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A Study of Bird and Bat Mortality at a Small Wind Turbine Facility During the 2010 Fall Migration.  
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### **Acknowledgements**

The authors wish to thank Orion Energy Systems for their cooperation in this study. We also thank various staff at the Wisconsin Dept. of Natural Resources, and Dr. Robert Howe of the University of Wisconsin-Green Bay for their advice.

### **Study Participants**

Kelly Eskew, James Knickelbine, Richard Luchsinger, Charles Sontag. Bernie Brouchoud collected bird banding data during the study period. Jessica Johnsrud assisted with searcher efficiency trials.

### **Summary**

A survey was done during the fall of 2010 at a small wind facility at Orion Energy Systems in Manitowoc, Wisconsin, where two wind turbines were installed in August and September of that year. Delineated areas beneath and around the turbines were searched each morning from September 1 through November 1, along with areas along the sides of the nearby office building for comparison. During that period, 2 bird carcasses, one beneath each turbine, were found, while 14 bird carcasses were found beneath windows at the office building. No bat carcasses were found.

### **Introduction**

Woodland Dunes Nature Center and Preserve is a nearly 1,200 acre wildlife preserve and environmental education facility located near Lake Michigan in east central Wisconsin between the cities of Two Rivers and Manitowoc. Founded in 1974, Woodland Dunes, a non-profit corporation, strives to protect and manage a complex of habitats, in particular forested ridges (dunes) and swales which are remnant shores of post-glacial stages of what is now Lake Michigan. Great Lakes forested ridge and swale habitat is considered to be of global significance in terms of wildlife and opportunity for conservation activity. Hundreds of species of plants and animals have been found at Woodland Dunes, including more than 260 species of birds, many of whom migrate seasonally along the shore of Lake Michigan.

Conservation of birdlife was a primary reason that Woodland Dunes was founded. Birds are an important part of local and global ecosystems in ways that far exceed the enjoyment of their appearance- they provide what are known as ecosystem services and to some extent contribute to not only environmental but economic health

through their role in provision of our food (eating crop pests, cycling nutrients, aiding pollination, dispersing seeds) regulation of climate by influencing habitats, of disease by scavenging, and by providing recreational activities which generate significant economic impacts. Birds are often “flagship” species whose population changes also indicate changes in environmental quality.

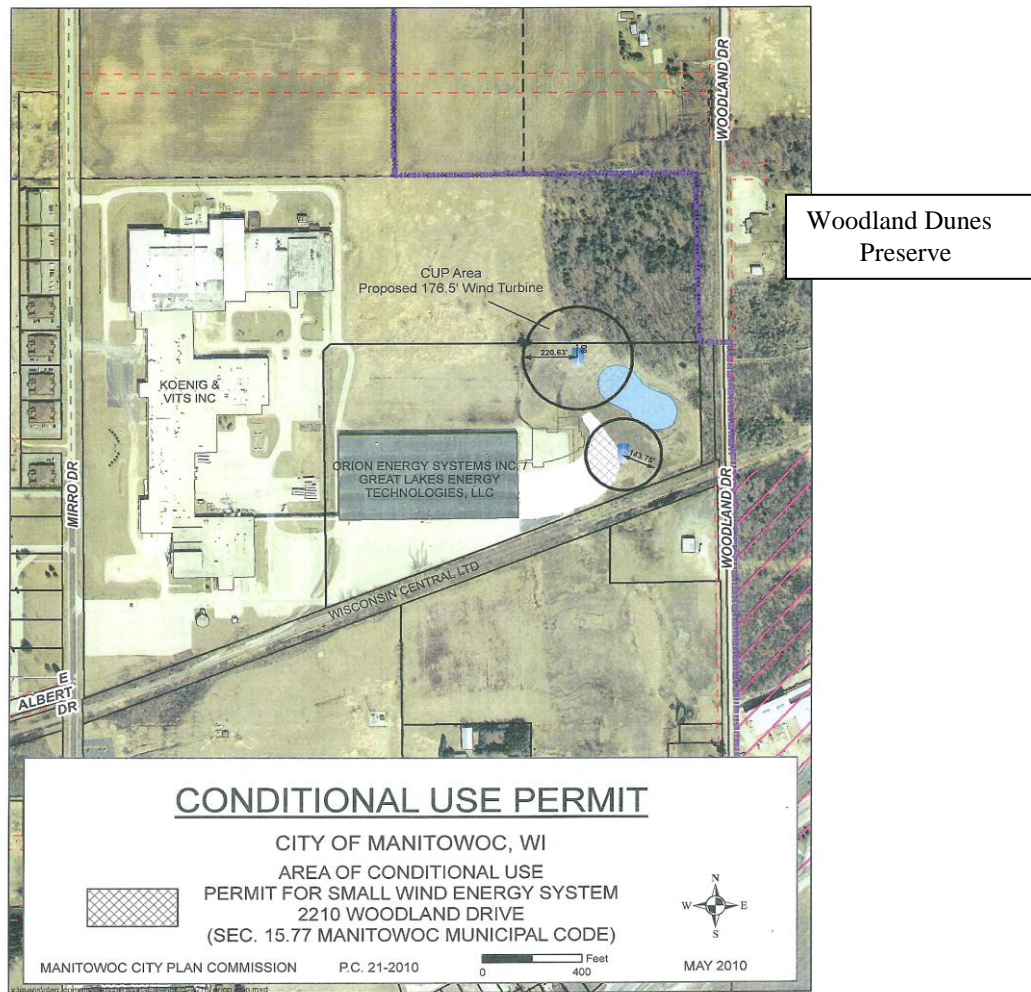
Recent installation of wind turbines as a demonstration project and means of generation of electrical energy at Orion Energy Systems, located adjacent to the Woodland Dunes preserve, has provided an opportunity for studying the risks posed by these structures to birds and bats. When Orion Energy Systems came to Woodland Dunes to discuss their intent to construct two wind turbines, both as a demonstration project and to generate electricity for their facility, we discussed our desire to ensure the welfare of wildlife in the preserve, but at the same time acknowledge the importance of development of sources of clean energy. Subsequent review of available research appeared to indicate that in many cases few birds were killed by colliding with wind turbines, but none of the studies found were conducted near a nature preserve close to the shore of Lake Michigan, a known migratory corridor for birds. We proposed conducting a study of the proposed turbine (at that time one was planned), and when comments were sought by the City of Manitowoc Plan Commission we again stated our desire to study the site. Orion agreed to allow us access to their property to conduct searches and other activities. The first turbine, a 20kW model 115’ in height, was installed in August 2010, and a second larger 55kW turbine 176.5’ in height was installed in September. This study was designed for and focused primarily on the smaller turbine, although the accessible area beneath the larger one was also searched.

Spring and fall migration periods, when birds travel along the shore of Lake Michigan entering and departing Woodland Dunes each morning and evening, were thought to be the most important periods to monitor the wind turbines.



## Purpose

To attempt to assess the degree to which the presence of two small wind turbines near the Woodland Dunes Preserve results in bird and bat mortality.



Orion Energy Systems Property- wind turbines are located at circle centers.

