WASHINGTON STATE RECOVERY PLAN FOR

August 1996

Ferruginous Hawk

Washington Department of
FISH AND WILDLIFE
Wildlife Management Program

In 1990, the Washington Wildlife Commission adopted procedures for listing and delisting species as endangered, threatened, or sensitive and for writing recovery and management plans for listed species (WAC 232-12-297, Appendix B). The procedures, developed by a group of citizens, interest groups, and state and federal agencies, require preparation of recovery plans for species listed as threatened or endangered.

Recovery, as defined by the U.S. Fish and Wildlife Service, is "the process by which the decline of an endangered or threatened species is arrested or reversed, and threats to its survival are neutralized, so that its long-term survival in nature can be ensured."

This document summarizes the historic and current distribution and abundance of ferruginous hawks in Washington and describes factors affecting the population and its habitat. It prescribes strategies to recover the species, such as protecting the population, evaluating and managing habitat, and initiating research and education programs. Target population objectives and other criteria for reclassification are identified and an implementation schedule is presented.

The draft state recovery plan was reviewed by ferruginous hawk researchers and State and Federal agencies. This review was followed by a 90-day public comment period. All comments received were considered in preparing this final recovery plan. Additional information on ferruginous hawks is available from:

Manager, Endangered Species Section
Washington Department of Fish and Wildlife
600 Capitol Way North
Olympia WA 98501-1091

Cover painting of young ferruginous hawks © Tony Angell, reproduced with permission.
Cover photograph of ferruginous hawk nesting cliff in Esquatzel Coulee, Franklin County by Harriet Allen.

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Washington State Recovery Plan

for the

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Washington Department of Fish and Wildlife
Wildlife Management Program
600 Capitol Way N
Olympia WA 98501-1091

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ACKNOWLEDGMENTS

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The plan was enhanced by information contained in *Status, Biology, and Management of Ferruginous Hawks: A Review*, a 1993 Bureau of Land Management publication prepared by Richard R. Olendorff.

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EXECUTIVE SUMMARY

North America's largest buteo, the ferruginous hawk, exists in low numbers in shrub-steppe and grassland regions of several eastern Washington counties. The state population, numbering between 50 and 60 nesting pairs, occurs at the northwest edge of the species' breeding range. The hawk was listed as State Threatened by Department of Game policy in 1983. In 1990, the Washington Wildlife Commission maintained the ferruginous hawk on the state list of Threatened species, a subcategory of protected status.

The size of the historic population cannot be determined. In 1977, a statewide population estimate of 20 pairs was published after nest searches in specific areas. A few years later, an estimate of 40 pairs was presented after a survey effort concentrating on known territories. Recently, more comprehensive surveys suggest a population of 50 to 60 pairs. The proportion of occupied territories with at least one nestling was 72% in 1992, 82% in 1993, and 87% in 1994. At least 88, 87, and 92 chicks hatched in 1992, 1993 and 1994, respectively.

Ferruginous hawks generally arrive on their Washington breeding grounds during February or March. They nest on isolated trees, rock outcrops, and other platforms that provide unobstructed views. Nests are built of branches and bark shreds from nearby shrubs and often contain dried dung. Two to six eggs are laid, with a usual clutch size of three or four. Adults share duties during an incubation period that lasts about 32 days. Young fledge about 41 days after hatching, generally from late May to late July. Post-fledging dispersal is gradual, with young remaining near the nesting territory for a few weeks before migration. Washington's ferruginous hawks probably migrate to the southwestern and southcentral United States or Mexico for the winter.

The diet of Washington ferruginous hawks consists primarily of small to medium-sized mammals, such as pocket gophers, mice, and ground squirrels, but often includes birds, reptiles, and insects. Nesting territories may be situated for exploitation of a particular prey species upon which the hawks are largely dependent. The fate of nesting attempts can be affected by fluctuations in prey abundance. Some hawks may leave an area in response to low prey densities, leading to a lifestyle sometimes described as nomadic.

Persecution by early settlers reduced the number of ferruginous hawks in Washington and the United States. Recent pressures are frequently related to land-use practices. Conversion of shrub-steppe for agriculture or grazing has broadened the influence of human activity, reduced nesting opportunities, and lowered the diversity and abundance of prey species. Human populations in the traditional ferruginous hawk range encroach upon nesting areas and may limit breeding success or reoccupancy of territories.

To recover and maintain Washington's population of ferruginous hawks, sufficient shrub-steppe and native grassland must be preserved and disturbance to nesting areas must be reduced or eliminated. The ferruginous hawk will be considered for downlisting from State Threatened status when Washington supports a 5-year average of 60 breeding pairs distributed to reflect probable historic conditions.

PART ONE

BACKGROUND

TAXONOMY

The ferruginous hawk (*Buteo regalis*) is a member of the order Falconiformes and the family Accipitridae. The genus *Buteo* includes 10 species that breed in mainland North America. This species, originally known as ferruginous roughleg, was first described by G. R. Gray in 1844, who named it *Archibuteo regalis* (Am. Ornithol. Union 1983).

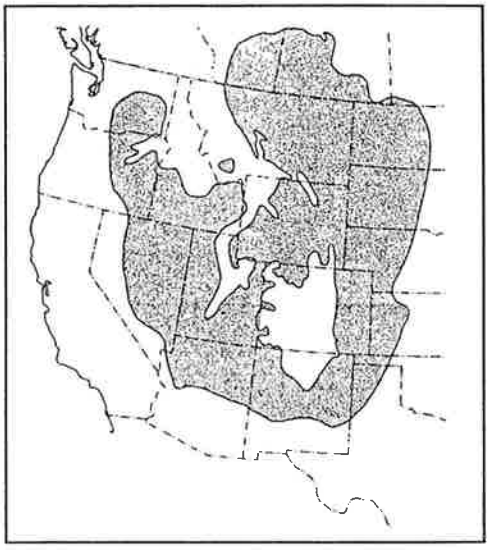

Figure 1. Breeding range of the ferruginous hawk (from Olendorff 1993).

Some researchers have proposed that the Rocky Mountains separate two distinct ferruginous hawk sub-populations (Schmutz and Fyfe 1987). To test this idea, Gossett (1993) examined recoveries of banded birds (n = 537) and performed morphological tests (n = 67 adults) and genetic tests (n = 29 adults) on birds from both sides of the Continental Divide. He concluded that east and west populations were not distinct. However, hawks tend to remain on their respective sides of the Rockies.

DESCRIPTION

The ferruginous hawk is the largest North American buteo. Adults measure 56-69 cm (22-27 in) from bill to tail tip and have a wingspread of 122-142 cm (48-56 in), with females averaging larger and heavier than males (Palmer 1988). Adults have reddish-brown upperparts and flanks. Their whitish underparts are sometimes streaked lightly with brown. The tail is white, stained with reddish-brown, and sometimes bears a subterminal band. Reddish-feathered legs are a prominent field mark on birds in flight. Melanistic adults are brown with rusty markings and a whitish tail. Young ferruginous hawks are grayish-brown above and whitish below, with a mottled, buff or rust-colored breast. Their tails are whitish on the basal third, then banded indistinctly with gray. Consult Bechard and Schmutz (1995) or Palmer (1988) for descriptions of plumage.

GEOGRAPHICAL DISTRIBUTION

North America

Ferruginous hawks inhabit arid, open country of 17 western states and 3 Canadian provinces during the breeding season, and winter primarily in Mexico and the southwestern

and south-central United States (Am. Ornithol. Union 1983, Olendorff 1993; Fig. 1). They are widespread in southern Idaho, including 25 pairs in the Snake River Birds of Prey Area in 1994 (R. Lehman, pers. comm.). In Oregon, about 26 pairs are found in counties south of Washington's Walla Walla and Benton counties (R. Morgan, pers. comm.). British Columbia has a small number of nests in its southern interior (Campbell et al. 1990).

Washington

Ferruginous hawk nests have been found in the steppe or shrub-steppe habitat of 12 eastern Washington counties, although three of these (Douglas, Garfield, and Kittitas) have not supported breeding birds for several years (Table 1). The Department maintains a database with 204 known ferruginous hawk territory locations. Fifty-six of the territories supported breeding pairs (evidence of eggs having been laid) at least once between 1974 and 1989 and again between 1990 and 1995. Fifty-eight others had breeding pairs sometime between 1974 and 1989, but have not been active since, and another 43 have had pairs only since 1990. Forty-seven territories have never been documented with breeding pairs. Territories are concentrated in Benton and Franklin counties (Fig. 2).

Table 1. Number of territories where ferruginous hawk breeding activity has been confirmed (observed incubating adult, eggs, or chicks) in years when at least 30 territories were surveyed (from WDFW Wildlife Survey Data Management). A dash (–) indicates no territories were surveyed in the county that year. Also shown are the number of known territories in each county.

	1978	1981	1985	1986	1987	1988	1989	1992	1993	1994	1995	Known territories
Adams	2	3	–	2	4	3	1	4	3	3	6	13
Benton	4	4	6	9	13	10	7	20	17	17	18	45
Columbia	1	0	–	3	3	3	1	2	2	3	2	7
Douglas	0	0	–	17	0	–	–	0	0	–	–	3
Franklin	18	16	6	0	24	7	7	13	12	18	15	66
Garfield	0	1	0	1	0	–	–	–	–	–	–	2
Grant	–	2	–	0	2	1	–	0	0	2	8	21
Kittitas	–	–	–	0	0	0	0	0	0	0	0	3
Lincoln	–	1	1	2	1	2	1	1	3	2	2	9
Walla Walla	1	2	0	2	4	6	–	3	6	6	10	19
Whitman	1	1	–	1	1	2	1	1	2	1	0	3
Yakima	–	0	3	0	4	4	–	5	5	4	2	13
												Total = 204
Total pairs	27	30	16	37	56	38	18	49	50	56	63	
Total inactive	7	25	14	40	64	30	13	99	90	91	120	
Total surveyed	34	55	30	77	120	68	31	148	140	147	183	

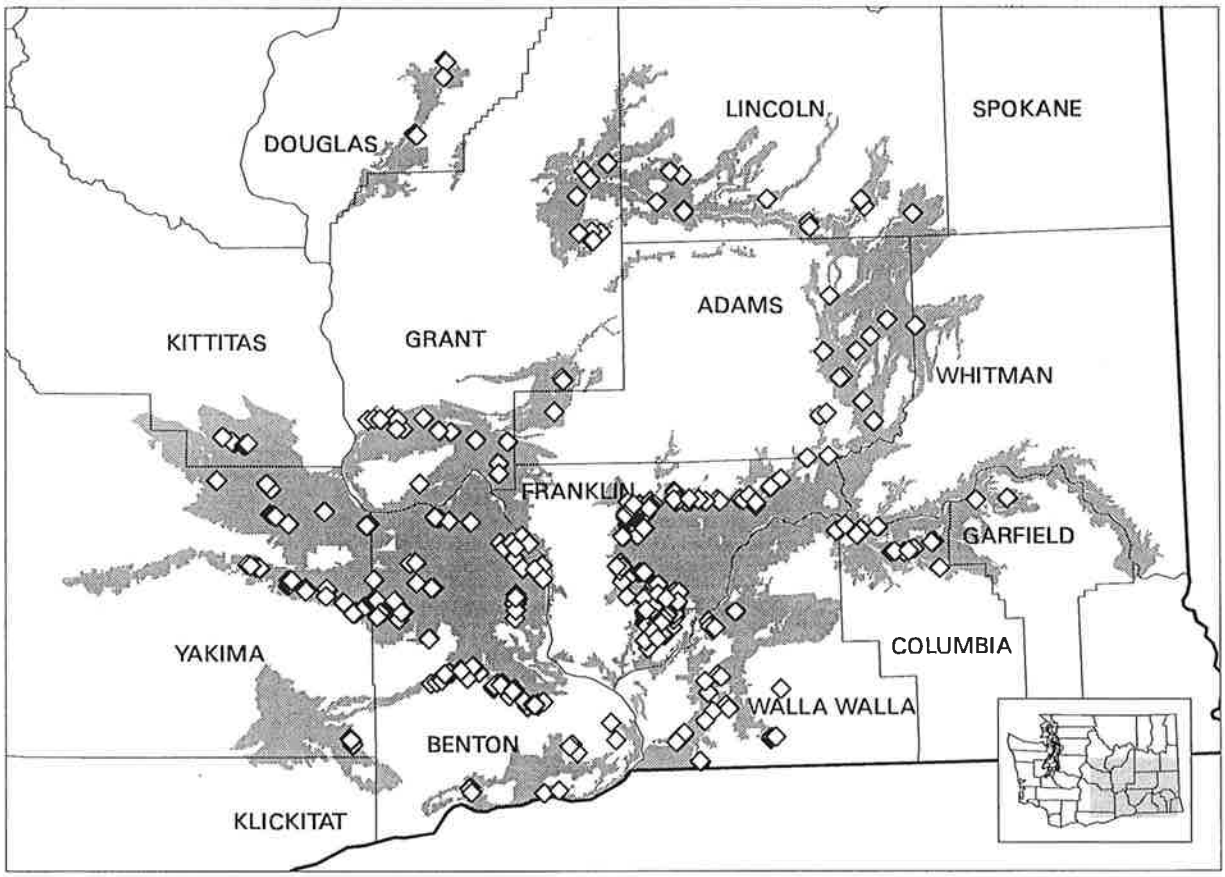

Figure 2. Predicted range of the ferruginous hawk in Washington, based on gap analysis (from Smith and Mattocks, in prep.). This technique applies known nest habitat descriptions across a landscape characterized through satellite imagery. The resulting map represents an expected distribution of the species. Diamonds mark locations of known territories.

NATURAL HISTORY

Reproduction

Chronology.—Winter sightings of ferruginous hawks in Washington are rare. Adults begin to arrive in mid-February. Copulation has been observed from 3 March to 19 April in Idaho (Powers 1981). Egg-laying may begin in mid-March and continues into May. Most eggs in Washington (>90%) hatch during May, with a peak in mid-month. Most young fledge from late May through late July. They generally depart from their natal areas 22 to 33 days (mean = 27 days) after leaving the nest (A. Jerman, pers. comm.).

