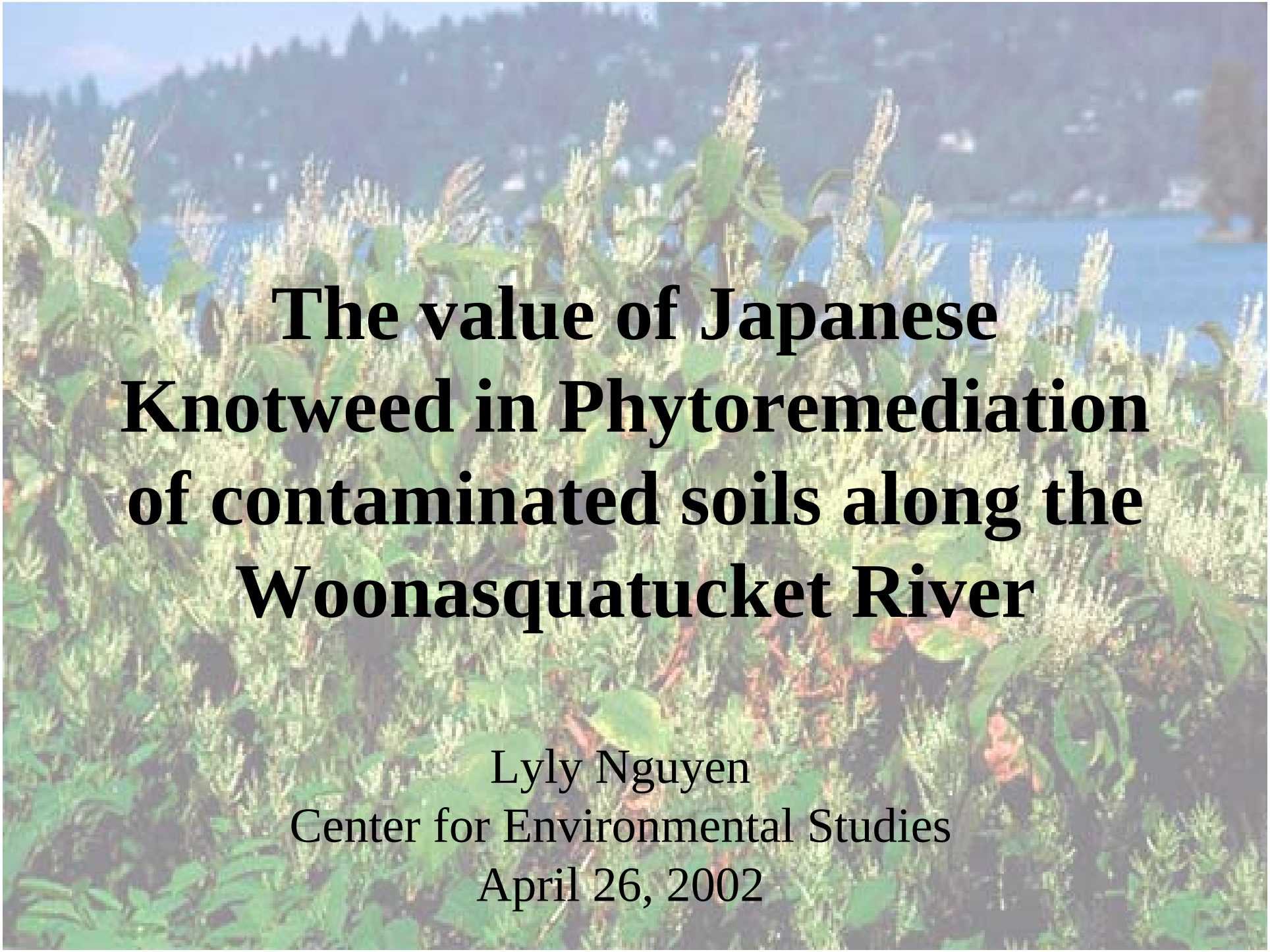

The value of Japanese Knotweed in Phytoremediation of contaminated soils along the Woonasquatucket River

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Center for Environmental Studies
April 26, 2002

Introduction

- The Woonasquatucket River:
  - Riparian buffer restoration
- Japanese knotweed:
  - Problems
  - Benefits
- Phytoremediation

