

Project Description: USGS Pilot Study of Mercury in Litterfall at National Atmospheric Deposition Program Mercury Deposition Network Sites

Introduction

Mercury in aquatic and terrestrial ecosystems can pose a threat to humans and wildlife because it accumulates and magnifies in food webs. Mammals and birds at the top of food webs can be exposed to levels of mercury that have neurotoxic effects. Much of the mercury input to these ecosystems is through atmospheric deposition.

The U.S. Geological Survey (USGS) is investigating mercury in litterfall at National Atmospheric Deposition Program Mercury Deposition (MDN) sites. The MDN collects weekly precipitation samples at more than 110 sites in North America to measure atmospheric mercury wet deposition. Information is needed on atmospheric mercury dry deposition at MDN sites, which may be obtained by an investigation of mercury in litterfall. Data on mercury dry deposition can be used to evaluate regional models of mercury deposition.

Litterfall is transferred to the forest floor when canopy material, mostly leaves and needles, drops from the trees. Mercury from the air is naturally trapped in the forest canopy. Mercury in litterfall consists primarily of mercury attached to the surface of leaves and needles or incorporated into the leaf tissue.

Previous investigations of mercury in litterfall in North America have been short-term studies in small watersheds. A large-scale study can help to document mercury in litterfall at MDN sites located in forest landscapes across a broad geographic range. Information from the study can lead to a better understanding of mercury dry deposition in different forest environments. If data on mercury deposition in litterfall are collected long-term, they can be integrated with long-term records of mercury wet deposition at the MDN sites.

The USGS investigation of mercury in litterfall includes a pilot study during autumn 2007 and autumn 2008 at selected MDN sites in the eastern United States. The pilot study will test field methods and gather an initial data set to guide and evaluate litterfall monitoring as a network program for the MDN.

Methods

The MDN sites selected for the pilot study are in the eastern United States and located in landscapes with deciduous forest or mixed deciduous and coniferous forest. In autumn 2007, litterfall samples were collected at 12 sites; these same 12 sites and 11 more were sampled in autumn 2008 (fig. 1).

Field activities for the pilot study were conducted by the personnel who operate the MDN monitoring equipment at each site. The USGS provided the supplies for sample collection and supported costs of shipping, sample processing, sample analysis, and project coordination.

Four low-profile passive samplers were used to collect litterfall at each site. A litterfall sampler (fig. 2) has a wooden base supporting a removable plastic sample box above the forest floor. Each box has a screen bottom for drainage. The forest sample plot at each site was a 16-meter by 16-meter area selected by the MDN operator and within 300 meters of the MDN precipitation sampler. The locations for the four litterfall samplers in each sample plot were determined by random number. The samplers accumulated and held leaves, needles, and other canopy material that would normally fall to the forest floor during the autumn.

During the pilot study in autumn 2007, two consecutive sets of four samples were collected during the leaf drop for 8-10 weeks. In autumn 2008 one set of four samples was collected for 8-10 weeks. After the leaf fall was completed, the MDN operator retrieved the four sample boxes of litterfall, isolated each one in a plastic bag, and shipped them to the USGS for processing and analysis.

The litterfall samples were dried, ground, homogenized, weighed, and analyzed under controlled conditions at the USGS Mercury Research Laboratory. Analysis includes determination of total mercury and methylmercury concentration. Field information and laboratory analytical data will reside in a USGS data base.



Figure 1. Autumn 2007-2008 litterfall study sites



Figure 2. Litterfall sampler

For more information, contact:
 Martin Risch, USGS project chief
 Indiana Water Science Center
 5957 Lakeside Blvd.
 Indianapolis, IN 46278
 317-290-3333 x 163 office
mrrisch@usgs.gov