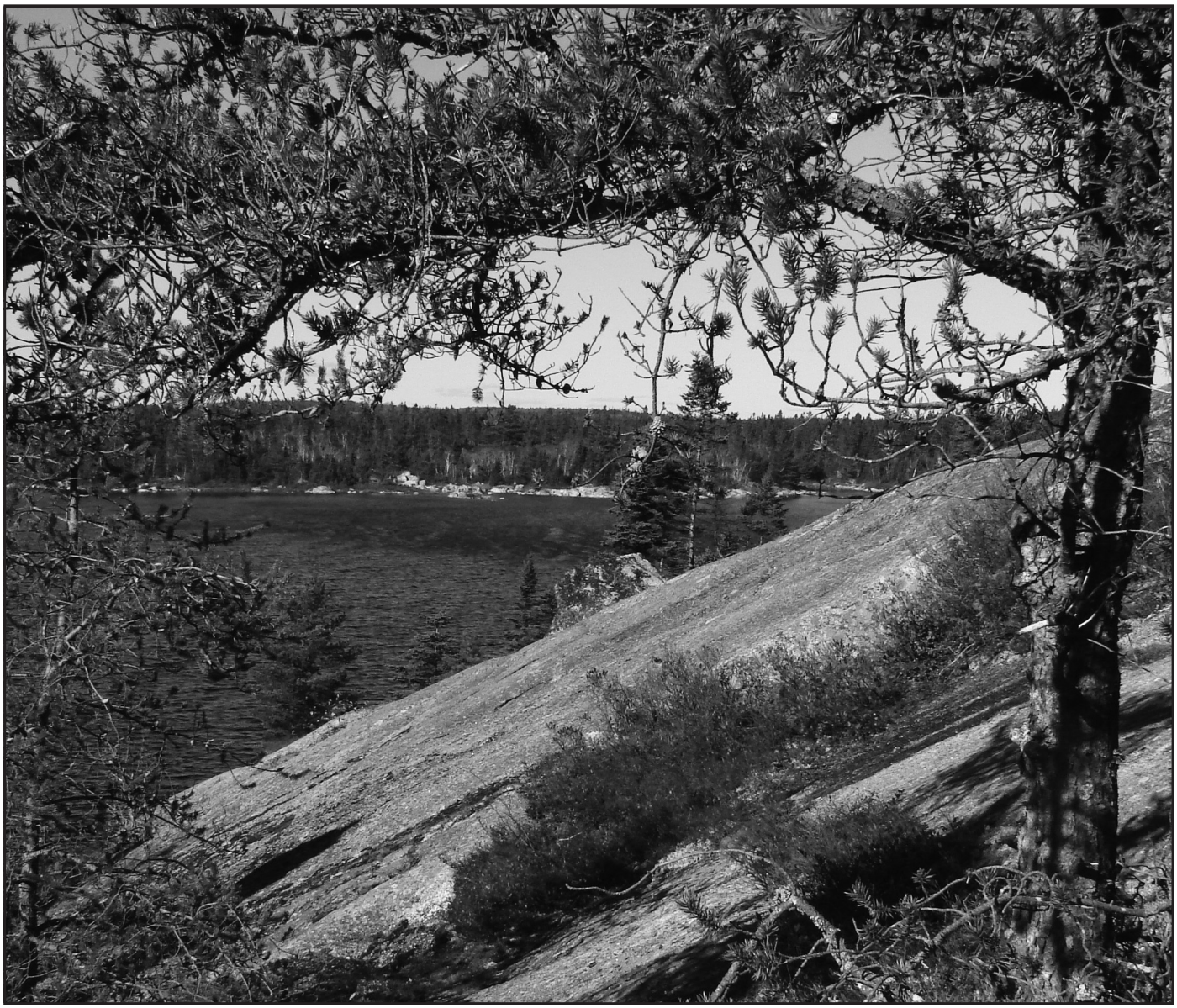
THE HALIFAX FIELD NATURALIST

No. 140
September to November, 2010



Return address: **HFN, c/o NS Museum of Natural History, 1747 Summer Street, Halifax, NS, B3H 3A6**

HFN TALKS

FOREST REGENERATION 2 SEPT.

