Riparian rehabilitation along the Colorado River in Glen Canyon National Recreation Area, Arizona

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Rehabilitation Setting in Glen Canyon

- Reduced flood frequency and sediment transport, no recruitment of native tree willow *Salix gooddingii*; beaver herbivory.

- Ecological stabilization of the riparian zone allowed colonization of lower riparian zone by non-native tamarisk (*Tamarix* spp.).

- Reduced flow fluctuations since 1991 allowed increased plant cover in lower riparian zone.

- Tamarisk leaf beetle (Chrysomelidae: *Diorhabda elongata*) causing mortality and rapid ecosystem change; restoration of *Salix gooddingii* and other native phreatophytes needed to provide corridor habitat for wildlife in the recreation area.

- Potential for northern leopard frog translocation to enhanced/ constructed frog habitat.

Conceptual Plan for Riparian Rehabilitation Projects

- Accessible pilot site: Lees Ferry, assess tamarisk removal and re-establishment of native vegetation. Heavy equipment and use of Lees Ferry irrigation system.

- Untreated site: Paria Beach tamarisk stand, long-term monitoring control (until alteration by tamarisk beetle).

- First stage remote site: Hidden Slough, apply Lees Ferry findings, boat accessible every 2-3 days, nearby camping, chainsaw removal and gravity irrigation, emphasize Goodding's willow recovery.

- Second stage remote sites: Hidden Slough plus Leopard Frog Marsh, riparian revegetation and leopard frog habitat rehabilitation. Construct frog ponds and monitor for habitat suitability and stability.

- Expanded monitoring sites: Paria Beach plus Lees Ferry, Hidden Slough, LF Marsh.

- Share findings with other riparian rehabilitation programs - Grand Canyon.

