# Feasibility Assessment for Intensive Management Program

Game Management Unit 24B (13,523 $mi^2$)
Proposed Upper Koyukuk Village Management Area (UKVMA)
1,359.5 $mi^2$ centered on Alatna and Allakaket (10.1% of Unit 24B)
to Increase Sustainable Harvest of Moose

Alaska Department of Fish and Game, Division of Wildlife Conservation

Version 1, Effective Date: 25 February 2011

**Executive Summary:** Residents in the Upper Koyukuk River Drainage in Unit 24B have experienced a decreasing moose population and an increased difficulty in moose harvest for the last 15 years. The economic impact of increasing hunter effort has been compounded by increasing fuel prices. Baseline biological data were collected in Unit 24B since 1989, and those data corroborate the declining moose population and the concerns of local subsistence hunters. The Department has assessed the moose population decline in Unit 24B, and has developed an Intensive Management (IM) Program to address the unique situation for this area.

In this Feasibility Assessment for Intensive Management, the department proposes to conduct lethal wolf control activities during early winter in a 1,359.5 $mi^2$ area near the villages of Alatna and Allakaket for up to five years, on an estimated population of 35-40 wolves (3 to 4 packs) within the IM area. Because this area comprises just 10.1% of the total area in Unit 24B, the management action proposed will not have a detectable affect on the wolf population dynamics of the overall wolf population in Unit 24B. Within the IM area, we project an increase in the moose population of up to 300-350 moose within ten years of treatment. However, like the wolf population, a nominal increase of just 300-350 moose will probably not be detectable in the overall moose population of Unit 24B.

This proposed Intensive Management Program, contains several components that are tailored to the unique biological and cultural issues inherent to Unit 24B; 1) black and grizzly bears are likely the primary mortality factor effecting calf survival based on field studies in adjacent GMU's (21D & 24D), but they will not be included in predator control activities, 2) strong cultural taboos in the area concerning bears, makes bear control an untenable option, 3) the scope of the program will be small in terms of area and wildlife populations effected, 4) the treatment area is nested within large tracts of USFWS land but will not occur on those lands, 5) IM treatment response monitoring will be mostly limited to the inventory activities of the current management program, 6) the current population and harvest estimates are below the Unit 24B IM objectives, and the department anticipates that the IM Population Objectives will not be achieved due to the limited scope of this proposed program, and 7) the department will prioritize efficiency and cost effectiveness in implementation of the program.

Finally, because much of the IM area is privately-owned native corporation land, the benefit of this action will mostly accrue to the local residents of Allakaket and Alatna. Additionally, because the scope of the treatment is limited, in terms of its overall impact on the wolf and moose populations, the context of the project is simply a *"reallocation"* of the moose resource from wolves to humans in a confined area, not necessarily creating a larger moose population.

**A. Biological factors** are the basis for evaluating potential to achieve population or harvest objectives. Information will be mostly numeric answers or not applicable depending on species or geography. In most instances, the professional judgment of the area biologist will be required to put numbers in context in the recommended management strategy (section 6) and public process (section 7).

I. Non-predation and non-hunting mortality of prey

a) Markedly reduced survival of young due to winters with snow ≥36 inches deep for moose or ≥20 inches for deer by 1 March (frequency over ≥10 year periods): 45% (9 winters out of 20) > 3 feet, 85% (17 winters out of 20) >2 feet at Bettles. (Figures 1 & 2)
b) Reduced survival of young deer because of prolonged wind chill <0°F in shrub-dominated coastal areas (frequency over ≥10 year periods): N/A
c) Vehicle mortality along road and rail system that reduces harvestable surplus in the population (estimated number killed annually): N/A
d) High prevalence of disease or parasites in the population (Y/N): No. Blood assessment of moose radio-collared in 2007 showed low incidence of exposure to common diseases. No die-offs have been reported.

II. Access for predator reduction and ungulate harvest (see also sections B.I.c and B.I.d)

a) Estimated availability (in miles) of all-season roads: <10 miles inside village
b) Estimated availability (in miles) of ATV trails: <20 miles. The Bettles Ice Road is open from approximately January 1 – March 15 each year. There are no other roads in the Game Management Unit (Unit). There are four primary snowmachine trails that originate from Alatna/Allakaket: 1) Allakaket-Tanana trail, 2) Koyukuk River trail to Hughes, 3) Bettles trail, and 4) Kanuti Flats trail. Additional trails go out to the Alatna River and various traplines. There are numerous lakes and gravel bars on rivers for landing strips, but the Kanuti Controlled Use Area prohibits the use of aircraft for hunting moose.
c) Availability (in miles) of navigable rivers: 100 miles. Small boat travel is extensive on the Koyukuk River, Alatna River, Kanuti River, South Fork Koyukuk River, and Henshaw Creek depending on water levels in late fall hunting seasons.
d) Feasibility of landing fixed-wing aircraft in winter for predator removal (Low, Moderate, High): Moderate
e) Feasibility of landing fixed-wing aircraft in fall for ungulate hunting (Low, Moderate, High): Moderate
f) Feasibility of ocean shoreline access for hunting or predator removal (Low, Moderate, High): N/A
g) Use of helicopters by public (under permit) for trapping or retrieval of carcasses from aerial shooting (Y/N): Yes
h) Controlled Use Areas that prohibit aircraft access for ungulate harvest (Y/N): Yes

III. Potential effectiveness of predator control

a) Are there concentrated calving and/or young rearing areas of ungulates for focused bear or wolf control (Y/N/Unknown)?: No. Based on population surveys and preliminary radio-collared moose locations, the population is broadly distributed at low density with no apparent distinct calving areas. The area of the Kanuti Flats probably holds the most cows in 24B, and the high density Trend Count Areas of the Henshaw Creek and Kanuti Canyon areas are probably the highest calving areas due to the relatively higher concentrations of moose.
b) Are there concentrated winter ranges of ungulates suitable for focused wolf control (Y/N/Unknown)?: Generally, the Henshaw Creek and Kanuti Canyon areas have higher concentrations of moose in winter (Figures 3 & 4). However, both areas are on the periphery of the proposed UKVMA, and most of the Kanuti Canyon area is on the Kanuti NWR.

IV. Potential effectiveness of public participation in predator control (under permit) or predator harvest

a) Number of licensed hunters and trappers within or near proposed management area (size of potential participant group): 0-2 trappers with planes, 4-6 trappers on snowmachine.
b) Estimated wolf harvest rate (percentage of estimated fall population, average of 3 most recent Regulatory Years [RY: 1 July to 30 June]): the harvest during 1998-2008 was 20-30 wolves/year with an estimated population of ~243 (Unit 24B; 16-21 wolves/1000 $mi^2$) for an annual harvest rate around 10-15% annually (population ≈ 25-35 wolves within the proposed UKVMA). Estimated 16-21 wolves/1000 $mi^2$ (6-8 wolves/1000 $km^2$) in northern Unit 24 (Adams et al 2008, Stout 2009).
c) Estimated black bear harvest rate (percentage of estimated spring population, average of 3 most recent Regulatory Years): 20-25 black bears/year by Alatna/Allakaket residents, estimated 5-10 by non-local hunters, for a harvest of ~30 black bears @ ~100 bl. bears/1,000 $mi^2$ = harvest rate of < 2.5% (Unit 24B; 50-210 bl. bears/1,000 $mi^2$ ≈ 676 – 2840 black bears).
d) Estimated grizzly/brown bear harvest rate (percentage of estimated spring population, average of 3 most recent Regulatory Years): 10-15 grizzly bears/year at a harvest rate of less than 4%, mostly by non-local hunters (Unit 24B; 33 grizzly bears/1,000 $mi^2$ ≈ 450 grizzly bears).