Pair bonding.—Ferruginous hawks begin to breed at an age of at least 3 years (Schmutz and Fyfe 1987). Courtship activities leading to pair formation may begin before adults return to breeding grounds. Establishment and maintenance of pair bonds can be promoted

by the gathering and delivery of nest materials, arrangement of the nest, and food transfer. Copulation may precede nesting by more than a month and continue after egg laying (Olendorff 1971, cited in Powers 1981).

Nest building.—In Washington, nests are built on cliffs, rock outcrops, small trees, transmission-line towers, and artificial platforms (see *Nest-site selection*, page 13). Nests typically measure 100-130 cm across and 30-50 cm deep, with exceptional nests measuring up to 190 by 180 cm in external dimension (Roth and Marzluff 1989). Weston (1968) reported that 43-58% of occupied nests in Utah were constructed during the year of occupancy. Nests may persist for long periods without maintenance if they are built in protected places. Wind destroys nests in exposed situations, fire burns others, and utility companies often remove nests constructed on poles.

Typically, materials brought for nest construction are gathered from where they lay on the ground, but ferruginous hawks will pull up vegetation or roots and shred bark from trees or shrubs. Materials may be gathered within about 100 m of the nest site (Angell 1969) or brought from a distance. Males apparently gather larger materials for the nest perimeter and females generally gather smaller "finishing" material characteristic of the nest cup (Powers 1981). In Washington, Fitzner et al. (1977) found nests built mostly from branches of big sagebrush (*Artemisia tridentata*) and rabbitbrush (*Chrysothamnus* sp.), while Decker and Bowles (1926) found nests constructed primarily of greasewood (*Sarcobatus vermiculatus*) branches and lined with shreds of bark and chunks of dried dung. Nugent (1995) found ferruginous hawks using larger-diameter sticks than Swainson's or red-tailed hawks. Anthropogenic materials incorporated into nests include paper, baling twine, barbed wire, plastic bags, and cardboard (Olendorff 1973, references cited in Powers 1981:28-29, Gilmer and Stewart 1983). Weston (1968) found paper in 65% of active nests. Greenery is not characteristically found in ferruginous hawk nests (Powers 1981, Woffinden and Murphy 1982).

Multiple nests.—Territories often contain more than one nest. Alternate nests allow hawks to relocate if a primary nest is destroyed or subjected to disturbance early in the nesting cycle (Newton 1979). Using different nests from year to year may also reduce susceptibility to parasites (Philips and Dindal 1977). Washington territories contain an average of about two usable nests (WDFW, unpubl. data).

Territory fidelity.—At the Snake River Birds of Prey Area in Idaho, ferruginous hawks reoccupied the same nesting areas 75% of the time between 1991 and 1994 (R.N. Lehman, pers. comm.).

Ferruginous hawk pairs sometimes change breeding areas from year to year, often for no discernible reason. This tendency has prompted some researchers to describe the species' lifestyle as nomadic. Disturbance during the preceding season or loss of a mate may cause

some hawks to move. Others may depart an area in response to reduced prey densities (Smith et al. 1981, Woffinden and Murphy 1989).

Egg laying and incubation.—Olendorff (1993) summarized clutch-size data from several studies. Mean clutch size ranged from 1.5 to 4.4 eggs per nest, with most nests averaging 2 to 4 eggs. Two weeks may be required for a female to lay 5 eggs; the length of time may be related to abundance of food (Bowles and Decker 1931). The incubation period is about 32 to 33 days (Palmer 1988). At one Washington nest, Angell (1969) observed a female incubating during morning and early afternoon and a male relieving her in mid-afternoon, with the pattern of attendance reversed after hatching. Weston (1968) saw only females incubating during his Utah study.

Hatching and nesting success.—Eggs hatch over a period of a few days (Angell 1969). In Washington, more than 90% hatch in May; 14 May was the median hatch date estimated from 162 nests where young were aged (all years combined). The proportion of known clutches hatching at least one chick was 72% in 1992, 82% in 1993, and 87% in 1994 (Table 2).

Brood rearing and fledging.—Females tend young by brooding or perching on the nest, sometimes shading their chicks (Wakeley 1978c). Angell (1969) observed a male devoting much time to brooding, but Wakeley (1978c) found adult male nest attendance to be very limited after hatching.

Both adults provide food for nestlings. Females generally remain at the nest to help feed young, while males tend to drop food and leave (Weston 1968, Leary 1996). Nestlings may be fed small birds and rodents at first, with larger prey becoming predominant later (Angell 1969). Young begin to feed themselves when about 17 days old (Angell 1969) and leave their nests after about 41 days (Olendorff 1993).

Reproductive success (young fledged per nest with eggs) varies among substrate types, geographic areas, and years. Most researchers report an average of between 2 and 3 fledglings per breeding pair per year (summary in Bechard and Schmutz 1995:12). Estimates for Washington declined from 2.6 to 1.5 between 1978 and 1995 (Table 2), but the reduction may be an artifact of differing survey methods or intensity. Productivity surveys during many years were completed before young reached an age at which fledging could be assumed (e.g., 31 days), possibly leading to inflated estimates. Other factors contributing to the apparent decline are unknown.

Several studies have shown higher reproductive success from elevated nests than those accessible from the ground (e.g., Schmutz et al. 1984, Gaines 1985, Ayers 1996). However, Gilmer and Stewart (1983) found more chicks fledging per ground nest than other nest situations, suggesting this might be related to the larger size and more stable substrate of ground nests.

Post-fledging period.—Olendorff (1993) suggested that young disperse from their natal territories an average of 27 days after leaving the nest. This estimate is supported by research at the Hanford Site in 1995, where dispersal occurred 22 to 33 days (mean = 27 days) after fledging (A. Jerman, pers. comm.). Members of a brood watched by Angell (1969) were believed to have departed their Washington natal territory within 14 to 19 days after fledging.

Table 2. Occupancy and productivity at Washington ferruginous hawk nest sites (territories) during years when the outcome of at least 20 nests was determined.

Year	No. of nest sites occupied[a]	No. of nests with known outcome	No. (%) of nests successful[b]	No. of young produced[c]	No. of young per nest[c]	
					All nests	Successful nests
1978	29	20	17 (85)	52	2.6	3.1
1981	32	27	25 (93)	70	2.6	2.8
1986	39	28	23 (79)	58	2.1	2.6
1987	64	58	41 (68)	124	2.1	3.2
1992	57	53	39 (72)	88	1.7	2.3
1993	54	51	42 (82)	83	1.6	2.0
1994	60	49	48 (87)	92	1.9	2.2

[a] Nest sites (territories) where at least one ferruginous hawk was seen during a breeding season survey.
[b] Number of occupied nests with evidence that at least one egg hatched.
[c] Productivity estimates are inflated, because they are usually based on the number of chicks seen during a single survey, regardless of their age. Young chicks included in productivity estimates may not survive to fledging. Nestlings that reach a given age (e.g., 31 days) sometimes are assumed to have a high probability of fledging. However, recent investigations in Washington (A. Leary, unpubl. data) reveal mortality during the late-nestling period, so assumptions about survival may in some instances be unfounded.

Fledged young may begin to kill prey within 4 days of fledging (Angell 1969). They may also use the nest site as a feeding station for 2 weeks and continue to be fed by adults up to 4 weeks after leaving the nest (Blair and Schitoskey 1982). Juveniles expand the maximum area used during the weeks after fledging (Blair and Schitoskey 1982, Woffinden and Murphy 1983). Their movements are influenced by factors such as land use practices, availability of perches, movements of adults, and activities of farmers (Konrad and Gilmer 1986).

Mortality

Ferruginous hawks can reach an age of at least 20 years in the wild (Houston 1984). Schmutz and Fyfe (1987) reported first-year mortality of 66% and Woffinden and Murphy (1989) estimated adult mortality to be 25%. Bechard and Schmutz (1995) cautioned that both these estimates might be high.

Primary causes of mortality include predation and human persecution. Causes of lesser importance may include disease or severe weather. Acute and chronic effects of poisons and other contaminants on ferruginous hawks are unknown, but they merit investigation.

Predation.—Mammalian predation of eggs may occur, with coyotes suspected of plundering ground nests. A great horned owl (*Bubo virginianus*) was implicated in the deaths of one adult and three young ferruginous hawks documented by Howard (1975). Chicks may be most vulnerable between the third and fourth week after hatching, when female night-brooding ceases (Powers 1981).

Shooting and persecution.—Wanton killing was apparently commonplace during the early years of this century. Decker and Bowles (1933:44) remarked, "...wherever we saw a flock of sheep in hawk territory we found empty nests and broken eggs." Ferruginous hawks continue to be victims of shooting, with published reports in Weston (1968), Beery (1974), Howard (1975), and Gilmer and Stewart (1983). WDFW biologists (unpubl. obs.) have reported shootings as recently as 1994.

Road kills.—Howard (1975) observed two young ferruginous hawks dead by a roadside and speculated that recently-fledged young risk being struck by vehicles while feeding on road-kills.

Weather.—Eggs or young can be killed when hailstorms occur or wind knocks down nests (Gilmer and Stewart 1983).

Parasites.—How extensively parasites contribute to mortality is not known. One arthropod species has been documented in nests of the ferruginous hawk (Philips and Dindal 1977). When hawks limit reoccupation of nest sites, they may reduce their susceptibility to ant or parasite problems (Philips and Dindal 1977, Gilmer and Stewart 1983). Internal parasites of ferruginous hawks may include *Cladotaenia* sp. (Scott 1930).

Disease.—Mesothelemia (a tumor) was diagnosed in a captive 4-year-old female, but its origin was unknown (Cooper and Pugsley 1984).

Poisoning.—No direct or indirect mortality caused through the use of poisons has been documented for ferruginous hawks. Hawks often eviscerate prey, reducing their risk of ingesting poison. The lack of any documented effects does not imply that use of poisons is free of risk. As Olendorff (1993:32) maintained:

> No poisoning or other control program, be it directed against prairie dogs, ground squirrels, pocket gophers, kangaroo rats, or lagomorphs, is without consequence to organisms of higher trophic levels.

Density and Home Range

In a review of numerous studies throughout the species' range, Olendorff (1993:67-72) reported a wide range of densities, with the highest (7.1 km^2/pair) found in Saskatchewan. Most researchers have reported densities between 10 and 80 km^2/pair.

Average home range of seven radio-marked adult males in a Washington study was 79 km^2 based on the 95% minimum convex polygon method, and 31 km^2 using the 85% adaptive kernel method (Leary 1996). The relatively large home ranges are due in part to hawks traveling considerable distances to forage. Certain males regularly foraged more than 15 km from their nests.

Home range of seven radio-marked adult males in a southwest Idaho study, based on the minimum convex polygon method, was 7.6±3.2 km^2 (mean ± S.D.), with home range increasing just before or during the post-fledging period (McAnnis 1990).

On natural nest structures, an average of 1 active nest/6.4 km (4 mi) has been reported along linear features in Esquatzel Coulee, Franklin County (Beery 1974), an area described by Knight and Smith (1982) as near-optimal nesting habitat for raptors. Presence of artificial platforms may encourage higher densities. For example, four nests were active during 1993 along less than 6 km (3.5 mi) of a transmission line at the Hanford Site (WDFW, unpubl. data) and 5 nests were found in a 16-km (10-mi) powerline segment in North Dakota (Gilmer and Wiehe 1977).

Defense and Territoriality

Ferruginous hawk responses to intruders range from no commitment, to escorting intruders through territories, to aggressive pursuit, diving, and striking. Combative reactions have been elicited by humans, coyotes (*Canis latrans*), golden eagles (*Aquila chrysaetos*), rough-legged hawks (*Buteo lagopus*), great horned owls, and other species.

Defensive reactions to intruders cannot be predicted solely on the basis of the species involved. While Powers (1981) observed golden eagles eliciting the most combative reactions from ferruginous hawks, Weston (1968) stated that eagles were tolerated wherever they roamed. Behavior of intruders may influence response intensity. For example, Powers (1981) saw stronger reactions to perched rough-legged hawks than to those soaring through ferruginous hawk territories.

The establishment of Swainson's hawk (*Buteo swainsoni*) territories adjacent to ferruginous hawk territories sometimes results in low-intensity interactions between the species (Powers 1981). However, interactions can occasionally be dramatic. Weston (1968) described an incident where an attacking Swainson's hawk received a talon-grasp from the harassed ferruginous hawk, after which the instigating Swainson's flew quickly from the ferruginous

territory. In contrast, Thurow and White (1983) reported regular occurrence of mutual defense, where Swainson's and ferruginous hawks together harassed intruders approaching their adjacent nesting territories.

Movements

Raptors generally do not migrate as family groups (Newton 1979), and ferruginous hawks apparently fit this pattern, based on observations of young birds migrating independently of adults (Woffinden and Murphy 1983, Schmutz and Fyfe 1987).

Ferruginous hawks that breed in Washington typically depart in late summer. Although their exact destinations are not known, they probably migrate to the southcentral or southwestern United States and Mexico (Am. Ornithol. Union 1983). Habitat cues may guide migrating or wintering hawks; individuals that nest in the grasslands of Alberta tend to be associated with grasslands on their Texas wintering grounds (Schmutz and Fyfe 1987).

Conditions during the non-breeding season may have a considerable influence on the recruitment of hawks into the breeding population. Because the exact wintering areas of Washington's ferruginous hawks are unknown, little is known about conservation of habitat and prey or other local efforts to protect wintering hawks.

Foraging

Wakeley (1978b) classified ferruginous hawk hunting methods in Idaho. Hunting from a perch was the most common method used (probably because it requires little energy), but the least successful. Hawks hunting from a perch always used fence posts, despite the availability of other perches with prey nearby. The distance between perch and prey varied from less than 10 m to more than 100 m. Hawks hunting from the ground, the most efficient method, usually struck at prey items within 1 m. Hawks also were observed hunting from low flights (below 30 m and usually about 20 m) and from high flights (above 30 m and usually about 100 m).

Ferruginous hawks were successful in 50 of 124 (40.3%) foraging strike attempts observed by McAnnis (1990). Wakeley (1978b) observed 808 strikes, 129 (16%) of which were successful. Most strikes in McAnnis's Idaho study occurred 300 to 700 m from the nest, while only five strikes were made further than 2400 m from the nest. In Washington, Leary (1996) found 3 of 7 males more than 10 km from their nests 27% of the time, a pattern probably related to procurement of food.

