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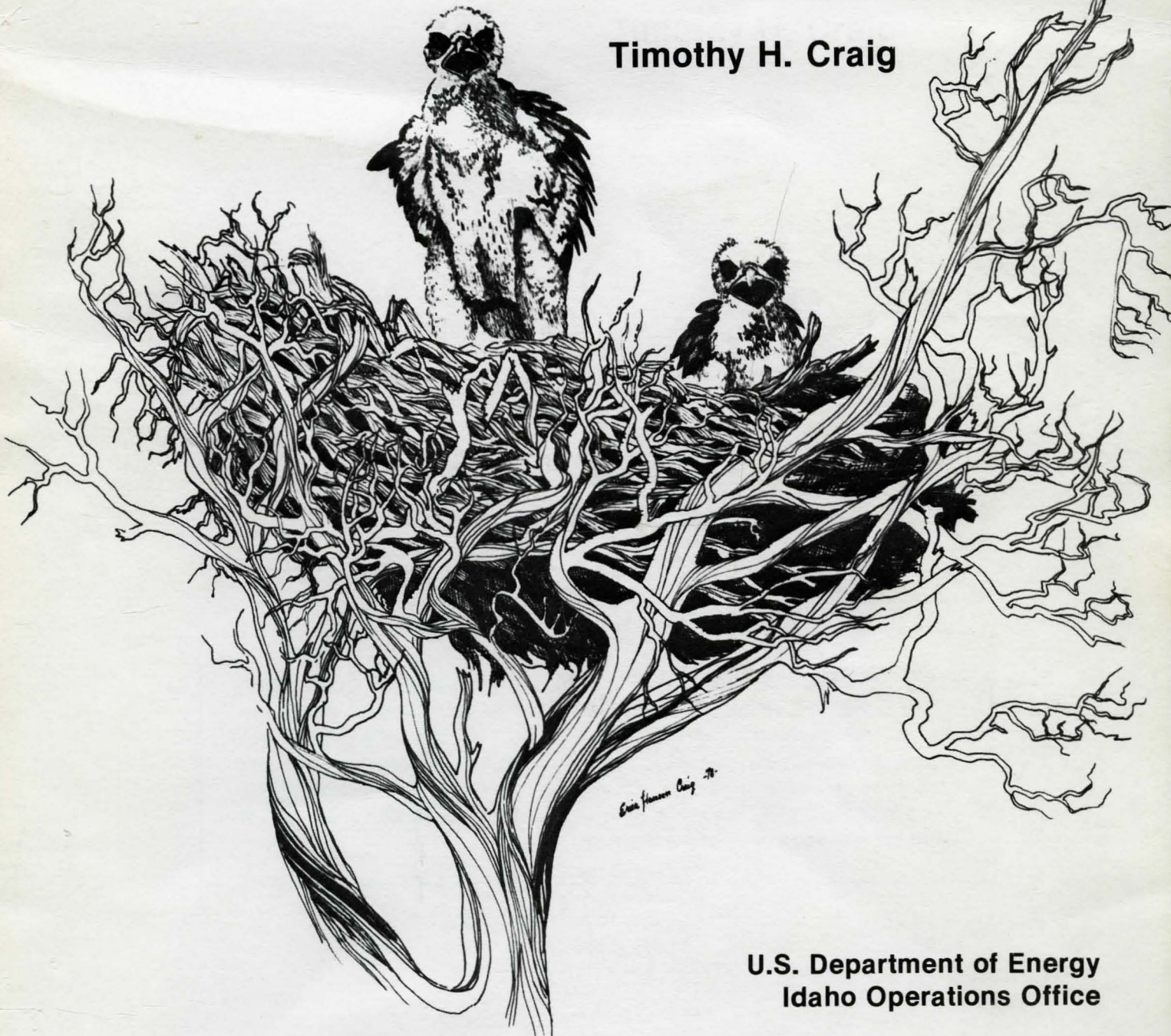
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The Raptors of the Idaho National Engineering Laboratory Site

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Timothy H. Craig



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THE RAPTORS OF THE IDAHO
NATIONAL ENGINEERING LABORATORY SITE

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ABSTRACT

From 1974 through 1976 base line data were gathered on the raptors which occur on the Idaho National Engineering Laboratory (INEL) Site. The INEL Site is a National Environmental Research Park on the Snake River Plain in southeastern Idaho. Thirteen species were observed on the INEL Site during the non-breeding seasons. American Rough-legged Hawks (Buteo lagopus), American Kestrels (Falco sparverius), Golden Eagles (Aquila chrysaetos), and Prairie Falcons (Falco mexicanus) were the most numerous. Marsh Hawks (Circus cyaneus), Ferruginous Hawks (Buteo regalis), Red-tailed Hawks (Buteo jamaicensis), Swainson's Hawks (Buteo swainsoni), Great Horned Owls (Bubo virginianus), Short-eared Owls (Asio flammeus), Merlins (Falco columbarius), Cooper's Hawks (Accipiter cooperii), the endangered Bald Eagle (Haliaeetus leucocephalus) and the endangered Peregrine Falcon (Falco peregrinus) were all observed on the INEL Site during the nonbreeding seasons although less frequently. Most raptors were seen in early morning and most were perched on tops of power poles. American Rough-legged Hawks and American Kestrels were commonly observed in agricultural lands while Prairie Falcons and Golden Eagles were usually seen in areas of native vegetation.

Nesting species of raptors on the INEL Site include American Kestrels, and Long-eared Owls (Asio otus), which are the most numerous breeding raptors on the INEL Site. Ferruginous Hawks, Merlins, Prairie Falcons, Red-tailed Hawks, Swainson's Hawks, Golden Eagles, Great Horned Owls and Burrowing Owls (Speotyto cunicularia) also nest on or near the INEL Site.

The nesting ecology of American Kestrels, Long-eared Owls, Prairie Falcons, Red-tailed Hawks, Swainson's Hawks, Golden Eagles and Great Horned Owls on the INEL Site in 1975 and 1976 are summarized in this report. The decline of nesting Ferruginous Hawks, Golden Eagles and Red-tailed Hawks on and near the INEL Site is discussed.

The Idaho National Engineering Laboratory Site is an important area for the study of raptors and contains a natural, undisturbed reservoir of nesting and wintering raptors. Several species nest on the INEL Site while many more, including two endangered species, winter on or migrate over the study area. Since the INEL Site is largely undisturbed, it is an excellent place to determine the relationship of raptors to their prey and to measure the effects of man's activities on the surrounding desert ecosystem.

The cover of this report is a drawing of young Ferruginous Hawks in a nest located in the southern part of the Idaho National Engineering Laboratory Site. Because of a recent decline in the number of Ferruginous Hawks on the Site, this nest was one of only a few on the site to successfully fledge young. Erica Hansen Craig, 504 Central Sugar, Nampa, Idaho drew the cover illustration.

