

Ecography

**ECOG-03553**

Robert, L.-E., Sturtevant, B. R., Cooke, B. J., James, P. M. A., Fortin, M.-J., Townsend, P. A., Wolter, P. T. and Kneeshaw, D. 2017. Landscape host abundance and configuration regulate periodic outbreak behavior in spruce budworm *Choristoneura fumiferana*. – Ecography doi: 10.1111/ecog.03553

**Supplementary material**

**Appendix 1.** Color plates maps of the Border Lakes Landscape (BLL) study area, illustrating key patterns in forest landscape configuration, composition, and climatic gradients potentially relevant to spruce budworm outbreak dynamics. Our analyses of these data are described in the Methods section of the primary paper.

**Figure Captions:**

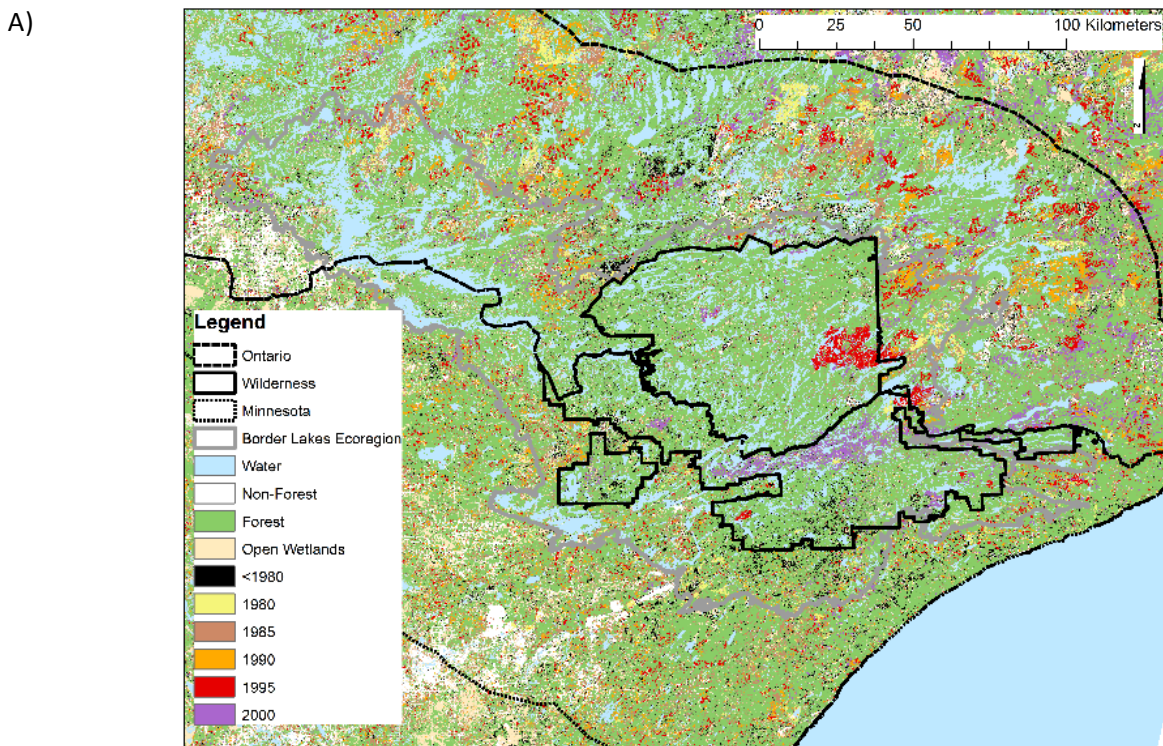


Figure A1-A. Patterns in the temporal sequence of forest disturbances for the BLL, as derived using land cover change methods by Wolter et al. (2012). Forest and non-forest areas are represented as well as the year of disturbances for pixel ranging from <1980 to 2000. Pixels assigned a numerical year value have been disturbed during the 5-year interval preceding the recorded year.

B)