V. Ability to confirm treatment response (e.g., predator control, habitat enhancement, selective harvest) in treatment areas with data from nearby and comparable untreated areas through assessment of biological parameters using existing techniques. Low sample size for survey data may limit applicability in low density situations.

a) Fall or late winter survey for abundance (Y/N): Yes
b) Fall composition surveys for young to adult female ratio as e.g., index to survival forbear predation during prior summer where wolf predation on young is comparative low) (Y/N): Yes
c) Fall composition surveys for yearling to adult female ratio as index to survival (e.g., , wolf predation during year since prior fall survey where bear predation on young is comparatively low) (Y/N): Yes

d) Radio telemetry for survival of age cohorts (Y/N): Yes (proposed)
e) Total prey harvest and age-sex composition of harvest among local residents, state residents, and non-residents (where applicable): Yes

**B. Societal factors** associated with hunting conflicts (e.g., constraints to access, acceptable methods, and harvest expectations) and public tolerance for intensive management practices

I. Public expectation for ungulate harvest may limit options to control growth of ungulate populations, which can affect nutritional condition and lead to public conflicts where increased harvest is biologically sustainable. A critical component of conflict mitigation is identifying potential for additional harvest opportunity that is acceptable to the hunting and non-hunting public. Defining the benefits of increased harvest is complex because hunter motivation may include economic factors (cost of meat replacement) and intangible measures of satisfaction (continuation of hunting culture, time spent in the field with family or friends, etc.).

a) Acceptable quantity and sex/age structure of ungulate harvest: 40-60 bulls:100 cows, 10-15 yearling bulls:100 cows, 30-45 calves:100 cows, in a growing population. Yearling survival key element to population growth. Within the proposed 24B IM area, we estimated 25% of the 297 adult moose are yearlings ≈ 74 yearling moose (based on 14 yearling bulls:100 cows and assuming 50:50 ratio of M:F). An increase in the population to 595 adults will yield at least 146 yearling moose/annually, depending on yearling survival. Yearling survival will increase with reduction in wolves, even though the population will still sustain high levels of mortality on the calf component of the population from bears. Cow and yearling harvest is acceptable.
b) Ability to inform constituents about ecological and biological constraints (nutrition, forage condition) relative to setting upper limits for population densities of managed ungulates (Y/N): N/A
c) Level of hunter density where significant conflicts occur between hunters (Low, Moderate, High): (High at low moose densities, Moderate at high moose densities) and between hunters and non-hunters (Low, Moderate, High): N/A
d) Potential for conflict in rural areas between local subsistence hunters and non-local hunters (Low, Moderate, High): High. Local residents are relatively intolerant of non-local hunters. However, most non-local hunters in 24B hunt well away from villages due to access regulations and rural residency requirements on federal lands. However, due to the KCUA, all non-local hunters are confined to the floatable rivers, which is where local hunters are confined as well (Figure 5). Local residents believe that non-local airplane hunters would over-exploit the moose population, fail to adequately salvage meat, and/or unfairly harvest trophy bulls in the absence of the KCUA. Local resident are concerned that airborne hunters would spot large bulls from the air then land and harvest them.
e) Conflicts or problems associated with access: existing access constraints (Few, Some, Many) Some, and acceptable strategies to spread out hunters and minimize trespass on private lands (Few, Some, Many) Some, and minimize unacceptable levels of trail damage on public lands (Few, Some, Many) Few.
f) Acceptance of restricted methods or means for harvest, particularly near communities (e.g., archery or muzzleloader) (Y/N): N/A

g) Acceptable level of vehicle mortality, which poses a public safety risk (Low, Moderate, High): N/A

h) Anticipation of strongly adverse public reaction to a management tool (e.g., predation control, prescribed fire, selective harvest), geographic area, or other facet of the proposed program (Low, Moderate, High). Moderate. Local public will favor wolf control but will not favor bear control due to cultural beliefs. Non-local public will be divided, and will probably question an IM strategy that does not include bear control when bears are the primary predator on calves.

i) Potential for predator control to have indirect negative effects on alternate prey, such as increase in medium predators that can prey on ungulate young (e.g., increased coyote abundance following extended periods of wolf control to benefit moose or caribou could increase predation on Dall sheep lambs during peak abundance of hares) (Low, Moderate, High): N/A

j) Coordination among hunters and trappers about control methods and allocation among ground based trappers, aerial gunners by permit, and Department use of helicopters (Low, Moderate, High): High

II. Land Ownership may restrict access for predator control or ungulate harvest. Proximity of restrictive status to communities or areas where management treatments would be most effective is the important context—see discussion of management strategy in section 6. If the objective is to increase harvest in a local area as progress toward a larger area objective, a program to reallocate mortality from predation to harvest without a substantial increase in ungulate abundance may be feasible with harvest coordination (but see Section C.I.c in context of State funds).

a) Percentage of National Park or Preserve and National Wildlife Refuge (where predator control may be restricted) in Game Management Unit or subunit or caribou herd range: 125 $mi^2$ (9.2%) federal land (BLM/USFWS) within UKVMA (Figure 5).

b) Percentage of area in federally designated wilderness where habitat or wildlife management may be subject to more extensive public process: 0%
Percentage of Alaska Native corporation land: 576 $mi^2$ (42.3%)

c) Access for predator control or ungulate hunting allowed on Alaska Native corporation lands (Y/N): Yes

**C. Economic factors** define estimated costs of management programs and expectations for public participation in predator control programs for comparison to perceived benefits by the Board and public

I. Cost of participation in prey harvest or predation control by public

a) Price (Dollars/gallon) of unleaded gasoline (average among communities): $6.50-$7.50/gal. unleaded.

b) Price (Dollars/gallon) of 100 octane low lead aviation fuel (average among communities): $8.00-8.50/gal.

c) Cost to hunters per prey animal harvested of alternative strategies (e.g., transportation cost to hunt in adjacent areas with harvestable surplus of ungulates relative to cost replacement value of meat): $1,400-$1,500/moose from GMU20A.

d) Value of predator hides or other parts legal to sell: $100-$300 wolves, $100-$200 black bears.

II. Potential for participation in predator control by public

a) Number of public participants (potential permit holders) in close proximity that are experienced pilots or shooters and likely willing to participate in a predator control program (Low, Moderate, High): Low
b) Availability of State funds for Department sponsored control programs (Low, Moderate, High): Low

III. Potential for cost sharing in habitat enhancement (see also sections B.I.f and B.II)

a) Potential to collaborate on prescribed fire where hazardous fuel reduction is the primary goal (Low, Moderate, High): Moderate
b) Potential to collaborate on forest management or mechanical vegetation treatments to produce wood products or reduce hazardous fuels (Low, Moderate, High): Moderate

**4) Availability of biological and harvest information** on population status of predators and ungulate species for modeling predator removal rates, ungulate population growth rates, and time until increase in harvest of ungulates is feasible (Y/N/unknown/not applicable)

- Ungulate population status:
  - Abundance survey within last 2 years: Yes
  - Abundance surveys on set schedule to estimate trend: Yes
  - Composition survey within last 2 years: Yes
  - Estimate of parturition rate within last 5 years: No, twinning rates only
  - Young survival estimate with mortality causes identified: No

- Harvest of prey:
  - Trends in reported harvest by residents and "local" (GMU) residents among general season, drawing permit, registration permit, and Tier II categories over last 10 years: *RY99-09* – 20 local residents, 42 non-local residents, 20 non-residents (GMU24B). Local hunting effort is under-reported, therefore Subsistence Division Door-to-Door survey data (1997-2002) was utilized to estimate a harvest demand for Alatna and Allakaket of 40 moose.
  - Where unreported harvest occurs, public perception of trend: Decreasing harvest.
  - Estimate of unreported harvest from telemetry, Division of Subsistence, or other sources: Subsistence Division household surveys have estimated the moose harvest from Alatna and Allakaket at 35-43 during RY97-RY02 compared with a reported harvest of 5-9 moose.
  - Department estimate of current sustainable harvest: RY07-RY09 range = 83-109 moose (~3.5% harvest rate of observable moose based on RY09 population estimate).
  - Amount Necessary for Subsistence (specify date of determination or updates, whether specific to proposed IM area or larger area, and number relative to IM objective): Unit 24 – (ANS=170-270 moose; IM=500-925 moose). There are no ANS numbers for Unit 24B independent of the entire GMU, the Unit 24B IM harvest objective =150-250.
  - Harvest by non-residents allowed (Y/N): Yes

