

A Biological Assessment of the Nonn Development on Eagles Wintering in the Sauk Prairie Area

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Assessing the impact of any type of development on eagles that winter in the Sauk Prairie area requires an evaluation of eagle habitat needs. These habitat needs are based on habitat use data that Ferry Bluff Eagle Council (FBEC) has collected over the last two decades. The way that eagles use winter habitats, in turn, varies according to different spatial and temporal scales over which eagle habitat use has been examined. The purpose of this document is to present data on eagle habitat use in the Sauk Prairie area that are relevant to the FBEC assessment of impact likely to arise if the proposed Nonn Development plan moves forward as presented.

Eagles in the Sauk Prairie area are strongly influenced by food availability that varies among 3 different spatial scales: 1) Sauk Prairie as compared to other regions of the Upper Midwest, 2) habitats within the greater Sauk Prairie region (Wisconsin Dells to Lone Rock), and 3) within a particular habitat area such as the environs of Eagle Island located in close proximity to the proposed development area. Eagle habitat use is further complicated by changes in food availability over time because ice conditions on the river vary greatly during the winter. Ice has a large impact on the availability of fish, a major food source for eagles wintering along the Wisconsin River. Data related to different spatial and temporal scales will be presented in the order listed above so that our assessment of the proposed Nonn development can be understood in the appropriate context.

Habitat Use of Sauk Prairie versus the Upper Midwest

Eagle numbers in the Sauk Prairie area vary dramatically among years (Figure 1). This variation in eagle numbers, however, does not match the consistent, annual increase in Wisconsin's breeding eagle population (Figure 2). Similar increases in the breeding eagle populations of other Midwestern states have occurred as well. Eagles captured in winter in Sauk Prairie have also been found summering in the Upper Midwest (Figure 3), so the eagle population trends of the Upper Midwest should relate to eagle numbers in Sauk Prairie during winter if population alone determined habitat use. Clearly, the number of eagles that winter in Sauk Prairie is influenced by something other than the size of the eagle population in the Upper Midwest. Presumably, habitat conditions in the Sauk Prairie area attract more birds in some years than others, or habitat conditions outside of Sauk Prairie do the inverse. Direct evidence of eagles moving between winter areas in the Sauk Prairie and other winter areas in the Upper Midwest come from data on radio-tracked eagles (Hall 2005). In this study eagles captured in the Sauk Prairie area readily moved as far north as Stevens Point and the Chippewa River and as far south as Des Moines, Iowa (Figure 4).

Figure 1.

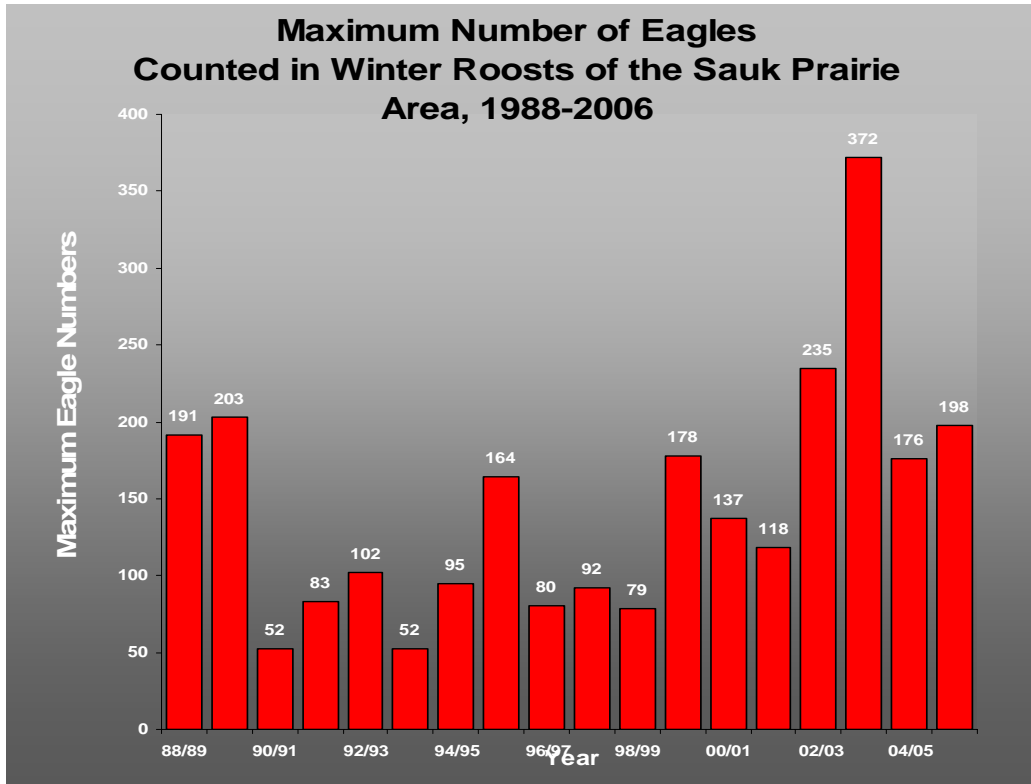


Figure 2.