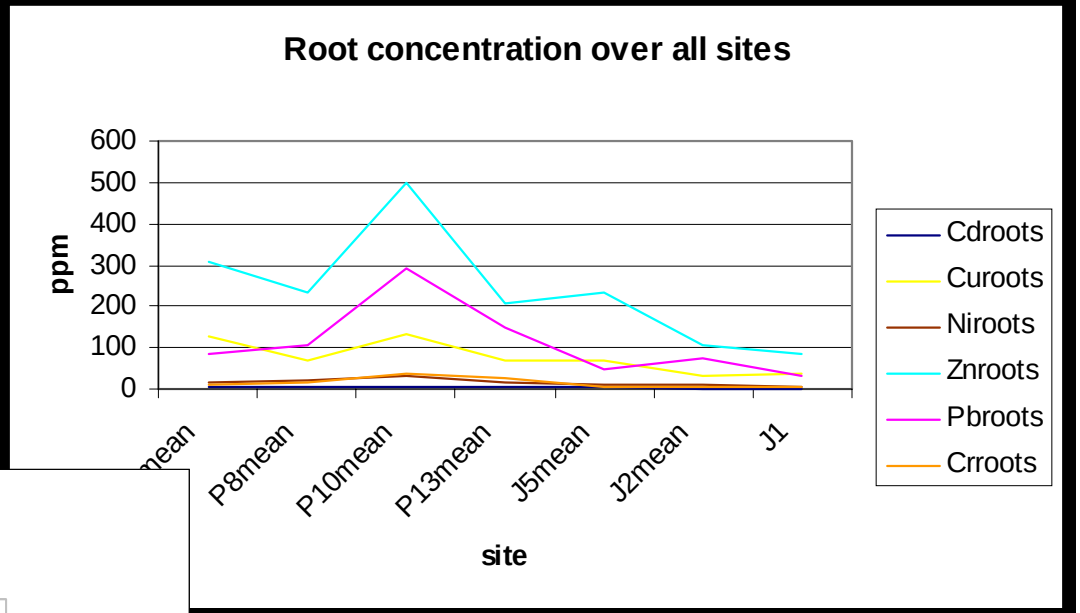
Should the state of Rhode Island implement a policy to manage Japanese Knotweed along the Woonasquatucket River?

