# A new framework to manage hunting: Why we should shift focus from abundance to availability

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# A New Framework to Manage Hunting

## WHY WE SHOULD SHIFT FOCUS FROM ABUNDANCE TO AVAILABILITY

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Credit: Aleya Brinkman

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" *I felt that growing up in western South Dakota was as good as it gets for a young hunter. Local ranchers welcomed folks to hunt mule deer, white-tailed deer, pronghorn, pheasant, grouse, and wild turkey on thousands of acres of river breaks and open prairie. During some years, game was so abundant that one rancher begged us to reduce his pronghorn population, saying, "Kill as many of those fence-ruining #!\*%$ as you can." Unfortunately, over time, most ranchers leased their hunting rights to groups above my family's tax bracket, and hunter competition in nearby public areas grew intense. I didn't blame the ranchers, but I was a little frustrated when wildlife managers projected excellent hunting for all South Dakotans because of abundant game populations. I could no longer see the connection between abundance and good hunting.* "

*– Todd Brinkman*

As researchers in Alaska, we have been grappling with this same disconnect. We still hear the terms "abundant game" and "good hunting" used synonymously. Indeed, "abundance-based management"—or primarily relying on game population size to predict hunting opportunities and make adjustments to regulations—has acquired much traction in recent years among agencies and sportsmen alike (*Anchorage Daily News 2009*, Boertje et al. 2010). This focus on game abundance is not new and not unique to Alaska. The general assumption is that increasing game abundance will increase harvest: "Population size is ... the currency by which success of many management programs is ultimately judged (Lancia et al. 2005)."

The problem is that this line of reasoning is not always valid. It is an over-simplification to assume that higher game numbers (abundance) equals more harvest opportunities, because this model ignores two other key variables of success: hunter access and game distribution. To get a more accurate picture, we have spent several years (from 2005 to 2011) analyzing the interplay of abundance, access, and distribution in different parts of Alaska.

We also considered related factors such as hunter density, hunter attitudes, and habitat suitability, then combined all these elements to develop what we call an "availability framework" for managing hunting opportunities. We believe this framework can be widely applied by state, provincial, and tribal agencies to ensure more-effective management of hunting opportunities.

## Building the Framework

At the outset, our goal was to create a framework that would merge abundance, hunter access, and seasonal distribution of game during the hunting season into a single "availability index" that would give an accurate picture of actual hunting opportunity. In our framework, we consider a game resource to be "available" if (1) the population size can sustain sufficient harvest (abundance), (2) hunters can get to harvest areas (access), and (3) game is present in areas accessible to hunters during the harvest season (seasonal distribution).

To build the framework, we created a three-tiered model (see diagram on facing page) with hypothetical data simulating nine equal-sized game management units characterized by features that are common to many hunting systems (top tier of diagram). Those features include:

***Habitat/Predators.*** We simulated units with good and poor habitat and with and without predators to assess variability in annual game abundance. The model assumes that good-quality habitat without predators would support the highest game population levels, and low-quality habitat with predators would support the lowest population levels. Three units in the simulated landscape (top left and bottom left and right) would therefore support the highest populations of game.

***Access***. We included management units with and without roads and with different land ownership types (public with hunting or private with limited hunting) to generate variability in hunter access.

The model assumes that public land with roads provides the best hunter access, and private land without roads provides the worst hunter access, so the middle-right and bottom-right units of the simulation would have the best access.

***Distribution***. We incorporated summer and winter ranges that influence seasonal distribution of game. During the hunting season, we assumed game was typically on winter range and sought sanctuary on private land, where there would be reduced hunting pressure, rather than on public land. So the model assumes that game is most likely to be distributed on winter range on private land during the hunting season (bottom-middle unit), and least likely to be distributed on public land on summer range.

