A Look at Burns Bog

Abstract

Burns Bog is a unique, urban wetland in the Fraser River delta, less than 15 km from the city of Vancouve, British Columbia. This article uses the geographical, botanical, anthropological, and political history of this local ecosystem to explain the significance of the Bog and the major threats to its continued existence. There are several possibilities for ecological restoration, but water table and drainage issues and exotic species control seem to be major priorities.

Introduction

Burns Bog, located in the Fraser River delta in Delta, British Columbia, currently covers about 3000 hectares, although its historical size was closer to 4300 hectares (Hebda et al., 2000). Two major businesses, Delta Fraser Properties Partnership and Western Delta Lands Partnership, own approximately 2200 hectares of the Bog (Guylas, 2001; Zyturak, 2002). The City of Vancouver landfill covers approximately 200 hectares, although this land is no longer considered a part of the bog ecosystem complex. There are several smaller private landfills along the northern and southwest borders of the Bog (Hebda et al., 2000). Over 70% of the Bog land is zoned for development (McDade, 2000). The Delta Nature Reserve, which covers about 60 hectares (2%) of the Bog, is the largest existing park or protected area in the Bog. Forty percent of the original area of the bog has been altered or destroyed by development (Hebda et al., 2000).

Burns Bog is classified as a 'raised' or 'domed' peat bog (Hebda et al., 2000); in its development, this type of bog forms a shallow dome of peat (Wheeler and Shaw, 1995). Due to its chemistry, form, flora and large size, this deltaic raised peat bog is globally unique (McDade, 2000). A peat bog differs from other types of wetlands in that it contains an internal mound of water that is acidic and nutrient-poor, a two-layered peat deposit, and plant communities dominated by *Sphagnum* and ericaceous plants. The growing conditions in bogs make them unique ecosystems, where only a relatively few specialized plants are able to thrive.

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Burns Bog has a rich history of human use dating back over 4000 years to earliest known traces of several First Nations groups' activities (Washbrook, 1996). After European settlement of the Canadian west coast in the 1850s, the Bog was purchased and used in various ways, including general agriculture, ranching and peat mining (Burns, 1997; Hebda et al., 2000). The outer edges of the Bog, particularly the southern and western portions, were drained, filled, and converted into farmland (Hebda et al., 2000). For decades, controversy over the Bog has involved First Nations, private owners, all levels of government, non-profit organizations, concerned scientists, and local community members. The fate of the Bog remains undecided.

Formation of the Bog

The most extensive, recent studies of Burns Bog, which provide a well documented history, are those by Hebda (1977) and Hebda et al. (2000). About 5000 years ago, the depression where Burns Bog was to form was a tidal marsh in brackish water. Early successional species took root first, with *Scirpus* species (bulrushes) stabilizing the loose sediments. Then *Typha* spp. (cattails), *Carex* spp. (sedges), and *Oenanthe sarmentosa* (Pacific water-parsley) colonized the increasingly fresh water. Plant remains did not fully decompose in this wet environment when they died, but accumulated thus creating the first base of peat.

Between 4000 and 5000 years ago, as the delta continued to build, the influence of the brackish ocean water decreased and the plant communities in the Burns Bog area changed to fresh-water river wetland vegetation of sedges and grasses. The two major sources of water at this time were groundwater and rainwater. By about 3500 years ago, the ground surface had built up enough to support the growth of shrubs such as *Myrica gale* (sweet gale) and *Spiraea douglasii* (hardhack), and consequently the accumulation of undecomposed plant material, which had reached significant levels by this time, now included woody material.

About 3000 years ago, the peat buildup resulted in the separation of the Burns Bog area from both tidal and groundwater influence. Rainwater, low in minerals and nutrients, became the major source of water for the area, thereby inhibiting the growth of most plants and creating true bog conditions. Bog plants, such as *Rhododendron groenlandicum* (Labrador tea)

colonized the acidic environment. *Sphagnum* or peat moss, a group of plants that thrives in acidic and nutrient-poor conditions, was able to colonize this stagnant environment soon after (Hebda et al., 2000). *Sphagnum* species are highly absorbent plants, and some species naturally grow in hummocks (Pojar and MacKinnon, 1994). The combination of these two factors resulted in the growth of a raised peat bog.

