

NORTH DAKOTA GAME AND FISH DEPARTMENT

Final Report

Breeding Ecology of Ferruginous and Swainson's Hawks in Relation to Energy Extraction  
Activities in Western North Dakota

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# Final Project Report

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## **Breeding Ecology of Ferruginous Hawks and Swainson's Hawks in Relation to Energy Extraction Activities in Western North Dakota**

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## Project Background

Populations of a number of species of raptors have declined on the northern Great Plains in recent decades (Johnsgard 2001, Dechant et al. 2003a,b). The recent rapid expansion of energy extraction activities in western North Dakota has occurred with little understanding of the possible effects of such activities on wildlife species of conservation concern. Given the sensitivity of some wildlife species (e.g., Ferruginous Hawks, *Buteo regalis*; Smith and Murphy 1973, Fitzner et al. 1977, Smith and Murphy 1978, Bechard and Schmutz 1995) to disturbance, studies on the effects of energy extraction activities on wildlife populations are clearly needed. Potential effects could include reduced nest densities in areas with intensive oil-exploration activity, as well as reduced reproductive success due to vehicle traffic, human disturbance, or habitat loss.

North Dakota is experiencing an unprecedented expansion of oil-extraction activity and land managers are in need of data on the effects of such activities on the state's threatened wildlife species. In North Dakota, Ferruginous Hawks and Swainson's Hawks (*Buteo swainsoni*) are both Tier 1 Species of Conservation Priority, with declining populations in some areas of the state (Hagen et al. 2005). In North Dakota, the effects of oil-extraction activities on the nesting ecology of these two species are unknown. Previous studies (Gilmer and Stewart 1983, Gaines 1985, Restani and McCarthy 2003) recorded data on the distribution of Swainson's and Ferruginous hawks breeding in North Dakota, but those studies did not collect data on reproductive success or on the relationship between breeding distribution and energy extraction activities.

In 2011, we identified and digitally mapped raptor nests, with a focus on nest sites of Ferruginous and Swainson's hawks, and then tracked reproductive success of these species in (primarily) Burke and Mountrail counties, northwestern North Dakota (Figure 1). These two counties were chosen for two reasons: (1) a large wind-turbine farm was being planned in Burke County; and (2) Mountrail County was experiencing extensive oil exploration and extraction activity. The approximate boundaries of our study area in 2011 can be seen in Figure 2.

In 2012, we performed similar fieldwork in southwestern North Dakota (Bowman and Slope counties; Figures 1 and 2), where oil-extraction activity is relatively light, but where future activity is likely. This latter area thus provides a suitable before/after area for a future study of the effects of oil-extraction activities on the distribution and breeding success of Ferruginous and Swainson's hawks.

## Methods

### 2011 fieldwork

We identified and tracked nests during fieldwork in 2011 from 16-20 May, 9-12 June, 24-29 June, and 19-20 July. Some difficulties in access this season were created by the unusually heavy snow melt and rainfall during the spring and early summer months, making secondary (and in some cases primary) roads impassable (Figure 3). This prevented us from accessing some areas, or meant long detours to access areas from other roadways. We attempted to access most roads within the defined study area, and also walked to or drove to high points to survey the surrounding landscape for nest sites.

At each nest site encountered, we recorded UTM (NAD 27) coordinates, raptor species (based upon identification of adults at the nest, or in the immediate nest area), the height (m) of the nest above ground, total height (m) of nest tree, distance (m) to nearest road, and distance (m) to any visible oil rig. On subsequent visits (normally only to Ferruginous and Swainson's hawk nests) we recorded number of nestlings by observing the nest for several minutes through a 20-60× spotting scope. In a few cases, nest contents were checked using a mirror on an extendable pole. Our summary data sheets (Appendix 1) include some nest sites where we never observed raptors, but that appeared to be nests under construction, or nests from previous seasons (these nests are noted as "empty" in column on nest contents).

We encountered nests that appeared to be completed or nearly completed, but were never seen to be occupied; these have been included in the nest summary tables, but not plotted on maps. As old raptor nests are a typical feature of most landscapes, it is

normally not possible to use the presence of old nests as a potential sign of site abandonment.

## **2012 fieldwork**

The proposed wind farm in Burke and Ward counties has been delayed, and the entire project is now under reconsideration. In addition, oil development has already progressed in these counties to an extent that it is now difficult to carry out meaningful before/after studies with respect to possible effects of oil-development activity on nesting raptors. Consequently, in 2012 we shifted the study area to Bowman and Slope counties in southwestern North Dakota, where there is considerable interest in developing the Tyler Formation (Figure 4). The focal species were Ferruginous and Swainson's hawks, but we recorded locations of any other raptor nests we found, and also the locations of Burrowing Owls (*Athene cunicularia*). Data recorded and methods were the same as in 2011.

Previous work by Restani and McCarthy (2003) suggested that the southwestern corner of North Dakota would be an area of relatively high density for both Ferruginous and Swainson's hawks (Figure 5). Our nest searches in these counties focused on the eastern two-thirds of the counties, as the Missouri River badlands terrain in the western portion of the counties restricts access to some areas and makes surveying much more difficult. Data we gathered in this study area will provide an excellent baseline for assessing potential effects of oil development, if and when the Tyler Formation is developed.

Fieldwork was carried out in 2012 from early May until late July. Surveys in early May are necessary for finding Ferruginous Hawks as nests are much easier to locate before trees have leafed out. While Swainson's Hawks were expected to arrive in that period and later, we found it advantageous to document nests of Swainson's Hawks already active, as well as to note locations of nests that likely were those of Swainson's Hawks from the previous year. Many Swainson's Hawks were already present and knowing locations of nests from the previous year facilitated our checking of those nests for activity after trees had leafed out. Thus, some newly constructed

nests could have been missed after trees leafed out, but many of the nests from the previous year were found to be active in 2012.