None of these variables alone can guarantee satisfactory hunting, however. For example, even though a unit might have high game abundance because of quality habitat and few predators, it would not necessarily provide good hunting opportunities if it lacked adequate access. To account for such variation, we assigned a qualitative score of good (3 points), average (2), or poor (1) for each of the three factors we assessed. Variables that support hunting opportunity—such as high-quality habitat, an absence of predators, presence of winter range, and road access—would rank a 3. Conversely, factors that might reduce hunting opportunity—such as presence of predators, absence of winter range, or lack of public land—would rank a 1.

For each simulated management unit, we assigned separate scores for abundance, seasonal distribution, and hunter access (second tier of diagram). We then averaged those individual scores to estimate one overall availability score for each management unit (bottom tier). Using this approach, the model shows that the top-left unit of the abundance tier of the diagram scores a 3, but the availability score (bottom tier) for this unit is only a 2 because of poor seasonal distribution and average hunter access. This availability framework therefore provides a simple tool that may help managers avoid pitfalls associated with a more narrow approach that relies primarily on abundance.

## Weaving in Human Dimensions

Theoretical simulations can be valuable tools, but only by adding information about actual hunter experiences—the human dimensions of wildlife management—can such models be implemented on

**New Framework for Managers: The Availability Index**
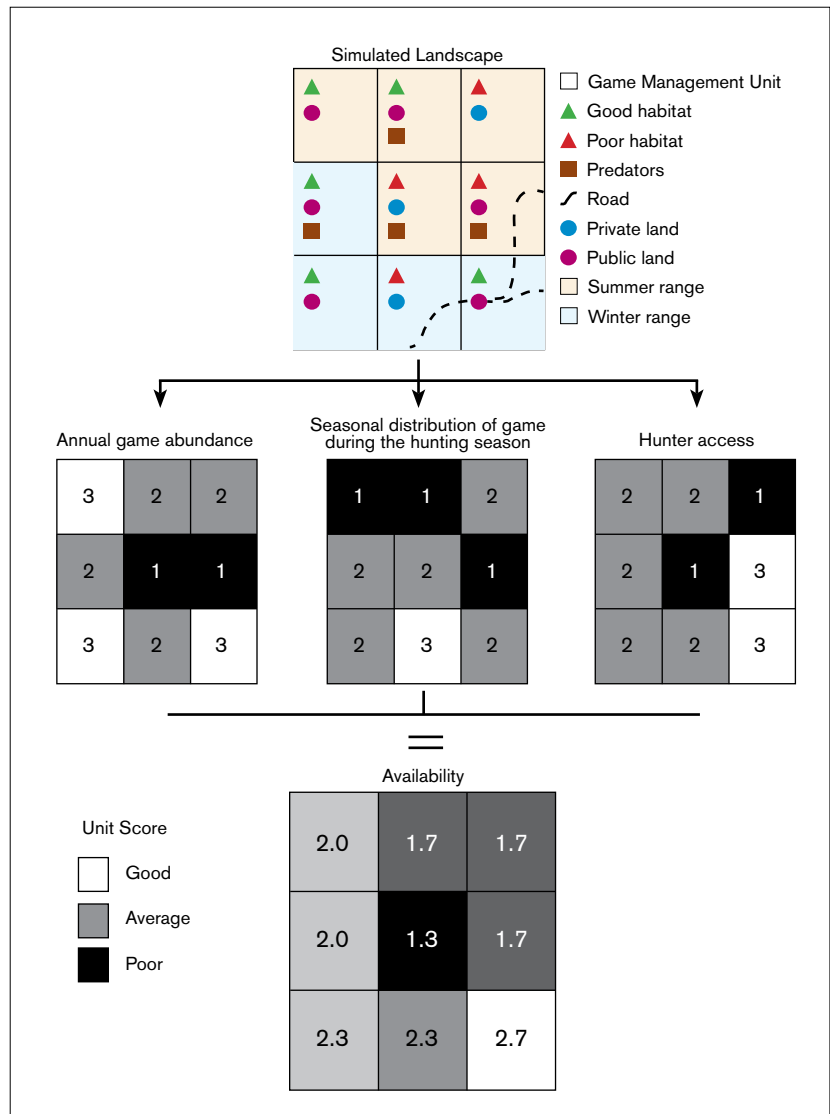


Credit: Brinkman et al. 2013

the ground. Our availability framework was largely motivated by previous social-ecological modeling (Kruse et al. 2004, Berman and Kofinas 2004) and by our own collaborative research with local hunters in three rural Alaskan communities: bowhead whale hunters in Wainwright, caribou hunters near Venetie, and Sitka black-tailed deer hunters on Prince of Wales Island (see map online). The remoteness of our study areas (none connected by road to an urban center) created unique opportunities to isolate factors influencing each hunting system.

We interviewed 121 hunters and drew on local and traditional ecological knowledge that hunters had acquired through education from previous generations and a lifetime of extensive observation

This diagram illustrates the availability framework and its application on a simulated landscape of nine game management units using hypothetical data about habitat, predators, roads, land ownership, and seasonal range. Each unit is scored for abundance, access, and distribution, then the scores are averaged to suggest actual game availability in a given area.