– Richard Beazley & David Patriquin

Richard Beazley and David Patriquin independently visited and photographed areas of barrens and associated forest that were burned in the 2009 Spryfield fire. They did this at regular intervals, focusing on two areas – The Purcell's Cove Conservation Lands (made up of adjacent Captain Arnell Conservation Lands and Napier Family Conservation Lands) and an area by Lower Mud Pond close to Herring Cove. They ended up collaborating for the above presentation, and we were delighted that it was attended by Jill Alexander and Chris Field, Chris being one of the seven Field brothers who donated the Captain Arnell lands to the Nova Scotia Nature Trust in 2003. (The Napier Family lands were donated in 2009. Jill Alexander is Chris's mother and the daughter of Captain Arnell.)

HFN has a special interest in the former area – we donated funds towards its land survey and its legal processing, and agreed to conduct a biological inventory of the property which has been an ongoing activity for HFN.

Outdoor and photography enthusiast Richard began by providing a travelogue-like overview of the landscapes and individual plant species as they began to regenerate after the fire. In turn, retired biologist David researched the mechanisms by which plants regenerate after a fire, and also discussed some of the implications of living adjacent to, or in, fire-prone areas. Their images are available on our HFN website, **halifaxfield-naturalists.ca/spryfieldfire**.

RICHARD – A POST-FIRE TRAVELOGUE

The Spryfield fire began on April 30th and burned for a couple of days into May. A nighttime photo of the fire taken by Ross O'Flaherty from Dartmouth showed a wall of flame above Halifax mainland south. The fire spread from its origin near Roach's Pond over a large area between the Purcell's Cove and Herring Cove Roads, extending southeast to just past York Redoubt. My interest in seeing and photographing the damage created by the fire and the later recovery was piqued by my initial sadness over the human-caused devastation of this wilderness habitat's fauna and flora, and later by the excitement of HFN members over the learning possibilities presented by the fire. Over 14 months, I visited the area seven times.

I made my first visit to the Purcell's Cove Conservation Lands on May 25th – three weeks post-fire. These Lands lie in a 120 m-wide strip extending from Purcells Cove Road to Flat Lake, 1.2 km inland. I described and showed what the area looks like when not burned, using two examples: the granite bedrock, thin soil, and variety of small trees and bushy ground cover at the abandoned Purcell's Cove rock quarry near Purcells Cove Road; and then the mixed forest and large variety of flora and fauna around Purcell's Pond, 500 m inland. The fire had burned strips along and over the granite outcrops and the barrens, moving from the inland extremity of the

Purcells Cove Conservation Lands at Flat Lake towards Purcell's Pond. It missed some larger, lower lying wetland areas, one of which stopped the fire's movement towards the Purcell's Pond area and also parts of the property closer to Purcell's Cove Road. I showed a series of images that illustrated what it looked like as one (i) entered the burned area along a hiking trail, (ii) stood in the midst of what appeared to be a totally devastated landscape, and (iii) stood surrounded by tree skeletons and blackened soil without groundcover. My photographs also showed that life was emerging from the thin, burned-over soil, as illustrated by images of a four-inch high (10 cm) Bracken Fern and a small Painted Trillium already in bloom.

On the 6th of June 2009, a foggy day, I went back for a second visit. My photos show blackened tree skeletons, scorched Jack Pine needles, and 12- to 15- inch-high (30 - 40 cm) Bracken Fern, a Pink Lady's Slipper, and six-inch-high (15 cm) saplings growing from the base of a burned Red Maple tree. I was heartened by the persistence of life exhibited so soon after the fire.

I next visited on August 13th, three months post-fire. I showed one image from this visit that portrayed both the surprising amount of growth in the Huckleberry bushes and the impressive granite outcrops, some of which form rounded hills up to 100 metres high, often with very steep sides.