INTRODUCTION

Raptors are important indicators of environmental contamination (Olendorff, 1973a) as their food consists of primary and secondary consumers which may concentrate some pollutants (Odum, 1971). Raptors may also be used as bioindicators of radioactive contamination (Olendorff, 1973b, Craig, et al., in press). Therefore, monitoring raptor populations is important to humans. The biological magnification of harmful contaminants, destruction of habitat and a multitude of other factors has caused a decline in raptor populations (Olendorff, 1973a). Consequently, it is important to monitor raptor population fluctuations and to try to safeguard these species.

The objectives of this research were to determine the species, abundance, nest site selection and some specific nesting parameters of raptors on the Idaho National Engineering Laboratory (INEL) Site. Since public visitation on the INEL Site is restricted, it serves as an ideal area for determining "base line" data on raptor populations in southeastern Idaho. The information generated by this study can be used to note changes in raptor populations on the INEL Site and to be included in Site environmental impact statements.

ACKNOWLEDGEMENTS

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STUDY AREA

The INEL Site is a 2315 km² government reservation on the upper Snake River Plain. The area is a cool desert (Odum, 1971) and big sagebrush (*Artemisia tridentata*) - grass vegetation types are predominant (Harniss and West, 1973). The average elevation of the INEL Site is 1524 m and the topography is flat to rolling. The INEL Site is bordered on the north by mountain ranges. Three water courses and their valleys open onto the Site from these mountains.

The characteristic vegetation of the Snake River Plain is interrupted along the Big Lost River by the cottonwood trees (*Populus deltoides*) which grow along its banks. These trees range in size from saplings to well over 9 m tall and they occur sporadically along the lower part of the river.

The mean precipitation in one place on the study area (Central Facilities Area - CFA) over a ten year period ending in 1963 was 20.9 cm with the greatest amount (3.6 cm) occurring in May while the low (1.3 cm) occurred in July. The mean temperature during this time was 5.8°C (Yanskey et al., 1966).

My observations on the INEL Site took place in 1975 and 1976. The spring of 1975 was cool and wet, while the spring of 1976 was comparatively warm and dry. In the nesting season (March through August) the average precipitation was 14.7 cm in 1975 and 12.6 cm in 1976, and the average temperature was nearly 2°C lower in 1975 than in 1976. The months of April and May averaged 4.5°C and 5.8°C cooler in 1975 than 1976 and the average precipitation was 0.3 cm and 0.2 cm greater for those months in 1975 than 1976, according to the National Oceanographic and Atmospheric Administration records for the Central Facilities Area.

MATERIALS AND METHODS

The raptor survey, utilizing an automobile, began on 20 November 1974. Each survey began after 0800 (M.S.T.) and all surveys were completed by 1435 h. An attempt was made to drive the survey only on calm, dry days. Surveys were conducted twice a month, but they were not evenly spaced throughout the month because of variations in weather conditions.

The route (Fig. 1) was driven (direction was alternated on each survey) at an average speed of 45 km ph, and all raptors observed were recorded. Data on location, activity and perch-site were noted. The survey was discontinued from 25 May to 30 August 1975 and 29 May 1976 as most migrant raptors had left the study area and nesting raptors were sedentary. Thirty-two surveys were conducted; 14 from 20 November 1974 to 25 May 1975 and 18 from 30 August 1975 to 29 May 1976. A total of 5984 km were driven during the more than 130 hours of surveying (187 km/survey).

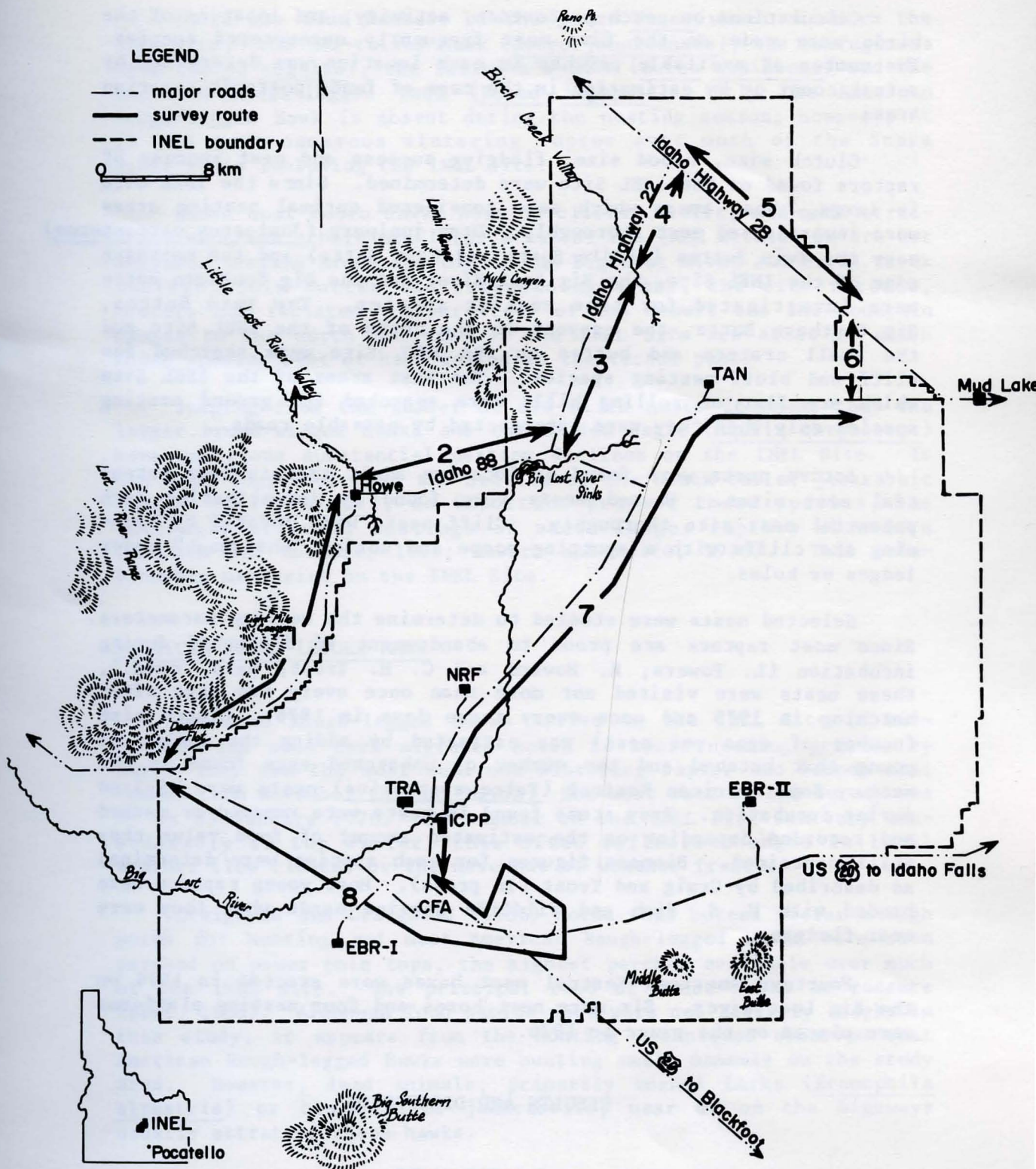


Fig. 1. Map of the Idaho National Engineering Laboratory Site showing prominent land marks and the car survey route used in 1974-1976.

