

**NOTE****Beetles in old growth forests: perspectives from the Townshend Woodlot, Prince Edward Island**

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Three hundred years of European settlement have dramatically altered the forests of the Maritime Provinces of Canada. Perhaps nowhere has the impact been greater than on Prince Edward Island (PEI). Pre-colonial PEI was largely dominated by old growth forests consisting of American beech (*Fagus grandifolia* Ehrh. (Fagaceae)), sugar maple (*Acer saccharum* Marsh. (Sapindaceae)) and yellow birch (*Betula alleghaniensis* Britt. (Betulaceae)), with smaller components of red spruce (*Picea rubens* Sarg. (Pinaceae)), eastern hemlock (*Tsuga canadensis* (L.) Carr. (Pinaeae)), red oak (*Quercus rubra* L. (Fagaceae)), white pine (*Pinus strobus* L. (Pinaceae)) and balsam fir (*Abies balsamea* (L.) Mill. (Pinaceae)) (MacQuarrie and Lacroix 2003; Sobey and Glen 2004).

By early in the eighteenth century, significant cutting of the forest had started and large areas of the island were burnt. By 1900, 70% of the island's forests had been cleared and the remaining 30% was highly fragmented and extensively disturbed (PEI Department of Agriculture and Forestry 1997; Loo and Ives 2003). In 1960, 60% of the land on the island was devoted to agriculture and a further 8% was otherwise open (unimproved waste land, marsh, barren, etc.) leaving only 32% as forest (Erskine 1960). Since then, farm abandonment has led to some re-growth so that by 1992, 57% of the land was forested (Anonymous 1992). Even where land has not been cleared, the best trees have been removed for generations, leaving a generally impoverished forest, both in terms of genetic quality and of species diversity. Only small relicts of the original vegetation of the island still exist (Loo and Ives 2003).

A relatively uninvestigated question is, the degree to which the history of land use on Prince Edward Island has affected the insect fauna, a point raised by Majka et al. (2007b) in regard to the province's long horn beetle (Cerambycidae) fauna. A perspective on this was provided by a recent visit to the Townshend Woodlot (46.42° N; 62.28° W) north of Harmony Junction on the Souris Line Road in Kings County, PEI. The International Biological Program classified this site as "the best remnant of the original deciduous forest cover of Prince Edward Island" (Tashereau 1974, 213). In a study of ecological continuity (the inverse of disturbance) of forests in the Acadian Forest Ecoregion, Selva (2003) examined 77 old-growth forest stands. Based on the composition of calicioid lichens (which exhibit a particular richness in undisturbed forest conditions, and hence are good indicators of ecological continuity) he selected 15 stands, including the Townshend Woodlot, as "ancient forests," described as the oldest of the old. Approximately 70 hectares of this 116-hectare site are dominated by an old growth sugar maple, American beech, yellow birch, and red maple (*Acer rubrum* L. (Sapindaceae)) forest (Griffin et al. 1986) (Fig. 1). Although relatively undisturbed, there has been some historical disturbance to the site including the creation of woods roads through parts of the site, and some illegal historical cutting of trees in more accessible sections (Griffin et al. 1986; Hovingh 1995). In 2007 the Prince Edward Island Forests, Fish, and Wildlife Division evaluated the Townshend Woodlot employing the Nova Scotia Old Growth Forestry Scoring system. It scored highly and was ranked as old growth, although it fell in the ranking as a result of the comparative lack of deadwood, believed to be a result of past firewood removal (Kate MacQuarrie, pers. com.)

Furthermore, in a study of six forest stands on Prince Edward Island, including the Townshend Woodlot, MacQuarrie

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Figure 1. A view of the Townshend Woodlot site in Prince Edward Island.



and Lacroix (2003) found some degree of penetration (up to 120 m) by 15 species of exotic plants, common speedwell (*Veronica officinalis* L. (Plantaginaceae)) and yellow hawkweed (*Hieracium lachenalii* L. (Asteraceae)) being the most invasive. This site was purchased by the Prince Edward Island provincial government in 1972 and is now protected by designation as a natural area under the provincial Natural Areas Protection Act (Griffin et al. 1986).

