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***Results of the 1981 Bald Eagle
Nest Survey in the Gulkana River
and Delta River Wildlife Habitat
Areas***

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Bureau of Land Management

Alaska

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Study Area

The study area encompassed the Gulkana River Wildlife Habitat Area (WHA) (1,132,300 acres) and the Delta River WHA (approximately 72,000 acres). This inventory was conducted in accordance with two BLM Habitat Management Plans (HMPs) which direct protection of bald eagle populations in these two drainages.

Gulkana River WHA

The Gulkana River WHA (Figure 1) is located approximately 35 road miles north of Glennallen, Alaska. It includes land in the Gulkana River drainage north and west of Sourdough. The area is virtually roadless although numerous Off-Road Vehicle (ORV) trails exist within it. Road access is limited to the eastern perimeter. The Gulkana River is composed of a Mainstem, a Middle Fork, and a West Fork. The West Fork has two branches.

Because of underlying permafrost and low relief, the southern third of the area (south of the West Fork) is poorly drained. Extensive boggy areas, numerous small lakes and interconnecting streams are the dominant features. Elevations generally range from 1800 to 2600 feet above sea level (a.s.l.) with occasional hills reaching over 3000 feet. Vegetation is characterized by bog species, such as black spruce (Picea mariana), shrub birch (Betula glandulosa, B. nana), willows (Salix sp.), and low ericaceous shrubs (Vaccinium uliginosum, V. vitis-idaea, Ledum groelandicum).

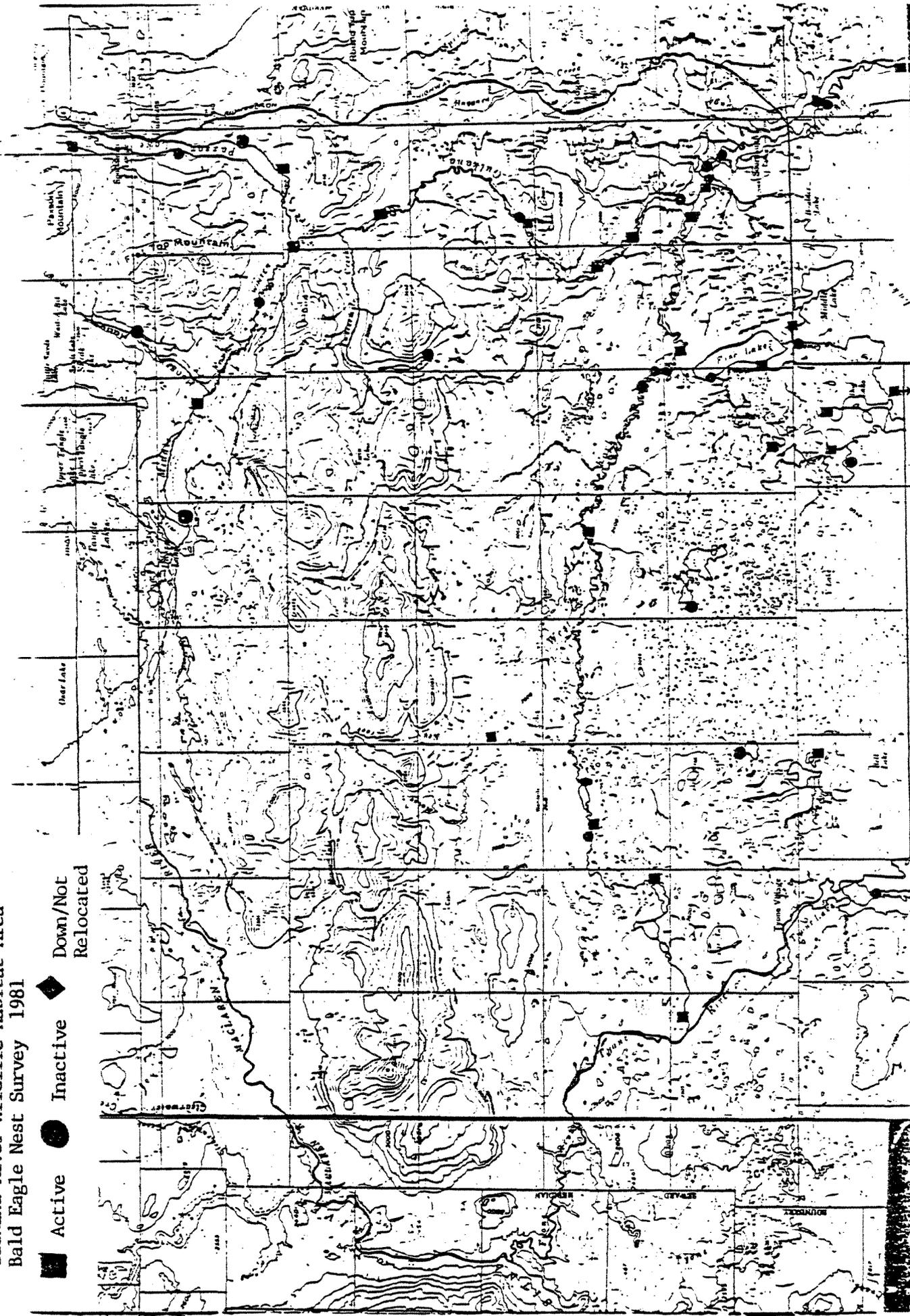
North of the West Fork, elevations range from 1900 to 5400 feet a.s.l. Hills and valleys are predominantly gently rolling except at the higher elevations, which can be quite steep. The vegetation above 3000 feet is dominated by dwarf birch, willow, and alder (Alnus sp.). Moist alpine tundra occurs at the higher elevations.

