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# Demography of the Black-backed Woodpecker in unburned boreal forest stands in eastern Canada

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UQAC Université du Québec à Chicoutimi

***Avian Conservation and Ecology – In review***

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# Black-backed Woodpecker (*Picoides arcticus*)

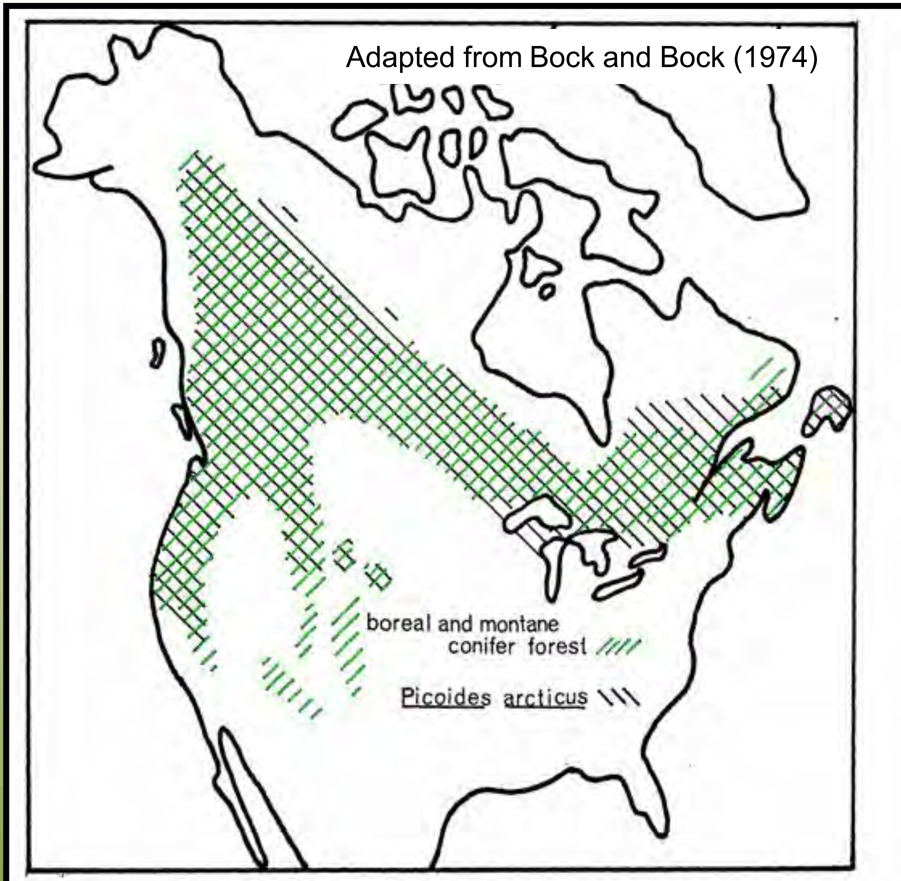




Photo: Jérôme Rioux

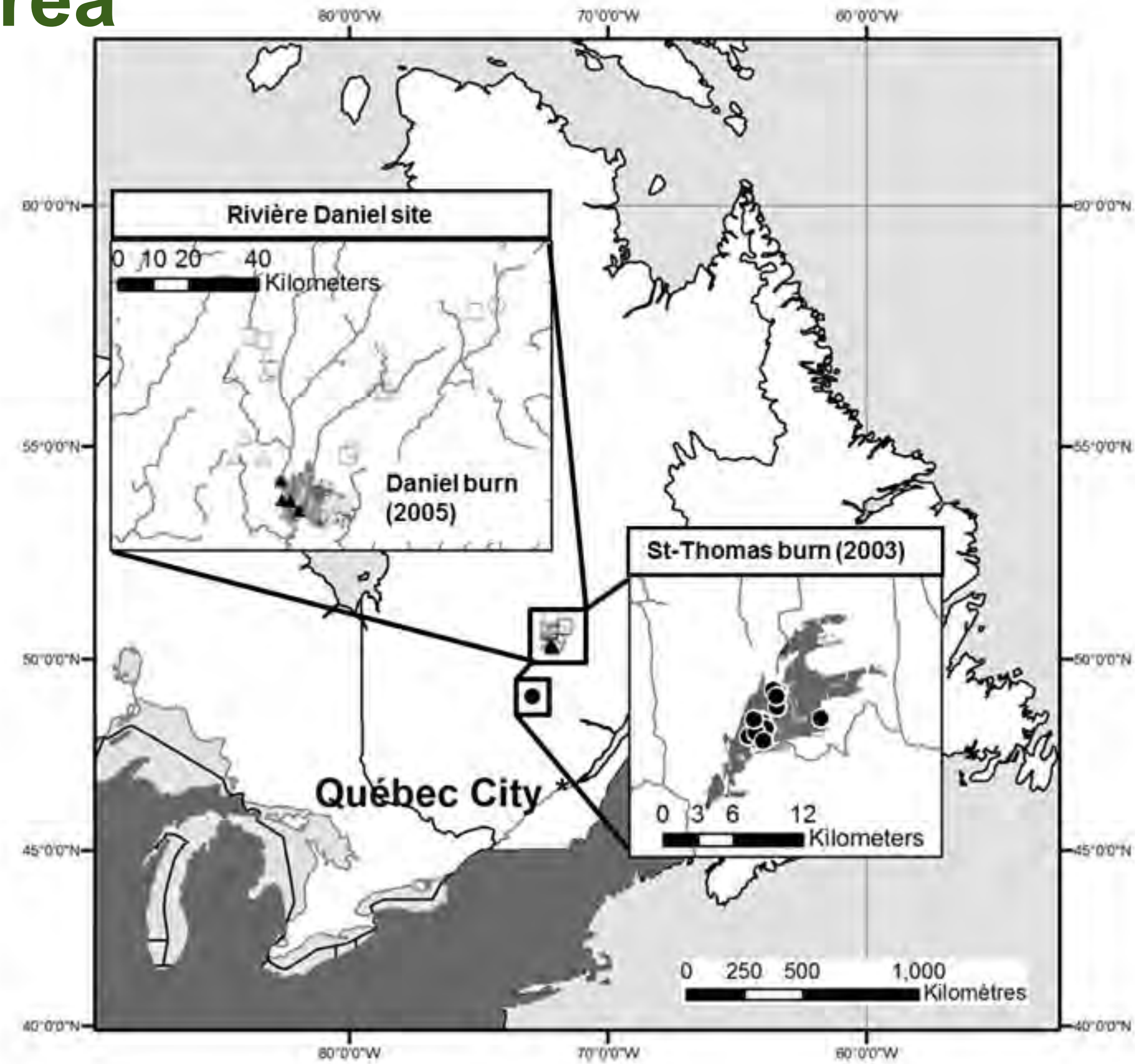
# Context

- Black-backed Woodpeckers are found at high densities in recently burned forests (Blackford 1955, Hutto 1995, Saab and Powell 2005, Nappi and Drapeau 2009, Nappi et al. 2010)
- The species breeds in unburned forests (Goggans et al. 1989, Tremblay et al. 2009, Craig 2014)
- Hutto (1995) hypothesized that Black-backed Woodpecker populations were maintained by a source/sink dynamic.
- Because recently burned coniferous forests are considered as high-quality habitat for Black-backed Woodpeckers, they should be occupied mainly by experienced, older individuals
- However, Huot and Ibarzabal (2006) suggested that at least part of the colonizing individuals arrived in the same year as the fire, and included mostly second-year birds.