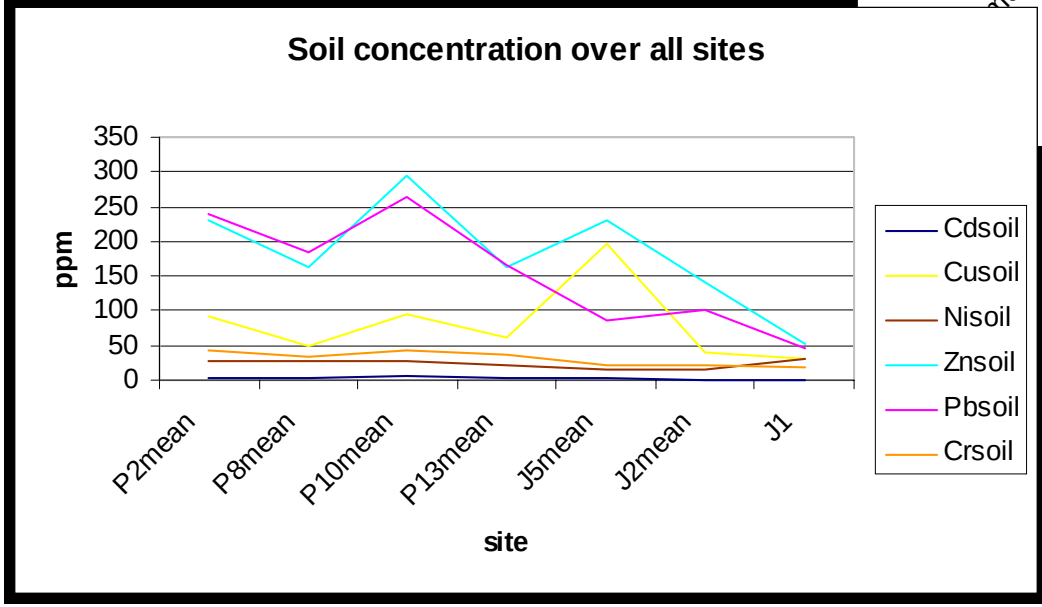
Methodology

- Site selection & description
- Sampling
- Analytical Analysis With AA and ICP

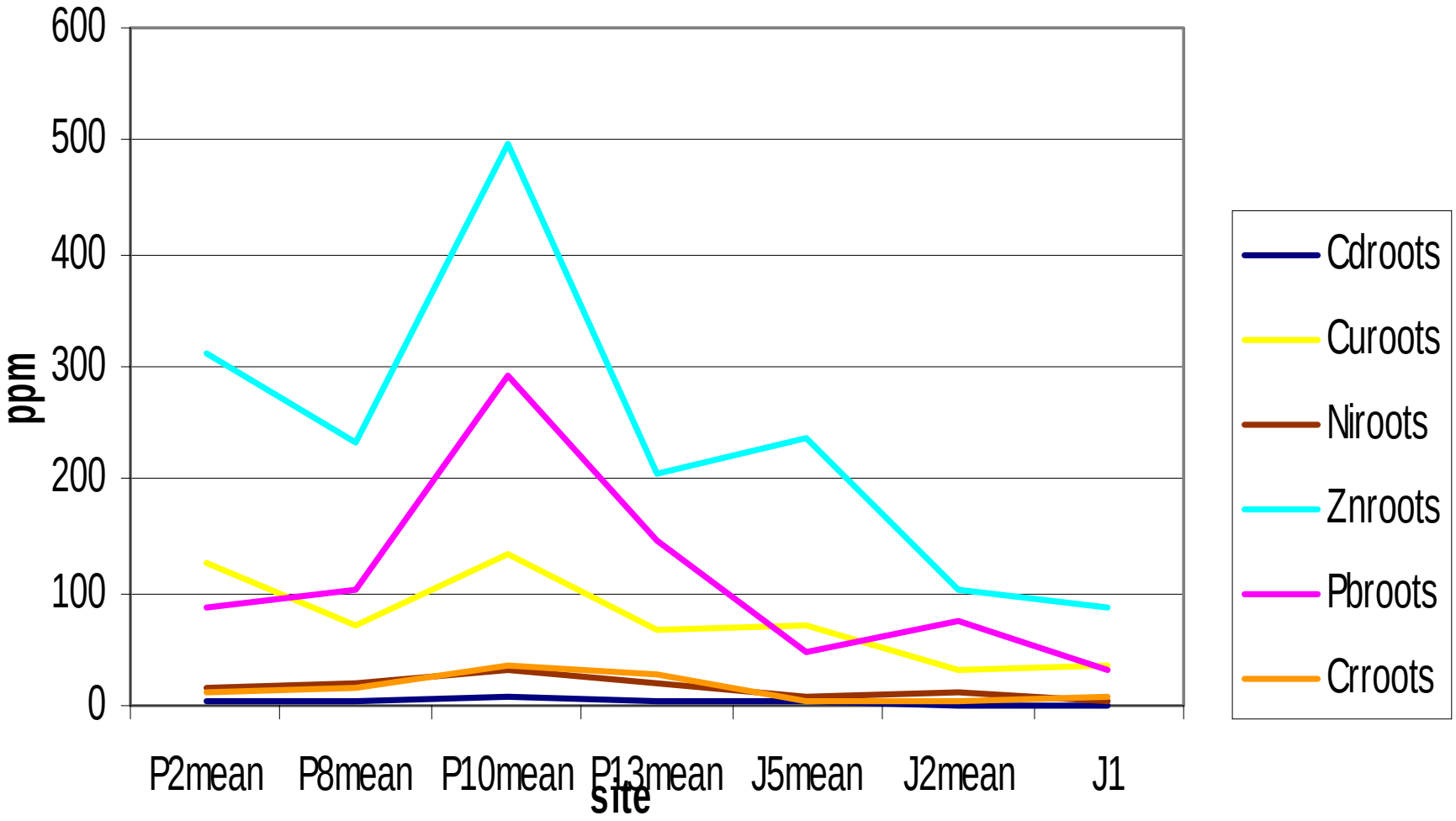
What heavy metals are most prevalent in the soil and roots?

1. Zinc
2. Lead
3. Copper





Root concentration over all sites



How do samples compare to "reported normal abundances"?

	Pb	Pb (my samples)	
• RI Soils	14	265	→ 1800%
• Soils (world)	10		
• Vegetation (above ground)	5	20	→ 400%

