Viewing Forested Landscapes in Michigan and Siberia

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Trees may grow slowly, but over time and under different management practices or disturbances (e.g., wildfires or logging), even large forested landscapes may cycle dramatically in terms of the type of forest they support. In Central Siberian Russia, Dr. Kathleen Bergen along with SNRE Ph.D. student Tingting Zhao, recent M.S. graduate Lara Peterson and Dr. Daniel Brown are using remote sensing to investigate large-scale change between types of forests (e.g. deciduous broadleaf forests of aspen and birch vs. coniferous forests of pine and spruce). Closer to home, at the University of Michigan Biological Station (UMBS) in northern Lower Michigan, Dr. Bergen, Ph.D. student Iryna Dronova, Dr. David Ellsworth and Dr. Burt Barnes are involved in a similar project applying remote sensing to study large-scale change in the types of forests in Michigan (Figure 1).

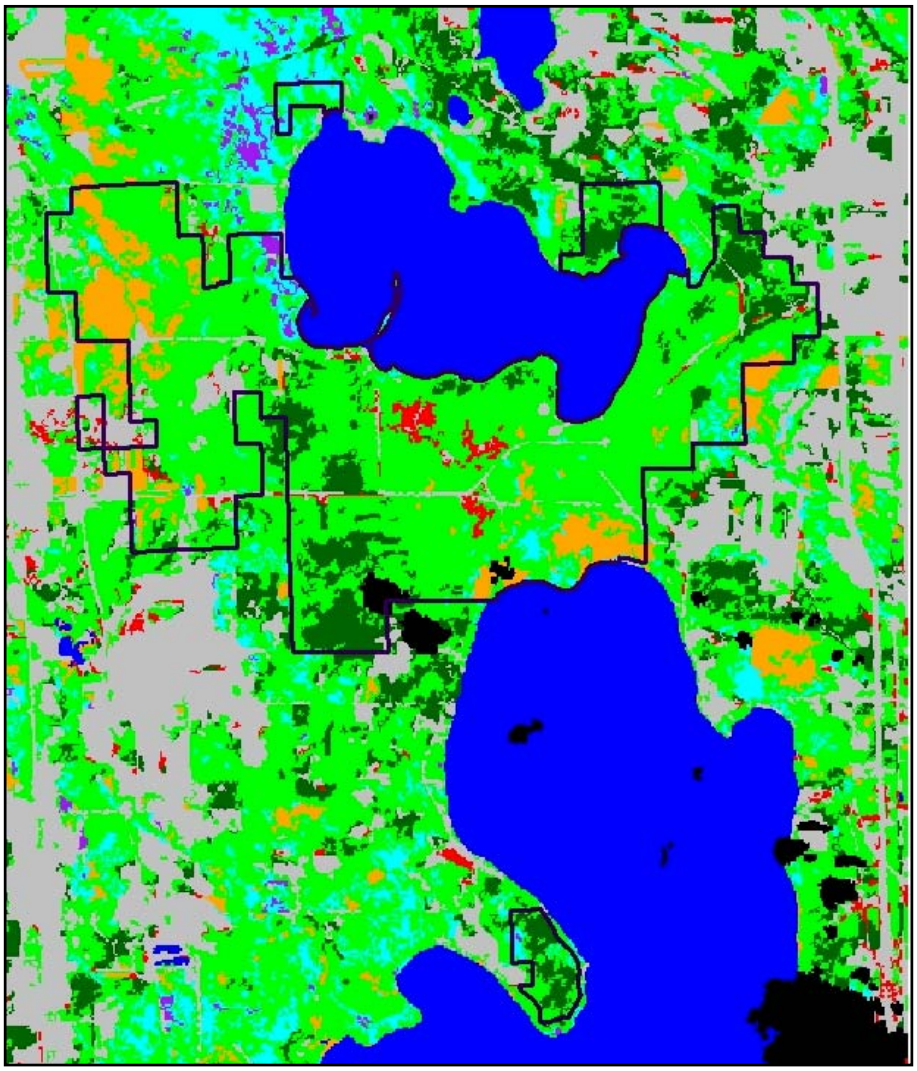

Figure 1. The current forest and land cover of U-M Biological Station (UMBS) and surrounding area mapped by SNRE researchers from Landsat remote sensing data. The boundary shown is the UMBS property boundary. Douglas Lake is to the north, and larger Burt Lake is to the south.

