Phytoremediation

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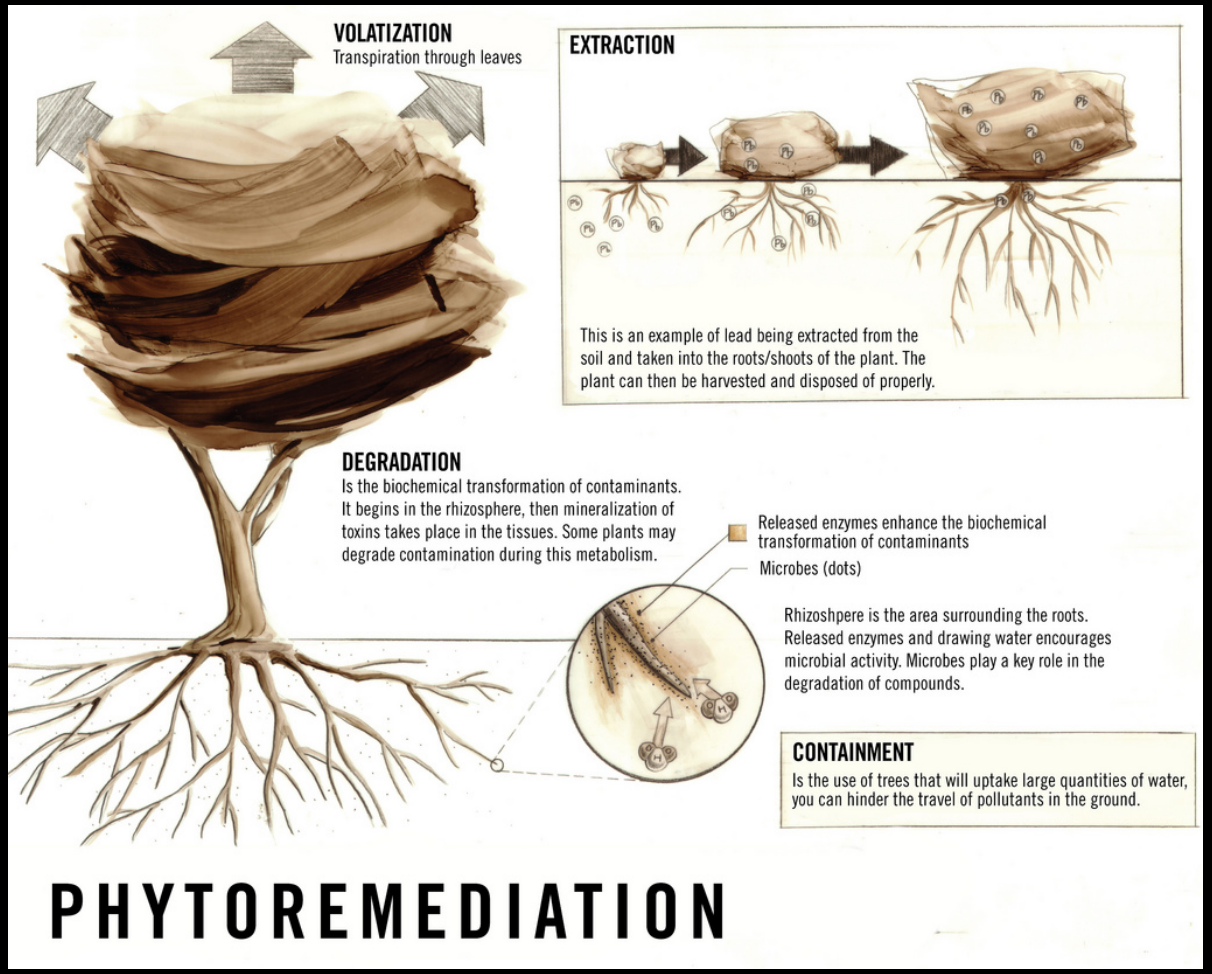


