

Soil Treatability Study

Energy Technology Engineering Center • U.S. Department of Energy

Phytoremediation Study

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U.S. DEPARTMENT OF
ENERGY

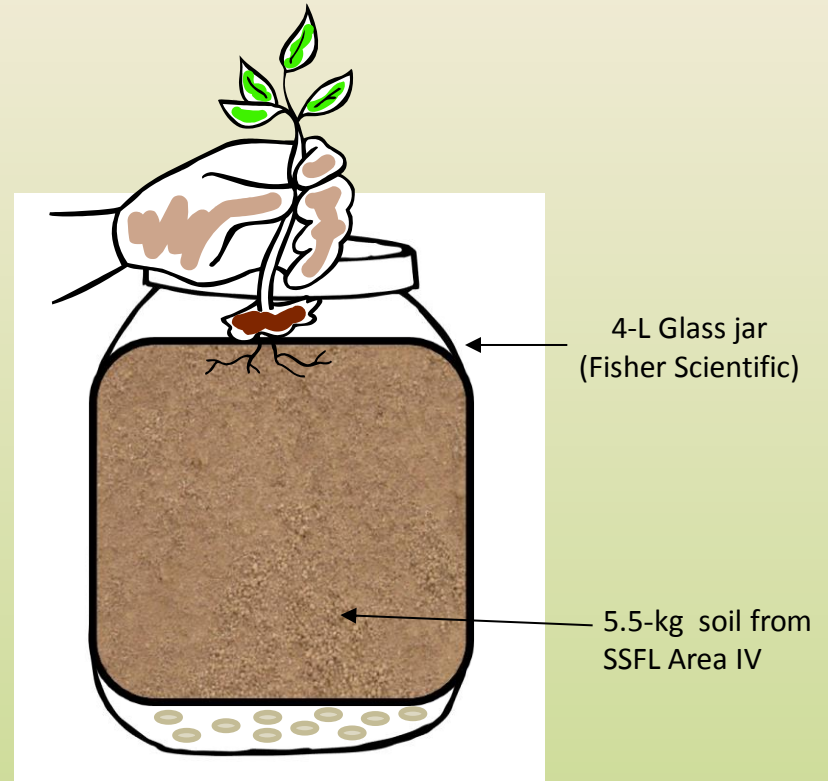
Phytoremediation: Use of plants for remediation of contaminated soil

Step 1: Field Screening



Photo: Mark Osokow

Step 2: Greenhouse “microcosms”



Phytoremediation Study Overview

- Study Plan: Approved
- Selected candidate species for screening
- Collected plants for screening analyses
- Plant propagation for microcosms
- Greenhouse microcosms
 - Collected soil for greenhouse microcosms
 - Currently setting up microcosms in the greenhouse



12 candidate species identified growing in study plots



Plant type	Scientific Name	Common Name
Grasses	<i>Elymus glaucus</i>	Blue Wildrye
	<i>Stipa cernua</i>	Nodding Needlegrass
	<i>Bromus hordeaceus</i>	Soft Chess
	<i>Bromus madritensis</i>	Red Brome
Forbs	<i>Hirschfeldia incana</i>	Summer Mustard
	<i>Asclepias fascicularis</i>	Narrowleaf milkweed
	<i>Sambucus nigra</i>	Blue Elderberry
	<i>Malosma (Rhus) laurina</i>	Laurel Sumac
	<i>Baccharis salicifolia</i>	Mule-Fat
	<i>Ericameria palmeri</i>	Palmer Goldenbush
	<i>Baccharis pilularis</i>	Coyotebush
	<i>Eriodictyon crassifolium</i>	Thickleaf Yerba Santa

Plant propagation for microcosms

- Collected seeds and tested germination (3x)
- Collected plant cuttings and attempted to root (2x)



Plant propagation for microcosms

--> Seed collection



Seed collected from plants in Area IV for propagating plants in greenhouse experiments (3 collection dates)

- May 29, 2013
- August 8, 2013
- November 4, 2013

Seed germination test (Nov/Dec, 2013)



Scientific Name	Common Name	Seed Germinated?
<i>Elymus glaucus</i>	Blue Wildrye	Yes
<i>Stipa cernua</i>	Nodding Needlegrass	Yes
<i>Bromus hordeaceus</i>	Soft Chess	Yes
<i>Bromus madritensis</i>	Red Brome	Yes
<i>Hirschfeldia incana</i>	Summer Mustard	Yes
<i>Asclepias fascicularis</i>	Narrowleaf milkweed	No
<i>Sambucus nigra</i>	Blue Elderberry	No
<i>Malosma (Rhus) laurnia</i>	Laurel Sumac	Yes
<i>Baccharis salicifolia</i>	Mule-Fat	No
<i>Ericameria palmeri</i>	Palmer Goldenbush	Yes
<i>Baccharis pilularis</i>	Coyotebush	No
<i>Eriodictyon crassifolium</i>	Thickleaf Yerba Santa	No

