Title: Integrating Conservation Practices on Western Oregon Grass Seed Farms to Maintain Farm Profits and Enhance Aquatic (Year-4 supplemental report)

Objective 1. Determine contributions grass seed fields make to the quality of fish and other aquatic wildlife habitats during winter high flow periods when water moves from fields to drainages.
Objective 2. Determine the best-suited conservation practices for grass seed farms and value to aquatic wildlife habitat quality.

Investigators

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Abstract of 2006 Progress.

A survey of fish and invertebrate populations of southern Willamette Valley field drainages, along with water quality analysis and the establishment of demonstration conservation practices, was completed in 2005. While 2005 was the final year of GSCSSA funding, carry over funds were used in 2006 to continue some targeted sampling which showed invertebrates were significantly more abundant in seasonal waterways with vegetated bottoms. Field tests identified three native grass species that persisted in seasonally ponded conditions. Use of wet tolerant species could be an important part of filter strip design.

Justification.

This project was initiated because of concerns that water quality and endangered fish species issues in the Willamette Valley might restrict farming practices or result in the need for additional conservation efforts. Maintaining water quality and wildlife habitat through good farming practices and use of practical conservation practices was identified as important to the seed industry.

At the beginning of this study, little was know about water quality and habitat conditions in drainages across the agricultural landscape where grass seed crops predominate. Extensive sampling of seasonal drainages between 2001 and 2005 showed the concentration of nutrients and levels of suspended sediments in water were generally below what is considered adverse to fish (GSCSSA Progress Reports FY 2005). Native fish and invertebrate species were found to use seasonal drainages that border grass seed fields indicating these systems provide valuable seasonal fish habitats.

At the beginning of this project there was also a lack of information to help identify suitable conservation practices aimed at protecting water quality and improving fish habitat. Therefore a complementary part of the project included the establishment of demonstration conservation practices. No-till crop rotation and use of vegetative filter strips and grass waterways using creeping red fescue were identified as practices compatible with commercial seed production. A potential benefit to growers was increased access to conservation program payments as an additional source of income.

Progress

At the conclusion of the 3-year sampling effort, questions remained about the importance of vegetation in seasonal drainages and ditches. Therefore, sampling was conducted during 2006 to measure the comparative abundance of fish and invertebrate on vegetated drainages versus drainages with very little vegetation. In addition, creeping red fescue and annual ryegrass had drowned out in the bottoms of previously established grass waterway filter strips, leading to significant erosion in the ditch bottoms. Therefore field testing was initiated with the NRCS Plant Materials Center to begin testing wet-tolerant grass species.

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Fish and wildlife surveys

The fish and invertebrate survey work conducted in this project between 2003 and 2005 demonstrated that seasonal waterways and streams flowing through grass seed fields in the Willamette Valley provide habitat for native fish, invertebrate, and amphibian species. Research showed that the majority of fish diet in these seasonal streams was comprised of aquatic, not terrestrial, invertebrates. Previous survey work also indicated a difference in the types of invertebrates collected between sites and suggested that densities of benthic invertebrates were higher at sites with more vegetation growing on the channel bottom.

In late winter 2005/early spring 2006 fish, amphibian, and benthic invertebrates were collected from 18 seasonal drainages in the Calapooia River lowlands (a major watershed in the southern Willamette Valley). Generally the vertebrate collection sites were within 1km of a downstream perennial stream or river to equalize potential for fish colonization among sites.

During winter floods, water from streams and large drainage ditches jumped their banks and flowed into several of our study tributaries. As a result, these temporarily inundated sites were colonized by several river invertebrates (the stonefly *Isoperla*, and the mayflies *Ephemerella*, *Eurylophella*, *Hexagenia*, and *Tricorythodes*, and the riffle beetles *Dubiraphia* and *Optioservus*) that we had not observed in our previous surveys. Overland flooding may be of ecological significance to the biology of the areas seasonal drainages and streams.

The sampling design was set up so that six sites had very little vegetation in the substrate or bottoms and six sites had extensive emergent vegetation growing in the channel. Eight sites were paired within streams (4 pairs) and were far enough away from downstream perennial water that they were not inundated by flood water. We used these paired sites to account for differences among streams and to test for the effect of vegetated vs. bare stream bottom on invertebrate abundance. Using a paired t-test, we confirmed that invertebrates were significantly more abundant with vegetated stream bottoms. Sites with vegetation growing on the stream bottom had up to 45 times as many invertebrates as their corresponding un-vegetated sites. Fish and amphibian abundance was also compared between the two channel types and analysis is pending.

