

# **Report as of FY2006 for 2006NJ102B: "Cranberry Agriculture as Wildlife Habitat in the Pine Barrens Wetland Ecosystem"**

## **Publications**

- Conference Proceedings:
  - Wen, Ai. 2007. The Habitat Use by Birds and Anurans of Active and Abandoned Cranberry Farms in the Pine Barrens of New Jersey. Poster to be presented at the 92nd Annual Meeting of the Ecological Society of America, San Jose, CA. August 9, 2007.

## **Report Follows**

## **Project Summary**

### **Objectives:**

As the need for agricultural development continues to grow, it is imperative to maintain or increase the ecological function of agroecosystems while minimizing negative influences on the surrounding environment. The cranberry farms located in the Pine Barrens of New Jersey provide an excellent opportunity to study this issue. Cranberries have been cultivated in this area for about 150 years. The 3,600 acres of active farms, as well as numerous abandoned bogs, are embedded in the riverine wetlands, where a great variety of lowland plants and animals live. This is a unique opportunity to study wildlife distribution in farmland habitat as well as the response of animal communities to plant succession after agricultural abandonment.

Objective1. To study bird and frog distributions within the farm with different habitat factors (vegetation, hydrology and landscape factors).

Objective2. To study the seedbank composition in cranberry beds with different water-table depth, and their germination under different hydrological conditions.

### **Methodology:**

#### 1. Bird transect survey:

Since the spring 2006, I monitored the distribution of bird species along the boundary transects of two active cranberry farms (530SN, 70S) and one abandoned cranberry farm (532W). Two more abandoned farms and one more active farm were added in spring 2007. Thirteen to fifteen transects were set along each farm. Each farm was visited two to four times a month. The number of individuals of each species observed in the transects were recorded. The survey has been continued and will be finished in spring 2008.

The landscape factors have been obtained from 2002 NJ aerial photos. The habitat vegetation surveys will be finished by the end of summer 2007.

#### 2. Anuran call survey:

During 2006, anurans were surveyed in two active farms (70S, 530SN), one newly abandoned farm (532W, 6 year abandonment) and one old abandoned farm (Pasadena, >50 years). The survey was conducted twice per month in each site. Right after sunset, I walked in the cranberry farms and stopped at different habitats (cranberry beds, ditches, reservoirs) to identify the anuran species and estimate their density by the calling intensity (level 1 to 4). Two more abandoned farms and one more active farm were added in 2007 to increase the replicates in order to compare the difference between active and abandoned farms.

In addition, anuran tadpoles were trapped with minnow traps in different habitats in each site. Traps were set right before sunset in each site and checked at the following dusk. The tadpoles were then identified and released.

### 3. Succession study in the abandoned cranberry farms:

In spring 2006, 25 wells were set in five beds of a newly abandoned cranberry farm to monitor water table changes. In fall 2006, 24 seed traps were set up in these beds to trap seeds dispersed by wind, aiming to compare the seed composition in these beds.

