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Vegetation Monitoring:

Remote Sensing of Vegetation

B. Ralston, GCMRC, October 15, 2008

U.S. Department of the Interior
U.S. Geological Survey

Vegetation of Colorado River Ecosystem

Mix of communities

Related to multiple resources

- -Wildlife
- -Recreation
- -Cultural/archaeology

Separate management objectives

- -exotic species
- -SSQ – shoreline habitat/backwaters

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Objective of Presentation

- Review results of 2002 Vegetation Mapping Effort
- Explain capabilities and utility of vegetation area change detection
- Provide examples application of vegetation map for other resources.
- Anticipated Activities/Results in FY09.

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Background

- Protocol Evaluation Panel Convened March 2000.
- Recommended river-wide GIS coverage of vegetated area for habitat analysis.
- May 2002 digital CIR flown for river corridor
- Vegetation Mapping Project Initiated March 2003.
- Final Open File Report completed July 2008.

  -http://pubs.usgs.gov/of/2008/1216/

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Why Map Vegetation?

- Vegetation is dynamic
  - -Operations
  - -Local climate
- Primary component of animal habitat
  - arthropods – food base
  - Nesting habitat/ground cover riparian birds/small mammals
- Knowing types and amount of vegetative cover can help explain other observed biological interactions
- Vegetated area is a component of AMP Information needs

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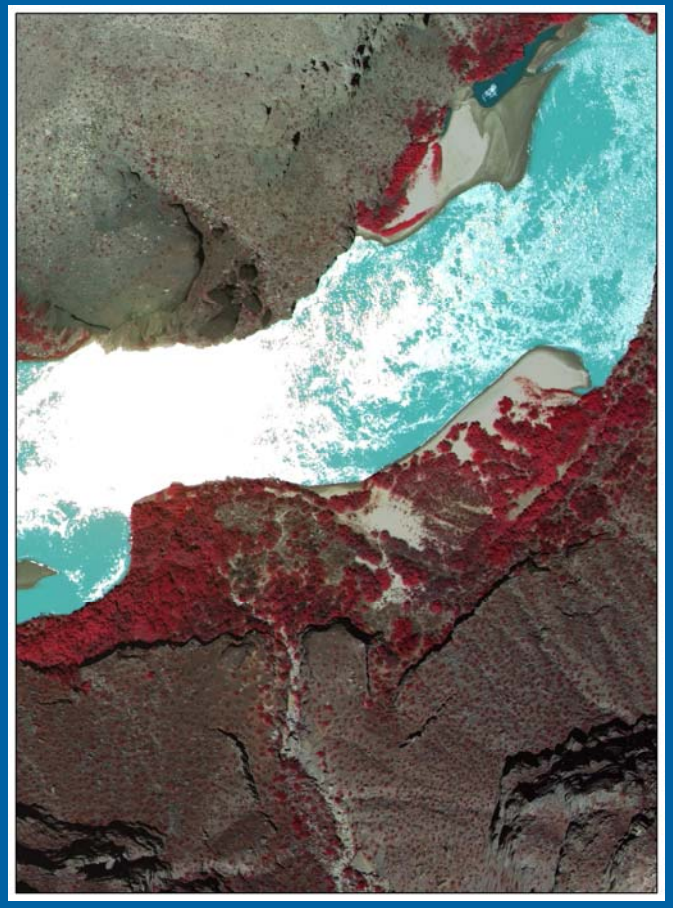
Vegetation Mapping Approach for CRE