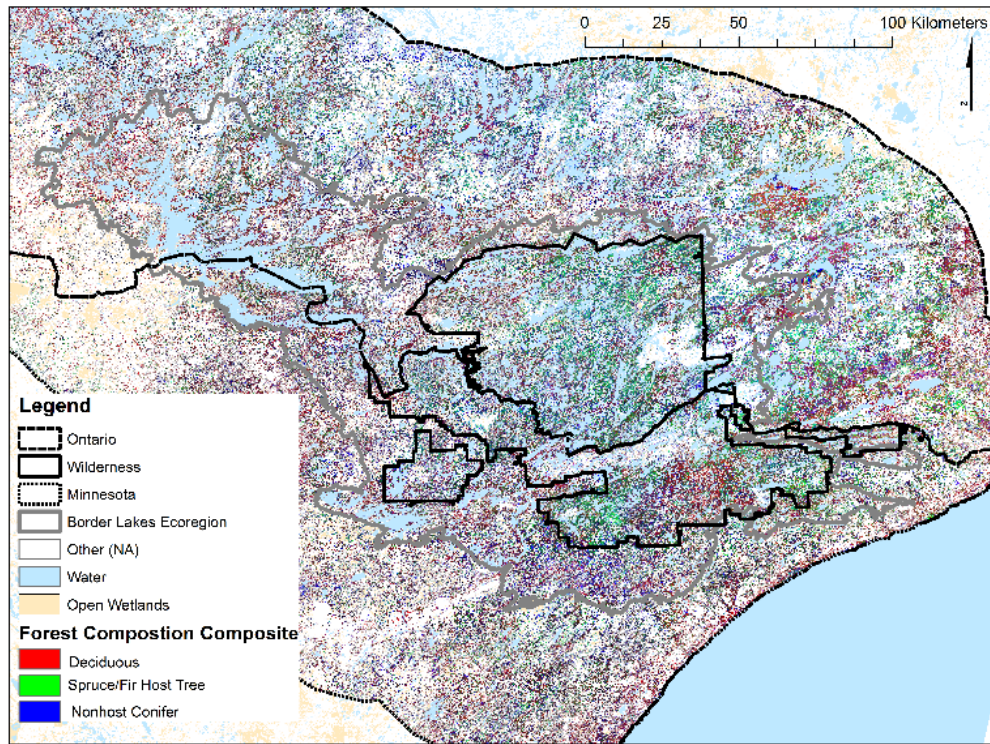


Figure A1-B. Forest composition composite map using tree species basal area estimated from Landsat TM analyses circa 2002 by Wolter et al. (2008), where the RGB index represents the basal area of deciduous species (red), spruce + fir (Green), and Non host conifer (blue).

C)

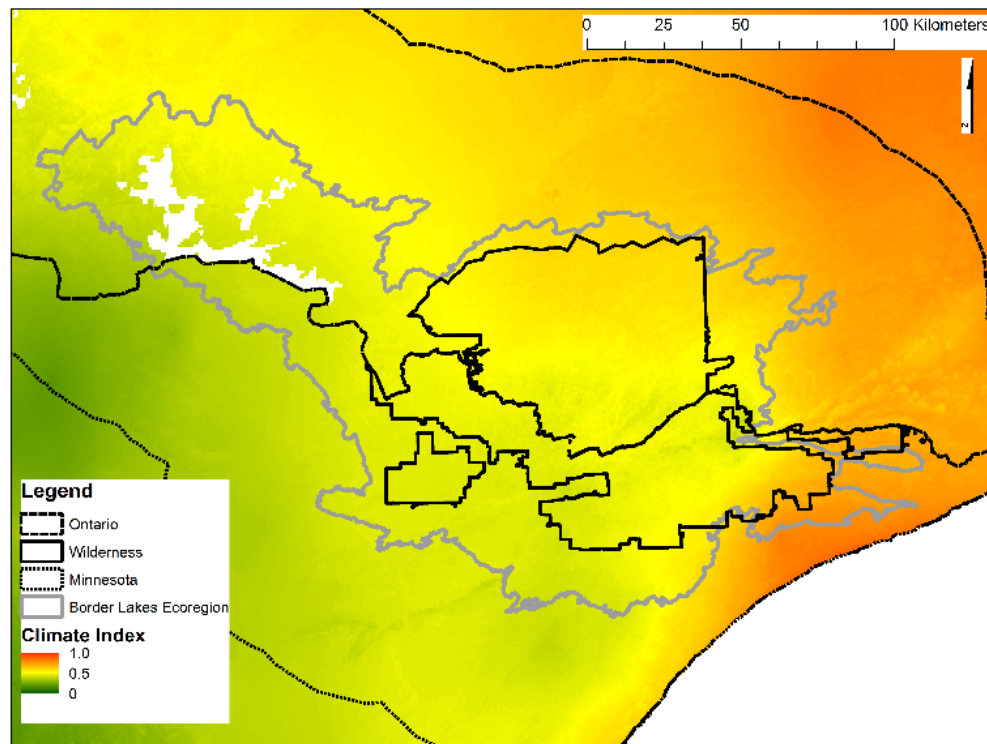


Figure A1-C) Spruce budworm growth index based on physiological constraints affecting overwinter survival and the ability of budworm to complete their life cycle within a single year. (Régnière et al. 2012). Values approaching 1.0 (i.e., warmer colors) represent areas where budworm population growth rate is optimal.