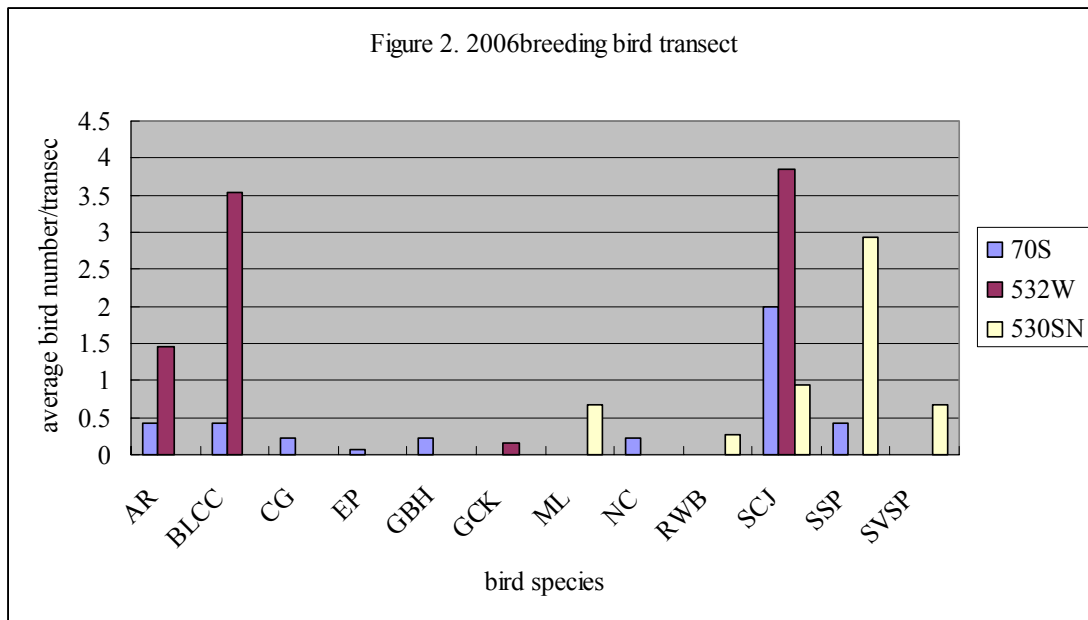
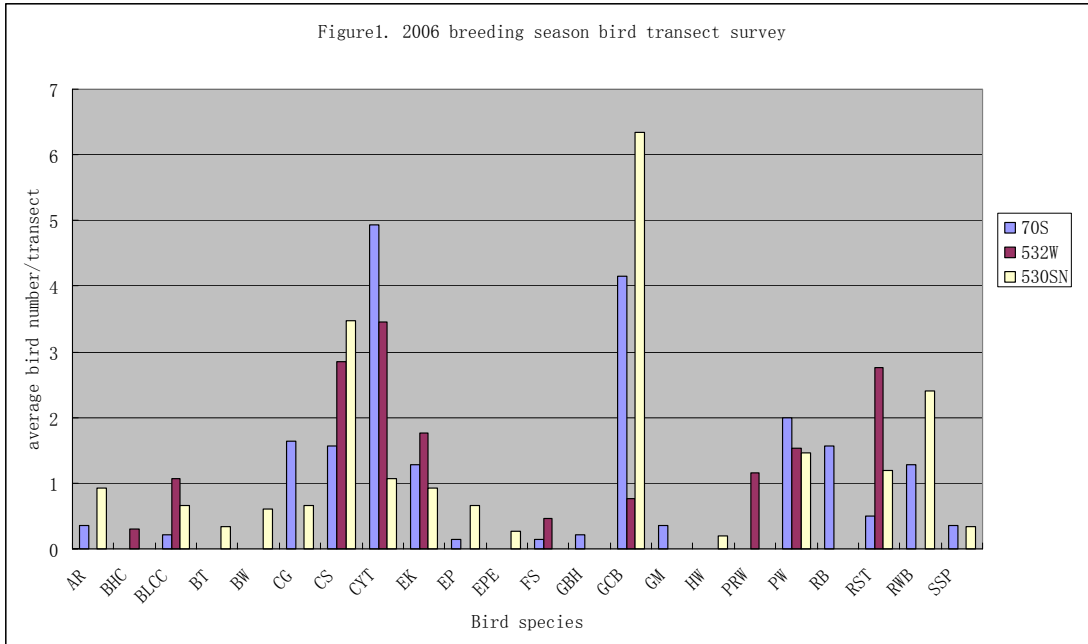
In spring 2007, soil cores were taken in eight beds (four beds with low water tables and four beds with high water tables; four cores were taken from each bed) and brought back to the greenhouse for germination. Besides regular mist spray, two out of the four cores from each bed are treated with flooding once in two weeks. The germination result will be compared between beds with high and low water tables, and dry and wet treatments. In order to examine the seedbank with different ages, each soil core was divided into three layers: top layer includes the recent cranberry plants and dead runners; middle layer includes the older layers that were covered by sanding during later years of cultivation; bottom layer is the original wetland soil from before the construction of the farm. All the layers were all treated with the same wet and dry condition to examine the germination result.

### **Principle findings:**

#### 1. Bird transect survey:

During 2006, a total of 115 bird species were recorded. Nine visits during the breeding season (June-August) and eight visits during the winter (December-March) were conducted at each farm. However, in order to only include bird species that are using the cranberry farms as their habitat, the data was processed with a Visual Basic program. In each transect, only bird species that were observed more than three times during the season, or observed in two consecutive visits, were considered as residents that are using the transect. Therefore, out of the 115 species, 22 species were residents during the breeding season, and 12 species were winter residents.

The bird density didn't show a significant difference among different farms during the breeding season or the winter (ANOVA, breeding  $P=0.74$ ; winter  $P=0.55$ ). The ANOVA analysis of each individual species shows that during the breeding season, only the Grey cat bird (GCB, *Dumetella carolinensis*) had significantly different distribution among different farms ( $P=0.01$ , Figure 1), and Rufous-sided towhee (RST, *Pipilo erythrophthalmus*) had a marginally significant difference ( $P=0.06$ , Figure 1); during winter the distribution of Carolina Chickadee (BLCC, *Parus carolinensis*) showed a marginally significant difference ( $P=0.06$ , Figure 2).



