

BALD EAGLE BREEDING HABITAT MODEL

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Introduction

Rapidly expanding bald eagle populations in the Upper Midwest are a conservation success story but present a unique challenge when siting wind farms or routing high voltage transmission lines (HVTL). The number of active nesting territories in Minnesota has grown from around 100 in the mid-1970s to over 1,300 during the most recent statewide survey (Baker & Monstad, 2005). Breeding bald eagles are now reported in 75 of 87 Minnesota counties (USFWS 2012, Minnesota Breeding Bird Atlas Project 2012) and the Iowa Department of Natural Resources now recognizes over 250 breeding territories in 86 of Iowa's 99 counties (IA DNR, 2010). Part of this range expansion is into flat and open agricultural landscapes, where wind conditions are favorable to commercial wind development.

This overlap between commercial wind facilities and nesting bald eagle territories has raised concerns about impacts to this iconic species, resulting from direct collision or disturbance of nesting activities. It can also present routing challenges for high voltage transmission lines, especially at river crossings. Though the Bald Eagle was recently delisted as an endangered species, it is still protected under the Bald and Golden Eagle Protection Act (1940) which prohibits the "take" of the species. The act defines "take" beyond fatal or harmful physical harm to include disturbance. Disturbance includes activities resulting in the loss of breeding productivity or nest abandonment. While obtaining an official "take" permit is not required for all wind projects, field stick nest surveys often need to be conducted to assess the risk to breeding bald eagles.

Commercial wind farms and HVTLs can cover large areas with a wide range of habitat, and as a result an efficient survey methodology was needed to focus field efforts on key habitat. To address this, HDR developed a Bald Eagle breeding habitat model for use within the Upper Midwest. The original target area for the model was the Prairie Parkland ecological province, which covers southern and western Minnesota, but later development demonstrated wider application in neighboring and similar ecoregions dominated by agriculture. By narrowing search areas to potentially suitable habitat, the model reduces field efforts required to review areas for eagle nests and allows users to concentrate their time in areas where eagles are more likely to be present.

Methodology

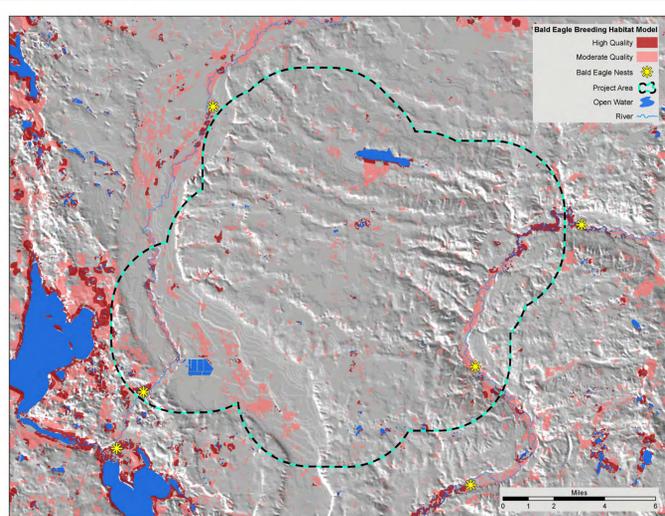
The habitat model is based on scientifically documented positive habitat influences, primarily proximity to open water and the presence of forested habitat (Buehler 2000, Guinn 2004). Open water was identified using the National Hydrography Dataset of lakes and rivers (USGS, 2012) and forested habitat was identified using the National Land Cover Database 2001 tree canopy layer (USGS, 2001). The model utilized ArcGIS to identify an initial tier of forested habitat within one mile of open water and a second tier of forested habitat within 160 meters of open water. These features were then assigned a score between zero (low) and three (high), to identify potentially suitable nesting habitat in the target area.

To generate this score, all forested habitat was given a score of one. Forested areas within one mile of open water were assigned a value of two and areas within 160 meters of open water were assigned a value of three. Buehler (2000) notes that most nests are located less than 2 kilometers (km) from water, so those habitats located within 1.6 km (1 mile) of open water are considered moderate quality (score of 2). High quality (score of 3) habitat is based on the findings of Grier & Guinn (2003), which reviewed the habitat conditions of 120 active bald eagle nests in Minnesota and found a mean distance to water of 160 meters.

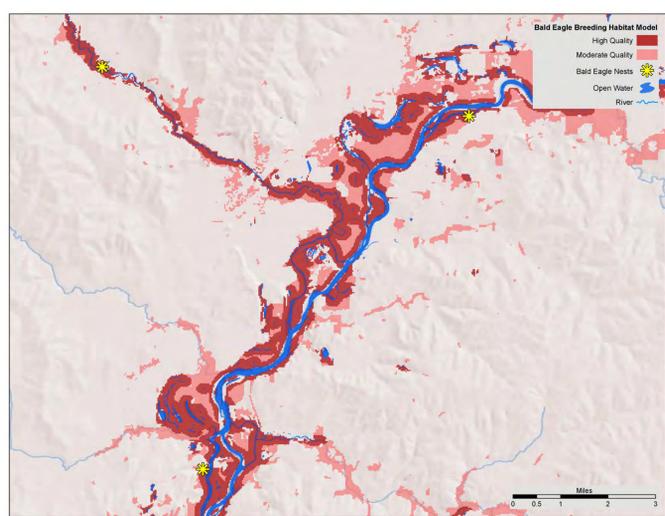
Other factors such as proximity to nearest home, proximity to roads, locations of public land and the presence of forested wetlands were considered but not included in the final model. Proximity to human development was not included in the model because human activity can be tolerated by nesting bald eagles (Grier & Guinn 2003). Using human development as an exclusion in the model could remove areas of potentially suitable habitat from the final results. Forested wetlands were considered as an alternative indicator of forested areas, but were not included to avoid double counting forested areas. Public lands are likely to present relatively open landscapes with lower levels of human activity but were not included because public land does not always include appropriate habitat. In particular size and accessibility of nest trees (open flight paths) are an important factor during nest site selection but difficult to spatially identify over large landscapes (Buehler, 2000).

