

Breeding habitat selection of Canada Warblers in three different landscapes of southern Quebec

Samuel Dufour-Pelletier¹, Carl Savignac², Vincent Lamarre³,
Bruno Drolet³, Jacques Ibarzabal⁴, Junior A. Tremblay³



¹Bureau Environnement et Terre d'Odanak
²Dendroica Environnement et Faune

³Environnement et Changement Climatique Canada
⁴Université du Québec à Chicoutimi

CONTEXT

Canada Warbler (*Cardellina canadensis*; hereafter CAWA) is a species listed as threatened under the Species at Risk Act in Canada and its critical habitat remains undefined to the current Recovery Strategy¹.

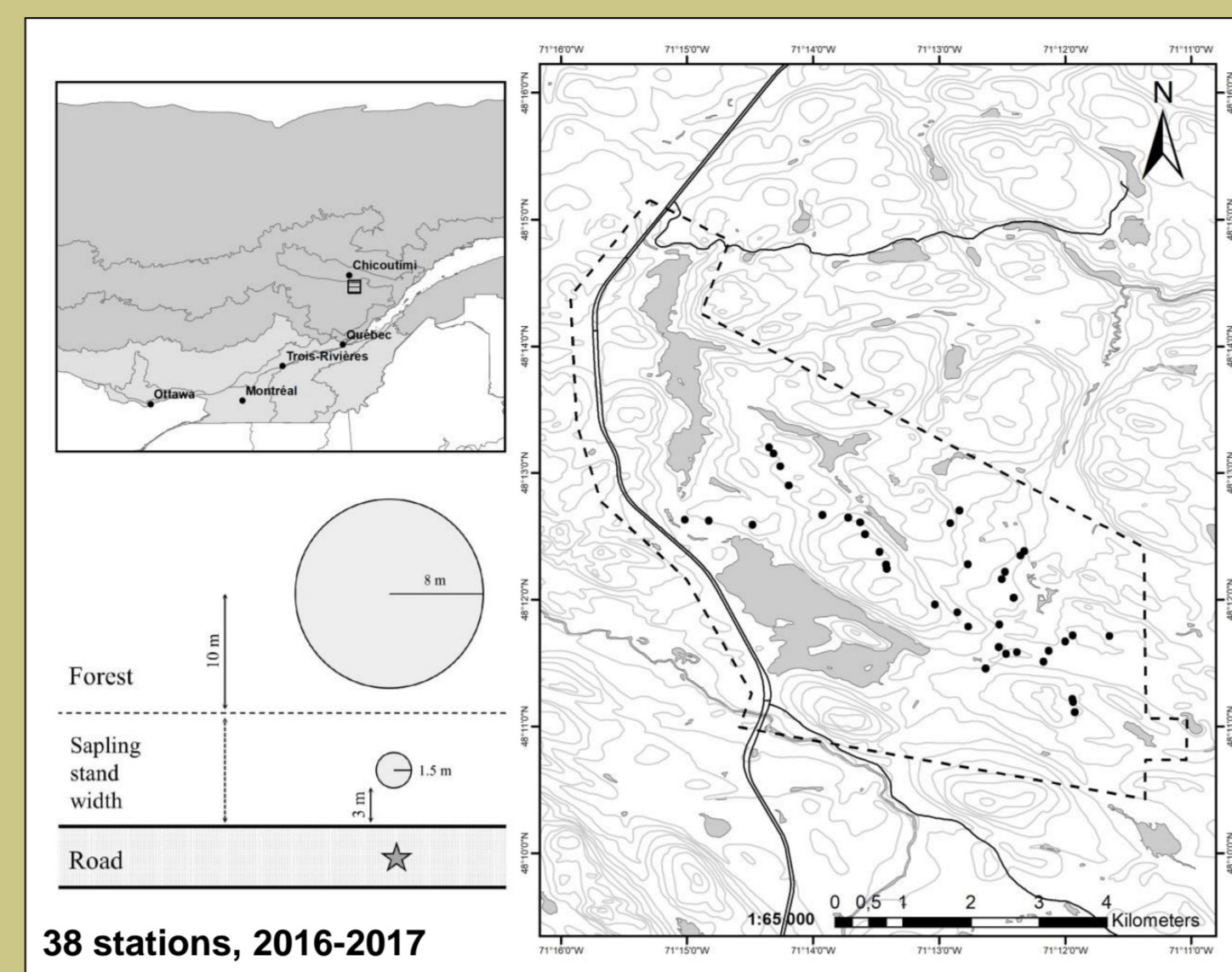


Existing literature demonstrates that regional specificities may lead to slight particularities in habitat selection of CAWA³. Depending on regions, different variables, such as soil wetness, number of perch trees, edge effect, forest gaps and topography have all been shown to influence the presence of CAWA.

