RYELAND ROAD ARSENIC SUPERFUND SITE
Remediation with Ferns / Restoration / Wetland Creation

Background

This arsenic contaminated site consists of five land parcels covering approximately 8 acres in Berks County, Pennsylvania. Four of the parcels are located on the former Standard Chemical Works Corporation and Allegheny Chemical Corporation properties where pesticides, fungicides, paints and varnishes were manufactured and disposed. The nursery parcel seen here encompasses a spring-fed creek, pond, and forested wetland which were contaminated by springs discharging groundwater high in arsenic and by a creek carrying water and sediments with high arsenic down stream.

The U.S. Environmental Protection Agency excavated arsenic-contaminated soil from the parcels from summer of 2007 through the spring of 2009. Excavation of contaminated sediments in this spring-fed creek was completed in February 2009. The contaminated pond was filled to cap the contaminated sediments in place. This former pond and adjacent soil excavation area were then graded to create a wetland, which is fed by the spring that previously discharged to the pond.

The forested wetland soils were contaminated by arsenic in the groundwater leaching from the springs and seeps that supply the wetland. The challenge was how to clean up these soils without cutting down all of the mature trees. At the recommendation of the U.S. Fish and Wildlife Service's Pennsylvania Field Office, a pilot study was started in 2007 to determine the effectiveness of arsenic removal using Chinese brake ferns (*Pteris vittata*), an arsenic absorbing plant, in the forested wetland. The ferns successfully reduced arsenic concentrations in sediments and shallow soils surrounding the springs, so the EPA decided to use them throughout the forested wetland.

Objectives

Reduce arsenic concentrations in forested wetland without destroying the forest
Restore native vegetation under the forest canopy
Create shrub-scrub wetland to replace the former pond

Approach

Plant Chinese brake ferns throughout the forested floodplain
Harvest fern fronds containing arsenic annually until water and soil are clean
Plant native shrubs and wildflowers under the wetland tree canopy
Seed the created wetland with a native grass and wildflower mix
Plant shrubs throughout the wetland

Methods & Monitoring

Forested Wetland –

We planted 167 flats of potted ferns in the floodplain where groundwater seeps discharge to create the forested wetland. We targeted areas with high arsenic concentrations. The ferns were planted eight to twelve inches apart. Most of the areas are shaded by tree canopy. Shade cloth was erected over areas that receive too much sun for the ferns.

The ferns grew well in moist areas, but those planted directly in the springs and seeps died due to excess water. Ferns grew better under the shade cloth, primarily because it reduced the growth of other plants. Based on this observation, we intend to use shade cloth throughout the wetland where competition was a problem for the ferns.

The ferns grew until the first hard frost killed the fronds. The fronds were then harvested, analyzed for arsenic, and sent to an appropriate landfill. Wetland soil was retested to track the reduction in arsenic accomplished by the ferns. The fronds successfully extracted arsenic and the soil concentrations decreased. The planted areas were mulched with straw to overwinter as many ferns as possible. Any ferns that die will be replaced each spring. Once the soil and groundwater arsenic concentrations have declined to safe levels, the remaining ferns will be removed and the areas planted with shrubs and wildflowers native to the region's forested wetlands.

Scrub-Shrub Wetlands –

We seeded the former pond and excavation area with a native wet meadow mix in spring 2009. We also planted 600 native shrub stakes of seven species along the spring and within the wetland. We modified some of the channels to increase the dispersal of the spring water throughout the wetland.

In fall 2009, we observed many of the plants in the mix were flowering or producing seeds. The shrub success was highest along the spring and surrounding pooled water. Despite being adapted to drier soils, numerous shrubs extending back from the pools did not survive. The shrubs are being browsed heavily by deer, so we may need to treat them until they become established. We will monitoring the wetland each growing season to make sure that enough plants survive to create good habitat.

Conclusions

The innovative techniques being used at the Ryland Road site demonstrate that contaminated areas can be cleaned without destroying habitat. This site is a model of how interagency cooperation can solve cleanup/habitat conflicts to benefit both humans and wildlife.

For additional information on this project, contact Kathleen Patnode (kathleen_patnode@fws.gov).