The higher density of invertebrates with in-stream vegetation was intriguing because managing stream vegetation in these channels could prove to be a means to provide more food for colonizing fish and amphibians.

Objective 2. Determine the best-suited conservation practices for grass seed farms and value to aquatic wildlife habitat quality.

The third goal of the project was to identify conservation practices compatible with commercial grass seed production in the Willamette Valley. One of the more successful demonstration practices was the construction of grass waterways or "vegetative filter strips" using a blend of creeping red fescue varieties and annual ryegrass. While these species were effective at controlling erosion on banks and aiding in weed control (through crop competition and use of selective herbicides), they did not survive seasonal flooding and therefore "drowned-out" in the ditch bottoms. The result was significant erosion in the bottom of otherwise successful grass waterway plantings.

In 2005, we began to evaluate the use of native "wet-land" grasses and one cultivated variety Seaside creeping bentgrass for erosion control in the bottom of seasonally wet waterways. Two field trials were established in 2005 and in 2006. The trials were conducted in cooperation with scientists from the USDA Plant Material Center in Corvallis, Oregon. Plots were situated in the bottom of seasonal ditches with a buffer of creeping red fescue (already established) between the trials and surrounding commercial grass seed fields.

Twelve species tested are listed in the table 1, and were selected after consulting with grass seed industry representatives. Efforts were made to avoid grasses which are known or likely weed problems. For example, we did not include western mannagrass in the study because it is known to be weedy in ryegrass fields. Seeding rates were based on live seeds per square foot and adjusted up or down from 500 per square foot based on seed size and seedling vigor.

At one location, none of the species established the first year due to erosion from early heavy rainfall followed by season-long ponding conditions. At a second location which was not subject to prolonged ponding (but too wet for annual ryegrass), there was fair to good establishment of several grass species: meadow barely, annual hairgrass, tufted hairgrass, spike bentgrass, slender hairgrass, and 'Seaside' bentgrass. The six grasses adapted to marshes or permanently moist, saturated, or shallow water conditions (rice cutgrass, western sloughgrass, tall mannagrass,

Table 1. Species tested for wet-ground tolerance and use in grass waterway bottoms.

Grass species	Seeding Rate live seeds/sq. ft.	Seeding Rate PLS lbs/ac	Seedlings/sq ft. Mean of 3 replications
spike bentgrass	600	4.8	8.7
meadow barley	200	58.1	27.3
tufted hairgrass	500	12.1	10.0
'Seaside' bentgrass	600	3.1	4.7
slender spiked mannagrass	500	16.8	0
annual hairgrass + rice cutgrass	100 + 300	4.8 +36.3	13 + 0
tall mannagrass	500	13.6	0
slender hairgrass	500	9.3	6.7
Canada bluejoint [9x9 ft only]	500	5.4	0
weak alkaligrass	500	11.2	0.3 (trace)
western sloughgrass	200	36.6	0.2 (trace)
red fescue	500	12.1	2.7

slender spiked mannagrass, weak alkaligrass, and Canada bluejoint) were not detected, except for a trace of western sloughgrass and trace of weak alkaligrass. Based on these results and observations of spring growth, three grass species (meadow barely, tufted hairgrass, and Seaside bentgrass) were selected for additional plantings in 2006. Use of species tolerant to wet winter conditions but dry summers could be an important part of filter strip design. Especially in high-flow drainages, vegetated bottoms help control erosion. They may also contribute to habitat for aquatic wildlife.

Interactions

The project involved cooperation between OSU research and extension faculty, USDA-ARS scientists, Soil and Water Conservation District staff, grass seed farmers, and with conservation agronomists with the USDA-NRCS.

Timeline

Water quality, fish, and invertebrate sampling	November – April, 2005/06
Establish native wet-land grass evaluation trials	September – November, 2005/06
Conference presentation on pre-2006 work	January 2006 - Ryegrass Growers
Extension/Linn SWCD farm tour	March, 2006

Publications and Presentations

No publications or presentations on the 2006 portion of the work have taken place.