Remarkable Plants and Ethnobotany

Drosera rotundifolia (round-leaved sundew) (Figure 1): Tiny and carnivorous, this perennial plant catches its insect prey on its tentacles, sticky with sweet-smelling dew, to obtain extra nutrients for survival in the nutrient-poor bog environment (Pojar and MacKinnon, 1994). This species is characteristic of nutrient-poor wetlands (Klinka et al., 1989), and grows particularly on the higher and drier parts of a bog, mostly associated with *Sphagnum* species (MacKinnon et al., 1992). The Haida used this plant as a good luck charm for fishing, and other Northwest Coast groups used the leaves to remove corns and warts (Pojar and MacKinnon, 1994).

Empetrum nigrum (crowberry): At the southern extent of its range in Burns Bog, this low, alpine, evergreen shrub has needle-like leaves and black, berry-like drupes that are a favorite food of bears. The Tsimshian and Haida ate the fresh berries in small quantities, although the Haida believed that eating too many would cause hemorrhaging (Pojar and MacKinnon, 1994). This species is most commonly found in peat bogs, where it occupies high ground (Klinka et al., 1989).

Gaultheria shallon (salal) Stó:lo name: T'áqa (Washbrook, 1996). The dark berries of *Gaultheria* are edible and were used extensively for food by northwest coastal groups. Many groups dried or ate the berries fresh, and they were often traded or sold after being mixed with other berries (Pojar and MacKinnon, 1994). This species is oxylophytic, meaning that it tolerates acidic soils (Klinka et al., 1989).

Kalmia microphylla subsp. *occidentalis* (western bog-laurel) (Figure 1): The leaves of this low shrub are leathery above, and whitish and almost smooth beneath. Like *Gaultheria, Kalmia* is oxylophytic, and is commonly associated with *Rhododendron groenlandicum* and *Sphagnum* species (Klinka et al, 1989). This plant contains the poison andromedotoxin, which causes dizziness,

cramps, breathing problems and vomiting if ingested (Pojar and MacKinnon, 1994). *Kalmia* was used to treat skin ailments and as a medicinal drink by several coastal First Nations peoples (Pojar and MacKinnon, 1994).

Pinus contorta var. *contorta* (shore pine) (Figure 2): This tree can grow up to 20 metres high at the edge of Burns Bog (Pojar and MacKinnon, 1994) but, as the water table rises closer to the centre, it becomes stunted and assumes a dwarfed, bonsai-like form, growing only one or two metres high, often with a twisted trunk and branches (Hebda et al., 2000). The Nisga'a used the split and twisted roots as ropes, and the bark was used medicinally by several First Nations groups (Pojar and MacKinnon, 1994).

Rhododendron groenlandicum (Labrador tea) (Figure 3) Stó:lo name: Móqwem (Washbrook, 1996): This oxylophytic species is characteristic of nutrient-poor wetlands, and is common in *Sphagnum*-dominated communities (Klinka et al., 1989). As the common name suggests, a tea can be made from the dried leaves of this shrub. First Nations peoples used the tea for medicinal purposes to treat such ailments as sore throats and colds (Pojar and MacKinnon, 1994). Being in the presence of this species in the Bog for several hours at a time causes an interesting soporific effect in some people, including me.

Rubus chamaemorus (cloudberry): This small and elusive dioecious shrub is at its southernmost extent in Burns Bog (MacKinnon et al., 1992; Hebda et al., 2000). The berries are edible and were a staple food for peoples of the Northwest Coast (Pojar and MacKinnon, 1994).

