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UNUSUAL RAPTOR NESTS AROUND THE WORLD

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ABSTRACT.—From surveys in many countries, we report raptors using unusual nesting materials (e.g., paper money, rags, metal, antlers, and large bones) and unusual nesting situations. For example, we documented nests of Steppe Eagles [*Aquila nipalensis*] and Upland Buzzards [*Buteo hemilasius*] on the ground beside well-traveled roads, Saker Falcon [*Falco cherrug*] eyries in attics and a cistern, and Osprey [*Pandion haliaetus*] nests on the masts of boats and on a suspended automobile. Other records include a Golden Eagle [*A. chrysaetos*] nest 7.0 m in height, believed to be the tallest nest ever described, and, for the same species, we report nesting in rudimentary nests. Some nest sites are within a few meters of known predators or competitors. These unusual observations may be important in revealing the plasticity of a species' behavioral repertoire.

KEY WORDS: *buzzard*; *eagle*; *falcon*; *hawk*; *nest*; *nest materials*; *owl*; *raven*.

NIDOS INUSUALES DE RAPACES ALREDEDOR DEL MUNDO

RESUMEN.—A partir de censos realizados en muchos países, documentamos el uso de materiales inusuales (e.g., billetes, trapos, metal, cuernos de ciervos y huesos grandes) para la construcción de los nidos y de situaciones de anidación inusuales por parte de las rapaces. Por ejemplo, documentamos nidos de *Aquila nipalensis* y de *Buteo hemilasius* en el suelo al lado de caminos muy transitados, de *Falco cherrug* en áticos y en una cisterna, y de *Pandion haliaetus* en los mástiles de barcos y en un automóvil suspendido. Otros registros incluyen nidos de *A. chrysaetos* a 7.0 m de altura, lo que se cree es el registro más alto descrito hasta la fecha y, para la misma especie, documentamos anidación en nidos rudimentarios. Algunos sitios de anidación están a pocos metros de depredadores o competidores conocidos. Estas observaciones inusuales pueden ser importantes en revelar la plasticidad del repertorio de comportamientos de la especie.

[Traducción del equipo editorial]

Intensive fieldwork over extended periods of time often yields a scattering of atypical observations. Most published research focuses on the mean, so unusual records are seldom published and are, over time, forgotten. Yet many of these are important in revealing the plasticity of a species' behavioral repertoire (Bortolotti 1992, Schmutz 1992). In developing raptor management strategies, it is not only important to know that an eagle nests on tall cliffs, but that, under unusual circumstances, it may nest on a hillside. Likewise, it is useful to know not only the average distance between pairs of kestrels, but also that on very tall cliffs they sometimes nest much closer together horizontally. Further, much of what is most interesting about raptors is revealed by presenting the extremes (e.g., the largest prey, the nearest proximal nesting, etc.).

Here we provide many extreme cases. The following accounts, selected from our field notes over four decades, highlight unusual behavior by wild birds under extreme circumstances. Because captive-reared animals often have unusual behavior, it is of limited interest that a released Peregrine Falcon (*Falco peregrinus*) nested less than 3 m from the ground on an abandoned building (e.g., Bunnell et al. 1997). However, observations of wild peregrines and wild Red-shouldered Hawks (*Buteo lineatus*) nesting on buildings (Groskin 1952, Hays

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Figure 1. Osprey nest on the mast of a sunken boat, southern Baja California, 27 March 1977. Photograph: Daniel Anderson.

2000) are worth publishing. Our emphasis is on providing photographic documentation of some of the most unlikely records.

OBSERVATIONS

Nests on or near Artificial Supports. The Osprey (*Pandion haliaetus*) is probably the raptor most prone to nest on artificial structures. By the late nineteenth century, Ospreys on the Atlantic seaboard were already making the shift to human-made supports. By 1973, only 32% of Ospreys in Chesapeake Bay were nesting in trees (Henny et al. 1974). A similar shift began later (1970s) in western North America (Henny and Anderson 1979, Henny and Kaiser 1996). In 2008, only 10% of 110 Osprey pairs in Michigan's Lower Peninsula were nesting on natural supports.

Today, Ospreys use a wide variety of human-made structures including not only power lines and buoys, but also such inconvenient locations as open drawbridges, athletic stadium light fixtures, and a mine dragline. In addition, in 1977, we found Ospreys nesting on the mast of a sunken steel boat (Fig. 1). Also in 1977, Ospreys built a nest on the roof peak of a vacation home near San Felipe, Baja California Norte, Mexico. In 1978, Ospreys built on the mast of a yacht in a busy harbor near Long Beach, California. In 2007, Ospreys nested on an iron-and-concrete sculpture of a cardón cactus (*Pachycereus pringlei*) in Sonora, Mexico. Most bizarre was the nesting in 2002 of Ospreys on the roof of an Infinity automobile in Orlando, Florida. Immediately after the car dealership, to promote a Presidents' Day sale, hoisted the car nearly 30 m aloft, Ospreys began building. It was early June before the dealership met state requirements by constructing an alternate nest nearby and were allowed to lower the car, badly soiled after 3.5 mo of Osprey use.

In recent decades, Saker Falcons (*F. cherrug*) also increasingly use human-made supports. On 13 June 1997, Saker Falcons nested on the floor of a 2.1-m-tall cistern (floor dimensions 1.8 × 1.2 m) amid the rubble of a demolished well house (Fig. 2). The adult falcon escaped from the pit by flying against one wall, then propelling herself over the rim on the rebound, an act which some or all fledglings from previous year(s) had been unable to master, as evidenced by their mummified remains on the cistern floor. We punched a hole through the wall and installed an interior ramp so the nestlings could fledge. Another two Saker Falcon eyries were in the attics of abandoned well houses (ca. 6 × 6 m) on the open steppes of southeastern Mongolia. Both of these structures were the only available elevated nesting sites for at least 3 km on the open steppe.