## Methods

**Preliminary Survey-** from April to August 2010, the site was visited nine times, during which five-minute point counts, centered on the proposed small turbine location, were conducted. All birds seen or heard during the five minute intervals were recorded. The site was visited as early in the morning as practicable, usually between 7:30 and 10 am. In addition, a bird banding station operated by Woodland Dunes less than a mile from the study site was active during the study period, serving to document the bird species present in that area at that time, many of them fall migrants.

**Search Area-** After researching criteria used to evaluate other sites, a square search area with each side 206 feet (180% of the turbine height) in length was delineated and marked with flags. The small turbine was centered in the search area. Almost all of the search area was either lawn or parking/driveway paved with asphalt. A small area along the south side was vegetated in wet meadow (reed canary grass, Canada goldenrod) and shrub (red-

osier dogwood and willow) species. After the larger turbine was erected partway through the study period, a roughly 200 by 200 foot area from the turbine to the south was also searched. The area north of the turbine was



Search Area- small turbine

not owned by Orion, and was either wooded or wetland/wet meadow and was not searched. Much of the search area was mowed by Orion staff or was unvegetated as a result of recent construction. Mowed grass facilitates more effective searches, as short grass does not conceal carcasses to the degree that taller vegetation does.

**Search Methods-** a total of five people participated in training to search for bird carcasses. All were familiar with birds of our area: three were staff of Woodland Dunes, two were federally licenced bird banders, and one was Professor Emeritus in Biology and a past president of the Wisconsin Society for Ornithology. Searchers were instructed to walk the search area on a north-south axis, searching along transects at five-meter intervals. If bird carcasses were found, the date, location and species were recorded. The east and south sides of the office building were also walked, and carcasses of birds which presumably had collided with windows were also collected. Searchers were asked to search as early in the day after sunrise as possible, and searches were usually conducted before 8 am. From the period of September 1 to November 1, searches were conducted on all but three days.



Small Wind Turbine



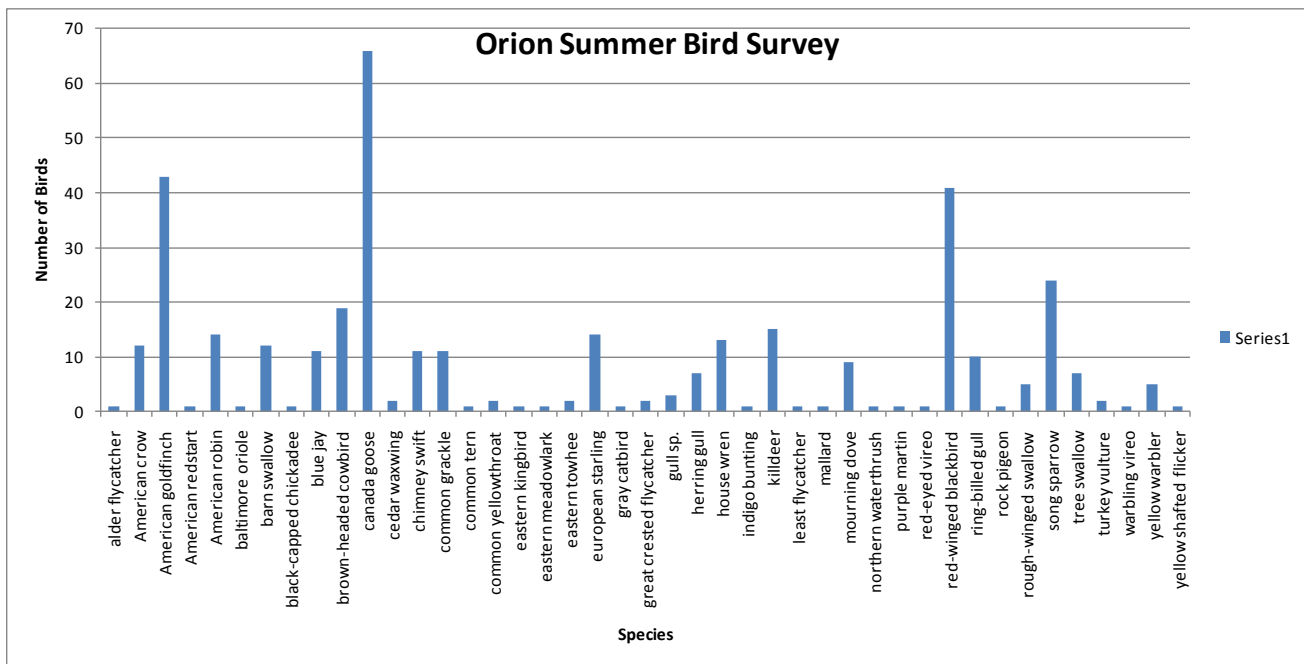
Office Building

**Scavenger Study-** it was anticipated that scavengers may locate and remove carcasses before searchers could find them, so a control study was also done to document the degree that they might influence study results. On two occasions, five marked bird carcasses were placed at various locations within the turbine and building search areas. The locations were recorded and checked daily to determine how long carcasses would remain on the site before being removed by scavengers. Orion was contacted and informed of this, and it was requested that employees be careful not to disturb or remove any birds.

**Searcher Efficiency-** on two occasions carcasses were placed on the site and the locations withheld from searchers, who were then asked to search the site as usual. The first involved the carcasses placed for the scavenger study, the locations of which were not given to searchers. For the second trial, a staff member not involved in the study placed five carcasses on the site out of sight of searches, who then were asked individually to search as usual.