The upper reaches of the Middle Fork and Mainstem flow through a rich tundra community of low shrubs and cotton grass. Below 2600 feet elevation the vegetation grades into an upland spruce-hardwood forest of white spruce (Picea glauca), poplar (Populus balsamifera), and cottonwood (P. trichocarpa). The vegetation type along the West Fork and lower reaches of the Mainstem is a lowland spruce-hardwood forest of black spruce, paper birch (Betula papyrifera) and cottonwood.

Delta River WHA

The Delta River WHA (Figure 2) is located about 90 road miles north of Glennallen. Road access is possible from the Denali Highway at Tangle Lakes (mile 20) and by the Richardson Highway between mileposts 212 and 226 (from Phelan Creek to the Black Rapids Glacier). The area includes Tangle Lakes, the Delta River from the Tangle Lakes to the

Figure 1.
 Gulkana River Wildlife Habitat Area
 Bald Eagle Nest Survey 1981



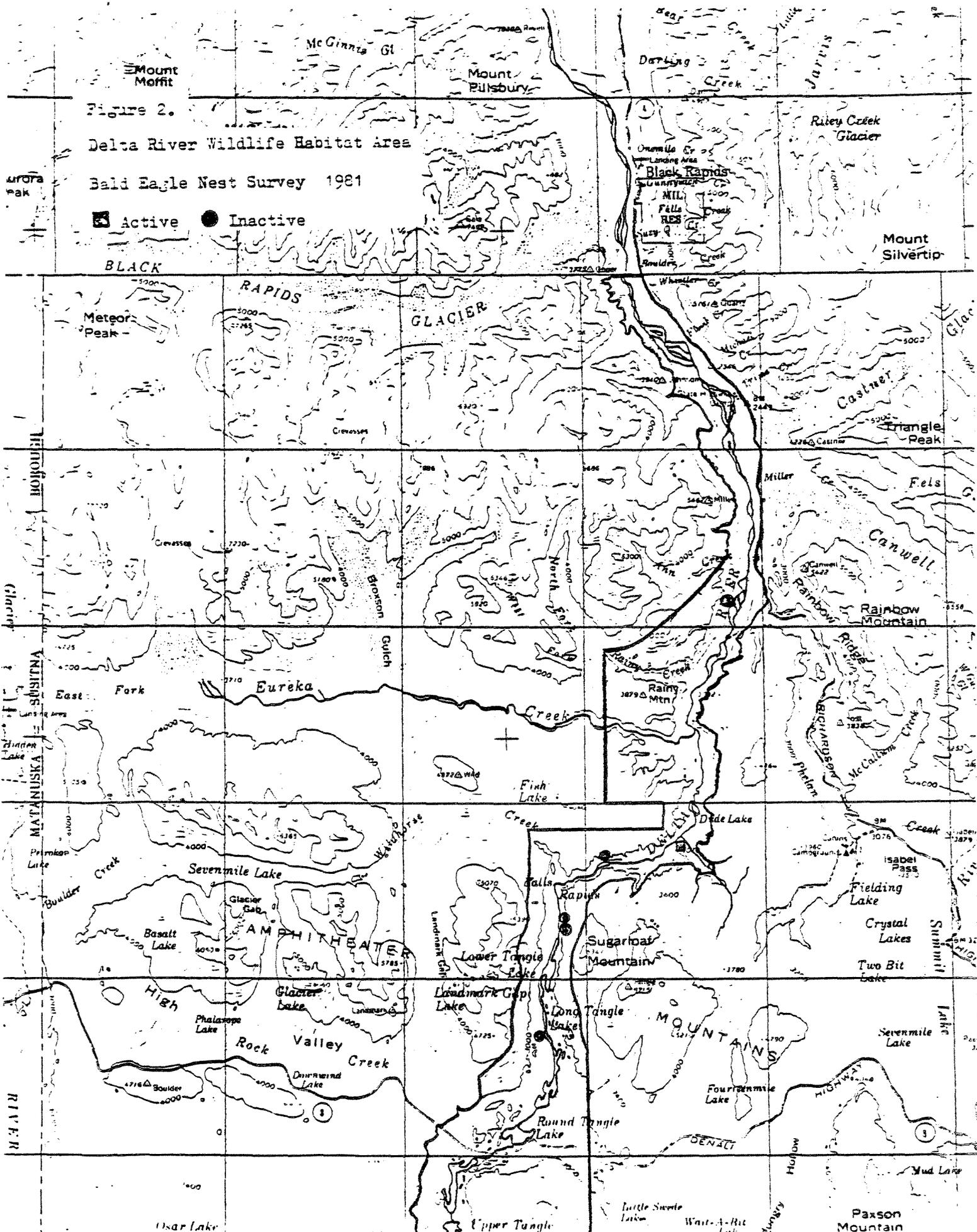


Figure 2.
 Delta River Wildlife Habitat Area
 Bald Eagle Nest Survey 1981

Active
 Inactive

BLACK

RAPIDS

GLACIER

Mount Silvertip

Meteor Peak

Castner

Triangle Peak

Fels

Canwell

Rainbow Mountain

East Fork

Eureka

Creek

Finch Lake

Dade Lake

Creek

Sevenmile Lake

Basalt Lake

AMPHITHEATER

Lower Tangle Lake

Sugarloaf Mountain

Fielding Lake

Crystal Lakes

Two Bit Lake

High

Glacier Lake

Landmark Gully

Long Tangle Lake

MOUNTAINS

Sevenmile Lake

Rock Valley Creek

Round Tangle Lake

Fourteenmile Lake

HIGHWAY

Usar Lake

Upper Tangle

Little Swede Lake

Walt-A-Bit Lake

Paxson Mountain

Black Rapids Glacier, and a corridor of land averaging two miles in width.

The Tangle Lakes are the headwaters of the Delta River. From these lakes the river flows north through the Amphitheater Mountains and the Alaska Range to the Tanana River. Topography is rugged with peaks reaching 6000 to 9000 feet in adjacent areas. The river is clear from Tangle Lakes to Eureka Creek, where cold, glacial, silt-laden water enters the river and changes the water quality for the rest of its course.

Shrub tundra is the dominant vegetation type for the entire WHA. This consists of dwarf birch, willow, and alder along with low ericaceous shrubs. Spruce-hardwood forest occurs where the drainage patterns are favorable, especially along the lower stretches of the river.

Methods