In Mongolia, Upland Buzzards (*B. hemilasius*) often build ''walk in'' nests (i.e., nests approachable

Figure 2. Adult Saker Falcon leaving the cistern eyrie, southeastern Mongolia, 8 June 1998. The hole was punched through the wall in June 1997 so the nestlings could fledge. Photograph: David Ellis.

on foot without climbing) on easily accessible hillsides or even on the open steppe. In wolf (*Canis lupus*) and fox (*Vulpes* spp.) habitat, such nests would seem likely to fail, but fledged young are regularly seen in and around these structures. Strangely, ground nests are occasionally seen immediately adjacent to conspicuous artificial objects. One surrounded a ca. 70-mm-diameter iron rod emerging from the steppe (Fig. 3). Another nest entirely filled the cavity in a discarded truck or tractor tire 6 m from a regularly used dirt road (Fig. 4). We also found two Upland Buzzard nests near coils of wire on the ground. Brown (1955) long ago reported a Golden Eagle (*Aquila chrysaetos*) nest in Scotland on the ground near a coil of wire.

Many buzzard and some Steppe Eagle (*A. nipalensis*) ground nests in Mongolia were near power or telephone poles (Fig. 5). Poles provide shade as

Figure 3. This Upland Buzzard nest (central Mongolia, 26 May 1995) is located at the base of a steel rod emerging from the ground. Photograph: David Ellis.

nestlings follow the daily path of the pole's shadow. The need for shade also explains the placement of Lanner Falcon (*F. biarmicus*) eyries amid metal rubbish on the open Sahara Desert (Goodman and Haynes 1989).

Upland Buzzards in Mongolia often nest on abandoned buildings and other natural and artificial supports. One such nest was atop a metal barrel on a boulder ca. 1 m in height (Fig. 6). The barrel required filling before the buzzards could nest atop it.

Ferruginous Hawks (*B. regalis*) often nest in odd situations. A 1999 nest with broken eggs was ca. 6 m up a ca. 7-m-tall human-made gravel pile within

Figure 4. Upland Buzzard nest in a discarded rubber tire, eastern Mongolia, 4 June 1995. P. Tsengeg (left) and Merlin Ellis pictured. Photograph: David Ellis.

Figure 5. Many Upland Buzzard nests, especially in eastern Mongolia, are placed on the ground next to power or telephone poles. Where poles have sufficient arms and wires to support a nest, ground nests are seldom encountered (May 2008). Photograph: David Ellis.

100 m of an active fossil fuel pumping station southwest of Powder River, Wyoming.

Although windmill nests have been described earlier (Bednarz 1995, Kochert et al. 2002), we illustrate a successful 1998 Harris's Hawk (*Parabuteo unicinctus*) nest on a retired windmill ca. 20 km east of Carlsbad, New Mexico (Fig. 7). Although the windmill's blades did not turn during nesting, the mill could pivot 360° and swung with each wind gust.

Although Prairie Falcons (*F. mexicanus*) nest almost exclusively on cliffs (Steenhof 1998), we have one record of nesting on a building. Following two

Figure 6. Upland Buzzard nest atop a metal barrel, southeastern Mongolia, 7 June 1998. D. Batdelger is pictured. Photograph: David Ellis.

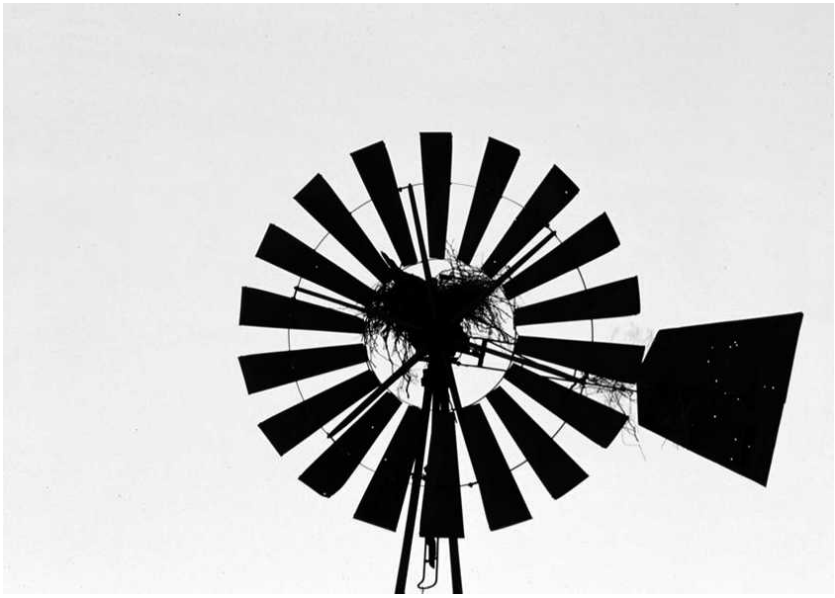

Figure 7. Adult female Harris's Hawk incubating atop a windmill in New Mexico. Photograph: James Dawson.

winters in which one, and occasionally two, Prairie Falcons roosted at the University of Calgary, Alberta, Canada (Nelson 1974), a pair attempted nesting there, on Craigie Hall. In the second week of April 1974, an adult male and a yearling female began courting. The first egg was laid on 26 April in a thin layer of dried pigeon (Rock Pigeon [*Columba livia*]) manure on sheet metal in a back corner of a large, north-facing cavity (ca. 4 m × 1.3 m × 1.6 m high) just above the upper floor (Fig. 8). Rain turned to

Figure 8. First documented nesting of Prairie Falcons on a building. Yearling Prairie Falcon at her scrape at the University of Calgary, 1 May 1974. Her third egg is in the scrape. The first and second are scattered about the metal ledge. Photograph: R. Wayne Nelson.

