facet of ecosystems is that the edges—the boundaries or transitions from one ecosystem to another—often exhibit high levels of species richness or biodiversity. These transitional areas often show features of species composition, structure, and function representative of the ecosystems they transcend, as well as having their own unique array of species and characteristics. Cultural transitional areas—zones where two or more cultures converge and interact—are similarly rich and diverse in cultural traits, exhibiting cultural and linguistic features of each of the contributing peoples. This results in an increase in cultural capital, and resilience, by providing a wider range of traditional ecological knowledge and wisdom on which to draw, especially in times of stress and change. We propose that indigenous peoples whose living territories traverse ecological edges have a correspondingly increased access to economically important resources and therefore have a greater capacity for flexibility. Finally, we suggest that indigenous peoples are drawn to areas having a high incidence of ecological edges, and furthermore, that they actively create and maintain ecological edges. This practice provides them with a greater diversity of cultural capital and helps to maintain their flexibility and resilience. Examples from several regions of Canada are provided, from the southern interior of British Columbia, to the Lake Winnipeg watershed of Manitoba and Ontario, to James Bay.

KEY WORDS: cultural diversity; biodiversity; resilience; traditional ecological knowledge; indigenous peoples.

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INTRODUCTION

A few summers ago, on a berry-picking expedition to a local mountain on Vancouver Island, one of us (NT) observed that by far the most productive and highest quality blueberries and huckleberries (*Vaccinium ovalifolium*, *V. alaskaense*, *V. parvifolium*, *V. deliciosum*) occurred not in the dense old growth subalpine forest, nor in the dry, hot center of a nearby clearcut, but in the area of confluence between the two, and especially at the edge of a creek. Here, right at the juncture of the forest, the creek, and the clearing, the picking was prime; buckets were filled in minutes, whereas in the dense forest and the center of the 15-year old clearcut, although the berry bushes were growing there, it would have taken hours to glean any quantity of berries. This kind of experience has been repeated among people all over the world in their search for and exploitation of the foods and materials they need for their survival.

In ecological terms, edges are zones of transition from one ecosystem to another, areas where two different types of habitat, or successional stages, meet and intergrade. A well-known characteristic of ecosystems is that these edges often exhibit high levels of productivity and species richness or biodiversity (Odum, 1971). These transitional zones can be high in biodiversity since they tend to incorporate features of species composition, structure, and function representative of the ecosystems they transcend. Just as the whole is more than the sum of its parts, ecological edges may have their own unique features and species as well (e.g., Brothers, 1993; Meiners and Pickett-Steward, 1999). Ecological edges, then, are significant since they are areas from which two or more unique ecosystems can be easily accessed. Thus, for example, by situating a camp or community on a shoreline, people are able to draw from both aquatic and terrestrial habitats to obtain needed goods.

McCay has discussed the diverse and productive nature of edges, proposing that the "edge effect" may be used as a metaphor for "the bringing together of people, ideas and institutions" (McCay, 2000). More than simply a metaphor, we would like to propose that, like ecological edges, cultural knowledge systems can intergrade producing a richness of knowledge and practices that enhances the resilience of local societies. Cultural edges, rather than being border zones between discrete social entities, are zones of social interaction, cross-fertilization, and synergy wherein people not only exchange material goods but also learn from one another. There may be exchanges of locally developed knowledge and practice appropriate to the diverse ecosystems in which the different societies are based. In addition, the benefits of the ecological edge effect can be created across

