Intactness

The ABMI was designed to detect large changes in biodiversity in Alberta. To do this, ABMI scientists developed the Biodiversity Intactness Index to better understand how the suitability of a species' habitat has been modified—highly modified habitats result in low intactness scores for the species, and vice versa. The ABMI uses the intactness index to report on the health of a given species in a region. Here's how we calculate it.

STEP 1 FIELD DATA COLLECTION

Methods vary by taxonomic group. For vascular plants, mites, bryophytes, and lichens presence/absence is determined in 4 quadrants of 1-ha sites. For birds, the ABMI has counted individuals at 9 point-count locations around 1-ha sites; analyses also included Boreal Avian Modelling Project data. For mammals, presence/absence has been determined along 1-km segments of 9–10-km linear transects. Going forward, bird and mammal methodologies will change as cameras and autonomous recording units (ARUs) are increasingly used.

STEP 2 SPECIES-HABITAT MODEL DEVELOPMENT

Models show the relationships of species with GIS habitat information, including human footprint, natural ecosystems, soils, climate, and latitude/longitude. They describe the relative abundance of each species in combinations of habitat variables, e.g., 30-year old pine forest in north-eastern Alberta.

STEP 3 MODEL APPLICATION TO CURRENT AND REFERENCE PROVINCE-WIDE MAPS

Models are applied to a current map, i.e., habitat and human footprint as they currently appear, and a reference map, i.e., where human footprint has been removed from the landscape in GIS and "back-filled" with the best estimate of the habitat that used to be there. This gives predicted current and reference relative abundances under these two conditions, which are then produced in 1-km^2 rasters across the province.

STEP 4 INTACTNESS INDEX

Intactness compares the predicted current relative abundance of a species in a given region to its predicted reference relative abundance in that region if there were no human footprint. An intactness of 100% represents a current abundance equal to that expected under reference conditions. Intactness declines when a species' abundance deviates from its expected value, either positively or negatively. In other words, species that are more abundant or less abundant than expected both have lowered intactness; the bigger the difference between current and reference abundances, the lower the intactness. The direction of the difference between current and reference relative abundance doesn't matter—only the degree. Thus, 50% intactness means either that the species is half as abundant OR twice as abundant as expected under reference conditions. Intactness decreases in both cases, so a species that increased due to human footprint does not cancel out one that decreased. Note that intactness analyses are only performed on species occurring at ≥ 20 sites.

A *difference map* shows the difference between the species' predicted current and reference abundances. This is, in effect, a visual representation of the species' intactness.

The ABMI conducts on-the-ground surveys at 1656 sites across Alberta (colours on the map indicate Alberta's Land-use Planning Regions).

STEP 5 REPORTING INTACTNESS

Intactness is first calculated at the species level, then averaged across groups in a given region. For example, if the ABMI reports intactness of old-forest birds, the values of all species in this group in this region are averaged. Similarly, intactness for a taxon is the average of all species in that taxon.

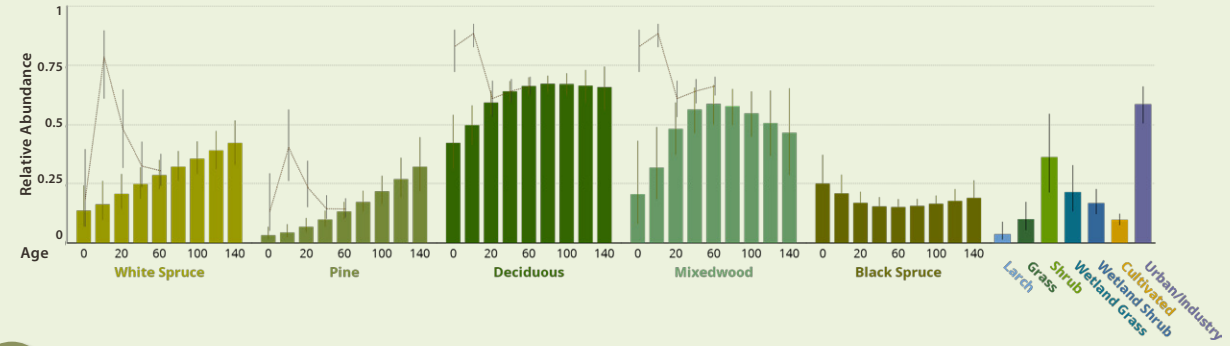
To calculate overall intactness of all organisms the ABMI currently surveys (birds, vascular plants, mites, bryophytes, lichens, and mammals), species within each taxon are averaged first, and the taxa are then averaged for a final intactness value. This way each taxon is weighted equally, regardless of how many species it contains.

Limitations

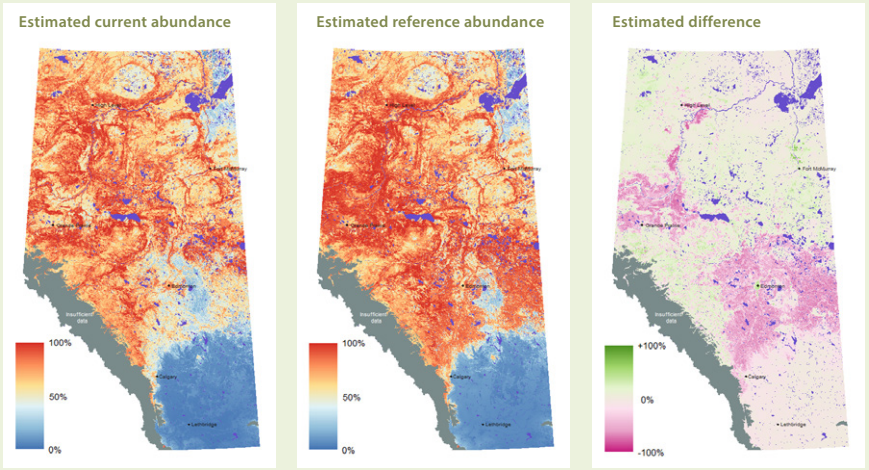
Intactness is a helpful way to understand how a species' habitat has been modified, but it doesn't necessarily correlate exactly with that species' abundance. It is based on predicted habitat suitability and doesn't take into account non-habitat factors (disease, pollution, predator/prey interactions, etc.) that may also influence the species' abundance. Full details on how intactness is calculated, and on its limitations, can be found in the *ABMI Species Website Manual*, available at abmi.ca.

EXAMPLE: BALSAM POPLAR* (See the ABMI's Biodiversity Browser)

STEP 1 Survey Balsam Poplar at 4 quadrants of every ABMI site visited.



STEP 2 Determine relationships of Balsam Poplar with different habitat and human footprint types. For example:



STEP 3 Apply models to current and reference maps of Alberta.

STEP 4 Calculate intactness and produce difference map.

Current = 0.065
(predicted relative abundance in a 1-km² raster)

Reference = 0.071

Current < Reference, so 0.065/0.071 x 100% = 91.55% intact

$$\frac{Current}{Reference} \times 100\% \text{ when } Current < Reference$$

OR

$$\frac{Reference}{Current} \times 100\% \text{ when } Reference < Current$$

** Data are presented for illustrative purposes only; visit abmi.ca for up-to-date values*

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