# General objectives

1. Compare the breeding success of Black-backed Woodpeckers in both unburned and burned forests
2. Compare the age composition of breeding Black-backed Woodpeckers in both unburned and burned forests
3. Evaluate the role of unburned forests in the general population demographics of this species

# Study area

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# Methods – Finding nests

# Methods – Telemetry

# Methods – Ageing


Molt pattern following Pyle (1997)

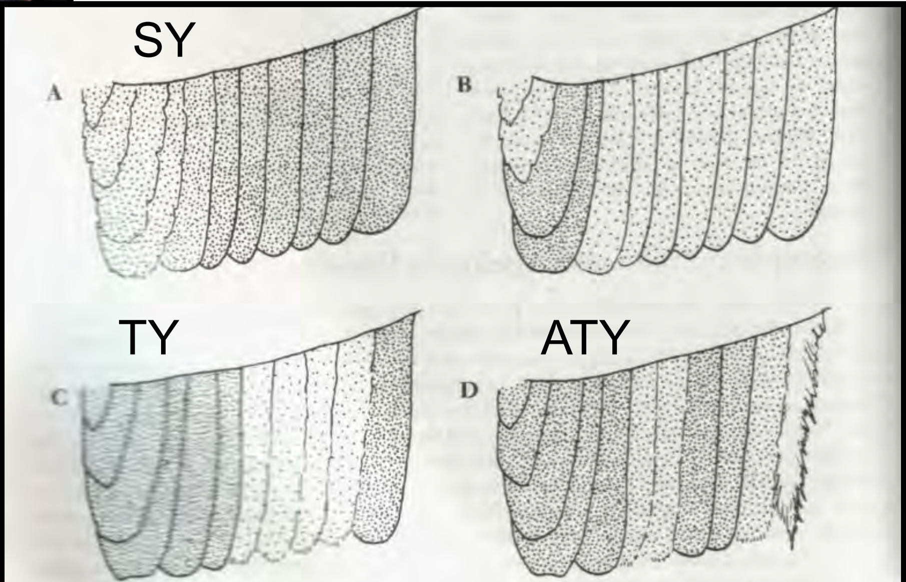



FIGURE 121. Replacement patterns among the secondaries of woodpeckers as an aid to ageing; see text and Figure 25. A single retained juvenal secondary (as shown in illustration **D**) can be found in occasional ASY/ATYs, and may indicate TY/4Y, but more study is needed. Many ASY/ATYs have a pattern similar to that in illustration **D** but without the juvenal feather. Figure from Pyle & Howell (1995)

Pyle (1997)

# Methods – Nest monitoring


# Methods – Statistical analysis

- Competing models for the daily survival rate (DSR) of nests were evaluated using generalized nonlinear mixed models (Dinsmore et al. 2002, Rotella et al. 2004)
- Given the relatively small sample size, the set of models was limited to 6
- The set of candidate models was evaluated using the Akaike's Information Criterion corrected for small sample size (AICc) (Burnham and Anderson 2002)

| Category | Variable name | Variable description |
|---|---|---|
| Abiotic | Min. Temp (°C) | Averaged min. daily temperature over the interval between nest visits |
| | Max. Temp (°C) | Averaged max. daily temperature over the interval between nest visits |
| Biotic | Habitat | Burned or unburned forest |
| | Parent age | Age of the older parent (SY, TY or ATY) |
| Temporal | Date | Julian date |
| | Year | 2004, 2005 or 2006 |

