The Ecology of the Rocky Heathlands of Western Nova Scotia

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THE ROCKY heathlands of western Nova Scotia, popularly called "barrens", occupy some 31,000 ha in Digby, Yarmouth and Shelburne counties (Fig. 1).

At the request of the Provincial government, an ecological examination was carried out between 1966 and 1968, to determine whether afforestation would be practical. The soil and vegetation of the heathlands were examined in detail and compared with adjacent soils and woodlands. Some planting trials were instituted and an attempt made to elucidate the history and origins of the barrens (Strang, unpubl. rep.).

The heathland soil was a bouldery, ortstein podzol derived from coarse granitic tills. The organic layers, in which charcoal was frequently seen, were from 2 cm thick on the tops of knolls to 10 cm on side slopes and even more in depressions. The Ah horizon was usually thin and indistinct but the well-developed Ae was commonly between 10 and 15 cm thick. Below the Ae lay a thin, friable Bh horizon over a cemented, massively platey Bfc 5 to 10 cm thick. An

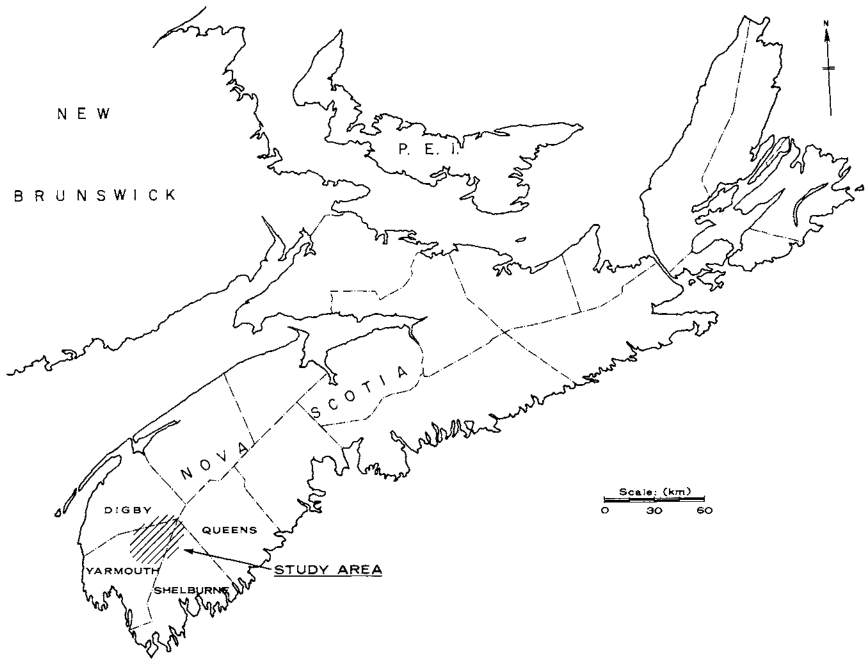

FIG. 1. Map of Nova Scotia showing location of the study area.

indistinct, wavy boundary separated this from the underlying B/C, a variable, compacted horizon thought to have been compressed by ice action, or in the immediate post-glacial era. The pan layers were impenetrable to roots and impervious to water. The subtending C horizon was deep, very coarse-textured and loose. Rocks and boulders were common in all horizons. Moisture retention, exchange capacity and nutrient content were low.

It was found, by X-ray crystallographic analysis, that the silt- and clay-sized fractions of these soils consisted of fine quartz and feldspar only.

In the vicinity of the heathlands, there were some 2,500 ha of glacio-fluvial outwash plains. Soil development was similar to that of the heathlands differing only in being almost boulder-free and in that the soil particles were noticeably less angular.

The vegetation was classified into four associations characterised by their dominant species. The areal proportions of each type were estimated from measurements along 6.5 km of randomly sited belt transects (Table 1). One small, open, relic stand of *Pinus strobus* was located on a knoll near the centre of the heathlands and other stunted trees, *P. strobus, Picea mariana* and *Abies balsamea*, were scattered throughout.

Site preparation by controlled burning was tested in a 4-ha block. Immediately after a cool, night fire, access was much easier than in unburned tracts but, within 2 years, *Gaylussacia baccata* and other shrubs had recovered to a point where the burned area was scarcely distinguishable from its surroundings (Fig. 2). Growth and survival of planted stock, *Pinus banksiana, P. resinosa, P. strobus* and *Larix* sp., were better on burned than on similar unburned sites but were nowhere good. Strong responses to nitrogenous fertilizer (urea) were noted in size and colour of needles but height differences were insignificant 3 years after treatment.