Figure 9. An extreme example of an Upland Buzzard trash nest in southeastern Mongolia, 4–5 June 1995. Photograph: David Ellis.

wet snow overnight with temperatures just below freezing. The following morning, the single egg lay on bare metal. After waiting until the female left the ledge, we spread sand on the ledge and placed the egg in a shallow depression. Following the blizzard, the male ceased his courtship and food deliveries. People then provided the female with ground squirrel (*Citellus* sp.) carcasses, which she ate. She laid three more eggs, but they were soon scattered about the ledge and disappeared one by one. Only one egg remained when the female finally abandoned the ledge. On sunny days in mid-May, the pair resumed courtship, including copulations, but no replacement clutch was laid, and no breeding attempt was made there in subsequent years.

Anthropogenic Nest Materials. In Mongolia, buzzard and eagle nests near towns and nomad camps usually consist largely of various anthropogenic discards, especially cloth, wire, and twine. In approximately one nest per hundred, we found a nestling falcon or buzzard tethered to the nest by rubbish (Ellis and Lish 1999, Potapov et al. 1999).

Two extreme examples of rubbish nests for the Upland Buzzard were found in eastern Mongolia in 1995. In the first (Fig. 9), wire and cloth not only made up most of the nest, but also dangled more than 1.5 m below. Wires crossing electrical conductors could cause fires, but we never saw a burned nest. The second nest was partially lined with paper money (Fig. 10).

We also found three Golden Eagle nests with paper money: two in central and one in southeastern Mongolia. Two contained one bill each and one had three bills. Each was likely collected from one of the many hilltop shrines (dedicated to the ''mountain spirits'') so prevalent across Mongolia. These consist of rock piles laden with offerings of money, silk scarves, skulls, and more.

Another power-line nest in Mongolia, perhaps built by Common Ravens (*Corvus corax*) but more likely by Upland Buzzards (because of its great diameter: 1.2 × 1.4 m), was constructed mostly of coarse (3.6–4.8 mm diameter) aluminum wire. However, the nest lining was mostly sticks. It was occupied by Saker Falcons in 1997 (Fig. 11). Of hundreds of eagle, raven, kite (Black Kite [*Milvus migrans*]), or buzzard nests found in Mongolia, none were so conspicuously constructed of metal as was this. Although this nest was built on a power pole, the conductors were already gone by the time we found the nest.

Another surprise nesting material was a steel muskrat (*Ondatra zibethica*) trap (single spring, Triumph No. 1, with 40 cm chain, total weight 280 g) found in a Golden Eagle nest in July 2007 in central Montana. Because the trap was heavily corroded in a fully closed position and lay atop recently delivered

Figure 10. Paper money (two bills) line the cup of this Upland Buzzard nest, eastern Mongolia, 14 June 1995. Photograph: David Ellis.

vegetation, we concluded that it arrived as nesting material, not as an attachment to mammalian prey.

Nests near Human Activity. Although some raptors regularly nest near humans, wild Golden Eagles and some other species are not known to do so; exceptions follow. A Steppe Eagle nest in eastern Mongolia (Fig. 12) was placed next to a km post between the most frequently used lanes of the primary (albeit dirt) road east from the regional capital, Choibalsan. On 12–13 June 1995, an adult female was attending one hatchling and one egg. Vehicles (5–10/d) in the most active lane passed less than 5 m from the nest.

Figure 11. Wire nest on an abandoned power pole occupied by Saker Falcons, southeastern Mongolia, 5 June 1997. Photograph: David Ellis.

Another exception was a Golden Eagle nest in the foothills southwest of Ferris Mountain in south-central Wyoming. It was only 160 m from an occupied human dwelling and only 143 m from a small outbuilding. The nest contained one nestling on a ca. 10-m cliff in 1968, but was not known to harbor eagles thereafter.

In the mountains in Catalonia, Lleida, Spain, a Golden Eagle eyrie was found only 15 m horizontally from and 6.3 m below a small stone chapel (Fig. 13). Each spring (about hatching time), a procession of people visit to celebrate Romeria, yet the eagles consistently fledge young here. Both this nest and the nest in Wyoming were out of sight from the buildings.

Two other Golden Eagle nests were near human activity. One was within 90 m of a paved and busy highway along the White River in western Colorado and within 210 m of, and in view of, an occupied farm house. The condition of the excrement and

Figure 12. Adult Steppe Eagle attending eaglet and egg at the foot of a concrete post between the most actively used lanes of a dirt road in eastern Mongolia, 12 June 1995. Photograph: David Ellis.

nest materials during a July 2006 visit indicated the nest was in use as late as 2005. The second pair (central Mongolia) nested in 2008 only 15 m from a footpath to a regularly visited, mountaintop shrine. Although this nest (with one nestling) was over a ridge top from the path, three alternate nests were on the same side of the ridge as the path and within ca. 35 m of it. All four nests were decorated with silk scarves and other cloth associated with people visiting the shrine.

Proximal Nesting. In the scientific literature, distances between neighboring nests are most often presented as horizontal measurements. Normally this measure is adequate. However, as Leslie Brown (pers. comm.) perhaps first described, there is also a vertical component of raptor territories, with some nests being very near horizontally, but much further apart when vertical distances were considered. At the extreme, Morlan Nelson (Newton 1979:51) reported that in the canyon of the Snake River in southern Idaho, pairs of Prairie Falcons sometimes nest one above the other in three tiers, with one pair each on the lower cliff, mid-elevation cliff, and rim cliff. Seychelles Kestrel (*F. araea*) eyries on the granitic islands of the Indian Ocean demonstrate this phenomenon. Internest distances for 33 pairs averaged around 450 m (Watson 1992). However, on each of two very tall cliffs, horizontal distances were much less.

At Morne Blanc, three nesting pairs of kestrels were within 500 m horizontally (Fig. 14). The pair near the summit of the mountain hunted exclusively to the north. The other two pairs nested about halfway up the mountain: one pair hunted to the southwest, the other to the southeast. At a second large cliff, another three pairs similarly tolerated relatively close neighbors by a degree of vertical separation. Seychelles Kestrels also bred significantly more successfully on cliffs, presumably because cliff eyries were less vulnerable to predation by exotic mammals such as cats (*Felis sylvestris*) and rats (*Rattus* sp.).