Field and Lab Based Activities

-Vegetation Class Identification

- Ground-based sampling
- TWINSPAN

- Selection of training areas*

- Identification of spectral signature of classes

- Classifying imagery

- Automated classification routine to assign class values to pixels

- Accuracy Assessment

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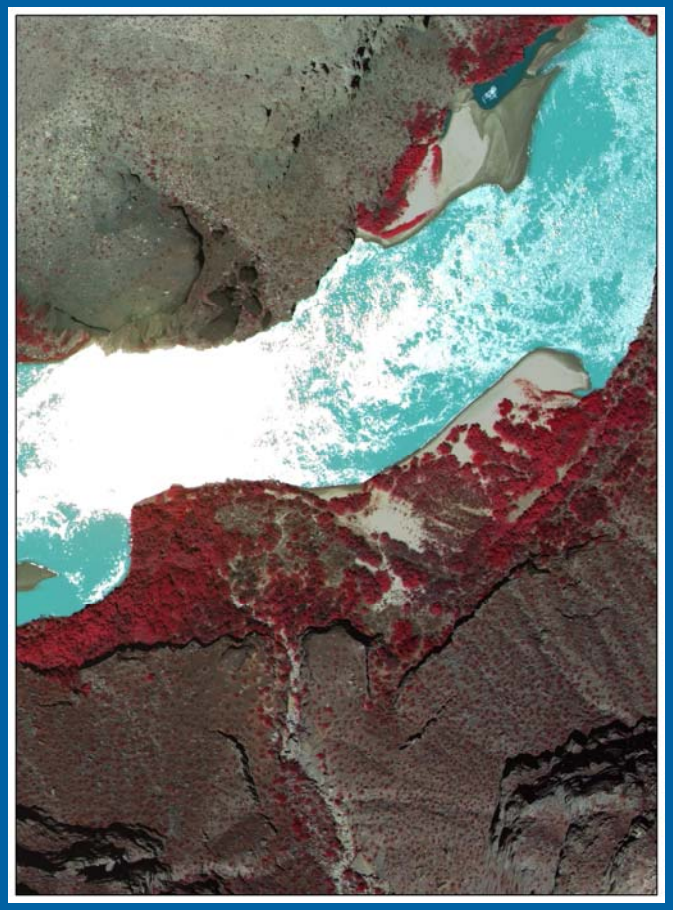
Vegetation Mapping of CRE



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Classification Categories

-Wetland - *Phragmites/Scirpus*, combined with *Typha domingensis/Carex aquatilis* (common reed/cattails/sedges)

-Baccharis emoryi/Salix exigua - **(**seepwillow/coyote willow)

-Tamarix ramosissima/Aster spinosa (saltcedar)

-Pluchea sericea (arrowweed)

-Prosopis glandulosa/Acacia greggii/Baccharis sarothroides (mesquite/catclaw acacia/desert broom)

-Sparse Shrubs (desert shrubs, bunch grasses)

-Non-vegetated (rocks, sand)

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Classification Accuracy

- Initial accuracies varied with each class from 49-100%.
- Accuracies affected by similar reflectance values of classes, density of vegetation, sparse, small foliage of dry adapted species.
- Accuracies improved to >80% among all classes with application of fuzzy logic*

*(alternative assessment approach that allows for degrees of membership to particular classes. Accuracies are assessed in categories of agreement such that a class might be mostly correct instead of simply correct or incorrect.)