# Results – Daily survival rate (DSR)

Nest

$n_{burned}$: 21

$n_{unburned}$: 16

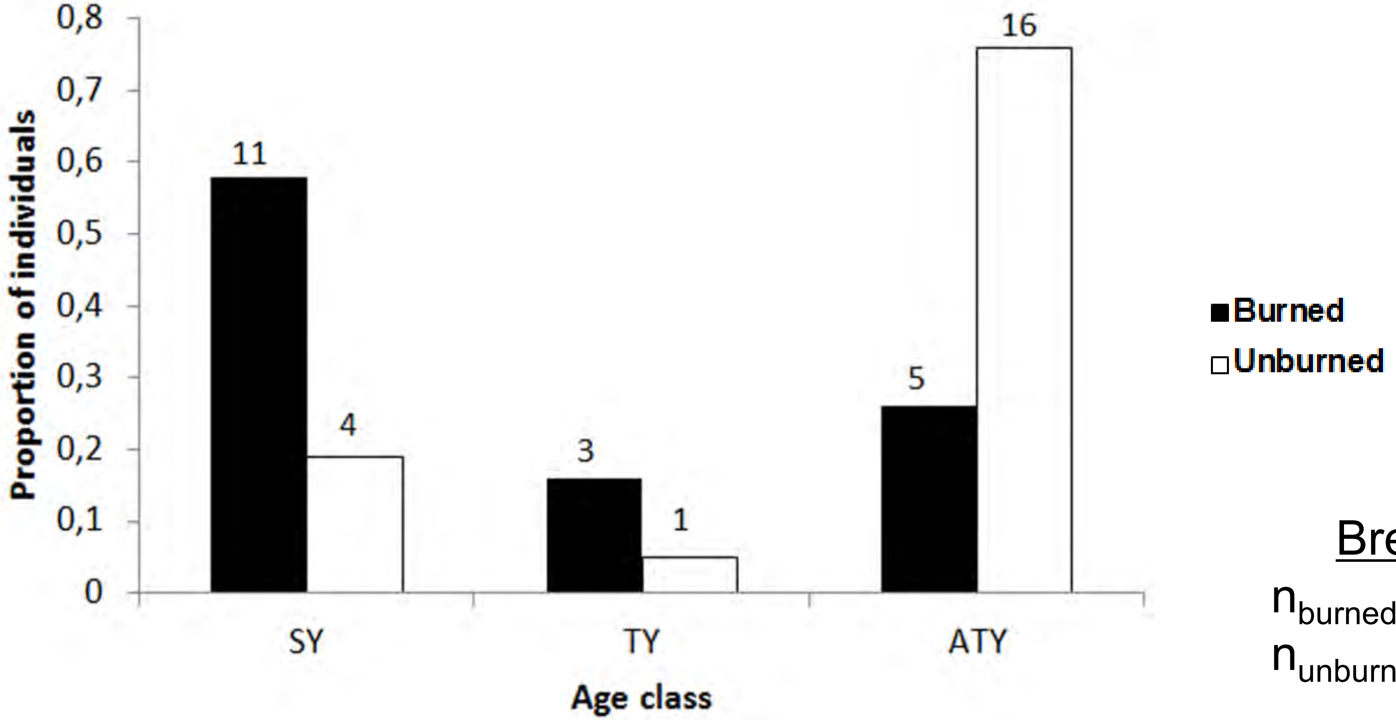
| Models | *k* | AICc | ΔAICc | $\omega_i$ |
|---|---|---|---|---|
| Habitat + parent age | 3 | 59.742 | 0.000 | 0.486 |
| Habitat | 2 | 61.932 | 2.190 | 0.163 |
| Habitat + date | 3 | 62.563 | 2.822 | 0.119 |
| Habitat + max. temperature | 3 | 62.856 | 3.114 | 0.102 |
| habitat + min. temperature | 3 | 63.591 | 3.849 | 0.071 |
| Habitat + year | 3 | 63.937 | 4.195 | 0.060 |

# Results – DSR by Habitat type & Parent age

| Factor | Daily survival rate | Nesting survival rate | Youngs per successful nest | Productivity |
|---|---|---|---|---|
| *Habitat type* | | | | |
| Burned | 0.990 ± 0.007 [21] | 0.79 ± 0.13 [21] | 3.0; 3.0; 3.0 [9] | 2.3 ± 0.3 |
| Unburned | 0.985 ± 0.008 [16] | 0.69 ± 0.13 [16] | 1.5; 2.0; 3.0 [11] | 1.5 ± 0.4 |
| *Parent age* | | | | |
| Second Year (SY) | 0.978 ± 0.029 [7] | 0.42 ± 0.27 [7] | 2.0; 3.0; 3.0 [5] | 1.0 ± 0.8 |
| Third Year (TY) | 0.984 ± 0.020 [4] | 0.52 ± 0.18 [4] | 2.5; 3.0; 3.0 [3] | 1.4 ± 0.5 |
| After Third Year(ATY) | 0.988 ± 0.015 [15] | 0.61 ± 0.12 [15] | 2.0; 2.5; 3.0 [10] | 1.5 ± 0.4 |

- The DSR of nests were similar in unburned and burned stands
- The number of fledglings per successful nest was greater in burned than unburned forest stands ($\chi^2 = 4.18$, df = 2, P = 0.04)
- But did not differ among parent age ($\chi^2 = 0.21$, df = 2, P = 0.90).