Calculations on perch-preference, activity, and location of the birds were made on the five most frequently encountered species. The number of available perches in each location was determined by actual count or by estimation in the case of fence posts in agrarian areas.

Clutch size, brood size, fledging success and nest success of raptors found on the INEL Site were determined. Since the INEL Site is large, those areas which were considered optimal nesting areas were investigated most thoroughly. Utah junipers (Juniperus osteosperma) near the Twin Buttes (Middle Butte and East Butte) and the northern edge of the INEL Site, the Big Lost River and the Big Southern Butte were investigated for tree nesting species. The Twin Buttes, Big Southern Butte, the canyons to the north of the INEL Site and the small craters and buttes on the INEL Site were searched for cliff and bluff nesting species. The vast areas of the INEL Site which are flat or rolling hills were searched for ground nesting species only when they were intersected by passable roads.

Active nests were found by locating adult raptors near potential nest sites. Unused nests were found by investigating each potential nest site thoroughly. Cliff nests were located by scanning the cliffs with a spotting scope and noting "whitewash" under ledges or holes.

Selected nests were studied to determine the nesting parameters. Since most raptors are prone to abandonment if disturbed during incubation (L. Powers, R. Howard and C. H. Trost, pers. comm.), these nests were visited not more than once every two days after hatching in 1975 and once every three days in 1976. Clutch size (number of eggs per nest) was estimated by adding the number of young that hatched and the number of unhatched eggs found in the nest. Some American Kestrel (Falco sparverius) nests were visited during incubation. Prey items found in nests were removed or marked and recorded depending on the estimated amount of food value they still contained. Biomass figures for each species were determined as described by Craig and Trost (In press). Most young raptors were banded with U. S. Fish and Wildlife Service bands when they were near fledging.

Fourteen American Kestrel nest boxes were erected in 1974 on the Big Lost River. Six more nest boxes and four nesting platforms were placed on the river in 1976.

RESULTS AND DISCUSSION

SOARING HAWKS

These birds have broad wings with rounded tips. They hunt from perches or dive on prey from a soar (Robbins, et al., 1966).

There are four members of the genus Buteo which occur on the INEL Site: the Red-tailed Hawk (Buteo jamaicensis), the Ferruginous Hawk (Buteo regalis), the Swainson's Hawk (Buteo swainsoni) and the American Rough-legged Hawk (Buteo lagopus). Only the American Rough-legged Hawk is absent during the nesting season; however, it is the most numerous wintering raptor over much of the Snake River Plain including the INEL Site.

Since most buteo hawks nest on cliffs, bluffs, man-made structures or trees, there are large areas of the INEL Site which are not suitable nesting areas for them. The Big Lost River and Birch Creek Valleys, Twin Buttes and surrounding areas, the cinder cones, craters and isolated juniper trees of the desert and the mountain ranges to the north and east of the INEL Site are areas in which these species nest or have nested in the recent past.

Judging from the number of old stick nests it seems that the larger broad-winged hawks and the Golden Eagle (Aquila chrysaetos) have undergone substantial nesting declines on the INEL Site. It has been suggested that the decline of the black-tailed jackrabbit (Lepus californicus), an important prey of these species, has adversely affected nestings of these larger raptors elsewhere (Beecham and Kochert, 1975; Howard and Wolfe, 1976). This relationship may exist on the INEL Site.

AMERICAN ROUGH-LEGGED HAWK

American Rough-legged Hawks arrive on the INEL Site in mid-October and most have migrated north to their nesting grounds by May. They are the most numerous wintering raptor and become most common from November through March. The most seen in one survey was 37 on 29 January 1976. The number on the INEL Site can vary considerably in the winter; this often reflects changes in local weather (low clouds) or the movement of weather fronts.

Craighead and Craighead (1956) noted that buteos prefer a high perch for hunting and most American Rough-legged Hawks were seen perched on power pole tops, the highest perches available over much of the INEL Site. The principal food of these hawks is rodents (Bent, 1938). Although food habits data were not actively sought in this study, it appears from the hunting techniques observed that American Rough-legged Hawks were hunting small mammals on the study area. However, dead animals, primarily Horned Larks (Eremophila alpestris) or black-tailed jackrabbits, near or on the highways usually attracted these hawks.

American Rough-legged Hawks were seen most frequently in section 2 of the survey route and next most frequently in section 6 (Fig. 1). Both of these areas traversed farming lands, which may be good hunting areas. In addition, section 2 contained 24.7% of the

total perches on the survey. American Rough-legged Hawks were seen in equal abundance over much of the rest of the route except in sections 7 and 8 where they (as well as other raptors) were infrequently seen.

FERRUGINOUS HAWK

The largest buteo in North America is the Ferruginous Hawk. This plains buteo arrives on the INEL Site in mid-March and leaves in September. Old nests have been found around the Twin Buttes, the Big Lost River, Kyle Canyon, the craters near the intersection of Idaho routes 88 and 22 and Idaho routes 20 and 26, the crater southeast of East Butte and near Idaho 88 and 22 and Deadman's Flat. There are at least 35 nests on the INEL Site which are thought to be old Ferruginous Hawk nests. Two of the nests were on ledges in craters, the rest were in trees.

During this study Ferruginous Hawks successfully nested in three areas. They laid a total of 11 eggs and hatched 11 young, 10 of which fledged from the nests (Appendix 1). The nests were on the Big Lost River and near Kyle Canyon. In six other areas, Ferruginous Hawks repaired nests (added sticks or lined the nest cup); however, the hawks did not lay eggs. In one of these areas, adult Ferruginous Hawks stayed near the nest site for 197 days. Since there were few active nests and many old nests (some attended by Ferruginous Hawks), it appears that a decline in the number of nesting Ferruginous Hawks has occurred on the INEL Site.