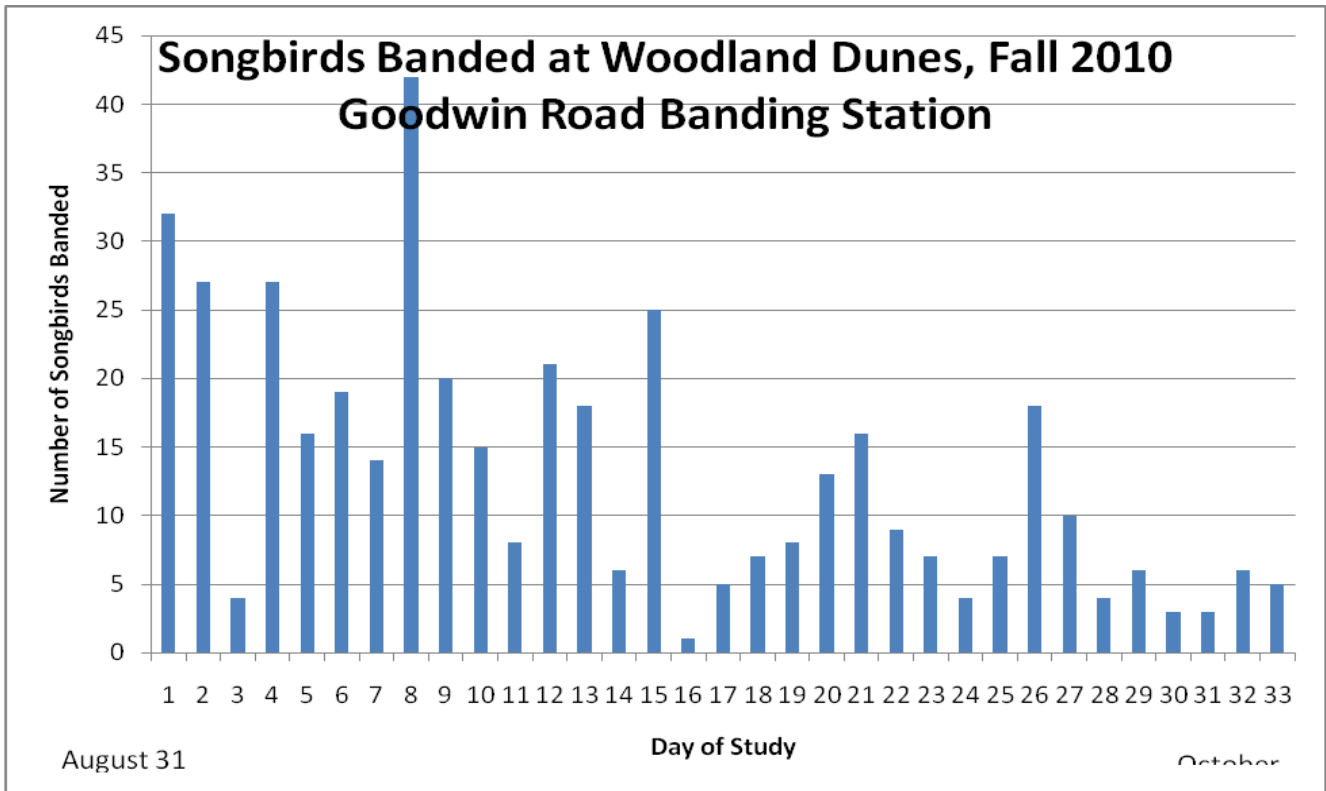
**Results-**

**Preliminary survey-** two hundred forty two birds of forty-three species were recorded during the spring and summer on or around the study site. The most numerous species were Canada goose, followed by American goldfinch and red-winged blackbird. A pond is located on the property, and three black swans (non-native and unable to fly) were also present there.

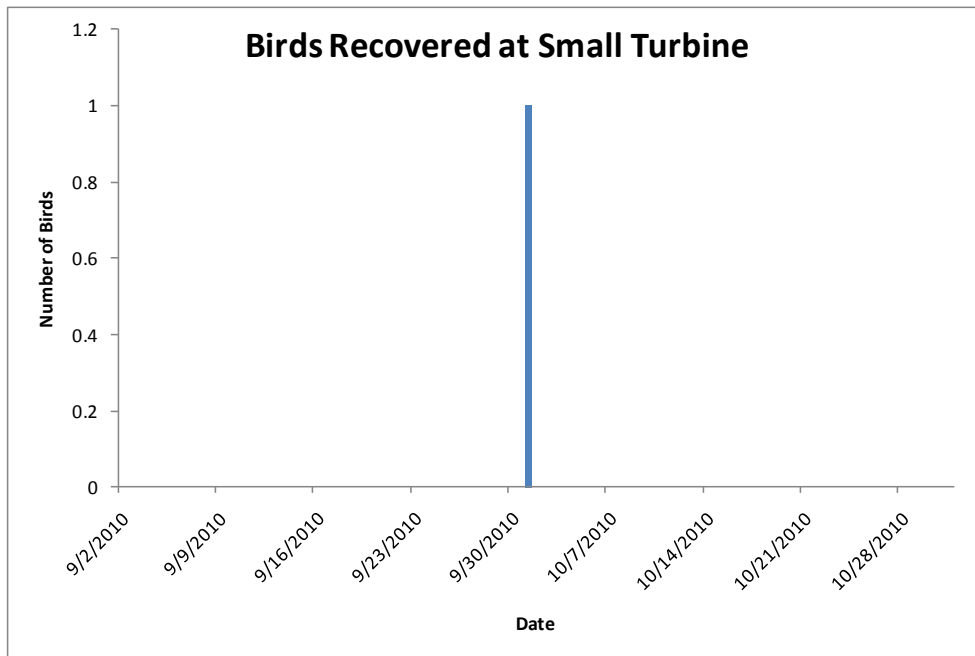


**Bird Banding-** In addition, during the study period, 462 songbirds of 43 species were caught, banded, and released at our banding station near Goodwin Road less than a mile from the turbine site. In addition, 304 northern saw-whet owls were also banded in September, October, and early November 2010.

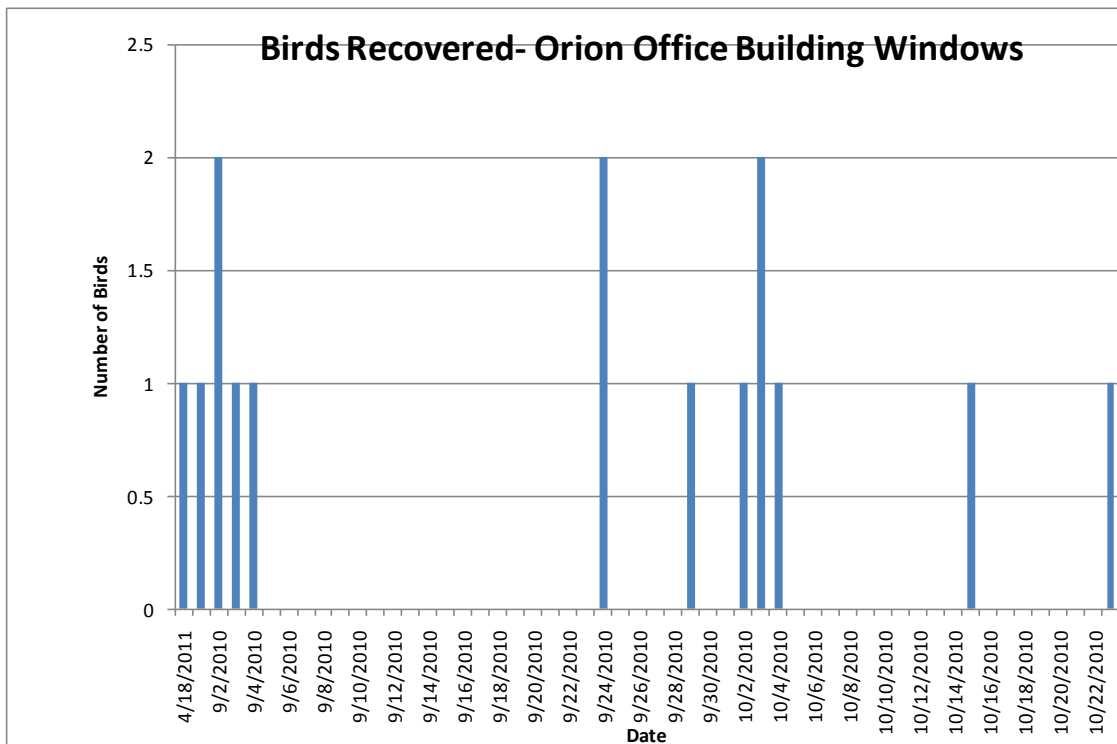
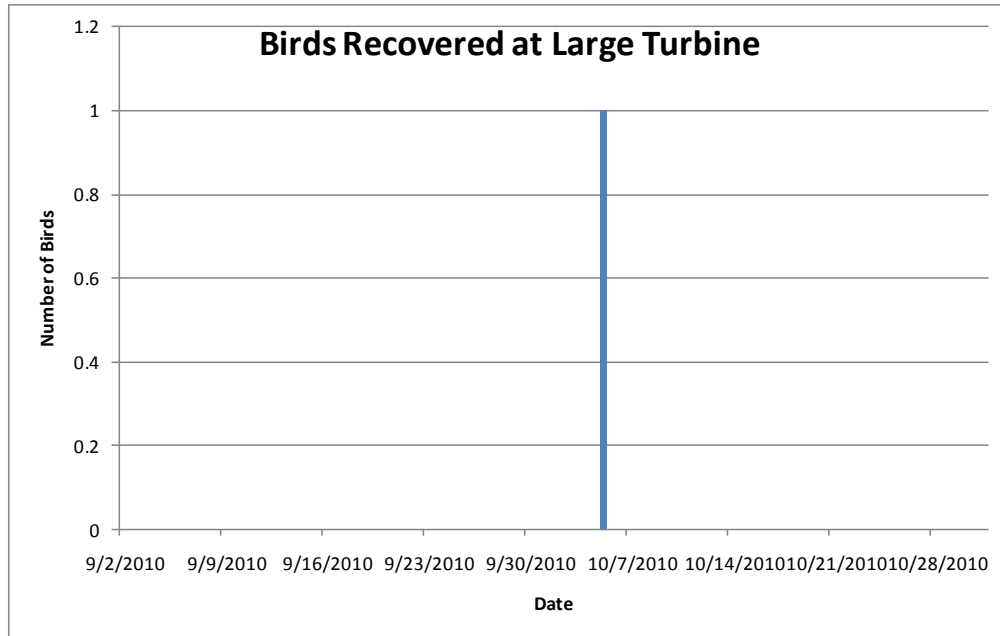
**Bat Monitoring-** although important to this study as we are interested in the interactions between turbines and bats, we did not monitor for bat species in the study area in 2010. We did visually observe migratory bat activity in mid-September both near the nature center headquarters and west of the harbor in Manitowoc.