Legend:
Aspen = Light Green
Northern Hardwoods = Dark Green
Oaks = Red
Pines = Orange
Water = Blue
Wetlands = Purple
Wet Deciduous = Cyan
Agriculture and Bracken = Gray
Clouds = Black

As a foundation for this remote sensing project, Dr. Barnes and recent M.S. graduates Ryan O'Connor, Ephraim Zimmerman, Kara Moore, and Catherine Yanca also engaged in "on-the-ground" studies of change in forest tree species and ecosystems at the UMBS (Figure 2); as have colleagues at the V. N. Sukachev Institute of Forest of the Russian Academy of Sciences for Siberian forests.

Figure 2. Dr. Burt Barnes, left (author of *Michigan Trees*) and former M.S. student Ryan O'Connor, reviewing "on-the-ground" forest measurements in an aspen-northern hardwoods stand at the U-M Biological Station. (Photo by Kathleen Bergen).

In the study region in Central Siberian Russia, a history of significant harvesting (logging) in the second half of the 20th Century has been changing parts of the "taiga" (Russia's famous vast conifer forests of pine, larch, and spruce) to deciduous forests of birches and aspens (Figure 3). In Michigan, catastrophic harvesting and burning of also vast pine forests at the beginning of the 20th Century has changed much of northern Lower Michigan's landscape to deciduous forests of predominantly aspen. Significant time has passed since these

(Figure 3) Photos above show a birch-aspen forest in Siberia (left) and an aspen forest in Michigan (right). Though the Siberian forest is currently dominated by birches and aspens, it was once a pine forest that was then harvested for lumber (note the large remnant pine in the center front). The Michigan forest was also once a pine forest that was then logged and burned and it is now an aspen forest. Both Siberian and Michigan forests could eventually become conifer forests again as both birches and aspens have a fairly short life-spans (e.g. ~80-100+ years) - note the young pine in the center growing up underneath the aspens in the Michigan forest. (Siberia: Photo by Lara Peterson, Michigan: Photo by Kathleen Bergen).

disturbances in Michigan, and now northern Lower Michigan's forests are on the verge of "succeeding" (e.g. changing or changing back), to a combination of pine forests and beech-maple (called "northern hardwoods") forests (Figure 3). While this is a natural succession, with the suppression of fire and with human land-use, Michigan's "new" forest, however, will not be exactly the same as its pre-settlement, pre-logging era, forest; key species (northern red oak and hemlock) are lost indefinitely.

The map (Figure 1) shows the UMBS property in northern Lower Michigan where summer courses for SNRE and other students are held, and where researchers from around the world come to study forest and lake ecosystems. The map was derived from Landsat satellite remote sensing data as part of the project to use remote sensing to study forest change at UMBS. The light green areas were once a combination of pines, northern hardwoods, and tiny pockets (called "clones") of aspen. They were heavily logged and then repeatedly burned by wildfires from 1890 to 1930, before the land became UM property. For the past 90 years these light green areas have been almost completely dominated by bigtooth and trembling aspens. But young pines and northern hardwoods species have grown up underneath the shade of these older aspens, and eventually the fairly short-lived aspens will die and a "new forest" a mosaic primarily of pines and northern hardwoods, will emerge and mature in the coming century. This successional stage is now beginning in these Michigan forests. Because the majority of the 20th Century disturbances were several decades later, this latter stage is not as widespread in many of the Central Siberian Russian forests under study, but it is likely that it will occur there as well. By using remote sensing SNRE researchers will be able to monitor and study this similar large-scale forested landscape change – in the northern forests of both Michigan and Siberia.