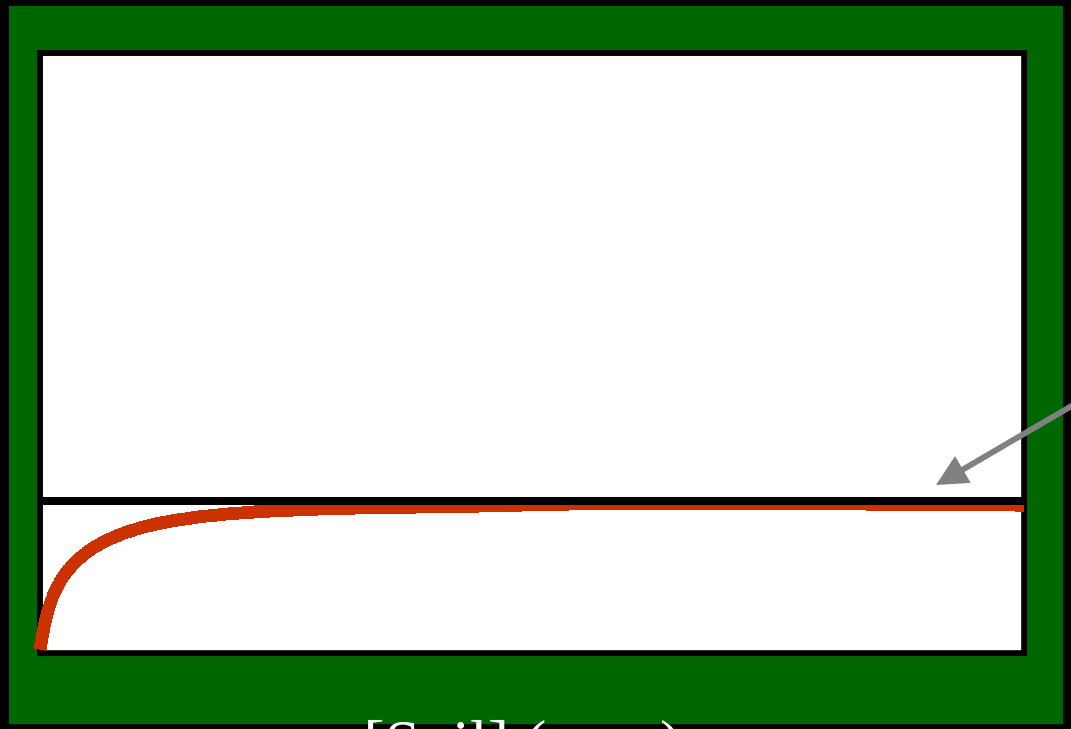
Cu soils: 500%
Vegetation: 30%

Zn soils: 600%
Vegetation: 28%

* Comparison of mean elemental concentrations in (ug g-1) in soil and vegetation (dry weight). Site P10

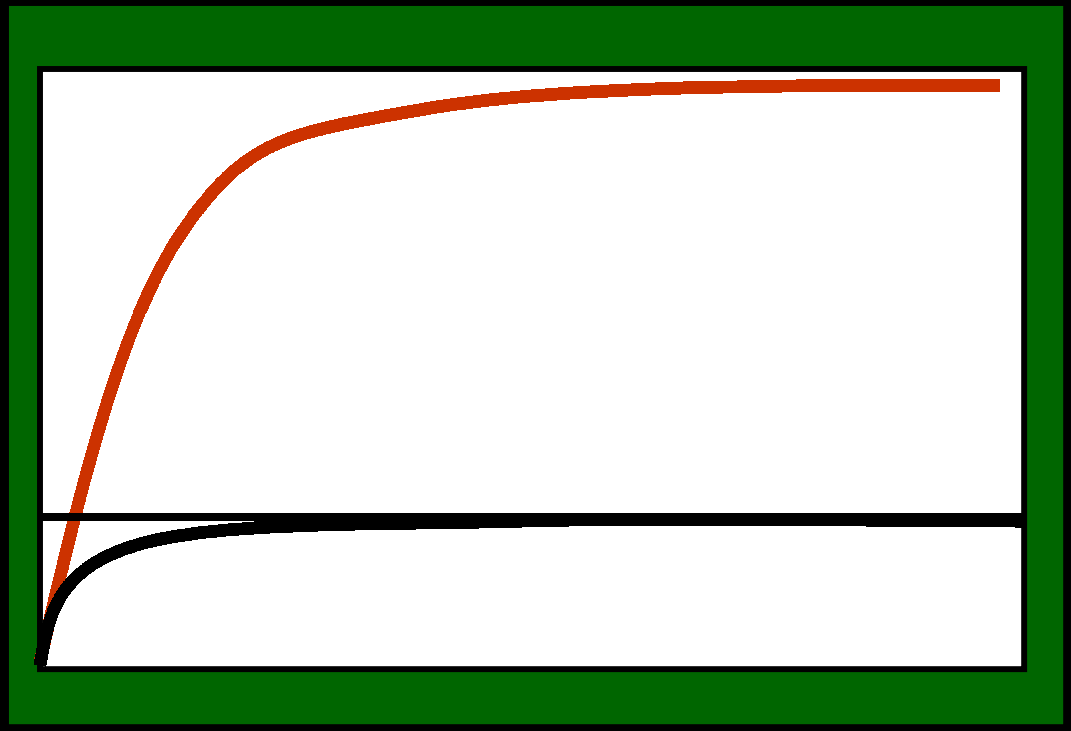
Non-tolerant plants

Root uptake proportional to soil concentration up to max threshold level, then levels off



