NORTHWEST UTAH FERRUGINOUS HAWK
NEST SURVEY 2009

HawkWatch International
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INTRODUCTION

From April through July 2009, HawkWatch International (HWI) surveyed and monitored nesting Ferruginous Hawks in northwest Utah. This report summarizes the results of this effort. HWI began surveying and monitoring nesting raptors in this region in 1998. Most surveys conducted before 2008 encompassed seven focal species (Smith and Hoffman 1998; Smith 2000a, b; Smith 2001, 2002, 2003, 2005; Smith and Hutchins 2006a, 2007; Smith and Slater 2008), including efforts expanded to include adjacent portions of northeast Nevada in 2004, 2005, and 2007 (Smith and Hutchins 2005, 2006b; Slater and Smith 2008). Due to resource limitations, we surveyed only Ferruginous Hawks in Utah in 2008 (Smith 2009) and 2009, but conducted another round of multi-species surveys in Nevada in 2008 (Slater and Smith 2009). We refer to the combined Utah-Nevada effort as our Great Basin Raptor Nest Survey (GBRNS).

The primary goal of GBRNS is to help provide the Utah Division of Wildlife Resources (UDWR), Bureau of Land Management (BLM), and other regional landowners and managers operating in the region with a scientifically defensible basis for making land management decisions and developing ecosystem management plans that maintain healthy populations of nesting raptors in the northern Great Basin. The focus is documenting the distribution, density, and productivity of diurnal raptors that nest on cliffs or in open woodland and shrubsteppe habitats characteristic of the northern Great Basin. Such baseline information is essential for projecting impacts of a variety of potential disturbances and assessing the effects of habitat change. Baseline distribution and abundance data are also essential to set the stage for potential controlled experiments to formally quantify the effects of specific human disturbances. The data we collect will significantly enhance land managers’ ability to make land management decisions and develop wildlife and ecosystem management plans that succeed in maintaining or increasing the proper functioning of Great Basin ecosystems.

Focusing on shrubsteppe and open woodland habitats meshes well with the UDWR’s designation of rangeland as a focal habitat and expression of interest in improving management of Utah rangelands (UDWR 2000: 21). More recently, the new Utah Comprehensive Wildlife Conservation Strategy (Sutter et al. 2005) further emphasizes priority concerns for improving management of Great Basin shrubsteppe, grassland, and open woodland habitats. Monitoring the Ferruginous Hawk (*Buteo regalis*) is of particular importance because the species is listed as a Wildlife Species of Concern in Utah (UDWR 2007, also see Parrish et al. 2002). Moreover, prior to HWI’s efforts, the UDWR and BLM, through a previously established cooperative agreement, had already invested considerable effort in documenting nesting by this species throughout the BLM Salt Lake Field Office (Doumitt et al. 2000). Our study provides a means of continuing this effort throughout roughly 25% of the field office region. The project also addresses monitoring and research needs highlighted in the PIF North American Landbird Conservation Plan for the Basin & Range Physiographic Area wherein Ferruginous Hawks are recognized as priority species in relation to conservation of shrubsteppe, sagebrush grassland, and pinyon-juniper habitats (Rich. et al. 2004).

STUDY AREA

For purposes of this survey, we define northwest Utah as bounded to the south by I-80, to the north by the Idaho border, to the west by the Nevada border, and to the east by the western margins of the Great Salt Lake. This includes the Silver Island Mountains, east side of the Pilot Range, Grouse Creek Valley and Mountains, Bovine Mountains, Goose Creek Mountains, Dove Creek Mountains, Raft River Mountains, Matlin Basin and Mountains, Hogup Mountains, Wildcat Hills, western Curlew Valley, areas of the Newfoundland, Grassy, and Lakeside mountains that lie outside of military lands, and all appropriate intervening habitats (Figure 1). Our focus includes shrubsteppe, woodland, and cliff habitats that are
particularly conspicuous elements of the Great Basin landscape and support most raptors that breed in the region. We exclude high-elevation, extensive conifer forests, which may harbor species such as the three North American members of the genus *Accipiter*, for practical reasons of logistical simplicity and resource limitation.

Much of the study region is private land, which restricts access to some important areas of the landscape. For example, many of the buteos in the region are strongly drawn to irrigated pastures and often nest nearby on private land. In many cases, it is possible to observe such nests from a distance to confirm nesting activity, but it is impossible to gather productivity information without gaining access to the private land. Our crews generally do not attempt to gain access to private lands that are clearly posted, but readily available landowner permission sometimes affords access opportunities.

**SURVEY METHODS**

Survey work occurred from early April through early July 2009. This period effectively encompassed the typical nesting cycle of the Ferruginous Hawk in northern Utah (Bechard and Schmutz 1995). This season we sought to revisit all Ferruginous Hawk nesting areas documented in the Utah study area through our previous 11-year GBRNS effort, while also keeping an eye out for and documenting any new activity areas we might encounter along the way. We conducted all surveys from four-wheel-drive vehicles and on foot, covering selected nest areas accessible by established backcountry roads and day hikes not requiring elaborate climbing gear and without violating trespass laws. We deemed known nests and nesting territories as inactive (i.e., non-breeding) if extended observations during the typical nest-building and incubation period for the species failed to reveal signs of recent activity (e.g., adults in courtship, exhibiting territorial defense behavior or nest building, or fresh feces or nest material at the nest) or if through distant observations we were able to clearly confirm that a given nest was unimproved, empty, and clearly unused. Most Ferruginous Hawk nests in the study area are easily observed from a distance suited to avoiding disturbance of an incubating adult, but detection of the incubating bird is not always easy from such distances. Accordingly, to confirm the activity status of nests prior to hatching time, when the presence of an incubating adult could not be easily determined through distant viewing and/or the actual nest bowl was not visible, we adopted a standard of one-hour observation periods. Otherwise, we identified new nesting territories by searching suitable habitat with binoculars and spotting scopes for exposed nest structures and adult birds, and more generally located active nests primarily by following adult birds exhibiting territorial defense behavior (e.g., aggressive vocalizations and diving at intruders), carrying nest material or food, or swapping incubation/brooding duties with mates (Fuller and Mosher 1987). Direct observation of nests with fresh eggs or young also frequently resulted in confirmation of active status despite the apparent absence of adults (Steenhof and Newton 2007).