Where potential breeding cliffs are small or limited in number, Peregrine Falcons and Common Ravens occasionally nest on the same cliff. Ratcliffe (1980:289) assembled records from England and Scotland of ravens nesting only 5, 10, and 25 m from peregrines, but such close associations are rare.

In an extreme example (from northeastern Arizona in 1982), Peregrine Falcons and ravens nested on the same wall in a complex of many sandstone cliffs, each ca. 200 m tall. In contrast to the nesting associations in the British Isles, the Arizona site had no shortage of suitable nesting cliffs, potholes, ledges, or caves. Approximately one dozen rings of excreta (apparently past falcon eyries) were visible on only one cliff face, and many cliff faces were available. Even with this abundance of nesting sites, the

Figure 13. Remote chapel in Catalonia, Spain, with nearby Golden Eagle nest (arrow). Photograph: September 2003, Antoni Margalida.

falcons nested horizontally only ca. 10–20 m from the ravens. However, these nests were 120 m apart vertically; the falcon eyrie was ca. 40 m from the top of the 210-m cliff and the raven nest was ca. 120 m below the falcons. When nesting in areas frequented by Golden Eagles, peregrines and ravens often nest commensally in the ''distant vicinity'' of each other (Sergio et al. 2004). Either species can warn of an eagle attack, and both mob eagle intruders.

Some proximal nesting records are remarkable. Extreme interspecific examples include (1) Great Horned Owls (*Bubo virginianus*) and Barred Owls (*Strix varia*) nesting in the same tree (Martin 2001) only 10.9 m apart, (2) Red-shouldered Hawks and Great Horned Owls in the same tree only 5.8 m apart (Wiley 1975), (3) Great Horned Owls incubating two eggs in a cavity in the side of a Bald Eagle (*Haliaeetus leucocephalus*) nest while the eagles were incubating

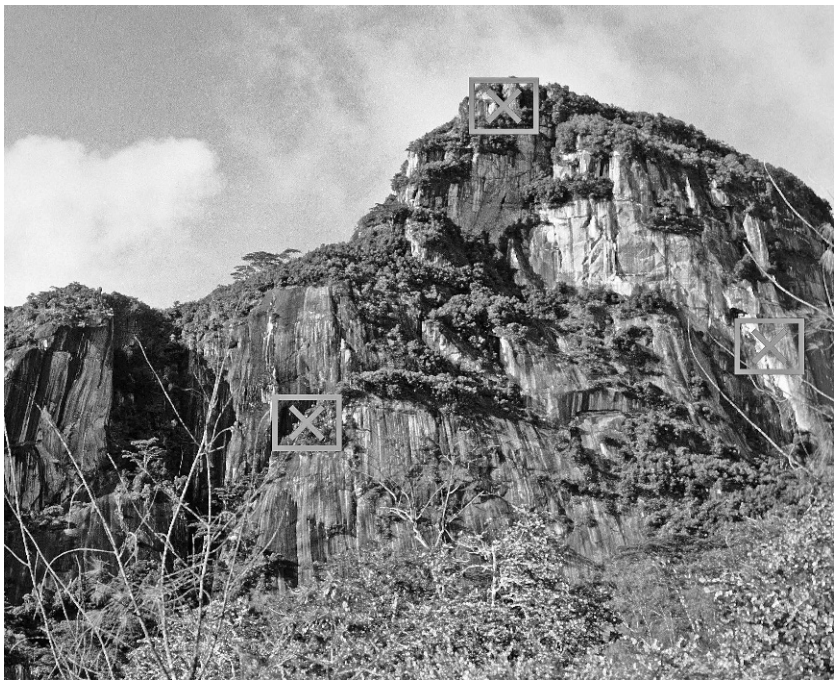

Figure 14. Morne Blanc on the Island of Mahé, Seychelles, showing the location of three nesting sites of Seychelles Kestrels. Photograph: Jeff Watson.

their two eggs less than 4 m above (Jacobs 1908), (4) Red-tailed Hawks (*Buteo jamaicensis*) nest-building on the canopy of an occupied Black-billed Magpie (*Pica hudsonia*) nest (Ellis 1992), and (5) a Saker Falcon brood only 4.4 m above a brood of Upland Buzzards (Ellis et al. 1997). In each case, the paired species were known antagonists. The complexities of symbiotic nesting were detailed by Haemig (2001).

Tall Nests. Some cliff and tree nests of large eagles under certain conditions become very tall (see reviews in Ellis 1986, Grubb and Eakle 1987). One Golden Eagle nest (Fig. 15), the tallest ever reported for any bird, was located on a basalt wall ca. 90 m tall southwest of Sun River, Montana. In 1972, it measured 5.96 m from rock support to compact rim and 6.1 m from dangling stick to uppermost stick, and in 2004, it measured 6.54 m (compact) and 7.0 m (extreme). A twig from the foundation of the nest grew (as determined by radiocarbon dating; Reimer et al. 2004) 1414 to 1444 A.D. at 1 S.D. The nest's longevity derives in part from it being bordered on three sides by columns of basalt. Its last known use for nesting was 2004.

The tallest eagle nests previously published were a ''17 foot'' (5.2 m) Golden Eagle tree nest in Scotland (Brown 1976), a Golden Eagle nest ''nearly 20 feet [6.1 m] high'' in northern British Columbia (Bent 1937), and a ''20 feet'' [6.1 m] tall Bald Eagle nest in Florida (Broley 1947). By context, these heights seem to be approximations. Another tall nest in the arid western United States was a 4.5-m (compact) or 4.8-m (extreme) nest east of Farson, Wyoming, which, by composition, was probably used by both Ferruginous Hawks and Golden Eagles.

Although ravens are not raptors, they function as predators, so we include the tallest Common Raven nest measured. Found three decades ago in the Snowflake Sinks (limestone pits) in northeastern Arizona, it was 4.0 m tall (extreme) and 3.5 m from base to compact rim when measured 8 March 2004. It lay in a long vertical cleft in the rock wall and was thereby stabilized on three sides.