Although we surveyed throughout Bowman County and most of Slope County, nests were concentrated in the eastern and central parts of both counties. Most nests were found in sections away from the badlands. The badlands along the Little Missouri River were difficult to survey because of lack of road access. However, the general lack of nest records of Swainson’s Hawks from that area also reflects that there in fact were few nests in that area. Swainson’s Hawks generally prefer taller trees in open, flat landscapes and such areas are relatively scarce in the badlands corridor. Due to time restrictions and a paucity of roads, the extreme northeastern section of Slope County (Dovre, Moord, and Rainy Butte townships) was not surveyed completely.

## Results and Discussion

### 2011

In 2011 we encountered a substantial number of nests that appeared to be completed or nearly completed, but were never seen to be occupied (e.g., adult incubating eggs); these are included in the nest summary tables (noted as “empty” in column on nest contents; Appendix 1), but were not plotted on maps. As old raptor nests are a typical feature of most landscapes, it is normally not possible to use the presence of old nests as a potential sign of site abandonment. The total number of active nests of each species is summarized in Table 1.

**Table 1.** Total number of nests for each raptor species in 2011, and nest fates for 2 focal species, Ferruginous and Swainson’s hawks.

Species	Nests				Mean no. young in successful nests
	Total	Failed	Successful	Unknown fate	
Ferruginous Hawk	8 <sup>a</sup>	2	3	3	2.33
Swainson’s Hawk	25	6	10	9	–
Red-tailed Hawk <sup>b</sup>	92	–	–	–	–
Great Horned Owl <sup>c</sup>	22	–	–	–	–

<sup>a</sup> Does not include nests of Ferruginous Hawks located in Dunn County (2 nests) and Slope County (1 nest) outside the main study area. Includes 1 nest (331) that had adults in attendance in May (but not incubating), but which was classified as Unknown fate.

<sup>b</sup> *Buteo jamaicensis*.

<sup>c</sup> *Bubo virginianus*.

Ferruginous Hawks and Swainson's Hawks were relatively uncommon nesters in Burke and Mountrail counties, with 8 and 25 nests, respectively. Rather, the most widespread nesting species were the Red-tailed Hawk and Great Horned Owl. Red-tailed Hawks were especially common on the Missouri Coteau, where they nested in small aspen groves (Figures 6 and 7). Ferruginous Hawks and Swainson's Hawks showed similar habitat affinities, nesting primarily in open areas of central Burke County and in areas with a high percentage of native grassland in Mountrail County (Figures 6 and 7).

Nesting success was followed at each of the Ferruginous Hawk nests, although during our visits to 3 nests late in the season we were unable to verify whether any young had fledged or not. Of the 5 nests where fates were known, nesting success was 60% (3 of 5 nests with large young late in the nesting cycle). Two Ferruginous Hawk nests were located within 100 m of active oil rigs (Figure 8). This is somewhat surprising given that previous studies have suggested that the species is sensitive to human activities near nest sites. However, both of these Ferruginous Hawk nests were successful in 2011, as each held large young (>30 days old) late in the nesting cycle.

## **2012**

Table 2 summarizes the total number of raptor nests monitored in 2012. In 2012 we found a marked difference in the breeding raptor composition, relative to the situation in Burke and Mountrail counties in 2011. We found no Red-tailed Hawk nests in 2012, whereas this species was the most common breeding raptor in Burke and Mountrail counties. Instead, Swainson's Hawks were the most common raptor in 2012, breeding throughout most of the area east of the Little Missouri badlands.



**Table 2.** Total number of nests for each raptor species in Bowman and Slope counties in 2012, and nest fates for the 2 focal species, Ferruginous and Swainson’s hawks. Successful nests were those that fledged at least 1 young.

Species	Nests				Mean no. young in successful nests
	Total	Failed	Successful	Unknown fate	
Ferruginous Hawk	10	1	9	0	2.22
Ferruginous Hawk (inactive nests)	7				–
Swainson’s Hawk	64 <sup>a</sup>	9	50	5	2.31 <sup>b</sup>
Great Horned Owl	6	–	–	–	–
Loggerhead Shrike <sup>c</sup>	4	–	–	–	–

<sup>a</sup> Minimum estimate. Does not include nests that were being built in May, but later found abandoned.

<sup>b</sup> Subset of 39 successful nests where number of young was accurately determined. Contents of some nests were not visible due to the height of nests or other factors.

<sup>c</sup> *Lanius ludovicianus*.

### Ferruginous Hawks

We found 10 active Ferruginous Hawk nests in 2012, of which 9 were successful and 1 failed. Nests were primarily in Bowman County, east of the Little Missouri badlands (Figure 9). The failed nest was on property where the ranch owners had negative attitudes towards “predators” and when asked about the fate of the particular Ferruginous Hawk nest, they responded that they hoped that the nest failed. Nest success of 90% is relatively high for this species, as studies from Utah, Idaho, Colorado, and Oklahoma showed nest success ranging from 50% to 93% (Wiggins et al., *submitted*).

We also found 3 old nests on small buttes (e.g., Figure 10) along the Little Missouri River badlands corridor, but no active nests in this area. However, although we scanned many buttes and ridges for hawk nests, a thorough survey of this area would require considerable surveying by foot in backcountry away from roads. We were surprised by the general lack of nests in central Slope County, an area where Ferruginous Hawks have historically bred in relatively high densities (North Dakota Game and Fish Department, unpubl. data). Some old, historical nest sites were located in this area, and 1 pair of Ferruginous Hawks not associated with a nest was observed there in mid-June. However, the current lack of black-tailed prairie dogs (*Cynomys ludovicianus*) in the area may at least in part be responsible for the lack of nesting Ferruginous Hawks.

Brood size at the 9 successful nests (Table 2) ranged from 1-4, with a mean of 2.2 young, similar to the 2.3 young found in successful nests from Burke and Mountrail counties in 2011 (Table 1). Fourteen studies from across the range of the species showed a mean number of young fledged from 1.3 to 2.4, with the mean values in 10 of the studies being below 2.0 young fledged (Wiggins et al., *submitted*).

Red-tailed Hawks were much more abundant in Burke and Montrail counties than in Bowman and Slope counties. The former counties historically were known as areas where the first explorers found Ferruginous Hawks common to abundant (Lewis and Clark journals). At that time, it was area of open and largely treeless prairie. Our study indicates that Ferruginous Hawks are much less common here than historically. Both in terms of nests and of sightings, Red-tailed Hawks were the clearly more common species in these counties. However, much of this may be attributed to general landscape changes. Many areas in Burke County are agricultural and shelterbelts are common across the landscape, making the area more suitable for Red-tailed Hawks than for Ferruginous Hawks.