# Results – Age-class structure




Breeders

$n_{burned}$: 21
$n_{unburned}$: 19

- The age-class structure of the woodpecker population differed between unburned and burned stands ($\chi^2 = 9.96$, df = 2, $P = 0.006$, $n = 40$)

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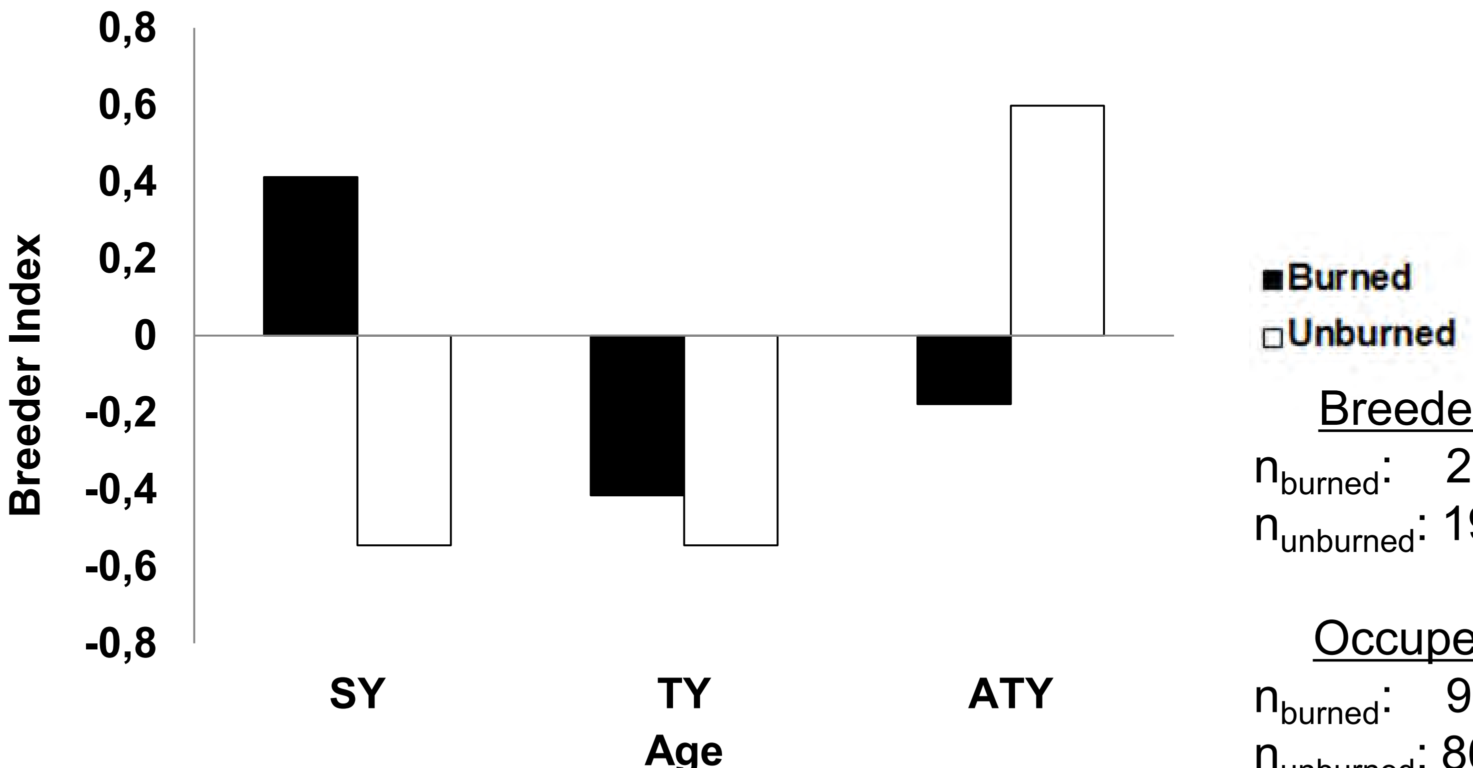
# Results – Breeder index