**Carcass searches-** one bird carcass was found beneath each wind turbine. At the smaller turbine, a hatch-year chipping sparrow was found, and at the larger turbine an orange-crowned warbler was recovered. During the period, fourteen birds of seven species\* were found near the office building beneath windows. No bat carcasses were found. None of the species identified during the spring and summer surveys were among the carcasses found.



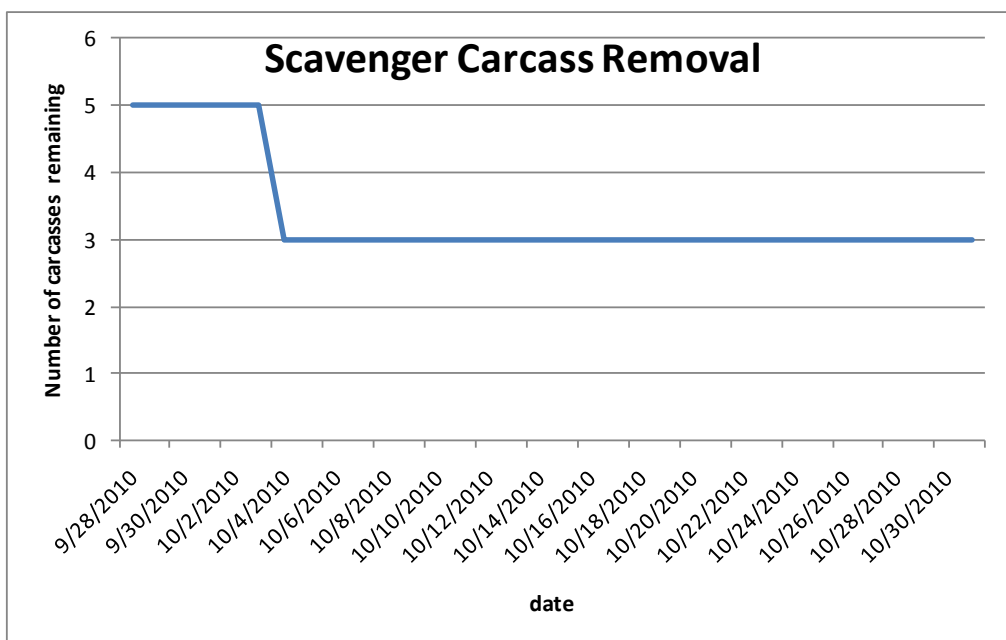
\*Species found at windows: Tennessee warbler, ruby-throated hummingbird, Swainson’s Thrush, Nashville warbler, magnolia warbler, hermit thrush, song sparrow, pine warbler, brown creeper, swamp sparrow, gray catbird, unidentified warbler, and unidentified sparrow species.



In addition, two carcasses were found near the building before the study period began (during the summer bird survey), and one old carcass, determined to have been present before the study period, was found within the small turbine study area.

**Scavenger Effects-** first trial (September 28)- of the five carcasses placed on the site, all remained as placed for five days. On the sixth day, two of the carcasses were missing. The remaining three were present throughout the remainder of the study period, more than four weeks. One consisted of a wing only, the other two were complete carcasses placed near the buildings. Both carcasses that had been removed had been placed on lawn

in the small turbine search area. On the second trial in early November five carcasses were placed only within the small turbine area, none were removed after 24 hours, after which time they were collected.



**Searcher efficiency-** in the trials done, searchers located 60% of the carcasses placed on the site.

## Discussion

This study is intended to examine wildlife interactions at a specific site and time period, is limited in scope, and is considered by the authors to be preliminary in nature.

The spring/summer resident bird survey and bird banding indicated that the area on and around the study site is frequented by a relatively large number of birds of dozens of species. Interestingly, none of the species recorded during spring and summer were among the carcasses recovered during searches either at turbines or windows. As a result, we surmise that most of the birds in this study either at turbines or windows were migrants.

During the study period, more bird carcasses were found near the windows of the building than were found near the wind turbines.

Some carcasses were being removed, probably by scavengers, in this case 40% after five days. This could reduce the number of carcasses recovered by searchers. However, because few days were not searched, it does not appear likely that scavenger activity alone could account for the low number of carcasses recovered at the turbines. Substrate was also considered- of the carcasses removed one was on lawn, and one on mulch near a tree. All of the remaining carcasses were on mulch either near the building or a tree and were untouched by scavengers.

Searcher efficiency was modest, even though the site was relatively easily searched (mowed lawn and asphalt). Late in the season when the efficiency trials were run, leaves and other dead vegetation observed may have

hampered searchers. However, considering both searcher efficiency and scavenger removal, it appears likely that most carcasses should have been detected.

It was observed that at this location that during the study period, winds were often light to calm at night, and early in the morning the small turbine was not operating. When the turbine blades are not rotating, it is assumed that the potential for bird collisions is reduced. It is not known if this is related to season or this location, or is consistent annually. See weather data charts in the appendices. It is thought that the sound of the rotating turbines may attract bats, but if the turbines are not moving at night we would expect them to be less attractive, which may explain the lack of bats found to some extent.

Both wind turbines are unlighted. The lack of lighting may reduce their attractiveness to birds. Both turbines also lack guy wires and are on tubular towers. The presence of guy wires and lattice construction of towers has been shown to present a greater hazard to birds than unguyed, tubular towers. Also, tower height may be a factor- studies of communication structures indicate that those taller than 500 feet pose a greater hazard to birds than shorter structures. Lighting would not be expected to be an attractant to bats, unless perhaps it was of a type which attracts insects to the turbines.