In addition, the Couteau Plateau Prairie was laced with aspen mottes, many of which contained nesting Red-tailed Hawks. This conversion of open prairie to aspen parkland, most likely because of fire suppression, also appears to favor Red-tailed Hawks over Ferruginous Hawks. Thus, while Ferruginous Hawks have become much less abundant than in historical times, current energy development may have little to do with this long-term, historical change. Rather, the wide-spread planting of shelterbelts, together with fire suppression favoring the establishment and abundance of aspen mottes, has likely favored Red-tailed Hawks and led to decreases in both Ferruginous and Swainson's hawks.

### **Swainson's Hawks**

Sixty-four Swainson's Hawks nests were found in 2012, primarily in Bowman County; all were east of the Little Missouri River badlands (Figure 9). Nest success was relatively high, with at least 50 of the 64 nests successfully fledging at least 1 young (minimum 78% success; Table 2). A summary of nesting success of

Swainson's Hawks from throughout the North American range showed values ranging from 55% to 82% (Wiggins et al., *submitted*).

In Bowman and Slope counties, Swainson's Hawk nests were found in a variety of wooded areas including elm shelterbelts (majority of nests), in trees around active and abandoned homesteads, and in riparian woodlands. We found no difference in the distance to the nearest road on the success of nesting attempts (successful mean = 77 m, SE = 8 m, n = 48; unsuccessful mean = 113 m, SE = 34 m, n = 8; Mann-Whitney U-test,  $W = 1334$ ,  $P = 0.44$ ). Although there was a suggestion that successful nests (mean = 6.1 m, SE = 0.3, n = 47) were placed higher in trees than unsuccessful nests (mean = 4.9 m, SE = 0.7, n = 8), the difference was not statistically significant (Mann-Whitney U-test,  $W = 1376$ ,  $P = 0.15$ ).

#### **Miscellaneous observations of other raptors**

Incidental sightings of Golden Eagles (*Aquila chrysaetos*), Burrowing Owls (*Athene cunicularia*), and Prairie Falcons (*Falco mexicanus*) also were recorded. In total, the following 9 eagle sightings were made: Slope County (1 near the Stach Impoundment and 2 sightings at and east of White Butte); Bowman County (4 sightings of 1 or 2 birds [including an adult and a younger bird] at and east of the Rhame Prairie; 2 sightings of single adults in Stillwater and Buena Vista townships in June). An old Golden Eagle nest was found less than 1.5 miles south of the North Dakota border on the Cox Road in Hastings County. Burrowing Owls were found at several locations as shown in Figure 9. A single Prairie Falcon was observed capturing a Lark Bunting (*Calamospiza melanocorys*) in July just north of Bowman.

#### **Potential impacts of energy extraction activities on nesting hawks**

Each active Ferruginous Hawk nest in 2011 was revisited in 2012 to assess between-year nest use (Table 3). Only 1 of the 10 active nests from 2011 was used in 2012. The only active nest in 2012 (nest 315) was 1 of 2 nests (the other was nest 405 in Dunn County) that was built within 150 meters of an active oil rig.

**Table 3.** Re-use of 2011 Ferruginous Hawk nests in 2012 in Burke and Mountrail counties.

Ferruginous Hawk nest	2011 nest fate	2012 nest status (30 June–1 July 2012)
71 (Burke County)	2 young fledged	Empty
120 (Burke County)	Failed	Empty
153 (Mountrail County)	Unknown	Nest not found
315 (Mountrail County)	3 young fledged	3 young, 30 days old
331 (Mountrail County)	Unknown	Empty, but 2 adults in area
335 (Mountrail County)	2 young fledged	Empty
349 (Mountrail County)	Unknown	Empty
353 (Mountrail County)	Not used	Not used
379 (Mountrail County)	Failed – nest down	No nest
405 (Dunn County)	2 young fledged	Empty (18 May 2012)
406 (Dunn County)	1 young fledged	Empty (18 May 2012)

Although our sample sizes are small, the rate of nest re-use between years (10%, 1 of 10 active nests re-used) was lower than that found between years in southeastern Colorado and the Oklahoma panhandle (Wiggins, unpubl. data). In the latter areas, over 60% of Ferruginous Hawk nests are typically used from year to year. These results suggest that Ferruginous Hawks may be abandoning traditional nest sites in Burke and Mountrail counties, where oil-extraction activity is rapidly expanding.

Ferruginous Hawks are known to be more sensitive to sources of human disturbance than are Swainson's Hawks (White and Thurow 1985, Richardson and Miller 1997). In North Dakota, we found that Ferruginous Hawks (mean = 274 m, SE = 70, n = 10) nested significantly further away from roads than did Swainson's Hawks (mean = 82 m, SE = 8, n = 56; Mann-Whitney U-test,  $W = 560$ ,  $P < 0.001$ ). When disturbed, incubating Ferruginous Hawks flush at much greater distances than do Swainson's Hawks (Wiggins, unpubl. data). Taken together, these results suggest that Ferruginous Hawks may react negatively to habitat fragmentation due to road construction, the latter being a common habitat feature in Burke and Mountrail counties.

In northwestern North Dakota (Burke and Mountrail counties), long-term landscape changes appear to have had the greatest negative effect on abundances of Ferruginous and Swainson's hawks. Recent energy development activities (e.g., road building, human presence) may have impacted Ferruginous Hawks as reflected in the dramatic change in nesting status between 2011 and 2012. Future studies comparing the data

we collected in Bowman and Slope counties on the abundance and success of Swainson's and Ferruginous hawks may confirm or refute the implications of the data from northwestern North Dakota. Our study can serve as a baseline for such future comparisons. An additional baseline year of checks on our known sites would strengthen any conclusions of effects of future energy development in this area.