Adult hawks that nest successfully must provide up to five nestlings with food while also capturing prey for their own needs. Small prey are fed to chicks for several days. As the chicks grow, larger prey are provisioned and mammals comprise most of their diet.

Wakeley (1978b) observed males doing most hunting during most of the brood-rearing period, with an average daily capture rate of 7 to 11 prey items.

Prey caching has been reported by Angell (1969:229) and Smith and Murphy (1978:87). Powers (1981) suspected caching at one nest based on indirect evidence.

Food

The ferruginous hawk diet varies according to locality, habitat, and prey abundance. Olendorff (1993) summarized 20 studies that described ferruginous hawk food habits (Table 3). Among 6,203 prey items were 41 mammal species, 30 birds, 10 reptiles, and 2 amphibians, as well as unidentified insects and other taxa. Additionally, ferruginous hawks sometimes consume carrion. Where leporids (hares, jackrabbits, and rabbits) are part of the ferruginous hawk diet, they contribute greatly to dietary biomass.

Table 3. Importance of various food types to ferruginous hawks in 20 studies throughout the species' range. Adapted from a summary by Olendorff (1993:20).

Prey type	Percent frequency	Percent biomass
Ground Squirrels and Prairie Dogs	43.8	25.4
Hares and Rabbits	19.8	65.9
Birds	13.2	4.1
Pocket Gophers	7.9	2.6
Kangaroo Rats	6.6	0.7
All others (each)	< 3	< 1

In August 1995, biologists revisited 34 of 63 Washington ferruginous hawk territories deemed active in May. They collected all pellets and prey remains within a given distance of nests and perches. The analyzed sample included intact pellets (n=420), bags of broken pellets (n=69), and carcasses (n=8). Prey items were identified based on the occurrence of body parts: mammals (skulls or jaws); birds (feathers, bones, feet); reptiles (scales); insects (exoskeletal remains). Pellet analyses revealed that northern pocket gophers (*Thomomys talpoides*) were the most widespread prey item and the predominant mammalian prey item (Table 4). In numerical terms, crickets (*Anabrus atriplex*) were most abundant.

Table 4. Prevalence of selected prey items in ferruginous hawk pellets collected in Washington during 1995.

Taxon	Territories (n = 34)	Sample bags (n = 497)		Items (n = 1930)	
		n	%	n	%
Northern Pocket Gopher	32	301	61	664	34
Mormon Cricket	17	105	21	741	38
Unidentified Snakes	19	75	15	not enumerated	
Great Basin Pocket Mouse	14	57	11	285	15
Unidentified Birds (largely gulls)	21	54	11	not enumerated	

An early description of the food habits of Washington's ferruginous hawks was offered by Bowles and Decker (1931), who stated that the hawks' diet seemed to be comprised of nothing but mammals. They noted that jackrabbit remains were "always" found around nests. More recently, Fitzner et al. (1977) tabulated prey remains and analyzed pellets to describe food habits at two Washington nest sites. The predominant food item was the northern pocket gopher, which comprised 37% of prey items in scabland habitat and 19% of prey items in juniper habitat. Snakes comprised one-third of the diet in juniper habitat and birds were an important prey component in both habitat types. Analysis of pellets and remains collected after a single season of breeding activity at a Yakima County nest revealed that small mammals, primarily deer mice (*Peromyscus maniculatus*) and sagebrush voles (*Lagurus curtatus*), comprised 53% of one pair's prey by frequency (Mazaika and Cadwell 1994). Rabbits contributed 31%, birds 13%, and insects 2%. No reptile remains were found at the site.

Interspecific Relationships

Prey availability.—Positive correlations have been found between jackrabbit or ground squirrel densities and the number of nesting pairs of ferruginous hawks, clutch and brood sizes, and the number of young fledged (Smith et al. 1981, Schmutz and Hungle 1989, Woffinden and Murphy 1989). Prey abundance also affects hawk numbers during migration (Cully 1991).

Resource partitioning.—Where ferruginous hawks nest sympatrically with other buteos, overlap in prey use, nest site selection, or timing of reproduction may occur. Coexistence should be simplified if resources are partitioned among species. In a Montana study, ferruginous and Swainson's hawks had 97% overlap in their use of nest substrates, but differed greatly in their diets (Restani 1991). Ferruginous hawks were also found closer to primary foraging areas. Red-tailed (*Buteo jamaicensis*) and ferruginous hawks had dietary and chronological overlap, but differed in their selection of nest sites, with ferruginous hawks selecting sites where a commanding view from the nest was available (Restani 1991).

In the vicinity of the Snake River in Idaho, ferruginous hawks share a prey base with red-tailed hawks. Steenhof and Kochert (1985) found that during periods of normal prey abundance in the area, Townsend ground squirrels (*Spermophilus townsendii*) were the most common prey in the diet of both species. However, regardless of prey abundance, more northern pocket gophers were taken by ferruginous hawks than by red-tailed hawks, while the latter species took more snakes.

Partitioning of nest sites by height above ground may occur in Esquatzel Coulee and on the Hanford Site, where ferruginous hawks build nests significantly lower than red-tailed hawks (Knight and Smith 1982, Nugent 1995). Working in north-central Oregon juniper groves, Green and Morrison (1983) found ferruginous hawks nested lower and nearer the bole in smaller trees, using larger materials than sympatric Swainson's hawks.

In Alberta, Schmutz (1984) found that ferruginous hawks preferred trees for nesting, but Swainson's hawks depended on them. Tree planting in prairie lands of Alberta increased nesting opportunities for ferruginous hawks, but also allowed Swainson's hawks to colonize areas that formerly held no suitable nesting habitat.

Neighboring species.—Ferruginous hawks nest nearer to congenerics than conspecifics in Montana (Restani 1991) and on the Hanford Site (Nugent 1995). They nest nearer to Swainson's than to red-tailed or other ferruginous hawks in Washington (Bechard et al. 1990). In a North Dakota study (Gilmer and Wiehe 1977), the closest spacing between ferruginous hawks and red-tailed hawks was 4.2 km (2.6 mi). Ferruginous hawks nested within 100 m of occupied common raven nests in an Idaho study (Steenhof et al. 1993). Active Swainson's hawk nests were found within 0.8 km of active ferruginous hawk nests 93 and 73% of the time in 2 years at a south-central Idaho study area, a tendency thought to be related to mutual defense of nest sites (Thurow and White 1983).

Behavior

Activity budgets.—During more than 552 hours of radio-tracking eight male ferruginous hawks between May and July in southwest Idaho, McAnnis (1990) found them spending their time almost equally divided between perching and flying. Most perching occurred above ground (37% of combined time), as opposed to on the ground (13.9%). Males made low, active flights 9% of the time and soared 40% of the time. Adult males observed by Wakeley (1978c) during the nestling period spent one-third of their day perched on junipers within 500 m of the nest tree, but less than 1% of their time was spent at the nest, and this was only to deliver food.

Foraging.—See page 9.

Drinking.—Wakeley (1978c) watched a male ferruginous hawk drink water from an irrigation ditch and breathe with its beak open. He surmised these activities helped to relieve heat stress.

Roosting.—Up to six ferruginous hawks roosted communally with bald eagles during winter in a cottonwood stand in South Dakota (Steenhof 1984). They left the roost within an hour before sunrise. A winter roost discovered in California held up to 24 ferruginous hawks (P. H. Bloom, cited in Olendorff 1993).

HABITAT REQUIREMENTS

Landscape Level

The ferruginous hawk is an obligate grassland or desert-shrub nester (Woffinden and Murphy 1989). As Bowles and Decker (1931:65) observed: "The drier the country, the better they seem to like it."

Landscapes comprised primarily of shrub-steppe, native prairie, haylands, and pasture are favored for nesting, while cropland is avoided (Howard 1975, Gilmer and Stewart 1983, Schmutz 1984, Roth and Marzluff 1989). In Washington, ferruginous hawks frequent shrub-steppe in the channeled scablands, as well as juniper-savannah areas of the Columbia Basin. Most nests are found in areas with higher percentages of grassland, shrubland, and juniper forest and low percentage of wheatland, although nests can be found in areas with 100% or 50% wheatland within 3 km (Bechard et al. 1990).

At the Hanford Site, ferruginous hawk nests are found in areas with more grass and light shrub cover, and less heavy shrub cover, than average (Nugent 1995). Using Mahalanobis distance probabilities to model ferruginous hawk nesting habitat, Nugent (1995) characterized Hanford Site as 0.2% excellent, 1.4% good, 6.6% fair, and 91.8% poor habitat.

Bechard et al. (1990) measured buteo nest-site characteristics in Washington between 1975 and 1980. Of 29 ferruginous hawk nests, 83% were between 200 and 300 m elevation, with none higher than 556 m. Also, 86% were lower than 10 m above surrounding terrain, 31% were more than 5 km from permanent water, and 73% were at least 2 km from roads and human structures. Further evidence of ferruginous hawks avoiding human activity was revealed by Gaines (1985), who found significantly fewer nests within 0.7 km of human habitation than near random points in North Dakota.

Ferruginous hawks in Alberta avoid areas with more than 50% cultivation (Schmutz 1984). This may relate to a change in the composition of prey species or to increased difficulty capturing prey or taking flight in dense vegetation. Most nesting areas in a Kansas study

(Roth and Marzluff 1989) included 50-75% rangeland and 25-50% cropland (primarily wheat), with 90% of territories found where land use was at least half rangeland. Although cropland was abundant in their study region, it was rarely incorporated in nesting areas; only 1 of 181 areas included greater than 75% cropland (Roth and Marzluff 1989).

In western Kansas, ferruginous hawks typically nested within 8 km (5 mi) of prairie dog towns, but few were within view of the town (Roth and Marzluff 1989). The authors speculated that the distance between nesting territories and prairie dog towns may have kept coyotes from switching to nestling hawks as prey when unsuccessful in prairie dog towns.

Nest Placement

Nests may be built on natural substrates such as rock outcrops, isolated trees, or on the ground in rolling terrain. They also may be built on manmade structures such as powerline towers, haystacks, or artificial nest platforms. Bowles and Decker (1931) claimed ferruginous hawks "very rarely" used nests of other large birds, such as ravens (*Corvus corax*). Roth and Marzluff (1989:132) suggested that the versatility in nest placement may occur "because undisturbed sites are actively selected and undisturbed sites have variable characteristics throughout the species' range." Structure selection in Washington is presented in Table 5.

Outcrops of rock on steep hillsides, as well as cliffs and ledges, constitute a common substrate for ferruginous hawk nests. Most nests in Washington are situated on outcrops or cliffs. In Kansas, 71.8% of 181 nests were on ledges, which tended to face northwest (Roth and Marzluff 1989). Broods raised on cliffs may sometimes use caves to keep cool (Angell 1969).

Trees are utilized preferentially in some areas (Howard 1975, Gilmer and Stewart 1983, Schmutz 1984, Gaines 1985). Nest trees generally are solitary or in isolated clusters or rows. Characteristic species include junipers (*Juniperus occidentalis* or *J. scopulorum*), black locust (*Robinia pseudo-acacia*), and cottonwood (*Populus* sp.). Junipers supported 95% of 97 nests found by Howard (1975) in southern Idaho and 40% of nests found by Weston (1968) in west-central Utah. Most tree nests in Washington are found in junipers, with many others in locusts. Cottonwoods (*Populus* sp.), willows (*Salix* sp.), and apple trees (*Pyrus* sp.) hold the remainder. Schmutz (1984) found that in areas of less than 30% cultivation, the density of ferruginous hawk nests was higher where there were trees.

Ground nests are common in the plains states and provinces. Weston (1968) found about half the nests in west-central Utah to be built on the ground. Ground nests often are lodged among boulders. Only one ground nest has been documented in Washington.

Artificial structures have become increasingly important as supports for ferruginous hawk nests. In Washington, structures such as powerline towers (Hanford Site) and specially-

designed platforms (Walla Walla County) have provided new or replacement opportunities for nest sites. Haystacks, windmills, and chimneys are sometimes used in other portions of the species' range.

Orientation of ferruginous hawk nests varies. Several researchers have reported preferences or tendencies, but a rangewide pattern is not apparent. Southern and eastern exposures, such as those found by Weston (1968) in Utah, may offer hawks the warmth of morning sun while screening the heat of afternoon sun. However, nests on hills in North Dakota (Gilmer and Stewart 1983) and ledges in Kansas (Roth and Marzluff 1989) tend to have a northwest exposure, while nests in southeast Washington had southern and western exposures (Bechard et al. 1990). Nugent (1995) found aspects to be used in proportion to their availability, while noting a long-distance exposure (unobstructed field of view to at least 200 m) of at least 180°. Restani (1991) reported no preference for nest exposure in southwestern Montana.

Table 5. Comparison of support structures for Washington ferruginous hawk nests occupied in 1981 and 1995.

	1981				1995			
County	Rock[a]	Tree	Artificial[b]	Total	Rock	Tree	Artificial	Total
Adams	3	0	0	3	4	2	0	6
Benton	5	0	0	5	9	2	7	18
Columbia	0	0	0	0	2	0	0	2
Franklin	10	6	1	17	4	10	1	15
Grant	2	0	0	2	7	1	0	8
Lincoln	0	1	0	1	1	0	0	1
Walla Walla	0	2	0	2	1	8	1	10
Whitman	1	0	0	1	0	0	0	0
Yakima	0	1	0	1	3	0	0	3
Totals (%)	21 (66)	10 (31)	1 (3)	32 (100)	31 (49)	23 (37)	9 (14)	63 (100)

[a] Rock includes cliffs, rock outcrops, talus slopes, and ground nests.
[b] Artificial structure in 1981 was a windmill; in 1995, 1 pole platform and 8 transmission-line towers.

Foraging

Wakeley (1978a) found vegetation density to be of primary importance to selection of hunting sites by ferruginous hawks. Hawks preferred bare ground and pasture, which presumably offered less protective cover for potential prey. They also returned directly to areas where they had been successful capturing prey.

POPULATION STATUS AND TREND

North America

Two recent reports have summarized state and province population estimates to provide a North American estimate. Olendorff (1993) reported 2,921 to 5,665 nesting pairs, while the U.S. Fish and Wildlife Service (1992) reported 5,220 to 6,004 pairs, with an average estimate of 5,612 pairs.