Aerial surveys were flown over both WHAs between 6/4/81 and 7/20/81. The majority of flights were in June during the eagle's incubation and early hatching periods. Flights totaling 24.5 hours of air time were required to complete the survey (21 hours in the Gulkana WHA and 3.5 hours in the Delta WHA). A Cessna 180 was used for most of the surveying. When the 180 was not available, a Cessna 185 or Piper Super Cub was utilized. The 180 seemed to be the best aircraft of the three for the job because it was slightly slower than a 185, a bit faster than a Super Cub, and extra observers could be used. An extra observer was a definite advantage.

Nests were numbered and pertinent information was recorded on Eagle Nest Tree Parameter Forms (Figure 3). Initially, a 1:250,000 map was used to plot nest and eagle locations. Because of the need to plot accurate locations, 1:63,360 series USGS maps were later utilized. Flight lines were traced on survey maps during the flights. Grid patterns were not used. Flights were chosen along wooded rivers, creeks, and lakes. Extensive, forested areas distant from water, and boggy areas without trees, i.e., the lake region, consisting of the southern third of the Gulkana WHA were not intensively surveyed. Approximately 90% (200,000 acres) of the WHAs estimated "eagle habitat" was inventoried. Because of the unusually rainy weather this season, the survey took over one month to complete. Clear, sunny days were utilized whenever possible.

When a nest was spotted, the pilot would circle the nest while information was recorded. Photos of nest and habitat were taken. Potential problems, such as nearby cabins or ORV trails, were noted. If a perched eagle was sighted, several passes would be flown in the

EAGLE NEST TREE PARAMETERS

1. ID NUMBER: _____
2. DATE: _____
3. OBSERVERS: _____
4. LOCATION: TOWNSHIP _____, RANGE _____, SEC. _____, MER. _____
5. ELEVATION: _____ . 6. DRAINAGE: _____
7. CIRCLE KIND OF EAGLE: BALD, GOLDEN, OR UNKNOWN

8. SPECIES OF TREE CONTAINING NEST: _____
9. HEIGHT OF NEST TREE: _____
10. DBH OF TREE: _____
11. DISTANCE OF TREE TO NEAREST WATER BODY: _____
12. AGE, SHAPE, & VIGOR OF TREE: _____
13. IS TREE DEAD ABOVE NEST (Y OR N); BELOW NEST (Y OR N)?
14. TREE'S ANGLE WITH GROUND: CIRCLE ONE--0-10°, 10°-30°, 30°-----
15. DIRECTION (S) OF FLIGHT APPROACH: _____
16. NEST TREE'S RELATIONSHIP TO STAND: _____
17. AGE, SPECIES, DENSITY, SIZE OF STAND: _____

18. HEIGHT OF NEST ABOVE GROUND: _____
19. EST. DIAMETER OF TREE AT NEST: _____
20. EXPOSURE (S) OF NEST: _____
21. ACTIVE NEST OR NOT: _____
22. HOW MANY EAGLES SEEN: _____
23. EST. DISTANCE OF NEST TO HUMAN ACTIVITY: _____
24. OTHER: _____

25. Visibility:
26. Accessibility:
 By foot
 By climbing
27. Habitat description:

28. Substrate and description of nest:
29. General observations:

Figure 3. Eagle nest parameter form.

vicinity to look for a nest.