Breeders

$n_{burned}$: 21

$n_{unburned}$: 19

Occupers

$n_{burned}$: 90

$n_{unburned}$: 86

- An index < 0 suggests that fewer individuals than expected breed
- An index > 0 suggests that more individuals than expected breed

# Results – Demographic contribution

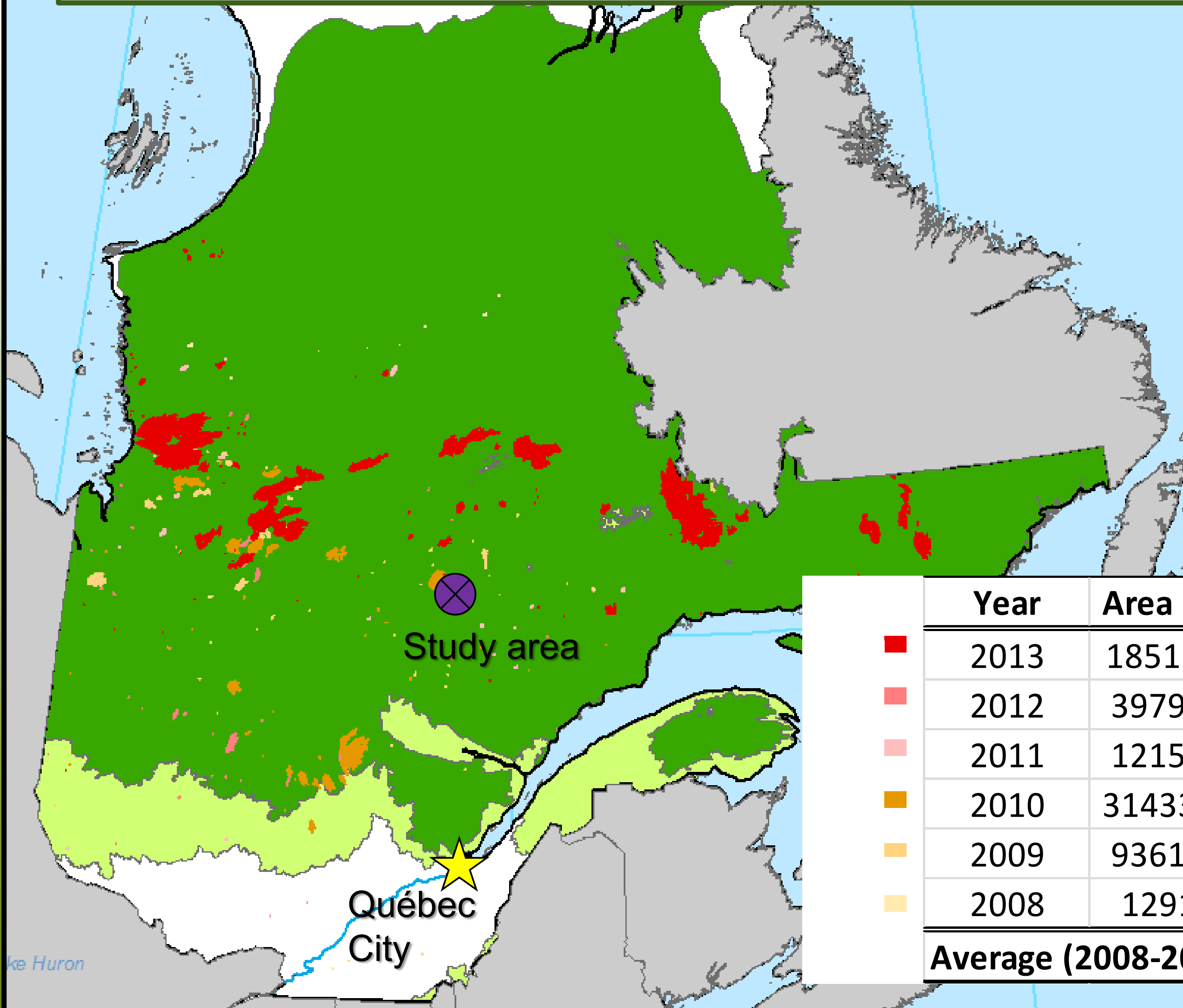
| Stand type[a] | % in the landscape[b] | Area (ha)[c] | Nb of nests[d] | Productivity[e] | Total ouput[f] |
|---|---|---|---|---|---|
| *Burned[g]* | | | | | |
| 1-yr burn | 0.4 | 1000 | 110 | 2.6 | 286 |
| 2-yr burn | 0.4 | 1000 | 70 | 2.2 | 154 |
| 3-yr burn | 0.4 | 1000 | 20 | 0.8 | 16 |
| 4-yr burn | 0.4 | 1000 | 20 | 0.8 | 16 |
| 5-yr burn | 0.4 | 1000 | 20 | 0.8 | 16 |
| 6-yr burn | 0.4 | 1000 | 20 | 0.8 | 16 |
| 7-yr burn | 0.4 | 1000 | 20 | 0.8 | 16 |
| 8-yr burn | 0.4 | 1000 | [illegible] | [illegible] | 16 |
| 9-yr burn | 0.4 | 1000 | [illegible] | [illegible] | 16 |
| 10-yr burn | 0.4 | 1000 | [illegible] | [illegible] | 16 |
| Total | | | | | 568 |
| *Unburned* (>100yr) | 65 | 162 500 | [illegible] | [illegible] | 1625 |

