



CANADIAN FOREST SERVICE

Science HIGHLIGHTS

REMOTE SENSING

Can satellites help monitor biodiversity more effectively?

The BioSpace project is developing the capacity for a national biodiversity monitoring system driven by remote sensing satellites

Canada has a heritage of rich biological diversity; however, it is possible for conditions to change and for biodiversity to become threatened. Many factors can impact the delicate balance of biodiversity in a region, such as population growth, human activities and climate change. Studying these factors, and predicting how they might influence different species over time, is key to maintaining the health and diversity of the Canadian landscape.

Monitoring changes in vegetation can give researchers valuable clues about the state of biodiversity. Traditionally, biodiversity has been studied on the ground, through detailed inventories of individual species. The result is valuable, but regionally focused, and the information can be time consuming to collect. This type of data collection makes it difficult to systematically monitor changes across Canada.

Satellites enable scientists to monitor biodiversity

Today, BioSpace—a collaboration between the Canadian Forest Service of Natural Resources Canada, the Canadian Space Agency and the University of British Columbia—is using satellite remote sensing to give researchers the capacity to monitor biodiversity on a national scale, including remote regions, which are otherwise inaccessible.

BioSpace operates on the premise that plant and animal species are closely tied to the land they inhabit and are affected by its many characteristics; when the landscape changes, species may change, altering their behaviour or moving to new areas. The project uses satellite and other spatial data sets (such as land cover, fire records, and digital elevation data) to measure four key indicators of biodiversity: physical environment, vegetation productivity, disturbances and habitat fragmentation.

“We have developed indicators of biodiversity based on satellite data and are exploring how well these indicators can be used to map and model the status of various species at a national level so we can characterize biodiversity in a consistent way,” says Mike Wulder, a research scientist who specializes in remote sensing and spatial analysis from the Canadian Forest Service–Natural Resources Canada at the Pacific Forestry Centre in Victoria, B.C. Wulder is the project manager for BioSpace.

What is biodiversity?

Biodiversity is the variety of life on earth in all its forms. It is the genes which make up all the species on earth, the species, and the way species assemble themselves into communities and ecosystems.

Overview

Remote sensing with satellites is giving researchers the opportunity to monitor biodiversity on a national scale.

Monitoring biodiversity indicators consistently could provide a national early warning system, showing areas where biodiversity may be changing.



A butterfly in Kluane National Park, Yukon Territory.
Photo: Meg Andrew

“Each of these indicators provides us with unique information on vegetation status and how it has changed. By correlating this information with predictions of vegetation conditions and levels of disturbance, such as forest fires, these indicators will aid the development of a national early warning system for biodiversity. For instance, we will be able to predict where biodiversity concerns may be occurring,” Wulder says.

The information gathered by BioSpace can also be used to inform on the status of other ecological goods and services besides biodiversity, such as salmon fisheries, carbon storage and water quality. BioSpace data has already helped scientists learn more about bird and moose habitat, and correlating with information on butterflies has helped to better understand the links between vegetation, change, and habitat conditions.

The big picture keeps getting clearer

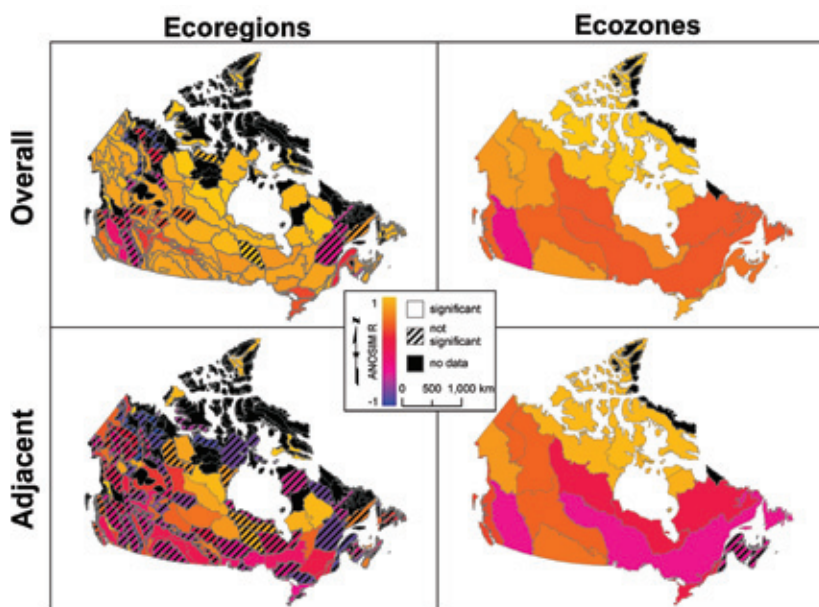
BioSpace is designed to provide information on a national basis and to generate consistent information that will allow conditions to be monitored and changes to be tracked over time. This allows BioSpace to provide warnings, determine where the greatest threats to biodiversity are and inform on where interventions could be made. By being able to predict where critical changes are unfolding, researchers and resource managers will be able to allocate resources to on-site research and recommend mitigation measures as required.

Because the BioSpace project can provide information across Canada it can also improve the ease and accuracy of Canada’s reporting on biodiversity, as required by national and international agreements. In addition, scientists are able to study many species at once, making the process of monitoring more affordable.

Using satellite data to measure and track biodiversity on a national scale is giving researchers and policy-makers better information on which to base decisions. This new information will help Canadian scientists and policy makers continue to protect biodiversity for the benefit of all Canadians.

BioSpace layers inform on parks

Forested ecosystems (trees, lakes, wetlands, etc) cover in excess of 60% of Canada. BioSpace layers have been used to aid in developing scenarios for description and possible augmentation of parks and protected areas over the forested area of Canada.



Map of butterfly assemblage uniqueness for Canadian ecoregions (left) and ecozones (right). Analyses presented in the top maps evaluated butterfly assemblages against those in all other ecoregions/ecozones in Canada. Maps on the bottom only considered assemblage dissimilarity between geographically adjacent ecoregions/ecozones. Regions with “warmer” colors have more unique butterfly assemblages and cross-hatching indicates regions with butterfly assemblages that are not significantly unique.