### **Conclusion and Recommendations**

The hazards which wild birds face are generally well known. Tall buildings and other structures, windows, free-roaming cats, motor vehicles- all take a toll on birdlife over and above the natural hazards birds face daily from disease, predators, and the like. The number of birds that we observed which appeared to have collided with the wind turbines was low in comparison to the numbers which appeared to have collided with windows at the building nearby. According to Kerlinger et al (2011) when considering scavenging and searcher efficiency rates final estimates are usually 2-5 times higher than the number of birds actually found. Using this rough estimate and our data, the number of birds expected to be killed by these turbines would be between 4 and 10 per year. If the same were applied to the windows nearby, the estimate would be between 28 and 70 per year by comparison.

In addition to background population studies for birds, we will attempt to monitor bats as well. In addition to searches during migration periods, periodic summer searches for resident bats will be considered.

That few birds were found at these small turbines might be consistent with published work suggesting that smaller wind turbines are less troublesome to migrating birds than larger turbines. That one bird was found in the small turbine search area that had died prior to turbine installation illustrates that birds die at the site from causes other than the ones we studied here.

In any case, only one migration period has been monitored so far, and additional monitoring is recommended as a larger data set will increase confidence in the results discerned. We appreciate that Orion Energy Systems has given permission to continue this project in spring 2011.

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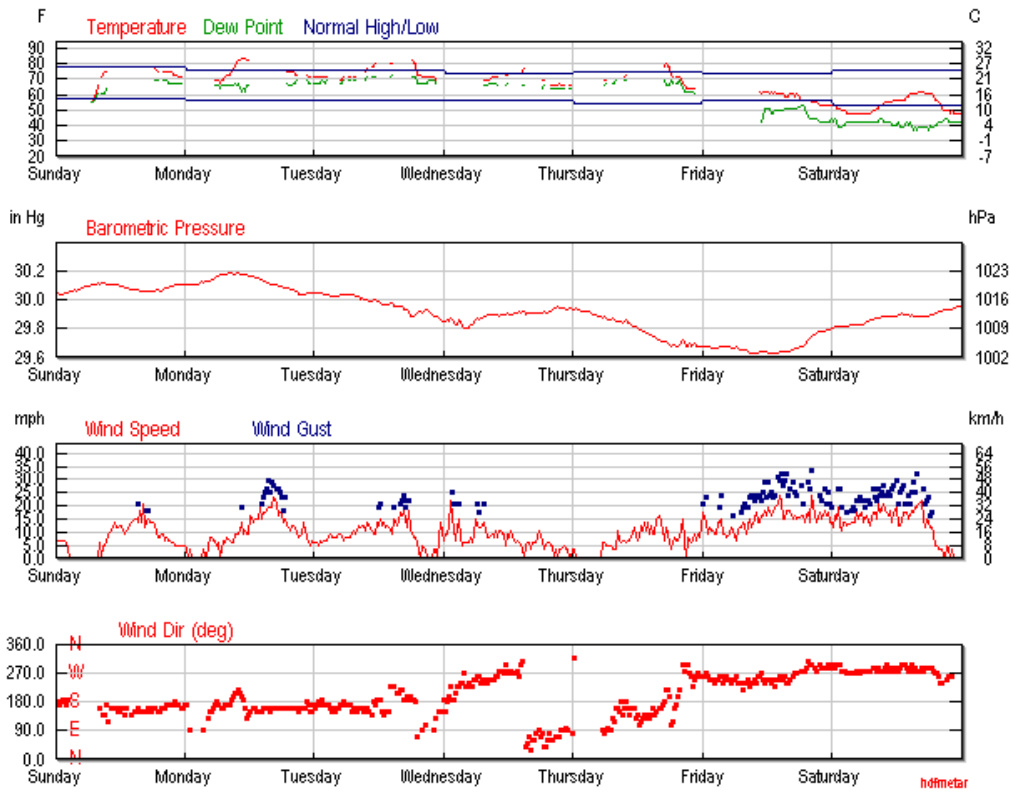
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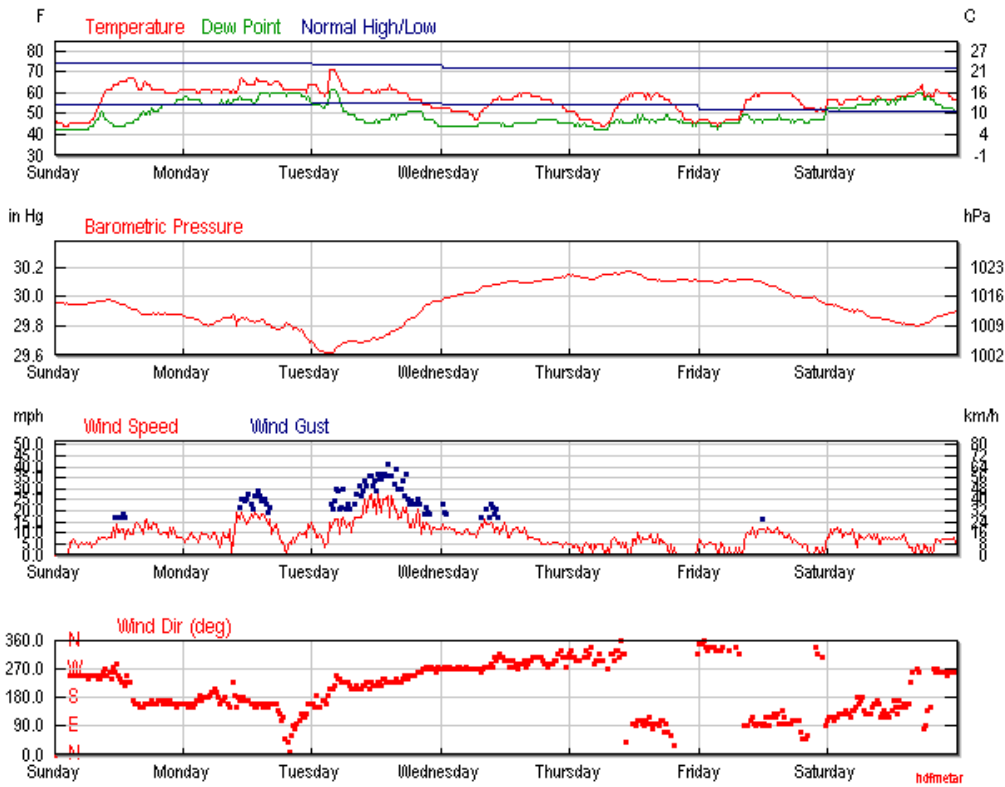
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Appendices below.