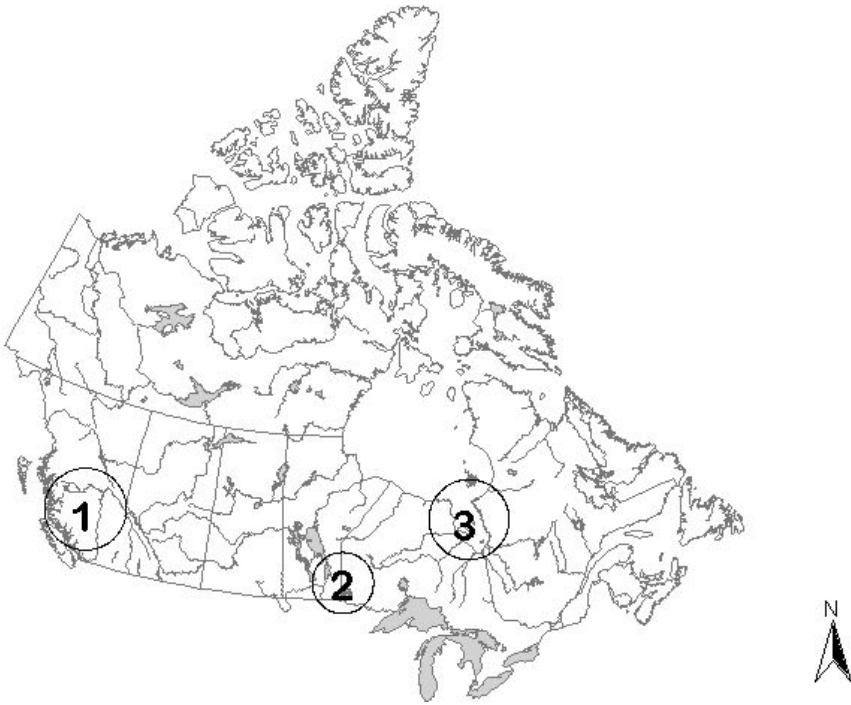


Fig. 1. Map showing general location of areas discussed in paper (IDH).

cultural edges through the development of institutions that allow people from different ecological areas to share knowledge and goods. Ecological and cultural edges increase the diversity of ecological and cultural capital upon which people can draw for their livelihoods (Berkes and Folke, 1994).

The issue we explore in this paper, using examples from our work in three regions of Canada (Fig. 1), is whether such a cultural “edge effect” may be significant in enhancing resilience, or flexibility and adaptive capacity. Resilience has three defining characteristics: (1) the amount of change the system can undergo and still retain the same controls on function and structure; (2) the degree to which the system is capable of self-organization; and (3) the ability to build and increase the capacity for learning and adaptation (Resilience Alliance, 2001). The resilience concept was originally developed for the study of ecosystem dynamics (Holling, 1973). In this paper, we apply it to social and social–ecological systems as well,

consistent with Gunderson *et al.* (1995), Berkes and Folke (1998), Adger (2000), Gunderson and Holling (2001), Berkes *et al.* (2003) and Davidson-Hunt and Berkes (2003). Key to the maintenance of resilience is the presence of diversity, which, as we will argue, is often found to be at its greatest in ecological and cultural edge situations. Specifically, we provide three related propositions:

1. Human communities benefit from association with and exploitation of ecological edges. Human societies situated “on the edge” ecologically and geographically, in terms of their access to the resources of two or more ecosystems, are likely to benefit from this increased diversity by being more flexible and resilient than those people situated within more homogeneous environments.⁵
2. Cultural edges, characterized by a diversification of social behavior and knowledge, support an increased degree of resilience. Situations in which different societies and communities interact and exchange knowledge, skills, and resources may, as with the resilience of ecological edges, serve to promote a capital of knowledge, practice, and institutional organization that helps maintain flexibility.⁶
3. Societies seek to expand their use of ecological and cultural edges. Societies tend to work to expand the ecological edges to which they have access, as well as to promote cultural exchange, thus enhancing their resilience. Thus, rather than being an accident of natural or social geography, edges are purposively created and maintained by people in their attempts to promote social–ecological resilience.

Our point in this paper is not so much to conclusively demonstrate these propositions but rather make a series of suggestions which we hope other researchers will draw on for further research and debate.

⁵Examples to the contrary are found in southern Africa (outside range of present paper) where edges are also areas of low productivity and therefore refuge zones for those fleeing the exactions of centralized hierarchical social orders (e.g., river valleys). Although people in such zones make use of and create ecological diversity to promote resilience, as well as engage in social exchange for the same purpose, arguably such people are not any more resilient than their neighbors, and perhaps even less so, since these low-lying areas are more prone to drought.

⁶At the outset, we must emphasize that, just as ecological edges (e.g., with introduced species acting as “weeds”) are not universally advantageous or positive, cultural edges may also be deleterious. The contributing systems may be unevenly or inequitably represented, or the interface may become a rigid barrier. One contributing system may dominate or overwhelm the other, or the benefits may flow only in one direction, as in colonialism. A globalized industrial culture interfacing with a traditional indigenous community will probably subsume it, to the detriment of the less dominant cultural system.

ECOLOGICAL EDGES AND RESILIENCE

At certain times of the year [the Gwich'in people] lived by rivers and lands and they moved along the rivers, and across lakes, creeks, the delta, and the mountains to get to their hunting and fishing areas Up to the age of six, I lived on the land year round with my family, moving around to inland fish lakes in the winter and to muskrat lakes in the spring, and we lived at our summer fish camp along the Mackenzie River. (Andre, 2000; p. 2)

