

Aliens in Western Stream Ecosystems

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EMAP West Reports:

<http://www.epa.gov/emap/>



United States
Environmental Protection
Agency

Office of Research and
Development
Washington, DC 20460

June 2005
EPA 620/R-05/005

Environmental Monitoring and Assessment Program (EMAP)

Western Streams and Rivers Statistical Summary



Environmental Monitoring and
Assessment Program

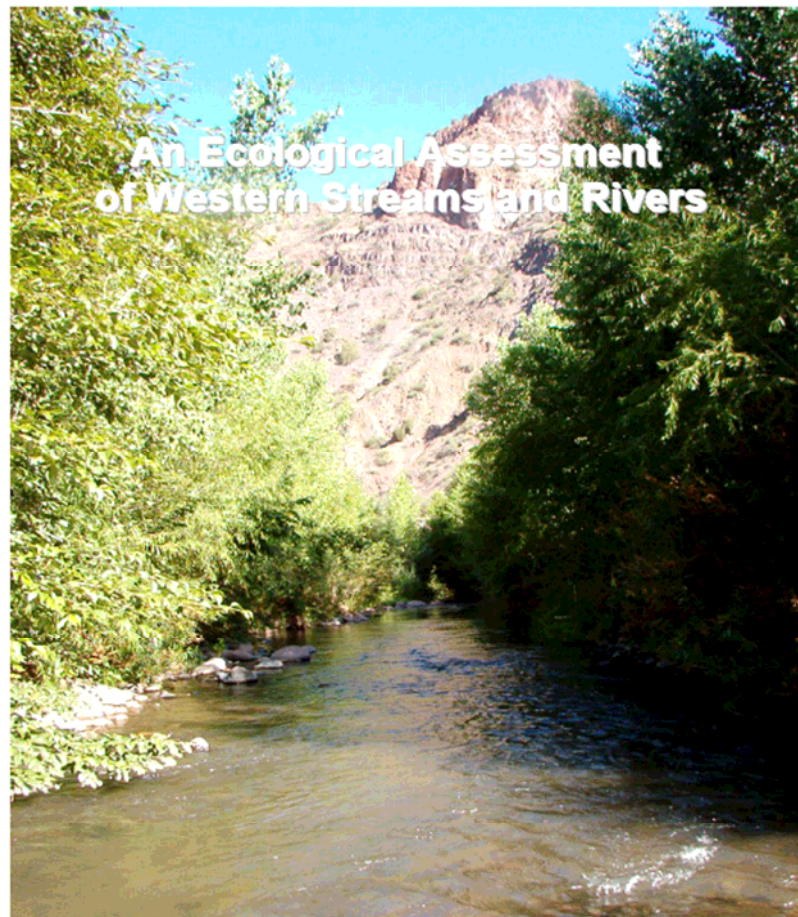


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An Ecological Assessment of Western Streams and Rivers

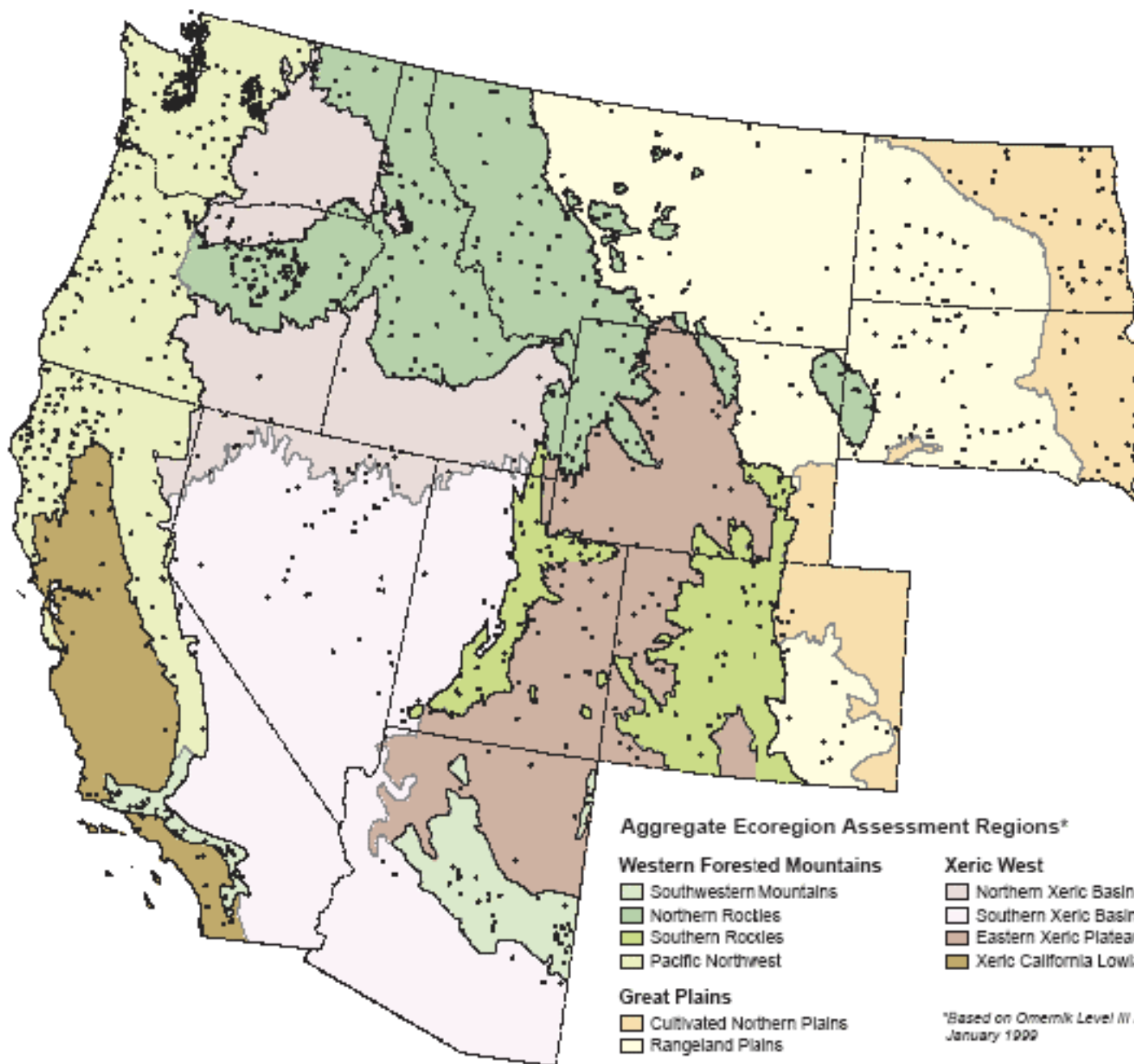


Why Aliens?

- Threat to biological integrity
- Economic burdens and benefits
- Unintended experiment providing ecological insights

Topics

- Invasive Riparian Plants
- Alien Macroinvertebrates
- Alien Fish



Specific Questions – Selected Invasive Riparian Plants

- Presence
- Association
 - Disturbance
 - Biotic Condition
- Presence at reference sites

Invasive Plant Taxon Selection

1. Ecologically intrusive

2. Short List

1000 alien plants in CA -- 60 are invasive (Dark 2004)