After assembling the model and obtaining the maps of potential moderate and high quality nesting habitat for several different projects in the upper Midwest, HDR biologists conducted field surveys. Surveys were conducted with the objective of locating nests within the target area. Nests were located by systematically driving public roads to observe areas identified as moderate or high quality breeding habitat. Surveys were conducted between February 15th and April 1st during the nest building and incubation period (USFWS, 2007) and before leaf out. When a potential nest site was located, high powered optical equipment was used to verify the presence or absence of bald eagles on the nest or perched in its vicinity. Although aerial surveys are considered optimal for stick nest surveys, ground surveys are more cost effective and can therefore be conducted on more occasions. Due to the open landscapes where wind development typically occurs, bald eagle nests can be observed from several miles away, often standing as stark silhouettes along the horizon.

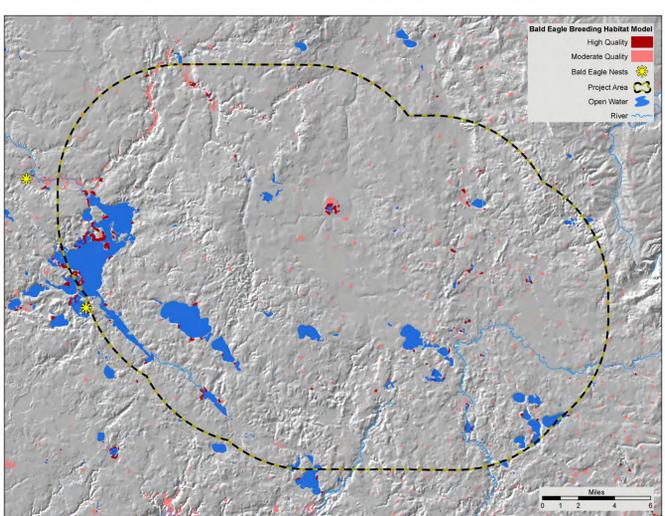
Paynesville Wind Farm



Transmission Line River Crossing



Dry Creek Wind Farm



Results

Overall, HDR survey teams have found a very strong correlation between areas identified as high quality habitat by the model and the quality of nesting and foraging opportunities actually present in these areas. At the Granite Hills Wind Farm in central Minnesota, sixty-nine percent of bald eagle observations were within areas identified as high or moderate quality and over 97 percent were located within a 250 meter buffer of these same areas. In the vicinity of the Central Long Distance Transmission Line, 15 nests were located in an agricultural landscape. 86 percent of these nests were located within areas mapped as high quality habitat. Finally, it also accurately predicted nesting locations of previously known breeding sites in the Lower Minnesota River Valley and Chippewa National Forest.

Table 1. Number of nests located in each project area and average nest score.

Project Name	Number of Field Verified Nest Sites	Average Nest Score
Dry Creek/Opportunity Wind Farm, MN	2	1.5
Aurora/Starlight, MN/IA	3	3.0
Black Oak/Gherty Wind Farm	2	3.0
Confidential Long Distance Transmission Line	15	2.86
Rothsay Wind Farm, MN	1	3.0
Paynesville Wind Farm, MN	6	2.17
Total	29	2.65

At the Paynesville Wind Farm in central Minnesota, five of six (83%) of bald eagle nests were within areas identified as high or moderate quality. In the vicinity of a long-distance HVTL, fifteen nests were located; thirteen (87%) of these nests were situated within areas mapped as high quality habitat with the remaining nests in areas scored a two. Two nests (one at Paynesville, one at Dry Creek) were located in areas scored as a zero by the habitat model. No nests were located in areas greater than one mile from open water.

Discussion

This model was applied to successfully locate bald eagle nests in project areas of various sizes, some of which were hundreds or even thousands of square miles in total area. As with all models, the key to producing an accurate output is good base data. The greatest limitation of the current habitat model is the forest cover, which is based on the National Land Cover Forest Canopy Dataset (2001). This dataset is old, and based on a 30 meter resolution. This coarse resolution is sometimes unable to depict narrow tree rows present along some water bodies in the agricultural landscapes in the Upper Midwest. Nests in areas scored as a zero by the habitat model can be attributed to this coarse resolution.

If available, more detailed tree canopy data could enhance the output of the model. A possible source for more detailed tree canopy data would be to generate a custom classification using contemporary Landsat images. While still limited to a 30 meter resolution, they would reflect current target area conditions. Another benefit could be to include scrub/shrub wetlands, which can include small stands of suitable nesting trees otherwise not captured by the coarse resolution.

This model was designed to identify habitat in the upper Midwest, and may need modification to reflect nesting habitat preferences in other regions. The source and abundance of open water to base the model off is also important and needs to be considered in the context of local bald eagle population dynamics. For example, growing eagle populations in Minnesota may limit the amount of available habitat along large bodies of water, pushing eagles to establish new territories in areas along smaller water bodies. Therefore, an effort was made to include these features in the model. To apply this model in drier areas, it may also be appropriate to consider alternative food sources, such as waterfowl, upland game birds or agricultural waste which could influence habitat selection (Buehler 2000, Mandernack et al. 2012).

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