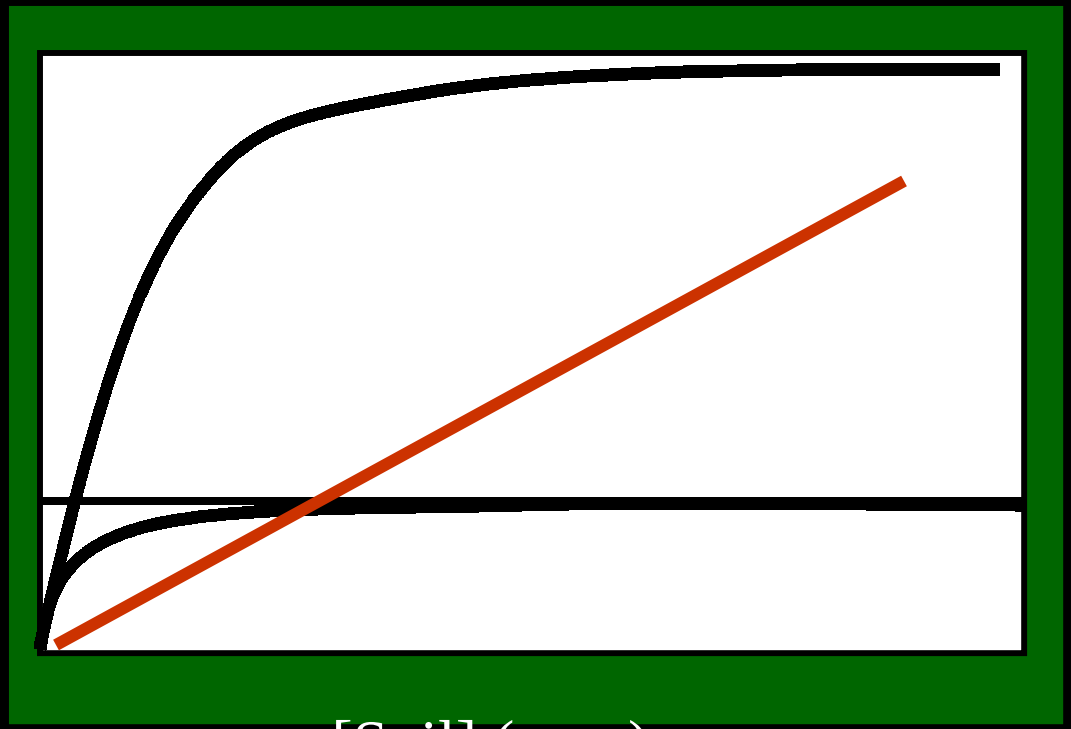
Hyperaccumulator plant

Root concentration exceeds threshold over a variety of soil concentration.