The final tall nest (Golden Eagle) was not at a remote location but only ca. 80 m south of Interstate Highway 80 at the west end of Rock Springs, Wyoming. On the northwest wall of 100-m-tall Toll Gate Rock stands a decaying column of sticks now about 6 m tall, but its compressed, serpentine shape suggests that it once stood 7 or even 8 m tall. Although it appears not

Figure 15. Sun River Golden Eagle nest in central Montana, 30 August 2002. In 2004, an extreme height measurement of the left, larger nest was 7.0 m. Photograph: David Ellis.

to have been used in recent years, many molted Golden Eagle feathers were found at the cliff rim, and a lone adult was present on one of three visits.

Small Nests. A scant Golden Eagle nest, containing a single eaglet lying on exposed basalt amid a scattering of sticks (Fig. 16), was found in a volcanic crater in southeastern Mongolia in 1998. No other large stick nests were noted on the cliff, although sizeable stick nests were found in the region. The exact eyrie ledge contained three nestling Saker Falcons in 1995. In 1997, a nearby ledge had one nestling saker. In 2008, abandoned saker eggs were found on the cliff.

In northeastern Arizona, where eaglets are regularly harvested, some Golden Eagle nests are so small as to be out of sight from most human-accessible vantage points. An extreme example was a ''nest'' on a cliff ledge behind a small shrub, ca. 60 m down a ca. 300-m wall in the Glen Canyon of

Figure 16. A rudimentary Golden Eagle nest in southeastern Mongolia photographed 11 June 1998. Eaglet rests on rock substrate. Photograph: David Ellis.

the Colorado River. When inspected from the cliff rim, on 2 May 2000, a single young eaglet (age ca. 30 d) lay on a flat sandy shelf; no sticks other than the basal limbs of the shrub were visible. A sizeable stick nest was available at a distance of ca. 200 m.

On 18 June 2000 in central Mongolia, a small downy Steppe Eagle (age ca. 7 d) was found on a cliff nest nearly as deficient as the Golden Eagle nests mentioned above. Although the chick rested on exposed granite, a small portion of its nesting ledge was occluded from view by a thin matrix of sticks. As in the above record, a sizeable stick nest (ca. 60 cm tall) was nearby, ca. 6 m distant.

Nests on Unusual Natural Supports. Boulder eyries were previously described (Ellis et al. 1997) for Saker Falcons in Mongolia, but none of these were as small, low, or accessible as a 1997 nest (Fig. 17) where 5-wk-old nestlings were found atop a 1.7-m-tall boulder with an area available to nestlings only 0.5 × 1.1 m.

A large lava tube at the Idaho National Engineering Laboratory, Idaho Falls, Idaho, was used by Prairie Falcons in 1982 (Fig. 18). The collapsed roof of the lava tube allowed the falcons access to an underground grotto. Three other subterranean nesting records are known for Prairie Falcons (Steenhof 1998), but the Idaho record was unique in that the birds nested about 10 m back into the depths. In this case, the falcons used a natural cliff ledge suspended from the ceiling and 10 m above the floor of the ca. 15-m-tall tunnel. The tunnel extended another 10–15 m past the eyrie. At least one young fledged from the site.

American Kestrels (*F. sparverius*) normally nest in elevated cavities in trees and cliffs. An extreme nest site along the Big Lost River (Snake River Plain, Idaho) was in a 0.5-m-tall cottonwood (*Populus* sp.) stump (Fig. 19). Early in the nesting season, a female was found incubating eggs in a cavity originally excavated by woodpeckers (probably Northern Flicker, *Colaptes auratus*). Later, the cavity, containing the partly consumed remains of downy young, was found swarming with pogo ants (*Pogonomyrmex* sp.).

Although Swainson's Hawks (*B. swainsoni*) often nest only a few m from the ground on shrubs, a site found in 1982 along Birch Creek about 30 km northeast of Howe, Idaho, was unique (Fig. 20). First, the nest rim was little over 1 m from the ground, second, the support was a sagebrush (*Artemisia tridentata*), and third, the bush was in the shadow of a ca. 7-m-tall cottonwood tree. Ironically, cottonwood sticks were used in nest construction. A possible explanation is that the nest blew out of the tree shortly before egg-laying and landed, largely intact, on the bush. In July, two fledglings were in the nest.

Ground Nests. Some raptors that nest in trees or cliffs on continents not infrequently nest on the ground on islands. For most raptors, mainland

Figure 17. Saker Falcon eyrie atop a 1.7-m boulder in southeastern Mongolia, 12 June 1997. Photograph: David Ellis.

ground nests are extremely rare. Exceptional records include Barred Owls in both Michigan and Florida (Postupalsky 2001) and Bald Eagles in Michigan (Brigham 1939). For both of these species, elevated nesting sites were readily available. Another (albeit unsuccessful) ground nesting of Bald Eagles took place in an open stubble field ca. 60 m from a regularly used dirt road in Ohio in 1976. Ground nesting on the open steppe is common in the Steppe Eagle, and Golden Eagles infrequently nest on sloping ground, easily accessible to predators (Crane and Nellist 1999, Kochert et al. 2002). In Scotland, Golden Eagle ground nests are not unusual on islands lacking foxes, but one female on mainland Scotland laid her clutch in a snow-free cavity beneath large boulders on a hillside during a year when late snows covered the traditional eyries. The result was a walk-in nest. Brown (1976) long ago noted that Golden Eagles move to alternate sites when preferred nests are buried in snow. In Mongolia,

Figure 18. Prairie Falcon eyrie (arrow) recessed ca. 10 m from the opening of a lava tube on the Snake River Plain of Idaho. Pale streak is an adult falcon. Photograph: Tim Craig.

where foxes (two species) and wolves are widespread, most Golden Eagle nests are on cliffs, but we have found six nests on boulder-strewn hillsides, and two on flat ground at the very edge of a cliff, where a mammalian predator could easily walk to the nest.