Soil and vegetation catenas were found to correspond almost exactly. The *Corema* association occurred on shallow soils on the tops of ridges and mounds or on slopes where large rocks lay just below the surface. The *Gaylussacia* association dominated all of the side slopes, height growth and crown development increasing with greater soil depth to pan on lower slopes. The *Rhodora* association was found exclusively on peat bogs in bottom lands. Other slopes ended in rocky water-courses with a mixed shrub association. A topographically similar catena in woodlands immediately surrounding the heathlands differed in both soil and physiognomy. The soil was a gray-brown, wooded podzol with no pan and with chlorite in the clay-sized fraction. The vegetation was a closed, mixed wood, 8 to 15 m tall, with *Gaylussacia baccata* occuring only in a few small open glades.

Pollen analyses showed a relative decrease upwards in pollen of *Pinus, Tsuga* and some hardwoods from about 55 cm depth. At the same levels, *Betula, Alnus, Ericaceae* and *Myrica* pollen increased. Cultivated grass pollen, probably *Zea mays*, was found at a depth corresponding to a time about 800 years ago.

If it is correct to assume that peat accumulates at a rate of about

TABLE 1. VEGETATION TYPES OF THE ROCKY HEATHLANDS

Vegetation type	Estimated[a] extent	Topography and site	Commonly associated species
1. *Gaylussacia baccata* (huckleberry)	45	Side slopes; deeper and less dry than 2	*Vaccinium angustifolium, Kalmia angustifolia, Aralia nudicaulis*
2. *Corema conradii* (broom crowberry)	17	Tops of ridges and knolls; dry, very shallow soil over pan	*Arctostaphylos uva-ursi, Gaultheria procumbens, Cladonia* spp.
3. *Rhododendron canadense* (Rhodora)	11	Depressions; peat over rocks	*Chamaedaphne calyculata, K. angustifolia, Ledum groenlandicum, Sphagnum* spp.
4. Mixed shrubs	10	Rocky water-courses; bouldery debris	*Acer rubrum, Betula populifolia, Picea mariana, Populus tremuloides; Amelanchier* spp., *Ilex glabra, Myrica gale, M. pensylvanica, Nemopanthus mucronata, Viburnum cassinoides*
Surface rocks	17	Various	*Gyrophora muhlenbergii*

[a] Percent of area.

FIG. 2. Ten-acre controlled burn on the rocky heathland. Before (A), immediately after (B) and 2 years after (C) burning.

2.5 cm every 100 years, these regressive changes coincide with or closely follow the onset of the sub-Atlantic deterioration about 600 B.C. It appears that charcoal was first formed about 900 years ago, a little earlier than the first date for cultivated grass. This can be shown as the time when man first occupied the Maritimes (Jeness, 1955) although he conceded that ". . . it is hardly credible that it was entirely uninhabited before . . .".

There appears to be a strong correlation between *Gaylussacia baccata* and pan formation especially on coarse soils. Throughout the heathlands, and elsewhere in Nova Scotia, *G. baccata* was usually associated with massive pan development. Where pan was absent, either the *G. baccata* was not dominant and its appearance suggested an invasive phase or the soils were of heavy texture, wet or rocky. When pan was found in the absence of *G. baccata*, a rare occurrence, other ericaceous low shrubs were dominant.

It seems likely that a shift away from an open *Pinus* woodland to a more open *Betula/Alnus* community with a well-developed shrub understorey began some 2,000 years ago in response to climatic deterioration. Periodic burning has accentuated this trend and fostered the dominance of *Gaylussacia baccata*. A cemented pan has developed subsequently. Competition both above ground and in the shallow, infertile soil inhibited tree growth to the point where the fire-tolerant heathland was almost a stable community. Occasional fires further hindered tree establishment but it is an over-simplification to regard the heathland as simply a fire-climax community.

The infertility, rockiness and vigorous shrub competition make afforestation a most expensive undertaking doomed to financial failure at best.

LITERATURE CITED

Jeness, D. 1955. Indians of Canada (3rd ed.). Nat. Mus. Can., Bull. 15, Anthropol. Ser. 15.