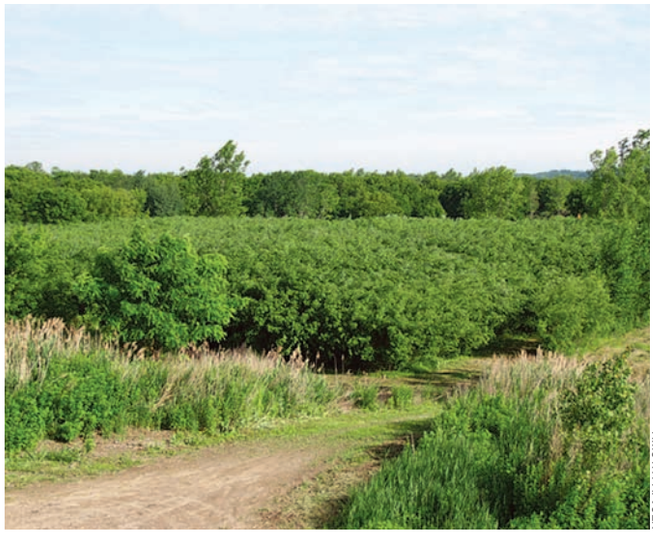
[HOPE]

Sucking Out the Poison

Plants have served humanity since we emerged on the planet, and now they're helping us fix our mistakes.

Over 400 species of herbaceous and woody plants around the world are cleaning up pollutants and turning wastelands into healthy ecosystems. Among the herbaceous heroes, Indian mustard extracts lead, Chinese brake fern draws up arsenic, and sunflowers absorb radioactive contaminants. Two related groups of trees – willow and poplar – excel at drawing toxins from groundwater and soil, or filtering them out before they get in.

The technical term for using plants to clean up pollution is phytoremediation. Plants suck up pollutants through the roots, just as they take up nutrients in water. Then the pollutants are translocated to stalks and leaves, where they're sequestered in cell walls.



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Willow evapotranspiration cover on the Solvay waste beds near Onondaga Lake, New York.

In many cases, the pollutant-laden plants are then harvested and incinerated. "The goal is to reduce acres to tons, and tons to pounds, of contaminated mass, which can be disposed of through conventional haz-waste methods," says Ian Balcom, assistant professor of environmental chemistry at Lyndon State College in Vermont. "The process is net carbon-neutral, especially compared to the dig-and-haul method. It's even a carbon trap overall if managed properly."

When the pollutants are heavy metals with high economic value, such as nickel or even gold, the plants can be incinerated so that the metals can be recovered and put to new uses. When the metals have low or no commercial value, the accumulating plants might be left in place for soil stabilization. There, the goal is to "change the soil chemistry; to drive metals from toxic, bioavailable forms into nontoxic, unavailable forms," explains Lee Newman, assistant professor of molecular biology and phytotechnologies at SUNY College of Environmental Science and Forestry in New York.

To neutralize petroleum compounds and other organic industrial chemicals, plants get help from the microbes that surround their roots. In some cases, plants attract the right bacteria to do the job, while in other cases, plants produce compounds that activate enzymes in the bacteria to degrade the contaminant. Alternatively, plants might pull a pollutant directly into their tissues for breakdown or transpire it into the atmosphere to be broken down by sunlight.

A major phytoremediation project is underway in upstate New York around Onondaga Lake, where nearly 20 acres of shrub willow form an evapotranspiration cover over settling basins once used for waste from soda ash production. When chloride, a by-product of this process, was found seeping into area watersheds, cleanup crews installed a conventional leachate collection system to capture polluted runoff from below, then planted willow to manage the water that enters from above. The system works so well that the New York Department of Environmental Conservation has approved an expansion of the project to cover 600 acres. The mature willows will be harvested to provide biomass for local power production.

Willow and hybrid poplar are preferred for groundwater projects, owing to their fast growth, big, deep root systems, and high-volume uptake. "Poplar is fastest," says Newman, "but certain varieties are susceptible to local diseases. You need to work with a reputable grower who knows the area."

Therein lies an opportunity for forestry professionals in the Northeast, Newman suggests, owing to the dearth of projects in this region. To advance phytoremediation as a viable method of cleanup and green-up, knowledgeable people need to recommend and use it. One of its pluses – lower expense than other methods – can be a minus for environmental engineering firms, for whom lower cost means lower profit. Regulators must make a similar adjustment, and landowners have to deal with phytoremediation's slower results. But a growing number of interested parties committed to the practice are helping spread the word.

"A successful phytoremediation project must be a team effort among environmental engineers, soil chemists, regulatory agencies, site owners, and plant growers," says Newman. "If one group goes solo, it doesn't work."

Balcom adds that phytoremediation offers significant benefits over traditional methods in restoring many degraded or lost ecosystems. Traditional methods, he says, "usually rely on some sort of risk transfer (from site to dump, from groundwater to air, from one neighborhood to another), whereas phyto actually deals with the problem."

There are times when dig-and-haul is the only option, says Newman, such as when "you have a site with imminent danger to human health or that has large commercial value. But if you have the land and the time, phytoremediation can be as effective as any other technology."

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