On 14 August 2010, I entered the Townshend Woodlot from the east via an old-woods road, proceeding for 1.1 km and collecting primarily along the northern side of the road. During two hours, I collected 37 species of Coleoptera (Table 1), primarily by sweep netting vegetation, and manually searching the ground under rocks, in decomposing wood, and on gill fungi. Despite being only a small fraction of the species actually present at the site, this small sample yields instructive insights. Eleven of the 37 species found (30%) have not been previously found on Prince Edward

Island (*Anthonomus lecontei* Burke, 1975; *Caenocara oculata* (Say, 1824); *Coelocephalapion emaciipes* (Fall, 1898); *Gyrophaena vitrina* Casey, 1906; *Piazorhinus scutellaris* (Say, 1826); *Platydracus violaceus* (Gravenhorst, 1802); *Quedius plagiatus* Mannerheim, 1843; *Silusida marginella* (Casey, 1893); *Sunius confluentus* (Say, 1834); *Tachyerges niger* (Horn, 1873); *Trechus apicalis* Motschulsky, 1845). Subsequently, on 14 August 2010, *Tachyerges niger* was also collected in a mature deciduous forest at Woodville Mills, Kings County, PEI, (46.2392° N, 62.5157° W).

The discovery of 11 new species for the provincial fauna at one site during a very short sampling period is a striking result. While it is the case that the Prince Edward Island Coleoptera has been comparatively less investigated than that of many other Canadian jurisdictions, research by the author over the past decade has added considerably to knowledge of the island's fauna. Nine of these 11 species (all but *Sunius confluentus* and *Quedius plagiatus*) are members of groups that have received recent biodiversity and distribution surveys in Maritime Provinces [the Anobiidae by Majka (2007a); the Carabidae by Majka et al. (2008); the Curculionidea by Majka et al. (2007a); the Aleocharinae by Majka and Klimaszewski (2010); and the Staphylinina by Brunke et al. (2010)]. This lends support to the contention that these discoveries do not simply represent common and well-distributed species that have been hitherto unreported on Prince Edward Island as a result of scientific inattention to these groups.

Two species of Chrysomelidae found at the site, *Mantura chrysanthemii* (Koch, 1803) and *Ophraella conferta* (LeConte, 1865), have also not previously been reported in the scientific literature from Prince Edward Island (LeSage 1991; Riley et al. 2003), however, both are actually common and widely distributed on the island (C.G. Majka, unpublished data). Thus, their collection from the Townshend Woodlot formally establishes their presence in the province.

Although the data from the Townshend Woodlot are necessarily preliminary and incomplete (see below), the large proportion of native species, 35 of 37 (94.6%), collected there is nonetheless noteworthy. Overall the native fraction of Coleoptera on Prince Edward Island is 77.4% (C.G. Majka, unpublished data). The many anthropogenically-disturbed habitats on Prince Edward Island are home to a large suite (57) of adventive species (C.G. Majka, unpublished data), whereas only two non-native species, *Mantura chrysanthemii* and *Propylaea quatuordecimpunctata* (Linnaeus), were found in the Townshend Woodlot. While this is a comparatively small number, it does indicate, as MacQuarrie and Lacroix

Table 1. Coleoptera found in the Townshend Woodlot, Prince Edward Island, 14 August 2010.