- Status and harvest of predators:
  - Survey/census of wolf density within last 5 years: Yes the harvest during 1998-2008 was 20-30 wolves/year with an estimated population of ~243 (Unit 24B; 16-21 wolves/1000 $mi^2$) for an annual harvest rate around 10-15% annually (population ≈ 25-35 wolves within the proposed UKVMA).
  - Survey/census black bear density within last 5 years: No, Unit 24B; 50-210 bl. bears/1,000 $mi^2$ ≈ 676 – 2840 black bears, based on extrapolated densities from similar habitats in Interior Alaska.
  - Survey/census grizzly/brown bear density within last 5 years: No, 10-15 grizzly bears/year at a harvest rate of less than 4%, mostly by non-local hunters (Unit 24B; 33 grizzly bears/1,000 $mi^2$ ≈ 450 grizzly bears), based on extrapolated densities from similar habitats in Interior Alaska.
  - Predator-prey ratio estimated: Incomplete, (24B; ~1 wolf:11 moose) (within 24B IM Area; 25-30 wolves:330-462 moose ≈ 1 wolf:13–15 moose)
  - Survey of alternative prey adequate to aid predator recovery: No, Caribou occur in variable numbers during winter and Dall sheep occur nearby, but there are no estimates.
  - Most wolf harvest accounted for by sealing data: No
  - Most black bear harvest accounted for by sealing data: No
  - Department estimate of black bear harvest where sealing does not occur: 20-25 black bears/year by Alatna/Allakaket residents, estimated 5-10 by non-local hunters, for a harvest of ~30 black bears @ ~100 bl. bears/1,000 $mi^2$ = harvest rate of < 2.5%
  - Most grizzly/brown bear harvest accounted for by sealing data: Yes

- Habitat condition:
  - Interior moose: Proportional removal of browse biomass in previous 5 years with no large population change or widespread disturbance (e.g., fire) since browse survey: Habitat is not limiting based on twinning surveys in 2008-10 and browse assessment in 2007. Browse biomass removal for sampled plants was 5.3% (95% CL: 4.3–6.3%, $n$ = 231 shrubs), which along with Unit 24C is the lowest measured to date in the Interior. The removal index extrapolated to the shrub counts and species composition in Unit 24B was 8.8% (6.8–10.8%, $n$ = 231 shrubs).
  - Interior moose: Proportion of browse species with broomed growth structure (history of browsing): The brooming index was relatively low at 0.34 (95% CL: 0.28–0.40, $n$ = 231 shrubs), and 51% of the plants had no evidence of past browsing by moose (T. Paragi, ADF&G, personal communication to G. Stout, 22 Jun 2007).
  - Moose: Proportion of area burned in last 10 years (potential browse availability): 0.8 $mi^2$ (0.06%) (Figure 6)
  - Proportion of area in appropriate habitat type based on vegetative classification (define as forage, cover, etc.): No field-validated vegetative classification exists for the entire subunit, however the 1992 Ducks Unlimited classification (83% overall accuracy validation) covers the SE half (52%, Figure 6) of the IM area and has 13% tall shrub with unknown proportion of browse vs. non-browse species. The unvalidated 2009 LANDFIRE classification of the entire IM area has 8% tall shrub. (Figure 7)

- Ungulate nutritional condition (representative of environmental conditions experienced during the most recent population census or estimate): [*options currently being discussed*]

- Percentage of productive 3-yr-old females (caribou; cohorts are radio marked for calf weights and monitored for photocensus coverage): N/A
- Weight of 4-month- or 10-month-old females (caribou or moose; *deer also?*): N/A
- Weight of adult (5-6 yr old) females (caribou; herd specific that requires baseline): N/A
- Yearling female mandible length (*caribou*? *deer?*): N/A
- Ratio of femur to hind foot length (*deer?*): N/A
- Two estimates of twinning rate in previous 5 years with no large population change (moose): 2008-35%, 2009-60%, 2010-58%
- *Other metrics?*

**5) Potential to achieve ungulate population and harvest objectives**

i. Population increase in ungulates required to reach population objective (may be represented as comparable density): The 2010 estimated density is 0.30 moose/mi$^2$ in Unit 24B for an estimate of 405 (90% C.I. ± 24%) observable moose within the UKVMA. An increase to 0.51 moose/mi$^2$ (690 observable moose) would provide for a harvest of 34 moose for the villages of Allakaket/Alatna (5% yield, all bulls), including an additional 6 moose harvested outside the management area would provide a total of 40 moose harvested annually. The 1993 density estimate on the Kanuti NWR was 0.76 moose/mi$^2$ with 1.17 SCF (0.65 moose/mi$^2$ observable), therefore 0.51 moose/mi$^2$ within the UKVMA seems reasonably achievable.

ii. Increase in average estimated harvest (last 3 RYs) to reach harvest objective: For entire Unit 24B, the current average 3-yr. estimated harvest = 103 moose and the lower IM harvest objective = 150 moose. See previous question for potential increase in harvest from the UKVMA as a contribution toward the IM harvest objective for GMU24B.

iii. Potential to mitigate biological limitations in proposed IM area (Low, Moderate, High): High

iv. Potential to reduce or moderate hunting conflicts (Low, Moderate, High): Moderate, Local residents are relatively intolerant of non-local hunters. However, most non-local hunters in 24B hunt well away from villages due to access restrictions and rural residency requirements on federal lands.

v. Anticipated public participation based on expense and other factors (Low, Moderate, High); Low

vi. Data availability for designing an effective management plan (Low, Moderate, High): Moderate

vii. Potential to measure or demonstrate progress in ungulate population recovery or an increase harvest within a defined time period (Low, Moderate, High): Moderate

viii. Potential to document reasons for success or failure in population recovery or harvest increase (Low, Moderate, High): Moderate

**6) Definitions, review of objectives and current status, and recommended management strategy**

a) Define the relevant geographic area for assessing abundance of prey and predators by geographic area: (see also: Appendix A, part 1): ): Proposed Upper Koyukuk Village Management Area (UKVMA) 1,359.5 mi$^2$ centered on Alatna and Allakaket (10.1% of Unit 24B) will be used to assess prey response and will define the boundary of wolf control. Wolf abundance will be assessed annually on the basis of GMU 24B.

b) Recommend a time period for evaluation of the proposed program that matches the regional Board cycle: _6_ years
c) Note if the feasibility assessment is for IM (legal requirements in Appendix A and the *IM Guidelines*) or another purpose: Yes.
d) List the population and harvest objectives for prey species; they are in regulation for IM (see also: Appendix A, part 2): *24B - Population Objective*: 4,000-4,500 (current est. = 2,362 ± 490), *24B - Harvest Objective*: 150-250 (current est. = 83-109)
e) Provide a brief feasibility review of IM objectives or other objectives for prey species: (Appendix A, part 2): The recommendation by the Area Biologist to subdivide the GMU 24 IM objectives into four subunits was adopted by the Board of Game in January 2006. The Department recommended new IM objectives for the subunits, which were adopted by the BOG at the March 2006 meeting.
f) List the population and harvest objectives for predator species in Survey and Inventory reports: Wolf Management Objective of 13–23 wolves/1000 $mi^2$ (5–9 wolves/1000 $km^2$). No population objectives for black bears or grizzly bears. In Unit 24, the average annual grizzly bear harvest by hunters during RY02–RY07 was 14.5 bears. The reported average harvest during RY05–RY07 in the northern (north of Allakaket) and southern (remaining) portions of Unit 24 was 11.0 and 1.3 bears, respectively. The number of bears taken by fishermen or trappers and not reported is unknown, but was likely <6 bears annually. The RY02–RY07 mean annual reported and estimated unreported harvest in the entire unit was 19.7 bears.
g) Briefly describe the proposed management strategy for the ungulate population (actions to be taken on habitat, predation, harvest, access, or other factors): (see also: Appendix A, part 2): Modeling of the current moose population in the proposed IM area (UKVMA) using estimates of predator abundance and information from similar ecosystems in Interior Alaska indicate a continued potential for slow decline (Figure 8). Conducting wolf control to remove 66% of an estimated pre-control abundance of 30 wolves in the UKVMA and maintaining the lower wolf abundance is forecasted to allow a slow increase in moose abundance in the proposed IM area (Figure 9). Encouragement of habitat enhancement (e.g., fuel breaks or willow crushing) near communities to increase browse may serve to attract or retain moose on winter range where bears and wolves are accessible to hunters and trappers and where a limited winter harvest of moose is economical. A conservative bull harvest may be increased slowly during predator control efforts (at the expense of population growth) as moose mortality is reallocated from wolves to humans. Alternatively, present harvest can be maintained until a population increase allows a greater harvest that may eventually include cows or calves.
h) Propose measures of progress toward population or harvest objectives to be evaluated, identifying if additional data collection is necessary: 1) Calf and yearling survival rates utilizing radio-collared animals, 2) calf and yearling survival rates using composition data from fall surveys, 3) Harvest in the communities of Allakaket and Alatna, 4) Moose population estimates from fall surveys, 5) Wolf population estimates.
i) Provide a brief explanation for collecting or evaluating data from untreated areas for comparison to areas treated under the management program as evidence in a scientific study design that the treatment effects are working as intended and not simply an artifact of non-treatment effects (e.g., widespread improvement in calf survival because of mild winter across region, not because of predation control in a specific area): Baseline moose population demographic data on the Kanuti NWR is available from as early as 1989. Baseline wolf population estimates are available since 1995. Moose and wolf monitoring data collection will continue and can be used for evaluating trends immediately adjacent to the proposed IM area.

