



Intensive Site Monitoring Delaware River Basin Pilot

Monitoring landscape change and its effects in the Delaware River Basin

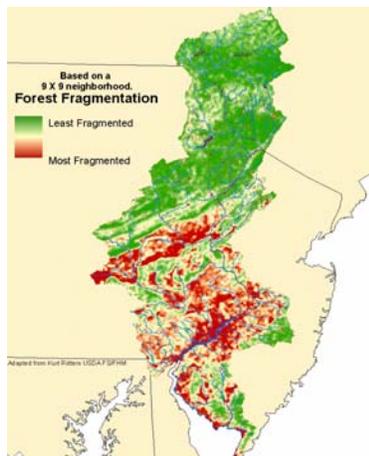
Issue: We are developing integrated landscape monitoring techniques to fully understand, quantify, and mitigate the effects of fragmentation and forest health threats on water quality and ecosystem services.

Discussion: The Delaware River Basin study began in 1999 under the sponsorship of three U.S. Forest Service Programs (Forest Inventory and Analysis, Forest Health Monitoring, and Global Change) and the U.S. Geological Survey (Water Resources Division). The initiative is serving as a model for regional collaborative monitoring networks that could be deployed throughout the United States. This pilot study features several themes that distinguish it from ongoing monitoring programs:

- Integrated, interagency monitoring of vegetation, soil, water, and air
- Linking process-level research with extensive sampling
- Issue-driven data collection and analysis of resource conditions

Regular measurement protocols used by the two agencies have been enhanced to address several important regional issues:

- Causes, consequences, and regional extent of calcium depletion
- Changes in forest biomass and productivity
- Identification and monitoring of forests vulnerable to non-native invasive pests
- Forest fragmentation and associated ecosystem changes
- Effects of forest cover changes on water quality of the Delaware River

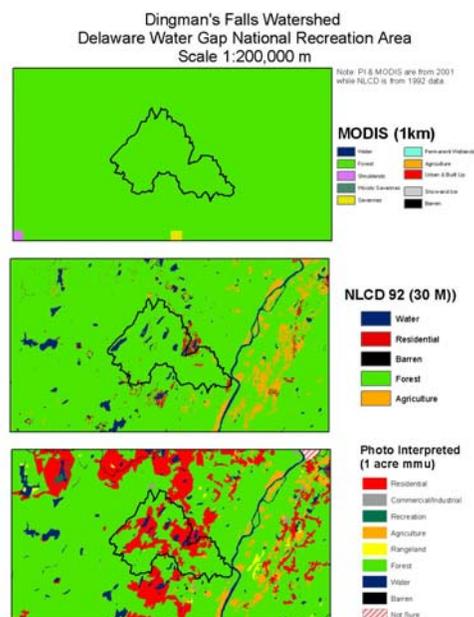


Forests of the Delaware River Basin are subject to high levels of pollution from areas to the west and south. Healthy forests in this region retain about 83 percent of the deposited nitrogen compounds, preventing its release to streams and avoiding adverse effects in downstream freshwater ecosystems. This valuable function is threatened by forest fragmentation, acidic deposition, and insect pests such as the Hemlock Woolly Adelgid. As the forests decline, their ability to retain pollutants also declines, and water quality is reduced. Our integrated monitoring protocols facilitate linking causes and effects across multiple scales, so that land managers can evaluate the impacts of ongoing and proposed changes in vegetation cover.

The results of this study should generate not just more maps of different measures of forest fragmentation and urbanization, but informed maps that can be directly interpreted for the extent and degree of impact on the physical, chemical, and/or biological aspects of water quality, and that suggest types and locations of land management or development that minimize adverse impacts on ecosystems.

In another aspect of this study sponsored by NASA, we are developing an application system using forest inventory, water monitoring, historical land use change evaluation, and remote sensing technologies to identify, characterize and quantify carbon sources and sinks. The approach involves characterization of carbon stocks and productivity from land inventories (including remote sensing) at several watershed scales, and comparison of land-based estimates with estimates derived from the MODIS satellite. Better understanding of how and where carbon sources and sinks change over time will allow landscape-scale management of forests to maintain or enhance carbon sequestration, thereby mitigating the anticipated effects of climate change.

Remote sensors of land cover have different capability for detecting fragmentation. The MODIS satellite, with a very coarse resolution, often fails to detect encroachment by homes into forested areas (top figure). Landsat-TM, with much higher resolution, does better (middle figure). Color infrared aerial photography detects far more fragmentation than any currently available satellite (bottom figure). Knowing the detection characteristics of various remote sensors helps quantify fragmentation and its effects at scales from small watersheds to continents.



Key Points:

- The Delaware River Basin collaborative monitoring project is “State-of-the-art”.
- Link with process research is a major advance and may pave the way for future expansion.
- Regional monitoring needs for selected issues are met.
- Interagency collaboration facilitates an integrated approach to ecosystem monitoring.
- New techniques can be readily implemented by ongoing programs (Forest Service FIA & FHM; USGS NAWQA; NASA Earth Enterprise; State programs).

For more information, contact:

Richard A. Birdsey, Program Manager, Northeastern Research Station, USDA Forest Service, (610) 557-4091; (610) 557-4095 (FAX); rbirdsey@fs.fed.us