For most raptor species, it is critical that direct disturbance to the nest be severely restricted until chicks have hatched. Before this stage in the nesting cycle, close intrusions may cause abandonment by adults or exposure of eggs to excessive environmental stress (Fyfe and Olendorff 1976). For this reason, we restricted our survey activities to observation from a distance with binoculars and spotting scopes until adult activity patterns (e.g., food deliveries) or carefully controlled intrusions governed by appropriate seasonal timing (i.e., timing based on projections from previous nest studies as to when most nests typically hatch in the region) clearly indicated that the timing was appropriate for more intrusive investigations. Minimum observation distances during high-sensitivity periods conformed to disturbance-buffer guidelines established by the U.S. Fish and Wildlife Service (Romin and Muck 2002). More generally, we always strived to record data and vacate active nest sites as quickly as possible to minimize disturbance. In addition to considerations of seasonal timing, we also strictly limited close intrusions on nests to times of day and weather conditions that did not expose eggs or young nestlings to excessive heat, cold, or moisture (Fyfe and Olendorff 1976).
For each new, previously uncatalogued active or inactive nest found, we recorded on a standardized nest-location data form (Appendix A) directions to the nest, a physical description of the nest, a description of the surrounding habitat, general land-use and prey information where relevant, and GPS coordinates (typically ±3–5 m resolution using a handheld GPS Map60CSx). We also record digital photographs of the nest site and subsequently ties these directly to the project database to facilitate relocation in subsequent years. At the same time we filled out a nest-location form for a given nest, we also started a record of specific activity during repeated visits on a separate nest-history data form (Appendix B) to record detailed observation data, behavioral observations, nest status information, and productivity data where relevant. For HWI internal and reporting purposes, we organized all nest data in a Microsoft Access 2003 database and using ArcGIS 9.x.

Included on our standard nest-location and nest-history data forms are places to describe the habitats and human activities within a 1-km radius of each nest site (Appendixes A and B). These data are useful for ground-truthing GIS data layers we are integrating with nest-location and productivity data to study relationships between raptor nesting ecology, habitat conditions, and land-use activities. In categorizing habitat types and land-use activities, we followed the standardized, hierarchical nomenclature developed for Utah habitat types by the UDWR (Appendix C).

**TERMINOLOGY**

In reporting our nest activity, success, and productivity results, the following definitions apply:

**Nesting territory:** clusters of nests with known species associations (i.e., have been confirmed as active nests during this or previous surveys) that are presumed to represent the unique nesting "territories" (actively defended or not) of specific breeding pairs based on spatial relationships and histories of non-overlapping (within years) use.

**Occupied territory:** breeding-age raptor persistently present during nesting season on known breeding territory, and/or courtship/territory defense observed.

- **No active nest:** no incubation activities documented; however may include territories where nest building and courtship were observed but no evidence of egg laying was found.
- **Active nest (or nest start):** incubation, nestling attendance or fledging activities documented—declaration of active status presumes that eggs were laid.
- **Alternate nest:** nest known to be an inactive alternate within a territory where another active nest was confirmed.
- **Unknown status:** no positive confirmation of nesting status obtained.

**Inactive territory:** no evidence of nesting activity, persistent presence of breeding age raptor or courtship/territory defense behavior observed.

**Inactive nest:** no evidence of nesting activity at the specific nest and no known territory association with any active nest.

**Successful hatching:** one or more eggs hatched.

**Hatching success:** percentage of confirmed nest starts that achieved successful hatching.

**Successful fledging:** one or more nestlings reaching ≥80% of the potential fledging age for the species.

**Fledging success:** percentage of confirmed nest starts that achieved successful fledging.

**Fledgling production per nest start:** average number of nestlings raised to ≥80% of fledgling age per nest start.
Fledging production per successful nest: average number of nestlings raised to ≥80% of fledgling age among those nests that produced at least one such nestling.

RESULTS

Survey Coverage

Our 2009 survey encompassed all 95 Ferruginous Hawk nesting territories known or believed to still exist before 2009 (excludes 14 previously catalogued territories that contained no functional nests by the end of the 2008 season) and covered two newly catalogued territories along the Utah–Idaho border region. We found no remaining, functional nests in three additional territories during the 2009 season. Both of the newly catalogued territories fledged young in 2009. One of these territories, encompassing at least three distinct, alternative nest sites in the Yost area of Utah, definitely existed prior to 2009, but is located deep within the Spencer Family ranch property (folks that have graciously allowed us full access to their property) in an area where previous activity may have been overlooked. We have now documented four Ferruginous Hawk territories on Spencer Ranch, with all active and successful in 2009. The other newly catalogued territory also was on private property, just southwest of Naf across the border in Idaho, with at least one possible alternative nest site nearby. Whether or not this nest had been used by Ferruginous Hawks previously is unknown; however, the territory almost certainly was not active in 2008.

Nest Numbers, Characteristics, and Distributions

Following the 2009 season, our GBRNS database contained records for 337 existing or former Ferruginous Hawk nests located in Utah or just over the border in Idaho, with a few others likely but not confidently catalogued as such due to indistinct characteristics and long-time inactive status. Fifty-one of these nests had disappeared or collapsed entirely before the 2009 season and we classified another 21 nests in this way after the 2009 season (Table 1). The latter comprised mostly old nests previously catalogued by the BLM in the late 1990s but not by us until now due to a lack of activity at these sites. During the 2009 season we checked all 286 previously known Ferruginous Hawk nests at a level sufficient to determine whether they were active or not, and catalogued 19 other distinctly Ferruginous Hawk nests for the first time (mostly old, disused nests).

Of the 265 Ferruginous Hawk stick nests known or presumed to still exist after the 2009 season, 208 (79%) were located in junipers (one on an artificial platform attached to the tree), 48 (18%) on rocky substrates, 3 (1%) on the ground, 3 (1%) on artificial nest structures, and 3 (1%) on utility poles (Table 2).