## **Summary**

Our study was aimed at providing a baseline survey of the distribution and success of Ferruginous and Swainson's hawks in western North Dakota, an area that is experiencing rapid energy development and exploration. In 2011, surveys were focused on Burke and Mountrail counties. We found low numbers of Ferruginous and Swainson's hawks in these counties, with both species concentrated near areas of remaining native grassland. The predominant raptor species present were Red-tailed Hawks and Great Horned Owls. In 2012, we surveyed for raptor nests in Bowman and Slope counties in southwestern North Dakota. In this area, limited oil development had occurred, but a significant increase in oil-exploration activity is forecast. We found similar low numbers of nesting Ferruginous Hawks as in Burke and Mountrail counties, with high nest success and relatively large brood sizes. Swainson's Hawks were the most common raptor in Bowman and Slope counties with at least 64 nests located and a success rate of approximately 78%.

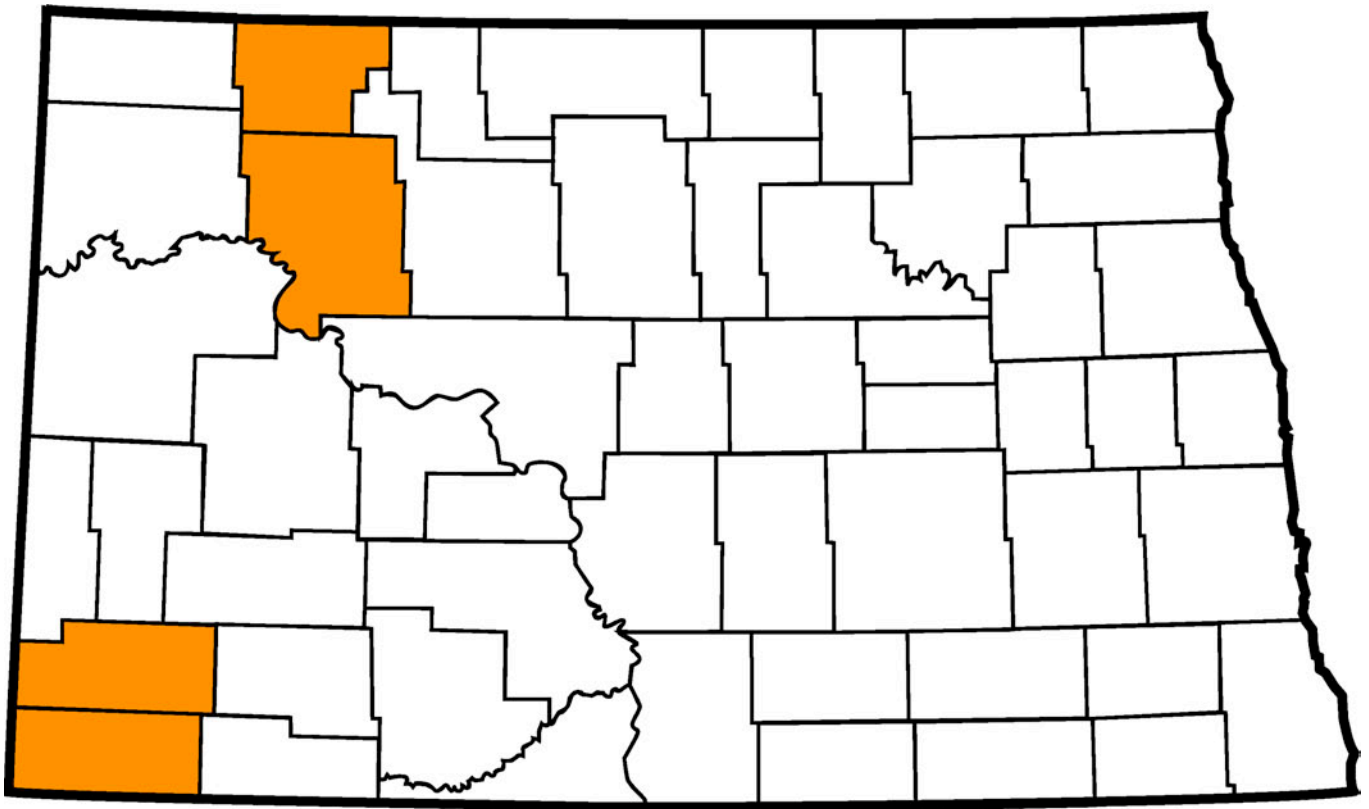
We found relatively few hawks nesting near active oil wells. Two Ferruginous Hawk nests in 2011 were located within 100 meters of active wells, and both succeeded in fledging young. Similarly, in Bowman County in 2012, 2 Ferruginous Hawk nests were within 150 meters of active wells and both successfully fledged young. Despite the small sample sizes, these data suggest that human activity around oil wells may not pose a significant disruption to nesting Ferruginous Hawks. However, we also found very low Ferruginous Hawk nest re-use from 2011 to 2012 in Burke and Mountrail counties, suggesting that hawks may be abandoning sites in these counties with substantial oil-extraction activity. Comparison of between-year Ferruginous Hawk nest re-use in Bowman and Slope counties (where oil extraction activity is still relatively light) would help to confirm this result.