3. Easy to id

4. Some riparian preference

5. Non-toxic to field crews

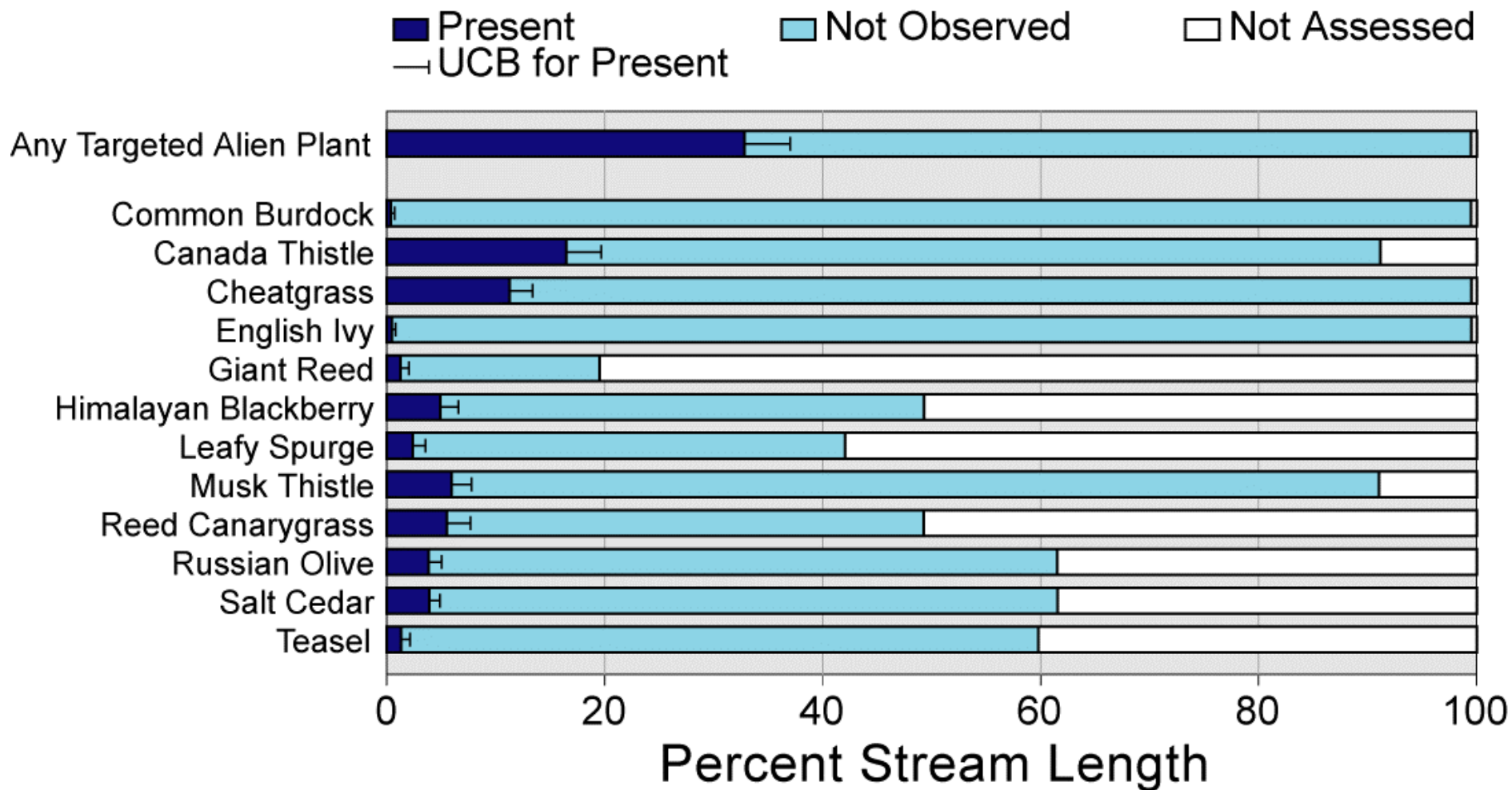
6. Regional interest

7. Differences within the set of species

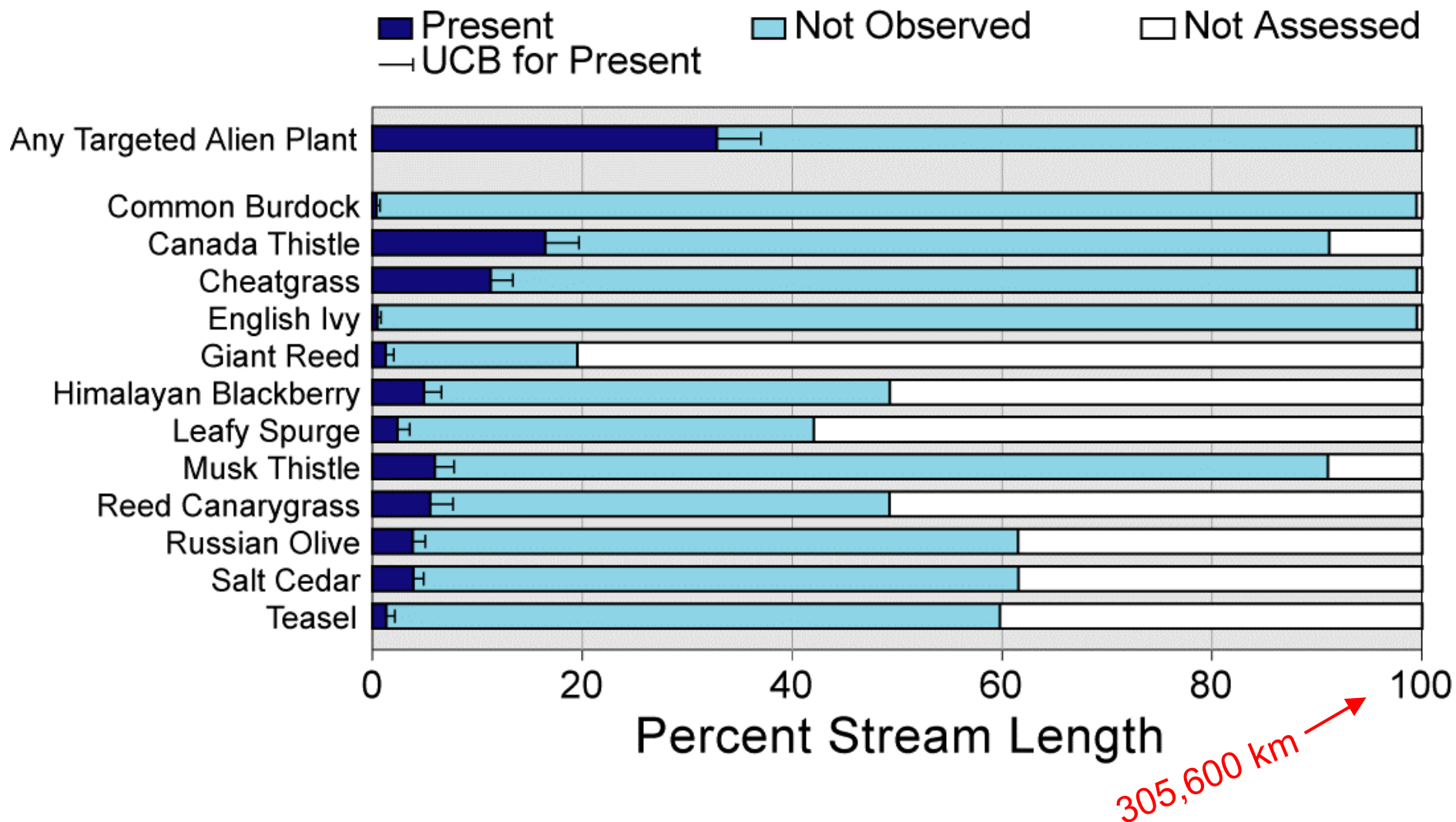
Twelve Selected Invasive Plants

- Common Burdock (*Arctium minus*)
- Russian-olive (*Elaeagnus angustifolia*)
- Giant Reed (*Arundo donax*)
- Leafy Spurge (*Euphorbia esula*)
- Cheatgrass (*Bromus tectorum*)
- English Ivy (*Hedera helix*)
- Musk Thistle (*Carduus nutans*)
- Reed Canarygrass (*Phalaris arundinacea*)
- Canada Thistle (*Cirsium arvense*)
- Himalayan Blackberry (*Rubus discolor*)
- Teasel (*Dipsacus fullonum*)
- Salt Cedar (*Tamarix spp.*)

