**Appendix 2. Derivation of remote-sensing variables used in *Cladonia rei***

**habitat models**

Because of their large grain, remote-sensing variables are less reflective of fine-scale microhabitat conditions but large-scale processes can influence species distributions and their inclusion permits models to be mapped across areas not previously surveyed for testing larger-scale habitat associations. We compiled data from the geographic information system (GIS) layers for soils, land cover types, climate and anthropogenic disturbance. We estimated the proportion of natural productive soil types (versus clay soils, saline soils and rapid-draining sandy soils) within the 1 ha site from a soil classification derived from a simplified interpretation of a combination of the Grassland Vegetation Inventory (GVI, Government of Alberta 2011), the Agricultural Region of Alberta Soil Inventory Database (AGRASID, Government of Alberta 2015b) and Government of Alberta high spatial resolution AGRASID enhancements. For polygons lacking native soils information, ABMI used historical information where possible (McNeil 2014) or topographic soil information from the surrounding area to estimate the most likely soil types.

We estimated the percent of each 1 ha site in different land cover classes such as grassland, shrubland, agriculture and different forest types from an ABMI Land Cover layer that represents the types and extent of 11 land cover classes across the province as estimated in 2010 (Alberta Biodiversity Monitoring Institute 2010). Similarly, the areal extent of anthropogenic disturbance (including agriculture, forestry, energy, as well as urban and industrial developments) was extracted from the ABMI Wall-to-Wall Human Footprint Inventory (Alberta Biodiversity Monitoring Institute 2012). Some site condition variables were highly skewed and correlated, where sites are almost exclusively covered by one condition. Consequently, we used a categorical approach for modelling the effect of site condition on the final suite of sites: Intact sites with little anthropogenic disturbance including pasture (mean undisturbed areal extent 89±17%), Pasture (mean pasture area 94.5±12.9%), and Alienated (mean disturbance 93.8±15.2%). 'Alienating' disturbances are those that remove or replace native species and ecosystem structure. In southern Alberta, the most extensive alienating disturbance is cultivation, with lesser amounts of industrial features (e.g., oil well pads), human settlement, and linear features (e.g., roads, powerlines and pipelines).

Remote sensing data were estimated at the scale of the sites (1 ha).

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