j) Provide an estimated cost of implementation (operations and field staff salary) for the proposed program over the evaluation time period. Six-year cost of predator control program (w/o personnel costs)

a. Survey and Inventory Activities (within IM area)

| | | |
|---|---|---|
| • Moose GSPE surveys (Years 1 and 5: 75-100 SU's) | | $ 60,000 |
| • Wolf population survey (Years 1 and 5) | | $ 20,000 |
| | Sub-total | $ 80,000 |

b. Research (1st Year pre-treatment + 4 Years treatment)

| | | |
|---|---|---|
| • Calf/yearling survival rate study (40 moose/yr) | | $ 265,000 |
| o Capture helicopter ($10K) | | |
| o Collars ($10K) | | |
| o Fixed-wing ($3K) | | |
| o 18 Relocation flights ($30K) | | |
| • Subsistence Division Harvest Monitoring | | $ 115,000 |
| | 5-year Sub-total | $ 380,000 |

c. Intensive Management (predator removal)

| | | |
|---|---|---|
| • Year 1 (helicopter + 2 fixed wing, 3-days) | | $ 24,000 |
| • Years 2-5 (helicopter + 2 fixed wing, 2-days) | | $ 64,000 |
| | Sub-total | $ 88,000 |
| | Total | $ 548,000 |

**7) If the Board requests development of an IM Plan, the Department should engage the public to receive input on:**

a) measures of progress toward objectives and criteria of program success;
b) acceptable methods for enhancing ungulate population and harvest, including a discussion of expected harvest levels and "hunter carrying capacity"

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**Appendix A**. Legal elements and criteria for IM objectives and a feasibility assessment

Area biologists should review and ensure the following 4 elements have been met:

1. Definition of populations:
   - The relevant area for defining an ungulate population under intensive management is that defined as a positive determination in Title 5, Alaska Administrative Code, Chapter 92, Section 108 (5 AAC 92.108)

        - Game Management Unit 24B (13,523 $mi^2$)
- "Game population" is defined in AS 16.05.940(20) as a "group of game animals of a single species or subgroup manageable as a unit," so clarify the purpose of ungulate or predator management zones proposed to be smaller than areas under 5 AAC 92.108
        - Proposed Upper Koyukuk Village Management Area (UKVMA) 1,359.5 $mi^2$ centered on Alatna and Allakaket (10.1% of Unit 24B)
- Consider whether a population with a positive determination for IM (5 AAC 92.108) should match or differ from Amounts Necessary for Subsistence (5 AAC 99.025) for the same geographic area

2. The Board has established population and harvest objectives for intensive management of identified ungulate populations for a high level of human harvest:

- Positive determination made for species and herd (caribou) or GMU subunit (moose, deer) per 5 AAC 92.106:
    - *Estimated harvest (reported and estimated unreported)* – RY07-RY09 range = 83-109 moose (~3.5% harvest rate of observable moose based on RY09 population estimate). Subsistence Division household surveys have estimated the moose harvest from Alatna and Allakaket at 35-43 during RY97-RY02 compared with a reported harvest of 5-9 moose.
    - *Accessibility* – The Bettles Ice Road is open from approximately January 1 – March 15 each year. There are no other roads in the Game Management Unit (Unit). There are four primary snowmachine trails that originate from Alatna/Allakaket: 1) Allakaket-Tanana trail, 2) Koyukuk River trail to Hughes, 3) Bettles trail, and 4) Kanuti Flats trail. Additional trails go out to the Alatna River and various trapline trails. There are numerous lakes and gravel bars on rivers for landing strips, but the Kanuti Controlled Use Area prohibits the use of aircraft for hunting moose. Small boat travel is extensive on the Koyukuk River, Alatna River, Kanuti River, South Fork Koyukuk River, and Henshaw Creek depending on water levels in late fall hunting seasons.
    - *Use of harvest primarily for meat* – Moose harvest is primarily for meat, but there is demand for non-local harvest by hunters targeting large trophy-class bulls.
    - *Hunter demand (reported hunting effort - RY09)* – 20 local residents, 42 non-local residents, 20 non-residents. Local hunting effort is under-reported, therefore Subsistence Division Door-to-Door survey data was utilized to estimate a harvest demand for Alatna and Allakaket of 40 moose.

- Population and harvest objectives established per 5 AAC 92.108:
    - *Population Objective*: 4,000-4,500 (current est. = 2,362 ± 490)
    - *Harvest Objective*: 150-250 (current est. = 83-109)
    - *Effects of weather, habitat capability, diseases and parasites*: Habitat is not limiting based on twinning surveys in 2008-10 and browse assessment in 2007. Browse biomass removal for sampled plants was 5.3% (95% CL: 4.3–6.3%, $n$ = 231 shrubs), which along with Unit 24C is the lowest measured to date in the Interior. The removal index extrapolated to the shrub counts and species composition in Unit 24B was 8.8% (6.8–10.8%, $n$ = 231 shrubs). The brooming index was relatively low at 0.34 (95% CL: 0.28–0.40, $n$ = 231 shrubs), and 51% of the plants had no evidence of past browsing by moose (T. Paragi, ADF&G, personal communication to G. Stout, 22 Jun 2007).

Twinning rates of collared moose in 24A/B from 2008-2010 were 35%, 60%, and 58% respectively. Blood assessment of radio-collared moose showed low incidence of exposure to common diseases. No die-offs have been reported.

- *Maintenance of viable predator populations*: Estimated 50-210 black bears/1,000mi$^2$ (20-80 black bears/1,000km$^2$). Estimated 33 grizzly bears/1000 mi$^2$ (13 grizzly bears/1000 km$^2$) (Reynolds 1976; Reynolds and Hechtel 1984). Estimated 16-21 wolves/1000 mi$^2$ (6-8 wolves/1000 km$^2$) in northern Unit 24 (Adams et al 2008, Stout 2009).
- *Maintenance of habitat conditions suitable for other species in the area*: the area is a high frequency fire area and maintains an abundance of early seral vegetation. River bank erosion and accretion provides abundant willow and riparian regrowth.
- *Effects on subsistence users*: Subsistence users depend primarily on moose, salmon, whitefish, black bears, and caribou when present. Small game and some furbearers (muskrat, beaver, lynx) may also provide food resources. Increased numbers of moose would reduce hunter effort and reduce expenditures on fuel for hunting.
- *Cost, feasibility and potential effectiveness of possible management actions*: Moose calf survival until fall is adequate for population growth (27-58 calves per 100 cows since 1999), but survival of yearlings is inferred to be low (4.9-20.1 yearling bulls per 100 cows during same period). Bears are likely responsible for the largest proportion of neonatal mortality (Osborne et al. 1991), whereas wolves are likely the primary predator of moose >12 months of age (Boertje et al. 2009), particularly for yearling bulls. If predator control is undertaken, a Department program with little public contribution is recommended. Administering a complicated permitting program for private individuals with low potential to achieve an adequate harvest of wolves or bears would compromise that effort. The area residents are culturally sensitive to the harvest and handling of bears, bear meat, and bear parts. Control of bears would probably be politically and culturally impractical and unnecessarily complicate a control program. Alternatively, wolf control would be designed to achieve and maintain 20-45% of pre-control abundance (National Research Council 1997) in the UKVMA (Figures 8 & 9). The area is remote, often extremely cold, and dark during most of the best time of the year to hunt wolves. The cost for private individuals to fly to Unit 24B to hunt wolves or bears is probably not economical. The extremely low density of moose (0.3/mi$^2$) equates to relatively low density of wolves, which will also reduce incentive for private hunters because so few wolves will need to be removed. However, because the area is confined to a small portion of Unit 24B, there are a relatively few packs in the area, and a relatively low harvest would be needed to successfully reduce the number of wolves in the area. There are no local pilots in Allakaket, and Bettles is the closest community with aviation fuel for sale. The efficiency in the program will be realized by maintaining a low administration overhead for the predator control program. A program that endeavors to improve survival of 6 month old to 24 month old moose, through a reduction in wolf predation is likely the only alternative biologically and socially.
- *Land ownership patterns within the range of the population*: The 24B Intensive Management area contains approximately 125 mi$^2$ (9.2%) of federal land (BLM/USFWS), 576 mi$^2$ (42.4%) native corporation, and 631 mi$^2$ (46.4%) of State land (Figure 5).
- *Degree of accessibility to harvest*: Primarily only by boat due to the Kanuti Controlled

Use Area (KCUA) that restricts the use of aircraft for hunting moose and excludes non-federally qualified users on the federal lands within the KCUA. There is currently an antlered bull, Dec. 15-Apr. 15 hunting season and a September 1-25 bulls only season in 24B under State and Federal regulations.