In addition, three ground surveys were conducted using raft or canoe. This was done along the West Fork and Mainstem of the Gulkana River, and in the Delta River-Tangle Lakes area. Two nests were walked to from the highway system, and Paxson Lake nest #5 was reached by canoe. Nest trees were measured for diameter at breast height (dbh), distance from water, habitat description, ease of climbing and accessibility. Observations at active nests were also recorded. When weather was cold and wet, disturbance was kept to an absolute minimum. If nestlings were large and easily excitable the nest tree was not approached for fear of a bird jumping out of the nest.

It is felt that more reliable nest tree statistics could be gathered from the ground than from the air. Ground survey dates were as follows:

July 2-6 Mainstem Gulkana River (Byrne, Daum, Recreation Crew)

July 23-24 Delta River/Tangle Lakes (Byrne, Daum, Recreation Crew)

August 3-13 West Fork Gulkana River (Tindall, Fish, Dapkus, Kajdan)

July 15, Paxson Lake nests #1, #2, and #5. (Byrne, Daum)

Results

1. Percentage of Active Nests

Forty-nine nests were found in the total study area during the 1981 BLM Bald Eagle Survey (43 nests in the Gulkana WHA, and six in the Delta WHA). Additionally, six nests were found outside the study area, two active and four inactive. These six are not included in any calculations or tables presented here.

The percentage of active nests was 49% for the total study area, 53% for the Gulkana WHA and 17% for the Delta WHA (Table 1). Only one active bald eagle nest was found in the Delta WHA. Nesting activity does not indicate reproductive success, however.

Active nests were determined by aerially observing the presence of adult birds on the nest, or the presence of eggs or young in the nest; or by ground observations of adult behavior. Bald eagles sometimes defend nests that are not active (Robards and Hodges, 1976). Thus, some nests recorded as active may not actually have been so.

Table 1. Number and Percent Active Nests

area	#nests	#active nests	%active nests
Gulkana W.H.A.	43	23	53
Delta W.H.A.	6	1	17
Total	49	24	49

Ospreys (Pandion haliaetus) also occur in the study area, although only one adult was observed during the 1981 field season. The sighting was on Pork Chop Lake (Vermillion Lake) in the Alphabet Hills region. It is possible that one or more nests classified as a bald eagle nests may be an osprey nest.

2. Distribution of Nests

Bald eagle nest locations were plotted to determine the distribution patterns. Interestingly, the Delta River area has no recorded nests down river (north) from the nest located near Ann Creek (Figure 2), despite the many large spruce stands on both sides of the river for 15 miles north of this site. The Delta River is very silty and braided over this section. The resultant low availability of prey might explain the absence of nests.

The distribution pattern of eagle nests in the Gulkana WHA varies by area. The area north of the Alphabet Hills and west of the Middle Fork of the Gulkana River was not surveyed. Because this area contains few large trees, and no salmon, it would likely support a sparse population of eagles. The Middle Fork area had four nests recorded, only one of which was active, although nests were found up to Dickey Lake where the survey ended.

Nests were scattered throughout the West Fork drainage on both branches with the exception of one 25 mile middle section. The Paxson Lake/Gulkana River Mainstem also exhibits a scattered nest distribution. A high concentration of inactive nests was located on the Mainstem below its confluence with the West Fork.

The lake area south of the West Fork consists of approximately 468 square miles. In this area eight active eagle nests were recorded out of 13 total nests. Seven nests were sighted in the Fish Lake/deep Lake region; the other six nests were scattered over the remainder of the lake area.

King and red salmon (Onchorynchus tshawytscha, O. nerka) occur in the whole Gulkana River system with the exception of the south branch of the West Fork. Reds also occur through a portion of the lake region from Fish Lake to Crosswind Lake. Grayling (Thymallus arcticus), whitefish (Coregonus autumnalis), and burbot (Lota lota) occur in waters throughout the whole Gulkana WHA. Rainbow trout and steelhead (Salma gairdneri) occur on the Mainstem and to Dickey Lake on the Middle Fork. Lake trout (Salvelinus namaycush) inhabit many of the lake region waters. Correlations between eagle nest and fish distribution patterns would be valuable, as fish seem to be the primary food source for bald eagles in this area. Waterfowl nesting habitat may also be a factor influencing nest tree selection.