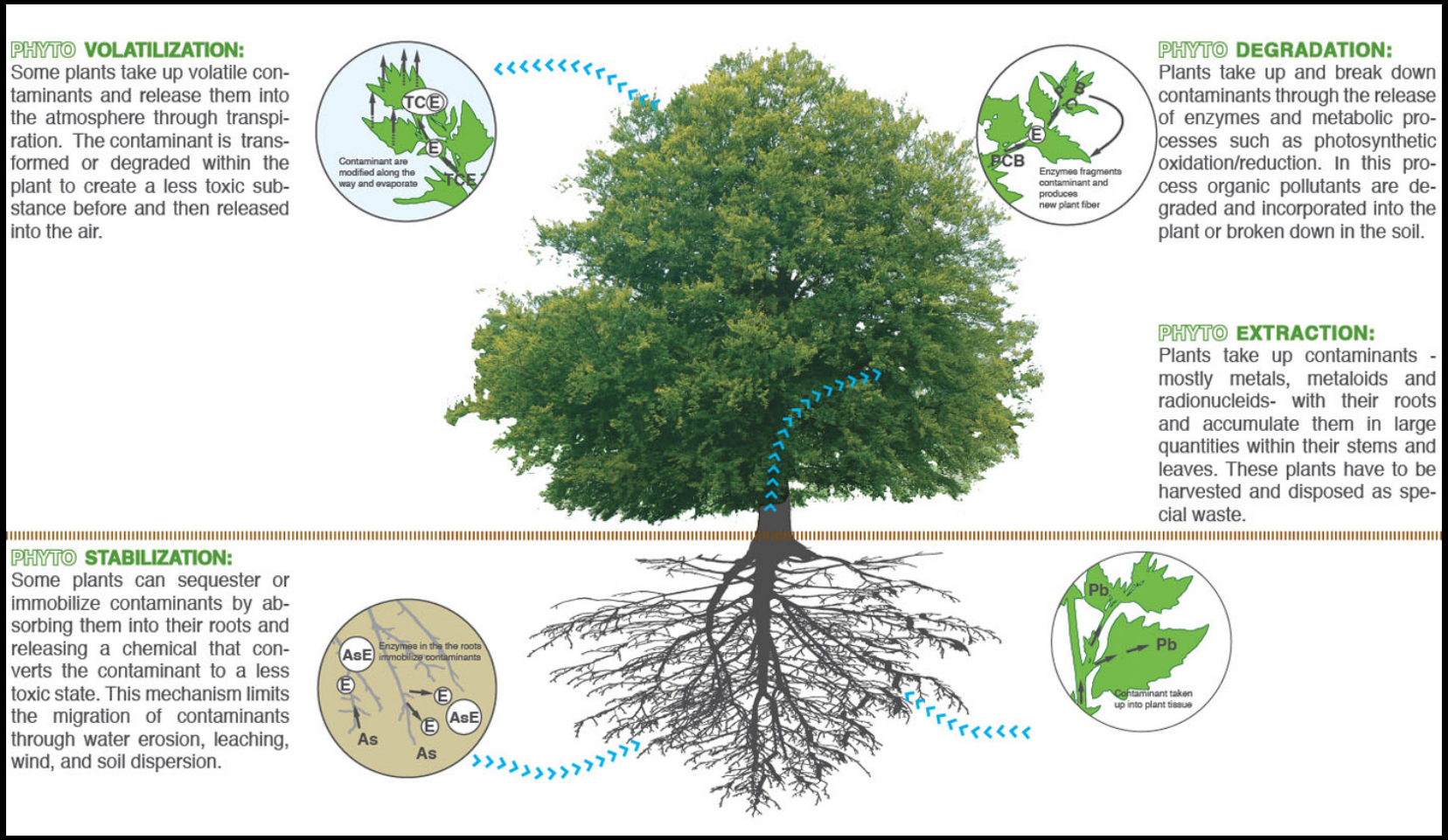
What is Phytoremediation?

Phytoremediation is the use of plants to remove contaminants from the soil and the water.