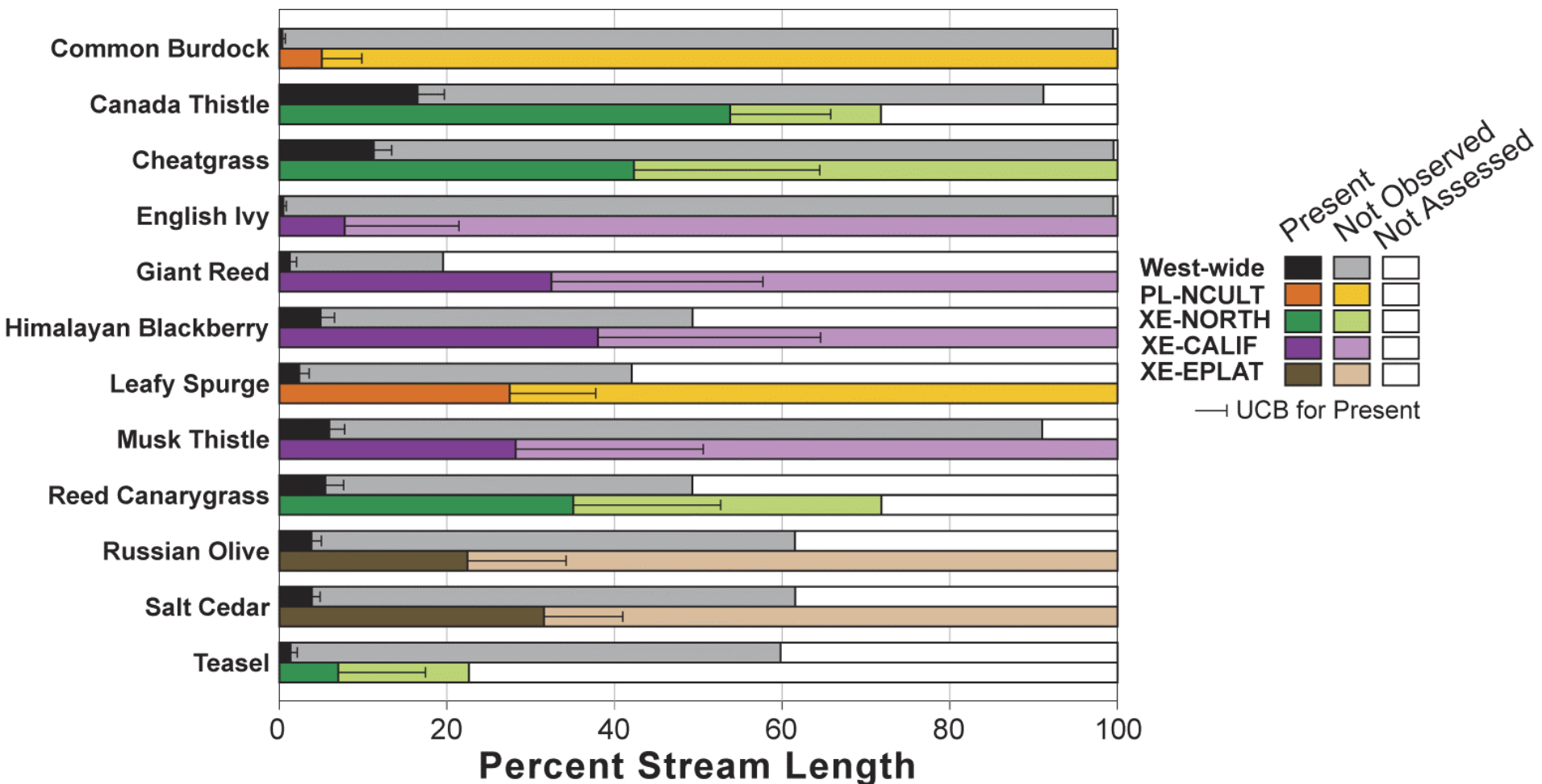
Selected Invasive Plant Presence – West Wide



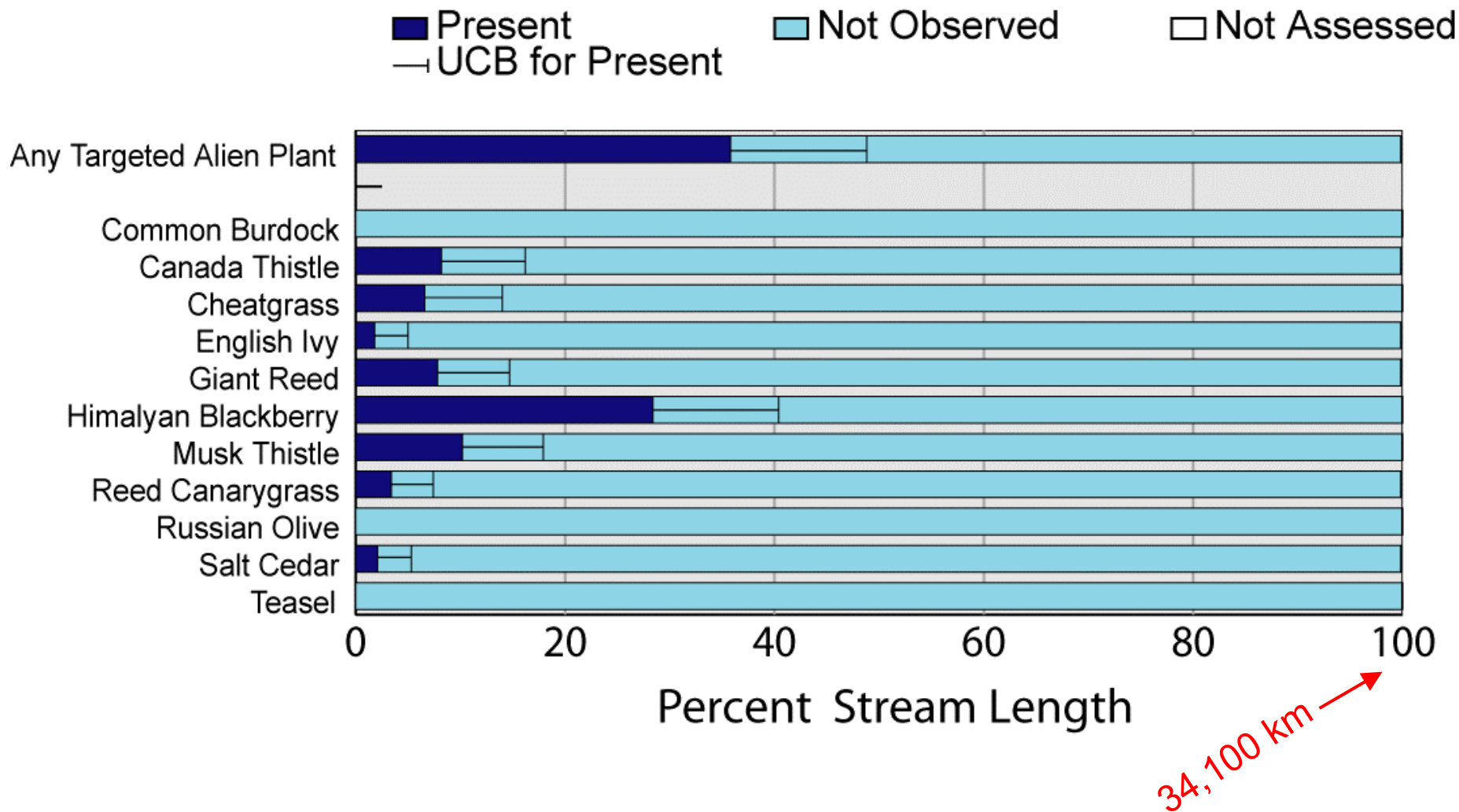
Selected Invasive Plant Presence – West Wide



