An Innovative Restoration Project in the Upper St. Johns River Basin

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Over the past two years the St. Johns River Water Management District performed some innovative restoration work in the Ansin West property within the upper basin of the St. Johns River (Fig. 1.). Restoration activities involved a suite of hydrologic alteration, vegetation control, and aerial alum application. The Upper St. Johns River Basin Project (USJRBP), is a federal flood control project extending from Vero Beach north to Melbourne. While originally conceived and designed as a flood control project, the area provides many environmental benefits derived from conserving marsh habitat and reclaiming and restoring agricultural land. Among the many other benefits, the USJRBP provides foraging and nesting habitat for the endangered snail kite (*Rostrhamus sociabilis plumbeus*). The Ansin West property is one of several areas within the USJRB that provides valuable open marsh habitat for the snail kite.

Figure 1. This map shows the Upper St. Johns River Basin. The Ansin West tract is shown in the inset figure.

Because of the importance of open marsh habitat in Ansin West for foraging and nesting kites, the St. Johns River Water Management District closely monitors wetland habitat in the area. Following improvement of the C-52 canal in 1996, increased quantities of agricultural water flowed into the southwest corner of Ansin West tract, which began showing signs of vegetation changes caused by nutrient enrichment. Specifically, cattails and later shrubs began replacing open marsh habitat. A berm was constructed on the western side of Ansin West in 2007 to route water into the reservoir north of the tract and reduce loading to the wetland areas. The berm appeared to reduce vegetation changes on the western margin of Ansin West, as intended. However, other areas of the property continued to lose open marsh habitat to cattail and shrubs. Vegetation changes appeared to radiate outward from a levee gap in the northwest corner of the tract (Fig. 2),

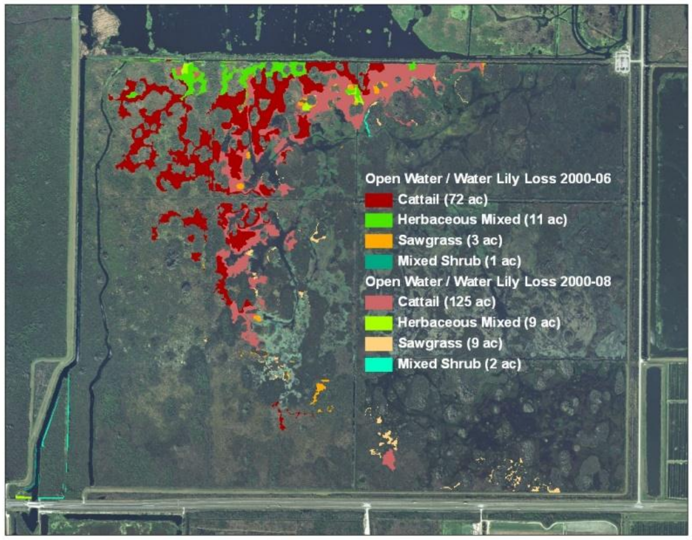

Figure 2. The colors show where open marsh habitat was lost to other community types for the time periods 2000-06 and 2000-08.

suggesting continued nutrient loading from a levee gap in the northwest corner. Additionally, high concentrations of sediment phosphorus (P) from legacy loading were identified as a likely driver fueling cattail expansion. Staff decided that both current nutrient loading and sediment P would have to be reduced to prevent and hopefully reverse cattail expansion and loss of slough habitat.

SJRWMD staff developed a multifaceted plan to deal with nutrient issues in Ansin West. First, the levee gap in the northwest corner was filled in the spring of 2011, hydrologically isolating the area and greatly reducing the potential for nutrient loading. Because of the low berm on the west and a predetermined plug elevation, high flood stages will still enter the area but the frequency will be greatly reduced. Second, cattail was reduced in areas where it had invaded over the past decade. A contractor applied the systemic herbicide Clearcast™ in June 2012 to approximately 283 ha of moderate to dense cattail. After allowing the cattail to die, SJRWMD land management staff performed a successful controlled burn of the area in August 2012. The burn provided both the immediate benefit of removing invasive cattail and opened up the area to apply chemical amendment.

In the third part of the plan, a chemical amendment--alum (Al_2SO_4) in this case-- was applied to bind bioavailable P in the sediments. Alum dosage was based on measured bioavailable phosphorus in the sediments. The innovative aspect of this alum application was that we applied a solid granular alum product. Granular alum was chosen so that it would readily fall through any standing vegetation rather than adhere as liquid alum would. We also chose granular alum to ensure that the material would settle rapidly through the water column (≈ 60 cm) to minimize interaction with water column constituents and remain maximally effective in capping the sediments. In August 2012, a contractor applied 136,078 kg of alum (≈ 5 mm grain size) over 243 ha using a helicopter with a metered bucket (Figs. 3-5). The application required approximately 150 trips with a turnaround time of 6-10 minutes. Minimal floc formation was observed shortly after the alum hit the water.

Alum can depress alkalinity and pH to the point that free aluminum reaches toxic levels. To address this issue, the contractor used a grid-based system to communicate the real-time application location to district staff, allowing rapid pH and alkalinity measurements in recently treated areas. District staff monitored water quality throughout the alum application and neither pH nor alkalinity decreased to unacceptable levels.

Three months post application is too soon to gauge the efficacy of the restoration work but we have observed some changes already. Between the herbicide and fire, the cattail were severely reduced throughout most of the 283 ha herbicide treatment area. Over the long term, some regrowth of cattail is expected because we chose a relatively conservative alum dose intended to reduce P availability and eventually shift the competitive advantage back to sawgrass. The water column is considerably clearer and there has been an explosion of *Chara* sp. coverage in the open water areas. Water quality data show no adverse effects of the application. Alkalinity dropped and Al increased but well below levels of concern. Water column SRP and TP did not decline but water column P was already quite low. Sediment bioavailable P showed some reduction but it was not significant. Given the slow kinetics of P in the sediments, we did not expect a rapid and obvious change. We will sample sediments again in 2013. We observed no obvious alum floc three months after the application.

This restoration project was unique and faced a number of challenges. The proposed treatment area was mostly inaccessible, requiring the use of aerial application of both the herbicide and the alum. We had to work with the alum manufacturer to obtain the product in the granular size appropriate for the delivery method. Likewise, we had to work with the applicator to find an aerial delivery method and equipment that delivered a calibrated amount of alum. This large effort cost approximately $360,000 and required two years planning and coordination. However, we are confident that the effort will have long-term benefit for the wetland habitat in Ansin West.

Figure 3. Loading a 909 kg bag of alum into the calibrated application bucket. The helicopter hovered over the bucket while it was being loaded!

Figure 4. The helicopter applying alum over the treated marsh (in the distance) with a view of the desired condition in the foreground.

Figure 5. Alum application over the burned area of Ansin West.