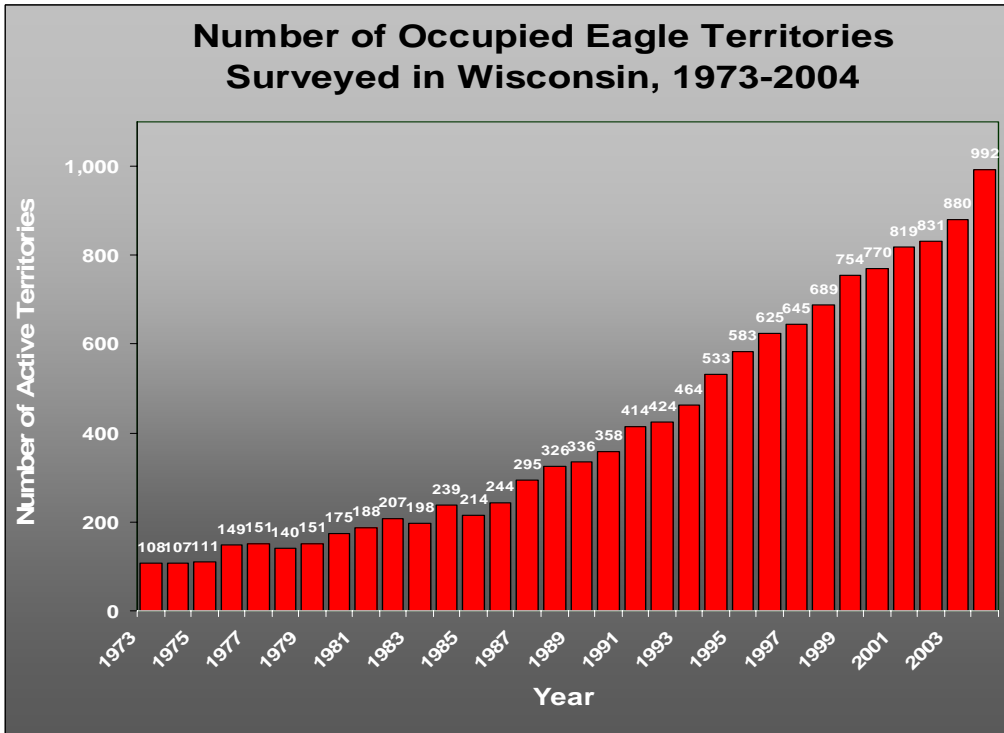


Figure 3. Eagle locations in summer (yellow) from birds that were captured in Sauk Prairie during winter. Flight path of the tracking airplane followed the red line.

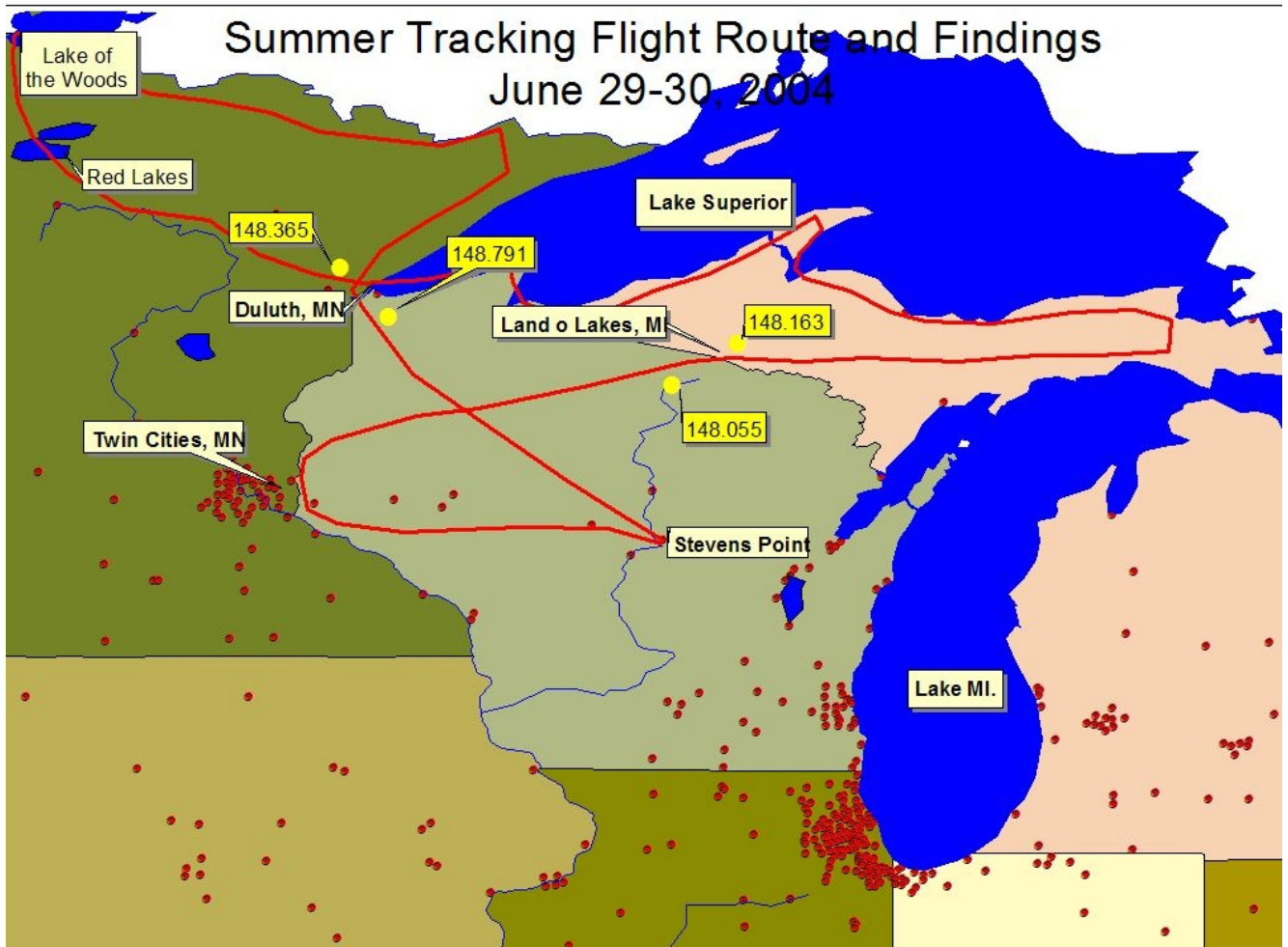
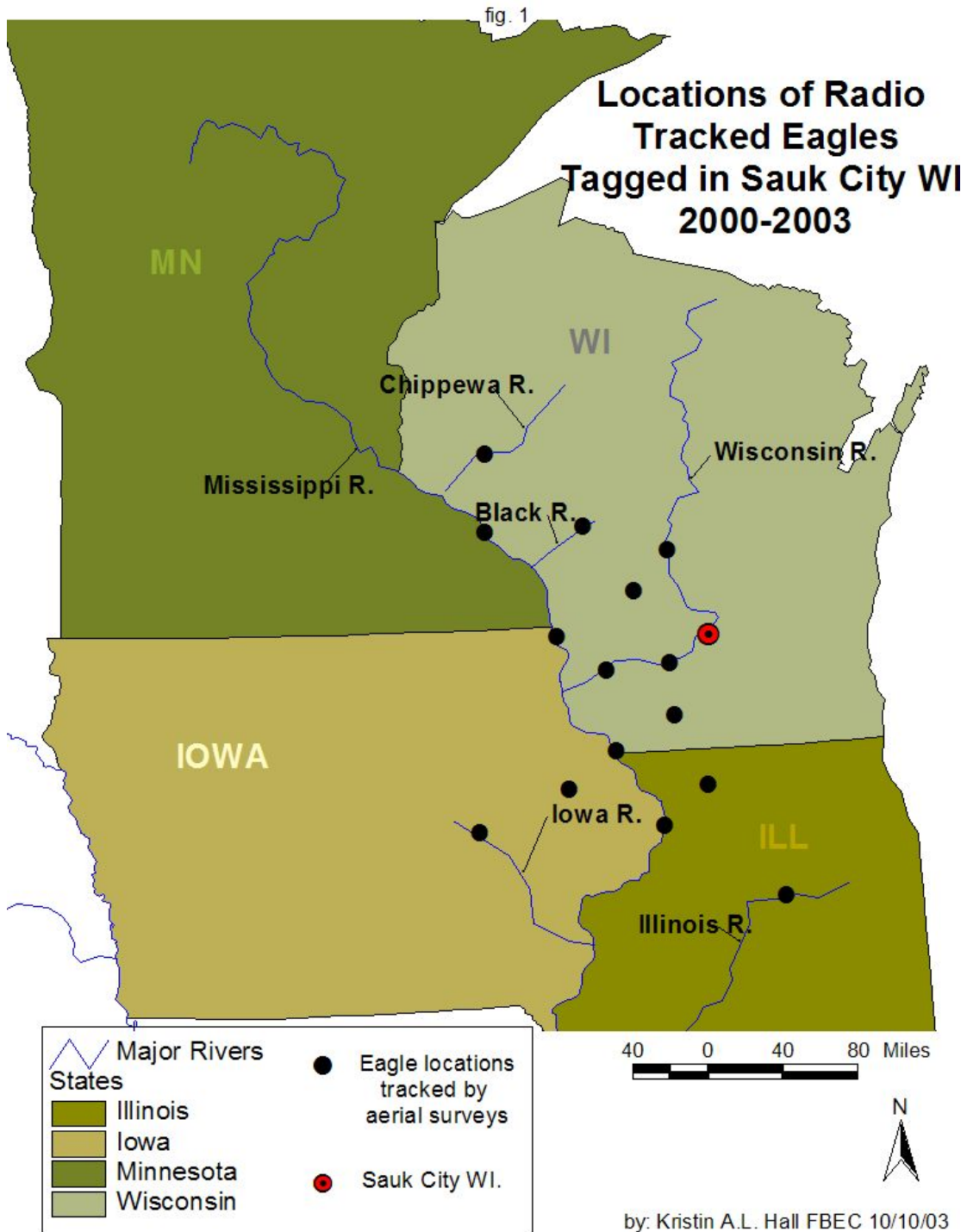


