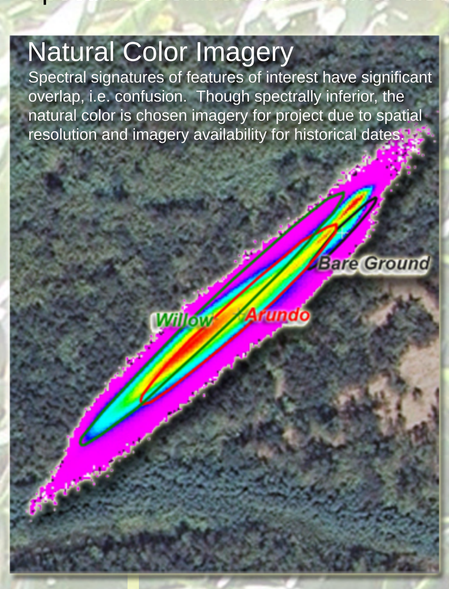
Arundo donax Monitoring - Remote Sensing

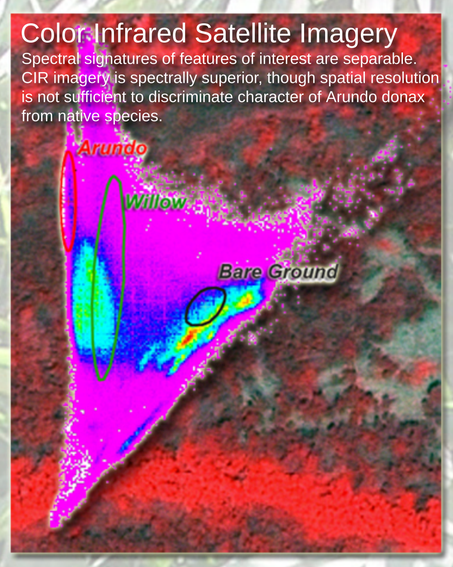
Mapping Weeds from the Ground, Air, or Beyond

A program to control giant reed (Arundo donax) on the Santa Clara River in Ventura County is the first part of a 233-acre comprehensive habitat restoration plan. The control has been implemented by the initial use of a Hydro-Ax to shred dense stands of giant reed, followed by herbicide application to treat root ball re-growth. To date, program effectiveness monitoring of the site has been based on field mapping; however, the site has some difficult access through dense riparian habitat. Therefore, we began exploring the use of remote sensing to increase the efficiency of monitoring over the 233-acres for the next seven years. Presented here are the results of our investigation into the use of remote sensing analysis to map A. donax and to complete the effectiveness monitoring. Utilizing freely-available natural color photography and advanced remote sensing techniques, A. donax was successfully quantified over the 223-acre site for the years 2005, 2007 and 2009. The use of remote sensing methodology makes possible the efficient delineation of this invasive species in otherwise impenetrable areas of our project site.

Remote Sensing Mapping Methodology

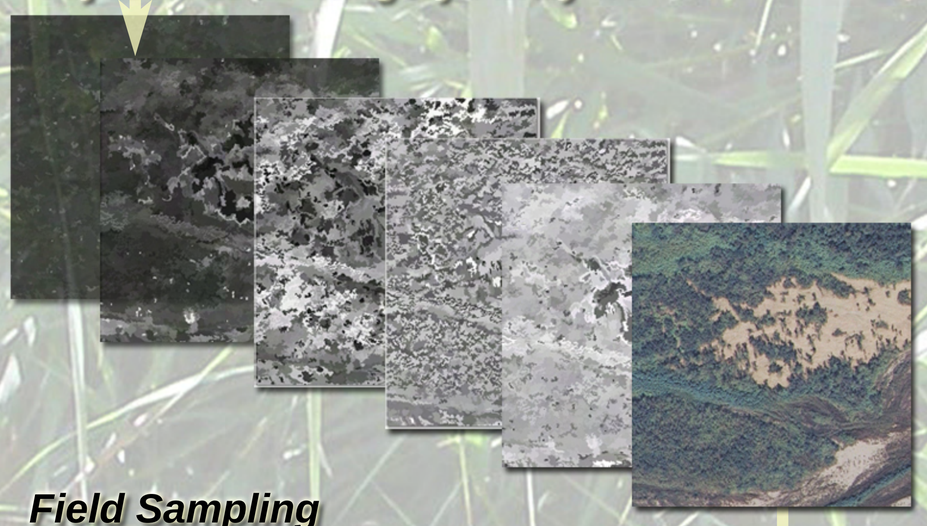
Challenge: Utilize historical imagery to determine Arundo donax extent. Historical imagery is primarily natural color photography which lacks spectral resolution sufficient to discriminate Arundo from native species.





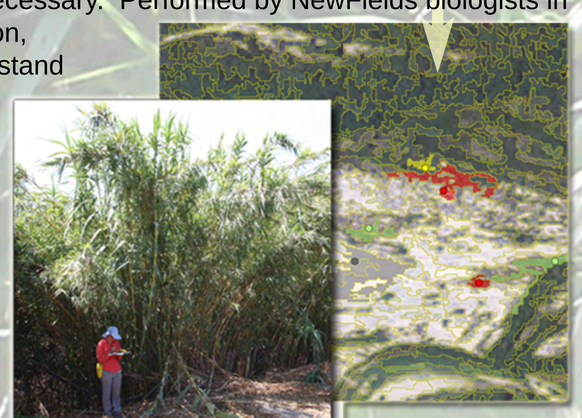
Lacking spectral resolution, leverage spatial resolution through use of object-based classification approach, rather than pixel-based. Base discrimination on spectral, textural, and contextual elements of imagery.

Object-Based Imagery Analysis



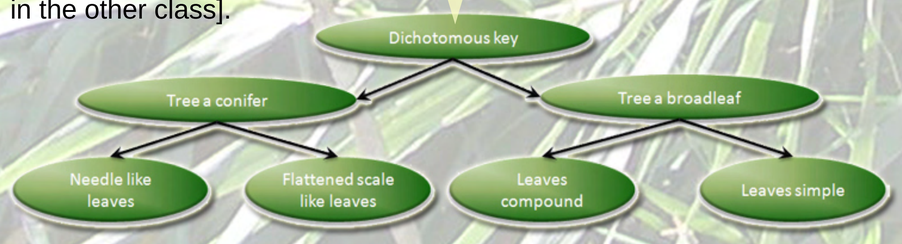
Field Sampling

Minimal Field Sampling necessary. Performed by NewFields biologists in 2009 recording X,Y location, homogeneous vegetative stand characterization, and field photo. Field Sampling leveraged to previous dates based on object characteristics.



Data Mining

Data mining procedure similar to dichotomous classification key in that the classifier decides which of two specified (binary) alternative conditions the object satisfies. The path followed from each point of divergence in such a key is based on the conclusion reached by the classifer as to what is being observed. Process continues until no separable conditions remain and all observations are classified. For example, the stem rough [resulting in assignment in one class] or the stem smooth [resulting in assignment in the other class].



Results / Accuracy Assessment

Project presently being finalized with statistical analysis of classification accuracy in progress. Early findings with commentary for three dates follow:
2005: 80% classification accuracy - NAIP imagery to 2005 site survey eval
2007: 87% classification accuracy - highest spatial resolution imagery (1')
2009: 75% classification accuracy - Analysis based on inferior quality NAIP (wavelet-compressed) imagery, thus lessening discrimination success.

NEWFIELDS