Therefore, birds' distribution among various farms doesn't show a significant difference in general. In each season, however, some transects did support significantly higher densities of certain species. I hypothesize this can be explained by the difference in habitat factors for each transect. I am therefore conducting a vegetation survey in each transect to obtain the number and coverage of evergreen trees, deciduous trees, evergreen shrubs, deciduous shrubs, berry-producing shrubs and grass/sedges. Also, the landscape factor of the coverage of human residence, agricultural land, coniferous forests, wetlands, and barren lands will be obtained from 2002 NJ aerial photos. These factors together with

the bird density will be analyzed with Canonical Correlation Analysis (CCA) to explain different bird species distributions in each transect. As a result, instead of using individual farms as replicates to monitor bird distributions, the boundary sections of these farms will be treated as replicates to evaluate the critical factors that determine bird habitat preferences.

The survey results of 2006 have demonstrated the difficulty of comparing bird distributions among different sites presumably because of the significant differences among each transect. Therefore, in order to compare the habitat function of active and abandoned cranberry farms, I have been surveying transects with similar vegetation types in three active and three newly abandoned farms. In each farm, three boundary transects and three dike transects were selected. I expect in this way I can eliminate the difference caused by transect variation, therefore each farm will then be treated as a replicate for either active or abandoned farm to compare the bird communities' composition.

## 2. Anuran survey

Eight species have been recorded by the call survey<sup>1</sup>. They are listed following the sequence of their call phenology: northern \*spring peeper (*Hyla crucifer crucifer*) (SP), wood frog (*Rana sylvatica*) (WF), \*carpenter frog (*Rana virgatipes*) (CARP), \*southern leopard frog (*Rana utricularia*) (SLF), \*Fowler's toad (*Bufo woodhousei fowleri*) (FT), \*Pine Barrens treefrog (*Hyla andersoni*) (PBT), \*green frog (*Rana clamitans melanota*) (GF), and grey treefrog (*Hyla versicolor*) (GTF). Species marked with an asterisk are believed to be the most common Pine Barrens species (Zampella and Bunnell, 2000). However, the survey result shows the distribution of these species is not even in the surveyed sites. Grey treefrog was only heard in the abandoned DeMarco site (accumulate intensity 5), where they could find an old artificial water pool to hold non-acidic water. The Pine Barrens treefrog and spring peeper have been only heard once in the two active bogs, but they were abundant in the Pasadena site. Fowler's toad, however, was found to be very abundant from May to early June in the active site 70S (the accumulate intensity was 26.0), but was never heard in the old abandoned Pasadena site, and only once intensively heard in the DeMarco site (accumulate intensity 4.2). In terms of the microhabitats they are using, PBT and SP were only heard in the surrounding canopies; FT was only heard along the roadside in the active site 70S and does not go into the bogs, but in the DeMarco site it was heard in the abandoned bogs. Similarly, CARP, the most abundant species throughout the season in all of the sites, was found in all kinds of microhabitats in both abandoned sites, but was only heard calling in the reservoirs or surrounding ditches in the active site. GF, on the other hand, was most frequently heard within the cranberry beds of the active farms. Interestingly, the tadpoles of CARP were trapped frequently both in the ditches and in the cranberry beds. This shows that the adult CARP doesn't use the beds for breeding, but the larvae like the narrow ditches in the beds for foraging. Overall, the two abandoned sites have the highest anuran diversity (all eight species have been recorded in the DeMarco site, and 6 out of 8 have been heard in Pasadena) and density. In both active sites, although five species have been recorded, the two widely distributed Pine Barren species (Pine Barrens treefrog and spring peeper), were rarely heard.

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<sup>1</sup> 1. Northern cricket frog (*Acris crepitans crepitans*) has been heard twice in August, but the call cannot be verified by visual evidence. Therefore it is not included in the result.

A quantitative comparison of the distribution of anurans in active and abandoned farms will be completed by the end of 2007. Survey results from the three active and three abandoned farms will be used to compare changes in anuran composition and density before and after abandonment. Because of anurans' restricted mobility and the differences in behavior among species, each anuran species' distribution will be compared respectively between the active and abandoned farms by two-way nested ANOVA.

### 3. Succession study in abandoned cranberry farms:

From April to August 2006, the water table fluctuations within five cranberry beds were monitored. They have shown significant differences between beds (ANOVA  $P < 0.001$ ), and multiple comparisons with Bonferroni correction shows the water table of three beds are significantly different from the other two.

The seed traps unfortunately failed to examine the wind dispersed seeds because of the extremely high wind intensity in the open farm. Only seeds with long glumes can be captured and remained on the trap. Therefore, instead seed traps, soil cores were dug this spring to study the seed dispersal and seedbank.

### **References:**

Zampella, R.A. and J.F. Bunnell. 2000. Distribution of Anurans in Two River System of a Coastal Plain Watershed. *Journal of Herpetology*, 34(2): 210-221.