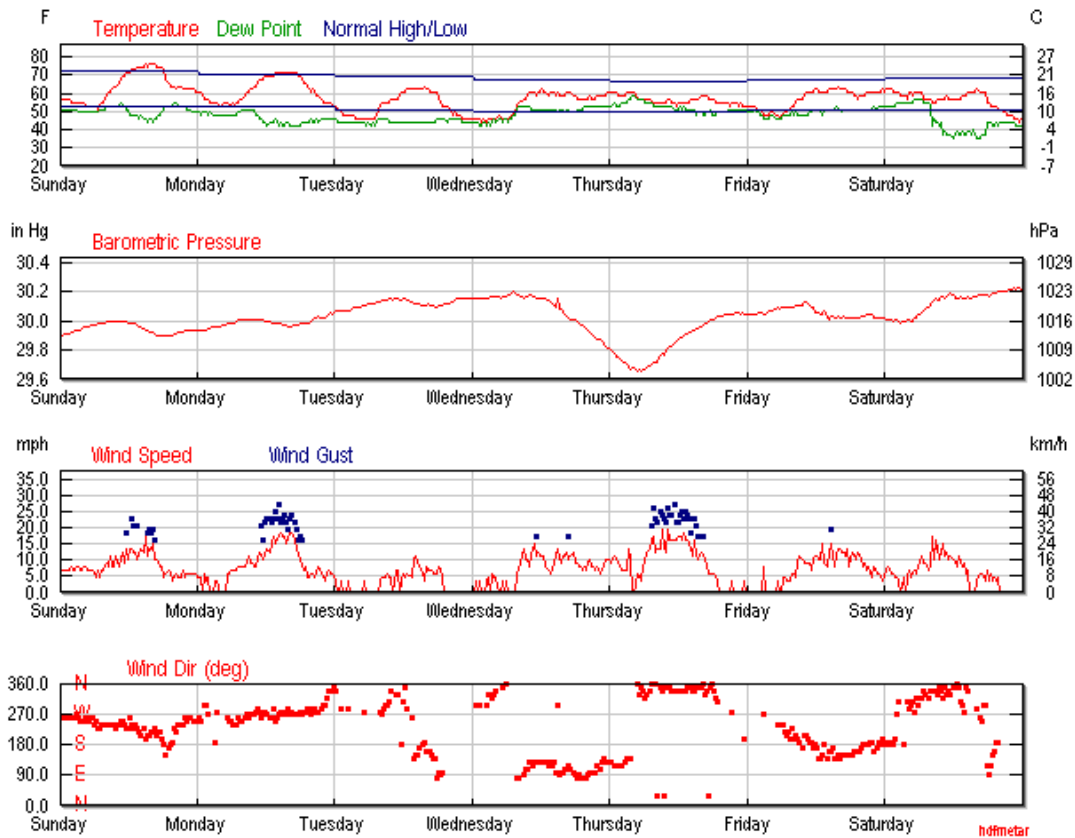
Appendices: Weather Data for Two Rivers, weather station at Stop N Dock Marina on West Twin River near Woodland Dunes. Charts are from weatherunderground.com



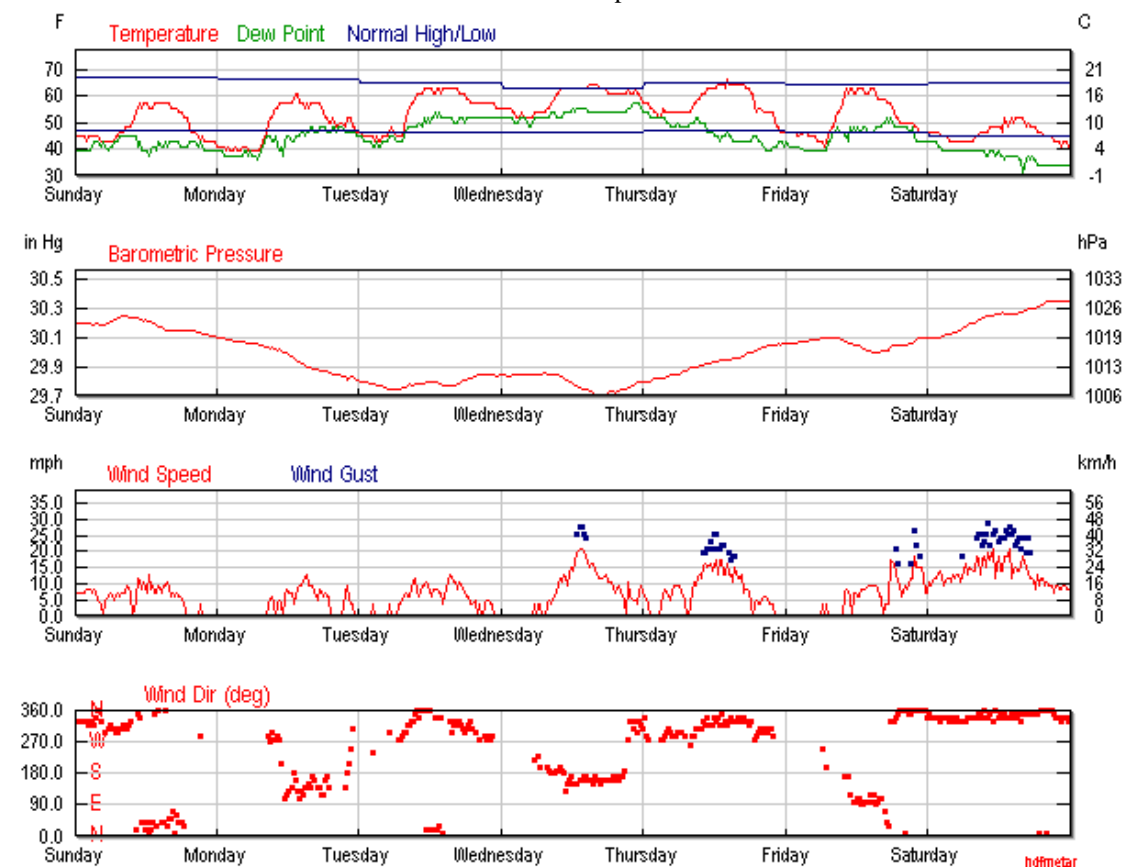
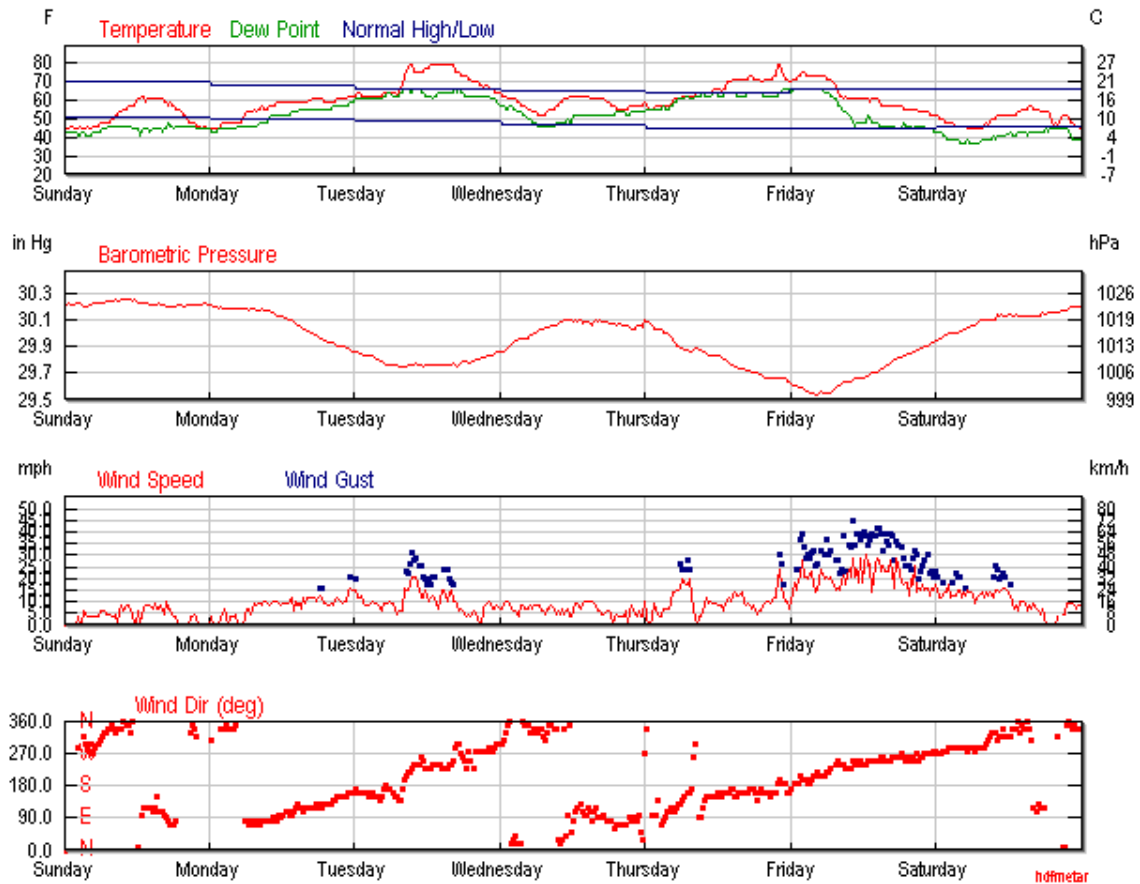
Weather graphs for week of Sept. 1 2010