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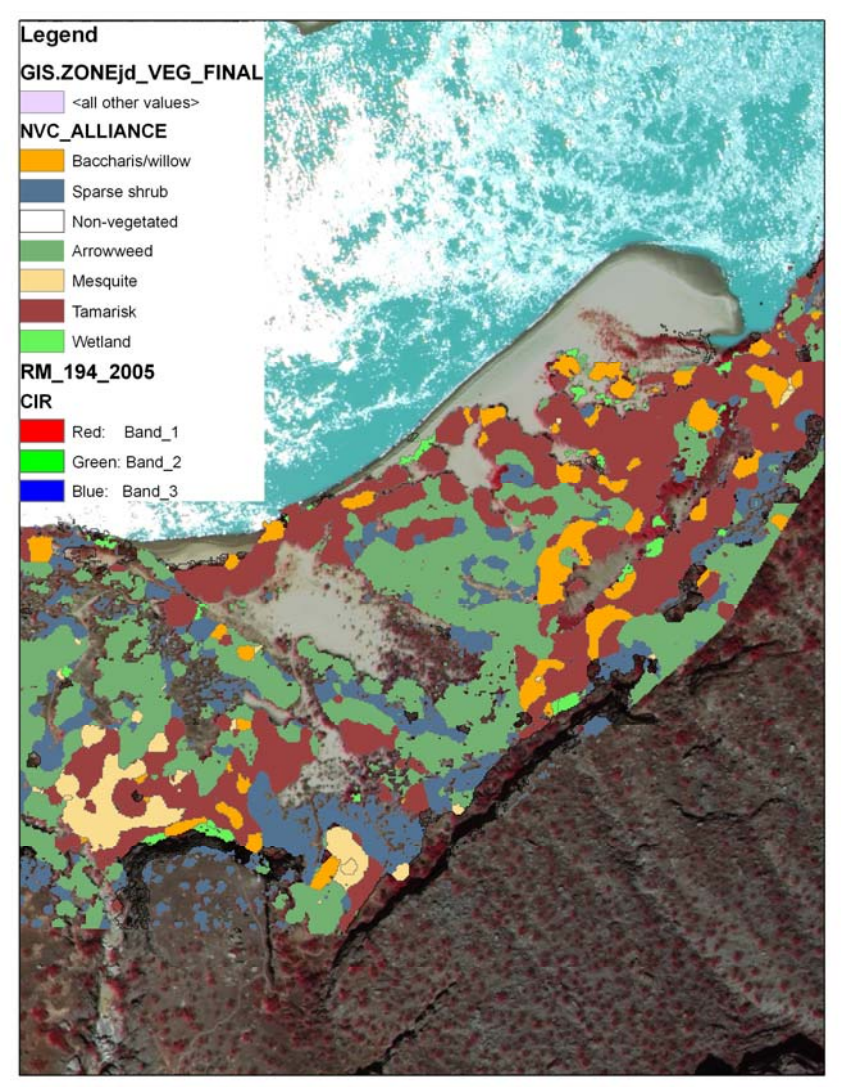
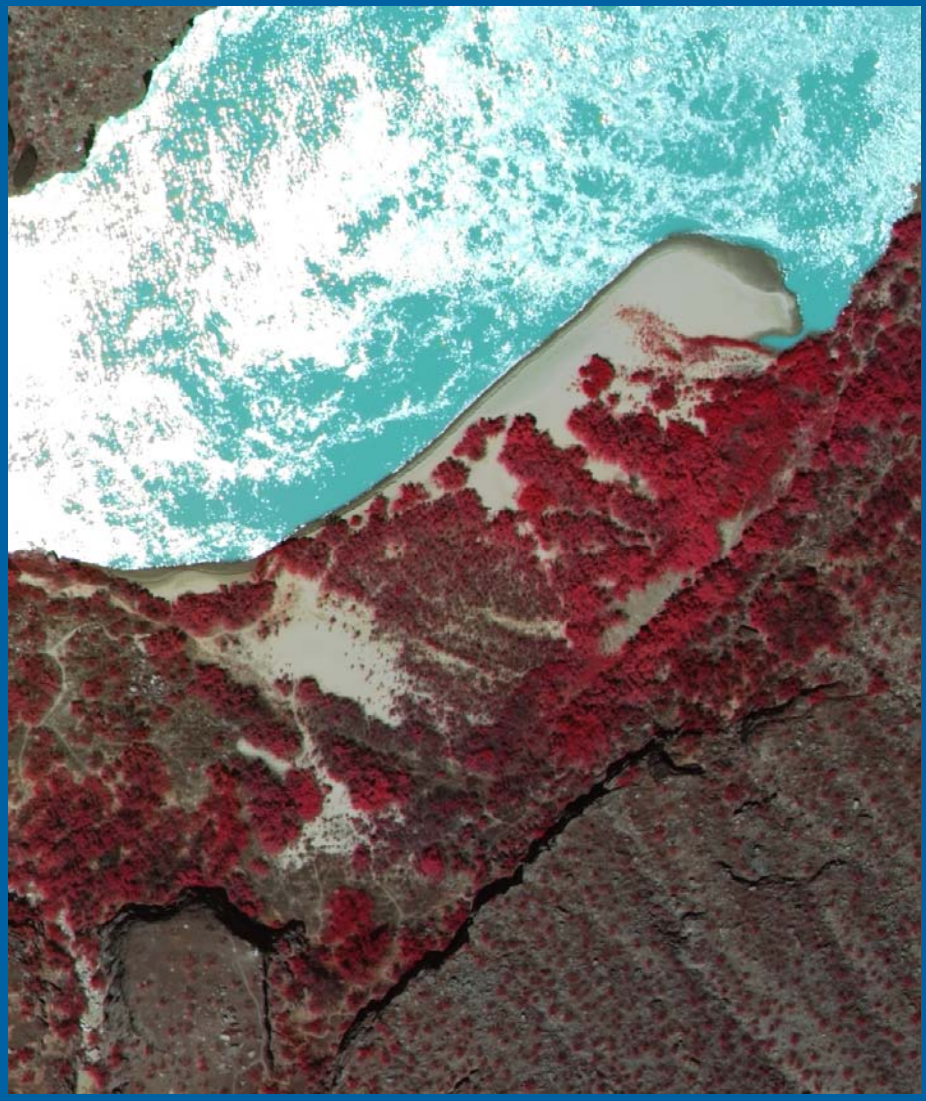