Sphagnum sp. (sphagnum peat moss) (Figures 1 and 4) Stó:lo name: Qwò:m (Washbrook, 1996): Approximately forty species of *Sphagnum* occur in coastal British Columbia (Pojar and MacKinnon, 1994). Its absorbent qualities made *Sphagnum* valuable for feminine hygiene and diapers; it was also used for bedding (Pojar and MacKinnon, 1994). Many of the *Sphagnum* species that occur in Burns Bog are indicators of nutrient-poor, acidic, organic soils, and are often associated with *Rhododendron groenlandicum* and *Vaccinium oxycoccus* (Klinka et al., 1989).

Spiraea douglasii (hardhack) Stó:lo name: T'á:ts'elhp (Washbrook, 1996): A characteristic wetland species, *Spiraea* tolerates fluctuating groundwater tables, is associated with *Gaultheria shallon, Juncus effusus,* and *Myrica gale* (Klinka et al., 1989), and forms thickets at the edge of Burns Bog (Hebda et al., 2000).

The stems of this deciduous shrub were used by some First Nations groups to make implements for collecting marine shells, which they then traded with other groups and used as currency (Pojar and MacKinnon, 1994).

Vaccinium oxycoccus (bog cranberry) Stó:lo name: Qwemchó:ls (Washbrook, 1996): The berries of this creeping, evergreen shrub were cooked and served in oolichan grease or oil. They were also eaten fresh, stored in moss, or dried into cakes (Pojar and MacKinnon, 1994). This species occurs on wet to very wet soils in nutrient-poor wetlands (Klinka et al., 1994).

Vaccinium uliginosum (bog blueberry) (Figure 3) Stó:lo name: Mó:lsem (Washbrook, 1996): Similar in range and ecology to *V. oxycoccus*, this species is indicative of very moist to wet, nitrogen-poor soils (Klinka et al., 1989). The delicious edible berries of this shrub have long been an important food for coastal First Nations peoples; blueberries were eaten fresh or dried into cakes (Pojar and MacKinnon, 1994).

History and Use

Archaeological evidence and information from interviews indicate that six First Nations groups historically used Burns Bog: the Tsawwassen, the Semiahmoo, the Katzie, the Musqueam, the Squamish, and the Stó:lo Nations (Hebda et al., 2000; Burns, 1997). The Stó:lo, whose traditional territory extended from the mouth of the Fraser River to Yale, were the dominant group in the area, (Washbrook, 1996). They set up temporary villages in the Bog during summer, coinciding with the salmon migratory runs (Burns, 1997). Activity in the Bog itself included hunting (elk, black-tailed deer, black bear, waterfowl) and gathering plants for food and medicinal purposes (Hebda et al., 2000).

Burns Bog is named after Dominic Burns, an immigrant from Ireland who purchased most of the Bog in 1905 for $26,000 (Burns, 1997 – note: no relation to Dominic Burns). Peat harvesting in the Bog began in the 1930s. Although initial attempts proved unsuccessful (Burns, 1997), there were large-scale extraction operations in the Bog until 1984 (Hebda et al., 2000), with the peat being sold to gardeners as a soil supplement and for use in greenhouse crop production (Daigle and Daigle, 2001).

The political history of Burns Bog is a colourful one. Development proposals over the years have included a deep-sea port and housing for

100,000 people, a world class thoroughbred race track, and an amusement park / entertainment complex that would have been the new home of the Pacific National Exhibition (PNE) (Guylas, 2001). This last proposal came very close to reality. However, in 1999, the authors of the *Burns Bog Ecosystem Review* (Hebda et al., 2000) concluded that approximately 2450 hectares must be protected in order to preserve the ecological integrity and viability of the Bog. The development proposal was dropped by the government, prompting lawsuits from the landowners (Gulyas, 2001). New development threats continue to arise.

In September of 2000, in response to a conclusion in the Ecosystem Review stating that the Bog's ditches drain water in excess of normal discharge leading to a decrease in water storage and thereby threaten the Bog's viability (Hebda et al., 2000), the municipality of Delta ordered control structures to be installed in the ditches of the Bog perimeter (Gulyas, 2000). In February of 2001, a government deal to purchase the Bog appeared imminent. All four levels of government – federal, provincial, regional, municipal – made an offer to buy over 2000 hectares of the Bog from Delta Fraser Properties Partnership (Gulyas, 2001). $65-70 million, plus tax credits, was the rumored bid. In March, talks were put on hold because the landowners were unable to reach an agreement between themselves (Gulyas, 2001). As of October 2002, an agreement between all the parties involved had not been reached.