Rehabilitation Project Sites

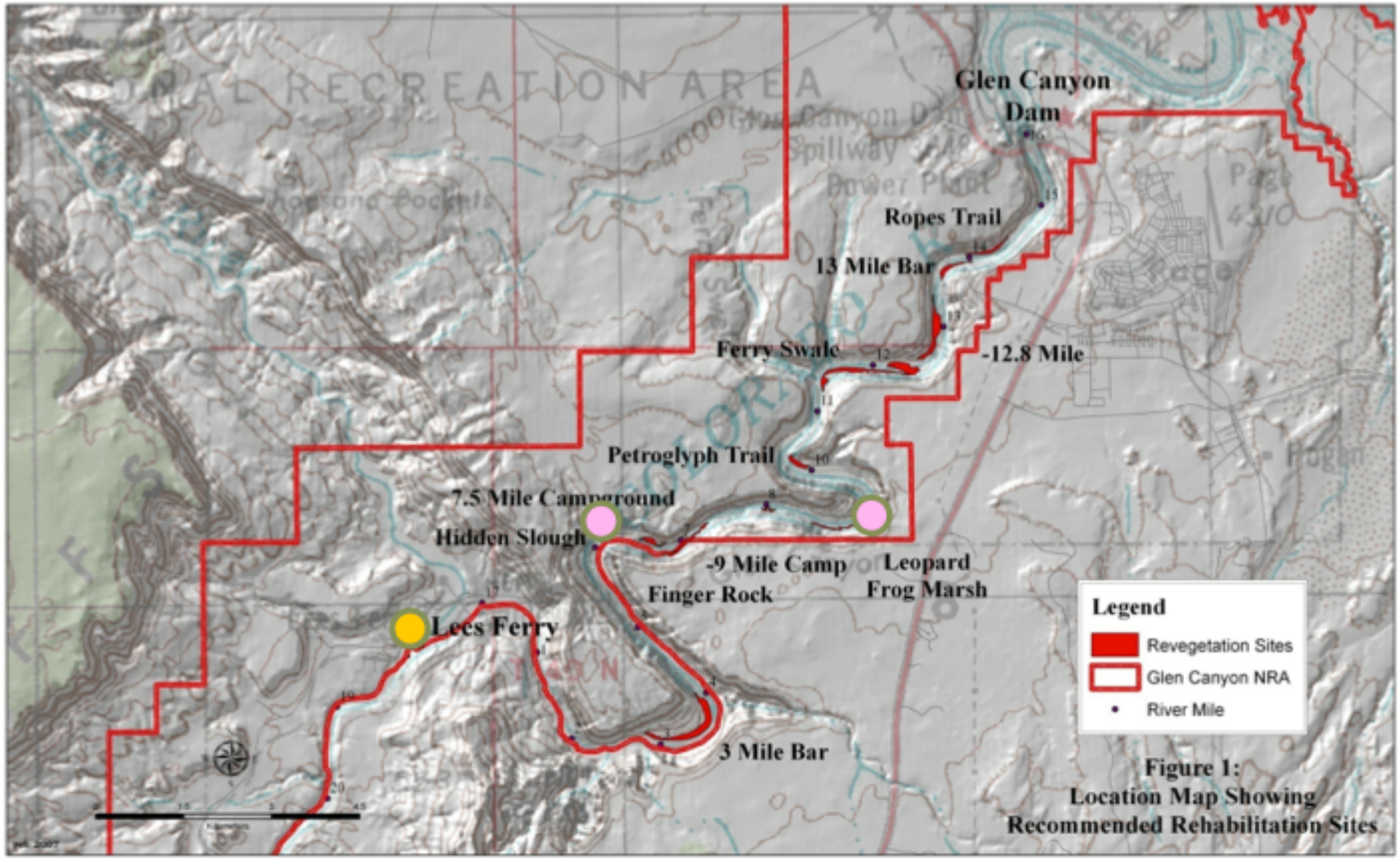
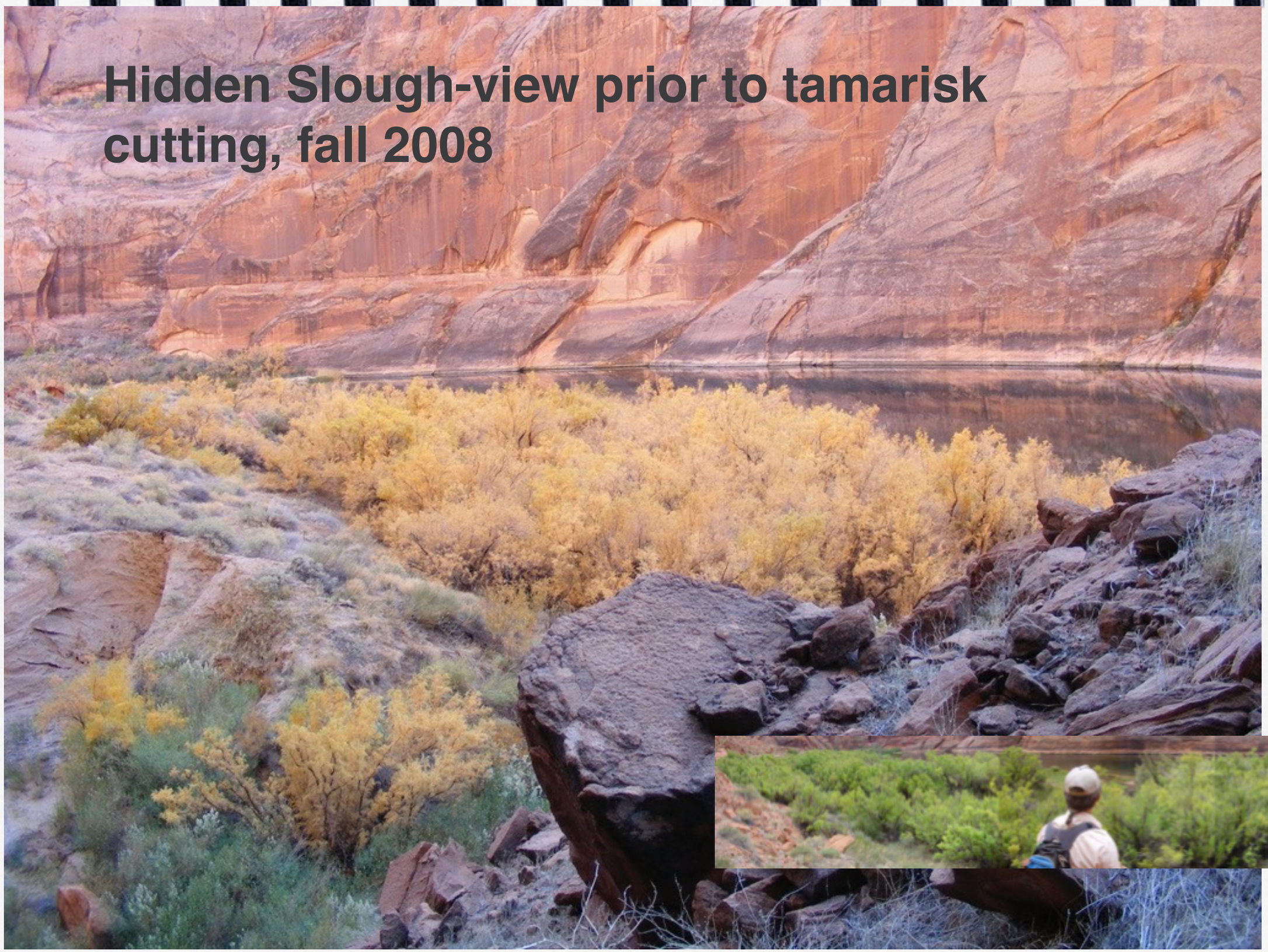