I made two visits in October, one on the 9th and the second on the 31st, five to six months post-fire. Images from the 9th showed leaves still green on Wire Birch, the beginning of colour changes in Huckleberry leaves, fern fronds turned brown, and suckers with fully reddened leaves on an otherwise lifeless-looking Red Maple tree. The images I shot three weeks later on the 31st recorded Huckleberry leaves in their brilliant red colour, a hillside scene with a variety of tree growth, and ground cover in varying degrees of colour change. One scene showed striking sweeps of fire-engine red Huckleberry below blackened tree trunks; David said it looked as if the area had been reignited as a surface fire!

My first visit in 2010 was on May 18th, one year post-fire. Not surprisingly, one distant image showed the area looking lifeless, much like it had a year earlier, but on closer inspection new growth was abundant, giving evidence to nature's persistence. There were 12-inch-high (30 cm) new sprouts of Rhodora, each with one flower, Blueberry plants and Shadbush in blossom, and three-foot high Wire Birch.

On the 21st of June, 13 months post-fire, I visited the Lower Mud Pond area with David. My images from that day show much second-year growth: four-feet-high (1.2 m) Large-Toothed Aspen; two-feet-high (60 cm) Huckleberry and Rhodora bushes, profusely spreading and flowering Lambkill; Blueberry bushes with green fruit; and four-inch-high (10 cm) Jack Pine seedlings. I concluded my part of the presentation by showing an unburnt wetland that lies adjacent to burnt forest near York Redoubt, and I highlighted the value of wetlands in limiting the spread of the fire and in protecting the flora and fauna.

DAVID – POST-FIRE REGENERATIVE PROCESSES

I went to the Lower Mud Pond area on May 4th, 2009, to view the forest and barrens as soon after the fire as possible. In a word – black! The soil surface and all above-ground vegetation were uniformly charred, and most of the finer branches of trees had burned off completely. When I brushed the blackened soil surface, brown peaty soil was revealed a few millimetres below. There was a stubble of burned off Huckleberry stems where once extensive and vigorous plants had stood one to four or more feet (30 -120 cm) high. The fire had stopped abruptly at the Leatherleaf stands surrounding Lower Mud Pond. However, smaller wetlands were affected – most striking were the mats of Sphagnum which were bleached or browned, evidently killed but not burned. I was very excited to see what I had hoped to see – the serotinous cones of Jack Pine had opened and were releasing their seed into the wind. I could even see them on the soil surface.

Three major categories of forest fires are commonly described: "**Ground fires** are mostly smoldering combustion of compacted duff or peat, with little flaming. A ground fire may creep only a few feet per day through the thick forest floor duff under a shady coastal forest. **Surface fires** burn above the ground in leaves, grasses and herbs, shrubs, and downed woody debris. **Crown fires** spread through the canopies of trees by torching out trees as the surface fire ignites them from below or by spreading through tree canopies independently of the surface fire. Crown fires are usually driven by strong winds or aided by steep slopes. (Arno, F. & Allison-Bunnell, S. 2003. Flames in Our Forest: Disaster or Renewal? Island Press) The Spryfield fire was a surface and canopy fire, killing most everything above ground. As suggested by Richard's images, there was evidently a lot below ground that wasn't killed.

I visited the Purcell Cove Conservation Lands and/or the Lower Mud Pond Area at one to two month intervals through the spring, summer and fall of 2009 and again in 2010. The Lower Mud Pond Area is more readily accessible than the burnt areas on the Purcells Cove Conservation Lands, but otherwise they are similar landscapes. Like Richard, I marvelled at how quickly the burnt areas were becoming revegetated. (I have enjoyed a similar experience in walks though Point Pleasant Park, recovering after Hurricane Juan.)

