ASSESSING TRADE-OFFS BETWEEN CROP PRODUCTION AND ECOLOGICAL SERVICES: THE CALAPOOIA BASIN

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Project Goals:

1. To quantify linkages between conservation practices in grass seed producing areas and biophysical responses including water quality and biological indicators; and,

2. To develop a model to assess tradeoffs between agricultural practices that maximize economic benefits and conservation actions that sustains or improve ecosystem services.

Specific Objectives:

1. Describe the extent, timing and placement of conservation practices currently in the study watershed;

2. Assess the effects of those conservation practices, their location and their interactions on water quality and quantity;

3. Evaluate the effects of conservation practices on key biological indicators that respond to cumulative alterations in land cover and resulting water quality and quantity.

4. Develop an objective-optimization model based on the information derived from objectives to assist farmers, NRCS (Natural Resource Conservation Service) staff, and local conservation districts in identifying cost effective conservation practice strategies;

Disseminate the findings of this research project to specific target audiences through adequate outreach activities and extension products.

Progress to Date:

In our attempt to quantify linkages between conservation practices and biophysical responses, including water quality and biological indicators, and to develop a model to assess tradeoffs between agricultural practices that maximize economic benefits and conservation actions that sustain or improve ecosystem services we completed the following steps during 2007.

- The SWAT (Soil and Water Assessment Tool) streamflow model was successfully calibrated and validated in the Calapooia watershed.

- A field season of new physical habitat, water quality, fish, amphibian, and bird data was collected.

- A new amphibian capture protocol was developed and implemented so that we could sample intermittent streams directly adjacent to grass seed fields.

- Fish and macroinvertebrate data collected in intermittent streams within the basin over the last six years were entered into composite databases.

    - For fish, five field seasons of winter-spring (November-May) data were combined into one database. Over this period, 54 different sites were sampled; some were sampled in more than one year. For each site, the number of species caught and catch per unit effort were determined.

    - The macroinvertebrate database included Spring samples collected in 2 years (2003 and 2004). Macroinvertebrate assemblage data were used to determine benthic invertebrate density, taxonomic richness, and proportional abundance, diversity, tolerance, and feeding group metrics.After elimination of six sites that were found to be flood impacted (dominated by outside macroinvertebrates being washed in) the final database had 30 different sample sites, some of which were sampled in more than one year.

- Relationships between fish and macroinvertebrate metrics and physical habitat, water quality, and GIS (Geographic Information System)-derived landscape metrics were investigated. Initial data analyses lead to the selection of four fish metrics and four macroinvertebrate metrics for detailed analyses. Most of these biological condition metrics were affected by distance to the nearest perennial water source. Species richness, diversity, and fish CPUE (Catch Per Unit Effort) decreased significantly as the distance to a perennial water source increases.

    - Comparing different metrics to distance to perennial water provide plots which are classic “envelope” relationships seen when multiple factors are involved. Adjusting these metrics with distance to perennial water requires looking at the changes near the stressor or controlling factor maxima, rather than the center of the distribution. These adjusted metrics may be a better estimate of the effect when that factor is the limiting constraint. Data analysis in second year of the project will focus on how these adjusted

metrics respond to the habitat, chemical and GIS stressor metrics.

Ongoing Efforts:

- Analyze water quality data and calibrate/validate SWAT for quality parameters (suspended sediments, NO_3^-, PO_4^{3-} etc.): per sub-basin and the whole watershed.

- Continue developing the link between SWAT, the economic model, and the biological indicators and implement them at different spatial scales.

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