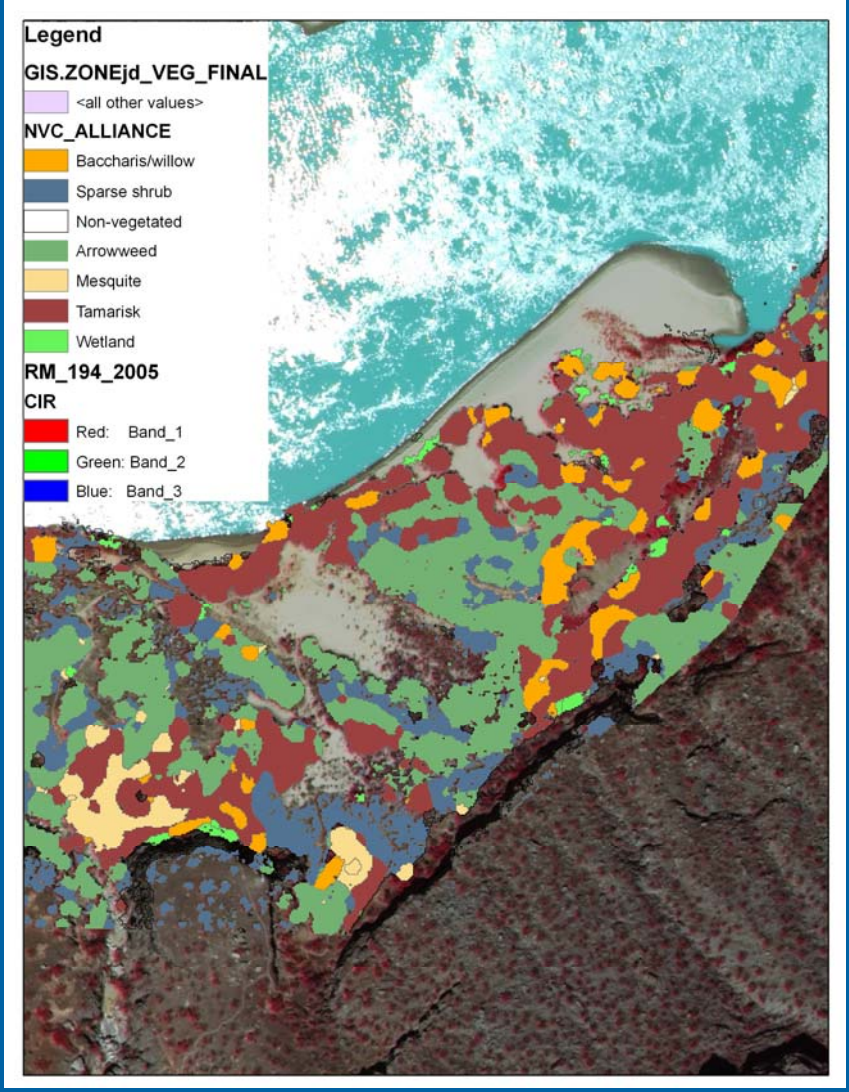
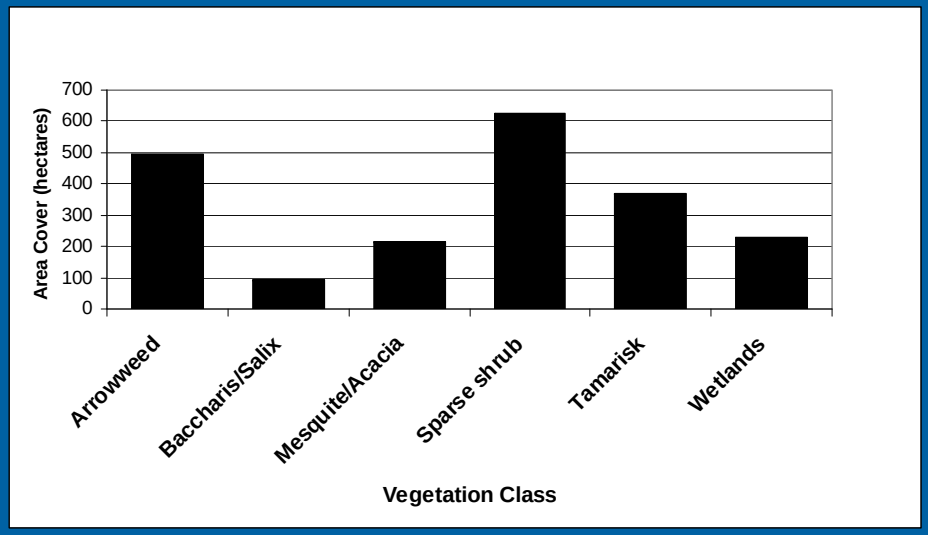
Vegetation Mapping of CRE