Although Peregrine Falcons typically nest on cliffs (and a few populations nest in trees), ground-nesting has long been known for the species (White et al. 2002). Steep slopes are not infrequently used for nesting along arctic and subarctic rivers, but nests on flat terrain are best known from islands (Ratcliffe 1980:179–180, Castellanos et al. 1997) and arctic or subarctic bogs (Linkola and Suominen 1969, Lindberg et al. 1988). We report two ground nests on dry, mainland sites.

Along the Fortymile River (interior Alaska), on 3 June 2007, an adult female was observed incubating at the end of a grassy ridge ca.1 m from the rim of a river cliff upon which peregrines bred the previous year. On 16 July, a 2-wk-old nestling was found in the eyrie. Peregrines are known to respond to human disturbance by breeding at more inaccessible sites (Ratcliffe 1980:170–174). The use of this ridgetop site was likely a response to the clamor of machines and human voices, which accompanied dredge mining activity along the river ca. 65 m below the eyrie. Although the floating dredge was about 1 km distant during both the June and July visits, human activity may have been closer during the egg-laying period.

A second walk-in peregrine eyrie (Fig. 21) was from the lava zone of southern Argentina just north of the Strait of Magellan. On 29 November 1981, four nestlings lay in a cave near the floor of a crater. After sliding ca. 100 m down a slope of volcanic grit, we walked ca. 30 m across a gentle slope directly to the eyrie, a 3.7-m-wide cave extending ca. 1 m into a mound of basalt ca. 2 m tall. That the peregrines did not nest high on the vertical cliff walls in the vicinity of the rim can perhaps be explained by the fact that the loose, gritty slope surrounding the cave on three sides provided a considerable barrier to mammalian travel. Further, human activity here, as at the Alaskan hilltop eyrie, was much more likely near the cliffs.

A parallel situation involves hundreds of Upland Buzzard nests on the ground and on small boulders across Mongolia. We ask why so few of these (only two active nests) were placed on the seemingly much safer tops of rockpile shrines (Fig. 22) that dot the hilltops, passes, and mountain sides all across Mongolia. The answer likely lies in the propensity of Mongols today to go on pilgrimages. Most of the tire tracks we see in remote places appear to be of vehicles going from hilltop to hilltop to perform perambulation ceremonies at each shrine. The result is that many likely places for Upland

Figure 19. Stump nest of American Kestrel, Snake River Plain, Idaho, June 1982. Tim and Erica Craig pictured. Photograph: Leon Powers.

Buzzards to nest are also places where they least often nest because of disturbance. Indeed, the shrine nest pictured here (Fig. 22) is very near the Chinese border in a restricted zone where few Mongols are allowed access.

However, we note that dozens of buzzard nests are placed within 5–10 m of the main roads (as in Fig. 4, 5, 6, and 9), close to human disturbance. We propose that automobiles speeding past pose no threat or only a brief threat to the birds, whereas humans circling a shrine nest eight times while tossing stones on the boulder pile pose a great threat and, if repeated often, can result in abandonment of the site.

Saker Falcons also occasionally nest on the ground. Such eyries are usually at the rim or base of cliffs (Ellis et al. 1997), but we also found two walk-in nests on boulder-strewn hillsides, and there is a record for central Mongolia of a saker nest with large young found on the open steppe far from power lines, cliffs, or trees (Ellis 2001). Similarly, falconer Husāmᵘ 'd-Dawlah Taymūr Mīrzā reported in 1868 (in Phillott 1908:55–56) that one variety of Saker Falcon in Turkey regularly nested on the bare ground.

Unusual Natural Nesting Materials. Large bones are regularly a minor component of Steppe Eagle nests, but we document (Fig. 23) an extreme example. A nest in the foothills of the Altai Mountains in northwestern Mongolia was composed primarily of the bones of large mammals. Similarly, a century ago, bison (*Bison bison*) bones, especially ribs, were a common component of Ferruginous Hawk nests on the Great Plains of North America (Bechard and Schmutz 1995).

Common Ravens have long been known to build with bones (e.g., Bent 1946), but we report two un-