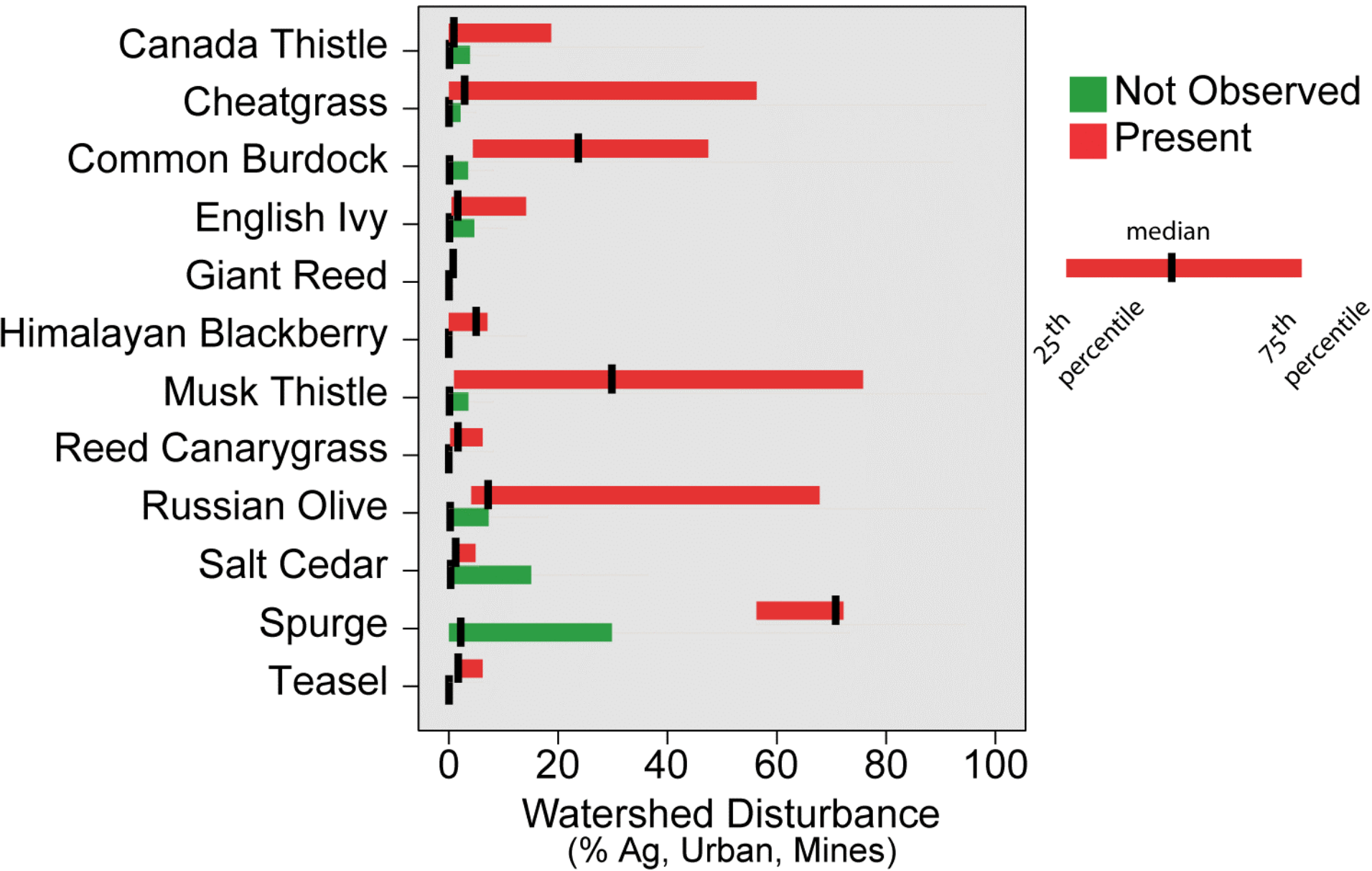
Selected Invasive Plant Presence - West Wide and Most Prevalent Region



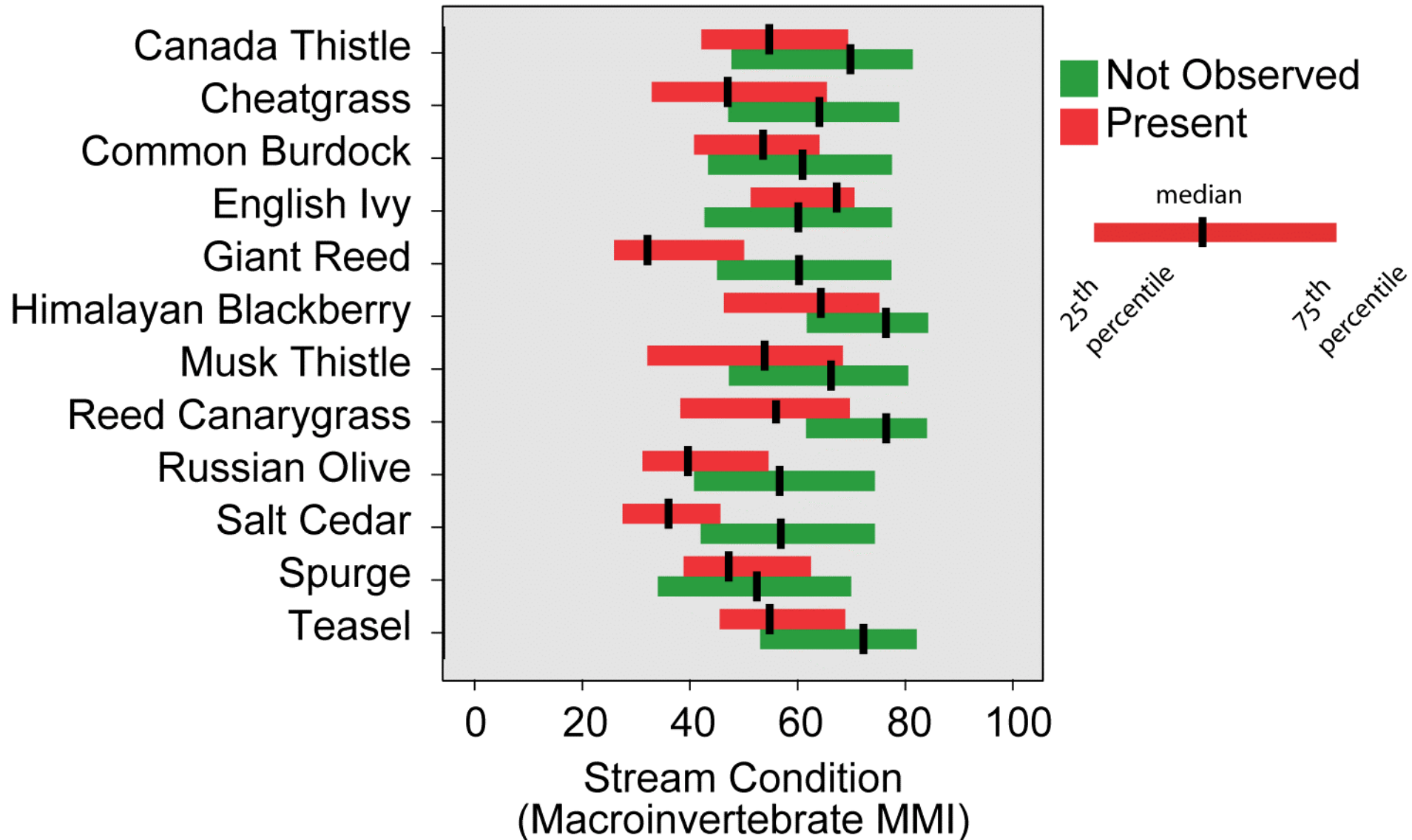
Selected Invasive Plant Presence – California