It is no coincidence that in Canada virtually all traditional Aboriginal communities as well as seasonal camps are situated along major ecological interfaces. Along the James Bay coast, for example, five of the eight Cree communities on the eastern (Quebec) side are located on the estuaries of rivers emptying into James Bay; the other three are located on lakes. On the western (Ontario) side, seven of eight Cree communities are on a river estuary on the James Bay coast; one is on a lake. Settlement along waterways is well known among the Assiniboine, Cree, and Anishinaabeg (Ojibway/Chippewa/Saulteaux). Camping sites are found on points along lakes, near rapids in river courses, and along shorelines close to other resources of interest such as sugar bushes (*Acer* spp. and/or *Betula* spp.) and manomin, or wild rice fields (*Zizania* spp.). Similarly, among Northwest Coast peoples of British Columbia, the majority of villages are located in close proximity to the ocean. Those inland from the coast are situated along rivers and lakeshores, or often at the confluence of major waterways. In British Columbia, a survey of First Peoples' villages from the study by Duff (1964, pp. 18–37, Table 2) shows 112 traditional communities located along the coast, 91 communities situated along rivers, and 23 along the edges of lakes, for a total of 100% located along the edge of some type of waterway or shoreline.

Access to water for personal use and transportation is obviously a key factor in locating habitation sites. Equally important, however, is the flexibility provided for people situated near water bodies through ready access to different ecosystems, and therefore to a wider range of resources at various geographical scales than if they were situated within only one ecosystem. As well as providing opportunities to exploit resources from the juxtaposed major ecosystem types, ecological edges facilitate exploitation of a wide variety of microsites and habitat interfaces situated within or in association with the major ecosystems. For example, villages located at the ocean's edge will yield easy access to a diverse range of marine and shoreline habitats. The epitome of this situation is the intertidal zone, renowned for the richness and productivity of its food resources. Immediately above and below the intertidal band are other ecological edge sites that are productive and culturally important, for example, sandy bays, lagoons, estuaries, tidal marshes, rocky headlands, and the like.

On the landward side of the interface there is, almost invariably, proximity to freshwater wetlands of various types—creeks, rivers, marshes, fens, bogs, ponds, lakes, and sloughs—as well as to forests of various successional stages, depending upon the natural and anthropogenic disturbance regimes, and on ecological composition, structure, and function based on topography, microclimate, and elevation. Each of these habitat edges yields characteristic suites of important biological and mineral resources that can promote and support health and well-being of the residents. Table I outlines some examples of regionally significant ecological edges made use of by aboriginal peoples in Canada.

Archaeological sites also reflect peoples' long-time preference for situating themselves on ecological edges. Two rather famous sites are the Ozette site on the Olympic Peninsula, an ancient coastal Makah whaling village, and Namu in Heiltsuk territory on the central British Columbia coast. Other ancient sites are found along the major rivers and lakes of the interior (Carlson, 2000; Hayden, 1992). On Haida Gwaii (Queen Charlotte Islands), recent archaeological research to identify ancient Haida village sites, now inundated by the ocean because of the subsiding of the Islands' land mass, has shown promise of ocean floor terrain reconnaissance in locating confluences and estuaries of previously existing rivers to predict ancient village sites (Captain Gold, personal communication, Nov. 2000; Quentin Mackie and Daryl Fedgie, archaeologists, personal communication, 2001). Other archaeological sites could undoubtedly be located through predictive modeling of past locations of ecological edges, whether it be ancient shorelines or previously existing treelines. In both ancient and modern times, it is these places that people are drawn to settle and make use of the ecological diversity characteristic of such ecological edges.

Ecological edges may be transient and associated with a particular stage of ecological succession. For example, after a disturbance such as fire, an otherwise more ecologically uniform habitat may contain patches in which succession has been altered so that within these patches nondominant species assume importance and different ecological dynamics are set in motion. Spatially, most species, even those that are widespread in terms of their overall range, are restricted in their living requirements to particular ecological habitats or niches (Winterhalder, 1983). Humans have adapted their own movements and patterns of exchange and interchange to take advantage of these variations. The Anishinaabeg of the Great Lakes/St. Lawrence and boreal forest landscapes, for example, have drawn upon temporal edges by moving between resource-rich patches in a yearly livelihood round. They know that the most abundant quantities of blueberries (*Vaccinium* spp.) can be found 2–3 years after a fire on a sandy site, usually previously occupied by jack pine (*Pinus banksiana*) (Davidson-Hunt, 2001), and that after 5–7 years, the

Table I. Some Examples of Habitat Interfaces that are Culturally Important for Canadian First Peoples