and experience. We then used this information to describe the roles that game abundance, seasonal distribution, and hunter access play in determining harvest opportunities in each hunting system. We also corroborated hunter observations with reports from scientific literature.

Through general conversations and specific questions in face-to-face interviews with experienced hunters, we were able to gain their perspectives on factors affecting game abundance, seasonal distribution, and hunter access. Hunters provided



Credit: Matthew Druckenmiller

Bowhead whale hunters in Alaska (above) travel across spring sea ice in search of a site near open water where they can set up a hunting camp and launch their boats. A tribal crew west of Barrow, Alaska (below) hauls a harvested bowhead onto the ice for butchering. As temperatures warm and the ice thins, it becomes more difficult to safely reach and harvest whales, making access—rather than abundance—a more important factor in the success of the hunt.



Credit: Adrienne Boland

spatial and temporal information so we could connect their experiences to a specific time of year and habitat type. This allowed us to link local knowledge with scientific data of similar spatial and temporal resolution. What we learned proved the theoretical point of our availability index: that abundance alone does not equate to game availability. The following case studies illustrate this fact.

## Access: Lots of Whales, Erratic Harvest

People of Wainwright hunt bowhead whale from the middle of April to early June when whales are migrating north through leads—stretches of open water in a field of sea ice—to summer feeding areas. Bowhead whale numbers have been rising by an estimated 3.2 percent since 1978 (George et al. 2004). Likewise, harvest quotas for Alaska have increased from 12 whales in 1978 to around 56 whales today (NMFS 2013). Despite these population and quota increases, harvest rates have been variable, with some of the lowest rates in recent years. For example, the annual quota of five whales for Wainwright was only met three times during 2000-2010, with two or fewer whales harvested during four years within that period. In contrast, annual harvest dropped below three just once during the 1990s. So why doesn't greater abundance equal greater harvest?

The answer lies in the ice. Hunters access whales by towing boats over ice to establish hunting camps on thick sea ice near open leads. Yet in recent years, hunters report that sea ice has been receding and thinning—factors that minimize hunters' ability to reach and establish secure hunting camps and platforms for landing harvested whales. Some hunters say that sea ice has become "rotten" (weak and unsafe for travel) earlier in the year, resulting in a shortened hunting season. Where they once saw 15-foot-thick ice, "we don't even see five-foot-thick ice much anymore," says one. Their observations support scientific data on sea ice melt (Stroeve et al. 2008, Markus et al. 2009).