Invasive Plant Presence and Disturbance

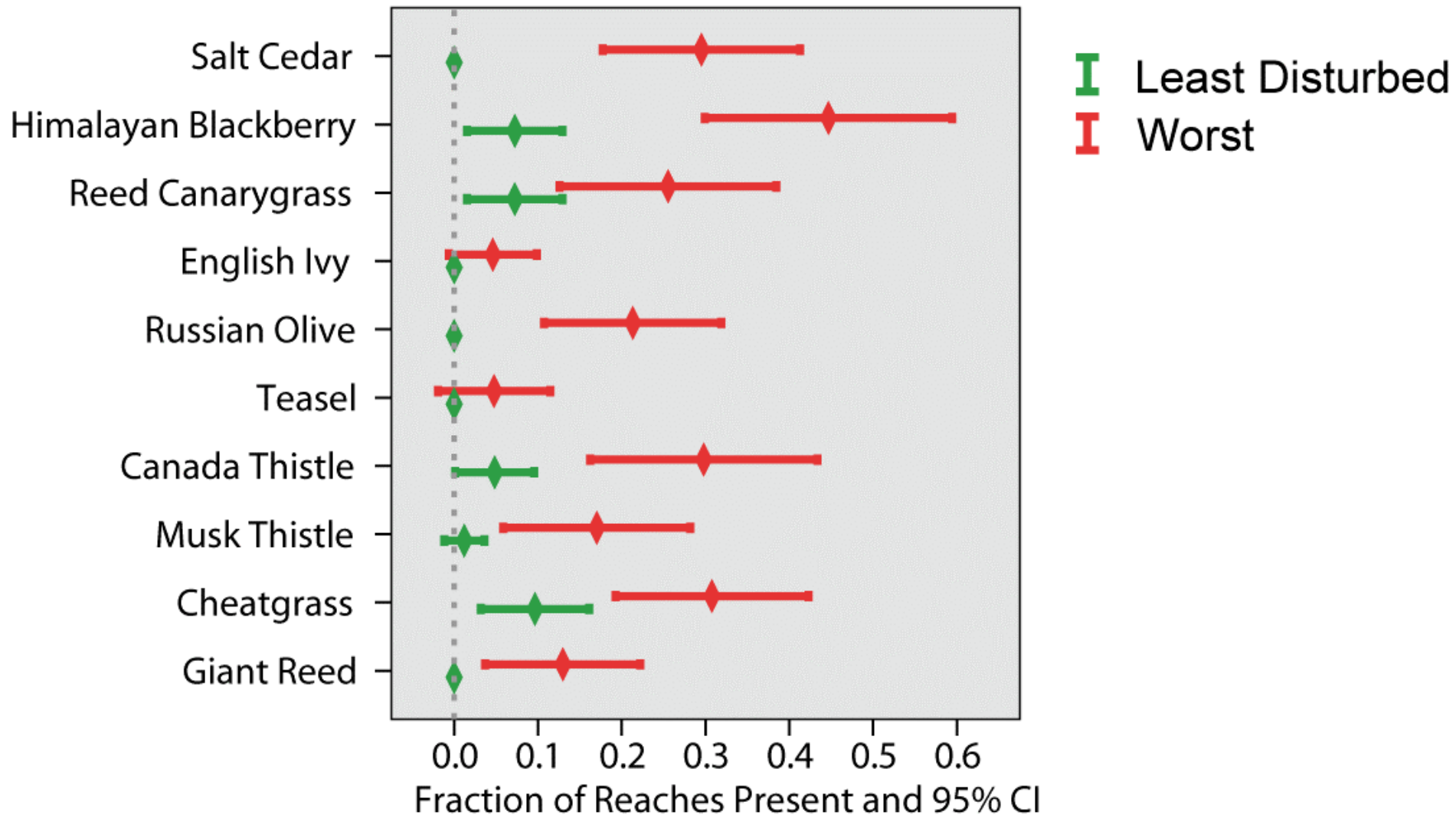


Invasive Plant Presence and Stream Condition



Minimal vs Least vs Worst

Ecoregions in CA



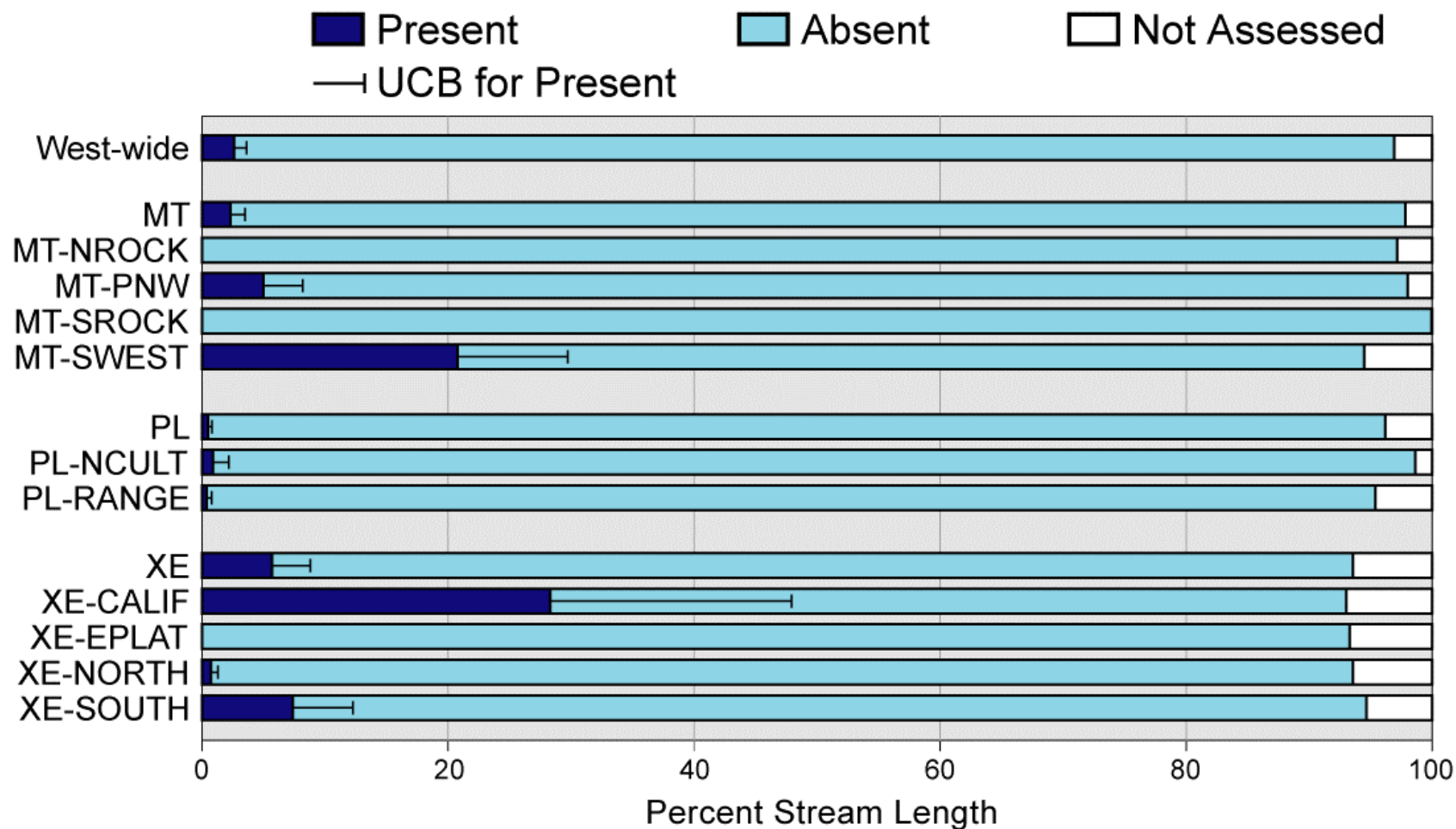
Conclusions – Selected Invasive Plants

- Extent of selected invasive alien plants in riparian ecosystems quantified
- Invasive plant presence associated with
 - Human activity
 - Reduction in stream biotic condition
- Cause and effect relationships cannot be inferred from these results
- Indicator of stream/landscape condition
- Minimally disturbed vs least disturbed

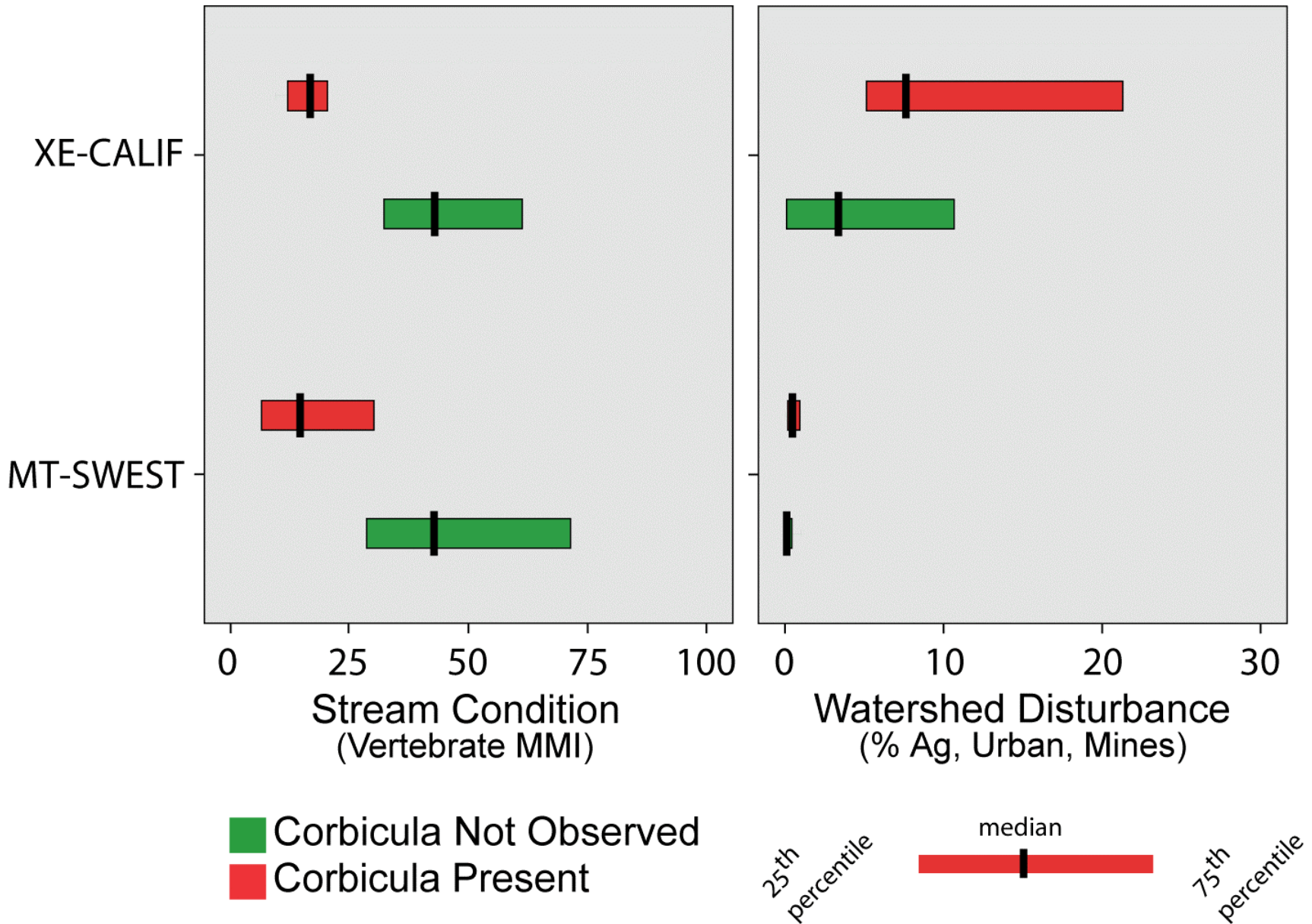
Alien Macroinvertebrate Analysis and Limitations