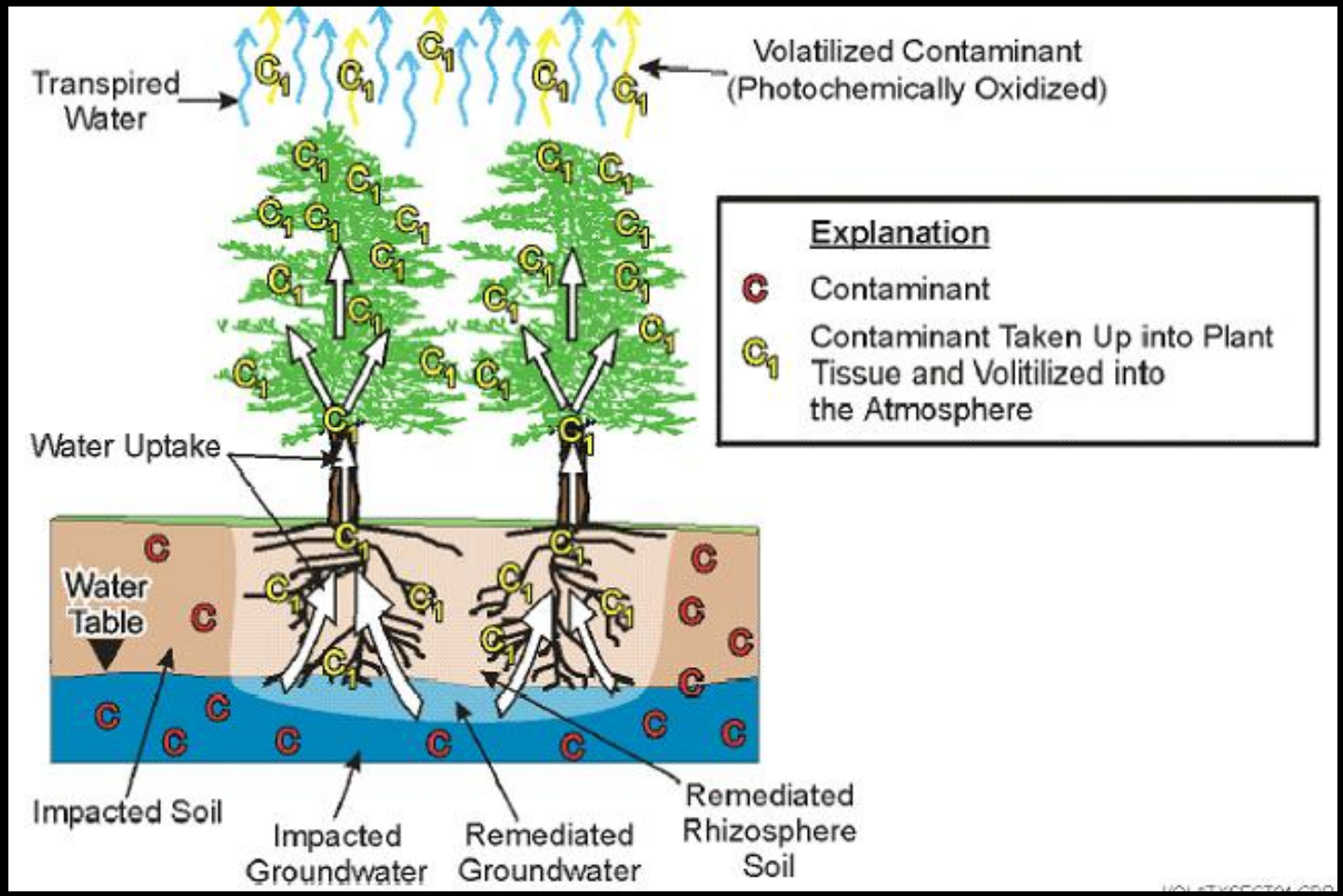
Benefits

- Harnesses the natural abilities of plants to clean groundwater, toxic soils, surface