Based on the sample of 265 nest sites known or presumed to exist after the 2009 season, BLM lands contained 62% (163) of the known nest sites and 60% (15) of the confirmed active nests, private lands 33% (85) of the nest sites and 32% (8) of the active nests, state lands 5% (13) of the nest sites and 4% (1) of the active nests, and military lands <1% (1) of the nest sites and <1% (1) of the active nests (Table 3).

For geographic summary purposes, we divided the study area into seven largely distinct regions based on the distribution of 7.5’ topographic quads: Silver Island Mountains (8 full quads and half of one UT/NV border quad), East and North Pilot Range and Adjacent Hills (e.g., Lion Mountain, Pigeon Mountain, and Lemay Island; 8 full and half of 4 UT/NV border quads), Newfoundland Mountains (6 quads), Matlin/Hogup/Wildcat/Curlew Basin (including the Rosette and Park Valley areas, Matlin Basin and Mountains, Hogup Mountains, Wildcat Hills, and western Curlew Valley; 27 quads), Grouse Creek Valley and Mountains (including the Bovine, Dove Creek, and Goose Creek Mountains; 15 full quads and half of 5 UT/NV border quads), Raft River Mountains (6 quads), and the Grassy and Lakeside Mountains (19 quads and small portions of 3 others that are mostly located south of I-80) (Figure 2). As far as we know, neither the Silver Island Mountains nor Newfoundland Mountains regions have ever contained any Ferruginous Hawk nests.
Broken down by region and based on 265 confirmed Ferruginous Hawk nests known or presumed to still exist after the 2009 season, the Grassy/Lakeside Mountains contained the most known and monitored nests (90), followed by the Grouse Creek Valley and Mountains (68), Matlin/Curlew Basin (68), and finally, well behind these areas, the Raft River Mountains (20), and Pilot Range and Adjacent Foothills (19; note that these number do not match the region-specific totals in Table 1 due to inclusion in that table of nests discovered to have collapsed or disappeared during the 2009 season). Rankings based on the numbers of active nests confirmed in each region in 2009 were similar except that the Raft River Mountains and Grouse Creek Valley and Mountains switched places and the differences between the highest and lowest ranked areas were less pronounced in an absolute sense: Grassy/Lakeside Mountains (9), Raft River Mountains (8), Matlin/Curlew Basin (6), Grouse Creek Valley and Mountains (2), and Pilot Range and Adjacent Foothills (1; Table 4).

Assessed relative to approximate nest densities (measured in terms of nests per 7.5' quad, which equals roughly 50 sq. mi.), the picture changed a bit (Table 4). Relative to densities of known and monitored nests, the rankings were similar but the differences among regions were less pronounced: Grassy/Lakeside Mountains (4.4), Grouse Creek Valley and Mountains (3.9), Matlin/Curlew Basin (2.5), Raft River Mountains (3.3), and Pilot Range and Adjacent Foothills (1.9). Relative to densities of active nests, the rankings again painted a different picture: Raft River Mountains (1.33), Grassy/Lakeside Mountains (0.44), Matlin/Curlew Basin (0.22), Grouse Creek Valley and Mountains (0.11), and Pilot Range and Adjacent Foothills (0.10).

Nest Success and Productivity

In presenting species-specific success and productivity summaries, we acknowledge two minor imperfections in obtaining comprehensive monitoring data for all active nests. At one territory in Grouse Creek Valley, at least one adult was present in the area acting territorial towards a pair of Swainson’s Hawks that also resided in the area, and we confirmed that at least two of three known nests in the territory were inactive; however, due to an unfortunate oversight, we failed to confirm whether or not a third nest in the territory (used by both buteo species in the past) also remained unused by Ferruginous Hawks. We suspect that it was not active, however, because despite several hours of distant observations in the area and a mid-season walking survey of much of the territory, we never witnessed a pair of Ferruginous Hawks in the area. Therefore, we catalogued this territory as occupied but likely inactive and did not consider it a “probable” nest start for purposes of calculating estimates of apparent nesting success and productivity per nest start. The only other imperfection in our monitoring data was for an active nest on the Black Butte quad, which hatched three chicks but for which our final nest check was inadequate to confirm whether the single near-fledging we observed was the only one that survived to that point. This nest is on private property that is generally accessible, but ranchers were working in the area during the last visit and for this reason SS decided not to pursue a closer nest-check at the time. Therefore, for this nest we quantified minimum and “probable” fledgling productivity as one chick, but indicated a maximum possibility of three chicks.

In 2009, we confirmed 30 occupied Ferruginous Hawk nesting territories with one other possible (a single adult circled high over the territory during one visit, but did not remain in the area; Table 5). Among the 30 likely occupied territories, 26 supported active nests (i.e., eggs laid) and 3 definitely did not, with 26 nest starts considered “probable” and the basis for all additional estimates of hatching and fledging success and productivity per nest start (Tables 1 and 5).

Among the 26 nest starts, 24 hatched one or more eggs and 22 raised one or more chicks to at least 80% of fledging age (Table 5). These data yield 92% apparent hatching success and 85% apparent fledging success. Confirmed brood sizes ranged from 1–4 chicks. Estimated productivity equaled 1.69–1.77 (most likely 1.69) 80% fledglings per nest start, 2.00–2.09 (likely 2.00) 80% fledglings per successful nest, and 44–46 (likely 44) total 80% fledglings (Table 5).
Interannual Comparisons: 2001–2009

Trends in Occupied and Active Territories.—We have monitored the majority of known Ferruginous Hawk territories every year except 2001 (Table 6). Numbers of both occupied and active territories dropped slightly in 2002, despite much greater coverage than in 2001 (Table 6). Thereafter, the number of probable nest starts rose each year to a new high of 36 in 2007, dropped back down substantially but remained at the third highest total to date in 2008 (25), and then remained essentially the same in 2009 (26). The number of occupied territories followed a similar pattern except for dropping 14% in 2006 before rising again to a peak in 2007 (39), with a comparatively moderate 30–31 territories occupied in 2008 and 2009. In relative terms, the proportions of checked territories that were occupied have varied from lows of 21% in 2002 and 30% in 2003 to highs above 40% in 2004, 2005, and 2007; 2009 ranked third lowest to date at 31% (Table 6). The proportions of checked territories that supported active nests also were lowest in 2002 (17) and 2003 (24), but were highest (above 30%) in 2001, 2006, and 2007; 2008 and 2009 ranked fourth lowest to date at 27% (Table 6).