Burned
568 fledglings

Unburned
1625 fledglings

[a] Based on historical stand age class from Boucher et al. (2011). Almost all regeneration … fire-produced
[b] The proportion of regeneration stands was divided equally between each years
[c] Based on a 2500 $km^2$ landscape
[d] Nest density of 11 nests/100ha for 1-yr burn, 7 nests/100ha for 2-yr burn and 2 nests/100 ha for 3 to 10-year burns (Nappi and Drapeau 2009) and of 0.67 nests/100ha in unburned forest stands (Tremblay et al. 2009)
[e] Productivity = Nest success * number of young per successful nest. Data in burned forest stands are from (Nappi and Drapeau 2009; one-year burn: 0.84 *3.1; two-year burn: 0.73 *3.0 and 3 to 10-year burns: 0.25 *3.0), and data for unburned forests are from the present study. We kept constant the values for 3 to 10-year burns and we consider this simulation conservative because most of the burned habitats are only suitable for Black-backed Woodpeckers for the first five after years (Saab and Powell 2005).
[f] Total ouput = Nb of nests * Productivity
[g] Burned forests were assumed to provide breeding habitat for Black-backed Woodpecker from 1 to 10 years after fire and so for unburned forests > 100yr.

# **Discussion** – Wildfires in Québec (2008-2013)




| Year | Area (ha) | % of boreal forest |
|---|---|---|
| 2013 | 1851200 | 1.73 |
| 2012 | 39798.5 | 0.04 |
| 2011 | 12158.3 | 0.01 |
| 2010 | 314335.8 | 0.29 |
| 2009 | 93614.6 | 0.09 |
| 2008 | 1291.1 | 0.00 |
| **Average (2008-2013)** | | **0.36** |

# Conclusion

- Burned forests are ephemeral resources and our results show that some Black-backed Woodpeckers still select unburned forests over burned ones, and older individuals tend to breed in greater that expected numbers in unburned habitats
- The results of the present study suggest that if a given habitat, whether unburned or burned, presents sufficient foraging opportunities for nesting, it will generally be selected, even if foraging opportunities are theoretically better in burned areas (cost/benefice tradeoffs).
- Black-backed Woodpecker demography should not be considered as a source-sink scenario as the number of  individuals originating from burned forest stands is not as large as previously thought and insufficient for the long-term persistence of the breeding population.
- The Black-backed Woodpecker should be rather seen as an oportunistic species within the context of a pulse-resource dynamic.

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# Thanks to our field crew !

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