The ferruginous hawk population has been considered stable or slowly declining during recent years; concern over the hawk's status prompted a petition for the U.S. Fish and Wildlife Service to list the species under the Endangered Species Act (Ure et al. 1991). However, an analysis of Breeding Bird Survey data from 1966 through 1991 showed stability in continental numbers, as well as significantly more survey routes reporting increases in number rather than declines (Knopf 1994). Further, in an analysis of Audubon Christmas Bird Counts from 1952 to 1984, Warkentin and James (1988) found no indication of a regional or range-wide decline in wintering ferruginous hawk numbers in the western United States. In fact, they reported a dramatic overall increase in numbers, but admitted the reasons for the apparent growth were unclear.

Washington

Past.—The first accepted record of a ferruginous hawk in Washington was one collected near Fort Walla Walla by Captain Bendire in 1881 or 1882 (Brewster 1882). Nests were inspected near Chelan in April 1896 (Dawson and Bowles 1909:513) and near Wallula in June 1918 (Jewett et al. 1953). Decker and Bowles (1926) found several nests, one of which was active, near Kiona, Benton County, during April 1926. These authors characterized the hawk's former abundance in the area as "very plentiful," judging by the number of old nests they found. They speculated that the reduction in active nest sites was due to shooting by hunters, ranchers, and sheepherders. Several years later, Bowles and Decker (1931:65) termed ferruginous hawks as "not at all rare" while commenting on their surprising absence from some areas:

> "Not a sign of them is to be found in miles of country that, to all appearances, would seem to provide every possible necessity that can be found in localities where they are to be found in comparative abundance."

Fitzner et al. (1977) found 71 ferruginous hawk nests on 31 nest sites in 1974 and 1975. They documented nesting by at least 15 pairs and estimated the state population to be about 20 pairs.

Friesz and Allen (1981) found 152 nests at 62 nest sites during a comprehensive search in 1981. They documented nesting by 28 pairs in 1981 (other biologists located 2 additional breeding pairs) and estimated the state population to be about 40 pairs.

Present.—An average of 55 breeding pairs nested in the state from 1992 to 1995. Fifteen years of survey work have revealed 204 ferruginous hawk breeding territories in 12 Washington counties. More than 60% are in Franklin and Benton counties, with eight counties holding 13 or fewer territories.

Selected areas within Washington

To present status and natural history information based on landscape features, the Department has established polygons that encompass most ferruginous hawk nests (Fig. 3). Polygon boundaries were drawn to represent areas with similar habitat, relatively contiguous ferruginous hawk activity, or other shared features. In some regions of the state, biologists have documented fairly complete histories of ferruginous hawk status. These areas sometimes show apparent trends that are lost when pooled with all territories in the state. A few of these regions are presented here.

Hanford Site ("Arid Lands Ecology Reserve" and "Hanford East")—The U.S. Department of Energy has supported surveys at the Hanford Site since 1973. The Site was searched for all raptor species between February and May 1973, but no ferruginous hawks were found, despite the availability of "excellent nest sites" (Olendorff 1973:13). The author believed the absence of ferruginous hawks was due to an inadequate prey base; few jackrabbits or ground squirrels were observed in the area. Single nests were found at the Hanford Site in 1977, 1978, 1980, and 1981, then three nests, all on cliffs, were active in 1984 (Fitzner 1985). The construction of transmission lines in the mid-1970's created opportunities for tower nesting by ferruginous hawks (Fitzner and Newell 1989). By 1991, the Site held 10 active nests, with eight on towers and two on trees (Fitzner et al. 1992).

Esquatzel Coulee ("Esquatzel North").—Three or four nests were active each year during the late 1970's and early 1980's, and several other territories were unoccupied during that time (Friesz and Allen 1981, Knight and Smith 1982). Active nests were reduced to two in 1987 and one or none during the 1990's. Reasons for the decline are uncertain.

Walla Walla.—Through 1992, two or three active nests were found annually in this area. Intensified survey effort began to increase the number in 1993. In addition, 42 pole-mounted nesting platforms were erected in 1993. Three of these held ferruginous hawk nests in 1996, further enhancing the local population (WDFW, unpubl. data).

Juniper Dunes.—Bird and mammal surveys in the Juniper Dunes area of Franklin County between 1971 and 1974 resulted in a single ferruginous hawk sighting; no nesting was reported (Williams 1975). The Bureau of Land Management and the Department have

surveyed the area during several years since the mid-1970s. Friesz and Allen (1981) estimated that a minimum of 15 nests were used by ferruginous hawks during 4 years between 1974 and 1981. The possible reasons for peaks in abundance during 1987 and 1994 are unknown.

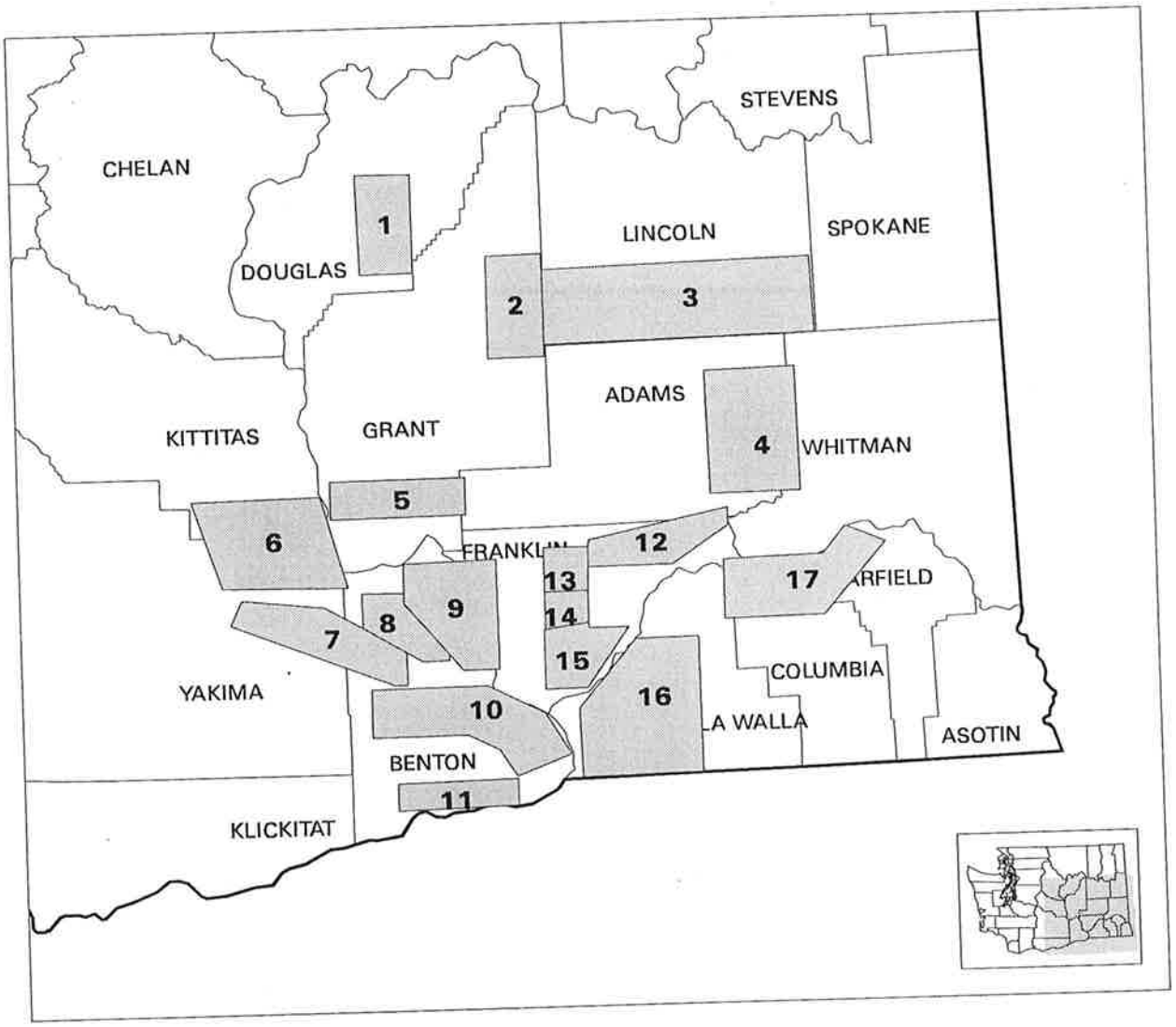

Figure 3. Ferruginous hawk areas in Washington, based on landscape features. Area numbers and names are: 1 Douglas, 2 Grant North, 3 Lincoln, 4 Adams East, 5 Crab Creek Lower, 6 Yakima Training Center, 7 Rattlesnake Hills, 8 Arid Lands Ecology Reserve, 9 Hanford East, 10 Horse Heaven Hills, 11 Lower Columbia, 12 Washtucna Coulee, 13 Esquatzel Coulee North, 14 Esquatzel Coulee South, 15 Juniper Dunes, 16 Walla Walla, 17 Snake-Tucannon.

HABITAT STATUS

Most native vegetation of southeast Washington has been eliminated by cultivation and water impoundment or modified by fire and livestock grazing (Fitzner et al. 1977). It is estimated that 60% of the state's original shrub-steppe acreage has been altered or replaced (Dobler et al., in prep.). Much of the remaining acreage is degraded to some degree.

The introduction or invasion of non-native plant species can change the suitability of habitat for ferruginous hawks. Woffinden and Murphy (1989) speculated that the proliferation of cheatgrass (*Bromus tectorum*) contributed to a decline of jackrabbits, which led to a decline in ferruginous hawk numbers.

Conservation Reserve Program

The U.S. Department of Agriculture Conservation Reserve Program (CRP) encourages removal of highly-erodable cropland from production, primarily to reduce soil erosion and secondarily to improve wildlife habitat. The CRP was authorized under the 1985 Food Security Act and the 1990 Food, Agriculture, Conservation, and Trade Act. It was reauthorized in the 1996 Farm Bill, although incentives to protect marginal habitat are less strong and dollar limits are reduced.

In eastern Washington, more than 4,500 CRP contracts account for 1.045 million acres, nearly 14% of the 7.6 million cropland acres in a 20-county area (Miller et al. 1993). Many of the CRP stands are beginning to regain components of original shrub-steppe communities. These recovering systems may provide future nesting or foraging habitat for ferruginous hawks.

Ownership

Most ferruginous hawk territories in Washington are found on private land (79%), with 18% on federal land and 3% on state land (Table 6). Three major landowners in the ferruginous hawk range are the U.S. Department of Energy, which operates the 148,200 ha (366,202 ac) Hanford Site, the U.S. Department of Defense, which operates the 104,624 ha (258,526 ac) Yakima Training Center, and the U.S. Bureau of Land Management, which has jurisdiction over the 5,665 ha (14,000 ac) Juniper Forest Management Area.

Table 6. Ownership of lands containing 204 ferruginous hawk territories in Washington (from WDFW Wildlife Survey Data Management).

County	(*n* territories)	Private (*n* = 154)	Federal[a] (*n* = 45)					State[a] (*n* = 5)	
			BLM	BOR	DOD	FWS	DOE	DNR	WDFW
Adams	(13)	13	0	0	0	0	0	0	0
Benton	(45)	23	2	0	0	0	19	1	0
Columbia	(7)	7	0	0	0	0	0	0	0
Douglas	(3)	3	0	0	0	0	0	0	0
Franklin	(66)	54	12	1	0	0	0	0	0
Garfield	(2)	2	0	0	0	0	0	0	0
Grant	(21)	16	1	0	0	1	0	0	3
Kittitas	(3)	1	0	0	2	0	0	0	0
Lincoln	(9)	4	5	0	0	0	0	0	0
Walla Walla	(19)	18	0	0	0	0	0	1	0
Whitman	(3)	3	0	0	0	0	0	0	0
Yakima	(13)	10	0	0	3	0	0	0	0
Totals	(204)	154	19	1	5	1	19	2	3

[a] Acronyms representing governmental ownership are Bureau of Land Management (BLM), Bureau of Reclamation (BOR), Department of Defense (DOD), Fish and Wildlife Service (FWS), Department of Energy (DOE), Department of Natural Resources (DNR), and Department of Fish and Wildlife (WDFW).

Grazing

No quantitative studies have determined beneficial or detrimental effects of livestock grazing on ferruginous hawks (Olendorff 1993). The distribution, intensity, seasonality, and management of grazing, as well as the species involved, are important in determining its effects. Fleischner (1994:631) summarized the ecological costs of grazing, each of which may impact ferruginous hawks:

(1) Alteration of species composition of communities, including decreases in density and biomass of individual species, reduction of species richness, and changing community organization.
(2) Disruption of ecosystem functioning, including interference in nutrient cycling and ecological succession.
(3) Alteration of ecosystem structure, including changing vegetation stratification, contributing to soil erosion, and decreasing availability of water to biotic communities.

CONSERVATION STATUS

Legal Status

Washington.—The ferruginous hawk received a "State Sensitive" designation under Washington Department of Game Policy 602 in October 1981, before the existence of a State Threatened status. In February 1983, the species was added to the newly-established State Threatened list. In 1990, the Washington Wildlife Commission maintained the classification of Threatened, a subcategory of protected wildlife, under Washington Administrative Code 232-12-011.

United States.—In 1982, the ferruginous hawk was designated a Category 2 Candidate for Federal listing under the Endangered Species Act. A petition to list the species as Endangered was received by the U.S. Fish and Wildlife Service in May 1991 (Ure et al. 1991). In March 1992, the Service determined that the petitioners did not provide substantial information to indicate listing was warranted (USFWS 1992). However, the Service maintained the species' status as Category 2. In July 1995, the Service discontinued using the term "candidate" to refer to Category 2 species. The field office that oversees eastern Washington has placed the hawk on its Species of Concern list. No specific protection is offered by the designation.

Canada.—The Committee on the Status of Endangered Species in Canada changed the status of ferruginous hawks from Threatened to Vulnerable on the recommendation of Schmutz (1994).

Management Activities

WDFW Priority Habitat and Species (PHS).—Wildlife species requiring protective measures for their perpetuation due to their population status, their sensitivity to habitat alterations, or their recreational importance are listed as Priority Species by the Department. The PHS unit of the Habitat Program provides management recommendations to governments and landowners as a proactive measure to protect vulnerable breeding and foraging areas. With its State Threatened designation, the ferruginous hawk is included among priority species.