Trends in Nest Success and Productivity.—Imprecise data preclude useful interannual comparisons of hatching success, which is a difficult measure to assess accurately with only periodic nest visits and remote observations until most nests are believed to have hatched. Imprecise data also confound comparisons of fledging success and productivity per nest start (Table 6), but less so than for hatching success. Moreover, despite some imprecision in the estimates, clear patterns of difference across years are apparent in the latter parameters.

In terms of absolute numbers, thus far the abundance of successfully fledged nests clearly was low from 2001–2004, high from 2006–2007, moderate in 2005, low in 2008, and high again in 2009 (Table 6). In relative terms, however, the most probable proportion of nest starts that successfully fledged at least one young clearly was highest in 2005 and 2006, only moderate in 2007, lowest in 2008, and then strong again in 2009. Similarly, the most probable estimates of productivity per nest start clearly peaked in 2005 and 2006, dropped to a moderate level in 2007 and to the lowest level yet in 2008, and then returned to a moderate level in 2009. Estimates of productivity per successful nest also confirmed relatively high productivity in 2005 and 2006, moderate productivity in 2007, the lowest to date in 2008, and then back to a moderate level in 2009. Curiously, however, the highest estimate of productivity per successful nest occurred in 2003 when the number of nest starts and productivity per nest start were among the lowest to date (Table 6).

Overall, the density of nesting Ferruginous Hawks increased steadily across the study area between 2001 and 2007, then dropped back down again slightly in 2008 and 2009; apparent fledging success varied from sustained lows during 2002–2004, to a high in 2006, but then declined again and dropped to a new low in 2008 before rebounding again to a moderately high level in 2009; productivity per nest start generally increased from 2001–2006 but then declined again and dropped to a new low in 2008 before rebounding again in 2009; and total estimated fledgling production was lowest in 2002, much higher than average from 2005–2007, dropped back to a relatively low level in 2008, and then rebounded again to moderately high level in 2009. In summary, although the number of occupied territories and nest starts was similar in 2008 and 2009 (moderately high), all measures of success and productivity confirmed that 2008 was among the least productive since 2001, whereas by all accounts 2009 was a good year for the species in northwest Utah.

DISCUSSION

Inter-annual Comparisons

The detailed analysis we recently presented in Smith and Slater (2009) confirmed strong relationships between variation in regional moisture conditions (a major drought cycle) and the patterns of nesting
activity, success, and productivity we documented for most species in the study area between 2001 and 2007, with generally lower activity and productivity levels during the drought and the highest levels to date in 2006 and 2007 after two years of recovery following the peak drought years of 2002–2004. Since then, late summer 2007 was a scorcher and then overall winter snow-pack and spring moisture conditions declined again preceding the 2008 nesting season and much of northwestern Utah and northeastern Nevada was again ranked as under moderate to severe drought conditions as the 2008 nesting season began. Apparently as a result, our anecdotal observations during the season once again suggested a dearth of prey, especially ground squirrels (a major prey item for Ferruginous Hawks), and although the number of Ferruginous Hawk nests started was again relatively high, the lack of food appeared to contribute to one of the poorest seasons yet for the study in terms nest survival and productivity. That said, as discussed in last year’s annual report (Smith 2009), other human-disturbance factors related to management of the extensive fires that occurred in 2007 also may have contributed to the poor showing for Ferruginous Hawks in 2008. Despite the difficult year in 2008, however, a return to good winter snow packs and spring rains appeared to stimulate initiation of a similar number of active nests and another moderately strong success and productivity year in 2009. One other bit of evidence testifying to the benefits of a return to positive moisture levels and temperatures for improving general ecosystem conditions was the profusion of wildflowers in the area’s sagebrush habitats at levels we had not seen for several years. Ground squirrels also were obviously much more abundant in 2009 in many areas than we had noticed for awhile.

**Disturbance Factors**

No obvious human-disturbance factors appeared to compromise Ferruginous Hawk nesting activity in 2009. That said, spring recreation activities on the Low quad near I-80 (Lakeside exit), involving major RV camps and ATV activity on the sand dunes in the area were again extensive, and although that activity did not seem to cause significant problems for the one active Ferruginous Hawk nest in the area, it definitely had an impact on the Red-tailed Hawks that typically try to nest there. During an early visit in April, we observed the resident pair circling and calling above the area while several ATVs were parked directly under their primary nest tree. We did not monitor this nest closely in 2009 to determine whether the birds were able to carry off a nest (which they have done before despite this typical disturbance), but there is no question that the recreational activity in the area confounded their early courtship and nest-tending activities.

We also documented a strange situation this year for one newly built and active Ferruginous Hawk nest located on the Sally Mountain quad on a power pole along side the Lakeside military-access road. We believe that this new nest was built by an established pair whose nesting territory previously was centered in the adjacent hills to the east. This is a territory that had been active and successful in most years since we began our study, but then in late 2007 most of the existing nest trees in the area, including the one supporting the nest they had used most years since 2001, were burned down. In 2008, the pair attempted to nest in the one remaining, robust nest still present in the area, but appeared to have laid only one egg and abandoned the effort before the egg hatched. Although we cannot be sure it was the same birds, the 2009 power pole nest was built roughly 500 m due west and within sight of the former territory center, and appeared to involve a similar pair of light-morph adults. Unfortunately, after we discovered the new nest and confirmed incubation, we returned to find the female dead on the nest, apparently before any eggs hatched. At that point, we also noted the presence of a lone adult male back up in the original territory area. Because we had no way to access the high nest up on the power pole, we were unable to inspect the dead bird or the nest’s contents, so we do not know why the adult died. Although such an accident seems unlikely, the way we found the dead bird, sitting down in the nest but with her wings slightly splayed out and her head somewhat tucked down in the nest near the pole, suggested that she may have crashed landed and hit her head on the power pole. Otherwise, there was no evidence to suggest electrocution as the cause of death; it is possible that she was shot while sitting on her nest; or some manner of disease or other infirmity could have been the cause of mortality.
ACKNOWLEDGEMENTS

Funding for this project in 2009 was provided by the Salt Lake Field Office of the Bureau of Land Management, Patagonia Outlet, and HWI private donors and members.

