Preliminary Economic Contributions to USDA-ARS Biological Control of Arundo donax in the Rio Grande Basin

Problem and Objective
- Consumption of scarce water resources exacerbated by the unmitigated growth of giant reed.
- Analyze the economics of proposed biological control management program.
- Estimate the program’s life-cycle cost and the potential economic benefit of recaptured water.

Giant Reed (Arundo donax)
- Perennial, aquatic invasive weed that thrives along riparian areas of the Rio Grande Basin.
- Native to the Mediterranean Basin and was imported by immigrants for thatching roofs and later used for erosion control (Jackson et al. 2002).
- 10,000-20,000 acres between Laredo and Del Rio in 2002 and an estimated 60,000 acres in 2007 (Goolsby).
- Exhibits a rapid growth/expansion rate.
- Grows to a height of 20-30 feet tall (Bell 1997) with a biomass of 8.3 dry tons per acre (Hoshovsky 1986).
- Consumes approximately 49 gallons per year for every square foot of giant reed (Jackson et al. 2002).
  - Reducing water to arid region
  - Native vegetation consumes 1/3 this amount
- Re-channelizes water stream, creating a faster, deeper flow.
- Undercuts roots, causing large stands to break off, float downstream, and damage infrastructure in its path.
- Expansive root system: rhizome can grow to approximately three feet thick
  - Sections of the rhizome (Wijte 2005).
- Consumes approximately 49 gallons per year for every square foot of giant reed.
  - Reducing water to arid region
  - Native vegetation consumes 1/3 this amount
- Unmitigated growth can be managed using mechanical and chemical control methods.
  - Measures are temporary, costly, cause damage to non-target vegetation and are potentially contentious (i.e., international chemical-use disagreement with Mexico).
- United States Department of Agriculture-Agricultural Research Service (USDA-ARS) proposed a biological control program for the management of the growth and spread of this invasive plant.
  - Four herbivore insect species under investigation to determine suitability and potential impact on giant reed.

Control Measures – Traditional and Potential
- Temporal growth curves for height, area, and density were determined using the logistic growth function.
- Residual returns to water were calculated using Extension crop budgets for District 12.
- After the total amount of cane was determined and entered into the growth equation, a value was calculated for the amount of water consumed.
- The temporal rate of growth associated with the biological control agents is currently being researched at the USDA-APHIS quarantine facility located on Moore Air Base in Mission, Texas.
- These results allow for the calculation of the net water saved, considering native replacement species.
- The results are preliminary and represent probable upper bounds of potential water savings and associated value from mitigating the growth of Arundo donax.
- An upper limit of two-thirds effectiveness is assumed regarding the potential efficacy of the biological control agents until further data is available.
- Water uptake of giant reed is assumed to be constant throughout the year (possibly an overestimate).
- Conveyance losses associated with the reduction of giant reed need to be considered.
- The range of the benefits of potential annual water savings may have a lower bound of $30-50 million.

Data and Methods
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Qualifications and Limitations to Results
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Preliminary Results and Potential Implications
- Analysis currently in process for determining the net impact of this project.
- Preliminary results indicate an amount of 262,300 acre-feet of water potentially saved from the elimination of giant reed, for a total annual value of $85.7 million in 2007.

Future Research
- Confirm and improve growth curve functions.
- Improve water-parameter related data.
- Confirm efficacy of beneficial insects.
- Assess biological control cost-related data.

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References

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