Surveys.—Early survey efforts in Washington included those by Fitzner et al. (1977), whose study area comprised 38,848 km^2 over 12 southeastern counties, and Knight and Smith (1982), whose study area comprised 6,400 ha along 13 km of Esquatzel Coulee in Franklin County. In 1981, the Department surveyed all territories known at the time (Friesz and Allen 1981). Coordinated efforts to survey all known ferruginous hawk nest sites and to search for new sites were undertaken by WDFW in 1987 and again from 1992 through

1995. In most cases, territories were visited in early May to determine occupancy and in June or July to measure productivity.

Artificial nest platforms.—New or replacement nesting opportunities can be provided by constructing artificial nest platforms. Base and Sievert (1987), Fitzner and Newell (1989), Howard and Hilliard (1980), and Schmutz et al. (1984) found hawks breeding in areas that had little or no nesting prior to the installation of artificial structures. Man-made structures and planted trees in central North Dakota provided nest sites for 59% of ferruginous hawk nests (Gilmer and Stewart 1983).

A period of familiarization with new structures seems to be necessary before ferruginous hawks will occupy them (Fitzner and Newell 1989). In Alberta, Schmutz et al. (1984) reported that 2 years after platform installation hawks began to use them preferentially over natural substrates. Once an elevated nest structure is used, security from predators (i.e., coyotes) may encourage a high reoccupancy rate. The rate for tower nests (63.7%) was higher than that for tree nests (43.4%) or ground nests (4.7%) during a 3-year central North Dakota study (Gilmer and Stewart 1983).

The use of transmission-line towers by this species depends on their structure. A suitable platform for nest-building at an appropriate height above ground seems most important. At the Hanford Site, ferruginous hawks usually nest on towers supporting 230-kV lines, but rarely use those supporting 500-kV lines (Fitzner and Newell 1989, Nugent 1995). Steenhof et al. (1993) found ferruginous hawks on towers supporting a 500-kV line in Idaho, but many were on the same type of tower used for Hanford's 230-kV line. These workers also learned that persistence of ferruginous hawk nests was greater on tower platforms than on the remainder of the structure. Slightly larger clutches were found in North Dakota tower nests (mean = 3.7) than in other nests (mean = 3.2) by Gilmer and Wiehe (1977). However, small brood sizes were observed on tower nests at the Hanford Site, although this may have been related to environmental factors other than nest support (A. Leary, pers. comm.). Ferruginous hawks using towers have had nest success matching or exceeding success of those nesting on other substrates, with Gilmer and Stewart (1983) reporting 86.7% success on towers in North Dakota and Steenhof et al. (1993) reporting 85% success in Idaho.

Twelve pole platforms were erected in the Juniper Forest Management Area (Franklin County) in 1987 and 1988 and 42 were built in Walla Walla County during 1993. Two additional platforms were constructed in Benton County in 1993. Several cliff platforms were installed in Lincoln County by the Bureau of Land Management beginning in 1989.

Tree planting.—Ferruginous hawks in Washington take advantage of abandoned homesteads by using black locusts and other trees originally planted for shelter.

Captive breeding, captive rearing, and rehabilitation.—Although captive management techniques are often used to aid recovery of raptor populations, they are unlikely to be employed for Washington's ferruginous hawks. Olendorff (1972) offered comments on hatching and rearing young buteos, including ferruginous hawks.

Hawks injured by natural or human-related events may benefit from time spent in a rehabilitation center.

FACTORS AFFECTING CONTINUED EXISTENCE

Disturbance

Whether people cause abandonment by approaching nests during incubation is uncertain, but suspicions that this is the case have influenced survey and research methods for many years (Olendorff 1993). Visits to active nests can impact raptors in several ways: adults may desert eggs or young; eggs may be broken or young trampled by adults; avian and mammalian predation may be increased; eggs or young may be subject to chilling or overheating; premature fledging may occur, causing injury or increasing opportunities for predation; other people may be made aware of the presence of the nest by observing the visitor; rocks or debris from cliffs may be knocked into the nest, harming young or breaking eggs (Fyfe and Olendorff 1976).

White and Thurow (1985) studied the effects of disturbance on reproduction of ferruginous hawks in south-central Idaho during 2 years. They exposed nesting hawks to controlled disturbance (walking, driving, noisemaking) and measured hawk responses. Control nests commonly fledged four or five young and disturbed nests one or none. Although territories with a history of regular use were normally reoccupied, eight of nine nests that failed due to controlled disturbance were not used the following year.

Development

Residential development in urbanizing areas increases disturbance in the vicinity of ferruginous hawk nests. Growth in the Tri-Cities region of Washington (i.e., Richland, Pasco, and Kennewick) will influence distribution and productivity of hawks nesting there.

Agricultural development alters landscapes in fundamental ways. Most of Washington's native shrubsteppe and grassland habitat has been converted to agriculture, reducing the suitability of many areas for nesting ferruginous hawks. Farming activities can disturb hawks and alter populations of small mammals and birds. Land used for wheat, potatoes, corn, and other crops are likely to be detrimental to ferruginous hawks, through loss of nest sites and reduction of prey base (Olendorff 1993). Similarly, vine and tree crops would

have negative impacts on hawks. In some cases, however, the impacts of cultivation may be reduced coincidentally. For example, pocket gophers are sometimes abundant in alfalfa fields, providing prey for hawks nesting in nearby uncultivated areas (Wakeley 1978a, Leary 1996). Unfortunately, prey are concealed as the crop grows, potentially reducing foraging success during the critical brood-rearing period.

Contaminants

Ferruginous hawks have apparently not undergone a population reduction that can be linked to environmental contaminants (Risebrough and Monk 1987:247). However, new chemicals are introduced to the marketplace regularly, often without a clear understanding of their potential impacts on raptors.

Ferruginous hawk eggs studied for organochlorine residues showed that DDE and heptachlor epoxide (a wheat seed treatment now prohibited from production for use in the United States) entered the food chain of this species, but eggs did not contain concentrations which affected fledging success (Henny et al. 1984). Levels of organochlorine pesticides, PCBs, and mercury found in ferruginous hawk eggs by Stendell et al. (1988:40), "were below levels known to have direct effects on survival or reproduction."

Evisceration of prey will reduce hawk vulnerability to pesticides. Schmutz et al. (1989:149) suggested this as a possible reason that strychnine-based ground squirrel poisons did not reduce survival of adult or nestling Swainson's hawks in their Alberta study.

CONCLUSION

Ferruginous hawks, while versatile in the placement of their nests, are susceptible to incompatible land-use practices and human disturbance. Widespread cultivation of native shrub-steppe has reduced the amount of suitable habitat for ferruginous hawk nesting in Washington and has altered the composition of prey communities. Activities accompanying human population growth—residential development, road construction, and increased recreation—have also limited distribution and abundance of hawks. Management of ferruginous hawks and their preferred habitat is required to assure the long-term stability of this species in the state. Part Two presents objectives, strategies, and tasks designed to promote recovery of ferruginous hawks in Washington.

PART TWO: RECOVERY

RECOVERY GOAL

The goal of the ferruginous hawk recovery program is to outline strategies which, when implemented, will maintain a population throughout much of the species' traditional range in Washington.

RECOVERY OBJECTIVES

The ferruginous hawk will be considered for downlisting from State Threatened status when Washington supports:

1) A population of at least 60 breeding pairs, measured annually by the number of nests with eggs, averaged over 5 years;
2) Distribution in South (≥10 pairs), Central (≥40 pairs), and North (≥10 pairs) Recovery Zones, delineated to reflect probable historic occurrence.

Rationale

Although historic population levels cannot be determined from available information, the ferruginous hawk is thought to have been about as common as it is today. Recent estimates (i.e., 1975 to 1995) suggest the population is increasing; with adequate protection this trend may continue. The population objective is based on a small increase over the average of 55 breeding pairs from 1992 to 1995. A population of 60 breeding pairs does not by itself constitute a viable population, but assures continued presence of the species in Washington through the foreseeable future. Observations that indicate eggs were laid in a given nest include: incubating adult, eggs, young, eggshell fragments, remains of nestlings, or considerable excrement on the nest rim.

The distribution objective is based on the estimated historic range of ferruginous hawks in Washington (Table 7, Fig. 4).

No productivity objective is presented, largely because productivity may be a misleading measure of long-term population stability. The Department should implement a research project to assess population dynamics in Washington and to establish an index for monitoring productivity and recruitment.

Although the notion of habitat security is not among recovery objectives, it is a desirable condition for ferruginous hawk territories. Its omission reflects an inability to define "secure habitat." Permanent or renewable nest structures, sufficient prey, and freedom from disturbance each contribute to the stability of habitat for ferruginous hawk nesting. However, ferruginous hawks sometimes move nesting sites from year to year, changes in

prey abundance are difficult to predict, and effects of different types and levels of disturbance at various distances are poorly known. The Department should continue attempts to answer the management question: What constitutes secure habitat for the ferruginous hawk?

Table 7. Distribution objectives for downlisting the ferruginous hawk in Washington. Individual Water Resource Inventory Areas have been combined into Recovery Zones, based on hawk distribution and natural continuities in habitat. The objectives approximate proportions of recently-active (nesting confirmed at least once between 1992 and 1994) and all known territories in each Recovery Zone.

Recovery zone	Recently active territories %	All territories %	Distribution objective % (n)	WRIAs
North zone	14	18	17 (10)	34 39 40* 41 42 43 44
Central zone	69	68	67 (40)	33 36 37 40*
South zone	17	15	17 (10)	31 32 35

* WRIA 40 is divided at the Benton-Yakima county line.

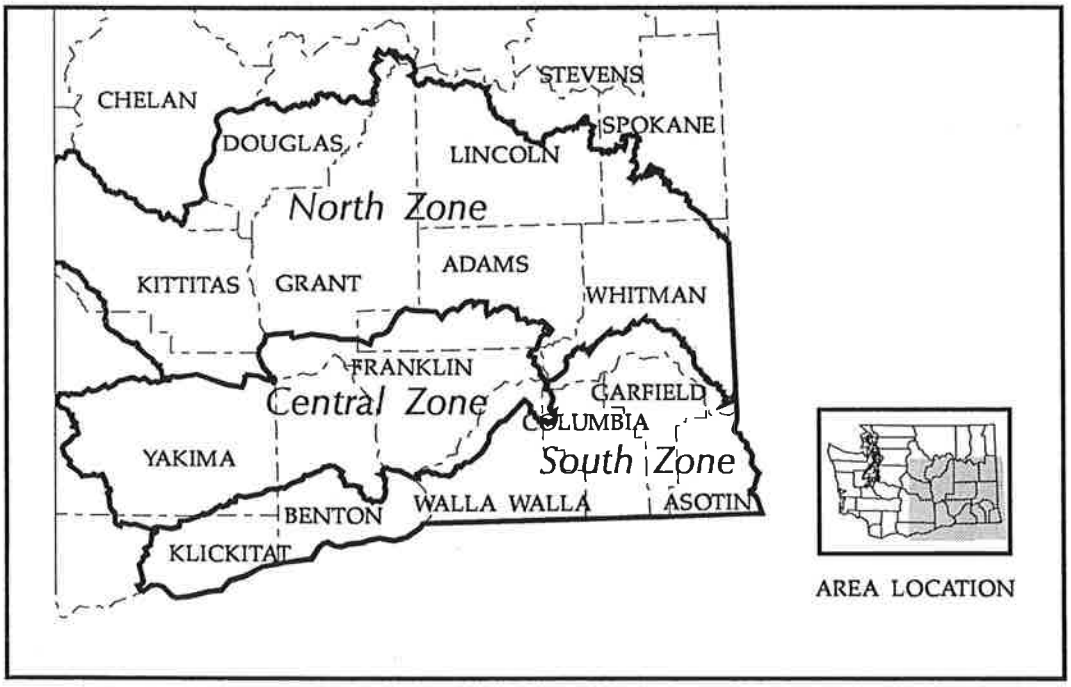

Figure 4. Ferruginous hawk Recovery Zones in southeast Washington.

RECOVERY STRATEGIES AND TASKS

1. Monitor the ferruginous hawk population.

1.1. Determine population trends through annual surveys.

An annual inventory of the number and locations of breeding pairs is needed for monitoring population trends and changes in distribution. Department biologists will expend effort proportional to the number of hawk territories in each region.

Occupancy surveys will done by helicopter or through ground checks. By either method, visits will impose the lowest level of disturbance possible. Surveys will be timed to coincide with the greatest likelihood of finding incubating adults. Territories will be checked for occupancy (presence of a pair) and activity (evidence of egg laying). Biologists will identify existing and potential threats to hawks and their habitats during surveys.

As an alternative to comprehensive surveys to monitor population trends over a broad geographic area, Olendorff (1993) recommends using the methods of Schmutz (1993) and Banasch (1991), by surveying territories in randomly-selected quadrats at 5-year intervals. A comparable method should be used in Washington to search for unknown territories and to map distribution of historic ferruginous hawk nest sites.

2. Protect the ferruginous hawk population.

2.1. Establish spatial and temporal buffers.

Ferruginous hawks are sensitive to human activity, so their nesting, roosting, and foraging areas should be given adequate protection from disturbance. Specific guidelines should be included in site management plans (Section 3.6). In general, human activities that alter adult behavior or put eggs and young at risk should be avoided.

Olendorff (1993) suggested a 7.0 km^2 buffer zone (1100 m radius around nest) for ferruginous hawks, based on several studies of home range. Because such a buffer will often be impractical, smaller buffers may be considered.

White and Thurow (1985) believed a buffer of 250 m around nests would prevent desertion by 90% of ferruginous hawks during years when prey are abundant and hawks in good physiological condition. They suggested expanding the buffer during years of less-optimal conditions. Ensign (1983)

suggested a 450 m buffer. Suter and Joness (1981) recommended that prolonged activity (½ hr to several days) be kept at least 1000 m from nesting attempts and suggested surveys be kept 500 m from active nest sites unless they are very brief and conducted when the temperature is moderate. For noisy, extended activities such as construction, they suggested a buffer of at least 1000 m. Holmes et al. (1993) stated that a buffer zone of 140 m around winter foraging areas would prevent flushing by about 90% of ferruginous hawks.

