Canada

BIODIVERSITY MONITORING FROM SPACE

Forestry

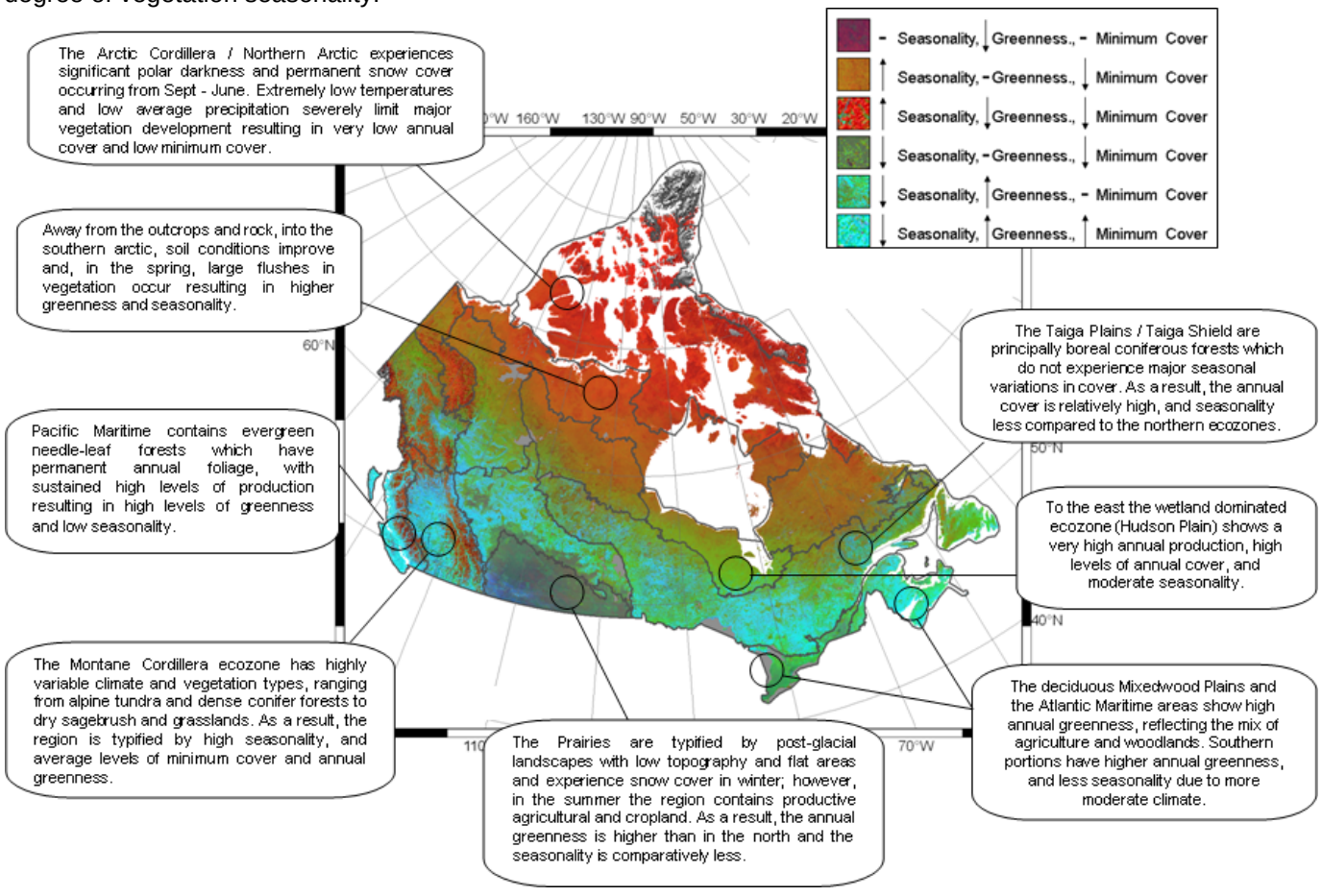
B I O S P A C E

Monitoring patterns of fauna diversity across the landscape, both spatially and temporally, presents special challenges due to the dynamic nature of populations and complex interactions with the local and regional environment. One area where progress is being made is the development of relationships between regional biodiversity with indirect indicators or surrogates, such as vegetative production.

As part of the BIOSPACE project, we have implemented a DYNAMIC HABITAT INDEX (DHI), modified to Canadian conditions, as a mechanism to monitor changes in habitat over Canada.