| Examples of edge habitats | Significance to First Peoples (References) |
|--|---|
| Pacific Coast shorelines | Site of many villages of Northwest Coast First Peoples; access to transportation, marine and terrestrial resources from a range of local habitats (Suttles, 1990) (Fig. 2) |
| Estuaries of rivers along the Pacific Coast | Site of many villages and camps; major harvesting areas for gamebirds, fish (salmon, herring, oulachen), and root vegetables (e.g., Bella Coola/Nuxalk community) (McIlwraith, 1948) |
| Forest/grassland interfaces, southern interior of British Columbia | Site of many villages and camps for hunting and harvesting root vegetables and berries (e.g., Stl'atl'imx at Keatley Creek) (Hayden, 1992) |
| Subalpine forest edges, interior of British Columbia | Usual sites for establishing summer camps for hunting, root digging, berry picking (Turner, 1992) |
| Marshlands, Central Canada, Lake of the Woods region | Marshes at the interface between water and land were a zone of great abundance for Assiniboine, Cree and Anishinaabe people (e.g., at Lake of the Woods where Prairie, Great Lakes/St. Lawrence Forest and boreal forest biomes meet). Marshes provided manomin (<i>Zizania aquatica</i>), as well as waterfowl, sweetflag (<i>Acoris calamus</i>), and waterlilies (<i>Nymphaea tetragona</i>) for medicine and bulrushes (<i>Scirpus lacustris</i>) for food and household goods (Davidson-Hunt, 2001; Densmore, 1974; Vennum, 1988) (Fig. 3) |
| Water/Land interface, Central Canada, Lake of the Woods region | <i>Giishkapkaa</i> , or rock cuts, are a prominent feature and a dramatic transition from water to land. However, certain of these sites are an important feature on lakes around Lake of the Woods for the harvest of sage (<i>Artemisia</i> sp.) (Davidson-Hunt, 2001) |
| Prairie/forest interface, Central Canada, Lake of the Woods region | Prairie openings in the Great Lakes/St. Lawrence Forest around Lake of the Woods provide the habitat for a number of species including "Indian Potatoes"/Jerusalem Artichoke (<i>Helianthus tuberosus</i>) (Davidson-Hunt, 2001) (Fig. 4) |
| Grassland (prairie)/parkland/forest interfaces, Central Canada | The parkland on the boundary between the Prairies and the boreal forest was a transition zone of great importance to Assiniboine and Cree. The Assiniboine moved from the Prairies and the Cree from the boreal forest into the parkland during winter months. Buffalo moved off the plains during the winter seeking shelter and thus afforded abundant food for these peoples in winter (Ray, 1974) |
| Treeline—the interface of the arctic and the subarctic | Hunting camps of the Chipewyan Dene were located on fishing lakes at or near the treeline, so they could hunt both the tundra and the boreal forest while counting on a staple food resource (Smith, 1978) |



Fig. 2. Herring eggs on western hemlock (*Tsuga heterophylla*) boughs (upper row; lower cooked)—an important food product for First Peoples of Pacific Coast shoreline/forest interfaces and example of an ecological edge resource that was also traded across cultural edges (Photo: R. Turner).

quantities of berries would start to decrease as other species begin to overshadow the berry plants. As the forest grows back in the patches created by fire, the edge is gradually eliminated. By this time, however, other patches, burned in the interim, would have come into full productivity.

The beneficial effects of ecological edges are also created spatially and temporally through purposive human activity. For cultures practicing farming and crop domestication, this is clear enough since an agroecosystem is almost by definition an edge insofar as succession on the landscape is inhibited so as to favor the growth of introduced species that require human care (i.e., domesticates). Edges of clearings and interfaces between domesticated fields and more natural areas provide important opportunities for genetic exchange between crop plants and their wild relatives, such as with maize and teosinte. Transplanting species across ecological regions could also be looked on as creating edges—providing opportunities for species otherwise not juxtaposed to intergrade. In the same manner, those people who do not cultivate domesticates also create ecological edges through anthropogenic processes. Aboriginal peoples, for example, prune and coppice bushes so as to obtain



Fig. 3. Marshlands, such as shown in this photo from Shoal Lake, Ontario, act as a transition zone between water and dryland. In this particular example the marsh acts as a source of sweetflag (*Acoris calamus*) for medicine, and bulrushes (*Scirpus lacustris*) for food and household goods (Photo: IDH).

straighter and more slender branches for making baskets (Anderson, 1996; Peacock & Turner, 2000; Turner & Peacock, in press). People have also pruned and burned individual berry bushes to enhance productivity, and, on a wider scale, have burned berry and root-producing patches—meadows and mountain slopes—so that their productivity will be maintained and promoted (Boyd, 1999; Cronon, 1983; Johnson, 1999; Peacock and Turner, 2000; Turner, 1999). People burn grassy river margins and low areas in the boreal forest to increase the forage available to moose and other ungulates of the boreal forest that are hunted (Lewis 1977, 1982; Lewis & Ferguson, 1988). These intentional activities have changed habitats across both small and large spatial areas and created patches and edges at different stages in a successional cycle.