Figure 4. All locations of 17 eagles who were captured in the Sauk Prairie area during the winter of 2001/2002 and 2002/2003 when they were not found within the Sauk Prairie study area.



Though eagles would often move out of the Sauk Prairie area in winter, they would also return often during the same winter period. Of 17 eagles captured in Sauk Prairie, 15 eagles (88%) returned to Sauk Prairie the following winter. Ten of the 17 captured eagles (59%) returned to Sauk Prairie in more than one winter following the winter they were captured. Also included in the study were five additional eagles that were injured, rehabilitated, and released in Sauk Prairie during winter. Conversely, none of these 5 returned during subsequent winters. A high fidelity of eagles to the Sauk Prairie area in winter, coupled with the birds demonstrated ability to wander widely outside of the Sauk Prairie area during any one winter suggests that habitat conditions, with respect to eagles within Sauk Prairie do change and that eagles respond to those changes. Eagles that were rehabilitated and released in Sauk Prairie (i.e. they did not choose to be in Sauk Prairie) had no fidelity to this winter area.

Habitat Use of Specific Areas within Sauk Prairie

Habitat use data from radio-tracking eagles

Through radio-tracking 17 wild eagles caught during winters of 2001-2003 in the Sauk Prairie area, a total of 1,530 times we estimated eagle habitat use in our study area (Figure 5, Hall 2005). The proportions of habitat types used by eagles were equally split between agriculture, forested bluffs, and river-related areas (Figure 6). Open water (i.e. non-frozen) and most of the forested and non-forested wetlands were located in or near the Wisconsin River.

The river-related areas of importance to eagles contain trees along the Wisconsin River and allow the birds to perch and fish from a stationary (i.e. low energy-demanding) location rather than soaring. The river areas located closest to traditional night roosts of the forested bluffs were important habitats. In addition to forested bluffs and river-related forests, the Wisconsin River reach located just downstream of the dam also provided critical habitat for the eagles. Finally, agriculture areas are likely important to eagles as well, however, eagle use of these areas occurred in proportion to their abundance so it is difficult to assess how important agriculture areas are from these data. Developed areas were not used extensively by eagles.

In summary, the river near the dam, forested bluffs near eagle feeding areas on the river, forested edges along the Wisconsin River, and agricultural fields (where eagles safely feed on carrion) are critical habitats for eagles in the Sauk Prairie area during winter.

Habitat use in relation to location along the Wisconsin River

Habitat type alone does not predict eagle use well. Many dams, for example, are located on the Wisconsin River but eagles only concentrate at one of those dams (at Prairie du Sac) during winter (Figure 5). Conversely, eagles congregate along areas located far from the dam during the winter, such as near Lone Rock (Figure 5). Many areas of the Wisconsin River have forested wetlands and undeveloped shores such as downstream of Lake Delton, but birds do not congregate extensively there (Figure 5).

Geographic location and the juxtaposition of several types of habitats are equally important in predicting what habitats the birds will use and how they will respond to

disturbances. With radio-tracked eagles, the average distance moved each day from night roost to daily feeding area was 4.48 km (Hall 2005). Eagles tended to concentrate in winter when forested bluffs, undeveloped forested river edges and open water existed within this average flight radius.

Figure 5. All locations of 17 eagles radio-tracked from 2001-2004 in relation to habitat type in the Sauk Prairie area. The study area is demarcated by the yellow lines and the towns within this area include Wisconsin Dells, Lake Delton, Portage, Baraboo, Sauk City, Prairie du Sac, Spring Green, Lone Rock, and Plain. A total of 1,530 locations were collected (Hall 2005).