LITERATURE CITED


Table 1. Status of Ferruginous Hawk nests in northwest Utah in 2009 by region.

<table>
<thead>
<tr>
<th>STATUS 2008</th>
<th>E/N PILOT RANGE AND ADJACENT HILLS</th>
<th>GRASSY/LAKESIDE MOUNTAINS</th>
<th>GROUSE CREEK VALLEY AND MOUNTAINS</th>
<th>MATLIN/HOGUP/WILDCAT/CURLEW BASIN</th>
<th>RAFT RIVER MOUNTAINS</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nest Gone/Not Found</td>
<td>1</td>
<td>8</td>
<td>9</td>
<td>3</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Inactive</td>
<td>18</td>
<td>53</td>
<td>37</td>
<td>41</td>
<td>5</td>
<td>154</td>
</tr>
<tr>
<td>Occupied Territory?-Inactive Nest</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
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<td>4</td>
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<tr>
<td>Occupied Territory-Inactive Nest</td>
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<td>1</td>
<td>20</td>
<td>5</td>
<td>0</td>
<td>26</td>
</tr>
<tr>
<td>Occupied Territory-Inactive Nest?</td>
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<td>0</td>
<td>0</td>
<td>1</td>
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<tr>
<td>Occupied Territory-Inactive Alternate</td>
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<td>27</td>
<td>8</td>
<td>12</td>
<td>7</td>
<td>54</td>
</tr>
<tr>
<td>Occupied Territory-Active Nest</td>
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<td>9</td>
<td>2</td>
<td>6</td>
<td>8</td>
<td>26</td>
</tr>
<tr>
<td>Total</td>
<td>29</td>
<td>114</td>
<td>93</td>
<td>79</td>
<td>22</td>
<td>337</td>
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Table 2. Substrates of Ferruginous Hawk nests still extant in northwest Utah after the 2009 season.

<table>
<thead>
<tr>
<th>SUBSTRATE</th>
<th>NUMBER OF NESTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artificial Nest Structure</td>
<td>3</td>
</tr>
<tr>
<td>Utility Pole</td>
<td>3</td>
</tr>
<tr>
<td>Cliff/Outcrop</td>
<td>48</td>
</tr>
<tr>
<td>Ground/hilltop</td>
<td>3</td>
</tr>
<tr>
<td>Tree-Juniper - Live</td>
<td>176</td>
</tr>
<tr>
<td>Tree-Juniper - Dead or Dying</td>
<td>31</td>
</tr>
<tr>
<td>Tree-Juniper / Artificial Platform</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>265</strong></td>
</tr>
</tbody>
</table>

Table 3. Distribution by landowner of Ferruginous Hawk nests still extant in northwest Utah after the 2009 season.

<table>
<thead>
<tr>
<th>LAND OWNER</th>
<th>NEST SITES</th>
<th>ACTIVE NESTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLM</td>
<td>163</td>
<td>15</td>
</tr>
<tr>
<td>Private</td>
<td>88</td>
<td>9</td>
</tr>
<tr>
<td>State</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td>Military</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>265</strong></td>
<td><strong>26</strong></td>
</tr>
</tbody>
</table>

Table 4. Approximate Ferruginous Hawk nest and nesting territory densities by region in northwest Utah in 2009.

<table>
<thead>
<tr>
<th>REGION</th>
<th># OF</th>
<th>NESTS¹</th>
<th>TERRITORIES¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>QUADS</td>
<td>KNOWN CHECKED</td>
<td>KNOWN CHECKED OCCUPIED</td>
</tr>
<tr>
<td>E/N Pilot Range and Adjacent Hills</td>
<td>10</td>
<td>1.9</td>
<td>0.6</td>
</tr>
<tr>
<td>Grassy/Lakeside Mountains</td>
<td>20.5</td>
<td>4.4</td>
<td>1.4</td>
</tr>
<tr>
<td>Grouse Creek Valley and Mountains</td>
<td>17.5</td>
<td>3.9</td>
<td>1.4</td>
</tr>
<tr>
<td>Matlin/Hogup/Wildcat/Curlew Basin</td>
<td>27</td>
<td>2.5</td>
<td>1.0</td>
</tr>
<tr>
<td>Raft River Mountains</td>
<td>6</td>
<td>3.3</td>
<td>1.8</td>
</tr>
</tbody>
</table>

¹ Values equal the number of nests or territories per 7.5-minute USGS topographic quad map (approximately 50 sq. miles) in each region.
Table 5. Status and productivity of Ferruginous Hawk nests/territories in northwest Utah in 2009.

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td># Known territories</td>
<td>97</td>
</tr>
<tr>
<td># Territories not checked</td>
<td>0</td>
</tr>
<tr>
<td># Occupied territories</td>
<td>30–31</td>
</tr>
<tr>
<td># No active nest</td>
<td>3–5</td>
</tr>
<tr>
<td># Confirmed/probable nest starts</td>
<td>26</td>
</tr>
<tr>
<td># Hatching failures (min)</td>
<td>2</td>
</tr>
<tr>
<td># Hatched nests (min)</td>
<td>24</td>
</tr>
<tr>
<td># Fledging failures</td>
<td>4</td>
</tr>
<tr>
<td># Fledged nests</td>
<td>22</td>
</tr>
<tr>
<td>% Apparent hatching success</td>
<td>92</td>
</tr>
<tr>
<td>% Apparent fledging success</td>
<td>85</td>
</tr>
<tr>
<td># Fledglings / nest start</td>
<td>1.69–1.77 (1.69)</td>
</tr>
<tr>
<td># Fledglings / successful nest</td>
<td>2.00–2.09 (2.00)</td>
</tr>
<tr>
<td># Fledglings</td>
<td>44–46 (44)</td>
</tr>
</tbody>
</table>

1 These statistics summarize all fledging failures, including hatching and brood-rearing failures. Fledging is equated with a nestling reaching ≥80% of the average fledging age for the species.