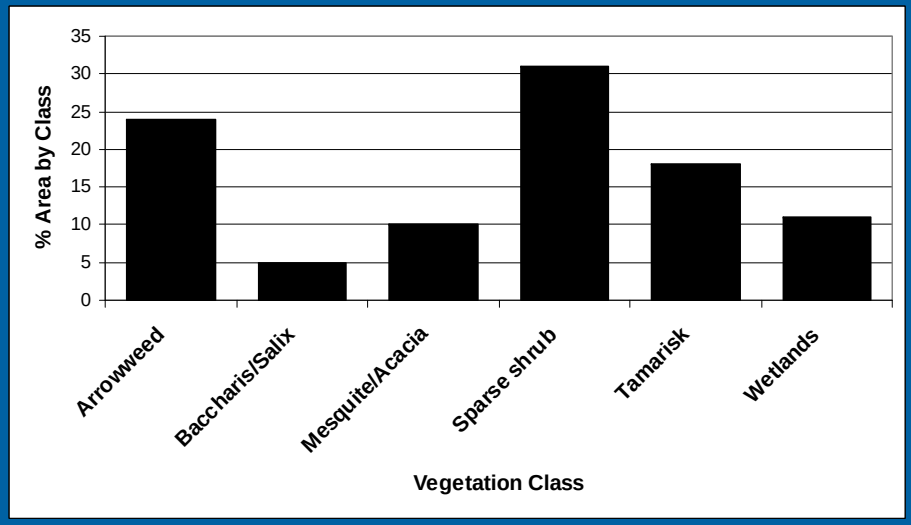




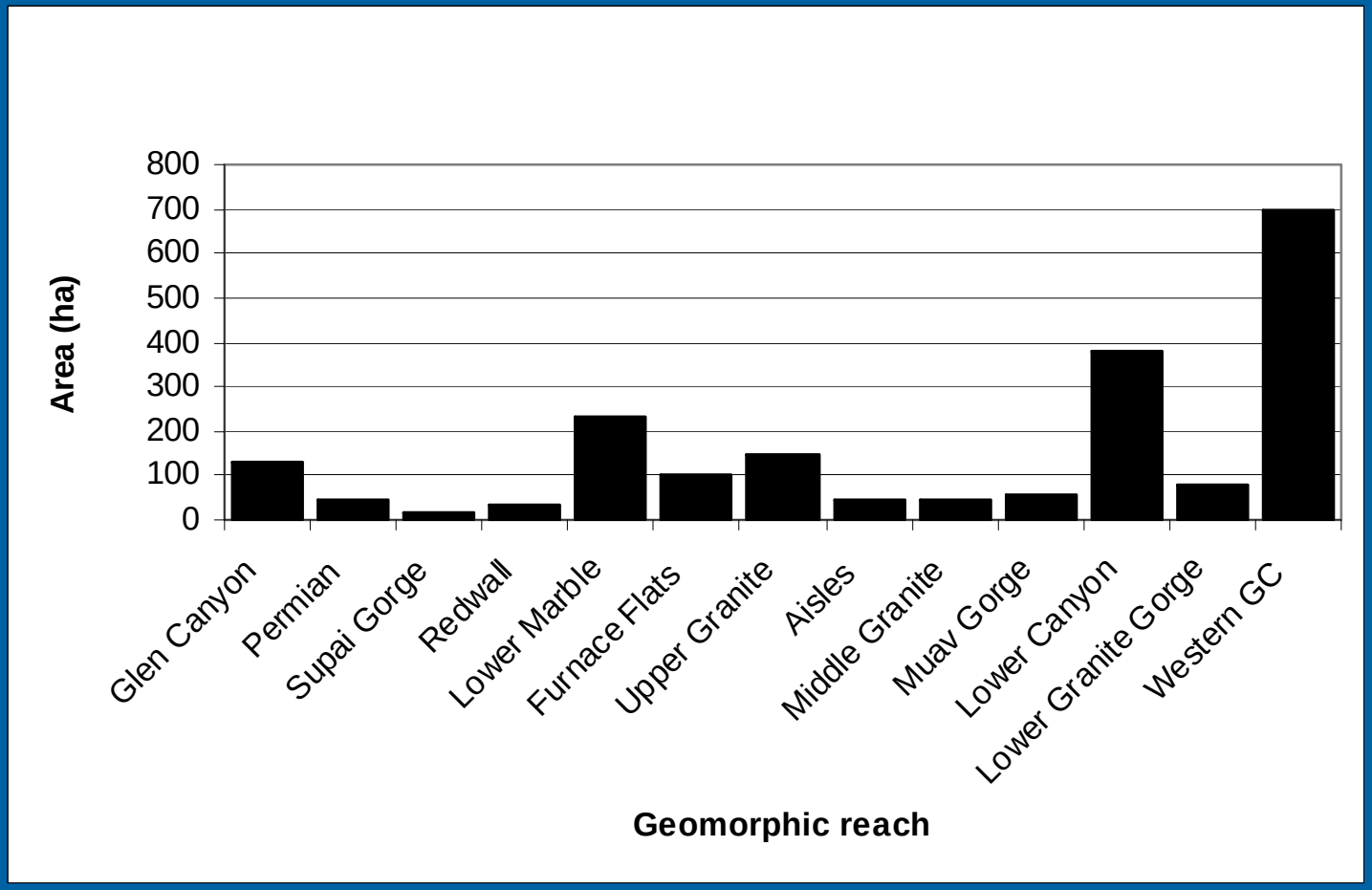
Vegetation Mapping of CRE







Area by Geomorphic Reach



