Ecoregional patterns of spruce budworm-wildfire interactions in Central Canada’s boreal forests

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Canada’s boreal forest disturbances

- Two main types:

  - Long-term effects on forest ecosystems
    
    (Jasinski and Payette 2005, Girard et al. 2008)
Empirical evidence of interactions

- Stocks experimental burns (Stocks 1985, 1987)
- Péch: no accumulation of fuel after sbw in NS (Péch 1993)
- Importance of local conditions in mediating interactions
Statistical evidence

- Distribution of area burned in relation to the timing since last defoliation in Ontario (1941-1996)

Fleming, Candau and McAlpine (2002)
Objective of the study

- How the relation between sbw outbreaks and fire varies over the landscape as a function of environmental conditions?
Methods

- Long-term (1941-2005), large-scale (40x10^6 ha) sbw and fire data in Ontario
- Identified “sbw-related” fires
- Statistical models relate the spatial distribution of sbw-related fires to environmental variables:
  - Climate: Climate Moisture Index
  - Forest Composition: Content in balsam fir, white spruce, black spruce, and hardwood
  - Frequency of sbw defoliation
- Sample for balanced design
- Use Classification and Regression Tree (CART)
Results

- Classification tree of the presence (1) or absence (0) of sbw-related fires

Total classified correct = 69.2%
Areas of predicted sbw-related fires
Assessing variable importance
Probability of interaction
Conclusion

- Climate, defoliation history and forest composition all help in explaining spatial variation of sbw-fire interaction
- Areas of sbw-fire interaction best explained by HW content in the S, FbSwSb content in the N and moisture in W
- An increased $T^\circ$ combined with a decrease in precipitation suggest a decrease in sbw-fire interaction in the W
- A northward extension of sbw defoliation would increase the opportunity for interactions with fire
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Interactions in a new context

- Climate Change: Drier, warmer climate will increase risk of sbw-killed stands to burn
- Effect magnified by change in spatial extent of sbw outbreaks (Candau and Fleming, 2011)
- Challenges for risk-assessment and management planning