Since the status of the Ferruginous Hawk is undetermined and there is concern that the populations are declining, these nests were not visited frequently. Thus strong data on the food habits of Ferruginous Hawks on the INEL Site is lacking. Of 30 prey items that were collected from the nests, 50% were northern pocket gophers (*Thomomys talpoides*), 37% were Townsend's ground squirrels (*Spermophilus townsendii*) and 13% were birds (Appendix 2). Howard and Wolfe (1976) found that Ferruginous Hawks preyed heavily on black-tailed jackrabbits when they nested in desert shrub habitat, whereas northern pocket gophers and Townsend's ground squirrels were found most frequently in nests located in crested wheatgrass (*Agropyron cristatum*)-alfalfa (*Medicago sativa*) vegetation types. These authors further suggest that the decline in the black-tailed jackrabbit population on their study areas was a factor in limiting Ferruginous Hawk populations. Black-tailed jackrabbit populations also declined on the INEL Site (Stoddart, 1976) and probably caused reduced nestings there also.

RED-TAILED HAWK

The Red-tailed Hawk is one of the most common nesting large raptors over much of North America. However, on the INEL Site only

a few nests were found. The parts of the study area which contain trees or cliffs are the only potential nesting sites for these buteos. The Big Lost River, Twin Buttes, and the surrounding area which contains juniper trees are the only areas where Red-tailed Hawk nests have been found, although there may be nests along the mountains to the north and east of the INEL Site.

In 1976 a Red-tailed Hawk nested along the upper Big Lost River on the INEL Site. The nest was in the same cottonwood tree in which a pair of American Kestrels nested successfully in a nest box. The Red-tailed Hawk laid one egg between 10 May and 25 May, but abandoned the nest by 9 June.

There are a number of old stick nests in the juniper tree area around the Twin Buttes. Most are located in tall trees which were inside the grove, typical of Red-tailed Hawk nest sites. There are at least 10 of these nests and most are in the same stage of disrepair indicating that perhaps all were active within a few years of each other.

Red-tailed Hawks do not winter on the INEL Site but occur there from April through November. Since these hawks winter in southeastern Idaho, it appears that the environment on the INEL Site during the winter may be too harsh to support Red-tailed Hawks.

SWAINSON'S HAWK

The Swainson's Hawk is the smallest and most numerous broad-winged hawk which nests on the INEL Site. Although these hawks nest in juniper trees in juniper-sagebrush (Artemisia spp.) ecotones in Idaho (pers. observation), all nests that have been found on the study area were along water courses in cottonwood trees or adjacent to agricultural areas.

Swainson's Hawks arrive on the INEL Site in late April and early May and depart in August and September. Since these hawks lay eggs in mid-May, courtship behavior begins shortly after they arrive. Young hatch in late June, and the nestlings fledge in early August.

Nine successful and three unsuccessful Swainson's Hawk nests were found on the Site from 1974 to 1976, most along the Big Lost River. The unsuccessful nests resulted from either windstorms or predators. During the study, Swainson's Hawks produced at least 26 eggs from which 19 young fledged (Appendix 1). As with Ferruginous Hawks, a number of old Swainson's Hawk nests were attended by adults throughout the year but no nesting occurred.

Most of the prey remains (N = 54) found in Swainson's Hawk nests (Appendix 2) were montane voles (Microtus montanus) (N = 22).

However, three nests adjacent to agricultural lands contained 20 of the montane voles. Mammals comprised 72.2% of the diet of Swainson's Hawks of the INEL Site and birds comprised 27.8%. The second most numerous mammal found in Swainson's Hawks nests was the Townsend's ground squirrel. All of the ground squirrels were from the same nest also showing heavy reliance on a local prey population. Apparently diets of Swainson's Hawks also vary in other areas as Oldendorff (1973a) found that birds were the most important prey species of Swainson's Hawks. Dunkle (1977), on the other hand, found that 68% of the vertebrate prey taken by Swainson's Hawks in Wyoming were mammals and 25% were birds.

GOLDEN EAGLE

The largest raptor that nests on the INEL Site is the Golden Eagle. Although no Golden Eagle nested successfully on the study area in 1975 or 1976, a number of old nests believed to be Golden Eagle nests were found. Golden Eagles generally nest in trees or cliffs. All old nests found on the INEL Site were cliff nests. The nests are large (1.5 m in diameter) and made of sagebrush twigs with a nest cup of innerbark (sagebrush or juniper trees). In the 1960's a pair of large raptors believed to be Golden Eagles built a nest atop a sagebrush bush near Mud Lake, Idaho (Rodger Jensen, pers. comm.). The nest was destroyed by sheep herders and the birds were not known to have re-nested in subsequent years.

Two eagle nests were located in cliffs on the northwest side of the Middle Butte. Although no Golden Eagles were seen there during the study, the presence of fresh whitewash around the nest sites indicates that some large raptor, perhaps a Golden Eagle, visited the nests in 1975 and 1976. These nests were very close together whereas the remnants of a third were further away. These were probably all alternate nests in the same territory, as Golden Eagles often build more than one nest in a territory (McGahan, 1968). Golden Eagles have also nested near the INEL Site on Big Southern Butte. Two old nests were found on the north and south sides of the butte but both nests were quite old and showed no sign of recent activity. West of the INEL Site boundary, an old Golden Eagle nest was found and a pair of immature birds were seen in courtship flight (see Brown and Amadon, 1968) over the cliff in late April. They were not seen when the area was revisited the next month.

In 1976 an active Golden Eagle nest was found in Eight Mile Canyon north of Deadman's Flat. The nest was southwest of the Eight Mile Canyon road and on a sheer cliff near the top of the range. Another active nest was found in 1976 in the mouth of the Little Lost River Valley. Two eggs, which is the usual clutch size for Golden Eagles (Bent, 1938), were laid in this nest. Both eggs hatched and one of the young fledged, the other young was found dead

beneath the nest cliff. An old Golden Eagle nest was found in a canyon north of Reno Point in Birch Creek Valley. This nest was in good repair, but no birds were seen in the vicinity during the 1976 nesting season.

No food habits data were collected on the INEL Site for Golden Eagles, but small mammals, mainly lagomorphs and rodents, appear to be the dominant prey species elsewhere (Snow, 1973). Beecham and Kochert (1975) suggest that availability of nest sites, adequate prey and minimum territory size regulate Golden Eagle populations in the Snake River Birds of Prey area near Boise, Idaho. Since there are a number of unused nests and territories on the INEL Site, it appears that the reduced prey population on the study area probably has resulted in a decline in nesting Golden Eagles, as has been reported in Nevada by Seibert, et al., (1976).

Golden Eagles are year-round residents on the INEL Site, but there are many more on the study area during the winter than the summer. Most were observed in the mouth of the Birch Creek Valley or in the mouth of the Little Lost River Valley. In January, 1971, an INEL worker counted Golden Eagles between Idaho Chemical Processing Plant (ICPP) and Test Area North (TAN) on four separate trips. On two trips from the Naval Reactor Facility (NRF) to TAN he observed 42 and 17 eagles respectively whereas on two trips from ICPP to TAN he observed 21 and 7 eagles, respectively (Tom Smith, pers. comm.). During the survey of 1974 to 1976 Golden Eagles were rarely seen on this section of road and only 0.08 birds/km were seen over a 53 km length of route which included the ICPP to TAN stretch. Since the black-tailed jackrabbit population had not declined in 1971, it is probable that the prey population on the INEL Site regulates wintering numbers of Golden Eagles. It appears that the INEL Site provides important wintering habitat for Golden Eagles when prey are available.