3. Nest Density

Nest density figures were calculated for the different areas (Table 2). Nest density in the riparian areas was calculated in nests per linear mile. In the lake area, nests per square mile calculations were used. Closest and farthest distances between active nests are presented by area.

For the density calculations, the Mainstem Gulkana River does not include Paxson Lake. Even so, the Mainstem Gulkana River had the highest density of total nests (.24 nests/mile), active nests (.13 active nests/mile) and closest distance between active nests (2 miles, a value shared with one location on the West Fork). The West Fork (both branches) had the lowest density of nests with .11 nest/mile. The Delta WHA had lowest density of active nests with .02 active nests/mile as only one active nest was found.

White spruce was the dominant nest tree species (86%) in the study area (Table 3). White spruce occurs most frequently along the water systems. There were substantial numbers of large cottonwoods, probably Populus balsamifera, but few contained bald eagle nests.

There are very few stands of trees in the Tangle Lakes region. Only one nest, an inactive ground nest, was found in 1981 in this section. Observation of two adult eagles perched approximately 1/2 mile up river on the lakeshore suggest that an active ground nest may occur in this relatively treeless area. An active ground nest was discovered and photographed by BLM personnel in 1979 in this area.

Forty-four percent of all nest trees were between 41' and 50' high, 48' being the average (Table 4). Of the nests in this height class, 76% were active. No active nests were in trees less than 30' tall, but six percent of the total nest trees were under 30' tall. (The one ground nest is included in this calculation.) Figure 4 depicts the percentages of active nests within a nest tree height class.

4. Location of Nests

The average distance from a nest tree to a water body was 127'. Sixty-one percent of the trees were located within 100' of water. Nest trees either 11'-50' or 401+' from water had the highest percentage of active nests. (Table 5).

The elevation of nests was also determined and the average nest elevation over the entire study area was 2350'. Gulkana WHA eagle nests had an average elevation above sea level of 2292', compared to the higher 2758' average elevation for the Delta WHA nests. Table 6 shows that active nests are found at a slightly lower average elevation

Table 2. Nest Density for Different Areas

Area	River Miles	Miles Surveyed	Nests per mile	Active Nests per mile	Maximum Dist. Btwn Act. Nests	Closest Dist. Btwn Act. Nests
Gulkana R. Mainstem	45	45	.24	.13	13 miles G-2 to G-7	2 miles WF-1 to G-13
Gulkana West Fork (Both Br.)	95	95	.11	.05	25 miles WF-5 to WF-8	2 miles WF-1 to G-13
Gulkana Middle Fork	30	30	.13	.03	17 miles MF-2 to G-1	only one (1) nest
Tangle/Delta River	56	49	.12	.02	only one (1) nest	only one (1) nest
	Miles 2	Miles 2 Surveyed	Nests per mile 2	Active Nests per mile 2	Maximum Dist Btwn Act. Nests	Closest Dist Btwn Act. Nests
Lake Region	468	351	.04	.02	10 miles SSL-1 to 20SL-1	2.5 miles DpL-1 to DvL-1

Table 3. Species of Nest Tree

Area	#Nests in White Spruce	%	% Active	#Nests in Cottonwood	%	% Active	Ground Nests	%	% Active
Gulkana W.H.A.	37	86	57	6	14	33	0	0	0
Delta W.H.A.	5	83	20	0	0	0	1	17	0
Total Study Area	42	86	52	6	12	33	1	2	0

Table 4. Nest Tree Height (ft)

Tree Height	Number			Percent			Percent Active		
	Total	Gulk.	Delta	Total	Gulk.	Delta	Total	Gulkana	Delta
0	1	-	1	2	-	17	0	-	0
1-10	-	-	-	-	-	-	-	-	-
11-20	-	-	-	-	-	-	-	-	-
21-30	2	2	-	4	5	-	0	0	-
31-40	11	9	2	22	21	33	27	33	0
41-50*	21	18	3	44	43	50	76	83	33
51-60	9	9	-	19	21	-	33	33	-
61-70	4	4	-	8	10	-	50	50	-