water, and sediments
- Low cost alternative to traditional cleanup

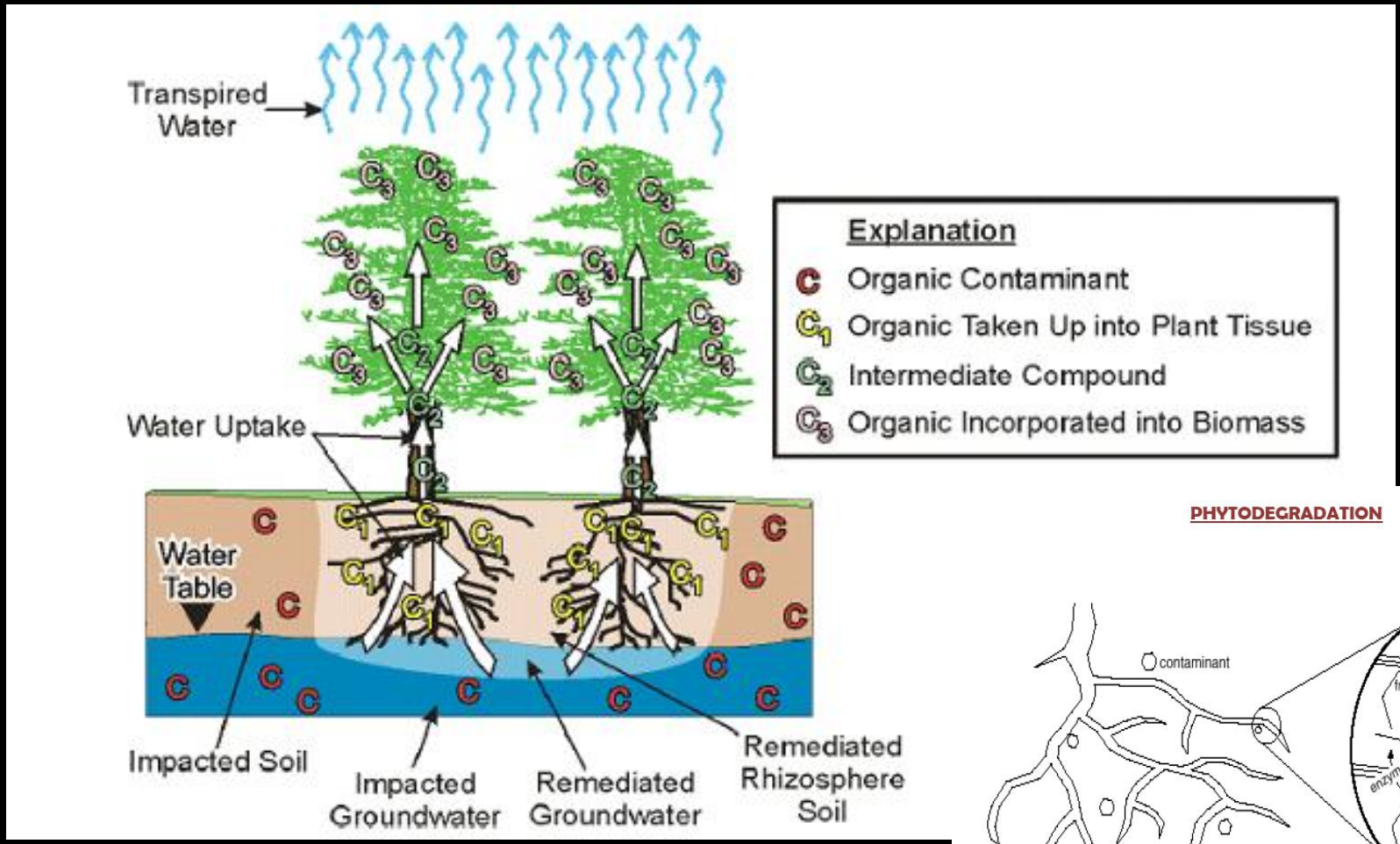
How Does It Work?