LONG-WINGED HAWKS

Falcons have long, pointed wings and usually capture prey by a fast pursuing flight. Five species in the genus Falco occur or are suspected to occur on the INEL Site sometime during the year. The Gyrffalcon (Falco rusticolus) and the Peregrine Falcon migrate over the INEL Site. Gyrffalcons have not been observed on the INEL Site, but they winter in southeastern Idaho and probably are found on the study area. I observed a Gyrffalcon 8 km west of Arco, Idaho in December, 1978. Prairie Falcons nest on and around the INEL Site and American Kestrels nest wherever nest sites are available on the study area. The Merlin was found to nest in one location in 1975, however, in 1976 the nest site was vacant. Since few Merlins nest anywhere in Idaho (Craig and Renn, 1977), this observation is unique.

North American falcons do not build their own nests but use nests of other birds or lay their eggs in depressions (scrapes) in cliffs, hollows, or man-made structures (Brown and Amadon, 1968). On the INEL Site, falcons have been found nesting in cliffs (Prairie Falcons and American Kestrels), on man-made structures or in hollow trees (American Kestrels), and in old Black-billed Magpie (Pica pica) nests (American Kestrels and Merlins). Prey remains found in falcon nests on the INEL Site were largely bird remains although small mammals, reptiles and insects were also preyed upon.

PRAIRIE FALCON

The Prairie Falcon is the largest falcon which nests on the INEL Site. In 1974 it was classified as a threatened species, but its status was changed since the population appears stable. Ogden and Hornocker (1977) report that in 1970, 1971 and 1972 the birds in the Snake River canyon (now the Snake River Birds of Prey Refuge) were at a high density, and this local population was stable or increasing. Prairie Falcons lay eggs in holes, or old stick nests on cliffs. The nest sites or eyries, are noticeable because of the whitewash (dried feces) which can be found beneath the entrance to the nest site. On and around the INEL Site most nests are on cliffs which are at least 6 m high and nearly vertical.

Prairie Falcons nested in seven nests on or around the INEL Site during this study, but young were fledged from only three. Of 36 eggs laid, only seven young fledged; the nests failed because of predation, removal of young by people and for unknown reasons.

Food habits of Prairie Falcons were not determined during this study since so few successful nests were found. Olendorff (1973a) found that thirteen-lined ground squirrels, Lark Buntings (Calamospiza melanocorys), Horned Larks and Western Meadowlarks (Sturnella neglecta) were commonly found in nests in Colorado. Enderson (1964) found Richardson's ground squirrels (Spermophilus richardsoni) and Horned Larks most frequently in Prairie Falcon nests. Snow (1974) reports in her literature review that these falcons feed mainly on ground squirrels and medium-sized birds.

Prairie Falcons are residents on the INEL Site and were seen in every month except December during the car survey in 1974, 1975 and 1976. Most birds were seen in mid-morning perched on power poles. Most birds (0.93 birds/km) were seen on Route 22 from the Big Lost River Sinks north to Birch Creek, an area adjacent to mountain cliffs where they nest.

We trapped and color-marked three adult and one immature Prairie Falcon in the Little Lost River Valley in mid-February, 1975 to determine if the wintering birds remained in the area and nested.

On 16 April one of the color-marked adult male Prairie Falcons was seen in the valley near the original trapping place. This evidence suggests that some birds remain in the area throughout the year (or move into the area earlier than mid-February); however, no color-marked Prairie Falcons were observed at any of the six known eyries in the Lower Little Lost River Valley.

Prairie Falcons are of interest to people ranging from amateur bird watchers to falconers. Although this interest is not likely to endanger the species as a whole, local populations can be adversely affected. For this reason Prairie Falcon nesting locations should be treated as confidential and known eyries near the INEL Site monitored loosely by responsible individuals to determine the effects of this "popularity".

AMERICAN KESTRELS

American Kestrels were the smallest falcons and one of the most numerous raptors which breed on the INEL Site. They did not winter on the study area but arrived in April and began nesting shortly thereafter. By mid-October the last birds were leaving the area and migrating groups of American Kestrels were seen perched along powerpoles at the base of the mountains to the northeast of the Site. Most birds were seen in sections 1, 2, 3 or 6 (Fig. 1) during the survey and most were perched on pole tops or crossarms. Sections 2 and 6 are farming areas and sections 1 and 3 are adjacent to the mountains northeast of the INEL Site.

American Kestrels nest around most of the INEL facilities, on the East Butte and perhaps on Middle Butte. Nests were found in the juniper areas around the Twin Buttes and probably occur in most of the craters where nest sites are available. Most of the nests studied were along the Big Lost River.

The mean clutch size of American Kestrel pairs along the river in 1975 and 1976 was 4.5 and 4.7 eggs/nest, respectively (Appendix 4). In 1975 a mean of 3.7 young hatched from these nests and in 1976 the mean was 4.0 young/nest. In both years all young which hatched also fledged (birds were assumed to have fledged if they were seen in the nest just prior to fledging).

The total number of nest sites available to American Kestrels also increased because more nest boxes were placed on the study area (7 in 1975 to 20 in 1976). American Kestrels nested in 3 boxes in 1975 and in 11 in 1976. Hamerstrom et al., (1973) also noted an increase in nesting American Kestrels after placing nest boxes on their study area. American Kestrels nested in trees at an average height of 2.7 ± 1.4 m and usually in cavities; however, in two instances, they used old Black-billed Magpie nests. Eight nest sites were reused in both 1975 and 1976, but it was not clear if they were reused by the same adults. One nest was in the same tree with a Long-eared Owl (*Asio otus*) nest, whereas another was in a tree where a Red-tailed Hawk nested.

American Kestrels preyed heavily on birds along the Big Lost River in both 1975 and 1976 (Appendix 5). Most were unidentified passerines or Western Meadowlarks. Smith, et al., (1972) found mammals to be the highest percent biomass in the diet of American Kestrels in Utah.

MERLIN

The Merlin has been recorded as a nesting species in Idaho three times (Stanley A. Temple, pers. comm.). All three records, based on museum specimens, were prior to 1913 and occurred in southeastern Idaho. Although the Merlin has not been recognized as a breeding bird in Idaho by recent publications (Burleigh, 1971; Larrison et al., 1967), nesting has been assumed by some ornithologists.