3 Numbers in parentheses indicate the most likely value. In this case, the only uncertainty was one nest that likely produced only one fledgling, but for which our monitoring was inadequate to determine whether or not two other hatched chicks survived to this stage.

<table>
<thead>
<tr>
<th></th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Known / Checked Territories</strong></td>
<td>84/45</td>
<td>89/82</td>
<td>91/80</td>
<td>89/81</td>
<td>89/79</td>
<td>95/90</td>
<td>99/93</td>
<td>98/92</td>
<td>97</td>
</tr>
<tr>
<td><strong># Confirmed Occupied Territories (% of checked)</strong></td>
<td>18 (40)</td>
<td>17 (21)</td>
<td>24 (30)</td>
<td>34 (42)</td>
<td>35 (44)</td>
<td>31 (34)</td>
<td>39 (42)</td>
<td>31 (34)</td>
<td>30 (31)</td>
</tr>
<tr>
<td><strong># Probable Active Territories (% of checked)</strong></td>
<td>16 (36)</td>
<td>14 (17)</td>
<td>19 (24)</td>
<td>20 (25)</td>
<td>22 (28)</td>
<td>28 (31)</td>
<td>36 (39)</td>
<td>25 (27)</td>
<td>26 (27)</td>
</tr>
<tr>
<td><strong># Nest Starts – confirmed / probable</strong></td>
<td>14/16</td>
<td>12/14</td>
<td>17/19</td>
<td>20</td>
<td>22</td>
<td>27/28</td>
<td>33/36</td>
<td>23/25</td>
<td>26</td>
</tr>
<tr>
<td><strong># Hatched Nests – minimum</strong></td>
<td>13</td>
<td>11</td>
<td>13</td>
<td>18</td>
<td>19</td>
<td>25</td>
<td>26</td>
<td>18</td>
<td>24</td>
</tr>
<tr>
<td><strong># Fledged Nests – confirmed / probable</strong></td>
<td>10/13</td>
<td>9/10</td>
<td>12/13</td>
<td>13/14</td>
<td>19</td>
<td>24/26</td>
<td>23/27</td>
<td>15/16</td>
<td>22</td>
</tr>
<tr>
<td><strong>% Nest Starts Fledged – confirmed / probable</strong></td>
<td>63/81</td>
<td>64/71</td>
<td>63/68</td>
<td>65/70</td>
<td>86</td>
<td>86/93</td>
<td>64/75</td>
<td>60/64</td>
<td>85</td>
</tr>
<tr>
<td><strong># Fledglings / Nest Start – confirmed / probable</strong></td>
<td>1.25/1.69</td>
<td>1.14/1.43</td>
<td>1.89/2.11</td>
<td>1.40/1.50</td>
<td>2.32</td>
<td>2.07/2.25</td>
<td>1.19/1.64</td>
<td>1.00/1.12</td>
<td>1.69</td>
</tr>
<tr>
<td><strong># Fledglings / Successful Nest</strong></td>
<td>2.00</td>
<td>1.78</td>
<td>3-3</td>
<td>2.15-2.31</td>
<td>2.68-2.84</td>
<td>2.42-2.54</td>
<td>1.87-2.30</td>
<td>1.67-1.93</td>
<td>2.00-2.09</td>
</tr>
<tr>
<td><strong># Fledglings – confirmed / probable</strong></td>
<td>20/27</td>
<td>16/20</td>
<td>36/40</td>
<td>28/30</td>
<td>51</td>
<td>58/63</td>
<td>43/59</td>
<td>25/28</td>
<td>44</td>
</tr>
</tbody>
</table>

1 An “active” nest or “nest start” equates to eggs laid.

2 Fledging is equated with young reaching at least 80% of the average fledging age for the species.
Figure 1. Approximate coverage (red hatched areas) of Ferruginous Hawk nest (green stars) surveys in Utah in 2009.
Figure 2. Regional classification of 7.5′ topographic quads used in summarizing the distribution of raptor nests.
Appendix A. Standard nest location data form.
HawkWatch International Nest Location Data Sheet

Species: _______________________________ Status (active, inactive, unknown): _______________________________
Observer(s): _______________________________ Date Discovered: _______________________________
7.5' Topo Quad: _______________________________ County: _______________________________
Township: _______ Range: _______ Section: _______ Quarter Section: _______ Elevation: _______ (m)
GPS model used: _______________________________ UTM nest coords: _____ Zone ____________ E ____________ N
UTM view coord: _____ Zone ____________ E ____________ N Distance/orientation to nest: _______________________________
Land ownership (indicate owner/manager name when known):
  Private: ___________________ State: ___________________ Federal: ___________________
Specific directions to nest site: ______________________________________________________________
____________________________________________________________________________________________
____________________________________________________________________________________________
____________________________________________________________________________________________
____________________________________________________________________________________________
____________________________________________________________________________________________
____________________________________________________________________________________________
____________________________________________________________________________________________
____________________________________________________________________________________________
____________________________________________________________________________________________
Map showing directions to nest site.