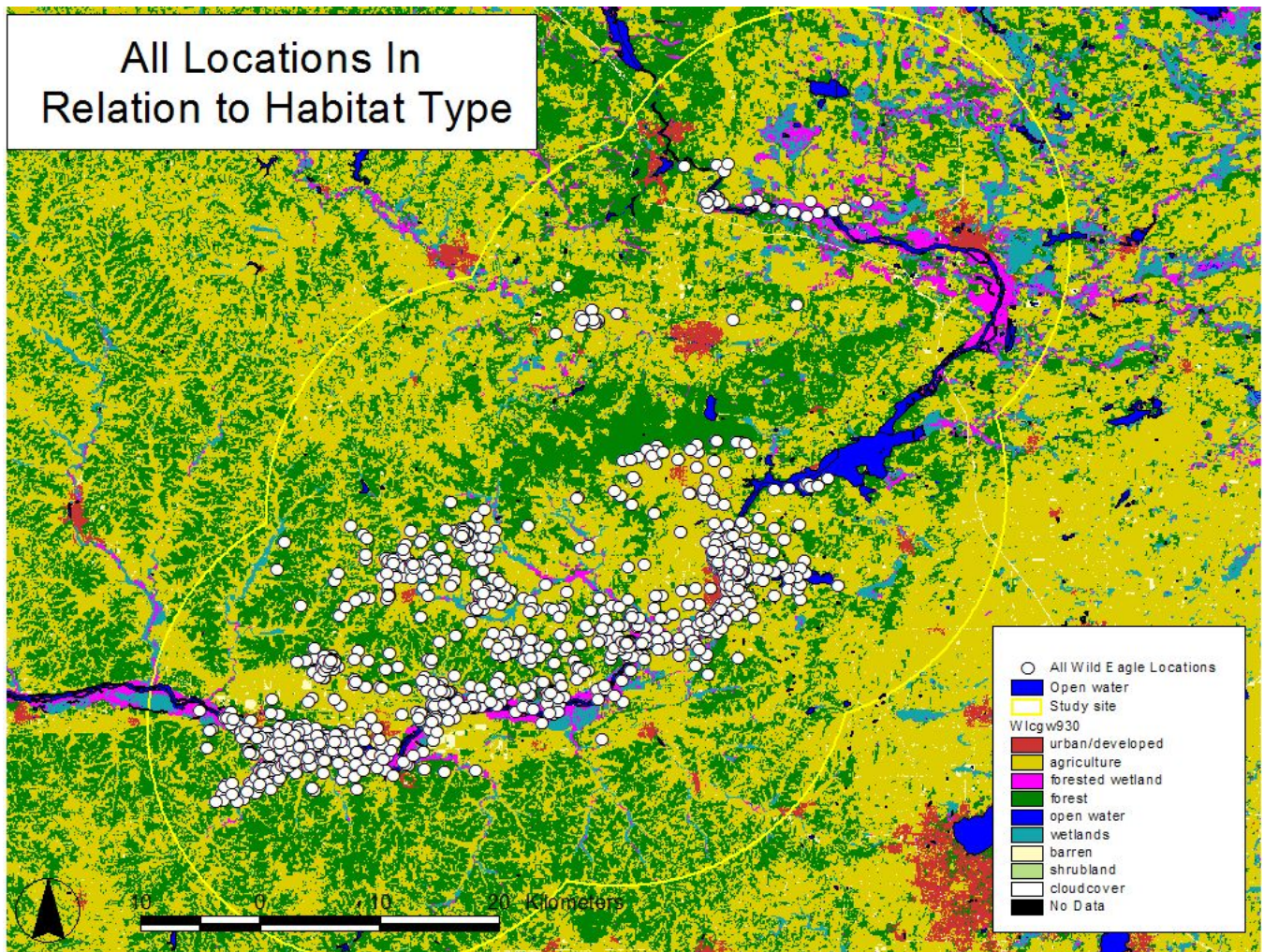
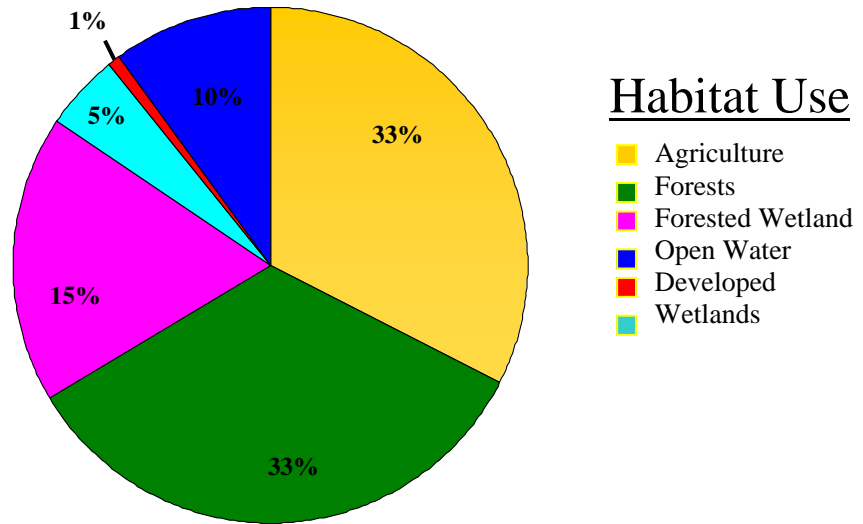


Figure 6. The proportion of habitat types used by 17 radio-tracked eagles in the Sauk Prairie study area. A total of 1,530 locations were obtained from 2001-2004 (Hall 2005).



Eagle Use within Habitat Types

Eagle Distribution

For the immediate area of Prairie du Sac and Sauk City, a confluence of important habitats occurs in close proximity (Figure 7): the undeveloped forested riverbank provides perching opportunities near the river; the forested bluffs provide night roosts located nearby; and the dam provides open water in all but the most severe winters. Agricultural habitat is also nearby. These habitats in close proximity to each other allow eagles to concentrate at the village limits of Sauk Prairie.

Careful examination of eagle use of the environs near the two villages suggest that, though habitat conditions for wintering eagles is very good, human disturbance is already influencing eagle distribution. As you would expect, eagle locations are concentrated near the dam upstream of Prairie du Sac and occur on both sides of the river. In this area the homes are sited well away from the river (Figure 7), reducing direct human disturbance. Downriver of the Highway 60 Bridge, where the village of Prairie du Sac closely abuts the river on the west bank, there is little eagle use of the west bank. Between Prairie du Sac and Sauk City, where less developed forested areas exist in Derleth Park, eagles again use the west bank. Once Sauk City abuts the river, eagle use of the west bank again dissipates until the river flows past the Highway 12 Bridge and homes are again set back from the river. In contrast, eagle use near Lone Rock is very different. The town of Lone Rock is located off the river and eagles use both sides of the river equally during the day (Figure 8).