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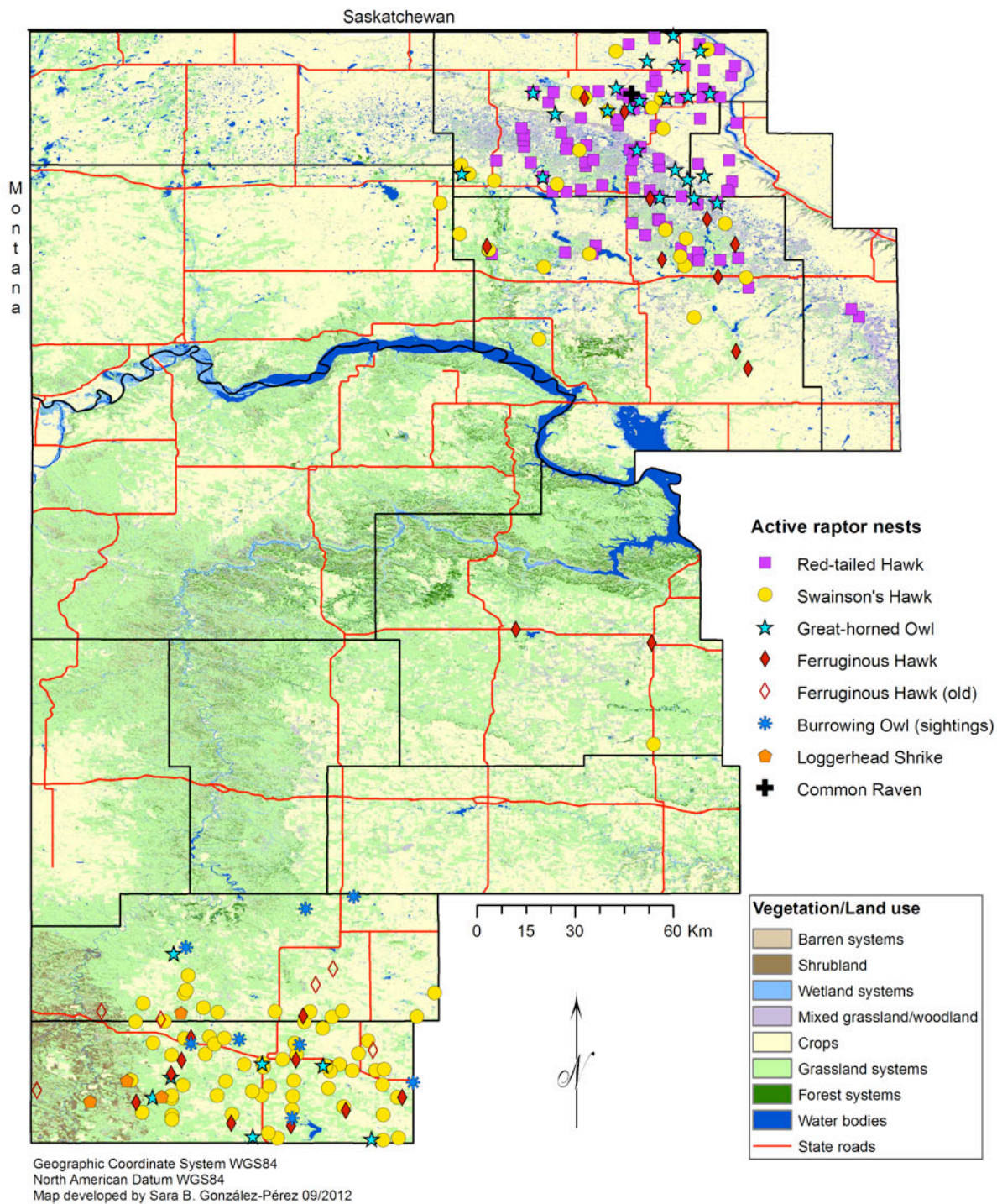
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**Figure 1.** County map for North Dakota, showing the 4 counties where raptor surveys were conducted.



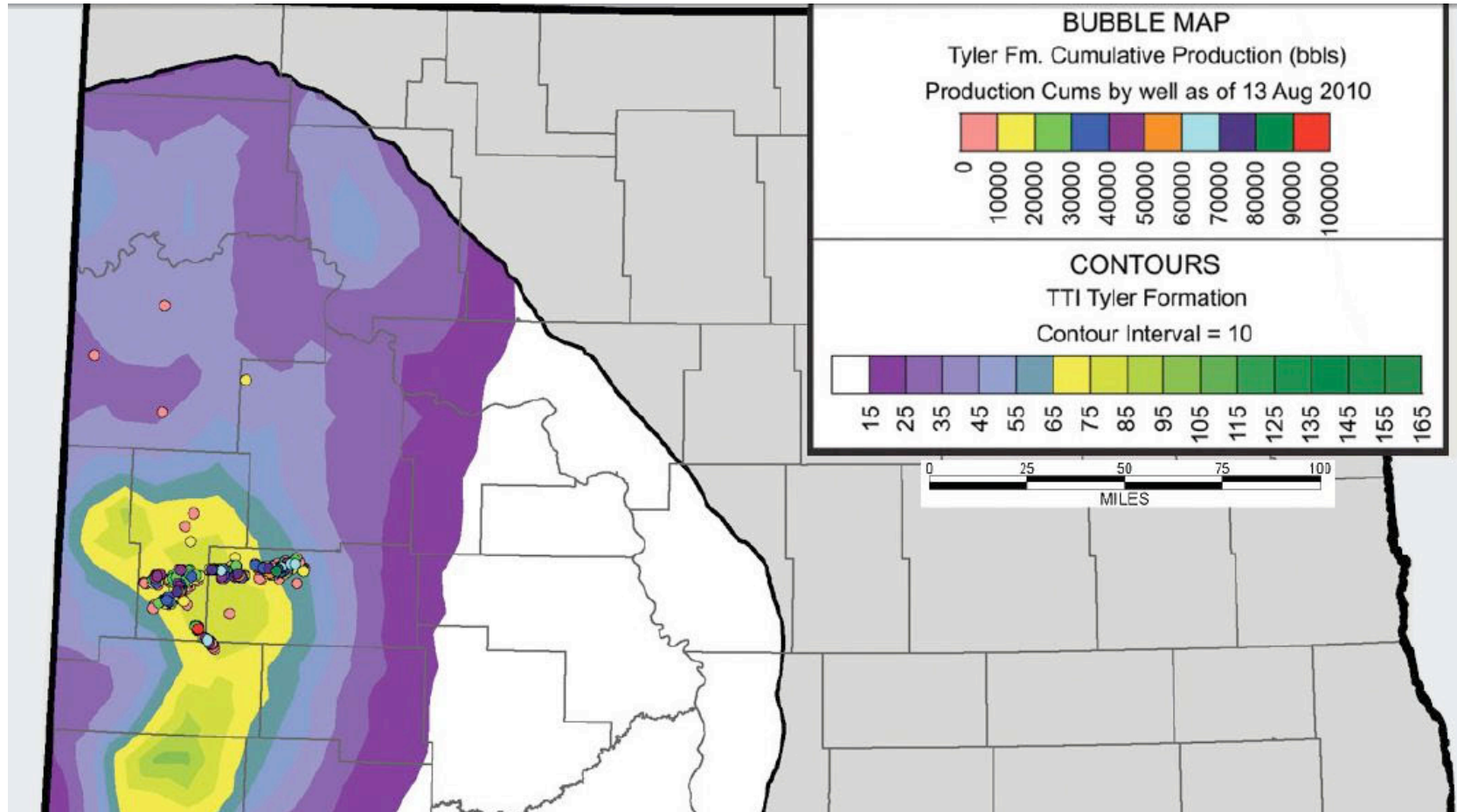


**Figure 2.** Outline of the general study area and nests found in 2011 and 2012. Concentrated efforts at finding nests in 2011 were made in the southern, central, and eastern portions of Burke County, the northern half of Mountrail County, and a small portion of western Ward County. In 2012, concentrated searches were conducted in Bowman and Slope counties.