*Note: WF-10 not included. Nest has fallen out of tree. $\bar{x} = 48'$

Figure 4. Percent Active Nests in Trees of a Certain Height Class

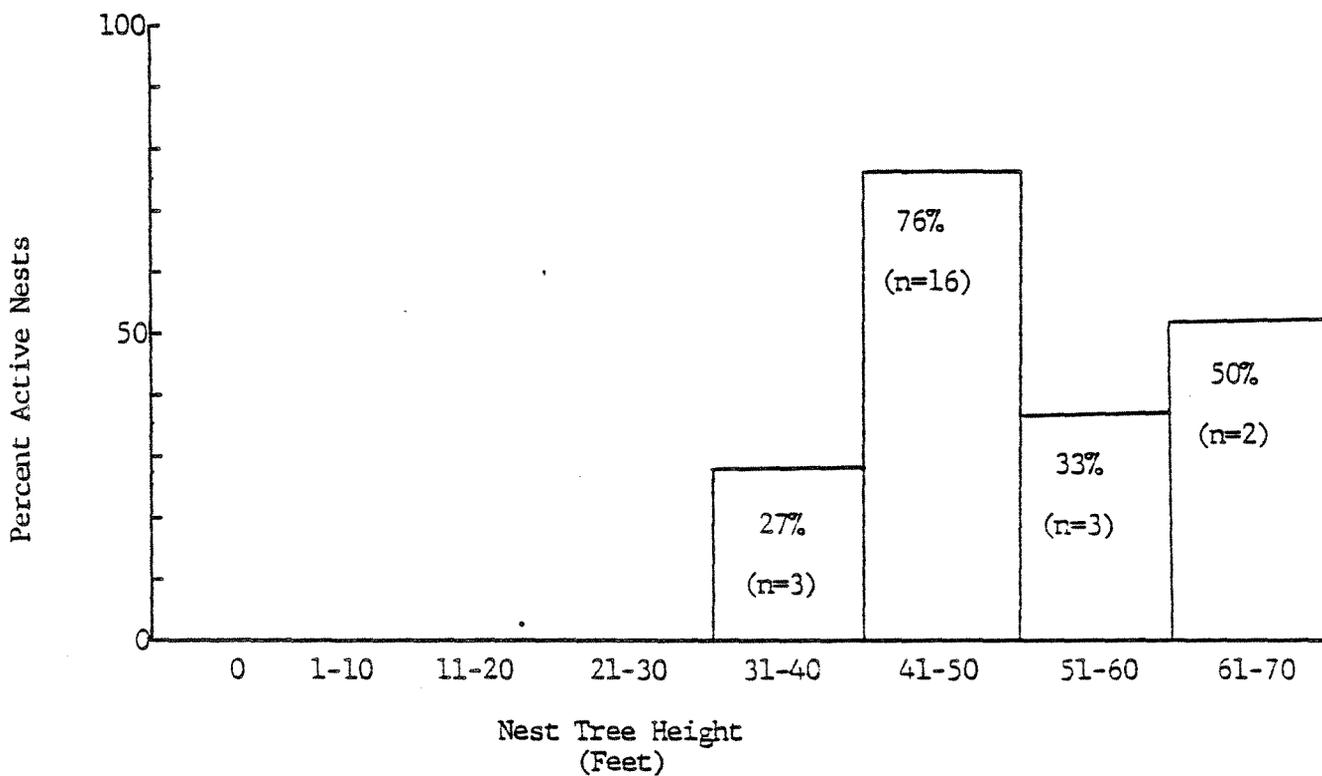


Table 5. Distance of Nest Tree from Body of Water

Distance From Water (Ft)	Number			Percent			Percent Active		
	Total	Gulkana	Delta	Total	Gulkana	Delta	Total	Gulkana	Delta
0-10	1	1	-	2	2	-	0	0	-
11-25	11	10	1	23	24	17	64	70	0
26-50	8	7	1	17	17	17	75	86	0
51-100	10	9	1	21	21	17	40	33	100
101-200*	6	5	1	12	12	17	33	40	0
201-300	11	9	2	23	21	33	36	44	0
301-400	-	-	-	-	-	-	-	-	-
400+	1	1	-	2	2	-	100	100	-

*Note: one nest located 125' from water fell out of the tree during the study and is not included in this data.

Table 6. Elevation of Nest Locations

Area	Total Nests Avg. Elevation (Ft)	Active Nests Avg. Elevation (Ft)
Gulkana W.H.A.	2292	2272
Delta W.H.A.	2758	2700
Total Study Area	2350	2290

Table 7. Percent Active Nests in Areas of Human Activity and Undisturbed Areas

Area	# Active Nests	# Inactive Nests	% Active Nests
<u>Areas of Human Activity</u>			
Gulkana R. (Mainstem) and Paxson Lake	9	7	56
<u>Undisturbed Areas</u>			
Middle and West Forks Gulkana River	6	8	43
Lake Region	8	5	62
Total Undisturbed	14	13	52

than are inactive nests. No bald eagle nests were located above 2900' in elevation.

5. Human Caused Disturbance

In the Gulkana WHA "areas of human activity" were compared with relatively "undisturbed areas" for percentages of active nests (Table 7). Disturbed areas were defined as the Mainstem of the Gulkana River and the Paxson Lake area. Over 3,614 recreationists (both persons floating and using motorized boats) used the river between Paxson Lake and Sourdough in 1981 (pers. comm., Bill Ziegler, BLM). A BLM campground is located on Paxson Lake which is widely used by fishermen. The Middle, West Fork, and lake region were categorized as relatively undisturbed areas. Some activities such as hunting, fishing and cabin use are scattered throughout these areas, but the human disturbance factors appear to be of a lesser impact than along the mainstem of the Gulkana River. In a 2 x 2 contingency table there was no significant difference between the number of active nests in the disturbed areas versus the undisturbed areas (Disturbed vs. West Fork and Middle Fork $X^2 .001(1) = .2679$; disturbed vs. lake region $X^2 .001(1) = .2679$; disturbed vs. undisturbed combined $X^2 .001(1) = .1250$).

