

7-2 and Table 7-2). The mean total weight and mean native weight of all samples is 609g and 391g, respectively (Appendix 7, Figure 7-3 and Table 7-3).

The total and native running means are beginning to stabilize in both the burned area and unburned area samples, indicating that the sample size in each group of samples was sufficient (Appendix 7, Figures 7-1 and 7-2). When all samples are pooled, the mean appears to stabilize well before the 50th sample (Appendix 7, Figure 7-3).

The mean total weight and mean native weight of the burned area samples are 84g and 174g greater than in 2001, respectively. The mean total weight and mean native weight of the unburned area samples are 117g and 274g greater than in 2001, respectively. The mean total weight and mean native weight of all samples are 101g and 219g greater than in 2001, respectively.

All analyses document that biomass, both native and total, is greater in all areas of the Upland Grassland in 2006 than in the year of NOC (2001). **The performance standard of having no less than 80% of the biomass at NOC present at COC has been met.**

4. DISCUSSION

The major portion of the Flambeau Mine site was seeded with a partial complement of the reclamation seed mixes in spring 1998, and the remainder of the site was seeded with the same seed mixes in the fall 1998. Some seeds that could not be obtained in 1998 were added in early summer 1999, and some supplemental planting occurred in spring 2000. All originally planned plantings were completed in 2001 in addition to supplemental plantings in the woodlands.

In fall 1998, the majority of the site was dominated primarily by cover crop species and agronomic leguminous species typically associated with roadside stabilization projects. This initial flush of agronomic species was anticipated because these species typically dominate the

initial year of reclamation plantings. Agronomic species still persist on site, but native species, which had established by the end of the first full growing season (1999), have increased in abundance over the past seven years. This year's 2006 data indicate that native species continue to be abundant on the site this year despite a severe drought in the region. Although average native vegetation cover for the entire site decreased to about 40% this year, biomass data and cover data from specific communities indicate that natives still dominate the site. Native species comprise nearly 65% of the biomass sampled in the upland grasslands in 2006, and native species biomass is over twice as great as it was in 2001. In addition, native cover in wetlands was well over 60% this year (2006). Consequently, monitoring data indicates that native species dominate both the wetlands and the upland grassland, and are common in the woodlands. Native vegetation is not as abundant in the woodlands as it is in the upland grasslands and wetlands because the woodlands have not been burned in order to protect the planted trees. Nevertheless, all planting zones at Flambeau continue to perform very well, and better than most restoration projects in the Midwest.

4.1 Erosion Control Effectiveness

No evidence of significant erosion or sedimentation in any upland, wetland, or biofilter settings was apparent on the mine in 2006. Swale systems are very stable. These swales have been stabilized through the use of soil bioengineering planting techniques, such as seeding, live staking with dormant wetland shrub branches, and plugging with other wetland vegetation.

Based on the collected data and field observations, very little bare soil was observed on the mine. And the bare soil that was present was stabilized by leaf litter, and surrounding dense vegetation cover.

4.2 Plant Community Development And Trajectory

The summer 2006 vegetation data clearly suggests that the plant communities anticipated in the restoration plan are well established and currently developing. All plant communities were well established in 1999, after the first full growing season. The abundance of planted native species has increased over the seven years since that first full growing season. Natives have increased substantially in all plant communities since installation and are well established and widespread on the site. Further, each plant community is assuming the structural characteristics intended. These intended structural characteristics are present in the upland grassland and wetlands, and slowly (as anticipated) developing in the woodlands.

Native planted species diversity on the site is high, and the diversity performance criteria has been met or exceeded again this year in the three plant communities. In fact, after eight full growing seasons, all planting zones at Flambeau continue to perform better than anticipated, and better than most restoration projects in the Midwest using similar planting specifications. The result of the data collected for this site demonstrates that the site is tracking the desired trajectory for plant community development, diversity, cover, and productivity. **All performance criteria for have been met again this year (2006) and native vegetation is abundant throughout most of the site.**