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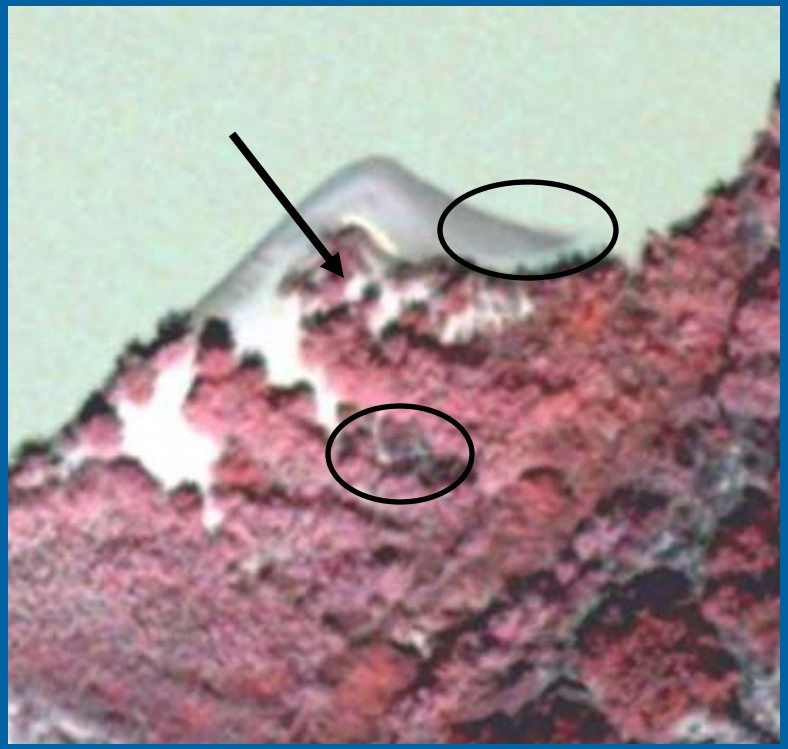
Application: Comparing 1998 and 2005 Imagery – CIR Allows Area Change of Classes