Plant propagation from cuttings (Nov/Dec, 2013)



Scientific Name	Common Name	Cuttings Collected?
<i>Elymus glaucus</i>	Blue Wildrye	No
<i>Stipa cernua</i>	Nodding Needlegrass	No
<i>Bromus hordeaceus</i>	Soft Chess	No
<i>Bromus madritensis</i>	Red Brome	No
<i>Hirschfeldia incana</i>	Summer Mustard	No
<i>Asclepias fascicularis</i>	Narrowleaf milkweed	No
<i>Sambucus nigra</i>	Blue Elderberry	Yes
<i>Malosma (Rhus) laurnia</i>	Laurel Sumac	Yes
<i>Baccharis salicifolia</i>	Mule-Fat	Yes
<i>Ericameria palmeri</i>	Palmer Goldenbush	Yes
<i>Baccharis pilularis</i>	Coyotebush	Yes
<i>Eriodictyon crassifolium</i>	Thickleaf Yerba Santa	Yes

So far – very limited success for all cuttings

Plant screening for contaminant uptake

January 15-17, 2014



Scientific Name	Common Name	Date Sampled
<i>Elymus glaucus</i>	Blue Wildrye	-
<i>Stipa cernua</i>	Nodding Needlegrass	-
<i>Bromus hordeaceus</i>	Soft Chess	-
<i>Bromus madritensis</i>	Red Brome	-
<i>Hirschfeldia incana</i>	Summer Mustard	Jan 2014
<i>Asclepias fascicularis</i>	Narrowleaf milkweed	Jan 2014
<i>Sambucus nigra</i>	Blue Elderberry	Jan 2014
<i>Malosma (Rhus) laurnia</i>	Laurel Sumac	Jan 2014
<i>Baccharis salicifolia</i>	Mule-Fat	Jan 2014
<i>Ericameria palmeri</i>	Palmer Goldenbush	Jan 2014
<i>Baccharis pilularis</i>	Coyotebush	Jan 2014
<i>Eriodictyon crassifolium</i>	Thickleaf Yerba Santa	Jan 2014

Collected foliage, roots and soil to test for chemical uptake

Foliage



Roots



Root Zone Soil



Plant screening status

- First sampling completed January 15-17, 2014
 - Collected at least one specimen of each forb species
 - Currently awaiting analytical results
- Duplicates and controls to be collected ASAP
- Grasses to be sampled after rains & grass growth



Greenhouse microcosms

- Collected soil for greenhouse microcosms
 - Approximately 390 kg soil collected on January 16, 2014
 - Collected from Sub Area 5B, 17th St Pond area
 - Site selected for mixture of chemicals at moderate concentrations

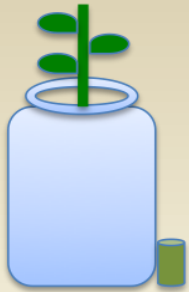


Greenhouse microcosms

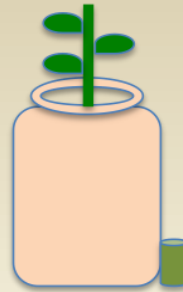
- Currently preparing soil for microcosms: sieving and mixing to ensure that all microcosms start with the same chemical concentrations.
- Waiting for analytical results so we know which plants to plant in the microcosms



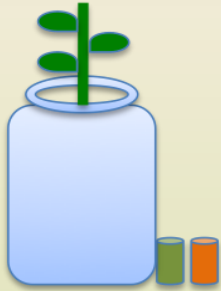
Greenhouse microcosms



Fertilized* Microcosm
Three Species



Sterilized‡ Microcosm
(fertilized*)
Only one species



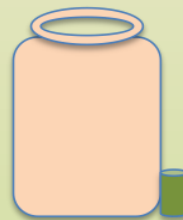
Fertilized* Microcosm +
Chelating agent
Only one species



Unplanted Microcosm
(fertilized*)



Unfertilized Microcosm
Only one species



Sterilized ‡ Unplanted
Microcosm (fertilized*)

*: All amendments will be analyzed for chemicals before use in microcosms

‡: Sterilized by licensed facility

70 total microcosms: 40 primary microcosms (30 planted, 10 unplanted) and 30 planted spares

Phytoremediation Study...

Questions?

