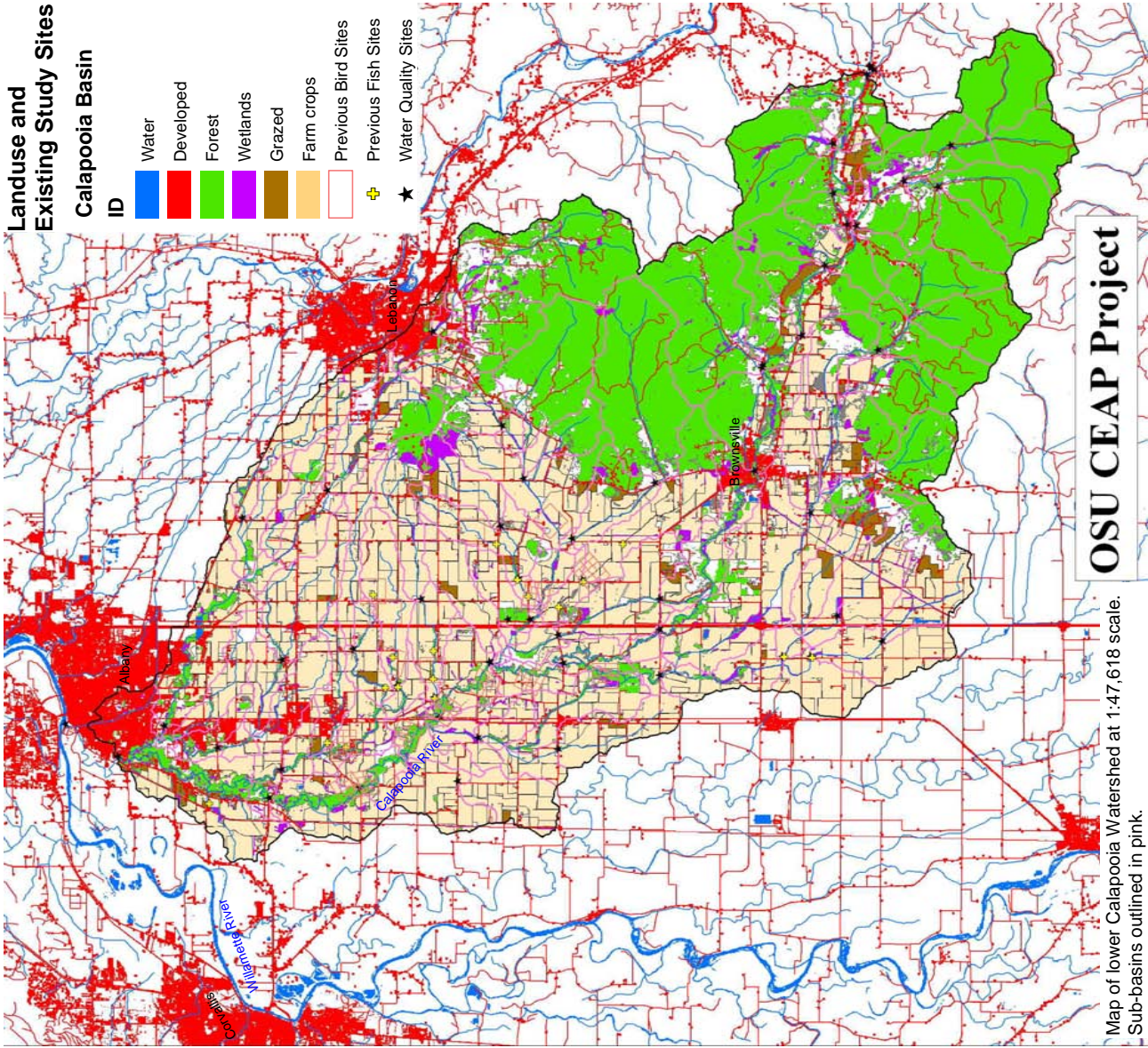


# Developing an Historical Landuse Record for Sub-Basins of the Calapooia River in Oregon.

George Mueller-Warrant, Stephen Griffith, and Gerald Whitaker, USDA-ARS, National Forage Seed Production Research Center, Corvallis, OR.