Also of concern is that storms, high winds, and rough seas are on the rise, decreasing the window for safe hunting. In the nearby community of Barrow, 86 percent of harvested whales were landed when wind was less than six meters per second (m/s) (Ashjian et al. 2009). Due to an increasing trend in windy days, hunters in Wainwright are now estimated to have seven fewer days of good hunting

conditions during the traditional whaling season compared to the 1970s (Hansen et al. 2013). Overall, this case study shows that the quality of hunter access may be more important than whale abundance—support for using an availability framework for managing hunting opportunities.

## Distribution: Where are the Caribou?

People of Venetie harvest caribou from the Porcupine and Central Arctic herds, hunting through most of the year except from May through July, when caribou inhabit distant calving grounds on Alaska's north coast. Historically, in August, caribou begin to migrate south to wintering grounds, where they typically stop in November. Hunters travel by boat, ATVs, or snowmobiles to access these hunting areas about 60 to 80 kilometers north of Venetie.

Regulations allow harvest of at least 10 caribou per person per year, depending on land ownership. Although caribou populations have increased from roughly 100,000 in the 1970s to near-record highs of roughly 240,000 animals today (ADF&G 2010b, Lenart 2009), hunters say that harvest opportunities have been unreliable, suggesting that abundance has had a relatively small influence on hunting opportunities. Some Venetie hunters speculate that lower harvest is due to herd declines—but that perception is inconsistent with population data. The actual reason for harvest uncertainty is likely a shift in seasonal distribution caused by the following:

- **Warming weather**. Consistent with climate data for Alaska (Overpeck et al. 1997, Euskirchen et al. 2007), hunters report later freeze-up in the fall and earlier spring snow melt, which seem to be causing caribou to migrate north earlier and south later, shortening the window for caribou hunting. Native elders also report increased variability in conditions affecting caribou movement, with both caribou movements and weather now less predictable compared to the past (Kofinas et al. 2002, Thorpe et al. 2002).

- **Forest fires**. Hunters note that an increase in forest fires to the north of Venetie over the last decade was turning caribou away during fall migration, which also corroborates with scientific findings on caribou avoidance of recent burns (Joly et al. 2007).

- **Development**. Hunters believe that increased industrial development (i.e., oil exploration



Credit: Kenneth R. Whitten

Caribou from the Porcupine Caribou Herd swarm across the summer calving grounds of Alaska's Coastal Plain, a time and place when caribou are completely inaccessible to Venetie hunters, making the population's abundance irrelevant.

and extraction) and non-local hunting pressure during fall migration have shifted traditional movement patterns of caribou. All of the hunters that we interviewed emphasized that large bulls lead the migration. With non-local hunters often focusing on larger bulls, the leaders may be at greater risk of being harvested, thus interrupting migration patterns.

In sum, record population sizes of caribou have little value to the hunters of Venetie if the herds' seasonal distributions do not overlap with the traditional hunting areas of locals. This again highlights the importance of considering an expanded availability framework beyond abundance.

## Habitat: A Hunter-Deer Disconnect

Residents of Prince of Wales Island (POWI) hunt Sitka black-tailed deer from the end of July through January, with a harvest limit of five deer annually. Deer are found in all major habitat types on POWI, but hunters favor open habitat such as muskeg (treeless peatlands), treeless alpine meadows, and clearcuts where all trees are felled regardless of age (Brinkman et al. 2009).

The least popular habitats for deer hunting are areas logged more than 12 years ago and clearcuts systematically thinned 10 to 20 years after logging. Although 86 percent of interviewed hunters avoid such areas because of thick vegetation and poor visibility, DNA-based estimates of deer density suggest that logged areas less than 30 years old support as

Credit: James Baichtal


Credit: Phil Mooney

Hunters use ATVs (top) to haul in harvests of Sitka black-tailed deer on Alaska's Prince of Wales Island. Surveys show that hunters typically prefer to hunt in open habitat and along roads, which deer tend to avoid. Deep snows can push deer toward the shoreline (above), creating a sudden shift in distribution and an easy target for hunters with boat access.

