



# Moose Surveys



**Moose surveys are usually conducted in late fall when there is a complete snow cover, so observers can easily see and count moose from the fixed-wing aircraft.**

Moose (*Alces alces*) are Denali's largest herbivore weighing up to 1500 lbs. You might observe a cow and calf browsing on willow shoots along the road or watch a bull partially submerged as he clips aquatic plants from a tundra pond. Perhaps the moose you were watching "disappears" into an alder thicket.

To count all the moose in Denali, and determine the ratio of bulls, cows, and calves, not only would you need to cover a lot of ground to find appropriate moose habitat, you would also need to be able to see each moose. Because both things aren't feasible, park managers rely on accurate estimates of moose population size, age structure, and sex ratios to evaluate if moose populations have remained "natural and healthy." Estimates help set hunting limits too (subsistence hunting is allowed in the new park and preserve, and sport hunting is allowed in the preserve).

#### **Development of survey techniques**

Early techniques used to estimate moose population numbers in North America included counts of moose droppings and various aerial surveys such as quadrat sampling, line transect sampling, and indexes of relative abundance based on the number of moose observed per flight-hour.

An aerial stratified random sampling method used in Alaska in 1978 was refined over the years into the standard technique employed by most agencies in Alaska through the late 1990's. Known as the Gassaway stratified random sampling technique, it used survey units that varied in size because they were delineated by topographic features. Biologists continue to use preliminary surveys to stratify survey units as "high" or "low" depending on the number of moose observed. Then, during the actual survey conducted for a sample of units drawn randomly from "high" and "low" units, biologists record the moose in each unit by sex and size (adult or calf). Statistical analyses are used to estimate population size and sex and age composition.

In the late 1990's, Ver Hoef used spatial statistics to improve the basic approach of stratified random sampling. This newer method is valued because the size of the overall survey area can be much larger, the systematic sampling design gives biologists more flexibility in selecting units to survey, and the estimates are more accurate. In addition, because GIS technology is used to lay out the units on a statewide grid (based on minutes of latitude and longitude), these coordinates can be used to navigate the borders of the units by aircraft—making this method substantially easier to conduct.

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*The complexity of the population dynamics of a large herbivore in the natural world is overwhelming.*  
—McCullough

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Photo by Stephan Krasemann



Surveys take place before bulls lose their antlers (top photo), so sex ratios of moose populations can be estimated. The number of calves per 100 cows provides a measure of productivity over time (middle). "Moose populations" is one of the vital signs selected for monitoring in Denali (bottom).

### Recent survey information

Based on the last successful survey conducted with adequate snow cover (2008), there are an estimated 1279 moose in the survey area on the north side of the Alaska Range, or about one moose for every 10 km<sup>2</sup> or one moose for every three square miles. Biologists actually observed only 830 moose in the units surveyed, but when the density is extrapolated to the units not surveyed, the population estimate for the entire survey area totals 1279 moose (that is, with 90 percent certainty that the estimate is within 20 percent of the actual number of moose in the area).