Haida archaeologist and cultural specialist Captain Gold (personal communication, 2000) has described how the Haida people created and expanded ecological edges. They cleared the forest around their villages, such as at Skangwaii on the southern tip of Haida Gwaii, thus benefiting not only from having the felled timber to use for fuel and in constructing their longhouses, canoes, totem poles and mortuary poles, but also from the clearing they had created. The stumps left behind and the additional light from



Fig. 4. Brennan Wapioke of Iskatewizaagegan No. 39 Independent First Nation examining Jerusalem artichoke (*Helianthus tuberosus*). Shoal Lake, Ontario, where this photo was taken, is a transition zone between prairie and boreal forest biomes. Jerusalem artichoke often occurs in association with oak savannas located on points in Shoal Lake. Such points represent prairie incursions into the boreal biomes and have also served as historic and contemporary residence sites of Anishinaabe people (Photo: IDH).

opening the canopy provided ideal edge habitat for highly productive berry growth (Figs. 5 and 6). Berry species like salal (*Gaultheria shallon*), blueberries (*Vaccinium* spp.), red huckleberries (*Vaccinium parvifolium*), trailing currants (*Ribes laxiflorum*), and highbush cranberries (*Viburnum edule*) do grow within the denser forest but, once the forest canopy is removed, are much more productive in fruit-bearing. In addition, the stumps provided a nutrient- and moisture-rich substrate for the growth of these species. Captain Gold maintained that it was just like having an orchard right beside the village. Crabapple trees (*Pyrus fusca*), red elderberries (*Sambucus racemosa*), cow parsnip (*Heracleum lanatum*), stinging nettles (*Urtica dioica*), and other desired species around the village also increase in productivity in such anthropogenic edge zones.

Another example of intentional maintenance and development of ecological edges is provided by Deur (2000) in his research on tidal marsh gardens of Kwakwaka'wakw and Nuuchahnulth peoples of the Northwest Coast. Deur maintains, on the basis of archaeological, ethnographic, and oral history evidence, that these peoples not only cultivated the wild root



Fig. 5. Skangwaii (Ninstints), Historic Haida village on Anthony Island at the southernmost end of Haida Gwaii, British Columbia, situated on an ecological edge that was in the past intentionally extended by clearing away the forest trees behind the village (Captain Gold, personal communication) (Photo: NT).

vegetables of river estuaries and tidal marshes—including springbank clover (*Trifolium wormskioldii*), Pacific silverweed (*Potentilla pacifica*), and northern riceroot (*Fritillaria camschatcensis*) (see Turner and Peacock, in press)—but they actually expanded the rather narrow zone in which these species naturally grow by building up the soil, constructing walls of rock and wood



Fig. 6. Tree stump at Skangwaii, from a tree at the edge of the village, showing dense, productive growth of salal (*Gaultheria shallon*) and other species of berries growing on the top (Photo: NT).

to trap tide-borne detritus, so that the specific linear band in this productive ecological gradient would be enhanced and expanded. There may be similar effects at the edges of lakes and marshes where harvesting of cattails, tule, wapato, and other wetland resources and the associated mounding of soils and detritus may work to increase the extent of these edge-situated populations.

Various other practices were also utilized to increase ecological interfaces so that the diversity and productivity of resources could be enhanced within a limited geographic space. The Coast Salish peoples of southern Vancouver Island cleared rocks and brush from their camas (*Camassia* spp.) meadows, leaving stretches of open parkland interspersed with stately garry oak trees (*Quercus garryana*). This practice utilized disturbance to maintain an early successional habitat in close association with mature forest habitat. The tending of the successional habitat mosaic provided the best possible conditions, not only for camas, but also for other root vegetable species, for wild strawberries (*Fragaria* spp.) and other berries, and for deer and other game at the edges of the woodlands, thus increasing the diversity of resources available in a limited geographic space.

Similarly, the Sto:lo, Stl'a'tl'imx, Secwepemc, and other peoples used fire to clear the brush away from the edges of the forests at the timberline in the interior montane country to expand the optimal zone of high productivity for edible root species such as yellow glacier lily (*Erythronium grandiflorum*), spring beauty (*Claytonia lanceolata*), and wild onions (*Allium cernuum*), and for berry species such as black mountain huckleberry (*Vaccinium membranaceum*), wild raspberry (*Rubus idaeus*) and blackcap (*Rubus leucodermis*) (Peacock and Turner, 2000; Turner, 1999). In fact, many culturally important species, including wild fruits, mat and basket materials like cattail (*Typha latifolia*), tule (*Scirpus lacustris*), and basket sedge (*Carex obnupta*), and fiber plants like stinging nettle and Indian hemp (*Apocynum cannabinum*), although they may grow in a range of habitats, are most productive at ecological edges according to reports and observations of elders (Peacock and Turner, 2000; Turner and Peacock, in press). Fire was utilized to increase both the diversity and productivity of species found in montane meadows.