- 1,073,587 organisms were evaluated!!
- 83% identified to genus or less
 - More than enough for bioassessment
- Native distributions often not well known or documented
- Asian clam -- *Corbicula fluminea*

Asian Clam Extent



Biotic Condition and Disturbance



Conclusions -- Macroinvertebrates

- Limited Analysis
 - Taxonomic identification
 - Natural history information
- Asian clam presence associated with
 - Human activity
 - Reduction in stream biotic condition
- Cause and effect relationships cannot be inferred from these results
- Indicator of stream/landscape condition

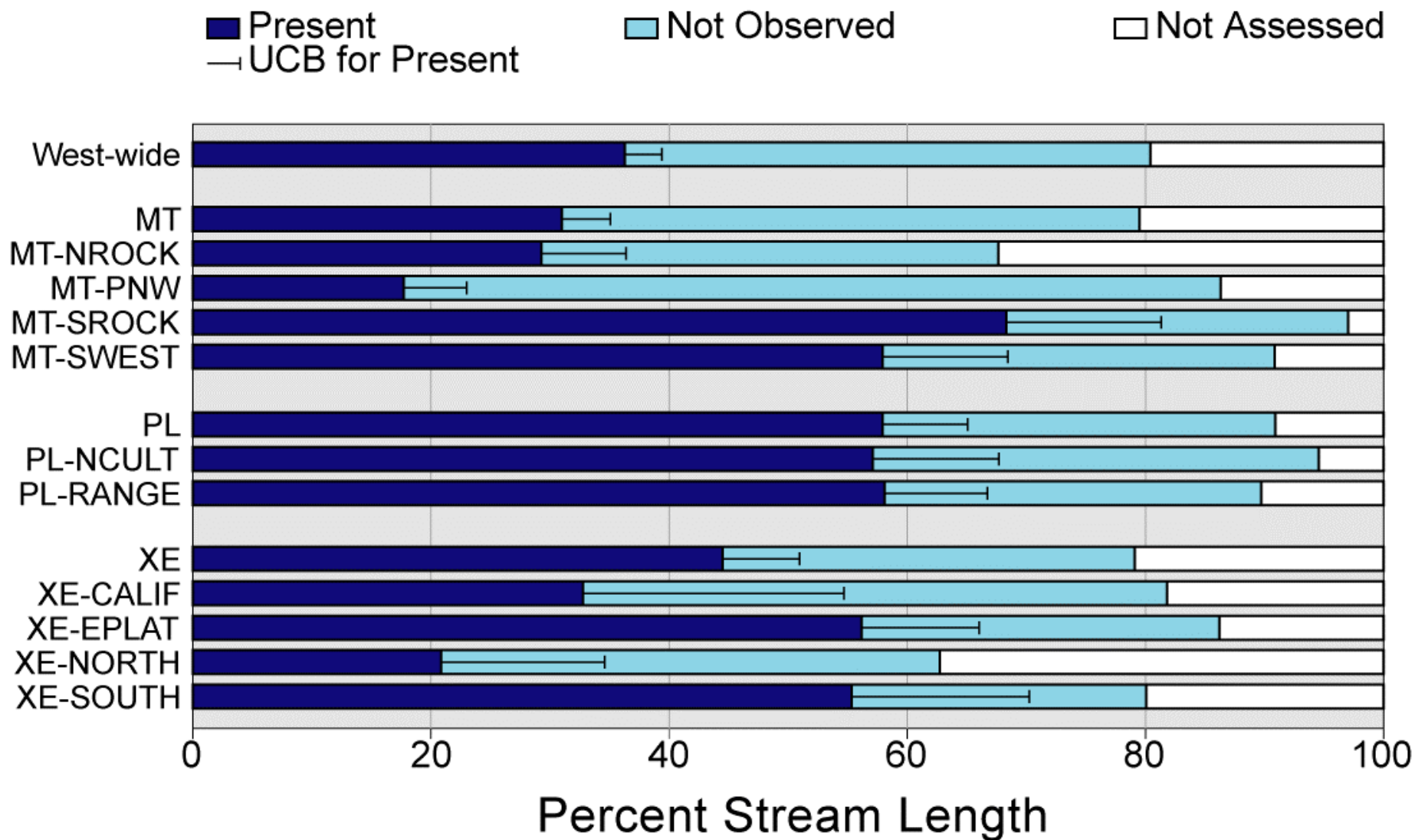
Specific Questions - Vertebrates

- Presence
- Relationship between native and alien fish
 - richness
 - abundance

Vertebrates

- 248,830 individuals evaluated
 - 157 fish taxa
 - 29 herp taxa
 - 17 T&E taxa
 - 131 taxa always native
 - 17 always alien
 - 38 alien depending upon location
 - Native, range extension, alien