These data reflect locations of radio-tracked eagles and are not meant to represent all eagle use. Eagles do use the west bank of the river in town. The large cottonwood opposite of Grand Avenue and the oaks near Culver Franchising are two good examples where eagles perch in close proximity to people. The use of these perches, however, is intermittent compared to the east bank of the river, or to perching trees on Eagle Island (Figure 7).

Figure 7. Locations of 17 eagles from 2001-2004 that were followed through radio telemetry in the immediate area of Prairie du Sac and Sauk City, Wisconsin. Daytime locations are in red while nighttime roost locations are in Yellow.

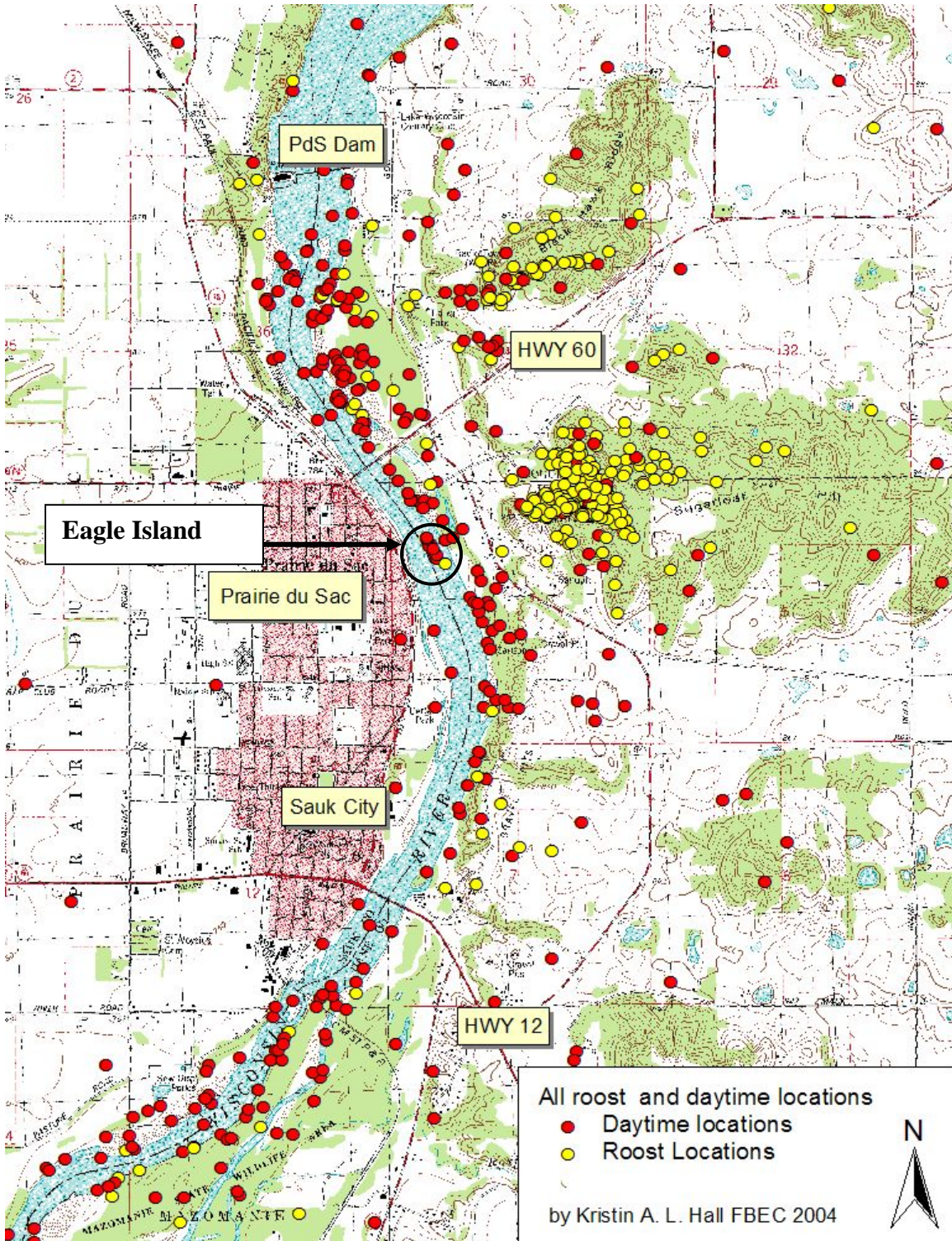
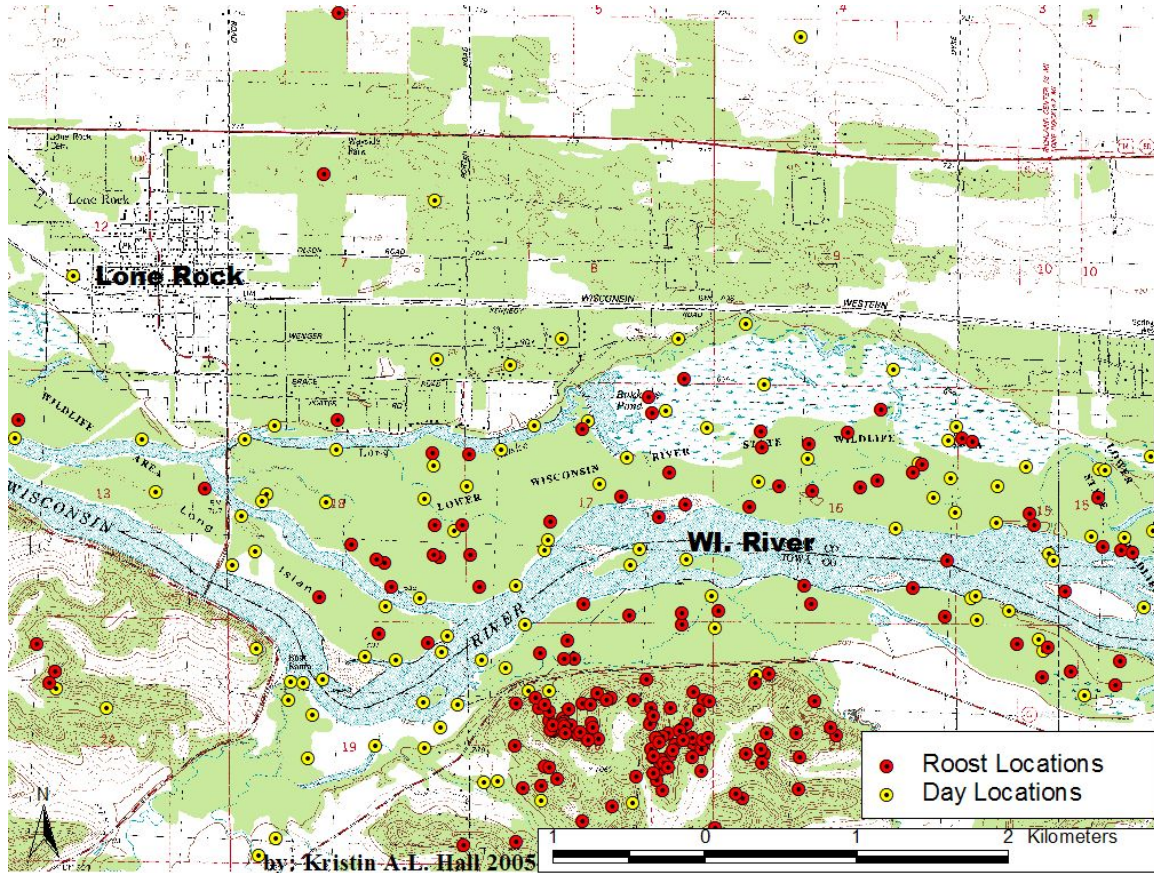