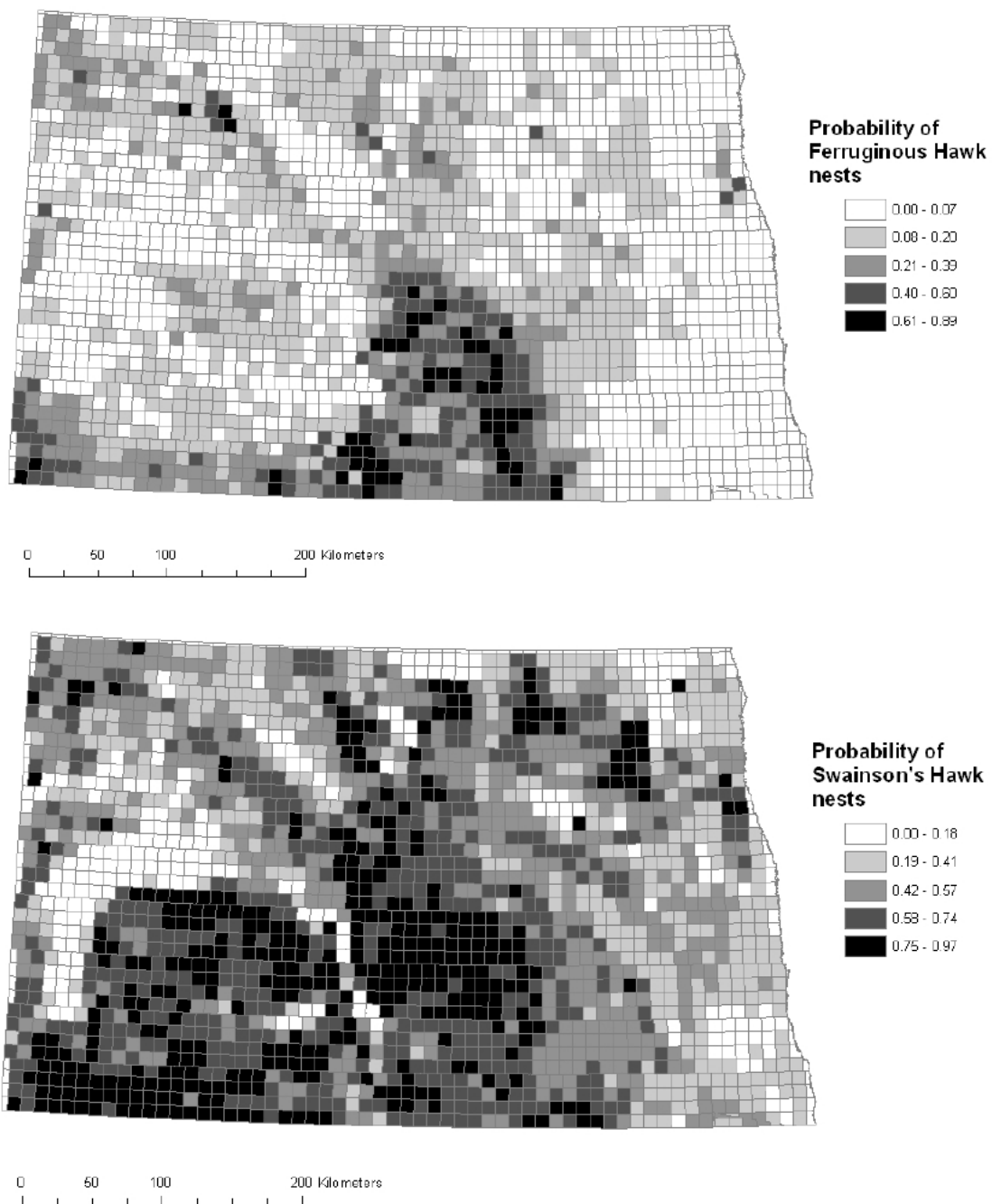




**Figure 3.** Minor (depicted here) and major flooding of secondary and primary roads caused considerable logistical difficulties during the 2011 fieldwork.