Even though numerous studies have been carried out during the last decade in western Canada^{4,5} and in north-eastern United States^{6,7,8,9}, very few information regarding fine-scale breeding habitat characteristics are available for eastern Canadian provinces.

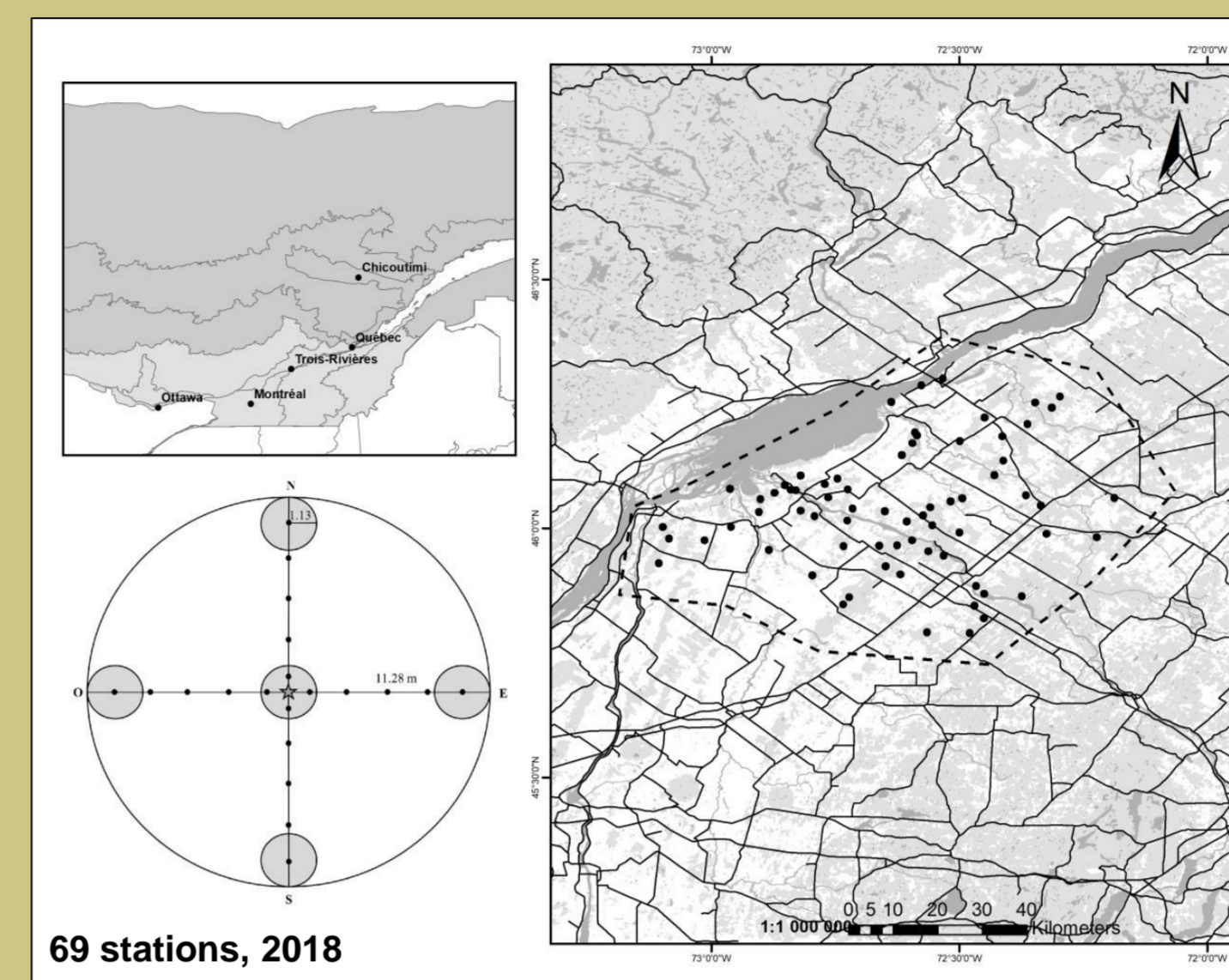
STUDY AREAS & METHODS

Mixed boreal forest



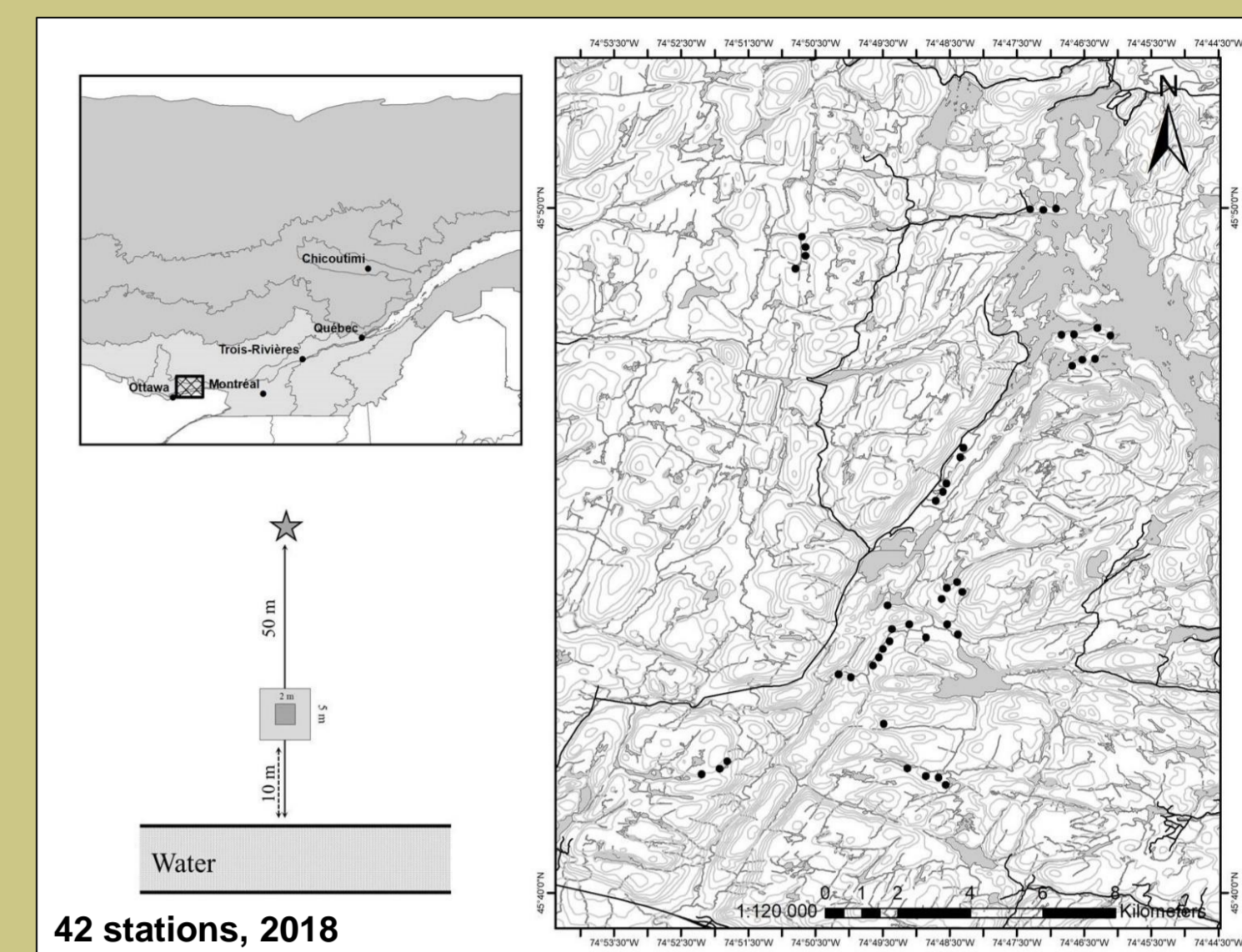
38 stations, 2016-2017
Walking survey with intraspecific calls along forest roads

Agroforest



69 stations, 2018
Point counts with ARUs within deciduous woods in Farmland

Riverine forest



42 stations, 2018
Point counts with calls at water edge in deciduous forest

Table 1. Codes and description of derived habitat variables for the three study areas.