## Obstacles and Opportunities

With game population size often being a secondary influence on hunting opportunities, why do we continue to devote most of our resources toward abundance-based management? There are several reasons. First, the strategy is intuitive: more game seemingly should equal more hunting success, so managers focus on population targets. Second, in some cases there *can* be a strong correlation between game abundance and hunting opportunities (Van Deelen and Etter 2003, Weckerly et al. 2005), usually in hunting systems where conservation concerns limit harvest quotas, quotas are consistently filled, and managers have strict control over hunter access and effort.

The third reason is rooted in the success of the North American Model of Wildlife Conservation, which began at a time when game populations had been overexploited by market hunting and needed reviving. The Model successfully restored game to bountiful levels for sustainable use by the public. Today, however, managers often contend with issues related to game overabundance and its impacts on ecosystems. Wildlife professionals are therefore faced with the challenge of evolving the Model to incorporate interactions between hunters and game that go beyond supply and address demand.

We fully recognize that some management programs already account for factors beyond abundance—such as seasonal distribution of game and hunter access—through actions such as modifying season length and closing or opening roads. Because we have seldom seen all the elements of availability integrated into a single equation, we encourage development of availability frameworks that explicitly consider hunting systems as dynamic social-ecological systems that must incorporate both the supply and demand sides. This would include variables such as hunter behavior and attitude (e.g., effort, willingness, skill level), hunter demographics (e.g., race, gender, income), and hunting technology, all of which can influence overall hunting opportunity.

Wildlife managers cannot manipulate all components of the game availability model. Nevertheless, accounting for the effects of each component may advance understanding of how hunting systems function, remedy communication problems between wildlife managers and hunters, and provide unforeseen options to increase effectiveness of management plans. For example:

many deer as unlogged forest, and twice as many deer as areas logged more than 30 years ago (Brinkman et al. 2011).

In addition, the most popular hunting habitat—muskeg near roads, where visibility is high—is generally avoided by deer and likely sustains relatively low deer densities because of poor quantity and quality of forage. Although hunting mostly occurs near roads, hunter traffic generally reduces the use of adjacent habitat by black-tailed deer and other ungulates, particularly in open vegetation types (Farmer et al. 2006, Proffitt et al. 2010). This disconnect on POWI between hunter habitat preference and deer habitat preference is yet another reason why management that is focused purely on abundance may not lead to hunting opportunity.

- Managers of spring bowhead whale hunting can't control sea-ice dynamics that affect access, but they can consider the potential for increased harvest during non-traditional times such as in September, when whales are migrating south. Hunters of Wainwright showed their willingness to explore this option by harvesting a whale in September 2010, the first fall harvest in recorded history.

- Managers monitoring the population movements of caribou could more-actively communicate with Venetie hunters during times when caribou are distributed in accessible areas to help hunters maximize windows of time when conditions are optimal for harvest. In salmon fisheries in Alaska, for example, managers monitor escapement downriver and dispatch information daily to help upriver communities anticipate peak times for harvest.

- To improve deer hunting opportunity and success on POWI, managers might consider manipulating forest types near roads to create areas that would be more favorable to both hunters and deer. Creating openings to increase visibility in older clearcuts could increase visibility for hunters and also prolong carrying capacity for deer by slowing forest transition to a closed-canopy stage with limited deer forage.

Our availability framework provides wildlife managers with a more holistic tool for analyzing, monitoring, and engaging the public to create options for managing hunting opportunities. The framework may be particularly beneficial to managers who have relied primarily on abundance as an index of hunting opportunities, and managers of overabundant game populations who would like to improve hunter harvest as a management tool. Expanding and integrating the indices of hunting opportunities—and simultaneously considering the effects of interactions among availability components—will result in wildlife management programs that are more responsive to local conditions with improved capacity to predict changes and to understand their consequences. In short, the availability framework could be a new paradigm that shifts away from a sole focus on abundance toward greater hunting success. ■

*This article has been reviewed by subject-matter experts.*