Figure 8. Locations of 17 eagles from 2001-2004 that were followed through radio telemetry near Lone Rock, Wisconsin. Daytime locations are in yellow while nighttime roost locations are in red (opposite of the depiction in Figure 7).



Estimating impact of development to eagles perching on Eagle Island

Though the disturbance created by the two villages in Sauk Prairie on eagle habitat use is subtle, it still appears important to eagles. Though much of this disturbance cannot be mitigated it is still relevant because new developments need to be compared to situations where disturbances already occur rather than to undisturbed scenarios. In situations where significant disturbance already occurs the question thus becomes: How likely is it that the new development will push conditions of disturbance past a point of tolerance by eagles?

In the case of the proposed Nonn development, the most sensitive winter eagle habitat that might be affected is Eagle Island (Figure 7), located directly across from the proposed development site. Eagle Island is used extensively by eagles and is well within a range where disturbance has been a concern in other studies (Brown and Stevens 1997, Buehler et al. 1991, Stalmaster 1987, Stalmaster and Gessaman 1982).

To assess the direct and immediate impact of the proposed development we looked at eagle use of Eagle Island in winter through a simulation of human caused disturbance. From Eagle Overlook to Graf Park, there are three businesses and two residences that occupy the land between the west bank of the Wisconsin River and Eagle Island.

The quality of any eagle-watching site depends on four primary factors. The downtown section has two of these factors built in: good access and a unique geometry that offers the closest possible viewing. It is the remaining factors that drive the viewing-quality of the site: how consistently eagles are present and in what numbers. More simply, it is the total number of eagle-hours (i.e. the number of eagles times the length of time they are perched on the island) that accumulate over the course of the day. The high number of eagle-hours that accumulate on Eagle Island make this location in town one of the prime viewing spots for eagle-watchers anywhere in town.

Eagles are wild birds, they choose when and where along the river they perch. The only aspect of eagle-hours that can be managed at any site is the number of times we intrude into their 'space', events that may create disturbances that cause them to fly away. Therefore, assessing the impact of any development so close to Eagle Island needs to focus on predicting whether the development will increase or decrease disturbances in this area. Disturbances that prevent eagles from using Eagle Island will have a biological impact that is discussed elsewhere in this assessment, but increased disturbances will also have a social and economic impact. In 2004, \$1.2 million was spent in the Sauk Prairie community by eagle watchers (Hall 2005) in large part because so many eagle-hours accumulate on Eagle Island. Eagle watchers thus see eagles and Sauk Prairie simultaneously. Development that reduces eagle-hours at Eagle Island will negatively impact eco-tourism arising from eagle watching.

Sensitivity Analysis of Impacts:

A sensitivity analysis was performed to examine the impact of multiple intrusions of brief duration. Its scope applies to the entire downtown viewing site. We express the results in terms of two factors relevant to eagles. The first is the proportion of each day that eagles have access to their foraging/perching habitat. The second is the proportion of the

day that an eagle can expect to remain perched in a tree before being flushed. Both are directly related to the number of eagle-hours that can accumulate at a viewing site such as Eagle Island.

The analysis takes into account that not all intrusions create actual disturbances that flush eagles. For example, two intrusions occurring closely together (in time) usually result in a single disturbance because eagles often take 30-60 minutes to return to their perch following a disturbance. From a management perspective it is much easier to count (and control) the number of intrusions than the number of actual disturbances they create.

Two key findings arise from a simulation of disturbance on eagles:

1) As expected, the access to their habitat declines with an increasing number of intrusions. The effective loss is smaller when eagle numbers are high. This is because when there are more birds moving around it takes less time for some bird or birds to return to the site (Figure 9, blue line). The loss is greater during the other 60% of the eagle season (Figure 9, green line). Reducing access time effectively reduces the eagle-hours at a site.

2) The average time an eagle can remain perched before being flushed (or flushed again) is another important factor. Increasing intrusions divides the day into smaller uninterrupted blocks of perching time (Figure 9, red line). Eagles usually stay perched for long periods of time (often for many hours). When flushed they tend to stay where they re-locate, accumulating in numbers along the least disturbed areas of the river. The number of eagles decreases with increasing intrusions, directly affecting the eagle-hours posted at a site.

An even more important observation is how the relationship of perching time flattens out with increasing intrusions (red line). Beyond about 10 intrusions, the time-to-disturbance becomes functionally equivalent to the busiest places--stretches known to be avoided by eagles in favor of alternative sites. After too many intrusions, a viewing site will become essentially abandoned by the birds.

Key Findings:

Intrusions have a profound effect on the distribution of the birds along the river--on how many eagle-hours accumulate along any given stretch. The results presented only reflect brief intrusions--events as quick as a single person walking into eagle 'space' or going out onto a proposed balcony, and retreating. Long-term disturbances (which may last for hours) have their own significant impact, and are not considered here.