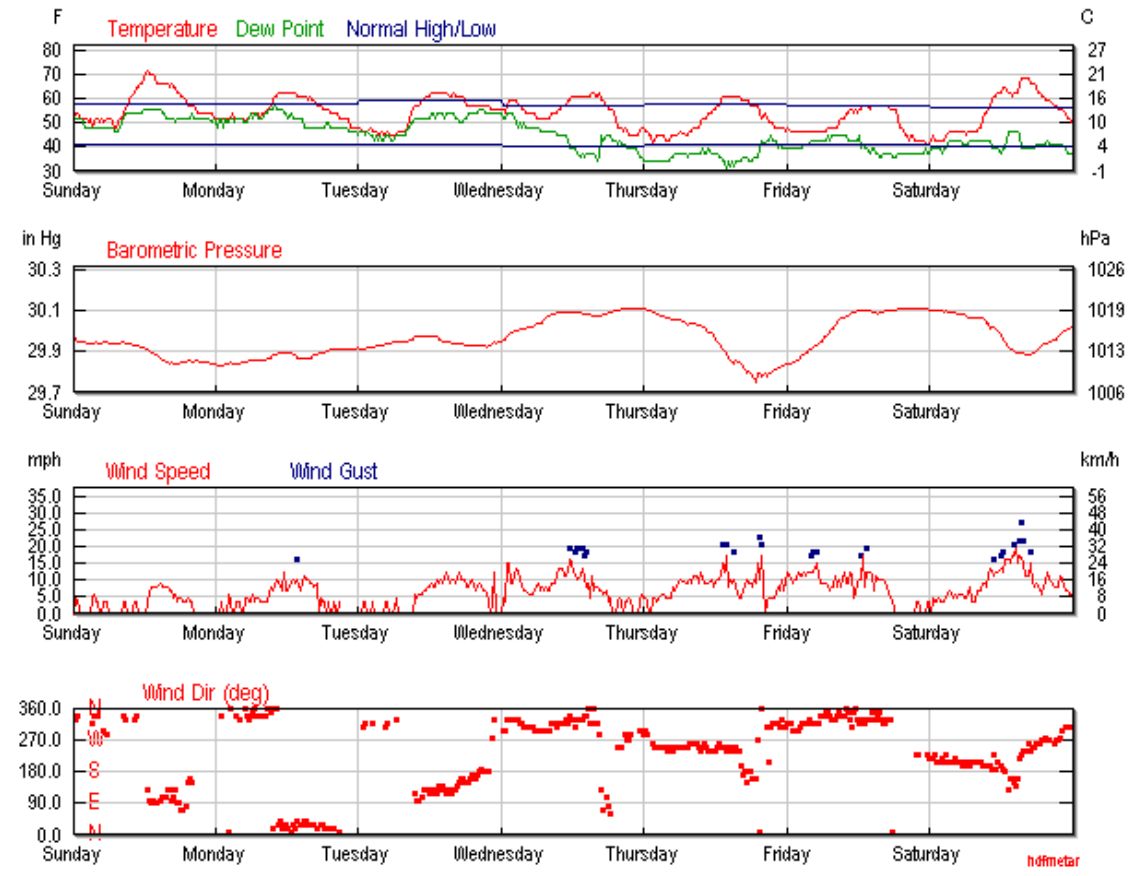
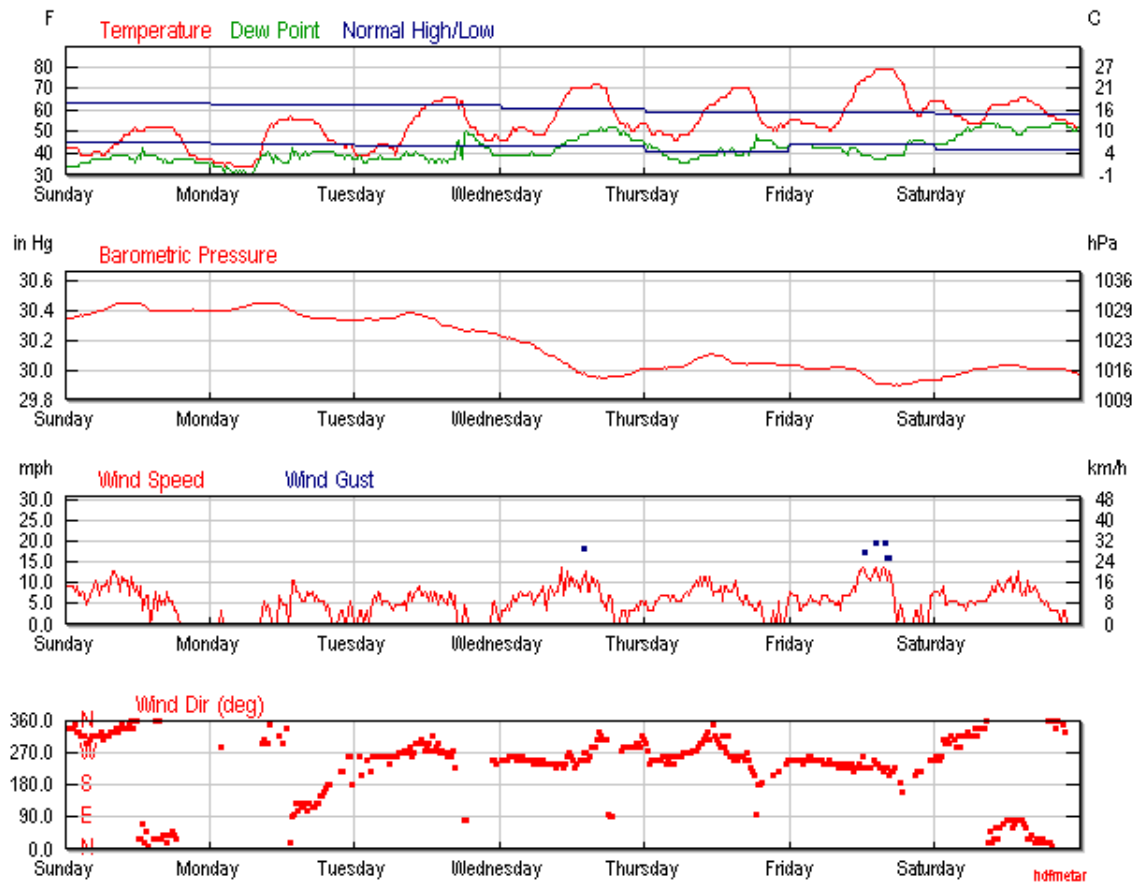