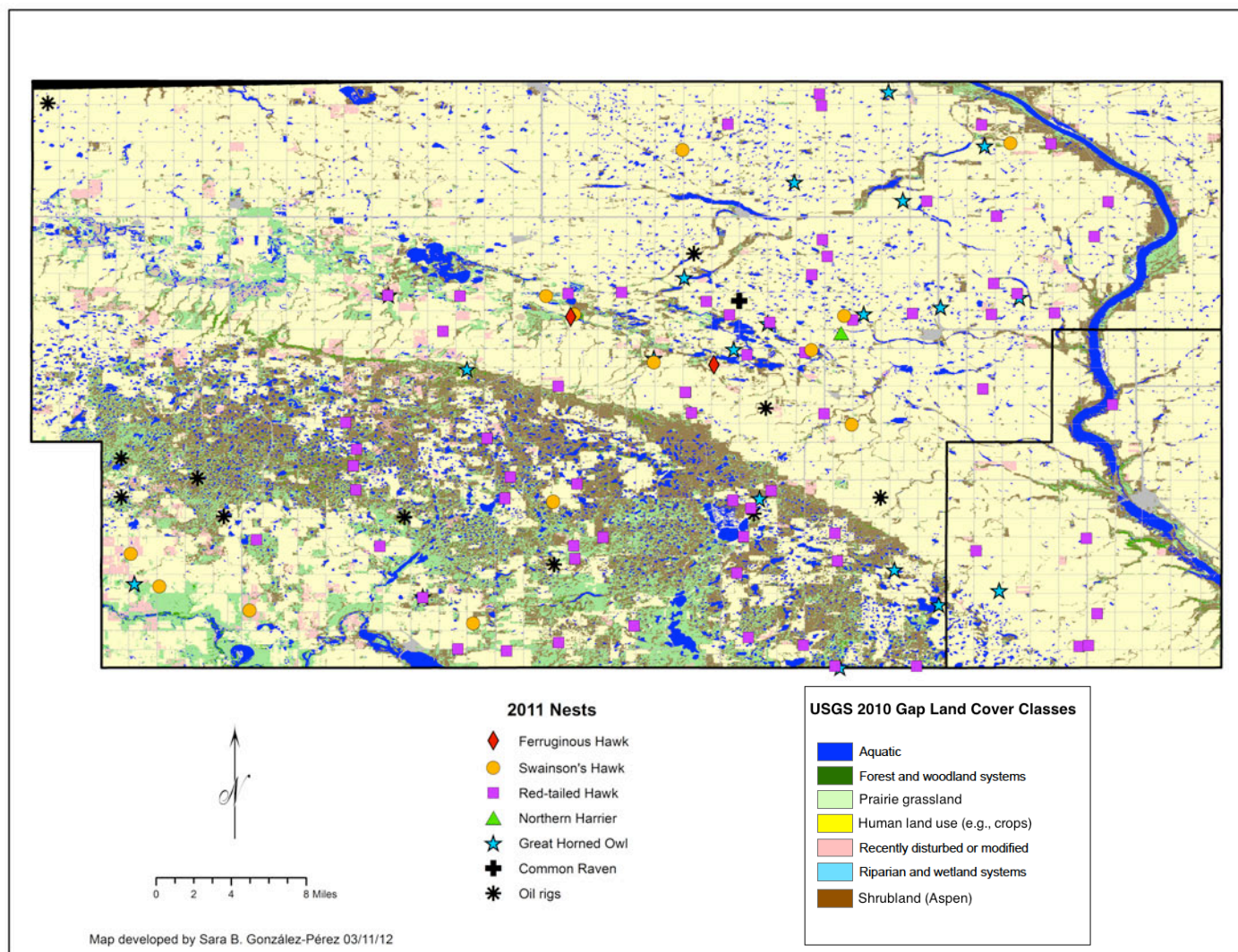


**Figure 4.** The Tyler Formation in western North Dakota extends into northwestern South Dakota, where 67,000 acres in Harding County have already been leased for exploration. Similar exploration and extraction activities are projected for Bowman, Slope, and adjacent North Dakota counties. Circles indicate individual oil wells.