Map of lower Calapooia Watershed at 1:47,618 scale. Sub-basins outlined in pink.



Roadside shiner



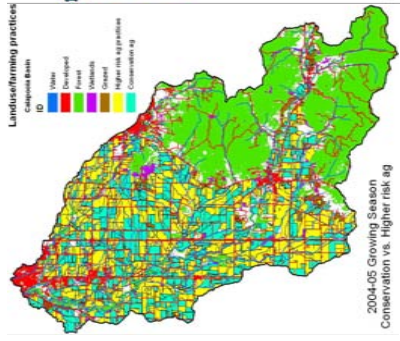
Sculpin



Cutthroat trout



Setting out minnowtraps in a field drainage



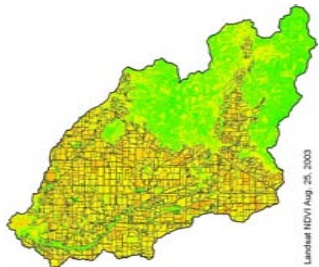
2004-05 Growing Season  
Conservation vs. Higher risk ag

2005-06 Growing Season  
Conservation vs. Higher risk ag

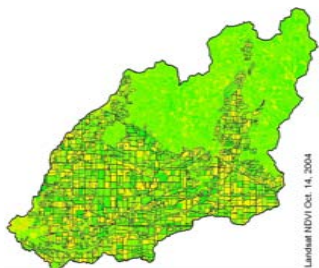
Changes in landuse between years stand out when these two maps are viewed as stereo pairs. Conservation ag was defined as: (1) previously established grasses kept in production, (2) no-till planting of new stands, or (3) full straw Italian ryegrass.

## USDA-ARS Western Oregon Landuse GIS

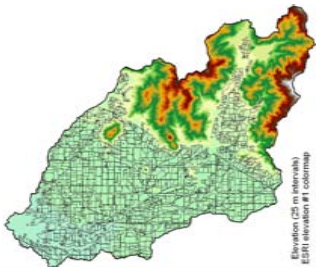
Agricultural landuse dominates many watersheds across the U.S. and detailed, spatially-explicit knowledge of the management practices employed in crop production could serve to identify nonpoint sources of nutrients, sediment, and pesticides in our watersheds. The USDA-ARS Western Oregon Landuse GIS was developed to support the development of farm programs, NGO-supported projects, or farmer-based initiatives. Agricultural landuse in lower elevations of the Calapooia River Watershed in Linn County, Oregon, is dominated by grass seed production. Fields producing seed of perennial grass species are undisturbed by tillage during the three to six, or more years that such stands are kept in production, following which stands are destroyed and a variety of rotational crops grown. While tillage is commonly employed during stand removal and seedbed preparation for new plantings of both perennial and annual species, an increasing diversity of no-till practices are being developed in response to soil erosion/water quality concerns and diversity and abundance of biotic indicators of ecosystem health ranging from invertebrates, amphibians, and fish to waterfowl and passerine birds. We have committed ourselves to the development of a publicly-available GIS detailing agricultural landuse practices from 1994 through the present. Nearly complete censuses of crops grown and partial enumerations of conservation practices employed were developed from roadside observations in the agricultural portion of the Calapooia River Watershed in the 2004-05 and 2005-06 cropping years. Ground-truth census data are being combined with more limited surveys of grass seed production fields in other western Oregon watersheds to develop a regional landuse GIS. The USDA-ARS Western Oregon Landuse GIS has been used to aggregate pixels classified from remotely-sensed data, improving overall classification accuracy by an additional 10%. Separate records of certified grass seed production comprising approximately 50% of all seed fields in Linn County, Oregon, will be used along with a series of late summer Landsat images to develop and validate remote sensing classification procedures for the period from 1994 to 2003. Preliminary analyses revealed the presence of 3-fold variation in proportion of fields filled among sub-basins within the Calapooia River Watershed, although this dropped to 2-fold variation in proportion of fields filled among sub-basins within the Calapooia River Watershed and is being used to test for possible linkage between variation in soil disturbance and water quality measurements over time among the sub-basins.