Photos

<table>
<thead>
<tr>
<th>Type</th>
<th>Camera</th>
<th>Photo#</th>
<th>Orientation</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
General Description of Nest Site:

Substrate (e.g., cliff or outcrop [rock type], tree/shrub [species, live/dead], ground, Artificial Structure [type]):

_____________________________________________________________________________________

Estimated height of substrate: _______(m)  Estimated height of nest above ground: _______(m)
Nest type and location on substrate (e.g., stick nest in upper/lower canopy stick nest on/in ledge, pothole, or crevice; scrape on/in ledge, pothole, or crevice; stick nest on artificial platform mounted in tree; tree cavity; burrow; etc.):

_______________________________________________________________________________________

Protection from weather (YES/NO; describe nature of protection, e.g., tree canopy, cliff backdrop, pothole/crevice, burrow, etc.):

_______________________________________________________________________________________

Approximate compass direction of exposure to elements (wind, sun, etc.): ____________________________

Describe visibility and accessibility of nest (relative to obtaining accurate status/productivity data, possibility for banding or nestling exams, searching for prey remains, and accessibility for predators, etc.):

_______________________________________________________________________________________
_______________________________________________________________________________________
_______________________________________________________________________________________

Nest size—indicate whether estimated or measured: __________________
  Height (top to bottom)_______  Width (left to right)_______  Depth (back to front)_______  (meters)

Known or probable alternative nests within territory and associated nest #’s:

__________________________________________________________________________________________
__________________________________________________________________________________________

Standard description of habitat types and land uses within 1-km radius of nest using UDWR classification codes and estimates of percentages of each habitat type within area, and any additional notes about apparent habitat condition: ________________________________________________________________________________
__________________________________________________________________________________________
__________________________________________________________________________________________
__________________________________________________________________________________________
__________________________________________________________________________________________

Additional notes about human activity within 1-km radius of nest (e.g., heavy road traffic, density of homes, recreational activities, etc.):

__________________________________________________________________________________________
__________________________________________________________________________________________
__________________________________________________________________________________________
__________________________________________________________________________________________

Miscellaneous Notes: _______________________________________________________________________
____________________________________________________________________________________________
____________________________________________________________________________________________
____________________________________________________________________________________________
____________________________________________________________________________________________
Appendix B. Standard nest-history field data form.
Date (mm/dd/yy): _______________  Observer(s): ____________________________  (24-hr clock, Local Standard Time only)
Species: __________________________  Time to confirmation of active status: __________________________

Status (courtship, nest building, incubating, nestlings, fledglings, occupied inactive territory, inactive territory and nest, unknown): _______________________________________________________________________________________

# Dead Eggs: ______  # Live eggs: ______  # Dead young: ______  # Live young: ______  Nest poled? Y / N
Estimated Ages of Young (days): __________________________  # Banded: __________
Basis for age of young (describe plumage and/or behavior):

Description of adult activity: __________________________________________________________________________
__________________________________________________________________________________________________

******************************************************************************

Date (mm/dd/yy): _______________  Observer(s): ____________________________  (24-hr clock, Local Standard Time only)
Species: __________________________  Time to confirmation of active status: __________________________

Status (courtship, nest building, incubating, nestlings, fledglings, occupied inactive territory, inactive territory and nest, unknown): _______________________________________________________________________________________

# Dead Eggs: ______  # Live eggs: ______  # Dead young: ______  # Live young: ______  Nest poled? Y / N
Estimated Ages of Young (days): __________________________  # Banded: __________
Basis for age of young (describe plumage and/or behavior):

Description of adult activity: __________________________________________________________________________
__________________________________________________________________________________________________

******************************************************************************

Date (mm/dd/yy): _______________  Observer(s): ____________________________  (24-hr clock, Local Standard Time only)
Species: __________________________  Time to confirmation of active status: __________________________

Status (courtship, nest building, incubating, nestlings, fledglings, occupied inactive territory, inactive territory and nest, unknown): _______________________________________________________________________________________

# Dead Eggs: ______  # Live eggs: ______  # Dead young: ______  # Live young: ______  Nest poled? Y / N
Estimated Ages of Young (days): __________________________  # Banded: __________
Basis for age of young (describe plumage and/or behavior):

Description of adult activity: __________________________________________________________________________
__________________________________________________________________________________________________

******************************************************************************

Date (mm/dd/yy): _______________  Observer(s): ____________________________  (24-hr clock, Local Standard Time only)
Species: __________________________  Time to confirmation of active status: __________________________

Status (courtship, nest building, incubating, nestlings, fledglings, occupied inactive territory, inactive territory and nest, unknown): _______________________________________________________________________________________

# Dead Eggs: ______  # Live eggs: ______  # Dead young: ______  # Live young: ______  Nest poled? Y / N
Estimated Ages of Young (days): __________________________  # Banded: __________
Basis for age of young (describe plumage and/or behavior):

Description of adult activity: __________________________________________________________________________
__________________________________________________________________________________________________

******************************************************************************

Date (mm/dd/yy): _______________  Observer(s): ____________________________  (24-hr clock, Local Standard Time only)
Species: __________________________  Time to confirmation of active status: __________________________

Status (courtship, nest building, incubating, nestlings, fledglings, occupied inactive territory, inactive territory and nest, unknown): _______________________________________________________________________________________

# Dead Eggs: ______  # Live eggs: ______  # Dead young: ______  # Live young: ______  Nest poled? Y / N
Estimated Ages of Young (days): __________________________  # Banded: __________
Basis for age of young (describe plumage and/or behavior):

Description of adult activity: __________________________________________________________________________
__________________________________________________________________________________________________

******************************************************************************
Nest condition (poor, fair, good, excellent, gone collapsed, burned; additional notes as relevant; with observation dates and times, as appropriate):

<table>
<thead>
<tr>
<th>Date</th>
<th>Condition</th>
<th>Comments</th>
</tr>
</thead>
</table>

Human activities (please fill out Human Activity/Disturbance for major or significant events):

<table>
<thead>
<tr>
<th>Date</th>
<th>Activity (see Human Dist. Sheet)</th>
<th>Vehicle Types</th>
<th># of People/Vehicle</th>
</tr>
</thead>
</table>

Comments with observation dates and times, please record any signs of non observed human activity and any bird reactions:

_________________________________________________________________________________________________________
_________________________________________________________________________________________________________
_________________________________________________________________________________________________________
_________________________________________________________________________________________________________

Habitat Condition and Changes (Please record developing conditions and changes to habitat in nest area such as fire or clearing):

_________________________________________________________________________________________________________
_________________________________________________________________________________________________________
_________________________________________________________________________________________________________
_________________________________________________________________________________________________________
_________________________________________________________________________________________________________

Prey Observations (for each potential species observed):

At Nest:

<table>
<thead>
<tr>
<th>Date</th>
<th>Species</th>
<th>Abundance or #</th>
<th>Remains</th>
<th>Comments</th>
</tr>
</thead>
</table>

Observations of prey distribution and abundance/ foraging feeding in nesting territory:

_________________________________________________________________________________________________________
_________________________________________________________________________________________________________
_________________________________________________________________________________________________________
_________________________________________________________________________________________________________
_________________________________________________________________________________________________________
### Appendix C. UDWR Utah habitat types classification scheme.