Mixed boreal forest		Agroforest		Riverine forest	
DomCan	Dominant canopy type	DomCan	Dominant canopy type	DomCan	Dominant canopy type
CHSap	Average cover height of sapling stand (m)	CanClose	Canopy closure (%)	CanClose	Canopy closure (%)
WiSap	Width of sapling stand (m)	CanHgt	Canopy height (m)	CanHgt	Canopy height (m)
DecTreeBA	Basal area of deciduous trees (m ² /ha)	DecTreeBA	Basal area of deciduous trees (m ² /ha)	DecTreeBA	Basal area of deciduous trees (m ² /ha)
ConTreeBA	Basal area of coniferous trees (m ² /ha)	ConTreeBA	Basal area of coniferous trees (m ² /ha)	ConTreeBA	Basal area of coniferous trees (m ² /ha)
SmallSap	Density of shrub (n/ha) [DBH < 2.5 cm]	SmallSap	Density of shrub (n/ha) [DBH < 2.5 cm]	SmallSap	Density of shrub (n/ha) [DBH < 2.5 cm]
LargeSap	Density of shrub (n/ha) [DBH > 2.5 cm]	LargeSap	Density of shrub (n/ha) [DBH > 2.5 cm]	LargeSap	Density of shrub (n/ha) [DBH > 2.5 cm]
		Seedling	Density low vegetation (n/ha) [Height < 50 cm]	Seedling	Cover of low vegetation (%) [Height < 2 m]

Statistical Analysis

Vegetation Structure: Comparable set of logistic models to predict the presence of CAWA according to literature-based and self-made hypotheses.

Plant Community: 1) Permutational ANOVA to detect differences in the general plant species composition between stations with presence VS absence of CAWA, 2) Indicator Species Analysis to evaluate which plant species were indicator of CAWA's presence

RESULTS

Table 2. Type III Wald χ^2 tests for fixed effects on the probability of presence of Canada Warbler

Parameters	χ^2	d. f.	p-value*
Mixed boreal forest			
DomCan	8.99	2	0.011
SmallSap	10.44	1	0.001
LargeSap	27.07	1	< 0.001
Agroforest			
DomCan	8.08	2	0.018
Seedling	4.71	1	0.030
Riverine forest			
DecTreeBA	4.48	1	0.034
ConTreeBA	5.66	1	0.017

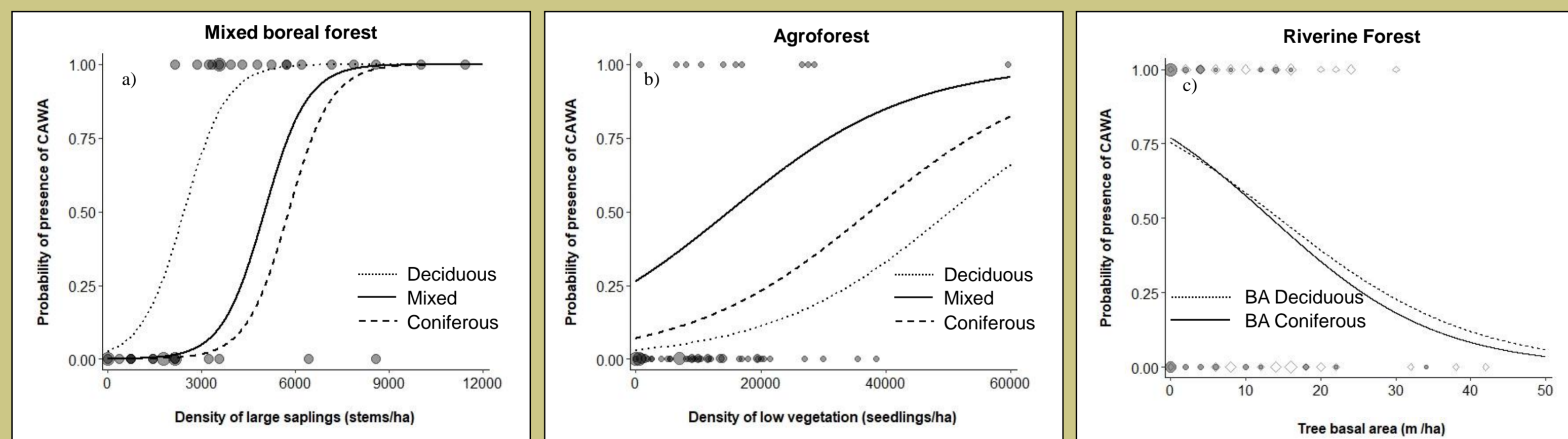


Figure 2. Projected probability of presence of Canada Warbler at stations.