On my most recent visit to Lower Mud Pond (August 27th, 2010) there was a blanket of leafy vegetation over the previously treed areas, reaching two m high in places. On the more open barrens areas, Huckleberry, Rhodora, Lambkill, and Blueberry had returned close to their previous heights and were already producing fruit. This rapidly regenerating vegetation consisted of deciduous species that regenerate from buds on the root crown, roots, or rhizomes when current top growth is removed or damaged by disturbances such as cutting, grazing, or fire. Species responding to fire this way at Lower Mud Pond and on the Purcell's Cove Conservation lands included trees (Red Maple, White and Wire birch, Large-toothed Aspen, and Shadbush), larger shrubs (Witherod, Mountain Holly, Alder), and smaller shrubs (Huckleberry, Rhodora, Lambkill, Blueberry).

The areas slowest to revegetate have been the small wetlands and areas where mats of Broom Crowberry had occurred on the open barrens. In places on the small burnt wetlands, Cranberry and Hairy Cap Moss were growing over the still largely dead mats of Sphagnum, and there were a few spots where Sphagnum appeared to be regrowing again (Aug. 27th, 2010).

In some areas of thin soil on open barrens, Teaberry, Three-toothed Cinquefoil, and one or two graminoids (sedges, grasses, rushes) had grown up from rhizomes. However, the extensive areas where Broom Crowberry had previously thrived were still largely bare on that date. Broom Crowberry, a creeping shrub with evergreen, needle-like leaves, is commonly found on granitic outcrops in the area of the shallowest soils between bare rock and Huckleberry stands; it's often mixed with Reindeer Lichen, and extends into the outer fringes of the Huckleberry. In places, fire and/or subsequent erosion had removed the thin soil and litter, exposing old burnt rhizomes. There was no sign of new growth from rhizomes right after the fire, but on August 27th I observed, for the first time, a few areas with Broom Crowberry seedlings. I expect there will be much wider distribution of Broom Crowberry seedlings by the same time next year. I also observed for the first time, seedlings of Goldenheather, another creeping shrub much less common than Broom Crowberry. Both species are considered to be fire-adapted and fire-stimulated. While the thin, shallow-lying rhizomes are readily killed by fire, seeds deposited in the soil seedbank survive and are scarified (stimulated to germinate) by the heat. Mountain Sandwort, which I first observed after the fire in September of 2009, also appeared to have regenerated from seed, rather than rhizomes.

Reindeer and other lichens, which were burnt to a crisp by the fire, had hardly come back at all by August 27th, 2010. However, on that date I observed what appeared to be young colonies of Reindeer Lichen in some of the Broom Crowberry areas, as well as several small patches of Hairy Cap Moss and Broom Moss. Also, Richard and I observed a large and visually striking patch of Purple Horn-toothed Moss in burnt forest near York Redoubt on June 21st, 2010.

Seedlings of Wire Birch and of a few weedy species, likely derived from outside sources, were observed in the fall of 2009 and subsequently in the open barrens and in the soil exposed where trees were uprooted during or after the fire.

Fire-adapted Conifers

The two conifers Jack Pine and Black Spruce were common in the burned areas prior to the fire. Both are boreal species, well adapted to recurrent stand-replacing canopy fires which are normal in the boreal forest. They survive by producing 'above ground seedbanks'. Jeffrey Danter summarises fire adaptations of Jack Pine as follows: "Jack Pine is well-adapted to fire. Serotinous cones, which have a waxy outer coating to protect the seeds, remain on the tree rather than dropping to the forest floor. Seeds can remain viable on the tree for 20 years or longer. When a fire occurs, the thick cone protects the Jack Pine seed from the intense heat. Jack Pine seeds have been known to still be viable after exposure to heat at 1000 degrees Fahrenheit. That heat, however, opens the scales of the cone and releases the seed onto the ground where the fire has removed much of the existing vegetation and litter. Jack Pine seeds require contact with mineral soil to germinate, so fire serves to prepare the seedbed, reduce competition from other plants, and release the Jack Pine seed. In addition, the short stature of Jack Pines makes crown fires a high likelihood; these very crown fires are necessary to release the seeds from dormancy." (Danter, K.J. n.d. Fire Dependent Ecosystems of the United States, **http://www.nifc.gov/preved/comm_guide/wildfire/fire_6.html**).