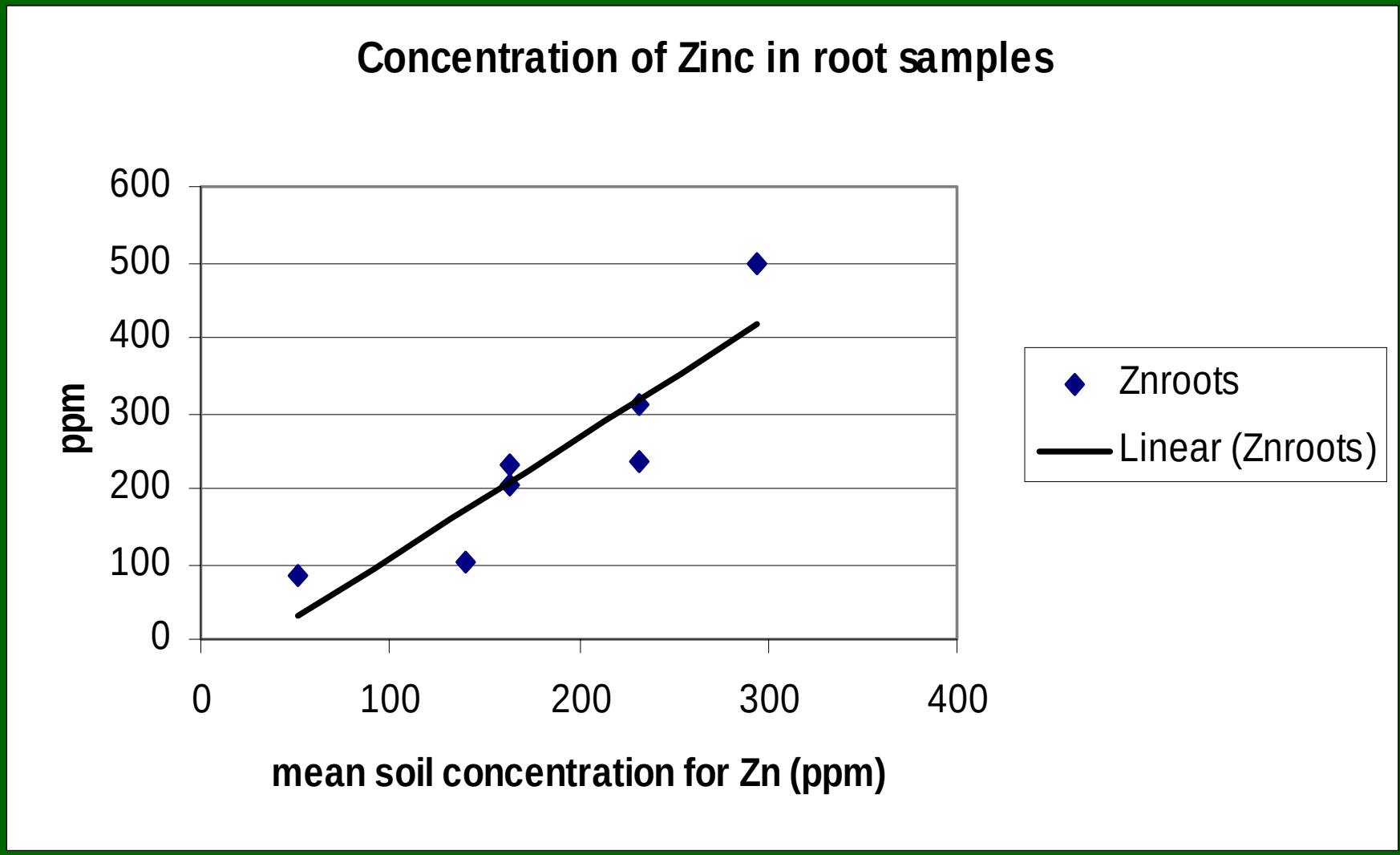


Tolerant/Accumulator plant

Metal concentration on roots reflect concentration
in soil-- change in soil explains change in root concentration



Is there a linear relationship between [soil] and [plant part]?



Sample calculations

Mean metal concentration (ug/g)

X

Mean aerial biomass (g)

X

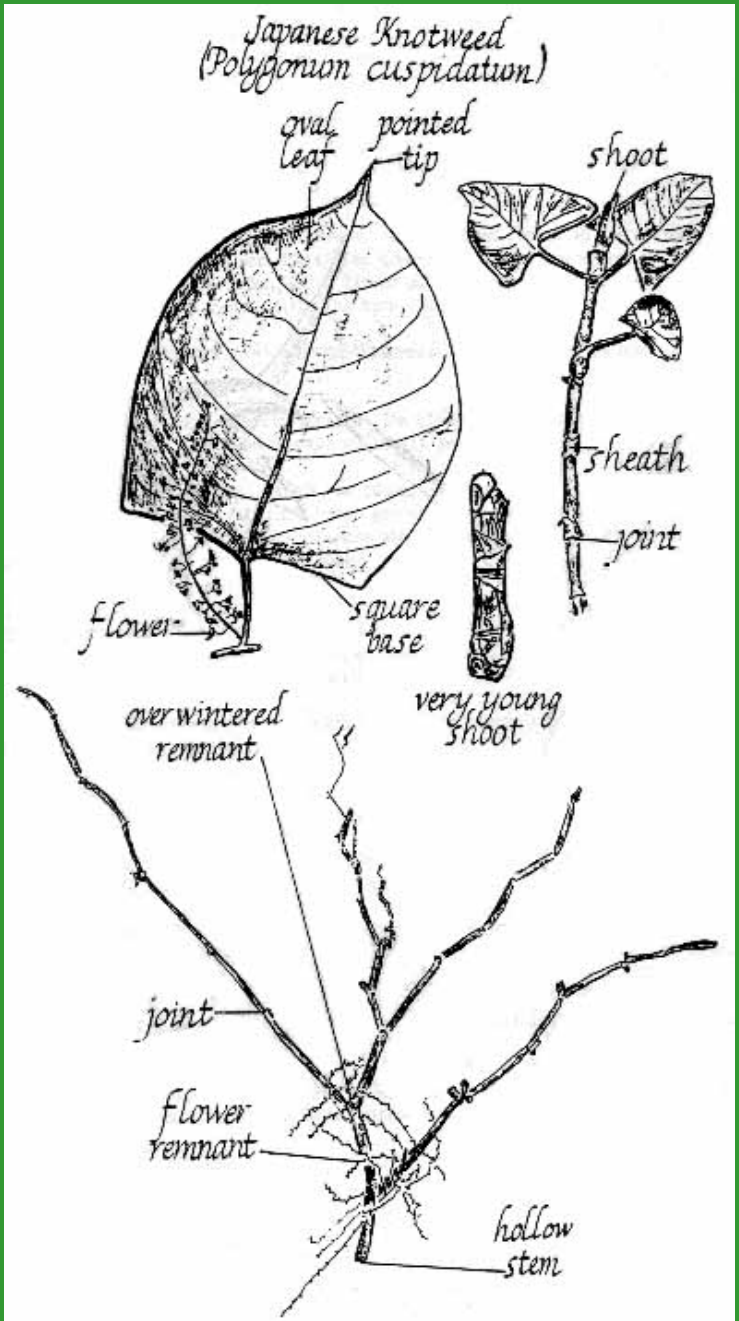
No. shoots per m^2

X

1000

↓

Total metal removed (mg/m^2)