Mean density of small saplings: **46,591** (Mixed boreal forest), **4,091** (Agroforest), **122,386** (Riverine forest)
Mean density of large saplings: **5,426** (Mixed boreal forest), **3,409** (Agroforest), **1,236** (Riverine forest)
Mean density of seedlings: **Unknown** (Mixed boreal forest), **19,500** (Agroforest), **Unknown** (Riverine forest)



Figure 2. Typical observed CAWA breeding habitat in a) Mixed boreal forest, b) Agroforest and c) Riverine forest.

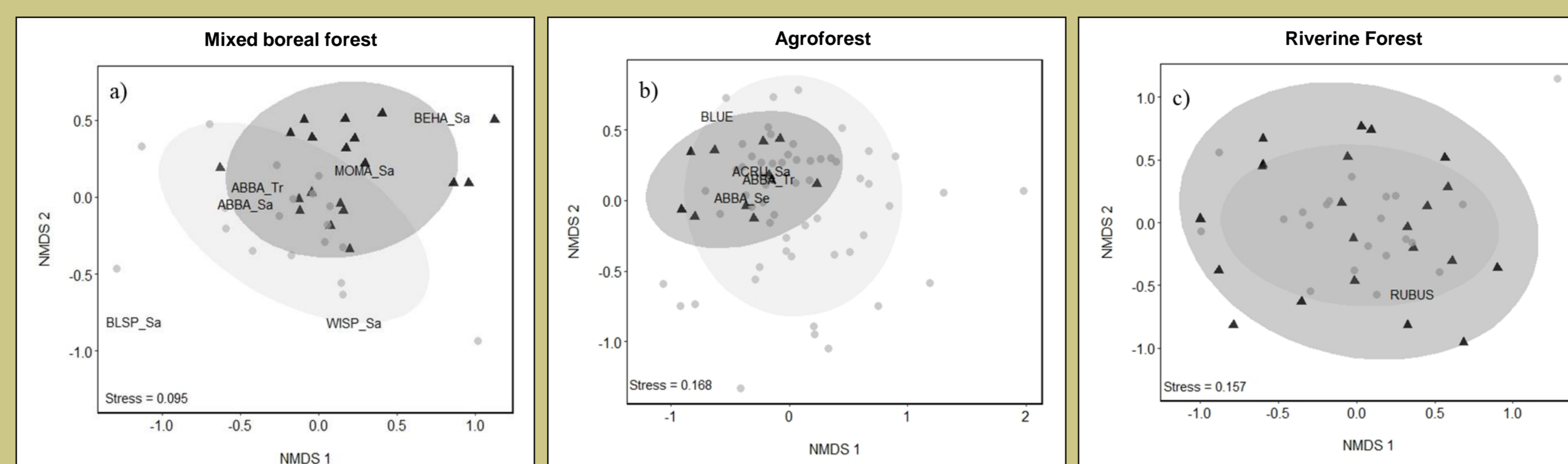


Figure 3. NMDS ordination of stations with presence of Canada Warbler (dark gray and black triangles) and stations with absence (light gray and gray circles). The overall woody plant community was different between stations with and without CAWA for the Mixed boreal forest and Agroforest ($F_{1,67} = 1.78, p = 0.02$; $F_{1,36} = 6.06, p < 0.01$ respectively) but not for the Riverine forest.

Most abundant Indicator species at stations with CAWA were: Mountain maple and Beaked hazelnut

Most abundant Indicator species at stations with CAWA were: Rhodora, Blueberries, Balsam fir (seedling) and Red maple (sapling)

Most abundant Indicator species at stations with CAWA were: *Rubus* spp.

TAKE HOME

- Dominant canopy seems to influence CAWA's breeding habitat selection depending on landscape composition.
 - In a **boreal landscape**, CAWA selects the less abundant component: **deciduous cover**.
 - In a **deciduous landscape**, CAWA selects the less abundant component: **coniferous or mixed cover**.
- Density of the understory is a key component that has been documented throughout its breeding range^{5,8,10}.
 - The type of understory differs between study areas, which may be explained by the different **survey protocols** used and the **raw values of stem density**.
 - Higher seedling or sapling densities seem to be linked to a higher probability of encountering CAWA. However, when densities are overall very high (such as in Riverine forest) it may become more difficult to detect optimal habitat amongst the others.
- Some plant species appears to be more important than others, but they all offer a **greater nest concealment**.
- Forest planners should aim for a **complex forest structure favoring a dense understory**, especially in private lands of southern Quebec where forest thinning is used extensively.