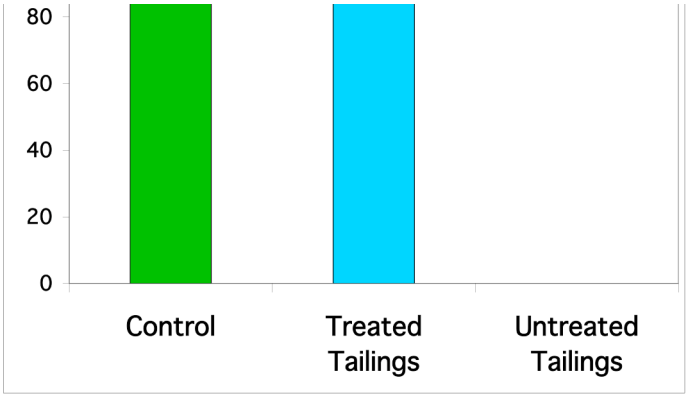
Biosolids and Wildlife

Sally Brown
University of Washington

People sometimes express concern that while using biosolids for restoration or for forest fertilization can provide the necessary nutrients for plant growth, contaminants in the biosolids can pose a danger to wildlife that will use these treated areas as habitat. Detailed discussions on contaminants in biosolids can be found in other sections of this white paper (see metals in biosolids, organics in biosolids and plants and biosolids). However, specific examples of how wildlife has fared in sites where biosolids have been used to restore severely disturbed ecosystems may help to clarify whether there is any basis for these concerns.

At a number of old mining sites that are included in US EPA's National Priorities List (under the Superfund program that is in charge of cleaning up the nation's most contaminates sites), the land had remained barren for generations. Plant growth was inhibited as a result of poor soil physical properties and toxic concentrations of heavy metals. There was no real concern about animal health at these sites because the contamination had left the areas void of habitat. At four of these sites, Bunker Hill, ID, Leadville, CO, Jasper County, MO and Palmerton, PA, plant growth was restored by applying high rates of biosolids in combination with limestone to the mine waste materials. As a result of the biosolids amendments, the sites are once again able to support lush plant growth. As habitat has been restored, the animals have come back to the sites in droves.

Mine tailings in Jasper County, MO before and after biosolids amendment. Small mammals were tested from the revegetated areas to make sure that the revegetation provided a safe habitat.



Percent survival of fat head minnows in water that had been incubated with normal soil (control), biosolids amended mine tailings (treated tailings) and untreated tailings from Leadville, CO

While on the surface the restoration of habitat and return of animals to these sites is a sign of success, there has been concern that project managers at these sites have effectively created an 'attractive nuisance' and that restoration of the sites has created a danger for animals returning to these sites. To address these concerns, Mark Sprenger (sprenger.mark@epa.gov), a toxicologist with the Environmental Response Team (a division of the Superfund program) conducted a wide range of testing at each of these sites. Testing included earthworm survival and metal uptake, fish survival assays, microbial assays and small mammal trappings and organ analysis for both total metal concentration and signs of tissue damage.

What Dr. Sprenger has found is that the animals at these restored sites are just fine. Earthworm mortality, while 100% at sites before amendment application, is now approximately 11% or similar to uncontaminated soils. Despite high metal concentrations at the sites (for example, total cadmium concentrations at the sites are 20- 50 times the cadmium concentrations in the biosolids) cadmium concentrations in the worms is within acceptable levels. There is minimal risk of contaminant transfer to carnivores who ingest worms. Similar results have been seen for fat head minnows: 100% mortality in water that was mixed with untreated mine wastes and close to 100% survival for fish where the biosolids amended mine wastes were mixed with water.

For small mammals, the kidney and the liver are the organs where heavy metals such as lead and cadmium will accumulate and cause damage. In a report presented at the International Conference on the Biogeochemistry of Trace Elements held in Adelaide, Australia, Dr. Sprenger presented kidney and liver pathology data for mammals collected at the Jasper County, MO Superfund site. This site is part of the Tri-State mining district and the mine wastes here have toxic concentrations of lead, cadmium and zinc. Once biosolids and lime were incorporated into the mine wastes, not only did the plant cover return, the small mammals came back. As Sprenger reported, all of the livers and kidneys tested from this site showed metal concentrations below toxic levels. Of the 40-50 organs tested, less than 5 showed any signs of cellular changes. The changes that were present were not sufficient to in any way compromise organ function.

These results show, that despite having measurable concentrations of heavy metals, the metal complexing capacity of biosolids in combination with their soil conditioning capacity and high fertility is sufficient to restore functioning ecosystems to our nations most toxic sites. Animals returning to these sites are healthy and the negative effects associated with high metal concentrations are gone. For normal forest sites or restoration sites such as gravel pits or coal mines where the soils are not contaminated, biosolids will only improve fertility and thereby create a healthier plant cover and better habitat for wildlife.