How much metal would be removed annually?

site	Cu (mg/m2)	Zn (mg/m2)	Pb (mg/m2)
P2	15.88	124.4	16.87
P8	36.14	232.19	18.55
P10	13.97	133.19	20.98
P13	14.67	111.43	7.76
J5	11.04	146.35	3.29
J2	13.76	146.03	11.25
J1	9.06	66.27	6.65

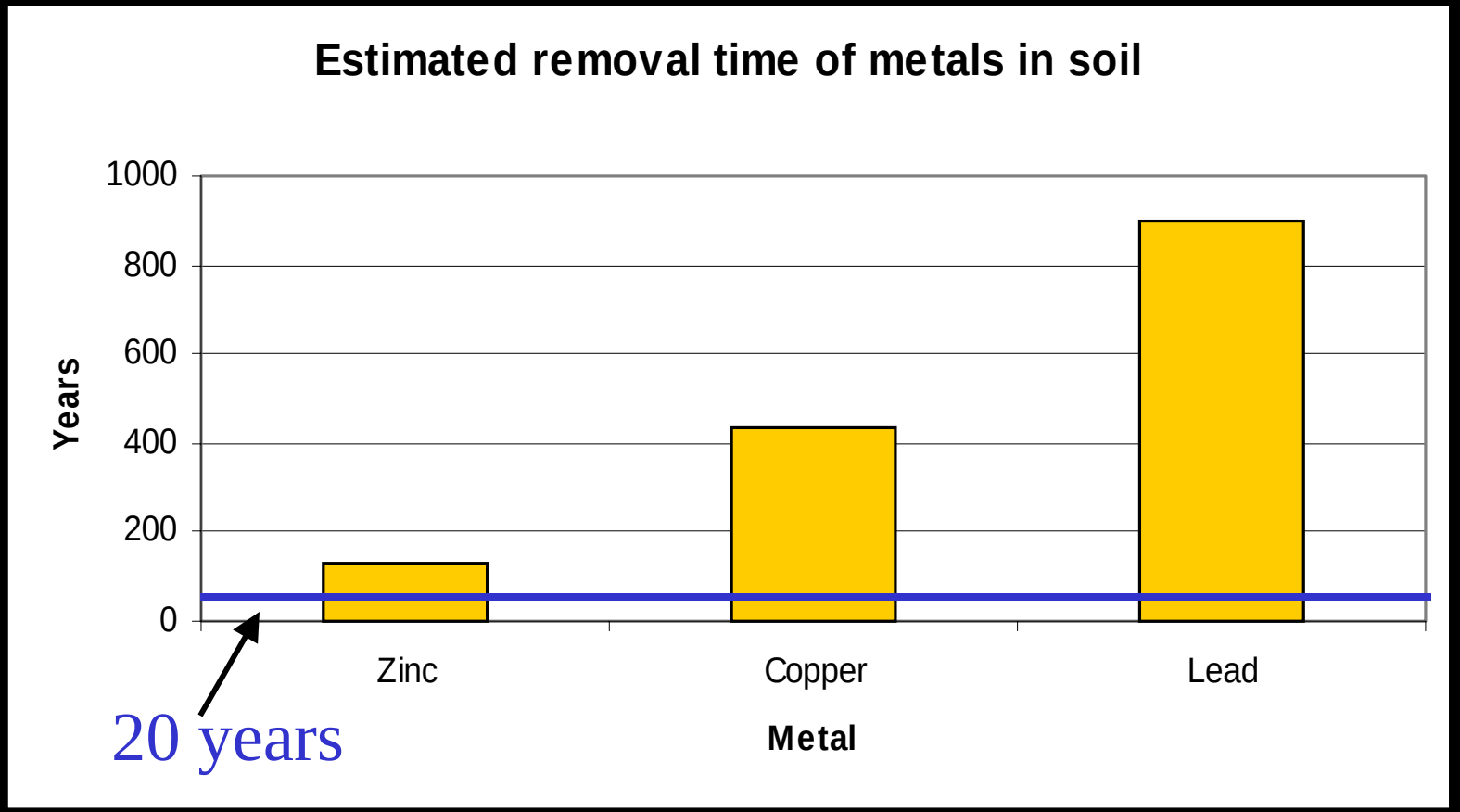
Calculations based on mean concentration of metals (per site) in aerial biomass of plant

How much metal would be removed from each site annually?

site	Cu (g/site)	Zn (g/site)	Pb (g/site)
P2	3.3	25.8	3.5
P8	6.5	42.1	3.4
P10	1.1	10	1.6
P13	1.4	10.4	0.72
J5	0.78	10.4	0.23
J2	0.48	5.08	0.39
J1	0.089	0.65	0.065

Calculations based on mean concentration of metals (per site) in aerial biomass of plant

How long will it take to reduce metal concentration to acceptable levels?