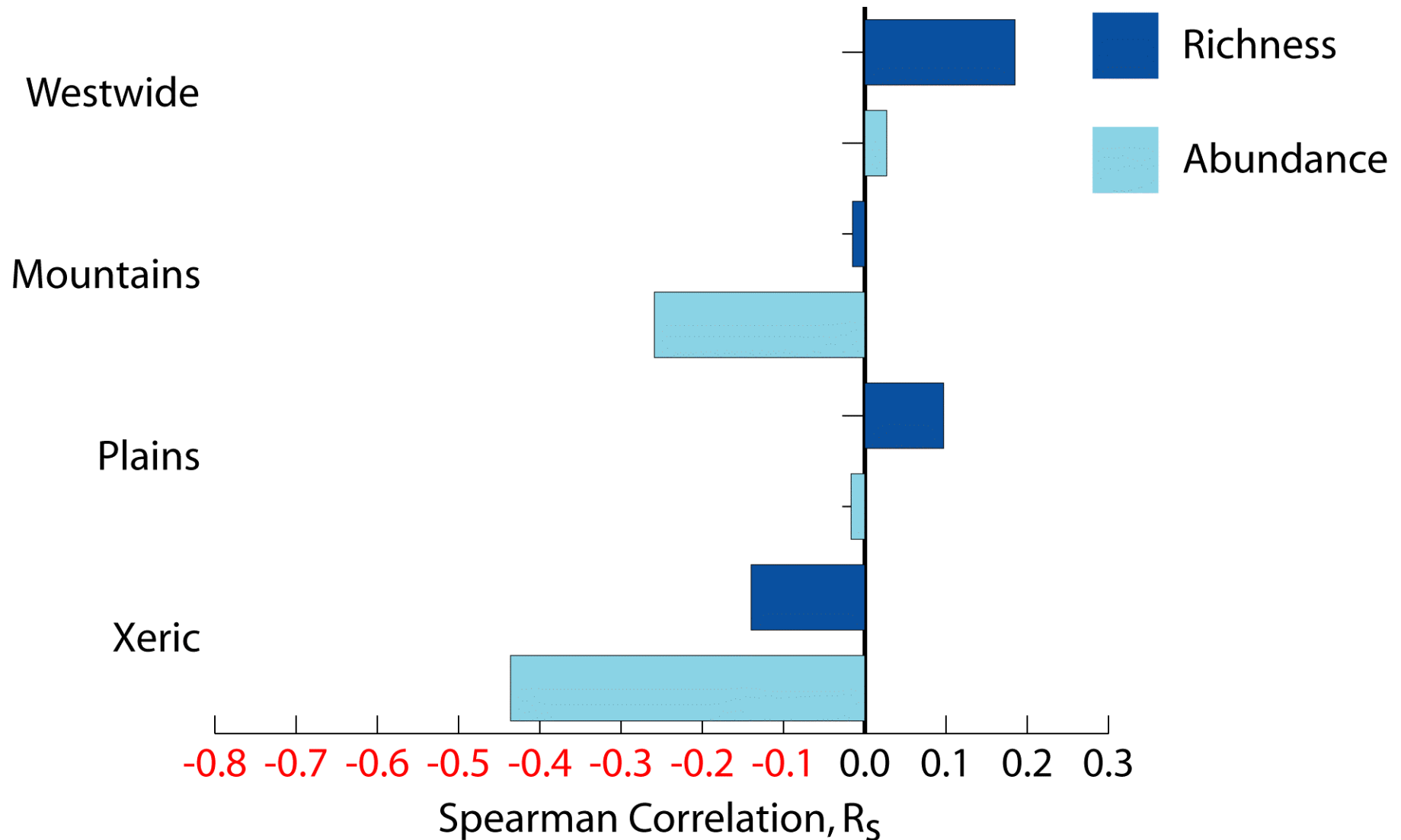
Alien Vertebrates



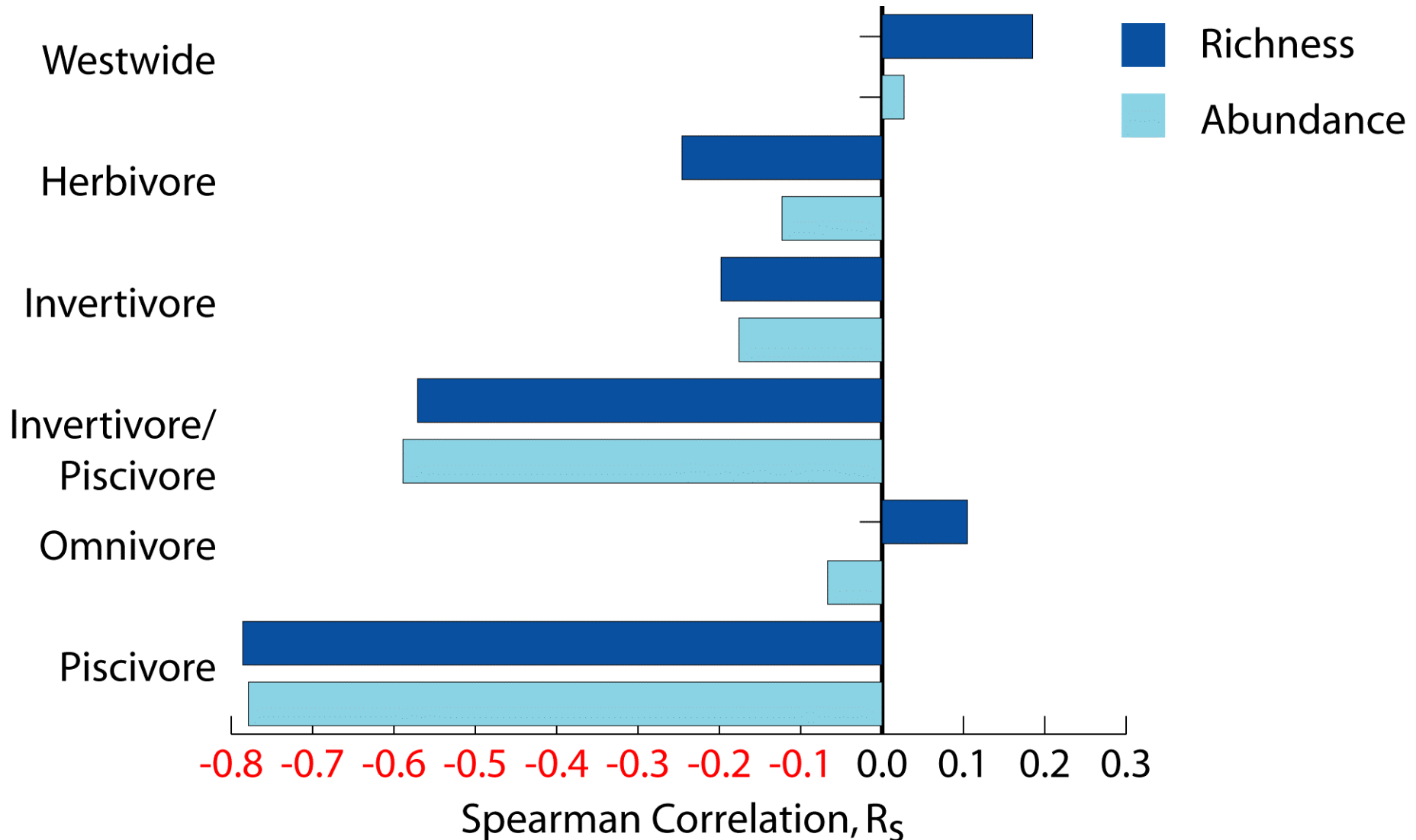
15 Most Prevalent Alien Vertebrates

- Brown trout
 - Brook trout
 - Rainbow trout
 - Common carp
 - Smallmouth bass
 - Green sunfish
 - Largemouth bass
 - Yellow perch
 - Red shiner
 - Yellow bullhead
 - Northern pike
 - Pumpkinseed
 - Bluegill
 - Bullfrog
 - Western mosquitofish
- 
- A photograph of a person's hands holding a brown trout over a body of water. The fish is speckled with dark spots and has a yellowish-orange belly. The person is wearing a dark green jacket. A yellow fishing rod is visible in the foreground.

Native vs Alien Fish



Native vs Alien Fish: Trophic Level



Conclusions - Fish

- Alien fish presence
 - Widespread
 - Generally intentional
- Aliens and natives negatively associated for some trophic levels
 - Insight to community assembly rules

Practical Implications for Bioassessment

- Fieldwork
 - Clean protocols for animals and plants
 - Invasive plants
- Laboratory Protocols
 - Taxonomic resolution
- Assessment Methods
 - Reference Conditions
 - Least Disturbed \neq Minimally Disturbed