As evidenced by Figure 7, disruptions are already reducing the quality of the downtown viewing-site and these disturbances cannot be mitigated completely. Managing intrusion numbers into the future will be a challenge under any development scenario. At about five brief daily intrusions, Figure 9 approximates the current level of disturbance that affects Eagle Island, given the current level of development that exists (i.e. Zick's Bait

Shop, Eagleview Dental, etc.). It offers a context of where we are now. It also provides a sense of how much more disturbance can occur before eagles will no longer use Eagle Island.

- ◆ Unless the total number of intrusions is kept below some critical level (perhaps 10 or so), the downtown could effectively eliminate itself as a viewing-site.
- ◆ Reducing the number of intrusions would lengthen the period of high-quality viewing throughout the whole eagle season. Increasing them has the opposite effect.

Issues Surrounding the Proposed Site:

FBEC has broached the issue of short-term intrusions (to both villages) in the context of the river-trail. The results presented here are relevant to this concern. But not all brief intrusions occur below the riverbank. In the downtown section, people in Graf Park, and residents living adjacent to it, also inadvertently flush birds.

The existing buildings (and the dense vegetation behind the fence) have provided a net benefit. The distance sensitivity of the birds is approximately bounded by the sidewalk that runs from Eagleview Dental to Graf Park. It is reasonable to infer that the few daily intrusions from the small number of people that live in those structures have had less impact than if the area was completely open and exposed to human activity.

This is the central problem that any redevelopment plan must face: the entire parcel is within an eagle-sensitive distance of Eagle Island and large portions of the opposite bank. What happens here will determine the future quality of eagle viewing at the downtown site.

Guiding Principle Applying to Any Proposal:

Protecting the viewing-quality of the downtown site requires us to minimize the number of human intrusions (both brief and long-term). Preventing an intrusion means protecting eagles in perching areas from seeing people at a distance that might cause them to flush. This distance varies somewhat from bird to bird, and even within a single bird.

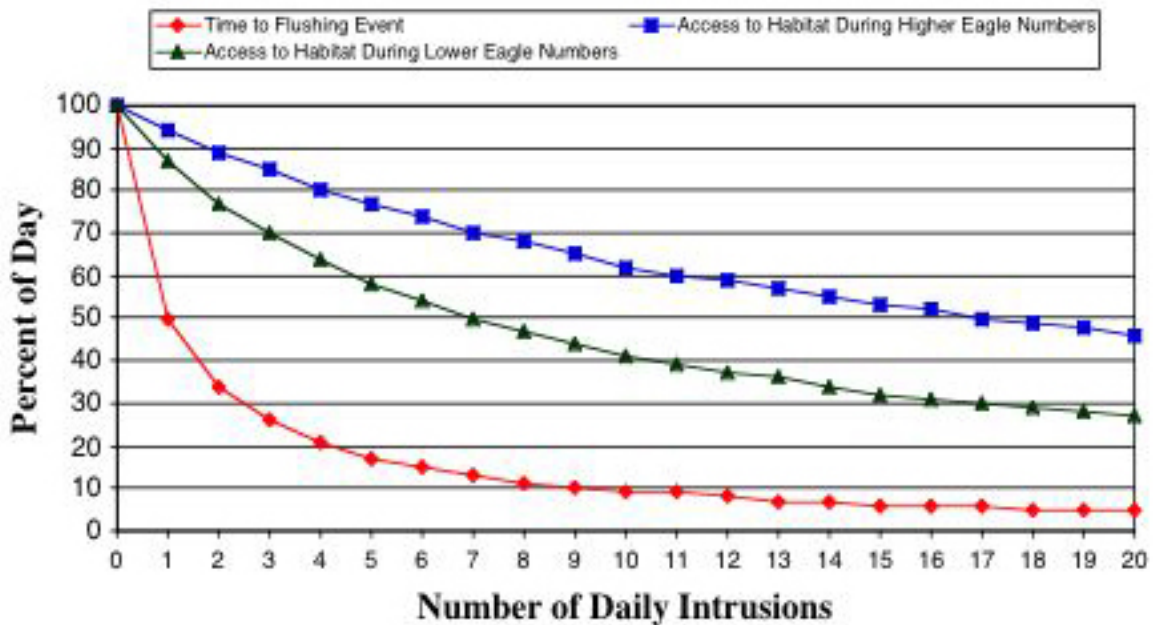
As a practical matter, it is appropriate to determine a distance that can be applied to most birds in most situations. This distance can be no less than 100 yards and could be larger. Each time anyone is within this distance to any perching tree, it counts as a separate intrusion. The total number of intrusions along the entire downtown site should not exceed the management goal of the Village. Our simulation (Figure 9) guides that goal. Currently there is good eagle use of Eagle Island when the daily intrusion rate is about 5.

Project proposals that physically satisfy the underlying visibility principle will naturally add little impact. Proposals that rely on assurances of human compliance to satisfy them are more problematic because it is unclear: 1) how adherence to rules will be monitored, 2) how tightly rules will be enforced, and 3) who will enforce these rules. If these issues are not resolved, the ability of the Village to protect its interest in eagles and eagle watching could easily and quickly erode. Even if appropriate rules were developed but

fail to elicit appropriate human behavior, disturbances to Eagle Island will quickly surpass a level that is tolerable by eagles and they will abandon use of the island as they have abandoned use of other habitat areas within the Sauk Prairie area (Figure 7).

Figure 9. Simulated analysis of intrusions by people into eagle perching habitat and the impact those intrusions may have on eagle use of that habitat.

The Effect of Brief Intrusions on Habitat Access and Flushing Time for the Wintering Eagle Population in Sauk Prairie Wisconsin



Habitat Use through the Winter In Relation To Ice Cover along the Wisconsin River