Phytovolatilization



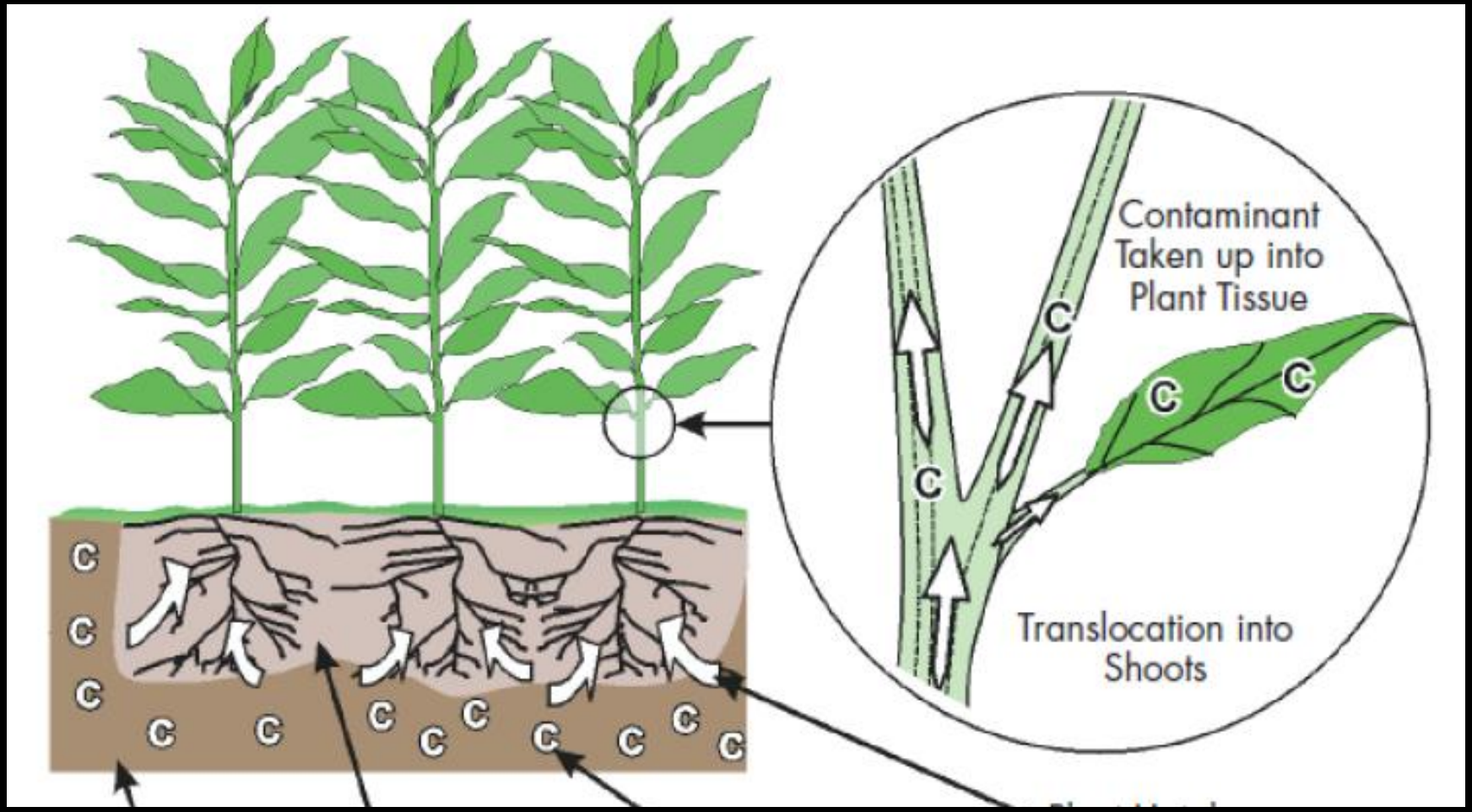
Phytodegradation



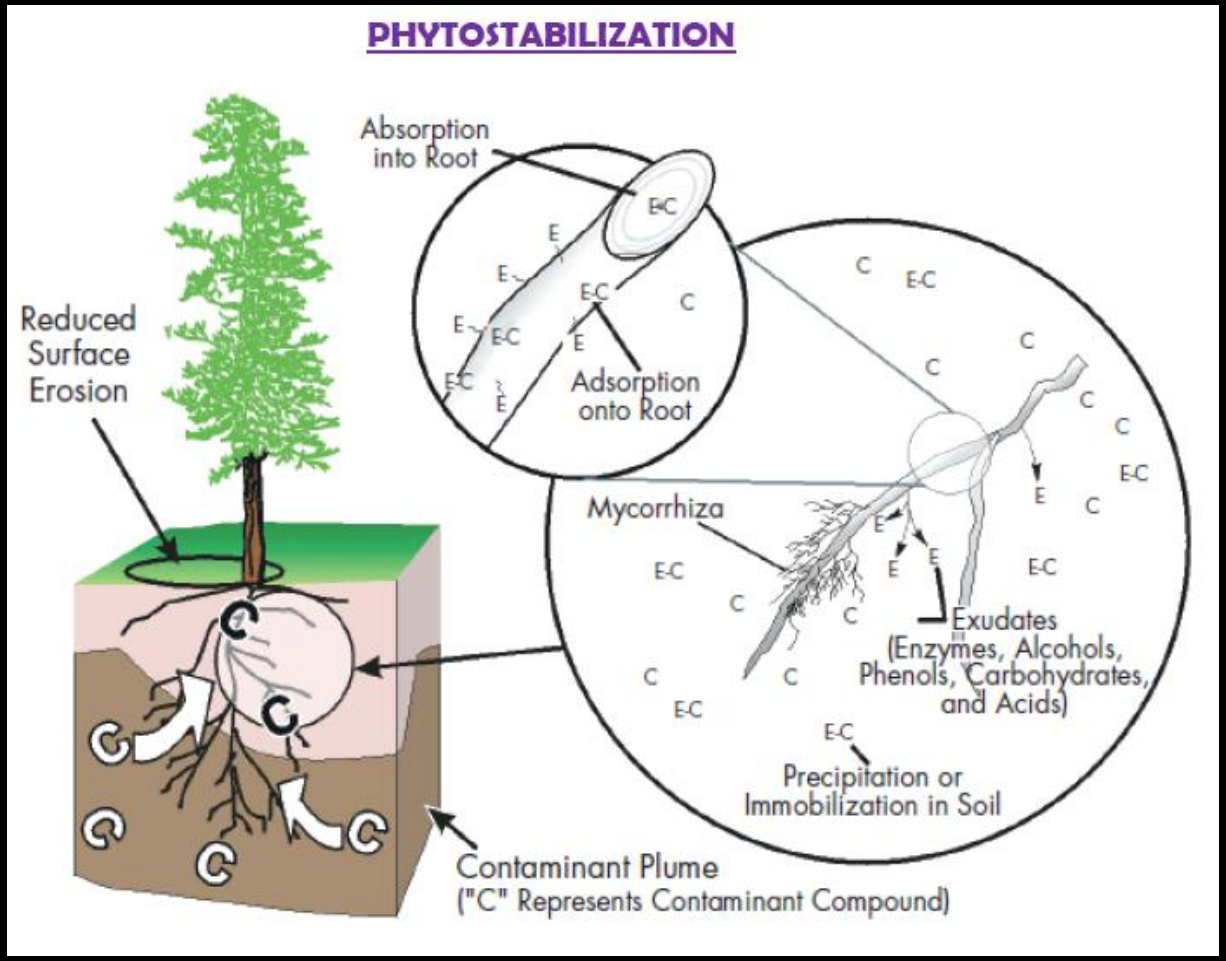
PHYTODEGRADATION

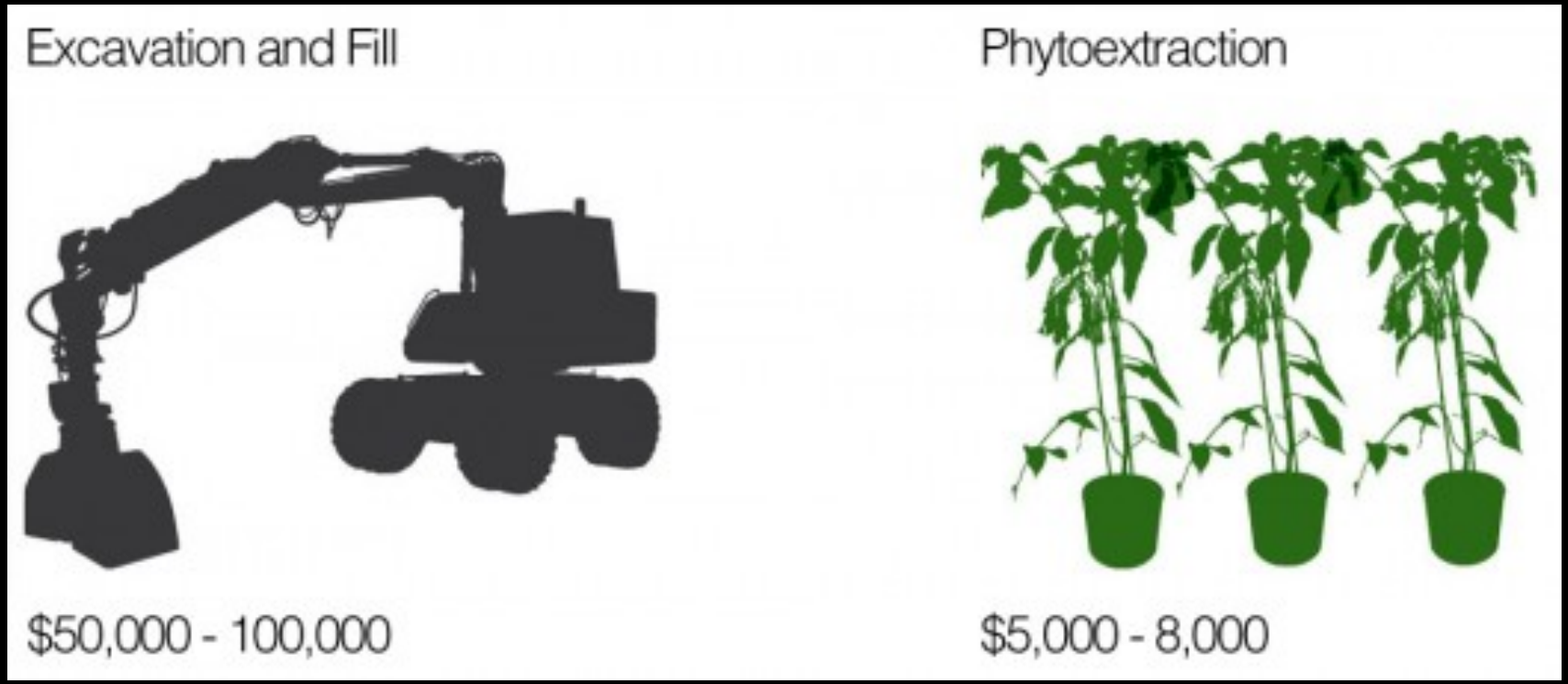
P/S: Rhizodegradation is similar to phytodegradation except fungi and bacteria living in the soil around the roots of the plants degrade the contaminants

Phytoextraction



Phytostabilization





The costs associated with remediating lead contamination on a 2,500sf lot through phytoextraction using Indian Mustard can be reduced to 10% of the cost of excavation and fill.

Potential in Urban Areas

- Urban designer Kaja Kuhl (with Lisa Brunie, Erik Facteau, and Jay Tsai) created the handbook, A Field Guide to Phytoremediation, to provide a smaller scale, cost-effective approach to removing contaminants from the land using plants.
- http://urbanomnibus.net/2010/11/from-brownfields-to-greenfields-a-field-guide-to-phytoremediation/

Collect a Soil Sample

Gather soil samples by taking them from at least 4 different areas per every 400sf of space. Samples should come from approximately 6 inches below the surface and should not contain any gravel, grass, trash, etc. Send samples to a lab.

Create a Remediation Plan and Start Planting

- Based on the results of soil testing, determine if/how contaminants should be remediated.
- Transplant seedlings to your site after the last spring frost when they are about 3” tall. Give them love, attention, and thanks.

Harvest and Re-Plant Site

- It will take the plants approximately 14 weeks to accumulate and become saturated with heavy metals and other toxins. Harvest the entire plant (roots, stems, and leaves) and repeat the entire growing process as often as climate permits.