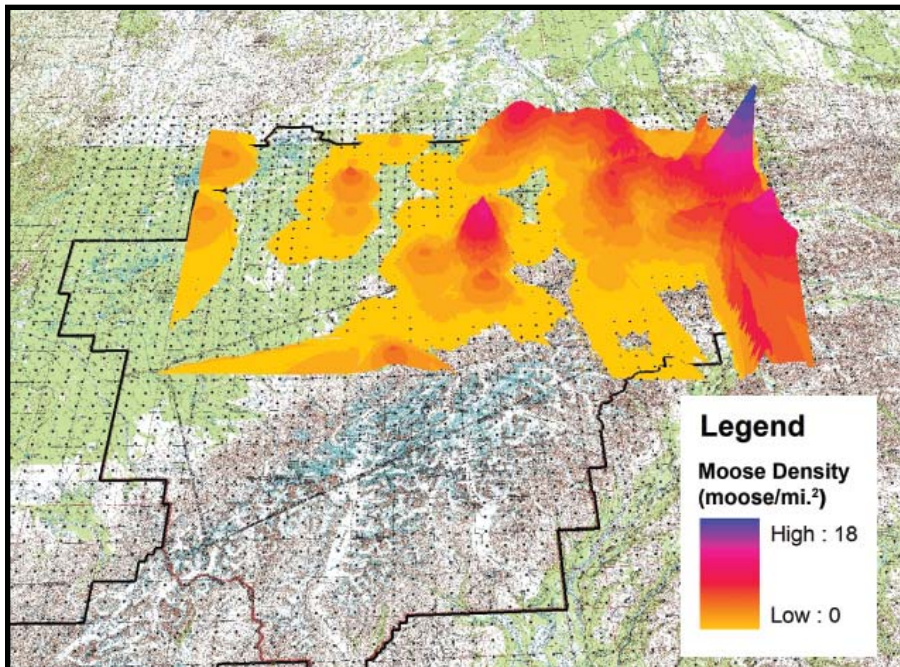
The calf : bull : cow ratio was 24 : 54 : 100, meaning that calves, bulls, and cows represented 13, 31, and 56 percent of the estimated population, respectively. If there are too few cows or calves, the future population size might be expected to decline. More than three-quarters of the cows (77 percent) were without calves, about one-quarter of cows (22 percent) had 1 calf, and 1 percent of cows had twin calves.

### Population trends

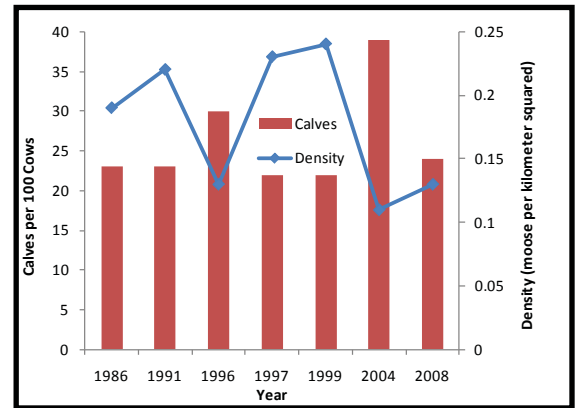
Survey results (estimates of population number and density) are difficult to compare among years because survey areas and unit boundaries have varied. Attempts have been made to keep overall survey areas similar so that comparisons of results among years and methods are meaningful (see graph at right).

### Monitoring moose as a vital sign

Denali is one of three parks in the Central Alaska Network (CAKN) for Inventory and Monitoring



Moose survey results (2008) for sampled survey units in the moose study area as displayed in an oblique view of a topographic map of Denali. Higher densities are shown as higher purple-red "hills" on the graph surface. Grid corners of all survey units are visible as dots.



Estimates of moose density (blue line) and of the ratio of calves per 100 cows (red bars) in Denali north of the Alaska Range, 1986 - 2008. Note: the time interval between sample years is different.

(I&M)—the other parks are Yukon-Charley Rivers National Preserve and Wrangell-St. Elias National Park and Preserve. These parks represent intact, naturally functioning ecosystems in subarctic Alaska.

Information generated by the I&M networks about "vital signs" of park health and disturbance pressures can be used in management decisions affecting the preservation of park resources.

"Moose populations" is one of the 18 vital signs selected to gauge the biological integrity of Central Alaska Network parks (36 vital signs in all). Because moose population change is typically slow, population estimates conducted once every 3 years would be adequate to detect change in abundance, distribution, or composition, and would be more practical (less costly) than annual surveys.

Thus, a moose survey will be conducted annually by CAKN, following standard monitoring protocols, but will rotate among the three parks. The next rotation will be Wrangell-St. Elias in 2010, Denali in 2011, and Yukon-Charley Rivers in 2012.

### For more information

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