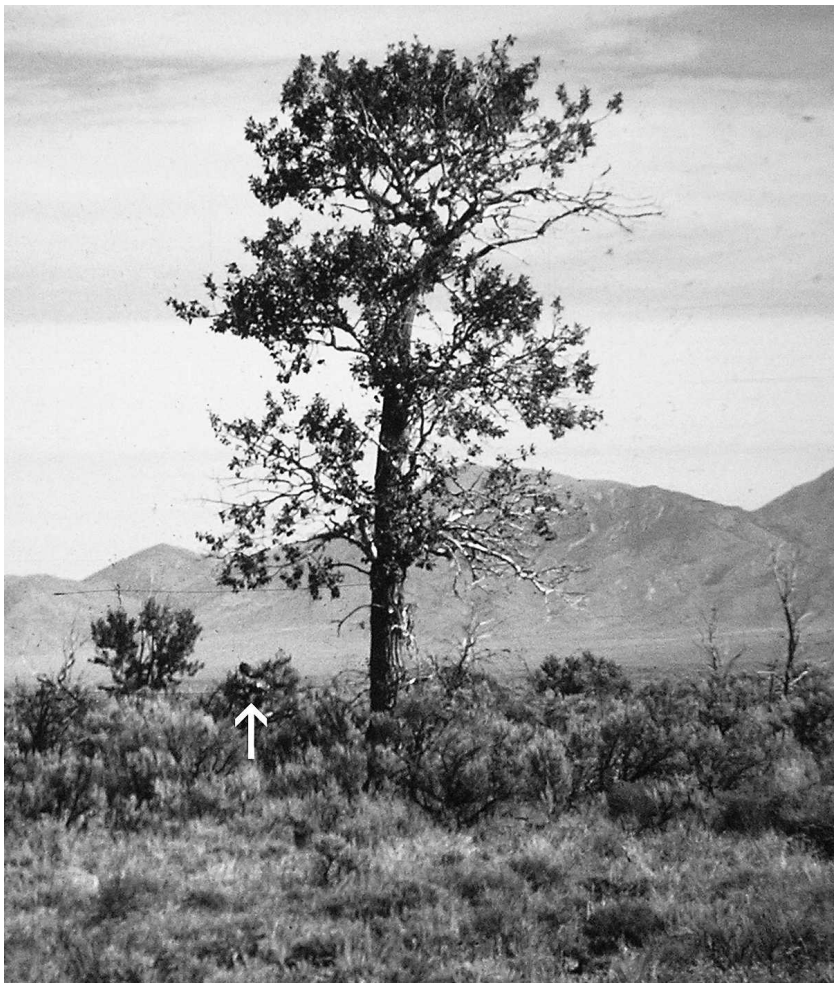

Figure 20. Swainson's Hawk nestlings (arrow) ca. 1 m aboveground in a sagebrush near Howe, Idaho. Photograph: Tim Craig.

usual raven nests, both from Mongolia, built almost entirely of rib bones. The outer rim of a nest (ca. 75 cm wide, 42 cm deep) found 24 June 1994 at the mouth of the Hobolnoor River in extreme northwestern Mongolia was almost exclusively constructed of rib bones (probably of domestic animals). Evidence at the site indicated that ravens had recently fledged. The second rib nest was found in central Mongolia on 1 July 1998 (Fig. 24). It was then ca. 60 m from an active Saker Falcon eyrie (also in a probable raven nest). In 2008, sakers fledged at least three young from the rib nest. By 2008, about a fourth of the bones had fallen: below the nest, we counted 220 ribs or large rib fragments (>10 cm in length) and noted thousands of smaller fragments. Most of the ribs were from mammals the size of domestic cattle (*Bos* sp.). The nest filled a long vertical cleft in the cliff and in 1998 was ca. 2 m tall.

Ospreys at three different nests in Michigan have brought partial porcupine (*Erethizon dorsatum*) carcasses (probably roadkills) to their nests, presumably as nest materials. In one case (1992), numerous loose quills became lodged in the underside of both young, causing death.

A previous note (Ellis 1993) defended the idea that falcons do not collect nest materials. However, we have circumstantial evidence from Argentina of Peregrine Falcons, although not actually bringing material to the nest ledge, creating a sandy substrate

Figure 21. A ''walk-in'' Peregrine Falcon eyrie near the bottom of a volcanic crater near the Strait of Magellan. James Fackler (nearer) and Brian Millsap pictured. Photograph: David Ellis.

into which the scrape (egg cup) was excavated. From 13–15 November 1981, we observed a pair of Peregrine Falcons at a cliff near the Chubut River in northern Patagonia, Argentina. This late in the breeding season, successful pairs in Patagonia were tending large nestlings. Although this pair clearly did not have live young, they were attending a meter-long, overhung, horizontal ledge on a ca. 90-m-tall vertical cliff. One extended ''ledge display,'' complete with about 30 sec of ''Eechip calling,'' was observed here as was a period of 2.45 hr during which the female remained in the supposed eyrie. To determine whether a late breeding attempt was underway, we returned to the site on 6 December. Both adults were still attending the cliff, but there was no evidence of excreta on the eyrie ledge. We entered the eyrie and found two well-formed scrapes on the ledge, but no eggs or eggshell fragments. Each scrape was about 20 cm in diameter. Falcon tracks were conspicuous along the ledge, as were about a dozen deep vertical scratches (some about 12 cm long) on the sloping back wall of the eyrie for a distance of about 65 cm. The back wall was composed of crumbly sandstone stabilized by a thin crust. The claw marks on the wall penetrated this crust and allowed sand to flow onto the ledge. The spacing of the claw marks was consistent with the spacing among digits 2–4 of a peregrine. Falcons excavate a shallow scrape by alternate left-right strokes with their feet raking debris out of the cup. Our observations reported here demonstrate that they can also use their feet to make loose material available in which to excavate the scrape.

Two special conditions created the circumstances under which these observations were made. First, the strong and prevalent Patagonian winds tended to remove loose sand from the ledges of this cliff (indeed neighboring ledges were free of loose sand as were portions of the eyrie ledge away from the talon-mark zone). Second, the availability of sand protected only by a delicate crust gave the falcons the opportunity to easily add sand to the ledge.

The rare, but widespread, use of deer antlers in Golden Eagle nests has been previously discussed (Ellis and Bunn 1998) with records of nests built largely of antlers for Scotland and northwestern Alaska. We here report a record for a red deer (*Cervus elaphus*) antler in a Golden Eagle eyrie in central Mongolia. The nest, when entered on 19 June 2000, contained two large nestlings ages ca. 43 and 45 d. On that visit, a single antler tine was visible emerging from the trodden nest surface. Once excavated, the antler proved to be five-tined, with a measurement of 1.0 m along the curvature, and a mass of 1134 g after drying indoors for 2 wk. In addition, in 1997, we found a mule deer (*Odocoileus hemionus*) antler (ca. 3.5 cm diameter at base) buried about halfway down in the matrix of an active Ferruginous Hawk nest near Clyde, Idaho.

Figure 22. Upland Buzzard nest on a mountaintop shrine, southeastern Mongolia, 11 June 1997. Note that this nest, far from human activity, is built almost entirely of natural vegetation. Photograph: David Ellis.