In 1975, I found an active Merlin nest near the INEL Site. The nest was in a Black-billed Magpie nest located in a juniper tree. The nest contained five eggs and from these three young fledged. On seven of nine visits to the nest, prey remains were found; they included 18 Mourning Doves (Zenaida macroura), three Horned Larks and two Western Meadowlarks.

OWLS

The owls which nest on the INEL Site are all nocturnal and feed predominately on mammals. They lay eggs in a variety of situations including old nests, burrows, cliffs or on man made structures; however, none build their own stick nests. All owls on the INEL Site are members of the family Strigiformes.

GREAT HORNED OWL

The largest owl which nests on the INEL Site is the Great Horned Owl. These owls nest near the nuclear facilities and in other areas which afford nest sites. This bird does not build its own nest but appropriates other raptor or Black-billed Magpie nests, cavities in cliffs, man-made structures or craters. Great-horned Owls are year around residents on the INEL Site and begin nesting earlier than any other raptors.

Seven Great Horned Owl nests were found on the study area in 1975 and 1976, and three of these were successful. The unsuccessful nests were due to predation and adverse weather conditions. Six young fledged from the successful nests in which at least seven eggs were laid. One nest was on the Big Lost River in a nesting platform

I had placed in a cottonwood tree. This suggests that artificial nest platforms may be useful management tools for this species. In early April, a Great Horned Owl laid three eggs in the nest and by 25 May there were three young in the nest, all of which fledged around 10 June. Other nests were on the East Butte and at Central Facilities Area (CFA) on man made structures. Great Horned Owls have been seen at Kyle Canyon and at the caves near Experimental Breeder Reactor II (EBR II) and Test Reactor Area (TRA) during the breeding season and all are probable nesting locations.

Only 11 prey items were recovered from nests during the study. Cottontail rabbits (Sylvilagus nuttalli) were found four times; while birds or mice composed most of the remainder. Of interest was a 20 cm rainbow trout (Salmo gairdneri) which was found in the nest near the Big Lost River. This unusual prey item was probably captured after the fish was trapped in a small pool of the river. Olendorff (1973a) found that most of the prey of Great Horned Owls in Colorado were small mammals with cottontail rabbits and northern pocket gophers occurring in nests most frequently.

LONG-EARED OWLS

Long-eared Owls are one of the most numerous breeding raptors on the INEL Site. Long-eared Owls were found on the Big Lost River throughout the year, but during the winter the number of birds was greatly reduced. Egg laying began in mid-April in 1976 and some late nests continued through the fourth week in May. The mean date of egg hatching for 11 nests was 25 May and of fledging, 14 July. The egg laying dates for various nests spanned 41 days. These dates are similar to those reported by Armstrong (1958) and Bent (1938).

In 1975, three Long-eared Owl nests were found to be active on the study area (0.12 Long-eared Owl nests/km of river), but in 1976 the number increased to 16 nests (0.6 Long-eared Owl nests/km of river) (Appendix 6). Long-eared Owls laid a mean of 3.0 and 5.3 eggs in 1975 and 1976, respectively, and from these 2.3 and 4.2 young hatched. Armstrong (1958) and Murray (1976) report similar clutch sizes, but Bent (1938) reports clutches of up to eight eggs. The largest clutch on the Big Lost River was six eggs. Two of the nests failed during incubation.

In 1975, two nests fledged 1.7 young per nest and in 1976, 4.1 young fledged per nest. Craighead and Craighead (1956) reported 4.3 young fledged per nest in Wyoming. Predation was verified at one nest each in 1975 and 1976. In the former case, the nest was destroyed; in the latter, one young Long-eared Owl died while four others fledged.

All Long-eared Owl nests were in or on old Black-billed Magpie nests along the Big Lost River. Twenty percent of all the Black-billed Magpie nests located near the river were used by Long-eared Owls and 88% had intact canopies when incubation began.

In 1976, a total of 97 prey remains were found at nest sites of Long-eared Owls, six of which were in castings (Appendix 7). Since I collected prey items every three days, they did not contain many of the prey which were counted as whole remains at the nest on the previous visit. The majority of the prey of Long-eared Owls was small mammals (97.2%), which is similar to other reports (Armstrong, 1958; Randle and Austing, 1952). Marti (1976) reports that northern pocket gophers account for only 0.7% of the known prey of Long-eared Owls in North America; however, along the Big Lost River 42.8% of the diet by biomass was northern pocket gophers.

Long-eared Owls nested along Birch Creek and one unsuccessful nest was inside the INEL Site boundaries. In both 1975 and 1976, dead Long-eared Owls were found along Idaho Routes 22 and 88 near Deadman's Flat and although no nests have been found in this area, the juniper trees there may be good nesting locations.

BURROWING OWL*

The Burrowing Owl is currently listed as a status undetermined species by the U.S. Department of the Interior. This monotypic species is found from southern Chile north to southern Canada. In North America, Burrowing Owls are generally found associated with plains, prairies, and deserts of the West. Very little information exists on the life histories, population densities, or migration patterns of the owls. In the midwest, where Burrowing Owls are largely dependent on prairie dogs (Cynomys ludovicianus) for nest sites, programs of small mammal eradication and outright habitat destruction have had serious effects on population levels (Olendorff 1973b; Martin 1973). In Idaho, Burrowing Owls are breeding residents of the Snake River Plateau, where rapid growth of human population and expansion of agriculture are drastically altering much of the habitat. The need for background information on population trends and ecology of Burrowing Owls, including assessments of the impact of habitat alterations, is becoming critical to insure the survival of these unique creatures.

Burrowing Owls arrive on the INEL Site and adjacent areas during the first weeks of April. By May, pairs have formed, burrows have been selected, and incubation of eggs has begun. Although the owls are not capable of excavating their own burrows, they are able to modify and expand abandoned mammal burrows. Most owls in the area utilized badger (Taxidea taxus) digs. However, during the summer of 1976, three pairs nested and successfully raised young in cavities in basalt outcroppings. The relative scarcity of suitable burrows in the INEL Site area may be an important limiting factor

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for the population. The 14 active pairs studied in 1976 showed no strong preference for any one habitat, and were found in open pastures in agricultural areas, adjacent to busy roadways, and in isolated areas of sagebrush.

Incubation lasts about 30 days, and by the first week of June young begin to emerge from their burrows. Twelve of the 14 pairs under observation produced at least 1 young; reproductive success based on brood counts averaged 4.7 young per breeding pair. Within three weeks the young were flying short distances and foraging for themselves. At this time, it was common for family groups to break up into two or three small groups, utilizing several burrows. Approximately 70% of the young birds survived through August and the average number of young fledged per pair was 2.9. Burrowing Owls have many potential predators: badgers, coyotes (Canis latrans), and the diverse population of large raptors in the area. Infanticide and fratricide may also be significant mortality factors.