Significance and Conservation

The values and uses of conserving bogs globally all relate to the conservation of Burns Bog and include: their contribution to global biodiversity, carbon storage, educational resources, scientific research, nature reserves and wilderness areas, archaeological archives and unique recreational experiences (Brooks and Stoneman, 1997). The Bog is considered to be extremely important to several First Nations groups in terms of cultural, archaeological, traditional, and current uses (Hebda et al., 2000). The unique nature of the Bog lends itself well to controlled ecotourism, which would benefit the local economy.

Burns Bog is a globally unique ecosystem in a metropolitan area. It is the southernmost *Sphagnum*-dominated domed bog in Canada and one of the southernmost raised bogs in western North America (Vitt et al., 1999). Bogs are uncommon in the Fraser Lowland, forming only 4.5% of the total

wetland area, but Burns Bog accounts for 80% of the Fraser Lowland bog area (Hebda et al., 2000). Despite high levels of disturbance, central areas of the Bog continue to support several bog-associated plant species that are uncommon in this region, such as *Carex paucifolia* (few-flowered sedge), *Drosera anglica* (great sundew), and *Empetrum nigrum* (crowberry) (Hebda et al., 2000).

The *Burns Bog Ecosystem Review* (Hebda et al., 2000) mentioned habitat loss for red- and blue-listed species[1] as a major concern if the proposed PNE development had occurred. Burns Bog lies on the Pacific Flyway, and is a major stop-over point for many migratory birds. *Grus canadensis tabida* (Greater Sandhill Crane), blue-listed in British Columbia, was very important to First Nations mythology and is said to have "darkened the skies" with its great migratory numbers during its annual arrival to the Lower Mainland every March (Burns, 1997). It was estimated in 1999 that there are 3-4 breeding pairs of out of a total of 9-11 individuals using the Bog each year (Gebauer, 1999). Burns Bog is one of only two documented breeding locations for this species in the lower Fraser River valley (the other is the Pitt Polder bog in Pitt Meadows) (Gebauer, 1999).

Red-listed *Clethrionomys gapperi occidentalis* (Southern Red-backed Vole), a rodent thought to be extinct in the Lower Mainland, was discovered in the Bog in 1999 during a small mammal study for the Ecosystem Review (Fraker et al., 1999). The last known record was in 1947 from Camosun Bog, an ecologically compromised location in Vancouver (Fraker et. al., 1999).

Other red-listed species that use Burns Bog include *Sorex bendirii* (Pacific Water Shrew), *Scapanus townsendii* (Townsend's Mole), *Falco peregrinus* (Peregrine Falcon), and *Progne subis* (Purple Martin). Blue-listed species include *Sorex trowbridgii* (Trowbridge's Shrew), *Butorides striatus* (Green-Backed Heron), *Botaurus lentiginosus* (American Bittern), *Ardea herodias* (Great Blue Heron), *Cygnus buccinator* (Trumpeter Swan), *Larus californicus* (California Gull), *Sterna caspia* (Caspian Tern), *Tyto alba* (Barn Owl), *Charina bottae* (Rubber Boa), and *Chrysemys picta* (Painted Turtle) (Hebda et al., 2000).

With respect to the global environment and global warming, Burns Bog has international importance. Peatlands trap greenhouse gases such as

[1]Blue-listed species are considered vulnerable in British Columbia. Red-listed species are extirpated, threatened or endangered

carbon dioxide and methane that would otherwise be released during decomposition processes. Of these two gases, methane is the greater threat – its ability to trap longwave radiation and thereby contribute to global warming is 25 times that of carbon dioxide. Methane emission increases when the top layers of a peatland are disturbed, such as by clearing for agricultural purposes (Parkyn et al., 1997). Keeping the remainder of the Bog intact would slow the acceleration of such methane emissions.