Family	Subfamily	Species	Trophic Category	Specific Bionomics
Anobiidae	Dorcatominae	<i>Caenocara oculata</i> (Say)	mycetophagous	forested habitats: puffballs (<i>Lycoperdon</i>)
Apionidae	Apioninae	<i>Coelocephalapion emaciipes</i> (Fall)	phytophagous	Fabaceae?
Carabidae	Harpalinae	<i>Agonum gratiosum</i> (Mannerheim)	predaceous	moist habitats
		<i>Lebia pumila</i> Dejean	predaceous: chrysomelid larvae	open, dry habitats
		<i>Pterostichus tristis</i> (Dejean)	predaceous lepidoptera larvae	forested habitats: under bark & logs
		Trechinae	<i>Trechus apicalis</i> Motschulsky *	predaceous
Chrysomelidae	Galerucinae	<i>Capraita subvitatta</i> (Horn)	phytophagous	open habitats: <i>Aster</i> & other plants
		<i>Chaetocnema borealis</i> White	phytophagous	moist habitats: host plant unrecorded
		<i>Mantura chrysanthemi</i> (Koch) †	phytophagous	open habitats: <i>Rumex acetosella</i>
		<i>Ophraella conferta</i> (LeConte)	phytophagous	open habitats: <i>Solidago</i>
Coccinellidae	Coccinellinae	Hispiniae	<i>Sumitrosis inaequalis</i> (Weber)	phytophagous forested habitats: various Asteraceae
		<i>Propylaea quatuordecimpunctata</i> (L.) †	predaceous	open habitats: aphids, adelgids, psyllids
Curculionidae	Curculioninae	<i>Psyllobora vigintimaculata</i> (Say)	mycetophagous	forested habitats: powdery mildews
		<i>Anthonomus lecontei</i> Burke	phytophagous	<i>Aster</i> spp.
		<i>Anthonomus signatus</i> Say	phytophagous	heathy & shrubby areas: <i>Rubus</i> , <i>Fragaria</i> , <i>Vaccinium</i>
		<i>Orchestes pallicornis</i> (Say)	phytophagous	forested habitats: <i>Amelanchier</i> , <i>Crataegus</i> , <i>Pyrus</i> , <i>Prunus</i>
Elateridae	Molytinae	<i>Tachyerges niger</i> (Horn)	phytophagous	forested habitats: <i>Salix</i>
	Lissominae	<i>Piazorhinus scutellaris</i> (Say)	phytophagous	forested habitats: <i>Quercus</i>
	<i>Oestodes tenuicollis</i> (Randall)	unrecorded	moist forested habitats	
Lampyridae	Lampyrinae	<i>Ellychnia corrusca</i> (Linnaeus)	predaceous	coniferous & deciduous forests; rotting logs & elsewhere
Latridiidae	Corticariinae	<i>Melanophthalma inermis</i> Motschulsky	mycetophagous	moist open habitats
	Latridiinae	<i>Stephanostethus liratus</i> (LeConte)	mycetophagous	eurytopic
Mordellidae		<i>Mordellistena fuscipennis</i> (Melsheimer)	phytophagous	coniferous & deciduous forests
Nitidulidae	Meligethinae	<i>Meligethes nigrescens</i> Stephens *	phytophagous	open habitats: <i>Trifolium pratense</i> & others plants
Scirtidae		<i>Cyphon confusus</i> Brown	saprophytic	wet habitats
		<i>Cyphon variabilis</i> (Thunberg) *	saprophytic	wet habitats
Scraptiidae	Anaspidinae	<i>Anaspis rufa</i> Say	mycetophagous	coniferous & deciduous forests
Staphylinidae	Aleocharinae	<i>Gyrophana vitrina</i> Casey	bolitophagous	forested habitats: gilled fungi
		<i>Leptusa brevicollis</i> Casey	predaceous	forests: under bark
		<i>Silusida marginella</i> (Casey)	bolitophagous?	forested habitats: gilled fungi
	Paederninae	<i>Sunius confluentus</i> (Say)	predaceous	forests: damp litter
	Staphylininae	<i>Atrecus americanus</i> (Casey)	predaceous	coniferous forests: under bark
		<i>Gabrius picipennis</i> (Mäklin)	predaceous	moist habitats
		<i>Platydracus violaceus</i> (Gravenhorst)	predaceous	forested habitats
		<i>Quedius plagiatus</i> Mannerheim *	predaceous	coniferous forests: under bark
Steninae	<i>Stenus flavicornis</i> Erichson	predaceous: Collembola	moist habitats	
Tachyporinae	<i>Tachinus picipes</i> Erichson	predaceous	forested habitats: decaying gill fungi	

Notes: †, indicates an adventive Palaearctic species; *, indicates a Holarctic species.