Landuse NDVI Aug. 25, 2000



Landuse NDVI Oct. 14, 2004



Elevation (20 m intervals)  
ESRI elevation #1 contour



NAIP 2004 Aerial photo mosaic

# Oregon State Univ. CSREES CEAP Project

Co-PIs: Guillermo Giannico, OSU, and Brenda McComb, U Mass-Amherst. Collaborators: Kathryn Boyer, Alan Herlihy, Judith Li, Bruce Dugger, Tiffany Garcia, Shawna Grosskopf, Rolf Fare, William Gerth, Rem Confessor, Randall Colvin, Mark Mellbye, George Mueller-Warrant, Stephen Griffith, and Gerald Whittaker.

Excerpts from proposal approved by CSREES July 2006.

## Assessing Trade-offs Between Crop Production and Ecological Services: The Calapooia Basin

### INTRODUCTION

We propose to use existing and supplemental water quality and land use-land cover data in combination with biological indicators of water quality to explore optimum tradeoffs between economic costs and ecological services of conservation practices in an intensively managed watershed. This work will result in a modeling tool that will aid landowners, policy makers, and regulators within a watershed in answering the question: "where and when can conservation practices yield the greatest return on the investment?" Specifically we will assess tradeoffs between economic net income and ecological services based on the area and spatial arrangement of two dominant NRCS Core 4 conservation practices in the Calapooia River Watershed of Oregon: conservation buffers and tillage management. These assessments will be made at two primary spatial scales (sub-basin and whole watershed) as well as a gradient of spatial scales between these two endpoints, allowing investigation into the tradeoffs associated with implementation of these practices incrementally time at each spatial scale.

Tools that allow informed decision-making are particularly important in this region. Farmers in the Willamette River Valley of Oregon produce over \$1 billion dollars in agricultural products annually. The area is also home to 65% of Oregon's population and an additional 1.7 million people are expected to live in the valley in the next 50 years (Hulse et al. 2002). The landscape has changed markedly since the mid-1800s and demands on natural resources have increased enormously during the last three decades. Most tillable land has been put into grass seed production, and many fields are tiled and drained to increase productivity. Natural grasslands and wetlands occupy less than one percent of historic levels, and the complex river channel system is now greatly simplified. Recent concerns over air quality and agricultural runoff into Valley streams have resulted in a shift from field burning to alternative crop residue management practices.

Our overall goals are to:

1. Quantify linkages between conservation practices and biophysical responses including water quality and biological indicators, and
2. Develop a model to assess tradeoffs between agricultural practices that maximize economic benefits and conservation actions that sustain or improve ecosystem services.

We will meet these goals by testing a set of specific hypotheses which in aggregate, will allow us to test the following *overall hypothesis*: the area and distribution of tillage practices and riparian vegetation are associated with an optimum balance of economic value and ecological services in the watershed. Our specific objectives are to:

- 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 those 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 (1a) through (3e) to assist farmers, NRCS staff, and local conservation districts in identifying cost effective conservation practice strategies;
- 5) disseminate the findings of this research project to specific target audiences through adequate outreach activities and extension products.