Figure 1:
Location Map Showing Recommended Rehabilitation Sites

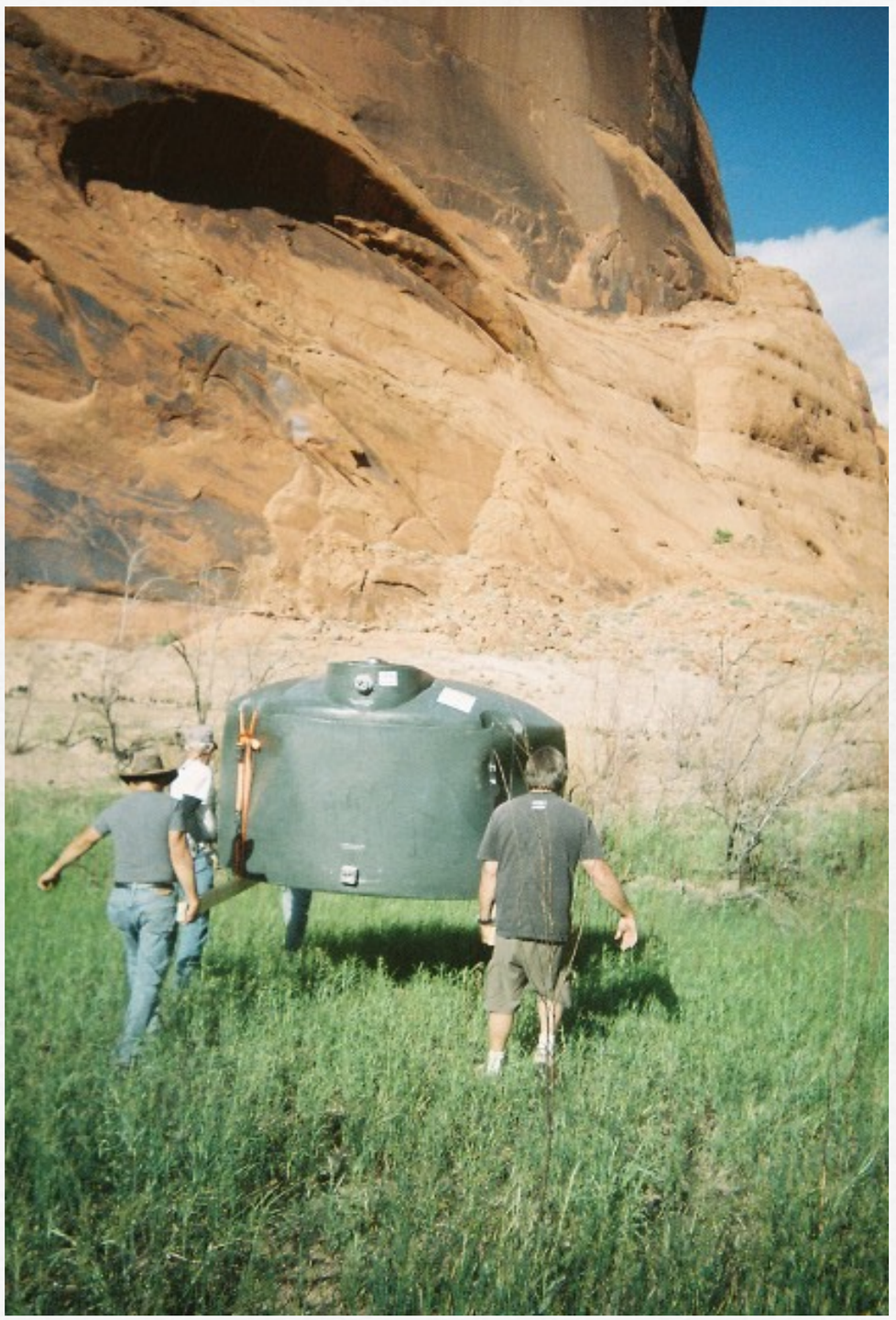
Lees Ferry site after 9 yrs.

