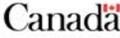



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Oil sands effects on boreal bird communities: characterizing niche, quantifying cumulative effects, and assessing sector and stressor effects

Dr. C. Lisa Mahon, Thea Carpenter, Dr. Judith Toms
 Canadian Wildlife Service, ECCC

- Physical disturbance is the key stressor for landbirds
- The boreal forest is naturally variable in habitats and there are many types of disturbances, so it is complex to assess impacts
- Impact of individual stressors and their cumulative impact is required to make predictions of landbird response



Global Forest Watch Canada

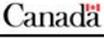
Holloway, Mahon & Bayne in review

Landbirds are being impacted

- Within the Athabasca oil sands area
 - Disturbance is affecting densities of 74% of species (negatively or positively)
 - 43% of species showed a substantial (>20%) change in density
 - Overall 15% change in bird community for 8.4% disturbance of landscape
 - Energy and forestry stressors are most important

Page 3 – December 9-16

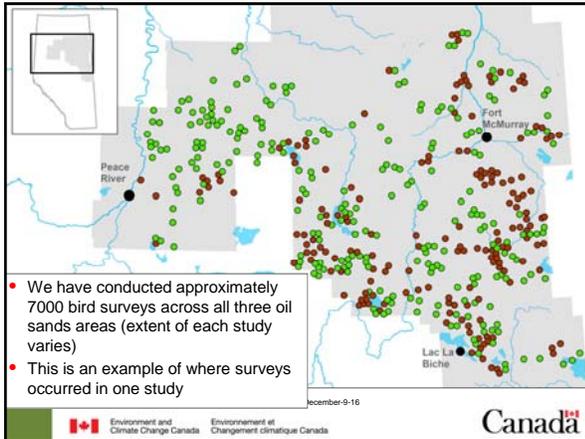

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Multiple approaches to assess impacts

- We needed to be able to set priorities
 - Problem is too big to tackle everything at once
 - Who are the specialists and generalists? Specialists are generally considered to be more vulnerable
 - What are the key stressors, are there under-studied habitats?
- Quantify cumulative effects
 - Both total impacts and specific effects
 - Are effects additive or interactive? Has big implications for assessing risks
- Conduct focused studies on priority areas

Page 4 – December-9-16



- We have conducted approximately 7000 bird surveys across all three oil sands areas (extent of each study varies)
- This is an example of where surveys occurred in one study

Mahon, Holloway et al. 2016

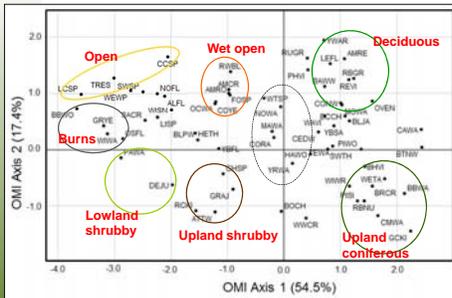
Prioritizing species

- Are there distinct bird communities within the boreal forest?
 - identified groups of species associated with specific habitats
- Are specialists at higher risk from development than generalists?
 - identified specialists and generalists
- Used ordination to associate species with habitat variables (local, landscape and regional scales)



Page 6 – December-9-16

22% of species are habitat specialists

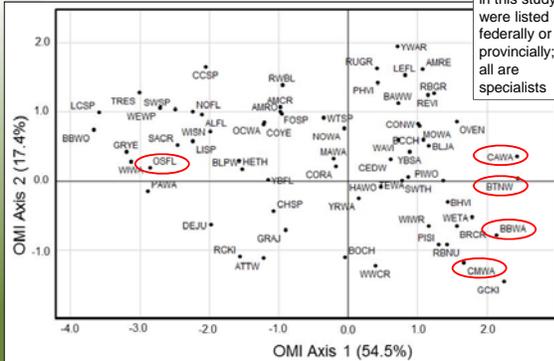


Species group into unique communities associated with specific habitats

Specialists are around the outer edges, generalists in the middle

Specialists include species of burns, open habitats and old coniferous forests

Listed species are specialists



Five species in this study were listed federally or provincially; all are specialists

Are specialists in trouble?

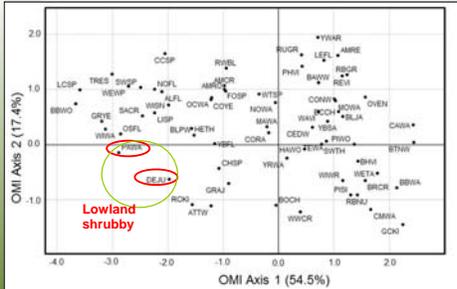
- The evidence suggests they might be
- Many use old forests – a rare habitat that can't regenerate quickly once removed
- 40% have declining populations
- 60% have declining species intactness indices
- Many listed species are specialists
- Generalists tend to have increasing populations
- Generalists can impact specialists through competition and predation
- Therefore it is important to study the entire community

Prioritized focal studies

- Designed a study to address high priorities
- Habitat – lowland forests make up ~40% of oil sands areas but have been little studied
- Stressors – SAGD disturbances are expected to be most common disturbance
- Species – specialist versus generalist



