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Engineering Forest Trees with Heavy Metal Resistance Genes

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Abstract. Pollution of soil and water with heavy metals such as mercury, cadmium and arsenic, is a worldwide problem. Phytoremediation, the use of plants to remove, sequester or detoxify pollutants, including heavy metals, offers an environmentally-friendly alternative to engineering-based methods for remediation. Forest trees have multiple features that make them particularly useful for removal of toxic heavy metals, especially if they can be engineered with genes allowing them to handle high levels of these elements. Although still in its infancy, research with transgenic trees carrying genes allowing them to detoxify or sequester some heavy metals has already made promising progress. Most of the work to date has been performed using poplar species and hybrids, although other woody species could be equally as useful. Trees have been engineered with genes for the handling of mercury, cadmium, copper and arsenic following two main approaches, phytoextraction and phytotransformation/ phytovolatilizaton. *In vitro* studies have shown the transgenic trees to have enhanced abilities to tolerate and/or accumulate these metals, and preliminary results from field tests indicate that the trees are functioning. New combinations of genes involved in metal transport or conversion may further enhance the heavy metal remediation capabilities of the transgenic trees. Given the environmentally friendly application, forest trees engineered for phytoremediation may be some of the first transgenic forest trees approved for operational deployment.