**TYPE** | **CODE**
--- | ---
**I. Forested**
A. Pinyon/Juniper | PIJU*
1. Juniper | JUNI
a. Utah Juniper | UTJU
b. Rocky Mountain Juniper | RMJU
c. Common Juniper | COJU
2. Pinyon | PINY
a. Pinyon Pine | PIPI
b. Silverleaf Pinyon | SLPY
B. Pinyon/Juniper Mix (PIJU with grass) | PJMX*
C. Spruce/Fir | SPFX*
1. Fir | FIR
a. Mountain Fir | FIR
1) Douglas Fir | DOFI
2) White Fir | WHTF
2) Alpine Fir | ALFI
b. Spruce | SPRU
a. Engelmann Spruce | ENSP
b. Blue Spruce | BLSP
1. Ponderosa Pine | POPI*
2. Limber Pine | LMPY
3. Lodgepole Pine | LDPY
4. Bristlecone Pine | BRTY
5. Mountain Mahogany | MMGY*
6. Serviceberry | SEVB
7. Squawbush | SQBY
8. Ceanothus | CEAN*
9. Choke cherry | CHCH*
**II. Scrub or Mountain Brush**
A. Mountain Shrub | MOSH*
1. Scrub Oak | SCOA*
 a. Gambel's Oak | GBOA
 b. Canyon Live-Oak | CLAO
2. Maple (excluding BOEL) | MAPL*
 a. Bigtooth Maple | BMTY
 b. Rocky Mountain Maple | RMMY
3. Bitterbrush | BRBY
4. Bursage | BRSY
5. Mountain Mahogany | MMGY*
6. Serviceberry | SEVB
7. Squawbush | SQBY
8. Ceanothus | CEAN*
9. Choke cherry | CHCH*
**III. Herbs – Shrubs**
A. Desert Shrub | DESH*
1. Sagebrush | SAGE*
2. Sage Mix (Sagebrush mixed with grass) | SAGM*
3. Blackbrush | BLCH*
4. Blackbrush Mix (BLAC w/PIJU or grass) | BLMX*
5. Creosotebush | CREO*
6. Bursage | CROB
B. Salt Desert Shrub | SDSL*
1. Greasewood | GREY
2. Shadscale | SHAD
3. Mat-atriplex | MATY
4. Castle Valley Clover | CVCL
5. Rabbitbrush | RABY
6. Russian Thistle | RUTH
7. Horsebrush | HORB
8. Pickleweed | PICK
9. Halogoton | HALO
10. Winterfat | WINT
11. Mormon Tea | MOME
C. Salt Des. Shrub Mix (SDSH w/ grass, SAGE, BLAC) | SDMX*
D. Other Shrub or Forb | OTSH
1. Snakeweed | SNAK
2. Prickly Pear | PRPE
3. Buffaloberry | BVBY
4. Singleleaf Ash | SIAS
5. Fremont Mahonia | FRMA
6. Joshua Tree | JSTY
**III. Herbs - Shrubs (cont.)**
A. Desert Shrub | DESH*
1. Winterfat | WINT
2. Mormon Tea | MOME
E. Mountain Meadow (grassy clearing in forest) | MOME*
1. Wet Meadow | WETM
2. Dry Meadow | DRYM
F. Mountain Forb (herbaceous opening in forest) | MOFO*
G. Alpine Tundra (above treeline) | ALTU*
**IV. Grasses - Sedges**
A. Grass | GRAS*
1. Cheatgrass | CHKY
2. Indian Ricegrass | IRAI
3. Dropseed | DROP
4. Saltgrass | STGL
5. Wheatgrass (except CRWH) | WTHG
6. Galleta | GALT
7. Needlegrass | NEDG
8. Bluegrass | BGRY
9. Grama | GRMA
10. Three Awn | THAW
11. Foxtail | FOXT
12. Bromes | BROM
13. Trisetum | TRST
14. Fescue | FESC
15. Reedgrass | REED
16. Timothy | TIMY
17. Crested Wheat | CRWH
**IV. Grasses - Sedges (cont.)**
A. Grass | GRAS*
1. Cheatgrass | CHKY
2. Indian Ricegrass | IRAI
3. Dropseed | DROP
4. Saltgrass | STGL
5. Wheatgrass (except CRWH) | WTHG
6. Galleta | GALT
7. Needlegrass | NEDG
8. Bluegrass | BGRY
9. Grama | GRMA
10. Three Awn | THAW
11. Foxtail | FOXT
12. Bromes | BROM
13. Trisetum | TRST
14. Fescue | FESC
15. Reedgrass | REED
16. Timothy | TIMY
17. Crested Wheat | CRWH
**V. River Bottom or Riparian**
A. Riparian | RIPA*
1. Cottonwood | COTY
2. Fremont Cottonwood | FRCO
3. Narrowleaf Cottonwood | NFCO
4. Willow | WLYW
5. Tamarisk | TAMK
6. Russian Olive | ROBY
7. Box Elder | BLOD
**VI. Aquatic Areas**
A. Wetland (other than RIPA) | WET*
B. Hanging Garden | HANG*
C. Open Water | WAT*
**VII. Barren Areas**
A. Urban (1-2) | URB*
1. Residential Areas | RESI
2. Commercial Areas | COMM
B. Agricultural | AGR*
1. Cropland | CROP
2. Pasture | PAST
3. Hedgerow/Shelterbelt | HEDG*
C. Other (explain in remarks) | OTHR
**VIII. Other**
A. Urban (1-2) | URB*
1. Residential Areas | RESI
2. Commercial Areas | COMM
B. Agricultural | AGR*
1. Cropland | CROP
2. Pasture | PAST
3. Hedgerow/Shelterbelt | HEDG*
C. Other (explain in remarks) | OTHR

* habitat categories currently used in GIS/GAP Analysis.