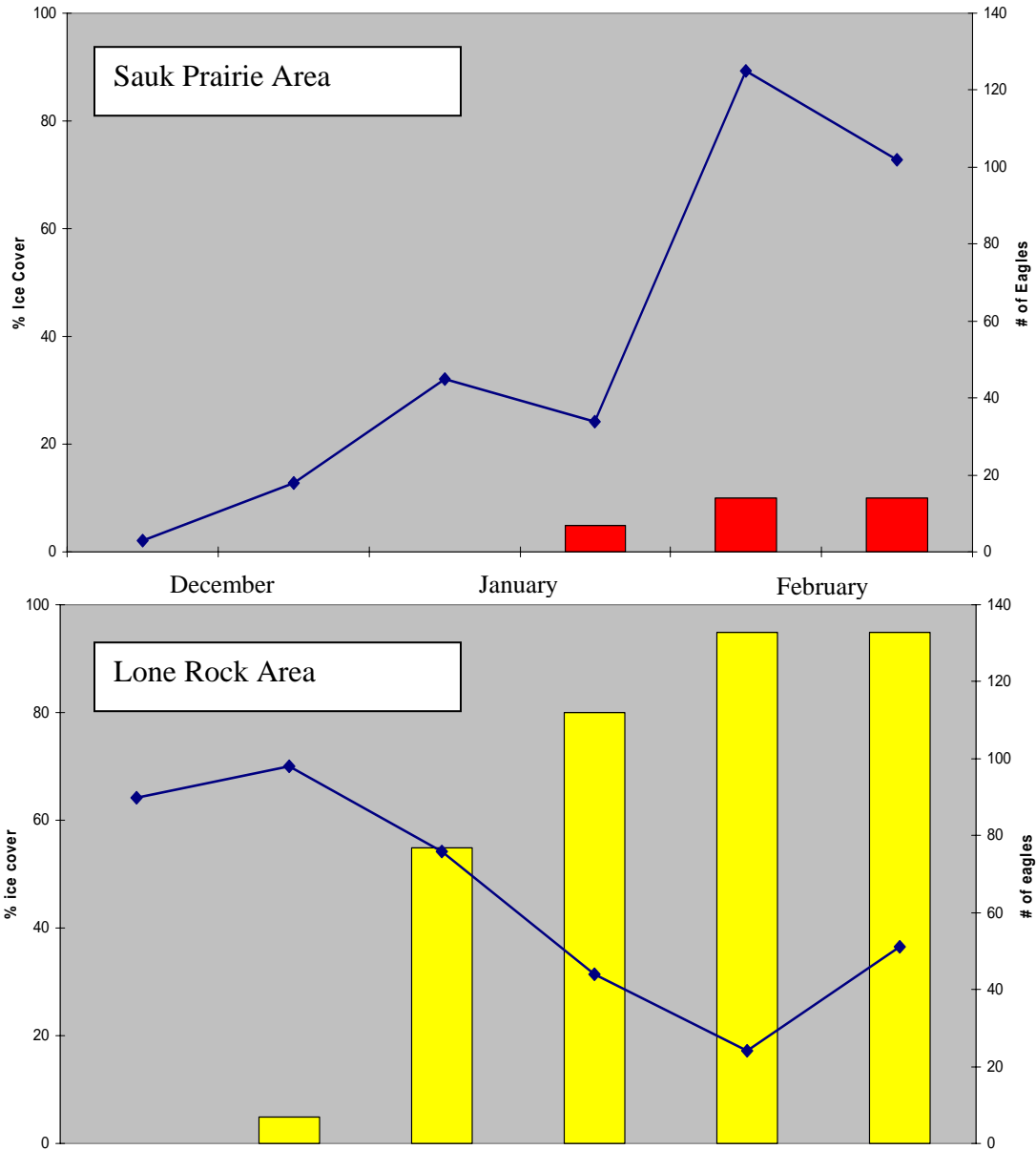
Food availability in winter is of extreme importance to eagles (Stalmaster 1987). The dam at Prairie du Sac is thought to be important because it creates open water where eagles can forage. This importance varies with the severity of each winter. Eagles typically utilize downriver areas (e.g. Lone Rock, Figure 5) extensively early in the winter but not in mid or late winter. Conversely, upriver reaches of the Wisconsin River are used by eagles most in mid or late winter and much less extensively in early winter. From roost count data, when eagle numbers using night roosts near Lone Rock are compared to ice cover downriver, eagle numbers decline as ice cover increases (Figure 10). Conversely, eagle use of upriver roosts (e.g. Blackhawk and Sugar Loaf) increases as eagle use of downriver roosts decline (Figure 10).

From radio-tracking data, individual eagles also shifted from downriver sites to upriver sites as ice cover in downriver areas increased. These data directly demonstrate response to habitat changes as opposed to immigration and emigration of eagles to different locations. When ice cover downriver near Lone Rock became great, individual eagles shifted their habitat use upriver to Ferry Bluff, Black Hawk, and Sugar Loaf Roosts. Black Hawk and Sugar Loaf Roosts are located in the bluffs directly across the river from Sauk Prairie.

Eagle habitat use corresponds closely with food availability as measured through ice cover. Of interest is that, when eagles have a choice, they will not concentrate in the Sauk Prairie area. In winter eagles tend to spread out downriver in less human-populated areas whenever they have a choice. Independent from Figure 7, the shifting of birds from downriver to upriver in relation to ice cover also suggest that disturbances in the Sauk Prairie region are already influencing eagle distribution and care must be taken to avoid increasing this disturbance.

Equally as important, when eagles do not have a choice, they will concentrate in the Sauk Prairie area because open water and other habitat conditions remain available there. Even though the Sauk Prairie area is not used all winter by eagles, the Sauk Prairie area does serve as critical habitat during the coldest periods of winter and likely is key to attracting concentrations of eagles in winter at all.

Figure 10. Percent ice cover (bars) in relation to eagle number (blue Line) upriver in the Sauk Prairie area and downriver in the Lone Rock area over time during the winter of 2002/2003. Eagle number is derived from roost counts conducted by FBEC and ice cover data come from aerial surveys conducted by FBEC during the same time.



Summary

The number of eagles using the Sauk Prairie region during winter varies greatly from one year to the next, implying that habitat quality here or elsewhere varies greatly. The high fidelity of eagles to Sauk Prairie suggests that it is habitat quality located in Sauk Prairie that causes much of this variation. If habitat conditions deteriorate in Sauk Prairie, eagles will leave. While in the Sauk Prairie region, eagles require forested edges along open river to perch on during the day for foraging, forested bluffs to sleep in at night and agricultural areas to provide alternative foods. These habitats must all be located in close proximity to each other and one location where this occurs is adjacent to the villages of Prairie du Sac and Sauk City. When the river ices up during colder portions of the winter, habitats near Prairie du Sac and Sauk City become even more important as eagles will concentrate in this relatively small area. Eagle use of Eagle Island and the river frontage near the two villages is already affected by human disturbance. Additional human disturbance in this area is likely to significantly diminish these important habitats even further. With less eagle use of the particular area, the quality of the most important area for eagle viewing will be diminished and the current eagle tourism income of \$1.2 million/annum will be jeopardized.

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