Dispose of Plant Matter

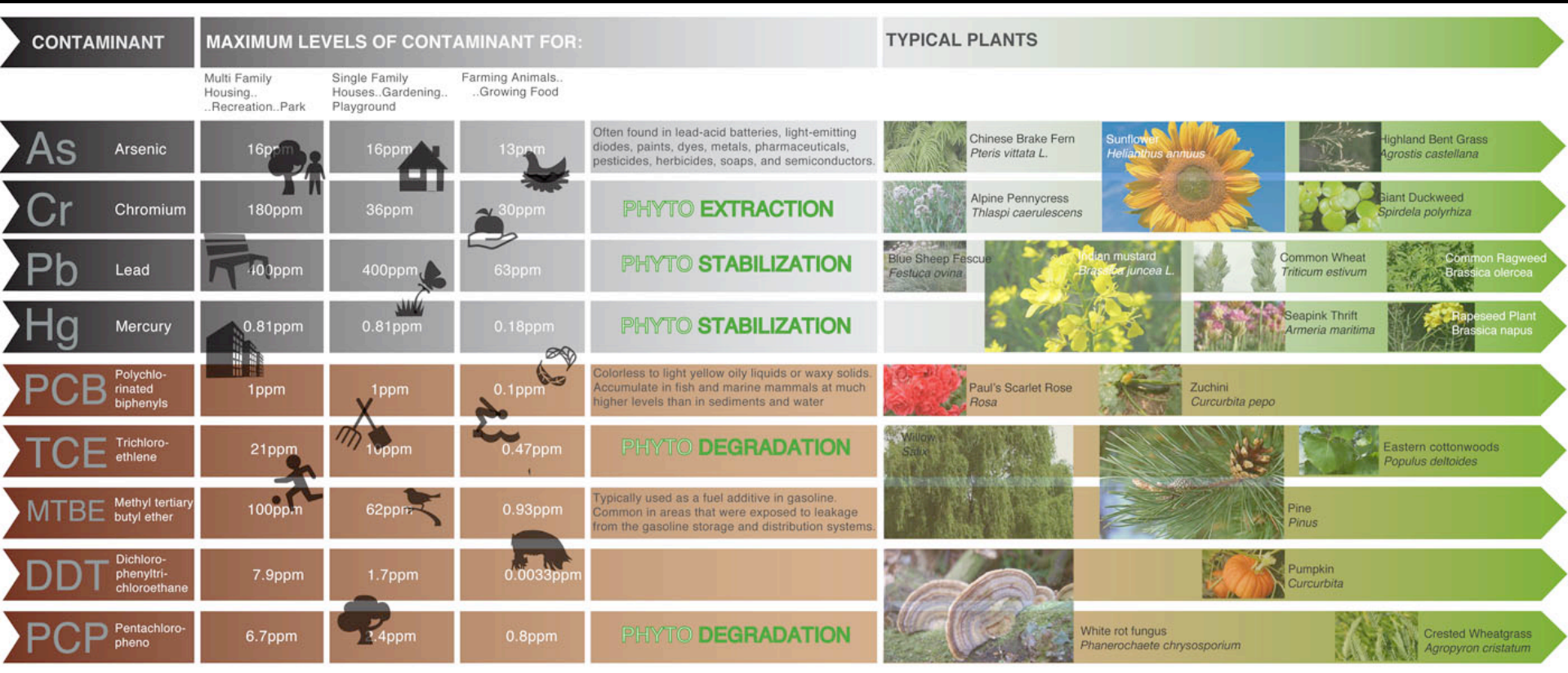
- Some plants are hyperaccumulators and must be disposed of as hazardous waste.
  - These plants store toxins in their plant tissue and will become toxic themselves throughout this process
  - Look for Special/ Hazardous Waste drop-off in your area

https://en.wikipedia.org/wiki/List_of_hyperaccumulators

Re-test Soil

- Re-test the soil at the end of the growing season to track any improvements
- This process may take a few years to remediate the contamination