At two Golden Eagle nests in central and one in southeastern Mongolia, we noted that some sticks were larger than normally seen in eyries, so we measured the four largest. At one eyrie, the largest stick accessible (i.e., not buried in the matrix) was 2.31 m long (chord) and 2.76 m (along the curvature). Its circumference at base (hereafter ''circ. b.'') was 11.6 cm (3.7 cm diameter). At another eyrie, the largest accessible stick was shorter (97.8 cm [chord]; 1.09 m [along curvature]) but thicker (21.6 cm circ. b.; 6.8 cm diameter). At two other eyries, we found very long sticks immediately below the nests. The first was 2.94 m (chord), 13.7 cm circ. b., and 850 g. The second was a long (2.59 m), slender (8.3 cm circ. b.) portion of an *orga*, a willow (*Salix* sp.) pole which, with a noose at one end, is used to capture horses. Three of these sticks were longer than, and the fourth was greater in diameter than, any sticks docu-

Figure 23. Steppe Eagle nest in northwestern Mongolia composed primarily of bones of large mammals, 25 June 1994. Photograph: David Ellis.

mented by Grubb and Eakle (1987) for 12 Golden Eagle nests in Arizona.

Ground nests of Steppe Eagles in southeastern Mongolia sometimes have large scraps of domestic sheep (*Ovis aries*) or Mongolian gazelle (*Procapra gutturosa*) skin with hair. Such items could confuse food habits studies, but when these are desiccated and without bones attached, we consider that they should be treated as nesting material. One ground nest, found within a volcanic crater in southeastern Mongolia on 22 June 1995, contained two large downy young (ca. 20 d) and was unremarkable except that it included, as nest material, a large wolf scat.

DISCUSSION

Just as measures of central tendency, dominating the contemporary scientific literature, tell us what is typical in the natural world, anecdotes hint at what is possible. But only under certain circumstances are individual anecdotes useful. Ockham's razor must always be applied to sort the remarkable from the unbelievable.

Of our many examples of remarkable occurrences, some had no obvious explanatory circumstances. Others were likely related to a local abundance of prey, nonavailability of natural nesting materials, the lack of more suitable nesting sites, or human disturbance.

In publishing these records, we issue a caution. It would be a mistake for land or wildlife managers to use this article to justify the construction of buildings within a km of a Golden Eagle nest. The fact that Golden Eagles once nested within 200 m of a farmstead or within 50 m of a church does not imply that most eagles will accept such intrusions. Further, the construction process is more disturbing than the presence of the building. (For reviews of the effects of human disturbance on the behavior and nest success of aquiline eagles, see Fremming 1980, Watson and Dennis 1992, González et al. 2006.)

It would also be a mistake to install dozens of cisterns in Saker Falcon habitat because one pair of sakers nested in one cistern (Fig. 2). Similarly, it would also be extremely misleading to classify all of the treeless and cliffless expanse of the Mongolian steppe as suitable breeding habitat for Saker Falcons (as was done by Shijirmaa et al. 2000), simply because there is one record of ground-nesting there far from trees or cliffs (Ellis 2001). Likewise, the floors of all volcanic craters in Argentina should not be considered suitable breeding habitat for Peregrine Falcons because the floor of one such crater was once used.

In short, these records demonstrate the extreme plasticity in the behavior of raptors. These are the unusual, not the expected.

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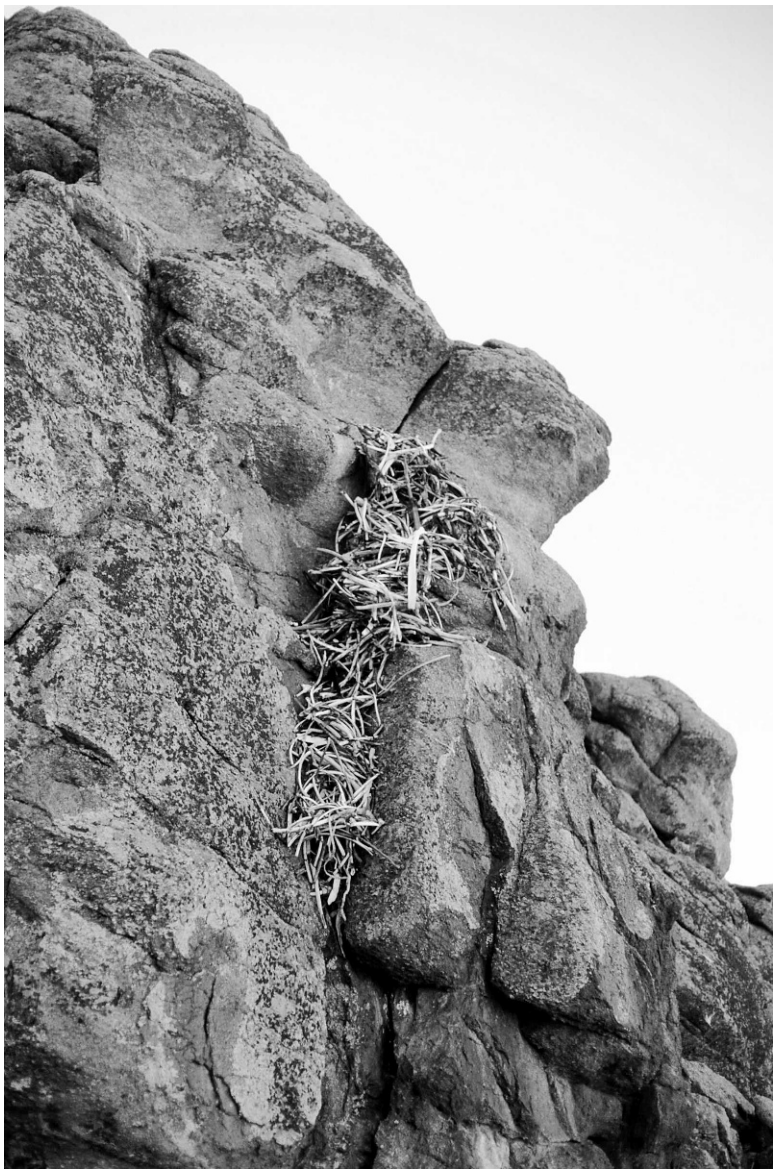

Figure 24. Common Raven nest (1998, central Mongolia) composed primarily of rib bones of large mammals. This nest was used in 2008 by Saker Falcons. Photograph: David Ellis.

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