Analysis of castings (regurgitated pellets) collected at burrows revealed that the owls utilize a wide variety of prey. During the early part of the summer, the adults rely mainly on the diverse population of small rodents: Ord's kangaroo rats (Dipodomys ordii), deer mice (Peromyscus maniculatus), Montane voles, Great Basin pocket mice (Perognathus parvus), and northern pocket gophers. As the summer progressed, insects became more available and were used to an increasing extent by the owls and were probably particularly important for the young. Grasshoppers, cicadids, scorpions, and ants were taken and, in addition, a vast array of beetles: ground beetles (Carabidae), carrion beetles (Silphidae), darkling beetles (Tenebrionidae), and scarab beetles (Scarabaeidae).

Burrowing Owls are migratory throughout the northern reaches of their range and usually depart from southern Idaho by the middle of October. The extent of their migration is not known, although large wintering populations are not commonly found north of southern Utah.

It is very difficult to assess the present status of Burrowing Owls because of the lack of background information. There seems to be an impression among some researchers (Olendorff 1973b; Zarn, 1974) that populations throughout the United States are declining. If this is the case, all possible measures should be taken to preserve existing areas which support populations and attempts continued to determine their habitat requirements.

MARSH HAWKS AND SHORT-EARED OWLS

Both Marsh Hawks and Short-eared Owls nest on the INEL Site. These raptors nest on the ground and feed largely on small mammals (Bent, 1938). Since their nest sites are difficult to find and the INEL Site is large, no attempt was made to locate nests of either

bird although some areas are suspected nestings sites. Marsh Hawks have been observed in courtship flight near the Test Reactor Area, Idaho Chemical Processing Plant and along the Big Lost River. Short-eared Owls have been frequently seen near the Central Facilities Area and along the Big Lost River during the breeding season. In 1976 a Marsh Hawk nest was found in the sanitary waste disposal pond at TRA (D. K. Halford, pers. comm.). These birds laid three eggs from which three young hatched and fledged.

Neither species wintered on the INEL Site although they were found in the more sheltered valleys to the northeast. Marsh Hawks moved onto the study area in April and were gone by November. My survey technique was not adequate to develop information on arrival and departure dates of Short-eared Owls but the few sightings that were made incidentally indicate they migrate at nearly the same time as Marsh Hawks.

UNIQUE RAPTOR SITINGS ON THE INEL SITE

The INEL Site is a large area which lies at the mouth of three major river valleys and along the northern edge of the Snake River Plain. During the migration periods, large numbers and varieties of birds move over the Site, as indicated by the waterfowl which accumulate each spring on the diversion ponds along the Big Lost River. Similarly, many species of raptors occur on the INEL Site at these times, some of which were sighted from 1974 through 1976 and are described below.

Hawks in the Genus Accipiter generally nest in wooded areas (Brown and Amadon, 1968). Although the nearest nesting habitat to the INEL Site for accipiters is the Big Southern Butte or in the mountains to the northwest, they do move across the area in spring and fall.

All three accipiters indigenous to North America, the Goshawk (Accipiter gentilis), the Cooper's Hawk (Accipiter cooperii) and the Sharp-shinned Hawk (Accipiter striatus) were observed on the INEL Site in fall and spring, either near the Big Southern Butte or along the edge of the mountains to the northwest. Additionally, the Goshawk and Cooper's Hawk were seen along the Big Lost River during the winter, suggesting that these species occur on the INEL Site most of the year except during nesting seasons.

The Bald Eagle, an endangered species, was observed in the Little Lost River Valley and Big Lost River Sinks area during the winter 1975 and 1976. Bald Eagles were also observed on Route 28 near Mud Lake, Idaho during the winter of 1976. No more than two birds were seen at one time and all birds were adults. I presume that because of the dearth of black-tailed jackrabbits (Stoddard,

1976) on the INEL Site, Bald Eagles were feeding on carrion during these winters. One was flushed from a dead pronghorn antelope (Antilocapra americana) in the Little Lost River Valley in 1975. Observations of Bald Eagles in the northern portion of the Site and along highway 28 are periodically reported during the winter months (O. D. Markham, pers. comm.). These areas may provide winter habitat for a limited number of Bald Eagles.

An Osprey (Pandion haliaetus) was observed on the Big Lost River near the Idaho Chemical Processing Plant on 7 May 1977. This bird remained near the river throughout that day but was gone by the next morning, probably migrating to a nesting area.

The Peregrine Falcon, an endangered species, was observed once during the study. An adult falcon was flushed from a power pole near the Big Lost River Sinks on 6 October 1975. The bird flew out over the INEL Site. Another large, bluish-gray falcon was seen near this area in October of 1974; however, no species identification was made. Although the Peregrine Falcon nests in Idaho, there is no suitable nesting habitat for this species on the INEL Site. A Peregrine Falcon has been observed more recently during late fall, 1978 near the site in the Little Lost River Valley. And another sighting was made during the winter of 1978-79 at the northern border of the INEL Site. (T. Reynolds, pers. comms.). It is postulated that prior to the recent decline in this species, Peregrine Falcons were frequent visitors to the Big Lost River Sinks area and northern portions of the Site during migration.

Two forest owls have been verified to occur on or around the INEL Site. A dead Saw-whet Owl (Aegolius acadicus) was on Idaho Route 22 near the northern edge of the INEL Site (Leon Powers, pers. comm.). This species is a woodland owl and although it was found in November, the bird was probably migrating over the area. Also an injured Saw-whet Owl was found at the ICPP in 1977. A Pygmy Owl (Glaucidium gnoma) was heard calling near the southern INEL Site border on two consecutive nights in April, 1976 (C. Trost, pers. comm.). I presumed that birds of this species were also migrating through the area.

Turkey Vultures (Cathartes aura) are not usually seen on the INEL Site, and there is little evidence to suggest that they nest near the study area. Four were seen on 25 July 1975 over the Big Southern Butte and they may have been a family group. The rocky canyons on the Big Southern Butte and the cliffs areas on the Twin Buttes seem to be good nest sites for these birds but no active nest sites were found.

CONCLUSIONS

The Idaho National Engineering Laboratory Site, as a National Environmental Research Park, is an important area for studying

raptors and as a natural reservoir for our dwindling raptor populations. Since the INEL Site remains essentially undisturbed, this controlled study area may be used to measure the effects of man's activities on a desert ecosystem. Although all faunal and floral forms are important in environmental monitoring, raptors as tertiary consumers, are especially noteworthy. Changes in distribution, nesting phenology, productivity, food habits and behavior of raptors may be an indication of general environmental health.