In general, access restrictions should be in effect between 1 March and 15 August each year, with special precautions taken during site selection, egg-laying, and incubation periods (1 March to 31 May).

Ferruginous hawks on certain nesting substrates (e.g., transmission towers) may be more tolerant of human activity. Relative exposure or concealment of the nest may also affect the required buffer distance. Research should be initiated to help refine buffer distances and timing for various nesting situations (Section 7).

2.2. Reduce mortality.

When active nests are impacted by natural or human-caused events, eggs or young can be transferred to other ferruginous hawk nests for adoption (Section 9). Direct persecution (e.g., shooting) may be minimized through an educational campaign emphasizing the benefits provided by ferruginous hawks (Section 6) and by increasing enforcement effort in susceptible areas (Section 4).

3. Manage habitat to increase ferruginous hawk abundance and productivity.

3.1. Identify causes of vacancy at historic nesting sites.

About half of the known ferruginous hawk territories in Washington have been unoccupied in recent years. Reasons for inactivity are known for some sites, but termination of hawk use at others has been puzzling. An effort to identify factors influencing use may improve our understanding of suitability or security of ferruginous hawk habitat.

3.2. Evaluate the capacity of existing and potential nesting habitat to support a recovered population.

3.2.1. Evaluate potential nesting and foraging areas.

Biologists should survey habitat that appears suitable for ferruginous hawks and characterize its potential to support nesting. Availability of nest structures, freedom from disturbance, and access to prey should be considered when visiting sites.

3.2.2. Monitor habitat capacity for nesting ferruginous hawks.

The extent of suitable habitat in a given area, considered with information about the nesting density of successful hawks, can assist with estimations of carrying capacity.

3.3. Improve suitability of existing and potential habitat.

Habitat should be managed to create and maintain conditions favorable to ferruginous hawk breeding and foraging.

3.3.1. Provide stability to existing nest substrates.

Ensure the continuance of nesting by reinforcing or protecting nest structures to prevent their destruction. Trim trees to provide easier access for adults. Encourage survival of young trees in areas frequented by hawks.

3.3.2. Provide nesting opportunities on natural and artificial structures.

Trees standing alone or in scattered stands should be left uncut if habitat otherwise appears suitable for nesting. Wire nest baskets may be installed in trees without nests. Material for nest construction may be provided near potential nest sites. Ledges or holes in cliffs can be created or enlarged. When removing utility lines, support structures should be left in place and improved with platforms. Nest platforms may be constructed to increase nest-building opportunities.

While artificial platforms can enhance ferruginous hawk populations, their use is less desirable than creating or improving natural nesting situations. Three assumptions underlie this belief: 1) although some artificial structures can be durable, generally such structures are not self-sustaining substrates for placement of nests, 2) artificial structures do not

represent native conditions, and are typically more conspicuous than natural sites, possibly making them more vulnerable to human disturbance than cryptic sites, and 3) artificial structures detract from the aesthetic experience for wildlife viewers.

3.3.3. Provide perches in suitable foraging areas.

Ferruginous hawks commonly use a low perch to rest or watch for prey. Those in Idaho frequently used "prominent perches," but did not use utility poles (Powers 1981). Supplying artificial perches where perch sites are limiting can increase raptor use of foraging habitat (Widén 1994). Constructing wire baskets around the perches to catch pellets could simplify collection of specimens for prey analyses (Simmons et al. 1991).

3.3.4. Mitigate effects of converting land to agriculture.

When converting land, owners should work during the non-breeding season (16 Aug to 28 Feb), leave a mosaic of treated and untreated areas, windrow brush for small bird and mammal populations, and use native plants when reseeding. When controlling undesired mammals, landowners may reduce numbers without eliminating the population.

3.3.5. Discourage construction activity and plans for increased recreational use that will destroy or degrade ferruginous hawk habitat.

Development frequently reduces the amount of nesting habitat, and may also account for significant disturbance through associated recreational use. Construction activities in or adjacent to ferruginous hawk nesting or foraging habitat should be discouraged through conservation easements, acquisition, zoning, or other means. When such activities cannot be avoided, they should be minimized, with construction restricted to the non-breeding period (16 Aug to 28 Feb).

3.3.6. Limit extraction activities near ferruginous hawk habitat during the breeding season.

Operations at gravel pits should be limited near active ferruginous hawk nests during the breeding season (1 Mar to 15 Aug).

3.4. Determine ownership and land-use practices in hawk activity areas.

Ownership and land-use practices in ferruginous hawk nesting and foraging sites should be determined to allow cooperation between land owners and wildlife managers.

3.5. Increase the manageable land base for ferruginous hawks.

Management of ferruginous hawks can be achieved most effectively when habitat is dedicated for the management of the species.

3.5.1. Evaluate fee acquisition of key sites through purchase, land exchanges, or charitable donations.

The Department should investigate acquiring land where ferruginous hawks breed and forage. Priority should be given to active and potential nesting areas where protection is less than optimal and where management for ferruginous hawks has a reasonable chance of success. State-acquired lands may be designated Wildlife Areas, Natural Area Preserves, or Conservation Areas.

3.5.2. Evaluate less-than-fee protection of land occupied by ferruginous hawks.

Landowners may protect ferruginous hawk habitat through conservation easements and tax incentives such as open space designation.

3.6. Prepare site-specific management plans.

Management plans should be written for currently-occupied or historic sites with the potential of supporting ferruginous hawks over the long term. Plans should describe elimination or reduction of threats, a monitoring program, and other recovery issues particular to each site. Department biologists should provide expertise or assistance when other landowners write plans.

3.7. Model habitat requirements.

Wildlife Habitat Relationships (Maser and Thomas 1983) or a Habitat Suitability Index (Jasikoff 1982) could be employed to determine whether certain areas are likely to support ferruginous hawk nesting. Modeling Washington conditions could help to refine recovery objectives.

4. Enforce restrictions designed to protect ferruginous hawks.

Human factors which may adversely impact ferruginous hawks include shooting, collection of eggs or young, and destruction of nests. Activities with indirect impacts include off-road vehicle use, pedestrian activity, and free-roaming pets in nesting areas. Federal, state, and local authorities should provide a coordinated law enforcement effort to eliminate these and other potentially-harmful activities near active breeding sites. Enforcement emphasis should occur during the breeding period (1 Mar to 15 Aug).

5. Establish information management and retrieval systems.

Ready access to information gathered during surveys and investigations will be critical for management decision makers. A centralized information system exists at WDFW, Wildlife Survey Data Management.

5.1. Maintain repository for ferruginous hawk records.

Survey data should be submitted to the Wildlife Survey Data Management section at the earliest opportunity following data collection. Data entry, manual storage, and digitization should be done as appropriate.

5.2. Update Priority Habitats and Species maps annually.

Polygons representing home range data or biologists' best estimates of breeding and foraging areas should be established for the WDFW Habitat Program PHS database and updated annually.

5.3. Produce an annual ferruginous hawk status review.

A report describing the status of the ferruginous hawk population, as well as management activities and their effects, should be prepared and distributed to interested parties each year.

6. Develop public information and education programs.

Development of informational materials and educational programs for schools, community groups, and other audiences should begin.

6.1. Develop educational materials.

Updated fact sheets should be developed for distribution to landowners. Posters may be created for display in communities. Video or slide shows describing the

plight of the ferruginous hawk and the status of recovery efforts should be produced.

6.2. Promote media contact.

Encourage the production of news releases, public service announcements, and articles in newspapers and magazines.

7. Initiate research to facilitate and enhance recovery efforts.

Specific research topics may include prey relationships, nest substrate selection, breeding adult behavior, winter ecology, hunting behavior, non-laying pair behavior, habitat use, post-fledging dispersal, nomadism, and the effects of human disturbance or contaminants. Projects related directly to achievement of recovery objectives should be emphasized.

Radio transmitters (VHF or satellite) may be used to relocate individuals to enhance certain studies. Ferruginous hawks have not been adversely affected by transmitter packages weighing 15-25 g when attached with a harness (Andersen 1994). However, mounting transmitters to the tail may be more effective (M. Bechard, pers. comm.). When sufficiently small solar panels become available, they can be used to increase the useful life of a radio package.

Video or timed-exposure cameras may be installed to monitor selected active nests, which would provide insight into behavior and diet. Solar-powered equipment would be suitable for use in ferruginous hawk habitat.

Eyrie monitors may be employed to collect information on attendance patterns, food habits, effects of disturbance, and other behaviors.

7.1. Determine metapopulation dynamics of the state population.

Investigate: 1) Whether Washington is a source or sink for ferruginous hawks, and 2) How productivity and recruitment vary over time. Productivity surveys should occur when nestlings have reached an age at which their survival to fledging is reasonably certain (e.g., 31 days; Lehman et al. 1993), but before they leave the nest (roughly 41 days after hatching).

8. Coordinate and cooperate with public agencies and other landowners.

Working in concert with other entities will enhance the potential success of WDFW recovery efforts.

8.1. Review regulations influencing ferruginous hawk habitat and populations.

Evaluate State and Federal regulations concerning use of lands owned, leased, or controlled by the Department of Fish and Wildlife and other agencies to determine their compatibility with recovery goals.

8.2. Provide management recommendations to landowners.

When ferruginous hawk breeding sites are discovered on private land, specific conservation recommendations and management actions should be discussed with landowners. Appropriate strategies may include, but are not limited to, voluntary protection agreements and management agreements, or regulatory protection via the State Environmental Policy Act or local Critical Area Ordinances. Strategies should be developed for each locality for the benefit of both hawks and landowners.

8.3. Create information exchange network between appropriate agencies.

Regular exchanges of information between State, Federal, and other entities involved in ferruginous hawk management will assist in assessment of local and regional trends. The Department should provide ferruginous hawk workshops to agencies involved with conservation planning.

8.4. Secure funding to support recovery activities.

Investigate availability of grants, cost-share agreements, and other types of funding to assist in implementation of Recovery Objectives. Federal, State, and non-governmental sources should be considered.

9. Prepare for direct population management.

If the ferruginous hawk population in Washington approaches extirpation, it may be necessary to become directly involved in manipulation of adults, young, or eggs. The following tasks are intended to be informational (i.e., most are not expected to be implemented during the near future).

9.1. Release adults or juveniles in hacking programs.

Captive breeding, captive rearing, and rehabilitation of injured or diseased birds may produce hawks that can be (re)introduced to the wild.

9.2. Use foster parents in the wild.

If abandoned clutches or broods are discovered, the eggs or nestlings may be placed under foster parents to be raised in natural situations. Additionally, runts may be transferred to nests with below-average brood size to improve their chances of fledging.

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PART THREE

IMPLEMENTATION SCHEDULE

IMPLEMENTATION SCHEDULE

The outline of strategies and tasks on the following pages identifies Washington Department of Fish and Wildlife responsibilities, provides estimates of annual expenditures, and assigns priority to recovery tasks, as follows.

Priority 1

Actions necessary to halt the decline and prevent the extirpation of the species in Washington and to monitor the population.

Priority 2

Actions meant to maintain the benefits of Priority 1 tasks and to enhance recovery efforts by stabilizing and rebuilding the population.

Priority 3

Actions that provide direction for future conservation needs.

Acronyms and symbols used to indicate WDFW responsibilities are:

WLM	Wildlife Management
RES	Research
WSDM	Wildlife Survey Data Management
HAB	Habitat
LAND	Land Resources
ENF	Enforcement
CTRL	Wildlife Control
IMR	Information and Media Relations

Implementation of Recovery Strategies is contingent upon availability of sufficient funds to undertake Recovery Tasks.

Strategies Tasks	Priority	Duration	Responsibility	Annual cost in thousands of $ 97	98	99	00	01
Monitor Washington ferruginous hawk population								
1.1. Determine population trends through annual surveys.	1	continuing	WLM	25	25	25	25	25
Totals				**25**	**25**	**25**	**25**	**25**
Protect the ferruginous hawk population								
2.1. Establish spatial and temporal buffers	1	continuing	HAB/WLM	3	3	3	3	3
2.2. Reduce mortality	1	continuing	ENF/IMR/WLM	Done with other tasks.				
Totals				**3**	**3**	**3**	**3**	**3**
Manage habitat to maximize ferruginous hawk abundance and productivity.								
3.1. Identify causes of vacancy at historic nesting sites	1	1 year	WLM	2				
3.2. Evaluate the capacity of existing and potential nesting habitat to support a recovered population.								
3.2.1. Evaluate potential nesting and foraging areas.	1	3 years	WLM	2	2			2
3.2.2. Monitor habitat capacity for nesting hawks.	1	4 years	WLM	5	5	5	5	
3.3. Improve suitability of existing and potential habitat.								
3.3.1. Provide stability to existing nest substrates	2	continuing	HAB/WLM					
3.3.2. Provide nesting opportunities on natural and artificial structures	2	2 years	HAB/WLM		10		10	
3.3.3. Provide perches in foraging areas	2	2 years	HAB/WLM		4		4	
3.3.4. Mitigate effects of converting land to agriculture	2							
3.3.5. Discourage construction activity and plans for increased recreational use of hawk areas	2	continuing	HAB	1	1	1	1	1
3.3.6. Limit extraction activities during the breeding season.	2	continuing	LAND	.5	.2	.5	.2	.5
3.4. Determine ownership and land-use practices in hawk activity areas.	1	continuing	LAND	.5	.5	.5	.5	.5
3.5. Increase the manageable land base for ferruginous hawks.								
3.5.1. Evaluate fee acquisition of key sites through purchase, land exchanges, or charitable donations.	3	as needed	WLM		1			1
3.2.2. Evaluate less-than-fee protection of land occupied by ferruginous hawks.	3	as needed	WLM		1			1
3.6. Prepare site-specific management plans	1	continuing	WLM					
3.7. Model habitat requirements	3							
Totals				**9**	**24.7**	**7**	**20.7**	**6**

Strategies / Tasks	Priority	Duration	Responsibility	Annual cost in thousands of $ 96	97	98	99	00
Enforce restrictions designed to protect ferruginous hawks.	1	continuing	ENF	5	5	2.5	2.5	2.5
Totals				**5**	**5**	**2.5**	**2.5**	**2.5**
Establish information management and retrieval systems.								
5.1. Maintain repository for ferruginous hawk records.	1	annual	WSDM	1.5	1.5	1.5	1.5	1.5
5.2. Update Priority Habitats and Species maps	2	annual	HAB	1	1	1	1	1
5.3. Produce ferruginous hawk status review.	2	annual	WLM	.5	.5	.5	.5	.5
Totals				**3**	**3**	**3**	**3**	**3**
Develop public information and education programs.								
6.1. Develop educational materials.	1	continuing	IMR	5	1	3	1	1
6.2. Promote media contact.	2	continuing	IMR	1	1	1	1	1
Totals				**6**	**2**	**4**	**2**	**2**
Initiate research to facilitate and enhance recovery efforts.	2	annual	RES	20	20	20	20	20
7.1. Determine metapopulation dynamics of the state population.		to be determined	RES					
Totals				**20**	**20**	**20**	**20**	**20**
Coordinate and cooperate with public agencies and other landowners.								
8.1. Review regulations influencing hawk habitat and populations.	2	1 year	WLM	1				
8.2. Provide management recommendations to landowners.	2	continuing	HAB	.5	.5	.5	.5	.5
8.3. Create information exchange network between appropriate agencies.	2	continuing	WSDM	.5	.5	.5	.5	.5
8.4. Secure funding to support recovery activities	1	continuing	ALL	Done as part of other tasks.				
Totals				**2**	**1**	**1**	**1**	**1**
Prepare for direct population management.								
9.1. Release adult or juvenile hawks in hacking programs		as needed	WLM	Not estimated; emergency task.				
9.2. Use foster parents in the wild		as needed	WLM	Done with other tasks.				
Totals								
GRAND TOTALS				**73**	**81.7**	**65.5**	**77.2**	**62.5**

Appendix A. Specimens of ferruginous hawks or their eggs collected in Washington. An asterisk (*) indicates the collector name is uncertain; initials indicate original holder of collection.