Focal species selection



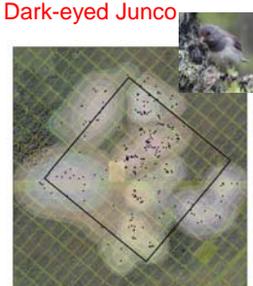
Selected two species that are typical of lowland habitats

Dark-eyed Juncos (DEJU) are generalists, Palm Warblers (PAWA) are specialists



Generalist uses disturbances

- *Note this work is ongoing so results are preliminary*
- Shaded areas are territories, dots are foraging locations
- May forage in vegetated disturbances, but do not yet know if they prefer them or not
- May have larger territories when disturbances are present
- Larger territories implies lower habitat quality



Evidence for declining diversity

- Generalists tend to be increasing in density, specialists decreasing
- Communities are shifting towards generalists
- Loss of diversity in both species and communities

Process of biotic homogenization



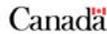
Alain Wolf

Page 16 - December-9-16



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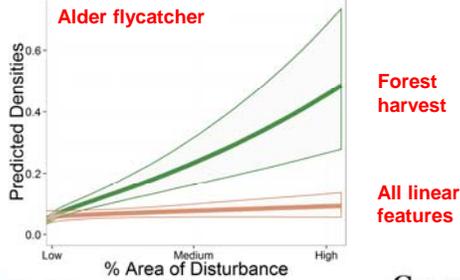
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Holloway, Mahon & Bayne in review

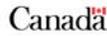
Which stressors are important?

Looked at forest harvest and several energy-sector stressors; within Athabasca OSA
Note that models have strong support



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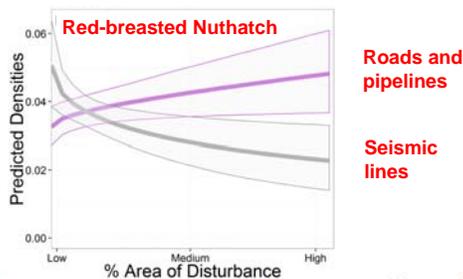
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Holloway, Mahon & Bayne in review

Important stressors depend on species

In both these species, effects were additive



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But effects can be synergistic



- Synergy: the effect of two stressors is greater than the sum of the two individual effects
- Or can be antagonistic (reduced effect)
- 39% of species show synergistic effects

Page 19 - December-9-16



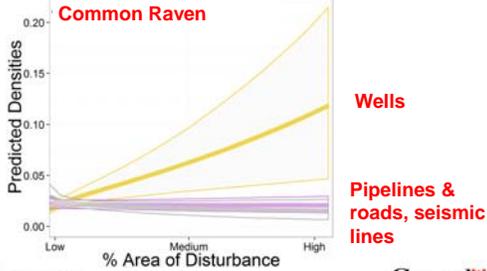
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Ravens show synergistic effects

Ravens respond positively to wells. This is a synergistic model.



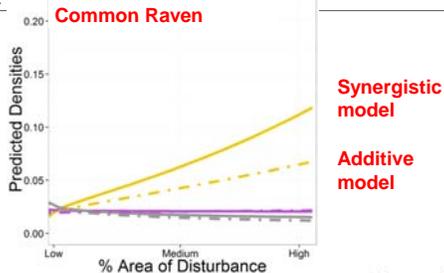
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Ravens show synergistic effects

Compare the effects of wells in the two models. The effect of wells is stronger when linear features are present. If we fit an additive model we would underestimate the impact of wells.



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Key conclusions

- Habitat disturbances are impacting many species on the breeding grounds
 - Most species (74%) are affected by disturbances
 - 22% of species are specialists; specialists seem to be more sensitive than generalists
 - Important stressors vary among species
 - Effects of disturbances are synergistic for 39% of species
- Caveat: most species are migratory so can be impacted at other times in their life cycle
- Results support the value of using multiple methods; each gives us a different piece of the puzzle and sometimes we need all of them to understand what the impacts are

Joint
Canada | Alberta
Implementation Plan
for Oil Sands Monitoring



See these papers for more details

- Mahon, C.L., G. Holloway, P. Sóllymos, S. Cumming, E. Bayne, F.K.A. Schmiegelow, S. Song. 2016. Community structure and niche characteristics of upland and lowland western boreal birds at multiple spatial scale. *Forest Ecology and Management* 361:99-116.
- Holloway, G., C.L. Mahon, E. Bayne. In review. Additive and interactive effects on boreal landbirds: A cumulative effects analysis in a multi-stressor landscape. *Landscape Ecology*.
- Mahon, C.L., G. Holloway, T. Carpenter, T. Mahon, J. Keim. In prep. Assessing impacts of steam assisted gravity drainage (SAGD) disturbance on lowland boreal birds using regional and lease data.
- Carpenter, T., C.L. Mahon, E. Bayne, S. Nielsen, J. Keim. In prep. Multi-scale resource selection of a habitat specialist and generalist in response to SAGD disturbance.