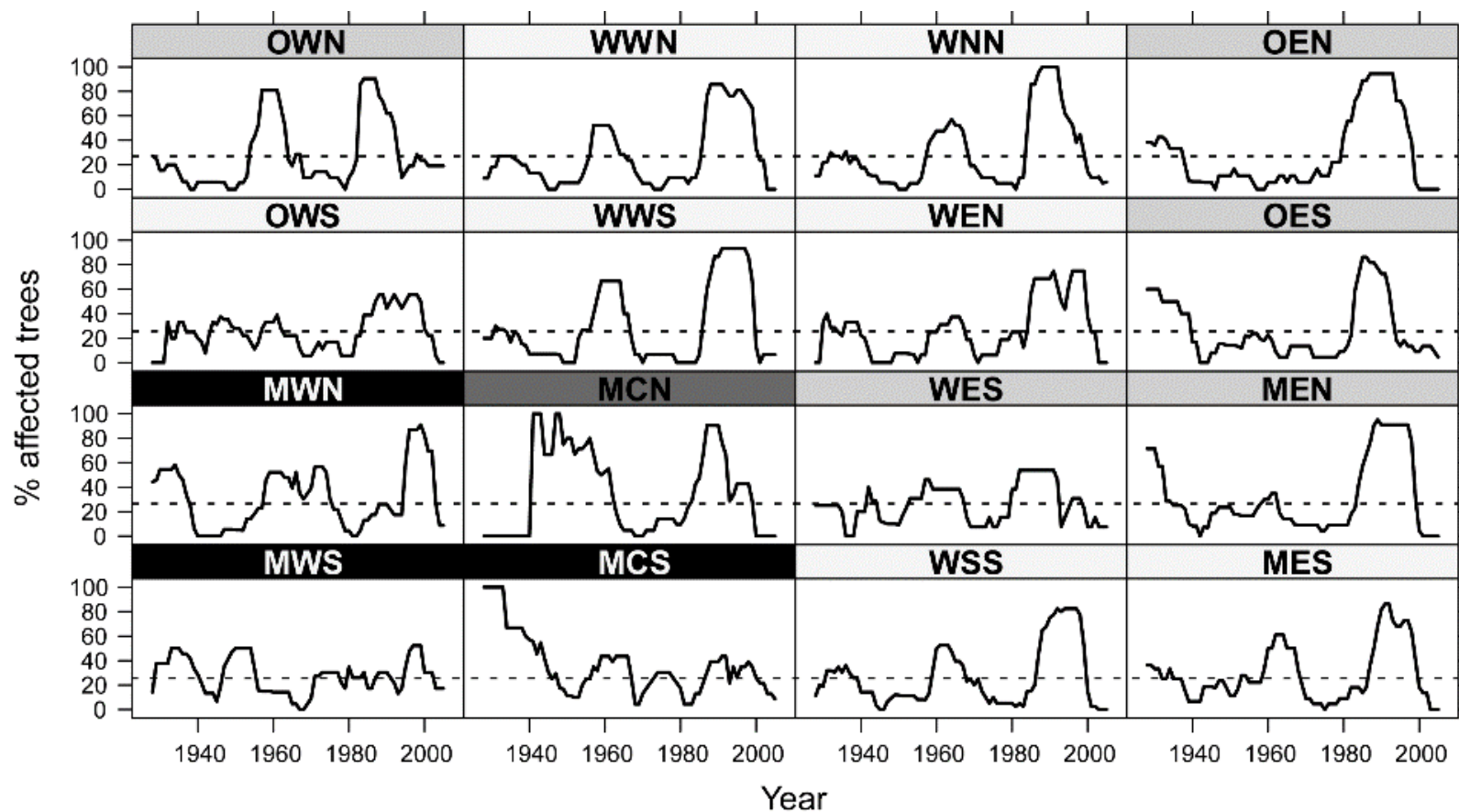
#### Literature Cited

Régnière, J., R. St-Amant, and P. Duval. 2012. Predicting insect distributions under climate change from physiological responses: spruce budworm as an example. *Biological Invasions* 14:1571-1586.

Wolter, P. T., P. A. Townsend, B. R. Sturtevant, and C. C. Kingdon. 2008. Remote sensing of the distribution and abundance of host species for spruce budworm in Northern Minnesota and Ontario. *Remote Sensing of Environment* 112:3971-3982.

Wolter, P.T., B.R. Sturtevant, B.R., B.R. Miranda, S.M. Lietz, P.A. Townsend, and J. Pastor. 2012. Forest land cover change (1975-2000) in the Greater Border Lakes region. Research Map NRS-3. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 17 p. [Printed map included].

**Appendix 2.** Time-series of percentage of trees affected by defoliation through time from the program OUTBREAK for each subarea: Ontario (O), Wilderness (W), and Minnesota (M). The second letter is the longitudinal areas (i.e., west, “W”; east, “E”; center, “C”). The third letter is the latitudinal subareas (i.e., north, “N”; and south, “S”) Acronyms used for subareas are described in Table 1 and their geographic position is described in Figure 1. Background color of labels represent the cluster group to which each subzones belongs to from Figure 3-4. The horizontal dotted line indicates the 25% threshold defining outbreaks in a previous study (Robert et al. 2012), and is used here for reference only.



**Literature Cited**

Robert, L.E., D. Kneeshaw, and B.R. Sturtevant. 2012. Effects of forest management legacies on spruce budworm outbreaks. *Canadian Journal of Forest Research* 42:463–475.