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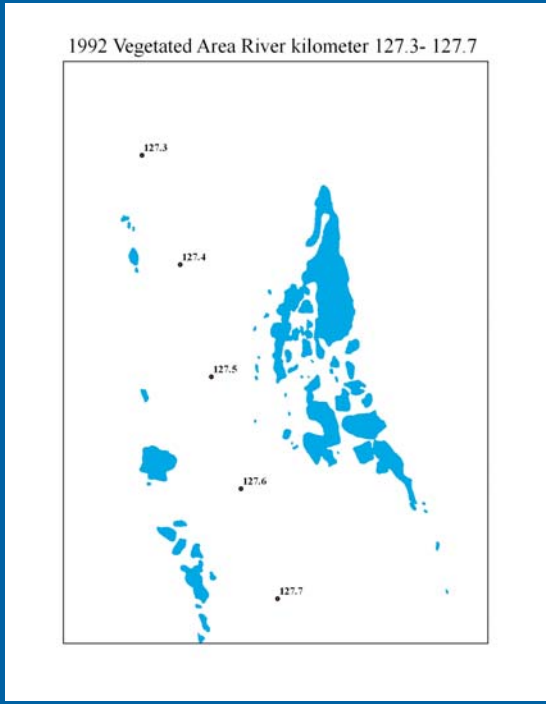
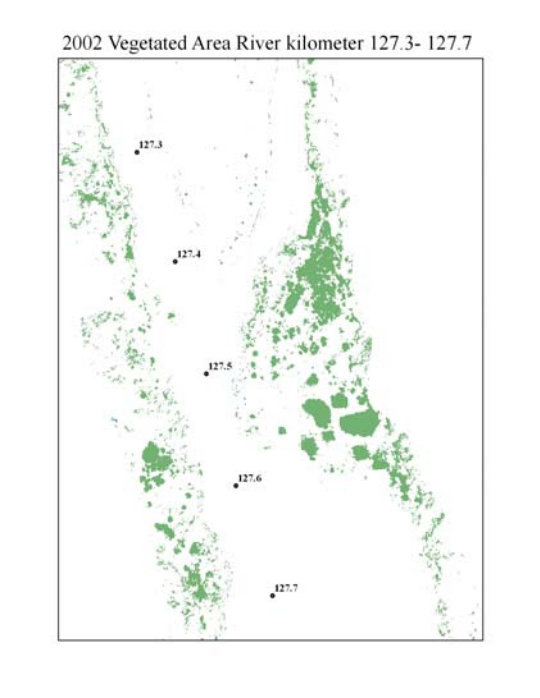
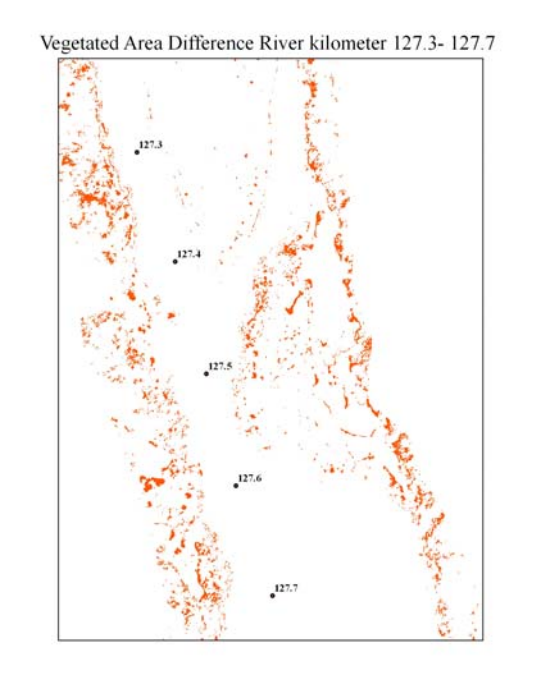
Application: Change Detection 1992-2002 of Vegetated Area







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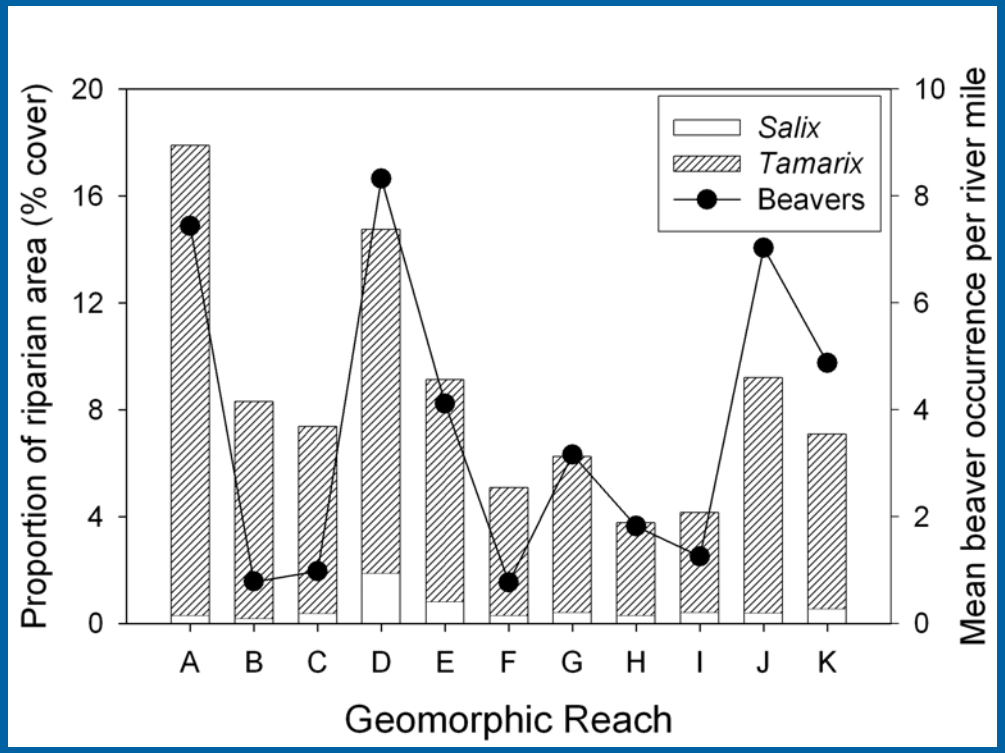
Application: Community Change/Biotic Interactions