Hidden Slough-view prior to tamarisk cutting, fall 2008

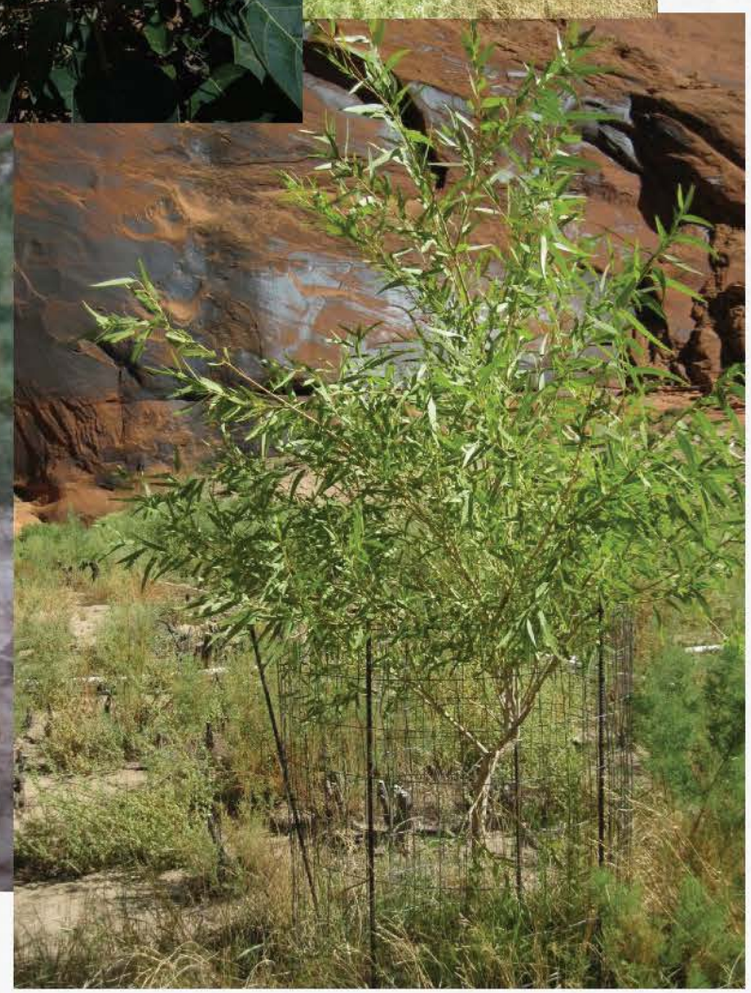


Zion National Park
Fire Crew Burn Photos
(March 2009)

Irrigation Piping (Sept 2009)



Seeding (four-wing saltbush, April 2009 and February 2010)



Site maintenance: boat with pump, tank refill pipe, cutting tamarisk shoots

Tamarisk Leaf Beetle larva

Hidden Slough - Summer 2014

Results

- *Populus fremontii, Salix gooddingii* and *S. exigua, Acer negundo,* and *Baccharis emoryi* required depth to water table of ≤2 m.
- Beaver fencing is essential, some success with sandy paint applied prior to HFEs to prevent herbivory above caging.
- Mean rate of tamarisk manual removal at HS was 0.003 ha/hr (2 weeks large field crew). Cut stumps were treated with Garlon, retreated and in following years re-sprouts hand cut.
- Gravity-driven irrigation proved most effective at HS.
- Phreatophyte pole planting is more efficient at remote sites.
- Rehabilitation sites require growing season maintenance 2-3 times/week.

Results continued...

- Lees Ferry, native vegetation cover increased to >80 percent within 3 yr, and riparian tree height exceeds 10 m after 10 yr. Hidden Slough plantings survivorship ave. 82% (2014)

- Avian diversity and herpetofaunal density at Lees Ferry exceeded that in the pretreatment tamarisk stand and at control PB within 2 yrs.

- Small mammal assemblage at Lees Ferry remains a monoculture of *Peromyscus eremicus*, lower diversity than at PB and LFM. LFM supports the only known population of western harvest mouse (*Rheithrodontomys megalotis)* remaining along the Colorado River below Glen Canyon Dam. Muskrat, raccoon, and possible badger tracks observed, and Woodhouse's toad (and juveniles)

- Rehabilitation of riparian vegetation can be rapid and effective, but not all ecosystem components recover at equal rates. Rehabilitation is farming.

Future opportunities...

- Proposed next stage: Paria Beach riparian rehabilitation.
- Future remote sites: implement priority sites identified in NPS Glen Canyon reach. Complete a corridor of native riparian habitat.