On the Mainstem of the Gulkana River, powered river boat use is mainly confined to the area from Sourdough to approximately four miles above the confluence of the West Fork. The maximum use period is during the king salmon run from mid-June to mid-July. In 1981 over 1200 people in motorized craft used this 12 mile stretch. The 30 miles up river from this section are almost exclusively used by non-motorized watercraft.

These two sections of river were compared for the occurrence of active nests (Table 8). The motor use area had substantially lower percentage of active nests (20%) than the non-motor section with 83%.

However, it should be pointed out that most non-motorized use in the WHA originates at Paxson Lake and terminates downriver at Sourdough or Gulkana Village. Thus the floaters also use the lower 12 mile stretch, giving that section of the river the most use.

Nest densities along the two distinct use areas of the Gulkana River are presented in Table 9. The 12 mile section with motorized use had a very high density of nests, but a low density of active nests compared to the non-motorized 30 mile section.

Discussion

Forty-nine percent of the bald eagle nests were active. This figure is very similar to the 43% (Robards, King 1966) and 49% (Robards, Hodges, 1976) active nest results found for southeastern Alaska.

Table 8. Active Nests Along the Motor Use and Non-motor Use Section of the Mainstem Gulkana River

Use Area	# Active Nests	Total Nests	% Active Nests
Motor	1	5	20
Non-motor	5	6	83

Table 9. Nest Density Along the Mainstem of the Gulkana River

Area	River Miles	Nests per Mile	Active Nests per Mile
Motor	12	.42	.08
Non-motor	30	.2	.17

The nest density figures from this study differ from densities along the coastline of southeastern Alaska. Our study area had nest densities ranging from .11 to .24 nest/river mile and from .02 to .13 active nests/river mile. In southeastern Alaska, Robard and Hodges (1976) determined nest density to be between .20 and 1.04 nest/mile while Robards and King (1966) estimated between .20 and .70 active nests/mile. Factors such as food supply, available nest sites, human disturbance, and climate may have an influence on nest densities. The bald eagle populations in the Gulkana and Delta drainages appear to be healthy, but low density figures indicate the need for intelligent management and further study to insure a viable and productive eagle population.

White spruce was found to be the dominant nesting tree (86%) in the study area. Other studies have documented other nest sites, for example, Sitka spruce (Picea sitchensis) (72.8%) in southeast Alaska (Corr 1974); ground nests on sea stacks and ridges (81.5%) on Amchitka Island, Alaska (Sherrod et. al., 1976); quaking aspen (Populus tremuloides) almost exclusively in northwestern Ontario (Orien et. al., 1981); and white pine and red pine (Pinus strobus, P. resinosa) (80%) in northern Minnesota (Mathison 1968). The almost exclusive use of specific nesting sites indicates a strong nest selection preference in different geographic locations of the bald eagle range. No doubt this is based somewhat upon availability of the specific tree species in a given location.

The overall effects of human disturbance on bald eagle populations are unclear. Stalmaster (1968), Corr (1974), and Juenemann et. al., (1972), found that human activities had a direct or indirect relationship with nesting behavior and wintering bald eagle populations. Mathisen (1968) reported no apparent difference in nesting success between disturbed and undisturbed areas. Many factors come into play when trying to assess the impact of human disturbance on nesting bald eagles. Timing of the disturbance during the eagle reproductive cycle seems important, as does the type of disturbance. Incubation and early nestling periods (mid-April through mid-July) are the most sensitive times. The majority of human contact is from mid-June to mid-July on the Gulkana River. From field observations, the bald eagles during this time of human activities are in the late incubation to the mid-nestling period.

Recreational use on the Gulkana has increased a great deal in recent years. In 1970, fewer than 300 people boated the river, and in 1980 over 3,000 did--a tenfold increase in ten years. An overall view of the study area suggests that little impact occurred on the Gulkana River during the 1981 nesting season. The percentage of active nests in disturbed and undisturbed zones are similar. These figures may be misleading since "active nests" do not necessarily denote reproductive success. Also, the classification of disturbed areas is somewhat

subjective. Since past bald eagle nest data is very limited in the study area, long-term impacts would be difficult to assess at this time.

Motor boat use may affect the percentages of active nests along the Gulkana River. The 83% figure for the non-motorized section is substantially higher than the 20% calculation for the motorized area. The low number of active nests and relatively high density of inactive nests in the motorized section suggests nest displacement may have taken place.