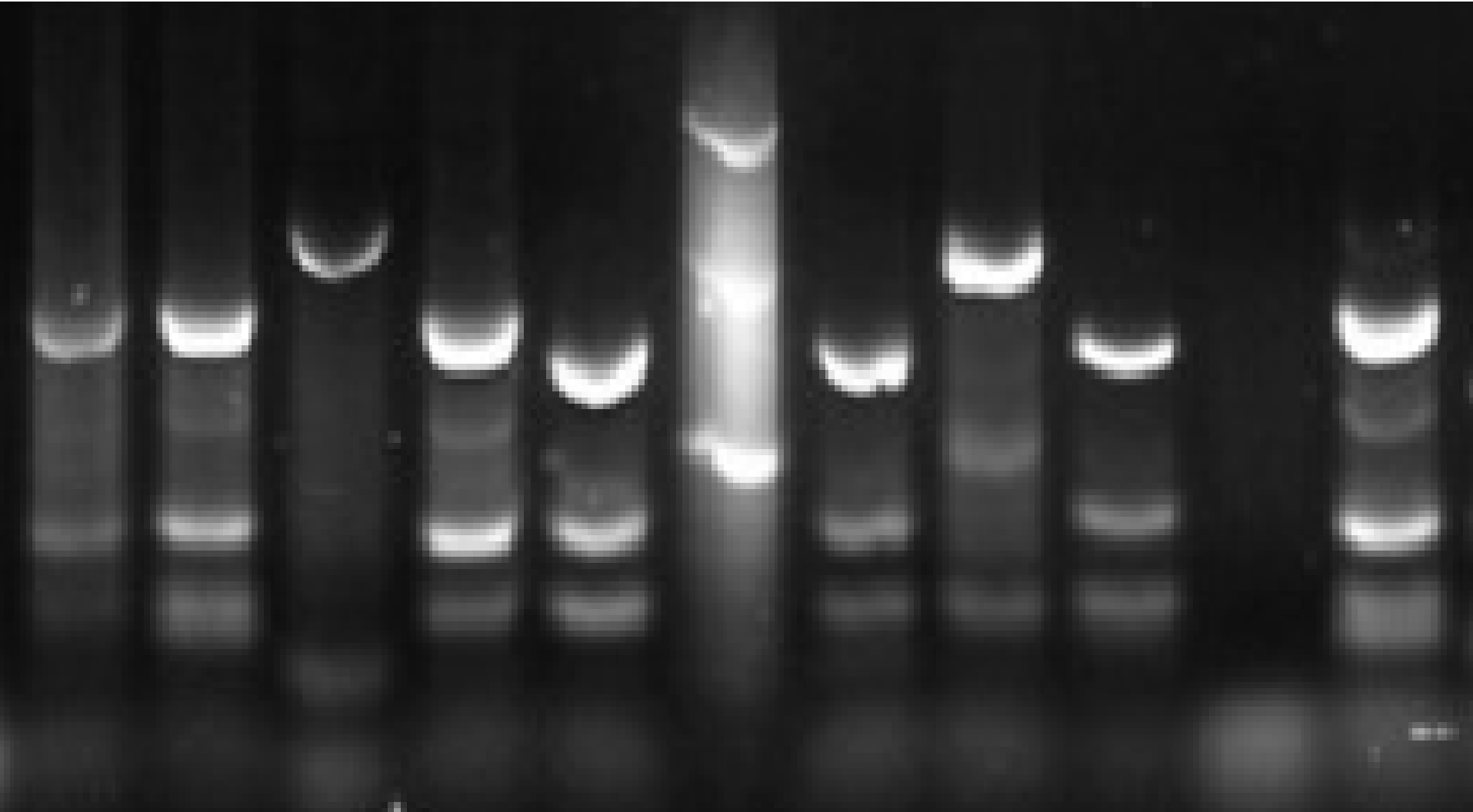
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New Zealand Mudsnail

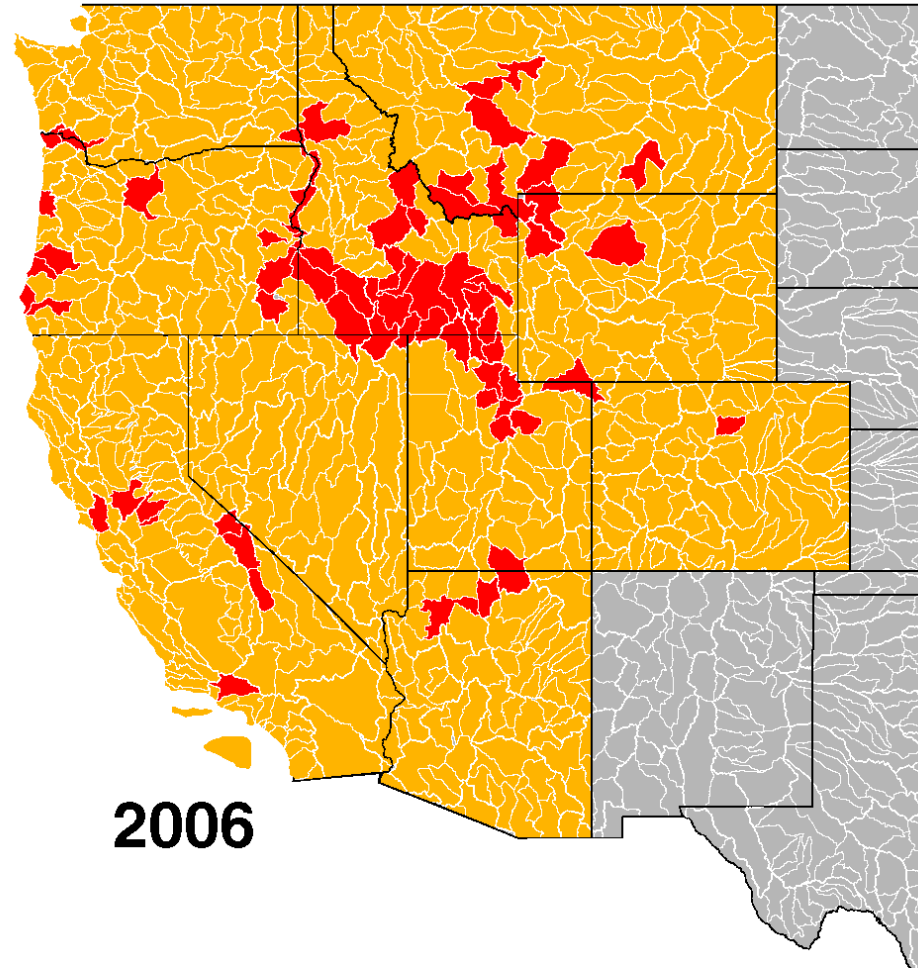
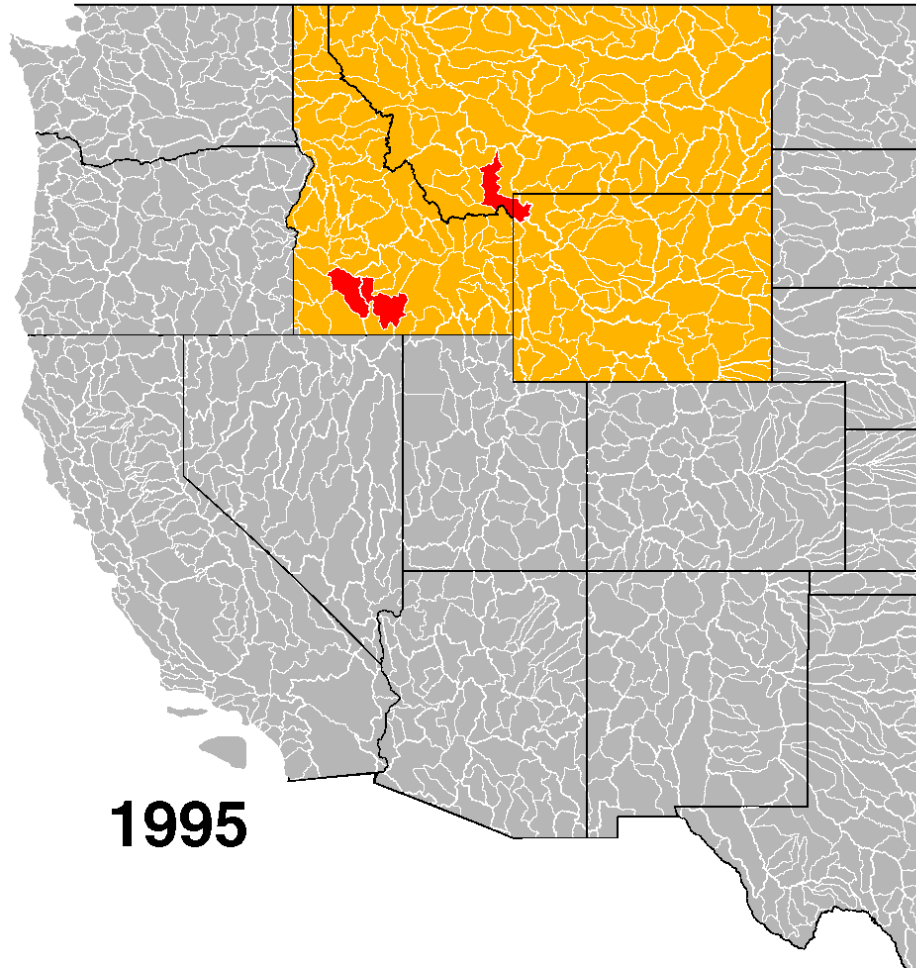
- 4 sites in Utah; < 0.5% of stream length
- Hydrobiidae not identified to species at 163 sites
- Molecular analyses – Paula Hartzell at EPA-WED
- Timing
- Sampling Protocol

Nine Hydrobiid organisms → 4 taxa

A A D A B REF B C B A



Timing



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