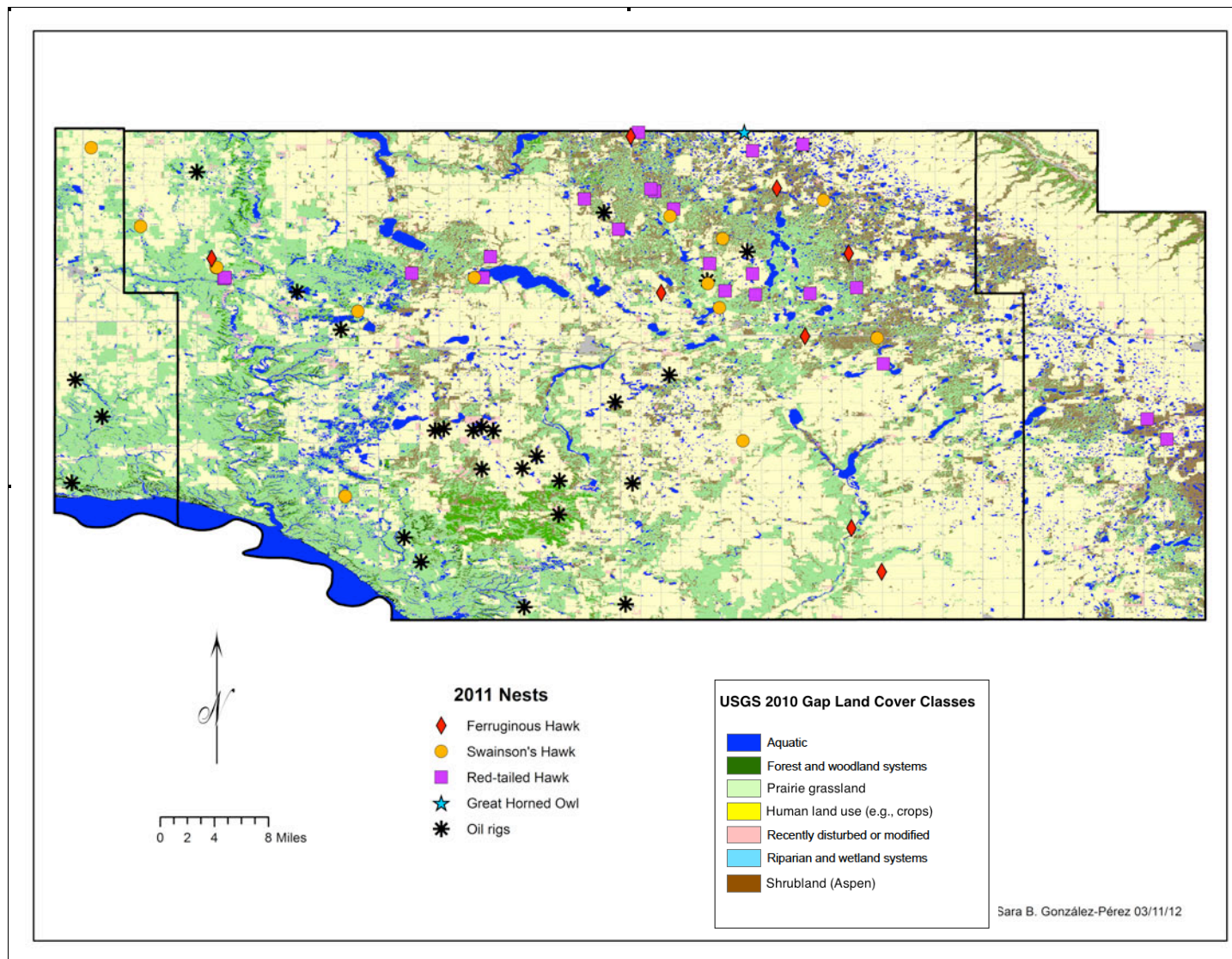


**Figure 5.** Maps of probability of occurrence of nesting Ferruginous Hawks (upper panel) and Swainson's Hawks (lower) in North Dakota townships. Data extrapolated from known vegetation associations of the species in North Dakota (Restani and McCarthy 2003). Note relatively high probabilities for both species in southwestern North Dakota, an area that overlaps with projected oil exploration in the Tyler Formation.





**Figure 6.** Distribution of raptor nests in Burke and (extreme western) Ward counties, North Dakota, May-July 2011.

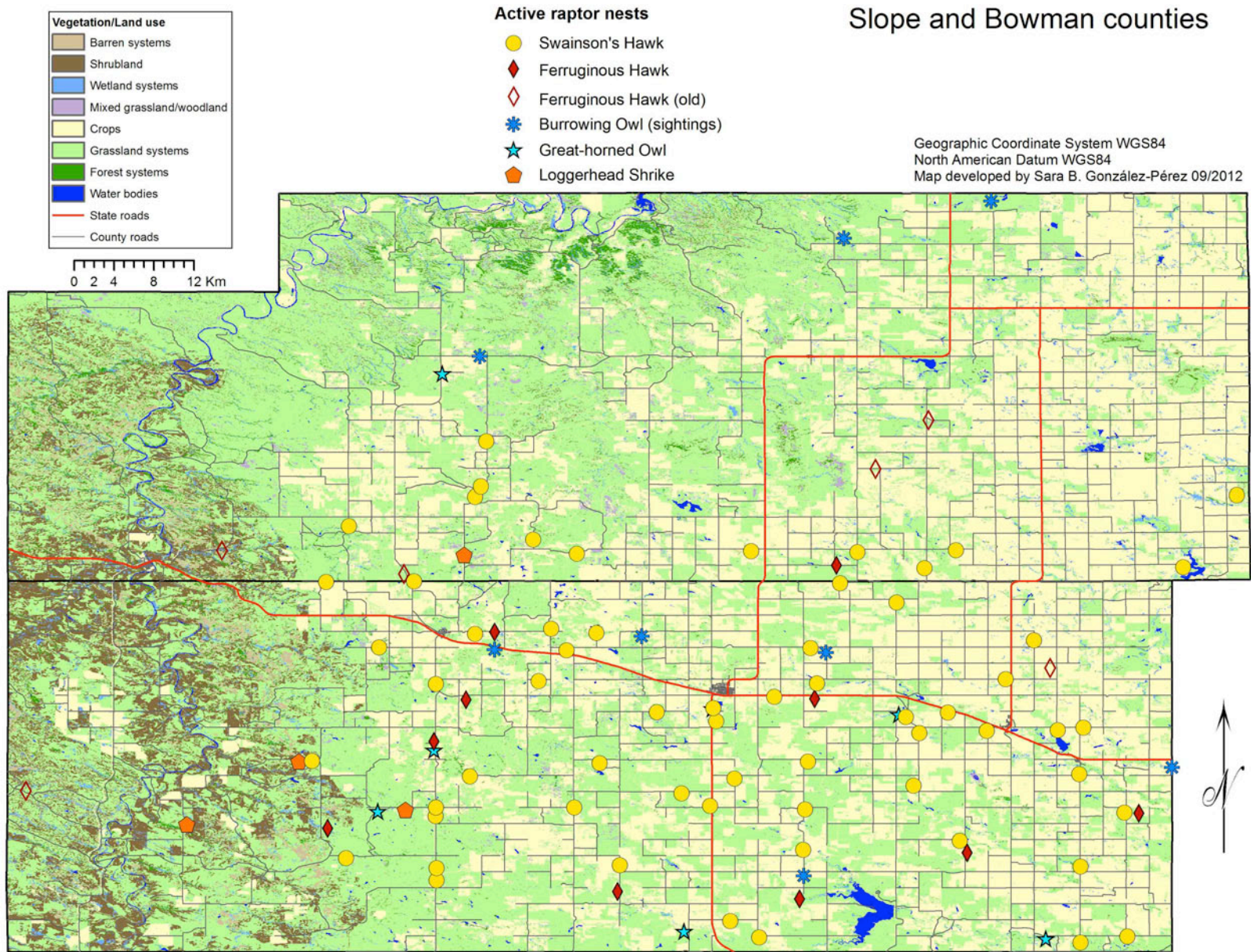


**Figure 7.** Distribution of raptor nests in Mountrail (center), eastern Williams (left) and western Ward (right) counties, North Dakota, May-July 2011.





**Figure 8.** Ferruginous Hawk nest 315 in Mountrail County in 2011. The nest is in the background (with downy young visible), center of the photograph, approximately 100 meters from the active well site.



**Figure 9.** Raptor nests in Slope and Bowman counties in 2012.





**Figure 10.** One of three inactive Ferruginous Hawk nests found in 2012 along the Little Missouri River corridor. This nest was within 50m of an active oil well (in background). This nest is the open triangle in the far southwest corner of Bowman County, along the Montana border, on Figure 9.

**Appendix 1.** Raptor nest data from Burke, Mountrail, Williams, and Ward counties, North Dakota, May-July 2011. Height of nest, height of nest tree, distance to road, and distance to any nearby oil rig were estimated in meters.

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**Appendix 2.** Raptor nest data from Bowman and Slope counties, North Dakota, May-July 2012. Height of nest, height of nest tree, distance to road, and distance to any nearby oil rig were estimated in meters. Nest contents text in red font reflects status during second nest check. GIS data layers are included in separate files.

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