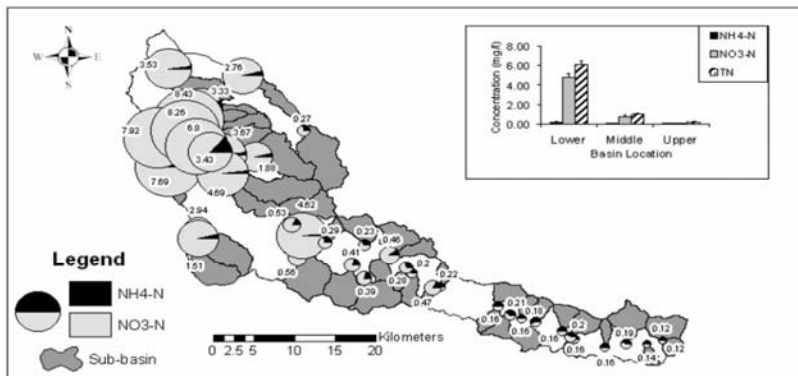


Figure 6. Mean base flow dissolved nitrogen component concentrations (winter 2003-2004) in the Calapooia Watershed, Oregon. Means are based on values below the detection limit being set to the detection limit. Note: numbers adjacent to pie graphs indicate the total concentration of dissolved inorganic nitrogen. Error bars on bar graph represent standard error of the mean (Floyd, 2005).

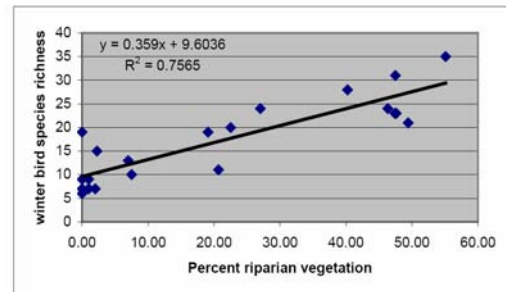


Figure 2. Relationship between riparian shrub and tree vegetation per square km and winter bird species richness, Calapooia Watershed, 2003-2005 (McComb et al. 2006).

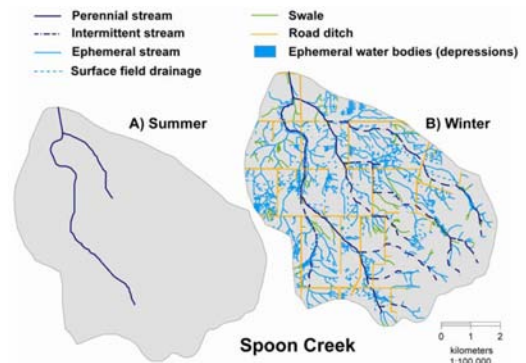


Figure 4. Seasonal changes in potential delivery of nutrients and sediment in a subwatershed of the Calapooia watershed (Wigington et al. 2006).

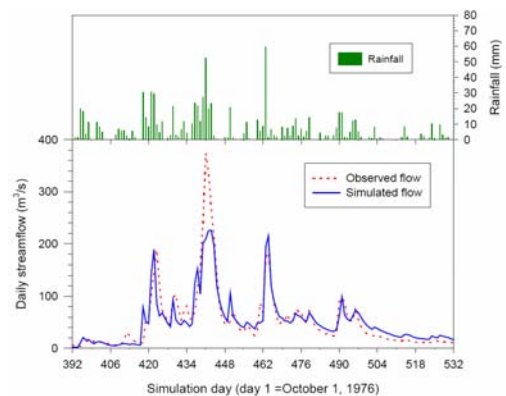


Figure 5. Validation results for the SWAT model: observed and simulated daily flows for the Calapooia Watershed.

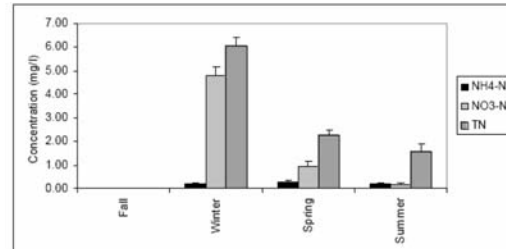


Figure 7. Seasonal (water year 2003-2004) comparison of mean dissolved nitrogen components in the lower zone of the Calapooia Watershed. Error bars on graph represent standard error of the mean. Sub-basins had no surface flow during the fall sampling period. (Floyd, 2005).