3. Depletion of the ungulate population [abundance or harvest below objectives] or reduction of the "productivity" [recruitment] of the population has occurred and may result in a "significant" reduction in the allowable harvest per Alaska Statute, Title 16, Chapter 5 (AS 16.05.255(e)).

4. Enhancement of abundance or productivity of the big game prey population is feasibly achievable utilizing recognized and prudent management techniques [AS 16.05.255(e)(3)]

5. The Board is not required to adopt regulations to provide for an intensive management program per AS 16.05.255(f)(1) if a proposed IM program is:

- (A) ineffective, based on scientific information
- (B) inappropriate due to land ownership pattern
- (C) against the best interest of subsistence uses

6. The Board may forego a feasibility assessment if per AS 16.05.255(f) (2) it declares that a biological emergency exists and takes immediate action to protect or maintain the big game prey population in conjunction with the scheduling for adoption of those regulations that are necessary to implement section (e).

**Literature cited (can be added later)**

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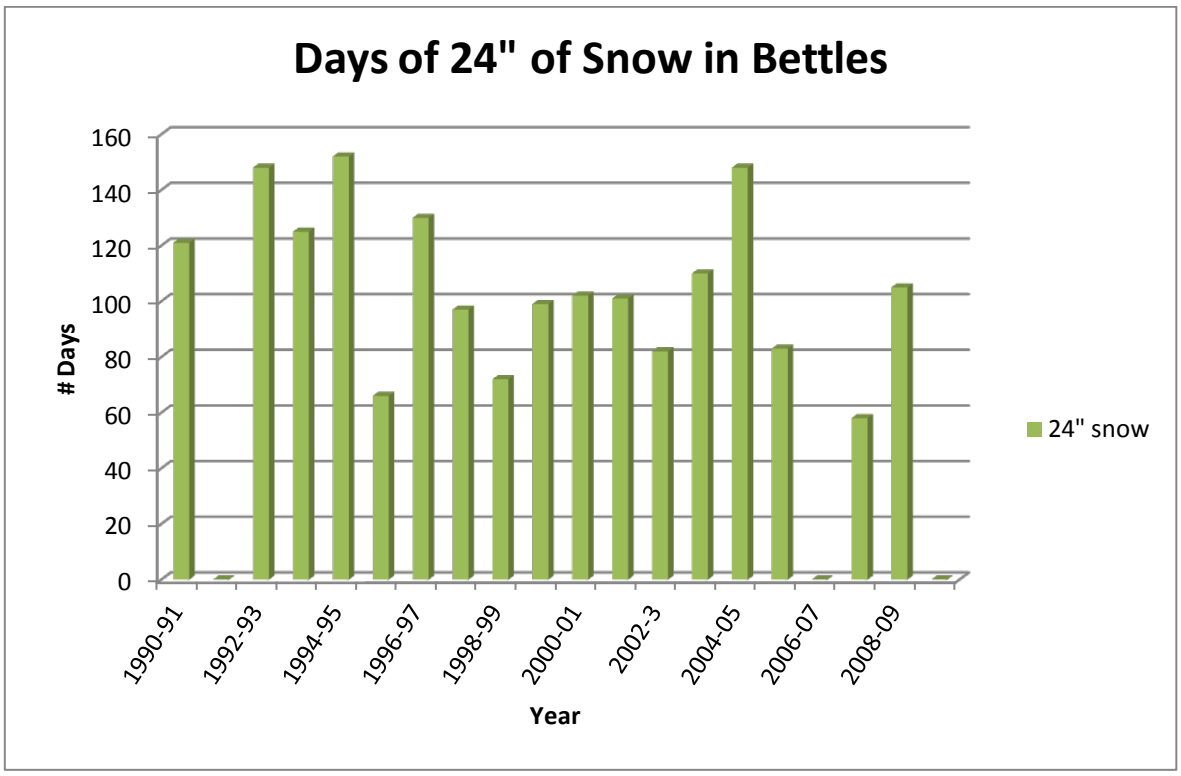


Figure 1. Number of days of 24" of snow accumulation at Bettles, AK, NOAA - 2010.

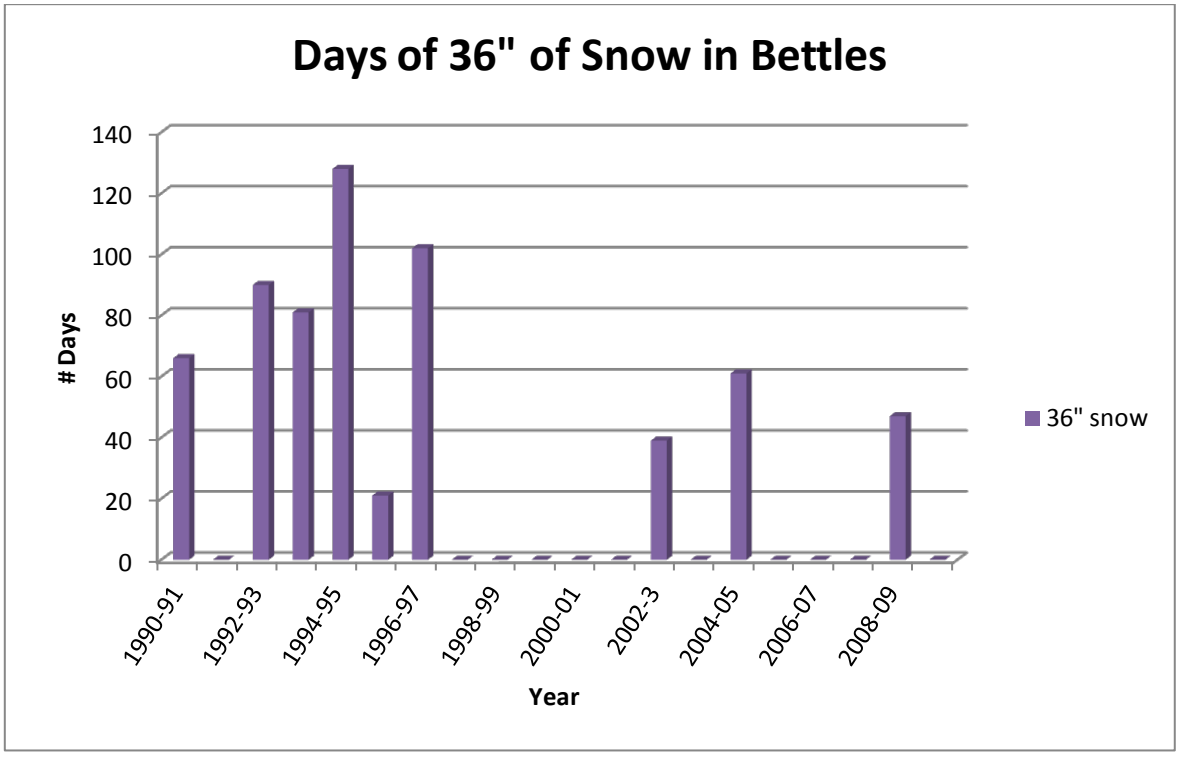


Figure 2. Number of days of 36" of snow accumulation at Bettles, AK, NOAA - 2010.