Contaminants and Plant Remediators



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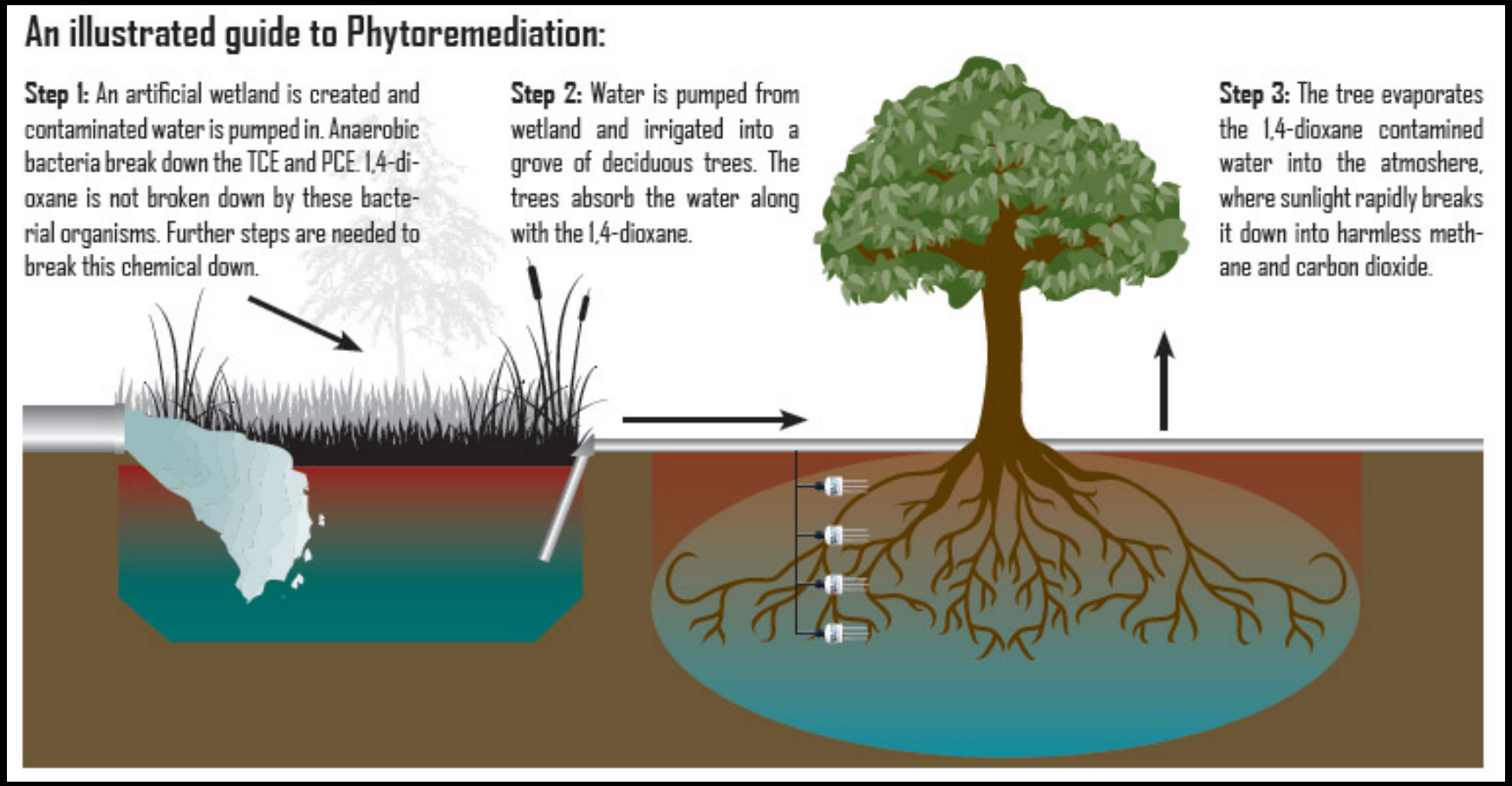
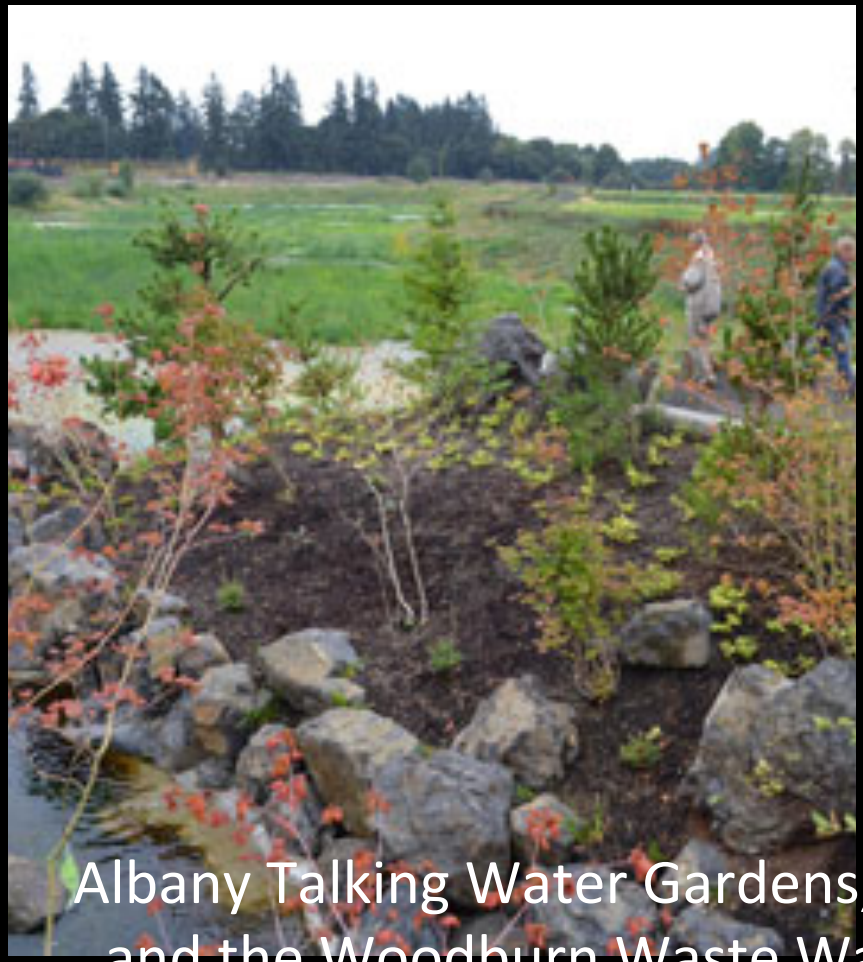
Cleaning Water Systems



Portland-area Phytoremediation Projects



Albany Talking Water Gardens, a constructed wetland project and the Woodburn Waste Water Treatment Plant, a poplar remediation plantation.

Other Opportunities

- Brownfield Programs
  - http://www.groundworkportland.org/programs/page-brownfield/

Phytoremediation in the Home

Pollutant	Sources	Solutions
Formaldehyde	Foam insulation, pluwood, clothes, carpeting, furniture, paper goods, household cleaners	Philodendron Spider Plant Golden Pothos Bamboo Plant Corn Plant Chrysanthemum Snake Plant
Benzene	Tobacco smoke, gasoline, synthetic fibers, plastics, inks, oils, detergents, rubber	English ivy Chrysanthemum Gerbera daisy Peace lily
Trichloroethylene	Dry cleaning, inks, paints, varnishes, lacquers, adhesives	Gerbera daisy Chrysanthemum Peace lily

More Resources

- Sampling of plant species studied for phytoremediation
  - http://www.superorg.net/archive/proposal/plant%20species%20phyto.pdf
- EPA's Phytoremediation Resource Guide
  - http://www.epa.gov/tio/download/remed/phytoresgude.pdf