Similarly, the INEL Site is important as an area for raptor research. The Red-tailed Hawk, Ferruginous Hawk and Golden Eagle are all large raptors which were found to nest on the INEL Site. During this study there were no more than three nests of any of these species. Judging by the old nests on the INEL Site, it seems that the number of nesting pairs had decreased recently. A possible reason for this phenomenon is the concurrent decrease in a potential prey of these raptors, the black-tailed jackrabbit. If raptor and prey populations are simultaneously monitored over a number of breeding seasons this possible predator/prey relationship may be elucidated. Of particular interest would be any changes in nesting Ferruginous Hawks or Golden Eagles and wintering Bald Eagle or Golden Eagle numbers.

The INEL Site and surrounding areas are important as nesting and wintering areas for raptors at a time when man induced habitat destruction has caused a global decline in many raptorial species. This wildlife reservoir hosts 11 species of nesting raptors, among them the Ferruginous Hawk, Prairie Falcon, Burrowing Owl and Golden Eagle. Many other species hunt on the Site during migration or over-winter including the endangered Bald Eagle and Peregrine Falcon.

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Appendix 1. Productivity of Buteo Hawks on the INEL Site in 1974, 1975 and 1976.

		# eggs	# hatched	# young fledged	# successful nests	# unsuccessful nests	productivity
Swainson's Hawk	1974	ND ^a	ND	8	4	1	1.6
Swainson's Hawk	1975	4	2	2	1	1	1.0
Swainson's Hawk	1976	13	9	9	4	1	1.8
Red-tailed Hawk	1976	1	0	0	0	1	0.0
Ferruginous Hawk	1975	3	3	2	1	0	2.0
Ferruginous Hawk	1976	8	8	8	2	0	4.0

^a No data.

Appendix 2. Frequency of occurrence of prey found in Swainson's and Ferruginous Hawk nests on the INEL Site in 1975 and 1976.

	Swainson's Hawks		Ferruginous Hawks	
	N	%	N	%
Pygmy rabbit (<u>Sylvilagus idahoensis</u>)	2	3.7	0	0.0
Townsend's ground squirrel (<u>Spermophilus townsendii</u>)	8	14.8	15	50.0
Ord's kangaroo rat (<u>Dipodomys ordii</u>)	2	3.7	0	0.0
White-footed deer mouse (<u>Peromyscus maniculatus</u>)	3	5.6	0	0.0
Montane vole (<u>Microtus montanus</u>)	22	40.7	0	0.0
Horned Lark (<u>Eremophila alpestris</u>)	2	3.7	1	3.3
Least chipmunk (<u>Eutamias minimus</u>)	2	3.7	0	0.0
Northern pocket gopher (<u>Thomomys talpoides</u>)	0	0.0	11	36.7
Western Meadow Lark (<u>Sturnella neglecta</u>)	3	5.6	2	6.7
Black-billed Magpie (<u>Pica pica</u>)	2	3.7	0	0.0
Unidentified passerine	6	11.1	0	0.0
Sage Grouse (<u>Centrocercus urophasianus</u>)	1	1.9	1	3.3
Sage Thrasher (<u>Oreoscoptes montanus</u>)	1	1.9	0	0.0
TOTAL	54	100.1	30	100.0

Appendix 3. Productivity of Prairie Falcons on the INEL Site in 1975 and 1976.

Year	# eggs	# hatched	# young fledged	# successful nests	# unsuccessful nests	productivity
1975	8	8	3	1	1	1.5
1976	18	14	4	2	3	0.8

Appendix 4. Nesting data for American Kestrels along the Big Lost River on the INEL Site in 1975 and 1976.

	N	clutch size $\bar{X} \pm SD$	Mean to hatch	Mean to fledge
1975	13	4.5 ± 0.7	3.7 ± 1.8	3.7 ± 1.8
1976	23	4.7 ± 0.7	4.0 ± 1.8	4.0 ± 1.8

Appendix 5. Prey remains found in American Kestrel nests along the Big Lost River on the INEL Site in 1975 and 1976.

	1975	(9 nests) Biomass % (g) Biomass		1976	(10 nests) Biomass % (g) Biomass	
	N			N		
Ord's kangaroo rat (<u>Dipodomys ordii</u>)	0	0.0	0.0	1	55.5	1.8
White-footed deer mouse (<u>Peromyscus maniculatus</u>)	3	51.0	2.8	2	34.0	1.1
Montane vole (<u>Microtus montanus</u>)	0	0.0	0.0	7	241.5	7.6
Least chipmunk (<u>Eutamias minimus</u>)	3	234.0	12.9	13	1014.0	32.0
Northern pocket gopher (<u>Thomomys talpoides</u>)	0	0.0	0.0	1	76.0	2.4
Starling (<u>Sturnus vulgaris</u>)	0	0.0	0.0	3	180.0	5.7
Western Meadowlark (<u>Sturnella neglecta</u>)	8	768.0	42.4	12	1152.0	36.3
Common Flicker (<u>Colaptes auratus</u>)	1	100.0	5.5	0	0.0	0.0
Unidentified birds	15	360.0	19.9	15	360.0	11.4
Short horned lizard (<u>Phrynosoma douglassi</u>)	11	267.3	14.8	1	24.3	0.8
Sagebrush Lizard (<u>Sceloporus graciosus</u>)	6	18.0	1.0	7	21.0	0.7
Insects	12	12.6	0.7	11	6.6	0.2
TOTAL	59	1810.9	100.0	73	3164.9	100.0
% Mammal			15.7			44.9
% Bird			67.8			53.4
% Reptile			15.8			1.5

Appendix 6. Nesting data for Long-eared Owls along the Big Lost River on the INEL Site in 1975 and 1976.

	N	clutch size	Mean to hatch	Mean to fledge
		$\bar{X} \pm SD$	$\bar{X} \pm SD$	$\bar{X} \pm SD$
1975	3	3.0 $\pm$ 1.0	2.3 $\pm$ 0.6	1.7 $\pm$ 1.5
1976	15	5.3 $\pm$ 0.7	4.2 $\pm$ 1.9	4.1 $\pm$ 1.8

Appendix 7. Prey remains found in 13 Long-eared Owl nests on the INEL Site in 1976, compiled from prey and castings found at the nest.

	N	Biomass(g)	% Biomass
Ord's kangaroo rat (<u>Dipodomys ordii</u>)	10*(3)	555.0	16.5
White-footed deer mouse (<u>Peromyscus maniculatus</u>)	29 (9)	493.0	14.6
Montane vole (<u>Microtus montanus</u>)	14 (14)	483.0	14.3
Great Basin pocket mouse (<u>Perognathus parvus</u>)	19 (19)	285.0	8.5
Northern pocket gopher (<u>Thomomys talpoides</u>)	19 (14)	1444.0	42.8
Shrew (<u>Sorex</u> sp.)	1 (1)	18.0	0.5
Unidentified birds	4 (0)	96.0	2.8
Insect	1 (1)	0.6	less than 0.1
TOTAL	97 (61)	3374.6	100.0

*Remains found in castings.

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