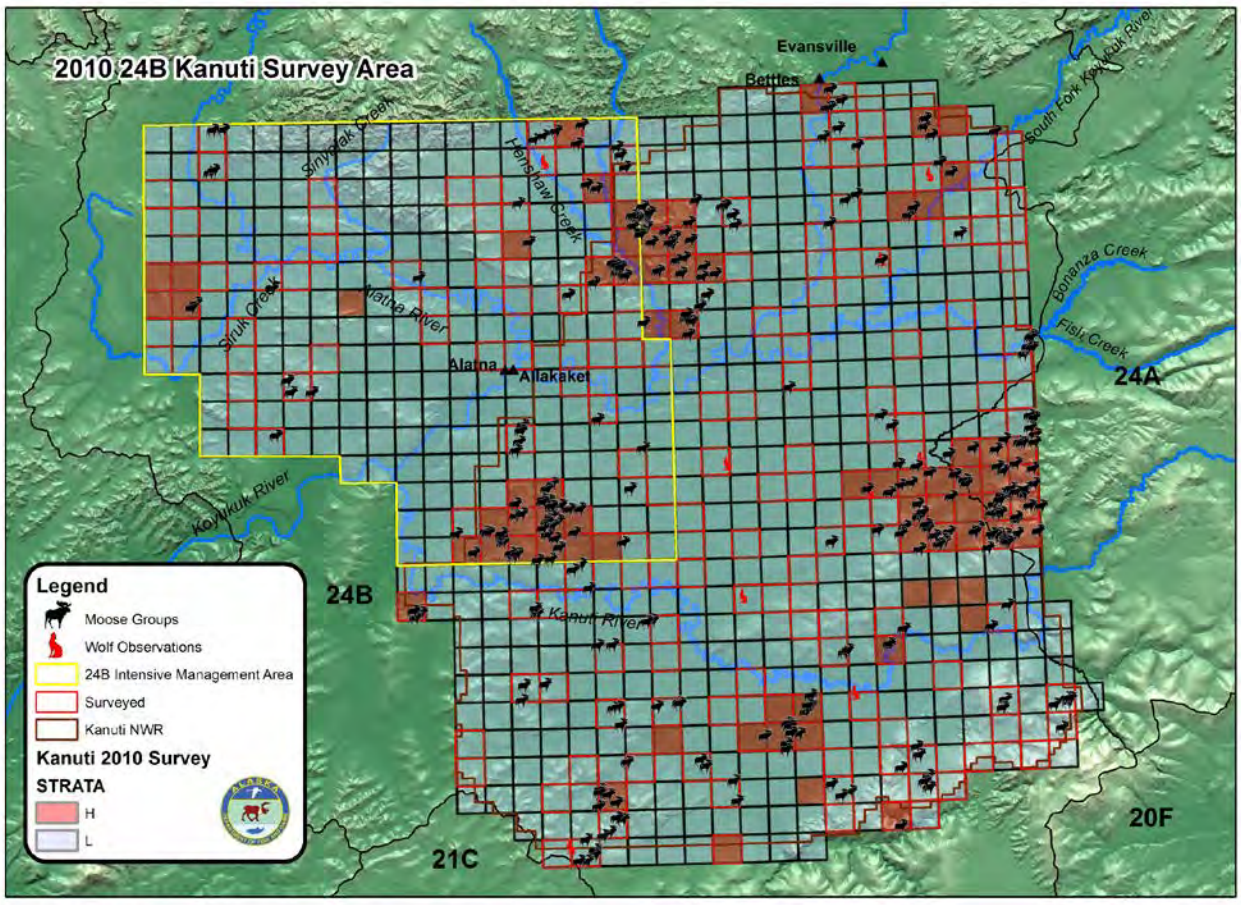


Figure 3. Moose distribution among high and low density sample units from moose observed in GSPE survey conducted in November 2010.

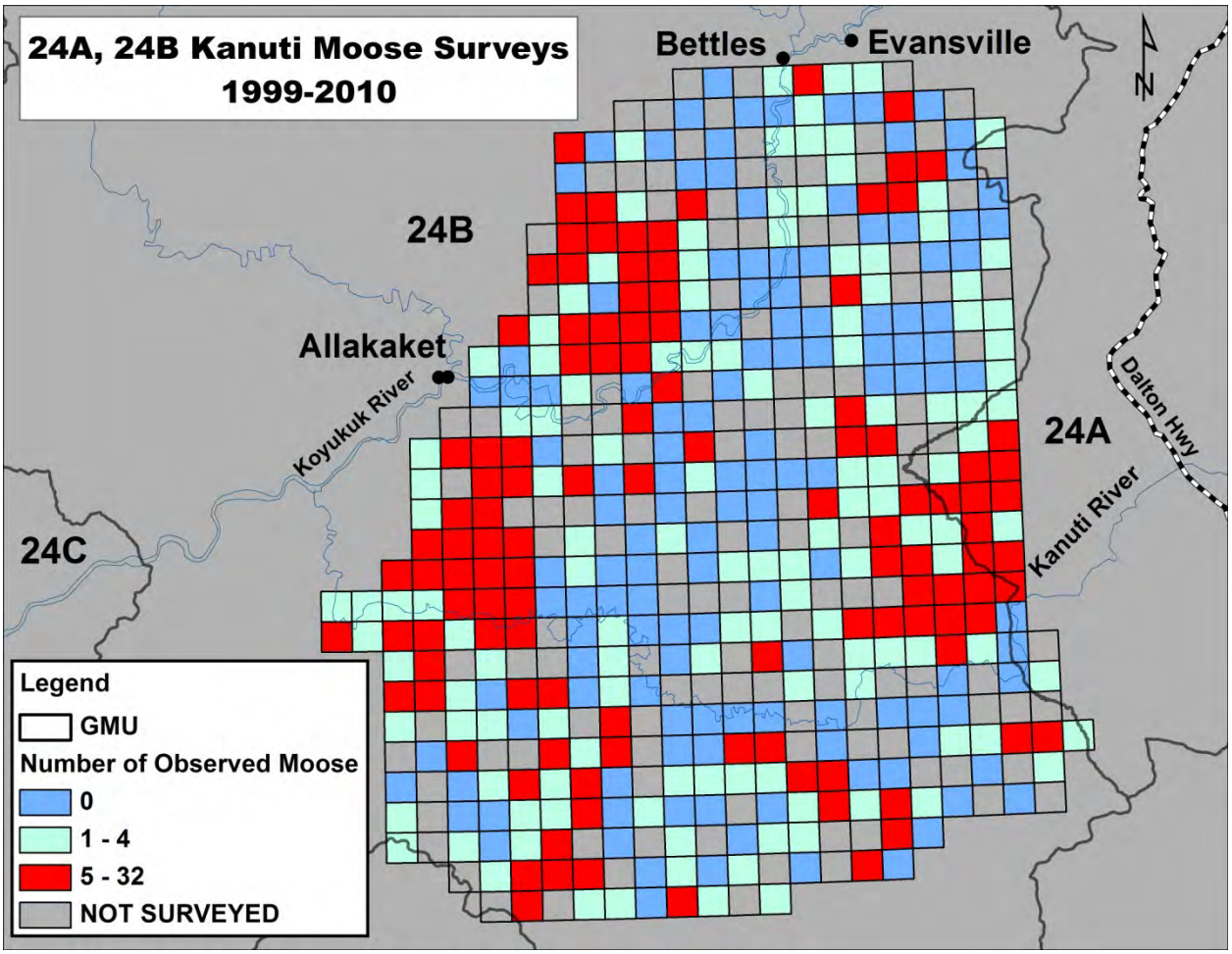


Figure 4. Moose distribution among high and low density sample units from moose observed in GSPE surveys conducted from 1999 to 2010.