The major threats to the continued existence of the Burns Bog ecosystem include agriculture, development, hunting, drainage ditches, road construction, chemical pollution, and landfills (Hebda et al., 2000; McDade, 2000). Although all of these pose serious problems, perhaps the most pressing concern to the current Bog environment is the ongoing loss of water from drainage ditches on private land. Data that I collected in the Bog during 2000-2001 showed that the water table was significantly lower near areas that were being actively drained by ditches than in the relatively less disturbed sites. Similar data were recorded two years earlier (Hebda et al., 2000). One drained site on the eastern side of the Bog is gradually becoming birch woodland due to low water table levels (Hebda et al., 2000). If this problem is not contained over the entire Bog perimeter in the next few years, such woodland succession can be expected to occur more frequently.

Restoration

If Burns Bog were fully protected by provincial government legislation and left without disturbance, it would eventually restore itself. However, due to the slow growth rate of bog vegetation, recolonization would take 50-100 years (Wheeler and Shaw, 1995). Immediate action to manage the restoration would allow us to maintain the habitat for extremely rare and other sensitive species that may otherwise be extirpated from the Bog, and to appease the concerned public of the Lower Mainland.

A tenet of conservation biology states that if the structural ecology of a system is maintained (e.g., richness, abundance, and variability of plant and animal species and communities), then the functional aspects of the system (e.g., interspecific, intraspecific, and evolutionary interactions) also will probably be maintained (Hunter, 1996). The principle behind the ecological restoration of Burns Bog is that by maintaining and restoring the Bog ecosystem towards its natural state, we can also preserve or enhance the

vital ecological functions.

Specific restoration issues that need to be addressed include:

1) Ditching and water management: (Figure 5) Ditches throughout the Bog should be blocked to protect the water mound that keeps the bog ecosystem intact. The bog is not likely to remain viable if the ditches are not blocked (Hebda et al., 2000).

2) Invasive exotic species: Plants such as *Cytisus scoparius* (scotch broom), *Rubus discolor* and *Rubus laciniatus* (non-native blackberry), and *Lythrum salicaria* (purple loosestrife) pose a competitive threat to native vegetation along the perimeter of the Bog; spread of such plants needs to be monitored and controlled (Hebda et al., 2000).

3) Trail widening and creation. (Figure 9) Trail widening and trail creation in the southwestern area of the Bog often occurs when people and vehicles move to the side of either established or informal trails to avoid wet areas or puddles. Unmanaged recreational pressure can have a considerable impact (Brooks and Stoneman, 1997) and visiting traffic should be restricted to walkers who are kept on resilient trails, preferably boardwalks.

4) Visitor access and impact: If the Bog becomes a public park, visitor impact should be kept to a minimum to restrict wildlife harassment and avoid damage to sensitive, slow-growing bog vegetation (McDade, 2000). Introduction of visitor quotas or closing off a portion of the Bog as an ecological reserve are two management options (McDade, 2000).

5) Peat excavation. It would be advisable for the government to close any remaining minor peat mining operations in the Bog in exchange for land in a less rare ecosystem, such as a different type of bog in northern British Columbia or Alberta.

6) Buildings and future development: (Figure 8) Any future clearing of bog vegetation and subsequent development should be viewed with extreme caution and an environmental assessment conducted first.

7) Public and private landfills: Although regular water-quality monitoring indicates that leachates from the Vancouver landfill and private landfills are not currently affecting the Bog's water systems adversely, the possibility of future contamination should be carefully monitored (Hebda et al., 2000).

8) Abandoned peat mining railway line and other cleared areas: Clearings exist throughout the Bog from the large-scale peat-mining operations (Hebda et al., 2000). These clearings should be revegetated and allowed to regenerate (Wheeler and Shaw, 1995; Brooks and Stoneman, 1997).

Restoration effort would probably be most effective if priority were given to resolving the most pressing concerns, namely 1) water table and drainage issues, and 2) invasion of exotic species.

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