The index, based on the fraction of photosynthetically active radiation (fPAR) absorbed by vegetation, analogous to green vegetation cover, and can be derived solely from satellite data provided by MODIS, SPOT VEGETATION, or MERIS.

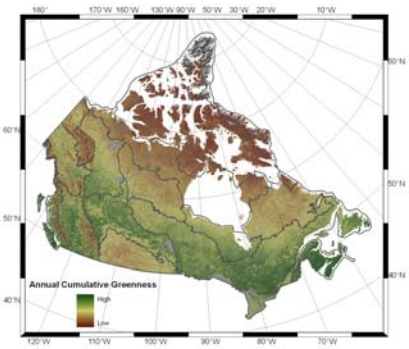
The index utilizes time series of satellite observations of greenness to derive three indicators of the underlying vegetation dynamics; (i) the cumulative annual greenness, (ii) the minimum level of perennial cover, and (iii) the degree of vegetation seasonality.

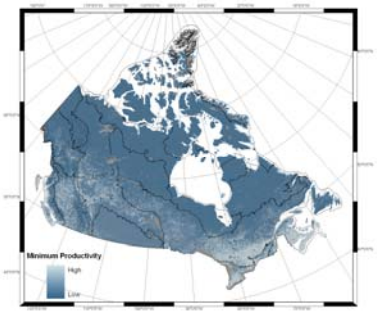


D Y N A M I C H A B I T A T I N D E X

Annual Cumulative Greenness

Strong linkages have been demonstrated between canopy light absorbance, or greenness, and species home ranges and abundance. These integrated indices of landscape greenness can be related to terrestrial net primary productivity and are based on both a strong underlying theoretical basis and significant empirical correlations. To estimate the annual integrated greenness we sum the monthly fPAR observations over the year to produce an annual greenness component for each year from 2000. These components were then averaged to produce a long term annual cumulative greenness component.



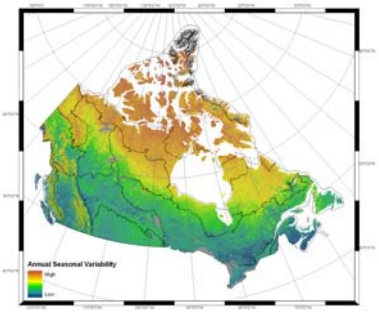


Annual Minimum Cover

In addition to the overall greenness of a site, the capacity of the landscape to support adequate levels of green vegetation over the year is an important factor for food access and habitat. The continual provision of food throughout the year is of particular interest to wildlife conservationists, as changes in the amount and quality of available vegetative cover influences behavior of many herbivorous species, and ultimately, the carnivorous species which prey upon them. Locations without significant snow cover in fall will maintain a cover of green biomass into winter providing continual food resources and habitat.

Seasonal variation in landscape greenness

The seasonal pattern of vegetation development depends on the climate and geography, with the arctic tundra having a much shorter growing season than the forests in the more temperate regions. Such context needs to be considered when applying indices of habitat, as seasonality exerts pressure on life history traits. We capture this seasonality as the coefficient of variation (standard deviation divided by the mean greenness for the year). Sites having high seasonality have large variations in greenness over the annual cycle with low seasonality indicative of areas that have consistent vegetation production throughout the year such as evergreen forests.



The DHI may serve as an excellent indicator of change in species composition and diversity within a given area. Furthermore, regional deviations are spatially delineated, giving biodiversity researchers a coarse resolution indication of what regions are undergoing disturbance and thus a methodology to track landscape changes at continental scales through space and time.

As the index is derived from remote sensing observations it can be applied over large management units where it is not feasible to conduct more detailed surveys and monitoring programs. By providing a coarse, initial stratification of changes in habitat condition, moderate or high spatial resolution imagery, combined with ground-based programs, can then be utilized to undertake fine scale investigations of regions of interest. This allows local scale interactions such as habitat fragmentation, and land cover change, both demonstrated at local levels to be related to extinction rates, to be more fully investigated.

This research has been described in detail in: Coops, N.C., Wulder, M.A., Duro, D.C., Han, T, and Berry. S. (2008) Large Area Characterization Of Habitat using Satellite Data Across Canada. *Ecological Indicators. In press.*

Image of TERRA provided by: www.spacetoday.org/Satellites/TerraAqua/TerraStory.html

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IRSS INTEGRATED REMOTE SENSING STUDIO

CSA ASC

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