Date	Locality	County	Collector(s)[a]	Notes[b]	Reference or Specimen No.[c]
27 Jun 1918	Wallula	Walla Walla	SGJ	F, juv	USNM 272970
28 Sep 1921		Benton		M, sub-adult	PSM 05990
16 May 1924	unknown	Franklin	DEB?	M	unpubl. notes
9 Apr 1925	near Pullman	Whitman	not on tag	M	UMMZ 62264
22 Jan 1926	Spokane	Spokane	unknown	?	Bent 1937:292
16 Oct 1928	Kiona	Benton	FRD	F	UWBM 11429
22 Oct 1928		Benton		F, sub-adult	PSM 05991
22 Apr 1928	W of Eltopia	Franklin	FRD	egg set of 5	WFVZ 148766
10 Apr 1929	Gobb Mtn, 72 km N of Kiona	Benton	FRD CEM	egg set of 2	WFVZ 147435
20 Apr 1929	Webber Canyon, SE of Kiona	Benton	FRD	egg set of 4	WFVZ 87821
12 Apr 1931	Whitcomb	Benton	FRD[d]	egg set of 5	WFVZ 148764
12 Apr 1931	Erie?	Benton	FRD	egg set of 3	WFVZ 148765
18 Apr 1931		Benton		egg set of 2	PSM 13328
26 Apr 1931		Benton		egg set of 3	PSM 13326
20 Apr 1932	unknown	Benton?	CEM	egg set of 4	WFVZ 148767
22 Apr 1932		Franklin		egg set of 3	PSM 13323
22 Apr 1932	28 km NE of Pasco	Franklin	LKC	egg set of 3	WFVZ 43225
23 Apr 1933		Franklin		egg set of 4	PSM 13334
8 Apr 1934	Ellensburg	Kittitas	REW*	M	UWBM 17187
16 May 1934	Eltopia	Franklin	DEB*	M br.	UWBM 11428
1 Apr 1935	Lind	Adams	REW*	F	UWBM 17188
6 Apr 1935	16 km NW of Kiona	Benton	WEG EFR FRD	egg set of 4	WFVZ 66325
7 Apr 1935	11.2 km E of Kiona	Benton	EFR WEG	egg set of 4	WFVZ 66321
31 Dec 1935	unknown	Columbia	SHL	unknown	DEB notes
15 Apr 1937	Allard	Benton	JBH	egg set of 3	WFVZ 27711
7 Apr 1940		Benton		egg set of 6	PSM 13331
6 Apr 1941		Benton		egg set of 4	PSM 13335
12 Apr 1942		Benton		egg set of 5	PSM 13332
11 Mar 1943		Walla Walla		F	PSM 17700
6 Jun 1946	Macall	Adams	GEH	nestling	CRCM 46-126
9 Jun 1946	Macall	Adams	GEH	M	CRCM 46-143
19 Jun 1946	Macall	Adams	RGJ	M, juv	CRCM 46-170
19 Jun 1946	4.8 km E of Macall	Adams	RGJ	M, nestling	CRCM 46-203
18 Apr 1952	near Prosser	Benton	WJS	F	LSUMZ 39184
18 Apr 1952	near Prosser	Benton	ENH	egg set of 3	WFVZ 4175
18 Apr 1952	near Prosser	Benton	ENH	egg set of 5	WFVZ 4176
18 Apr 1952	near Prosser	Benton	WJS	egg set of 3	WFVZ 141093
24 Jul 1954	9.6 km SW of Benge	Adams	GEH	ad	CRCM 54-238
29 Apr 1958	3.2 km NW of Pullman	Whitman	GAG	M	CRCM 58-110
2 Jun 1974	3.6 km NE of Kahlotus	Franklin	GAM DB LB	ad? skeleton	CRCM 78-31
4 Jun 1976	1.6 km S of Washtucna	Adams	GAM	ad?	CRCM 83-193
1 Jun 1978		Benton		F, sub-adult	PSM 10142
12 Jun 1992	near Pasco	Franklin	BA	M	CRCM 93-173
no date		Benton		egg set of 1	PSM 13311

Notes for Appendix A.

[a] Collectors were B. Anderson, D. Beery, L. Boyd, D. E. Brown, L. K. Couch, F. R. Decker, G. A. Granger, W. E. Griffee, E. N. Harrison, G. E. Hudson, J. B. Hurley, R. G. Jeffrey, S. G. Jewett, E. A. Kitchin, C. E. McBee, G. A. Murray, W. J. Sheffler, R. E. West.

[b] M = male, F = female, juv = juvenile.

[c] Specimens deposited in the following museums:

CRCM:	Conner Museum, Washington State University, Pullman
LSUMZ:	Museum of Natural Science, Louisiana State University, Baton Rouge
PSM:	Slater Museum of Natural History, University of Puget Sound, Tacoma
UMMZ:	Museum of Zoology, University of Michigan, Ann Arbor
USNM:	National Museum of Natural History, Smithsonian Institution, Washington, D.C.
UWBM:	Burke Museum, University of Washington, Seattle
WFVZ:	Western Foundation of Vertebrate Zoology, Camarillo, Calif.

[d] Collected for F. R. Decker by Saxan, a road surveyor.

The following museums were contacted, but held no specimens:
American Museum of Natural History
California Academy of Sciences
Carnegie Museum
Central Washington University
Cleveland Museum of Natural History
Cornell University
Milwaukee Public Museum
Museum of Comparative Zoology
Natural History Museum of Los Angeles County
Peabody Museum
The University of Montana Zoological Museum
University of Oregon Museum of Natural History
Virginia Museum of Natural History at Virginia Tech
Whitman College

Appendix B. Washington Administrative Code 232-12-297. Section 11 addresses Recovery Plans.

WAC 232-12-297 Endangered, threatened, and sensitive wildlife species classification.

PURPOSE

1.1 The purpose of this rule is to identify and classify native wildlife species that have need of protection and/or management to ensure their survival as free-ranging populations in Washington and to define the process by which listing, management, recovery, and delisting of a species can be achieved. These rules are established to ensure that consistent procedures and criteria are followed when classifying wildlife as endangered, or the protected wildlife subcategories threatened or sensitive.

DEFINITIONS

For purposes of this rule, the following definitions apply:

2.1 "Classify" and all derivatives means to list or delist wildlife species to or from endangered, or to or from the protected wildlife subcategories threatened or sensitive.

2.2 "List" and all derivatives means to change the classification status of a wildlife species to endangered, threatened, or sensitive.

2.3 "Delist" and its derivatives means to change the classification of endangered, threatened, or sensitive species to a classification other than endangered, threatened, or sensitive.

2.4 "Endangered" means any wildlife species native to the state of Washington that is seriously threatened with extinction throughout all or a significant portion of its range within the state.

2.5 "Threatened" means any wildlife species native to the state of Washington that is likely to become an endangered species within the forseeable future throughout a significant portion of its range within the state without cooperative management or removal of threats.

2.6 "Sensitive" means any wildlife species native to the state of Washington that is vulnerable or declining and is likely to become endangered or threatened in a significant portion of its range within the state without cooperative management or removal of threats.

2.7 "Species" means any group of animals classified as a species or subspecies as commonly accepted by the scientific community.

2.8 "Native" means any wildlife species naturally occurring in Washington for purposes of breeding, resting, or foraging, excluding introduced species not found historically in this state.

2.9 "Significant portion of its range" means that portion of a species' range likely to be essential to the long term survival of the population in Washington.

LISTING CRITERIA

3.1 The commission shall list a wildlife species as endangered, threatened, or sensitive solely on the basis of the biological status of the species being considered, based on the preponderance of scientific data available, except as noted in section 3.4.

3.2 If a species is listed as endangered or threatened under the federal Endangered Species Act, the agency will recommend to the commission that it be listed as endangered or threatened as specified in section 9.1. If listed, the agency will proceed with development of a recovery plan pursuant to section 11.1.

3.3 Species may be listed as endangered, threatened, or sensitive only when populations are in danger of failing, declining, or are vulnerable, due to factors including but not restricted to limited numbers, disease, predation, exploitation, or habitat loss or change, pursuant to section 7.1.

3.4 Where a species of the class Insecta, based on substantial evidence, is determined to present an unreasonable risk to public health, the commission may make the determination that the species need not be listed as endangered, threatened, or sensitive.

DELISTING CRITERIA

4.1 The commission shall delist a wildlife species from endangered, threatened, or sensitive solely on the basis of the biological status of the species being considered, based on the preponderance of scientific data available.

4.2 A species may be delisted from endangered, threatened, or sensitive only when populations are no longer in danger of failing, declining, are no longer vulnerable, pursuant to section 3.3, or meet recovery plan goals, and when it no longer meets the definitions in sections 2.4, 2.5, or 2.6.

INITIATION OF LISTING PROCESS

5.1 Any one of the following events may initiate the listing process.

5.1.1 The agency determines that a species population may be in danger of failing, declining, or vulnerable, pursuant to section 3.3.

5.1.2 A petition is received at the agency from an interested person. The petition should be addressed to the director. It should set forth specific evidence and scientific data which shows that the species may be failing, declining, or vulnerable, pursuant to section 3.3. Within 60 days, the agency shall either deny the petition, stating the reasons, or initiate the classification process.

5.1.3 An emergency, as defined by the Administrative Procedure Act, chapter 34.05 RCW. The listing of any species previously classified under emergency rule shall be governed by the provisions of this section.

5.1.4 The commission requests the agency review a species of concern.

5.2 Upon initiation of the listing process the agency shall publish a public notice in the Washington Register, and notify those parties who have expressed their interest to the department, announcing the initiation of the classification process and calling for scientific information relevant to the species status report under consideration pursuant to section 7.1.

INITIATION OF DELISTING PROCESS

6.1 Any one of the following events may initiate the delisting process:

6.1.1 The agency determines that a species population may no longer be in danger of failing, declining, or vulnerable, pursuant to section 3.3.

6.1.2 The agency receives a petition from an interested person. The petition should be addressed to the director. It should set forth specific evidence and scientific data which shows that the species may no longer be failing, declining, or vulnerable, pursuant to section 3.3. Within 60 days, the agency shall either deny the petition, stating the reasons, or initiate the delisting process.

6.1.3 The commission requests the agency review a species of concern.

6.2 Upon initiation of the delisting process the agency shall publish a public notice in the Washington Register, and notify those parties who have expressed their interest to the department, announcing the initiation of the delisting process and calling for scientific information relevant to the species status report under consideration pursuant to section 7.1.

SPECIES STATUS REVIEW AND AGENCY RECOMMENDATIONS

7.1 Except in an emergency under 5.1.3 above, prior to making a classification recommendation to the commission, the agency shall prepare a preliminary species status report. The report will include a review of information relevant to the species' status in Washington and address factors affecting its status, including those given under section 3.3. The status report shall be reviewed by the public and scientific community. The status report will include, but not be limited to an analysis of:

7.1.1 Historic, current, and future species population trends.

7.1.2 Natural history, including ecological relationships (e.g., food habits, home range, habitat selection patterns).

7.1.3 Historic and current habitat trends.

7.1.4 Population demographics (e.g., survival and mortality rates, reproductive success) and their relationship to long term sustainability.

7.1.5 Historic and current species management activities.

7.2 Except in an emergency under 5.1.3 above, the agency shall prepare recommendations for species classification, based upon scientific data contained in the status report. Documents shall be prepared to determine the environmental consequences of adopting the recommendations pursuant to requirements of the State Environmental Policy Act (SEPA).

7.3 For the purpose of delisting, the status report will include a review of recovery plan goals.

PUBLIC REVIEW

8.1 Except in an emergency under 5.1.3 above, prior to making a recommendation to the commission, the agency shall provide an opportunity for interested parties to submit new scientific data relevant to the status report, classification recommendation, and any SEPA findings.

8.1.1 The agency shall allow at least 90 days for public comment.

8.1.2 The agency will hold at least one public meeting in each of its administrative regions during the public review period.

FINAL RECOMMENDATIONS AND COMMISSION ACTION

9.1 After the close of the public comment period, the agency shall complete a final status report and classification recommendation. SEPA documents will be prepared, as necessary, for the final agency recommendation for classification. The classification recommendation will be presented to the commission for action. The final species status report, agency classification recommendation, and SEPA documents will be made available to the public at least 30 days prior to the commission meeting.

9.2 Notice of the proposed commission action will be published at least 30 days prior to the commission meeting.

PERIODIC SPECIES STATUS REVIEW

10.1 The agency shall conduct a review of each endangered, threatened, or sensitive wildlife species at least every five years after the date of its listing. This review shall include an update of the species status report to determine whether the status of the species warrants its current listing status or deserves reclassification.