Used location and area of saltcedar, coyote willow from vegetation map and beaver data from NPS (1999-2003) to correlate changes in vegetation cover and species occurrence with beaver densities (Mortenson and others, 2008)

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Limitations of Remote Sensing

- Only provides area cover of general categories
  - Does not provide information about community change (e.g., herbaceous exotics) – need ground based sampling & remote sensing
- Change detection at class level is dependent on image quality
  - Reflectance value overlap reduces ability to separate vegetation classes
  - Object-oriented and additional environmental variables can be used to increase accuracies

http://pubs.usgs.gov/of/2008/1216/

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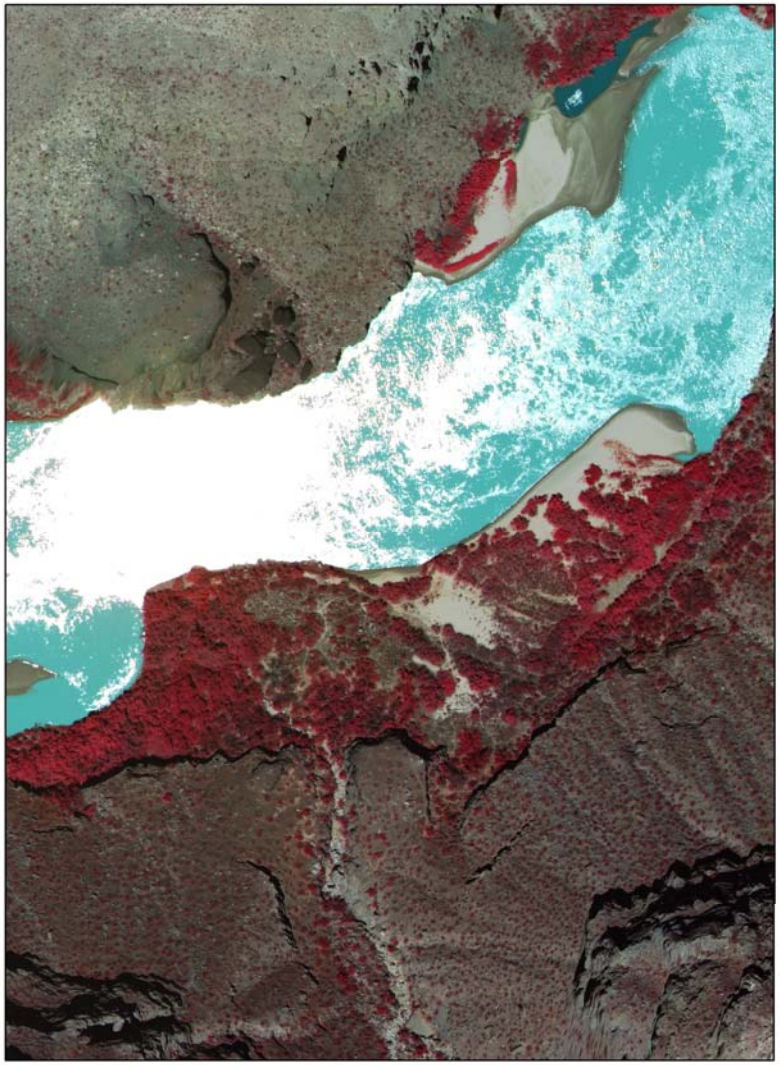
FY09 Vegetation Mapping Activities

- Complete mapping of 2005 vegetation classes with accuracy assessment in May 2009 (coinciding with 2009 over flight).
- Compute change detection of 2002 – 2005 vegetation classes.
- Develop draft report by summer/fall 2009



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