Black Spruce is not so extreme in its adaptations; it produces semi-serotinous cones which stay on a tree for several but not many years. As noted above, I observed cones of Jack Pine to be open and releasing seeds within a few days of the fire. I also observed groups of blackened Black Spruce cones on the ground and some still remaining attached on burnt trees. I observed only a few seedlings of Jack Pine in the fall of 2009; they become quite common by the late summer of 2010. I have

not yet seen seedlings of Black Spruce, but I may not be looking hard enough.

Jack Pine is generally considered to be a 'fire-dependent' species, and thus its presence in an area to be indicative of a history of recurrent fires. (Black Spruce is not so fire-dependent. It is longer lived than Jack Pine and is shade-tolerant so is not so affected by competition as the shade-intolerant Jack Pine.) Commonly cited intervals for fire in Jack Pine stands are in the range of 25 to about 120 years. Seed production begins at five to ten years, and if fires repeat at very short intervals, Jack Pine gives way to a treeless (barren) landscape. It rarely lives more than about 170 years, and is generally replaced by other species after intervals of 200 to 300 years without fire. The likelihood of fire in Jack Pine stands increases with time: "The accumulation of litter and debris on the forest floor over time increase the likelihood of moderate- or high-severity fire… A lichen mat, a highly flammable and continuous fuel source at ground level, develops within 40 years and is important in supporting fires in Jack Pine forests." (Carey, J.H. 1993. Fire Effects Information System: **Pinus banksiana, http://www.fs.fed.us/database/feis/**).

The precise relationship of Jack Pine to fire in Nova Scotia needs to be clarified through scientific study. In the boreal forest, most cones on Jack Pine are the closed serotinous type, but in Nova Scotia there tends to be a mixture of closed serotinous cones and cones that have opened without fire, with one or the other often much more numerous according to the tree and site. There may be some situations where disturbances and stresses other than fire are sufficient to maintain this shade-intolerant species. However, it seems pretty likely that the abundance of Jack Pine, as well as Broom Crowberry, on the more exposed granitic landscapes of Halifax mainland south reflects a history of recurrent fires. A local resident told me that the last big fire in the Lower Mud Pond Area occurred 45 years prior to the 2009 fire. At the HFN talk, Jill Alexander said the last big fire on the Captain Arnell property was in 1917. Certainly, fires have been common since the Europeans arrived. Likely before that, fires were less frequent, but First Nations Peoples tended to settle mostly near the coast and also set fires deliberately or accidentally, and lightening can spark fires in these sorts of environments. The important point, I think, is to recognize that areas with abundant Jack Pine are likely to be very prone to fires.

Forests and Fire in HRM

Halifax is surrounded by forest, not farmlands as are most cities. Most of the areas where the city has expanded have been in typical mixed Acadian forest which has a relatively low susceptibility to fire. More and more, however, there is pressure to build in what were once very challenging areas – the barrens and associated pockets of forest on high granitic outcrops. Indeed they can be exceptionally beautiful places to situate a residence. The first time I went into Jack Pine stands close to Halifax, I was reminded of the lovely, quasi-open fire-prone Aleppo pine forests with shrubby understories at Kareas, a suburb on the hills overlooking Athens, Greece, which I visited in the mid-1980s. In July of 1998, international news reports showed footage of a horrendous fire which swept through that area. The flames of the Spryfield fire, which I viewed from the Halifax Peninsula on April 30th, 2009, presented very similar images.

As in other places where people settle in areas of fire-prone vegetation, we are faced with a dilemma – we want to prevent and/or put out fires quickly, but by doing so, we allow the fuel load to increase, in this way increasing both the likelihood of fire and its intensity when it does strike.