In sum, aboriginal peoples intentionally change the temporal and spatial characteristics of ecological cycles in order to create physical edges and thereby increase the abundance of resources of a patch and change the spatial distribution of resource patches to more favorable harvesting locations. Thus, people do not just seek out and live along “naturally” occurring ecological edges but intentionally change the temporal and spatial dynamics of ecological systems in order to increase ecological diversity and resource abundance. Evidence from other parts of North America (Anderson, 1996; Blackburn and Anderson, 1993; Bye and Linares, 2000; Ford, 2000; Minnis and Elisens, 2000; Nabhan, 2000; Nabhan *et al.*, 2000; Nicholas, 1999) supports the notion that edge-producing practices are a widespread means of maintaining and enhancing a resource base and, hence, of maintaining livelihood flexibility and social–ecological resilience. People do this through the use of their technological knowledge and skills, which, in turn, are supported

and organized through social and cultural institutions. Through these institutions people are able to make use of and create ecological edges on the landscape as well as simulate the effects of ecological edges through social exchange and interchange.

CULTURAL EDGES

Trade between villages was necessary to provide a continuous supply of food and accumulate wealth. Goods were exchanged by sharing, bartering, or trading a gift for a gift. Trade included sharing land that had a profusion of berries or hunting grounds full of game. As there was an abundance of seafood on the coast, and similarly, an excess of meat and berries among the Gitksans, the exchange offered variety in our diets. (Watts, 1997, p. 1)

Just as ecological edges provide special opportunities for high productivity, energy exchange, dissemination of propagules, and genetic transfer within and among species, in a similar fashion, cultural interfaces allow for and promote exchanges and transferences of many types of goods, technologies, and knowledge amongst peoples. In the way that we have used the term, cultural edges are not boundaries between coherently defined and discrete social groups. Rather, cultural edges, like ecological edges, are processes of interchange—in this case, the social exchange of goods, technologies, and knowledge between groups with access to or use of different resources. Particularly relevant are the means by which cultural edges, zones of knowledge exchange, expand and emulate ecological edges drawn upon for the day-to-day practices of a livelihood.

Historically, throughout North America and beyond, there have been areas of special ecological richness—ecological edge regions—that became central locations for cultural interfaces. Not only are products of diverse regions and ecosystems shared and redistributed when cultural groups meet and mingle, so too are concepts, skills and technologies, narratives, names, dances and songs, religious ideas, and linguistic traits and vocabulary (Decosse, 1980, p. 126; Teit, 1909, pp. 180, 779, 782–783; Turner and Loewen, 1998). In ethnobiological terms, cultural exchange may be reflected in borrowed names and biological vocabulary between and among language groups, in shared technologies for fishing, hunting, food processing, basketry, and other survival activities, in shared methods for managing and promoting resources, and even in redistribution of plants and animals beyond their natural ranges. Examples of such interchanges are many, both in oral traditions and ethnographic literature and in physical and biological evidence from archaeology and ecology. Some important examples of cultural exchanges across ecological edges are detailed in Table II.

Table II. Examples of Trade Products, Technology, Techniques, and Knowledge Exchanged Across Cultural Edges

| | Notes |
|---|---|
| <i>Trade products</i> | |
| Edible greens, roots, berries, and other plant foods, as dried products | Traded between Upper to Lower Nlaka'pamux territories in southern British Columbia (Turner <i>et al.</i> , 1990), between Coast Salish and Nuu-Chah-Nulth (Turner, 1995; Turner and Loewen, 1998) |
| Red laver seaweed (<i>Porphyra abbottae</i>) | Dried seaweed a high value, nutritious article; traded from NW coast to Gitksan, Carrier and other interior peoples; used to prevent goitre (Birchwater <i>et al.</i> , 1993; Compton, 1993; Turner, 1995) |
| Indian-hemp (<i>Apocynum cannabinum</i>) | Raw fiber and manufactured products traded widely throughout southern British Columbia and from interior to Coast (Teit, 1900; Turner, 1998; Turner <i>et al.</i> , 1990) |
| Pacific salmon (all species) | The most widely exchanged product; traded fresh, dried, in many different forms, from Vancouver Island to mainland, from the coast to interior, and from interior to coast; rendered oil also a trade item (Teit, 1900) |
| <i>Techniques and Knowledge</i> | |
| Exchange of subsistence expertise | On the eastern James Bay coast, the Chisasibi Cree say they learned seal hunting at the ice-edge and how to use dog teams from the Great Whale Inuit. In turn, the Cree taught the Inuit goose hunting techniques and use of gillnets for fishing (Berkes, unpublished field notes) |
| Fishing techniques | On Vancouver Island, the Cowichan Salish learned reef net fishing from their Saanich neighbors; the Saanich learned river weir fishing from the Cowichan (Suttles, 1987) |
| Birch-bark (<i>Betula papyrifera</i>) basket and canoe making | Learned by Nuxalk of Bella Cooola from Carrier and Tsilhqot'in peoples of central British Columbia (Turner, 1998). |
| Split cedar-root (<i>Thuja plicata</i>) basketry | Learned by Sliammon weavers from Interior Salish peoples of southern British Columbia (Kennedy and Bouchard, 1983) |
| Exchange of hunting knowledge | The Assiniboine taught the Cree the buffalo hunting technique of encircling the buffalo in prairie openings in the parkland and shooting them as they tried to escape from the slowly closing circle (Ray, 1974) |
| Caribou hunting techniques | Similarities in Dene, Cree, and Inuit caribou driving and corralling techniques (use of drift fences, chute, and pound) indicate that these three culturally different groups must have learned from one another (Berkes, 1999, p. 101) |