Recommendations

The Gulkana River and Delta River Wildlife Habitat Areas are heavily used by recreationists, especially along the river systems. Also, oil and gas leasing may occur in the Gulkana Basin in the near future. Because of these pressures on the wildlife resource a wise management program should be adopted to protect and ensure that wildlife species maintain productive populations. The bald eagle is protected by both federal and state laws; therefore, these raptors should be given special attention.

Bald eagle populations along the Gulkana and Delta Rivers are in direct contact with ever-increasing numbers of river enthusiasts. Over 2000 people floated the Mainstem of the Gulkana during the summer of 1981. Some areas along the river are very popular camping sites. Also in 1981, over 1300 fishermen using outboards, jet units, and air boats, established fish camps during salmon season along the Gulkana from Sourdough up river to beyond the confluence of the West Fork. These activities are at a peak from mid-June through mid-July. Bald eagles during this period are at a sensitive state reproductively, in that the eggs are either being incubated or the young have just hatched. Therefore, the bald eagle populations should be strictly monitored to see if these disturbances are affecting the maintenance of a viable population.

Two aerial surveys should be flown each year over the Gulkana and Delta WHAs. A Cessna 180 has proven effective during this type of survey work because of room for an additional observer and the relatively slow flight speed. Data should be recorded on 1:63,360 USGS maps. One flight should be flown in late May to identify active and inactive nests. The whole survey should be flown in a one-week period, weather permitting. A second aerial survey should be flown in late July to obtain any nest displacement and/or loss information, and nestling numbers when possible. Total flight time for both surveys would be approximately 25 hours. Both surveys should include all the nests in both WHAs so a reliable data base can be established between "disturbed" and "undisturbed" areas. These surveys would be an efficient aid to

measuring how the bald eagle population is faring from year to year.

Also a project should be initiated on the Gulkana River to determine what effects human disturbances have on bald eagles. Two active nests should have a wooden sign up river and down river from the nest restricting camping and disturbance. This would be a test to see if signs are an effective means of protection. One sign location should be in the lower portion of the Gulkana where riverboat activity is heavy and the other sign location up the Gulkana where floating activity is exclusive (no power boats). A float trip should be done in early June (after aerial survey) for strategic placement of signs. BLM should monitor both a "posted" active nest and "unposted" active nest in the exclusive float craft section of the Gulkana. Also undisturbed areas (lake or river with salmon) should be monitored between mid-June and Mid-July for comparison purposes. Approximately 5 hours flight time will be needed for this part of the study.

A color banding program should also be undertaken to accurately identify birds in the field. This would help in monitoring displaced birds and nest fidelity. Equipment for banding and the markers would be an added cost. The marking effort should be coordinated with the USFWS. A banding license must be obtained from the bird banding laboratory, Office of Migratory Bird Management, U.S. Fish and Wildlife Service, Laurel, Maryland 20810, before color-marking the birds.

Bibliography

- Alaska Department of Fish and Game. 1978. Alaska's Fisheries Atlas. Vol. I and II.
- Corr, P.O. 1974. Bald Eagle Nesting Related to Forestry in Southeastern Alaska. MS. Thesis. University of Alaska, College, Alaska. 144 pp.
- Grier, J.W. 1969. Bald eagle behavior and productivity responses to climbing in nests. J. Wildl. Manage. 33(4); 961-966.
- Hensel, R.J. and W.A. Troyer. 1964. Nest studies of the bald eagle in Alaska. The Condor. 66(4); 282-286.
- King, J.G., F.C. Robards, and C.J. Lensink. 1972. Census of the bald eagle breeding population in southeastern Alaska. J. Wildl. Manage. 36(4): 1292-1295.
- Mathisen, J.E. 1968. Effects of human disturbance on nesting of bald eagles. J. Wildl. Manage. 32(1): 1-6.
- Robards, F.C., and J.G. King. 1966. Nesting and Productivity of Bald Eagles Southeastern Alaska. U.S. Department of the Interior. Bureau of Sport Fisheries and Wildlife. Juneau, Alaska. 30 pp.
- Robards, F.C. and J.I. Hodges. 1977. Observations from 2,760 Bald Eagle Nests in Southeast Alaska. USDI Fish and Wildlife Service Eagle Management Study. Juneau, Alaska. Prog. Report 1969-1972. 27 pp.
- Sherrod, S.K., C.M. White and F.S.L. Williamson. 1976. Biology of the Bald Eagles on Amchitka Island, Alaska. Living Bird. 15: 143-182.
- Snow, C. 1973. Habitat Management Series for Endangered Species. Southern and Northern Bald Eagles. USDI Bureau of Land Management. Technical Note No. 5. 58 pp.
- Stalmaster, M.V. and J.R. Newman. 1978. Behavioral responses of wintering bald eagles to human activity. J. Wildl. Manage. 42(3): 506-513.
- Steenhof, K. 1977. Management of wintering bald eagles. USDI Fish and Wildlife Service. 60 pp.