So how do we address this issue in HRM? Landscape-specific building codes requiring extended buffer zones and use of fire-resistant building materials in fire-prone landscapes may be part of the answer. It's obviously important to retain whatever wetlands we have in these landscapes. Personally, I think there should be significant restrictions on development in the areas of granite barrens and associated forest on the Chebucto Peninsula, both for public safety and for conservation of species like Broom Crowberry (a coastal plain species that is 'apparently secure' in Nova Scotia, but imperiled elsewhere; it is declining in N.S. because of development and other pressures), Goldenheather (imperiled), and Mountain Sandwort (imperiled), and a dozen or so more rare species found in the 'permanent coastal barrens' as documented by Jeremy Lundholm and colleagues at Saint Mary's University. Contribution of private lands for conservation in the area (The Purcells Cove Conservation Lands) is an especially encouraging move in this direction. Let's hope there will be more! There are some big chunks of crown land in the area as well (see: The Herring Cove Backlands Wilderness Area, **www.publicland.ca/herringcovebacklands.html**). I do hope that these issues will be flagged in HRM's Urban Forest Management Plan, currently under development.

FOR MORE INFORMATION:

On the coastal barrens –

Oberndorfer, Erica C. & Lundholm, J.T. 2009. Species richness, abundance, rarity and environmental gradients in coastal barren vegetation. Biodiversity & Conservation 8:1523-1553

Burley, S.T. & Lundholm, J.T. 2010. Environmental predictors of forest expansion on open coastal barrens. Biodiversity & Conservation 19: 3269-3285.

On wildfires and fire ecology –

Le Goff, H. & Sirois, H. 2004. Black Spruce and Jack Pine dynamics simulated under varying fire cycles in the northern boreal forest of Quebec, Canada. Canadian Journal of Forest Research 34: 2399–2409

Martine, C.T., et al. 2005. The biology of *Corema conradii*: natural history, reproduction, and observations of a post-fire seedling recruitment. Northeastern Naturalist 12(3): 267-286.

The U.S. Fire Effects Information Service provides detailed information on the fire ecology of individual species at **http://www.fs.fed.us/database/feis/plants/index.html**

Wildland fire in ecosystems: effects of fire on fauna, ecosystems, cultural resources, and archeology, soil, and water. Comprehensive documents by the U.S. Forest Service. See links listed at **http://frames.nacse.org/1000/1287.html**.

Is Your Home Fire Smart? –

http://www.gov.ns.ca/natr/forestprotection/wildfire/firecentre/fire-smart.asp. This also gives links to other N.S. Government pages dealing with wildfires.

On Jack Pine and Broom Crowberry in N. S. –

See listings under 'Ericaceae' in the Species section of the Nova Scotia Wild Flora Society website, **nswildflora.ca**.

FOREST REGENERATION SPECIES

Reindeer Lichen	*Cladonia* spp.
Sphagnum Moss	*Sphagnum* spp.
Hairy Cap Moss	*Polytrichum* spp.
Broom Moss	*Dicranum* spp.
Purple Horn Tooth Moss	*Ceratodon purpureus*
Black Spruce	*Picea mariana*
White Pine	*Pinus strobus*
Jack Pine	*Pinus banksiana*
Red Oak	*Quercus rubra*
Wire Birch	*Betula populifolia*
White Birch	*Betula papyrifera*
Mountain Sandwort	*Minuartia groenlandica*
Large-toothed Aspen	*Populus grandidentata*
Broom Crowberry	*Corema conradii*
Teaberry	*Gaultheria procumbens*
Golden-heather	*Hudsonia ericoides*
Rhodora	*Rhododendron canadense*
Lambkill	*Kalmia angustifolia*
Leatherleaf	*Chamaedaphne calyculata*
Blueberry	*Vaccinium angustifolium*
Cranberry	*Vaccinium oxycoccos*
Shadbush	*Amelanchier* spp.
Three-toothed Cinquefoil	*Sibbaldiopsis tridentata*
Red Maple	*Acer rubrum*
Painted Trillium	*Trillium undulatum*
Pink Lady's Slipper	*Cypripedium acaule*