•Metal removal was calculated for the most contaminated site, P10. Calculations are based on assumption that a cubic meter of soil weighs approximately 75,000g.

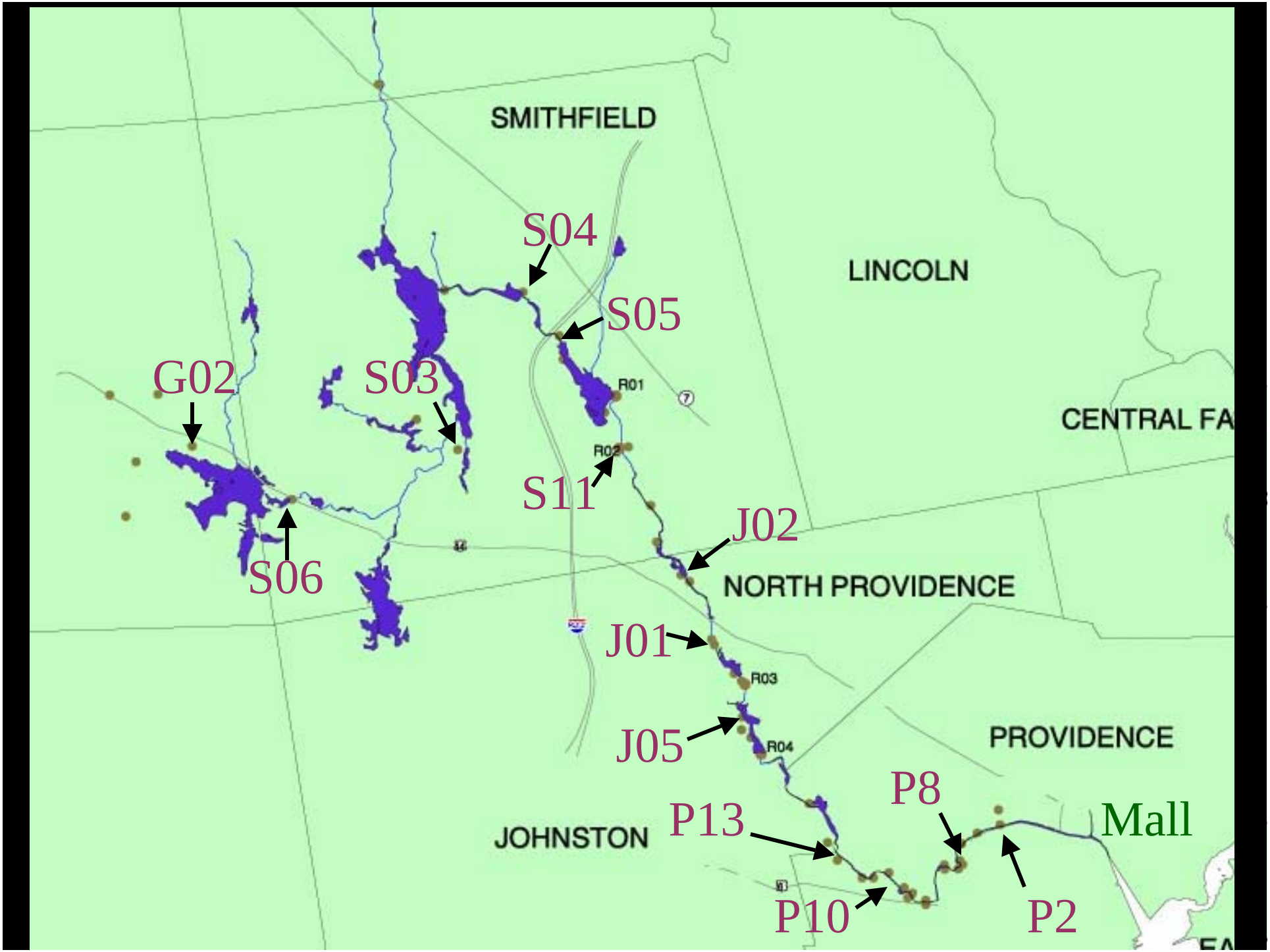
Conclusions

Japanese Knotweed:

- tolerates Pb, Cu, and Zn
- Not a hyperaccumulator
- Not effective at removing metals from soil within a reasonable timeframe
- Is a pervasive pest, and should be controlled to prevent its spread

Policy recommendations

- Prioritize limited resources to areas in most need of restoration
- Harvest “target” sites annually for 10 years at peak biomass—July
- Policy to manage Knotweed should encompass: control, public education and awareness, removal funding


SMITHFIELD
LINCOLN
CENTRAL FA
NORTH PROVIDENCE
PROVIDENCE
JOHNSTON
S04
S05
G02
S03
S11
S06
J02
J01
J05
P13
P8
Mall
P10
P2
R01
R02
R03
R04