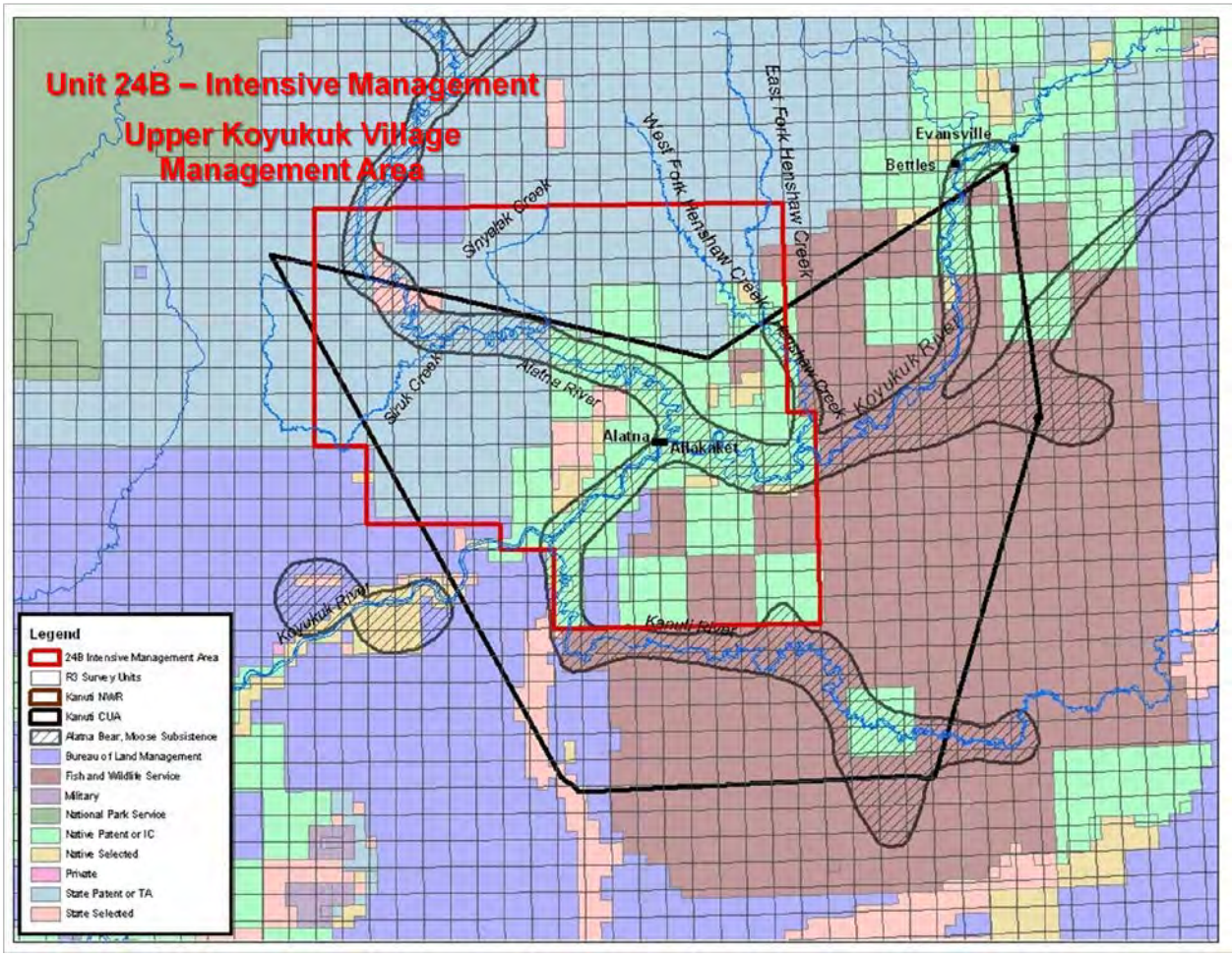


Figure 5. Land ownership and Subsistence resource us patterns within the Upper Koyukuk Village Management Area of Unit 24B.

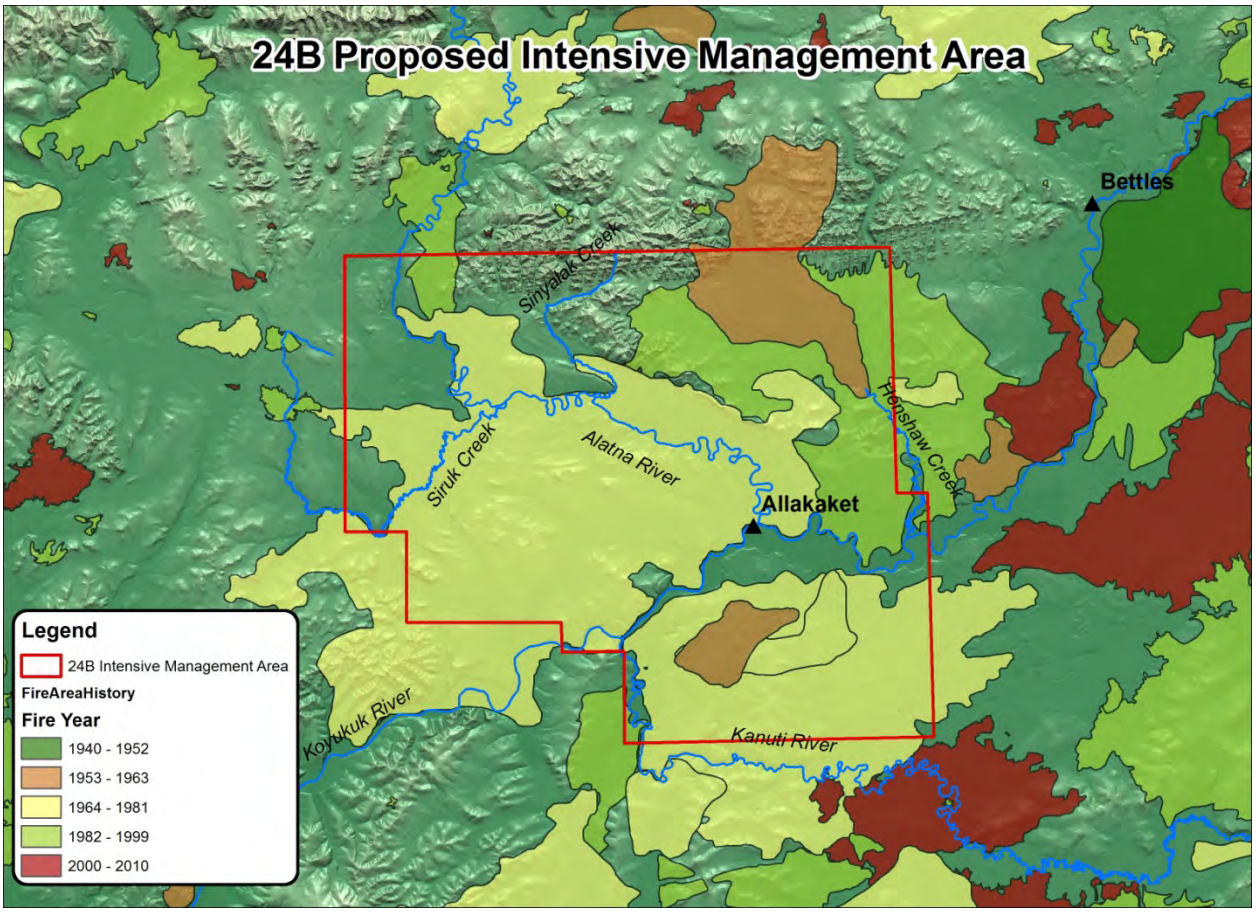


Figure 6. Fire history within the Upper Koyukuk Village Management Area through 2010.