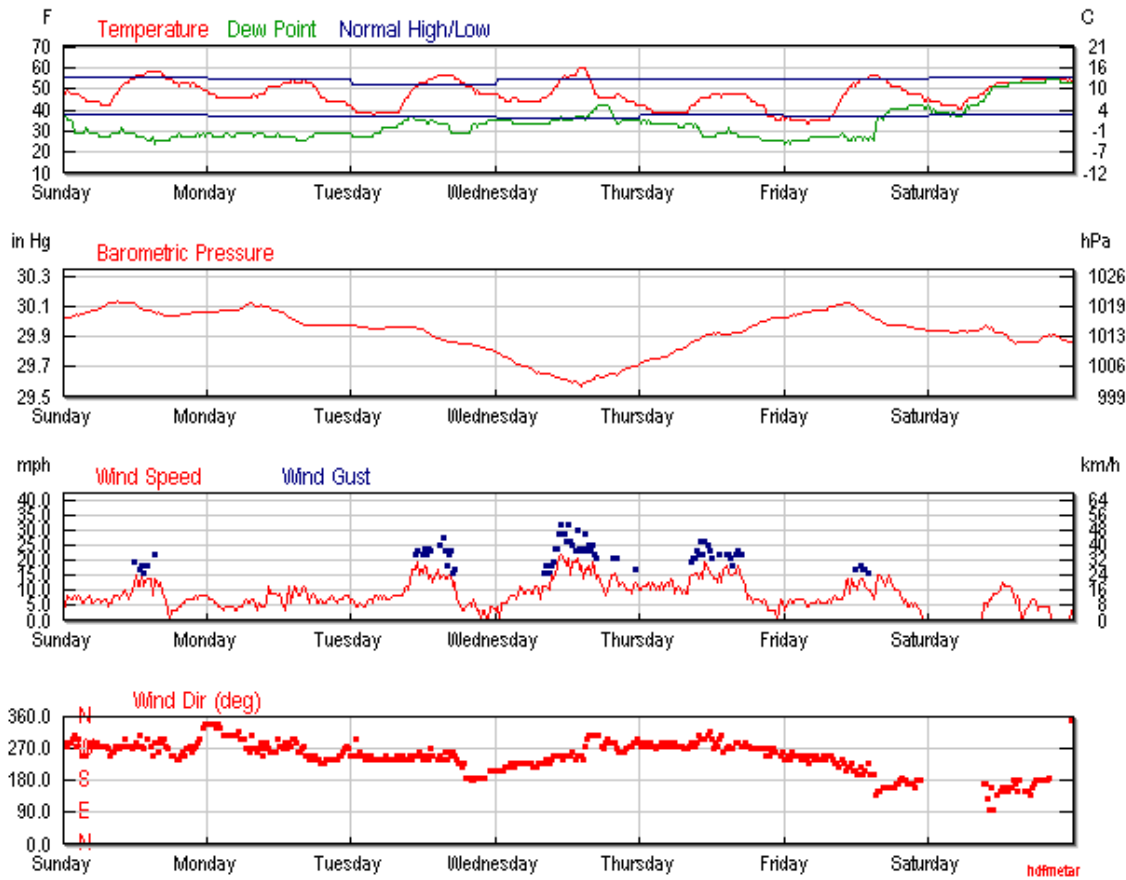
Week of Sept. 6



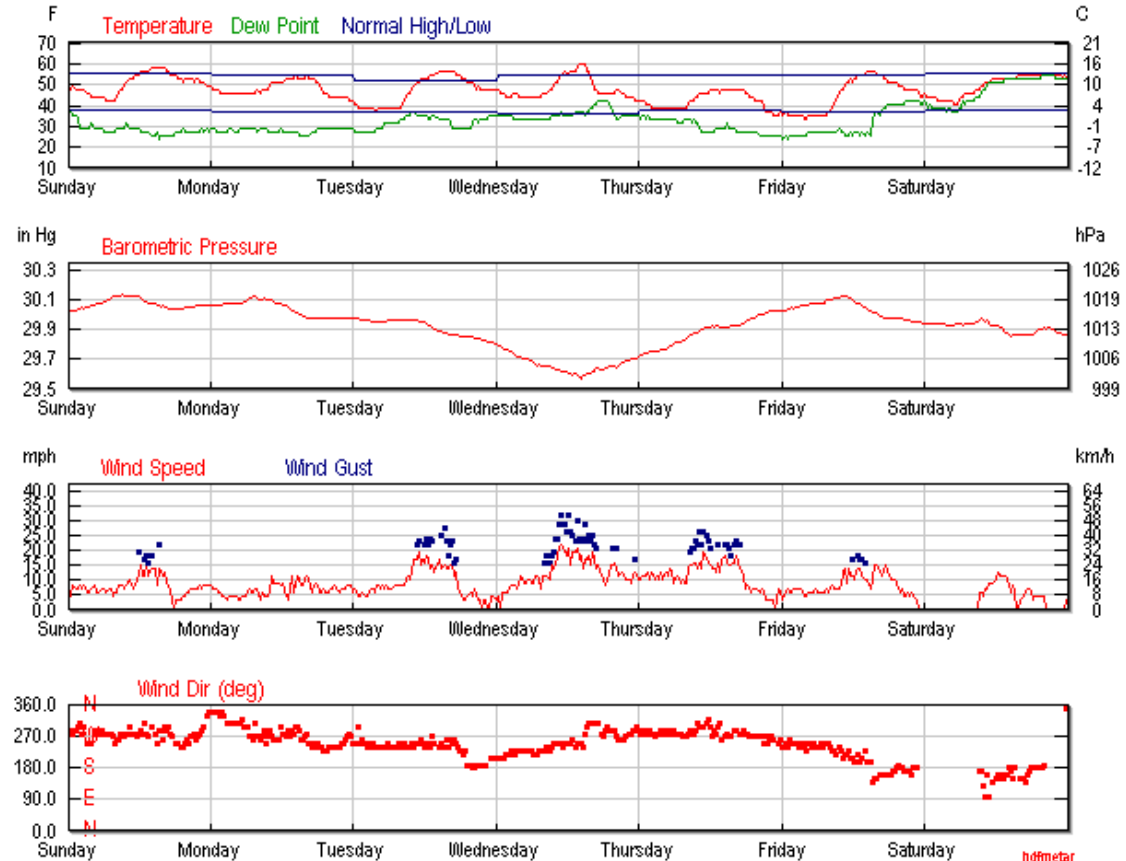
Week of Sept 13







Week of October 17



Week of Oct 24