(2003) found in relation to vascular plants, that there is some degree of penetration of the site by adventive species.

Although the bionomics and trophic categories of the species found are quite diverse (Table 1), the large majority (29 of 37 species, i.e., 78%) are, to varying degrees, indicative of forested habitats. Nonetheless, eight species (*Lebia pumila* Dejean, *Capraitia subvitatta* (Horn), *Mantura chrysanthemii*, *Ophraella conferta*, *Propylaea quatuordecimpunctata*, *Anthonomus lecontei*, *Melanophthalma inermis* Motschulsky, and *Meligethes nigrescens* Stephens) are primarily found in open habitats. These were all found along the wood-road that runs through the site, where occasional small clearings support vegetation or microhabitats where these species can survive. Their presence is also indicative of a penetration into this forested site by faunistic elements not characteristic of forests.

Without a systematic investigation conducted over an entire season employing a variety of collecting techniques, it is impossible to say what the scale of the beetle fauna of the Townshend Woodlot might be. However, one potential basis of comparison does present itself. Since the year 2000, the author has been engaged in an ongoing study of the Coleoptera of a 27 hectare forested site in St. Patricks, Queens County, PEI. Two hundred and forty-eight species of beetles (C.G. Majka, unpublished data) have been found there. Although the two sites differ (the St. Patricks site includes areas of deciduous forest, coniferous forest, mixed forest, and a regenerating old field ecosystem), this finding does provide some indication of the potential scale of the forest beetle community, and a baseline against which future investigations might be compared.

It must be emphasized that these are very preliminary findings, however, the discovery of such a large number of hitherto unrecorded Prince Edward Island beetles at this woodlot, does provide some evidence that such comparatively undisturbed sites provide habitat for species which are otherwise rare, scattered, disjunct, or even extirpated from other portions of the province, possibly as a result of the long history of anthropogenic disturbance to PEI forests. It is not unreasonable to assume that the resulting habitat degradation, fragmentation, if not virtual disappearance, of ancestral Acadian forest in the province may have significantly impacted the invertebrate fauna.

In particular, a faunistically and ecologically significant suite of beetles one might expect to encounter in the Townshend Woodlot are the species that are associated in various ways with the decomposition of wood. The short sampling effort conducted by the author found only a few such beetles. Most are not adequately sampled

by techniques such as sweep netting of vegetation and manual searching in daylight hours. Many species are nocturnal and are best collected with flight intercept or Lindgren funnel traps baited with attractants. Some exist at relatively low population levels and are active as adults for short periods of the season necessitating an extended collection timeframe. As earlier noted, the comparative lack of deadwood in the Townshend Woodlot (historically removed for firewood) may be a factor in population levels of saproxylic invertebrates there. It is saproxylic beetles which have been most affected by historical forest management practices. For example, Majka (2007c) found that 33% of saproxylic species found in the Maritime Provinces were “apparently rare” (i.e., representing < 0.005% of specimens examined). Majka (2007b,c) suggested that the large proportions of such apparently rare saproxylic beetles were ascribable to the history of forest management practices in the region.

The present study indicates that relict old growth stands such as the Townshend Woodlot might be one of the few remaining areas on Prince Edward Island where some species of forest beetles persist. Consequently, ensuring their preservation and the ecological integrity of the site is an important goal, not only to conserve this biodiversity, but to serve as a reservoir from which such forest beetles could potentially disperse from and re-colonize other island forested sites in the future.

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