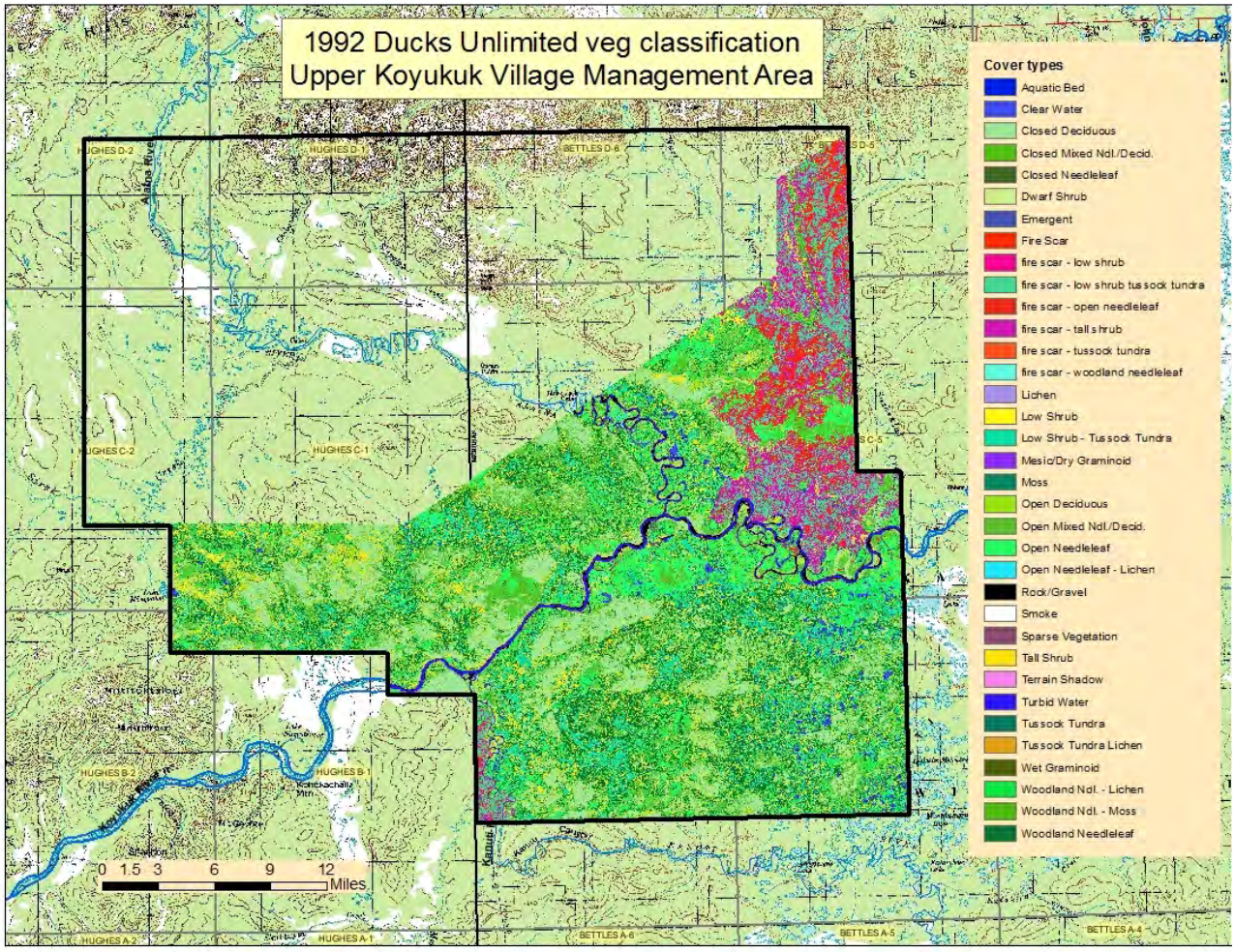


Figure 7. Ducks Unlimited vegetative classification within the Upper Koyukuk Village Management Area.

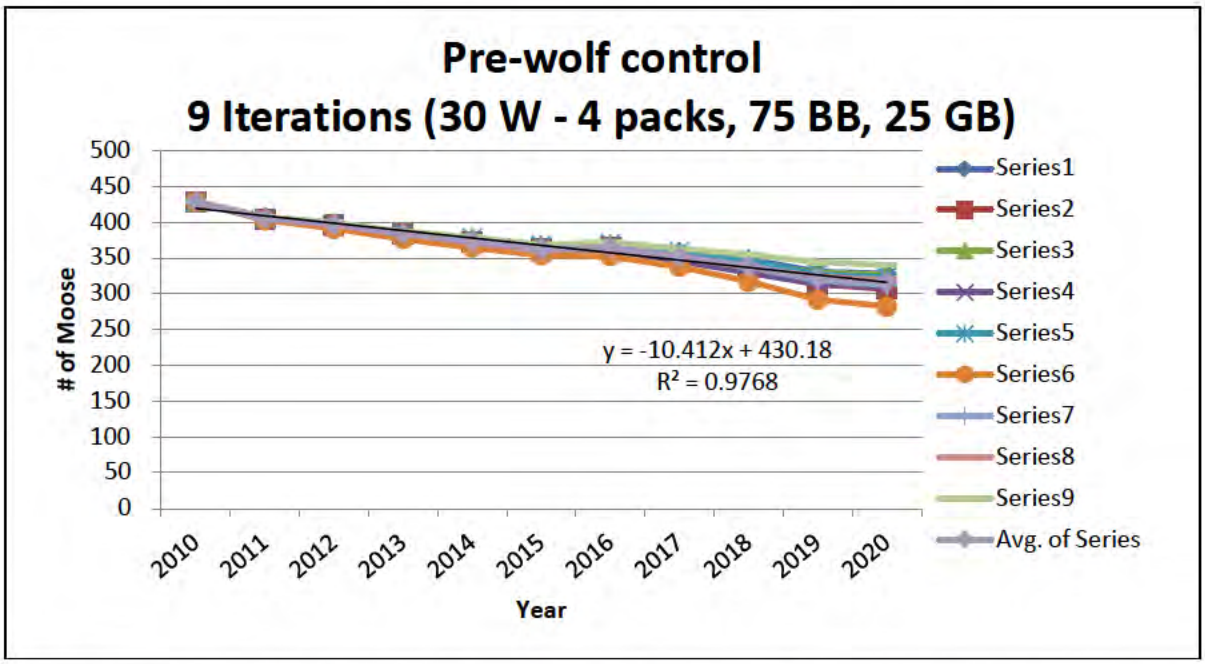


Figure 8. Predprey modeled moose population for the Upper Koyukuk Village Management Area without predator control. This assumes current estimated moose abundance of 429 at start and a moose harvest of 13 and existence of 30 wolves, 75 black bears, and 25 grizzly bears in Area throughout duration of the forecast.

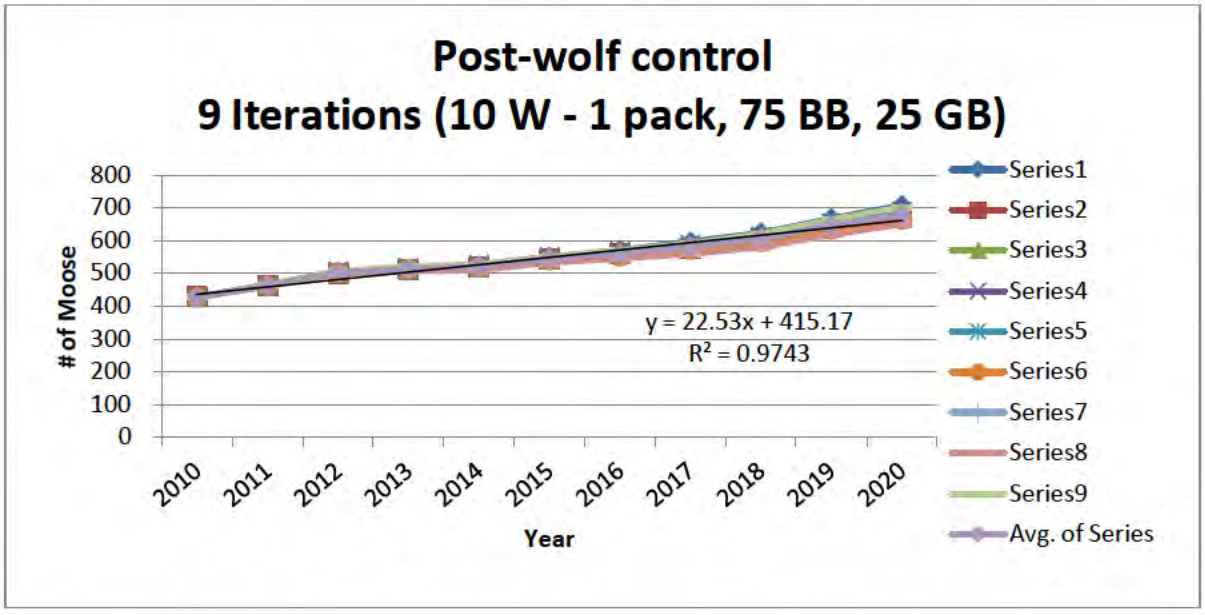


Figure 9. Predprey modeled moose population for the Upper Koyukuk Village Management Area with wolf control. This assumes current estimated moose abundance of 429 at start, removal of 20 wolves (3 packs) at beginning and maintenance of this reduced wolf abundance in Area throughout duration of the forecast, with an annual moose harvest of 13 throughout duration of the forecast.