10.1.1 The agency shall notify any parties who have expressed their interest to the department of the periodic status review. This notice shall occur at least one year prior to end of the five year period required by section 10.1.

10.2 The status of all delisted species shall be reviewed at least once, five years following the date of delisting.

10.3 The department shall evaluate the necessity of changing the classification of the species being reviewed. The agency shall report its findings to the commission at a commission meeting. The agency shall notify the public of its findings at least 30 days prior to presenting the findings to the commission.

10.3.1 If the agency determines that new information suggests that classification of a species should be changed from its present state, the agency shall initiate classification procedures provided for in these rules starting with section 5.1.

10.3.2 If the agency determines that conditions have not changed significantly and that the classification of the species should remain unchanged, the agency shall recommend to the commission that the species being reviewed shall retain its present classification status.

10.4 Nothing in these rules shall be construed to automatically delist a species without formal commission action.

RECOVERY AND MANAGEMENT OF LISTED SPECIES

11.1 The agency shall write a recovery plan for species listed as endangered or threatened. The agency will write a management plan for species listed as sensitive. Recovery and management plans shall address the listing criteria described in sections 3.1 and 3.3, and shall include, but are not limited to:

11.1.1 Target population objectives.

11.1.2 Criteria for reclassification.

11.1.3 An implementation plan for reaching population objectives which will promote cooperative management and be sensitive to landowner needs and property rights. The plan will specify resources needed from and impacts to the department, other agencies (including federal, state, and local), tribes, landowners, and other interest groups. The plan shall consider various approaches to meeting recovery objectives including, but not limited to regulation, mitigation, acquisition, incentive, and compensation mechanisms.

11.1.4 Public education needs.

11.1.5 A species monitoring plan, which requires periodic review to allow the incorporation of new information into the status report.

11.2 Preparation of recovery and management plans will be initiated by the agency within one year after the date of listing.

11.2.1 Recovery and management plans for species listed prior to 1990 or during the five years following the adoption of these rules shall be completed within five years after the date of listing or adoption of these rules, whichever comes later. Development of recovery plans for endangered species will receive higher priority than threatened or sensitive species.

11.2.2 Recovery and management plans for species listed after five years following the adoption of these rules shall be completed within three years after the date of listing.

11.2.3 The agency will publish a notice in the Washington Register and notify any parties who have expressed interest to the department interested parties of the initiation of recovery plan development.

11.2.4 If the deadlines defined in sections 11.2.1 and 11.2.2 are not met the department shall notify the public and report the reasons for missing the deadline and the strategy for completing the plan at a commission meeting. The intent of this section is to recognize current department personnel resources are limiting and that development of recovery plans for some of the species may require significant involvement by interests outside of the department, and therefore take longer to complete.

11.3 The agency shall provide an opportunity for interested public to comment on the recovery plan and any SEPA documents.

CLASSIFICATION PROCEDURES REVIEW

12.1 The agency and an ad hoc public group with members representing a broad spectrum of interests, shall meet as needed to accomplish the following:

12.1.1 Monitor the progress of the development of recovery and management plans and status reviews, highlight problems, and make recommendations to the department and other interested parties to improve the effectiveness of these processes.

12.1.2 Review these classification procedures six years after the adoption of these rules and report its findings to the commission.

AUTHORITY

13.1 The commission has the authority to classify wildlife as endangered under RCW 77.12.020. Species classified as endangered are listed under WAC 232-12-014, as amended.

13.2 Threatened and sensitive species shall be classified as subcategories of protected wildlife. The commission has the authority to classify wildlife as protected under RCW 77.12.020. Species classified as protected are listed under WAC 232-12-011, as amended.

Appendix C. Responses to written comments received during Recovery Plan review, organized by plan section.

Section	Comment *Response*
Description	Suggest using "morph" rather than "phase", which implies a temporary condition. Tail bands of young are gray, not brown. Comment on size dimorphism between adult male and female. *These details have been addressed.*
Geographic Distribution	The distribution map is confusing. Use a scale bar instead of latitude and longitude. *The map has been considerably altered.*
	What is the reason for relating hawk distribution to Water Resource Inventory Areas? *WRIA's reflect features in the landscape, rather than political boundaries, so they seem appropriate for managing wildlife populations. Many people remain unfamiliar with WRIA's, however, so they have been largely abandoned in favor of discrete units that are more readily recognized (e.g., Juniper Dunes, Hanford Site, Esquatzel Coulee).*
	British Columbia has nesting birds (a few pairs). *This small population is now mentioned.*
	Add detail to North American range description and add more of a regional context. *The general range map is adequate for this plan. Details on hawk populations in adjacent areas of Oregon, Idaho, and British Columbia have been added.*
Natural History	Clarify meaning of "occupied" and "active" territories; the term active is falling out of use. What is meant by "occupied territories successful"? *A survey early in the nesting season (May) reveals whether a hawk territory is "occupied" by one or more adults. If so, the territory is "active" when eggs have been laid and "inactive" when no evidence of egg-laying exists. An active territory is considered successful if at least one egg hatches. Productivity and reproductive success are measures of the number fledged young.*
	Explain the apparent decrease in productivity over time. *Table 2 presents data from 7 years of occupancy and productivity surveys. The number of young fledged per territory was 2.6 in 1978 and 1981, but has not exceeded 1.9 in recent years. The trend is negative, but may not be significant. Importantly, methods of gathering information on reproductive success have changed through time, so the data may not be comparable. A research task to investigate a possible reduction in productivity has been added.*
	Clarify susceptibility of ground nests to predation. *Success at ground nests is often lower than at elevated nests, presumably because predation by mammals (e.g., coyotes) is higher. However, in one study higher*

success was reported for ground nests. This was attributed to the stability of the nest.

How often is nest failure wrongly assumed when nests are empty during productivity checks?
Rarely, surveyors hope. Many nests are accessible from the ground after the breeding season, so biologists inspect them for signs of use. Presence of prey remains, pellets, droppings, and feathers generally means the nest was used for much of the season. The absence of such signs might suggest failure. To increase accuracy of productivity estimates, timing of survey visits is critical. Ideally, biologists check the nest after young reach an age of 31 days, but before they fledge about 10 days later.

Jackrabbits may be far less abundant now than when Bowles and Decker (1931) reported they were predominant at ferruginous hawk nests.
This is apparently true. A recent broad-ranging prey study revealed few rabbit remains at Washington ferruginous hawk nests, suggesting a shift in prey selection since the days of Bowles and Decker. Long-term effects of the absence of a prominent, high-biomass prey species are unknown.

Nest attentiveness is related to prey abundance.
Adult hawks that travel long distances to obtain prey to feed their young cannot be as attentive as those that capture prey near the nest site. Although hawks sometimes situate their nests away from prey populations (Roth and Marzluff 1989, Leary 1996), protecting habitat near the nest may increase the territory's ability to support prey populations, thereby increasing long-term territory viability.

Prey base is important to home range size.
Details from a recent study on this topic have been added.

Discuss intraspecific territoriality.
Data on intraspecific spacing of breeding pairs has been added.

Additional information is now available on home range and post-fledging behavior in Washington.
The information has been added.

Present data on reoccupancy rates.
A section on the rate of reoccupancy and its importance has been added.

Although young hawks may be fed birds by adults, this may not be a general principle.
The section on nestling diet has been revised.

Mention the importance of wintering ecology.
A paragraph has been added. A research task to investigate winter range of hawks that breed in Washington has been added.

Are productivity differences by nest type related to nest structure or habitat?
This topic has not been specifically investigated.

Provide additional details on nomadism.
Nomadic behavior in this species is speculative.

Report specific foraging success rates in certain habitats.
This information has not been reported. Wakeley (1978a,b,c) pointed out that foraging success would be influenced not only by habitat, but also by prey density and hunting methods.

Is there any further information on prey caching?
The causes and effects of prey caching in ferruginous hawks have not been specifically studied. Smith and Murphy (1978) suggested prey caching occurred when prey were abundant.

What is the importance of nest exposure?
In general, nest exposure can assist in thermoregulation. In this species, it may be relatively unimportant. Several researchers have reported exposure information, but no rangewide pattern is apparent. Many ferruginous hawks nest in situations where their young are exposed to sun throughout the day.

Population Status

Regarding metapopulation dynamics: is Washington's population a source or sink?
Insufficient data are available. A research task to explore this question has been added.

The Canada population is estimated to be 2000 to 4000 nesting pairs.
Noted.

What region was covered by the Christmas Bird Count analysis?
The region is now identified in the text.

Habitat Status

What are the specific effects of grazing on hawk prey and habitat?
Grazing's effects are uncertain beyond those already stated.

Does fire modify vegetation in a way that is detrimental to hawks?
Fire destroys sagebrush, which is often a component of ferruginous hawk territories. In addition, hawks apparently do not hunt in cheatgrass landscapes. As this introduced grass invades disturbed areas (such as those left by fire), hawks may lose foraging opportunities.

Why, if the Hanford Site has such good shrubsteppe, have ferruginous hawks "avoided"the site?
Although the Hanford Site includes relatively undisturbed shrubsteppe components, it may not provide all features desired by ferruginous hawks. The recent exploitation of powerline towers suggests that nest sites may have been limiting in the past. However, a recent model assessed habitat quality for ferruginous hawks nesting on Hanford Site. According to the model, only 0.2% of the habitat is excellent, 1.4% is good, 6.6% is fair, and 91.8% is poor (Nugent 1995).

Have the various artificial platforms installed in several areas been used by hawks?
Yes. Details on platform use have been added.

	Grassland availability is limiting the Alberta population. *Noted.*
Conservation Status	What is the relevance of the captive breeding/rearing discussion? *Although no captive programs are expected to be used for recovery, circumstances may arise where eggs, chicks, or adults will benefit from a period in captivity. The section has been revised to include the potential for rehabilitation of injured hawks.*
	Additional information on artificial structures is available. *Citations have been added.*
	Status in Canada has changed from threatened to vulnerable. *The change has been noted.*
	Shade is not important for artificial nest structures. *No mention of shading structures has been retained.*
Factors Affecting Continued Existence	Provide more information on disturbance experiments. *Additional detail has been added.*
Recovery Objectives	Does averaging population estimates over 5 years (population objective) account for possible prey cycles? *Yes.*
	Don't most recovery plans contain a productivity objective? *The state's first two recovery plans, for upland sandpiper and snowy plover, had productivity objectives based on demographic studies. Equivalent research has not been completed for the ferruginous hawk. However, this long-lived species is less sensitive than shorebirds to short-term fluctuations in productivity. A research task has been added to study population dynamics, in particular to measure productivity and recruitment into the state population.*
	The population objective seems arbitrary. How exactly does the small increase relate to a population objective? How does the population objective relate to the total of more than 200 territories known in the state? *No biologists offered an estimate of population size until 20 years ago, but there is no evidence that this species was once significantly more abundant than the population objective. Not all territories in the state are active in a given year. Why some territories remain unoccupied for several years merits investigation.*
	Why would a recovered population require additional habitat for movement and expansion? *The recovery objective does not equate with carrying capacity. Habitat protection outside of occupied territories would allow continued growth of the population, as well as providing hawks with alternate areas for nesting and foraging should current habitat become unable to support the species. However, the questioned passage has been deleted.*

	What is meant by "distributed to reflect probable historic conditions"? *Reaching the population objective in a restricted range could leave the population vulnerable to unpredictable, catastrophic events. Also, a recovered population should be found across much of its historic range.*
Recovery—Monitoring	Detail the monitoring plan. *More specific information on surveys has been added.*
Recovery—Protection	Access restrictions into August are very conservative. *A conservative approach is desirable in Washington until further information on post-fledging dispersal becomes available.*
	Use specifics for buffer zones. *Ferruginous hawk responses to disturbance vary by individual and by type of disturbance. To account for all variables under every circumstance would require buffer distances that would be unrealistic in many cases. The plan presents results of disturbance and home range studies to provide biologists with guidance when preparing site-specific recommendations for buffer distances.*
Recovery—Habitat	Emphasize tasks that will protect habitat benefitting additional species. Manage habitat not currently occupied by hawks. *The Department has increased multi-species management at a landscape level.*
	The discussion on the desirability of natural rather than artificial nest structures is appreciated. Encourage natural nesting/perching structures over artificial platforms. Stress the value of planting trees now to provide nest structures in the future. *The preference for protecting and providing natural nest structures has been emphasized.*
	Be site-specific in habitat management. *Agreed.*
	Strengthen the recovery task to mitigate effects of converting shrubsteppe to agriculture. *This activity is best addressed through landscape management, rather than being emphasized within a single-species recovery plan. Because specific effects of conversion on ferruginous hawks are unclear, the general recommendations have been retained.*
	What are the benefits of the recommended grazing regime? *Overgrazing native shrubsteppe can reduce animal populations that may be prey for hawks.*
	Providing basket nests in trees is an effective management tool. *This technique has been emphasized.*

Recovery—Research	Tail mounts are better than backpacks for radio packages; solar radios are still too large for ferruginous hawks. *The section has been revised.*
	Many new chemicals on the market have unknown effects on wildlife; evaluate potential toxicity of these contaminants and track sources of impacts. *A research task has been added to address these concerns.*
Recovery—General	Identify specific changes in the ferruginous hawk's status that would trigger various management actions. *Annual tasks are identified in the Implementation Schedule. Tasks may be initiated at any time, but it is frequently difficult to undertake a task strictly due to a specific change in population status. Implementing recovery tasks is often limited by available funds and competing priorities.*
	The text of the plan should explicitly state priorities; they are hidden in the implementation schedule. The arrangement of strategies and tasks does not reflect ferruginous hawk conservation priorities. *This plan follows a standard format developed for all state recovery plans. Priorities are assigned in the implementation schedule for ease of reference. These suggestions will be considered if the recovery plan format is revised.*
Appendix	What museums were contacted and had no hawk specimens? *A footnote answering this question has been added.*
Tables	Captions for tables 1 and 2 are confusing. *The captions have been rewritten.*
	Various tables report inconsistent totals for number of territories. *Slightly different subsets of data were used for tables, resulting in different totals. Table captions now identify the limits of each data set.*
	Restructure the prey table so as not to list items twice. *Done.*

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