4.3 Habitat Development And Key Wildlife Group Trajectory

Studies of vegetation performance, and bird and butterfly-use of the mine clearly suggest that the revegetated Flambeau Mine provides habitat for a diverse avifauna, and is becoming increasingly used by a more diverse resident butterfly fauna (Apfelbaum, 2006, Birds of the Reclaimed Flambeau Mine, Ladysmith, Wisconsin; and Apfelbaum, 2006, Butterflies of the Reclaimed Flambeau Mine, Ladysmith, Wisconsin). During these studies, many other wildlife species and signs of wildlife were observed. A number of bird species not recorded during bird monitoring were observed on or flying over the site including cooper's hawks, white

throated sparrows, bald eagles, night hawks, and wild turkeys. Northern harriers were observed hunting on the site this year and nesting in the upland grassland in 2002 - 2004. Over the past several years, the following observations have been made: kingfishers from the river frequently foraging in the wetlands or on the river, sparrow hawks and red-tailed hawks hunting in the grassland zones, several common egrets and great blue herons utilizing the wetlands, and sora rails and yellow headed blackbirds regularly using and even nesting in the 8.5 acre wetland. Other wildlife observations during this and previous years include white-tail deer, black bears, red fox, American badger, coyote scat, cottontail rabbits, a striped skunk, porcupine, eastern chipmunks, many frogs and toads, (e.g. Spring peepers, gray tree frogs, leopard frogs, American toads), wood turtles, and garter snakes. In the spring of 2006 two, state threatened, wood turtles were observed in the biofilter wetland and swales. Small notropid minnows and large populations of water fleas (Cladocerans) have been observed in the wetlands on site. In addition, an abundant insect fauna was also noted each year since 2000, including several species of ants, numerous beetles, grasshoppers, tree crickets, numerous moth and butterfly species, dragonflies, and at least two species of katydids.

While there were no specific wildlife performance requirements for the reclaimed mine facility, it is clear that the mine has reached the desired trends in diversification conceptually contemplated in the mine permit.

In addition, the Habitat Evaluation Procedure Analysis (HEP) was completed as a part of the reclamation program. The first HEP report, Habitat Analyses, was prepared with 2000 monitoring data. Three subsequent Habitat Analyses reports were updated with the 2001, 2002 and 2003 monitoring data.

The three updated Habitat Analyses reports provided summary findings consistent with the first report for each bird species:

Savanna Sparrow – Grassland habitats currently support savanna sparrows by providing food, cover and reproductive requisites. This species can utilize a vast majority of the site because the grassland community covers a continuous area over more than 70 percent of the site. Populations are assumed to be relatively stable or will fluctuate with seasonal seed and insect prey availability while the habitat quality may appear relatively stable.

Great Crested Flycatcher – Great Crested Flycatcher will be supported in the woodland in approximately 20-30 years with the current and anticipated rate of woodland development on the site. As expected, this species' need for woody vegetation, canopy closure, and nesting sites in larger woodland cavernous trees are not currently met in the young immature woodlands. Currently, Great Crested Flycatchers documented as utilizing the woods around the perimeter of the reclaimed mine site occasionally feed, but do not breed, on site.

Tree Swallow – Tree Swallows are currently supported within all restored habitats at the reclaimed mine. All communities of the site provide foraging habitat, and nesting boxes provide reproductive habitat throughout the site as well. Cavernous trees are expected to provide natural nesting opportunities on the site within 20 years.

During both extreme drought and normal moisture years, the areas planted and reclaimed at the Flambeau mine have performed with annual improvements in diversity of plants and animals. This increasing trend, even during stressful growing years, suggests the establishment of desirable native plant and animal communities has reached an important level of stability.

In summary, after eight full growing seasons the reclaimed mine site has shown a remarkable development of native plant communities and habitat and wildlife utilization. Site reclamation has been very successful and site conditions are expected to continue improving.

5. SITE PHOTOGRAPHIC RECORDS

As in each previous year, photographs were taken at the starting endpoint (the zero endpoint) of each study transect during summer 2006. All photographs were labeled with the transect identification code, and date, and were photographed from approximately 2-3 meters on an extended line along the transect axis. Photographs are included as a record of the visual appearance of the planting in Appendix 8.

6. REFERENCES

- Apfelbaum, S. I. 2006. Birds Of The Reclaimed Flambeau Mine Ladysmith, Wisconsin. Applied Ecological Services, Inc., Brodhead, Wisconsin. 28 pp.
- Apfelbaum, S. I. 2006. Butterflies Of The Reclaimed Flambeau Mine Ladysmith, Wisconsin. Applied Ecological Services, Inc., Brodhead, Wisconsin. 41 pp.
- Gleason, H.A. & A. Cronquist. 1963. Manual of Vascular Plants of Northeastern United States and Adjacent Canada. Willard Grant Press, Boston Massachusetts. 810 pp.
- Goff, F. G. 1982. A Sample Grade System for Vegetation Studies. Consumer's Power Company, Environmental Dept. .Technical Report No. 20. 122 pp.
- Goff, F.G., G. A. Dawson, and J.J. Rochow. 1982. Site Examination for Threatened and Endangered Plant Species. Environmental Management. 34 pp.