Cultural exchanges that transcend geographical space can be fleeting and occur through chance encounters between individuals or families traveling long distances for trade, vision quests, or even raiding and slave acquisition (Mitchell and Donald, 1988; Suttles, 1990). However, in order to constitute a proper cultural edge, the encounters must be continuous and habitual, such as when neighboring cultural groups traditionally share hunting or fishing territory, or routinely visit and associate at resource harvesting areas or cultural events. On such occasions, resources accumulated by one family, clan, or community are distributed at feasts, and at the same time, opportunities for learning new names and methods of preparing these goods, as well as other types of knowledge, are communicated. Such cultural edges, or institutionalized networks of social and cultural exchange, provide the means through which goods, information, songs, stories, vocabulary, ideas, techniques, and technologies are exchanged, thereby increasing the resilience of individual family units (see also Densmore, 1979; Hallowell, 1992; Mattern, 1996; Ray, 1974; Vennum, 1988). Cultural edges also allow for the development and maintenance of contacts for marriage and other forms of social exchange that are not necessarily directly ecological in nature but are nevertheless important for ensuring the continuity of social ties that promote the exchange and diversification of goods, knowledge, and technologies among different populations. Such was the situation on Vancouver Island, where the Cowichan Salish exchanged expertise with the Saanich on reef net fishing and river weir fishing (Suttles, 1987).

Similarly, there are intercultural reciprocal arrangements for people to reside and harvest in neighboring territories and share access to joint resource regions. As Suttles (1951, p. 27) pointed out, "a host at one time and place is potentially a guest at another." There are many other examples of prolonged, mutually beneficial and sanctioned cultural interfaces (Decosse, 1980; Greer, 1995; Sproat, 1987). A clear example of this is found on the Northwest Coast where the Hanaksiala, North Wakashan people, shared the use of a seaweed-halibut fishing/processing camp with the Southern and Coastal Tsimshian people in exchange for the latter groups' use of the Hanaksiala eulachon fishing/grease-processing camp on other occasions (Compton, 1993). Such reciprocal arrangements are still occurring today.

Social and cultural institutions are also important in "creating" ecological edges between groups residing in noncontiguous ecological habitats. That is, the effect of an ecological edge is emulated through institutionalized exchanges that provide people with access to goods and resources to which they would otherwise be denied access. This understanding is not new and was first recognized from studies of mountainous regions where an ecological approach was utilized to consider how different altitudes were linked through social and cultural institutions (Barth, 1956). Work in the Andes and

Himalayas identified ways in which people drew upon the resources of very different and physically isolated ecological zones, i.e., highlands and tropical valleys, through social and cultural institutions (Brush, 1976; Rhoades and Thompson, 1975). In this way, cultural edges can simulate and provide the same benefits as ecological edges by bringing together biological species from two different habitats. From this point of view then, the Salish and other Northwest Coast potlatches are not only a mechanism for the redistribution of wealth but a mechanism for bringing together people from disparate ecosystems, even if this is not the principal goal of the institution. These cultural edges provide a means by which something harvested in the present at a specific place can be utilized at a different place at some point in the future (Halperin, 1994).

A paper by Ray (1974) demonstrates the process of maintaining cultural edges to increase the availability of ecological diversity. The Assiniboine, who lived in southern Manitoba, did not grow corn (*Zea mays*), but maintained access to corn by traveling every year to visit and exchange with Mandans who lived on the upper Missouri River (Ray, 1974; Wilson, 1987). In another example, anthropologist Suttles (1987), in a classic paper on economic exchange and reciprocity among Salishan First Nations of the Northwest Coast, discusses the intricacies of reciprocal traditional economies across cultural boundaries. Among other factors, these involved a balance of exchange systems between kin groups, and in particular between “co-parents-in-law” (parents whose children were married to one another) residing in different communities and having access to different resources. Suttles describes how, among Coast Salish kinship and trade networks, the excess from a large catch of herring, or a harvest of camas (*Camassia* spp.), which provided more food than a community could store for its own use, might be taken to an in-law’s community. It would then be repaid by other useful goods, especially mountain goat wool blankets or, later, cash. On another occasion, a gift of dried sturgeon or bog cranberries (*Vaccinium oxycoccus*) might come from the other kin direction, to be reciprocated again with payment or “thanks” in some form. Ray (1974) summarizes nicely the cultural and ecological importance of exchange between Assiniboine and Cree peoples that promoted economic flexibility and resilience:

It was through these overlapping economic systems . . . that the tribes of grasslands, forests, and parkland came into contact with each other. These economic contacts encouraged an inter-regional exchange of ideas. Through these exchanges, the various bands learned to cope with the different habitat zones that characterized the regional landscape. The Cree, for example, learned the technique of constructing and using the buffalo pound from the Assiniboine. The ability to exploit all of these zones gave these groups a great deal of ecological flexibility. This flexibility permitted them to make rapid adjustments to changing economic conditions in the late eighteenth century . . . and it facilitated rapid inter-regional migration. (Ray, 1974, pp. 47–48)

CONCLUSIONS

Ecological edges can be understood as places where one habitat type changes to another, which are at the same time zones of specialized habitat with unique biological species. They can also be realized temporally as periods of time where one stage gives way to another. Ecological edges, in other words, are both places in and of themselves, as well as markers for the transition from one type of ecosystem to another, or from one phase to another within a single ecosystem. Thus, mixed habitat patches and zones where different successional stages abut one another can be areas of unique ecological diversity and interchange.

In using the term “cultural edges” we are not concerned so much with how cultural groups maintain their perceptions of boundedness and difference such that one can speak of a cultural center against which an “edge” or limit of a cultural group can be defined. Rather, the concept of cultural edge seeks to explain the processes of *interaction* between social groups that promote the exchange of knowledge, technologies, and resources in such a way so as to increase the adaptive repertoire available to any one local group. Such cultural edges are like ecological edges in that they allow for a diversification of resources, in this case cultural resources. In addition, through institutionalized forms of exchange of ecological resources between people residing in discrete, noncontiguous ecosystems, people are able to emulate the effects of ecological edges where those ecosystems do not in fact intergrade on the ground.

As noted in the introduction, resilience can be defined as the ability to absorb shocks and perturbations, the ability for self-organization, and the ability to learn and adapt. Locating on edges, and actively creating, maintaining, and emulating edges, contributes to livelihood and social–ecological resilience. The concept of edges thereby draws our attention to social, cultural and ecological processes that impart temporal and spatial texture to peopled landscapes, which in turn provides for livelihood flexibility. Through the diversification of resources, goods, technology, and knowledge, people are able to make use of a wider suite of adaptive responses in both time and space, thereby increasing their chances of obtaining a harvest in any given year.

We would like to propose that social groups living on ecological edges, or those who are able to significantly expand and elaborate such edges through anthropogenic processes and cultural edges, are more likely to be flexible and resilient than those situated within more homogeneous environments, or those with access to more limited environments. Ecological and cultural edges increase resilience as they expand the diversity of the resources people can draw upon for livelihood purposes. Ecological and cultural edges enhance the biological and cultural diversity of a landscape and allow for

the exchange of oral histories, technologies, songs, information, genetic materials, and goods that may be necessary to adapt to both expected and unanticipated changes in ecological and social systems.

A key aspect of the way people gravitate to, adapt to, and create ecological edges to enhance flexibility and resilience is the question of how new knowledge is created and communicated. As people undertake their livelihood activities and are faced with changing ecological and social systems to which they must respond and adapt (Ingold, 2000), it is cultural edges that help people to meet these challenges. It is *cultural* knowledge, acquired, exchanged, and passed on across cultural edges and temporally down through generations, that has provided people with an understanding of the importance of ecological edges and has allowed them not only to take full advantage of ecological edges but also to create and extend ecological edges for their own benefit. This knowledge cannot be understood outside of its cultural context in that it is rarely simply adaptive, nor is its adaptive character readily separable from other aspects that inform the (re)production and use of knowledge in specific cultural contexts. Thus, cultural edges may be more complex for us to understand than ecological edges. Making sense of the way cultural edges are maintained for social–ecological resilience will require more than simply recording the content of local practices and knowledge as they can be translated into and understood by scientific (ecological) models.

Nevertheless, for humans, ecological edges and cultural edges are inextricably linked. In both cases they provide increased social–ecological resilience as they broaden the diversity of biological species and cultural knowledge that can be drawn upon for a livelihood. They allow humans to respond to expected natural cycles and interrelationships as well as the ability to manipulate these relationships for their own benefit. Equally important, they provide the means for people to better adjust to those times of unanticipated and unpredicted change. It is on these occasions that people draw upon the enhanced ecological and cultural diversity, including an extended knowledge base, provided through ecological and cultural edges.

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