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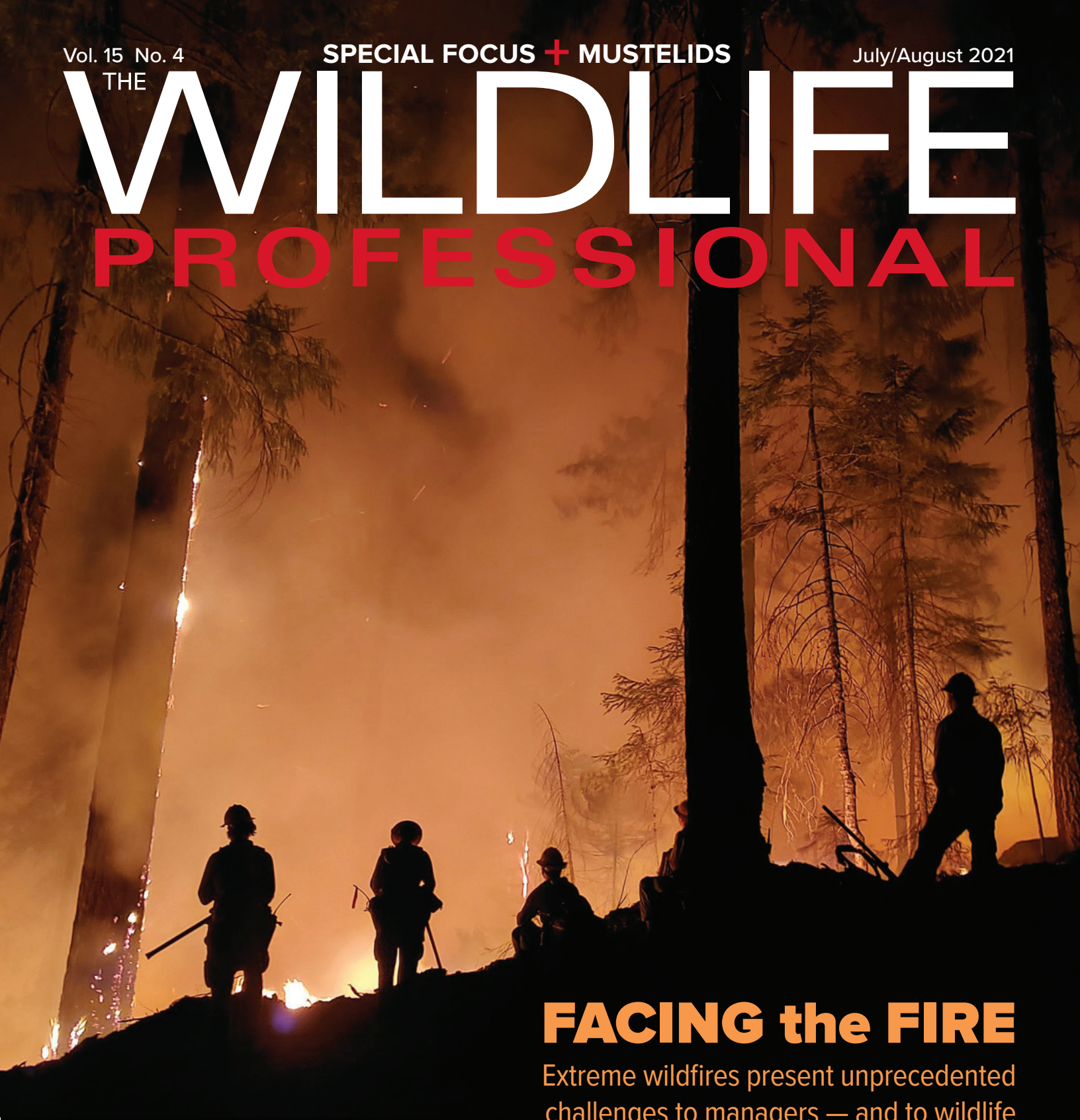
THE WILDLIFE PROFESSIONAL



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A Rare Beast in a Busy Backcountry

NEW RESEARCH CAN HELP GUIDE WOLVERINE CONSERVATION EFFORTS IN BRITISH COLUMBIA

By Garth Mowat, Andrea Kortello and Doris Hausleitner

Credit: Doris Hausleitner

▲ **A drone flight investigates a potential wolverine denning area in the south Columbia Mountains in April 2019.**

In 2011, co-authors Andrea Kortello and Doris Hausleitner told me they intended to submit a proposal to study wolverines in British Columbia and asked if I had any interest in partnering with them. This question recalled earlier discussions I had with two friends who had done extensive wolverine studies in British Columbia. Their work showed that trapping caused high mortality and was a risk to wolverine populations wherever they were trapped (Krebs et al. 2004, Lofroth and Ott 2007). That was especially true for southern populations, which may have smaller untrapped refuges and weaker connectivity among breeding sub-populations. Despite the conclusions of the earlier work, no substantive changes had been made to the wolverine trapping regime in British Columbia.

Because the agency I work for is directly responsible for managing trapping, I wanted to use the proposed work of Hausleitner and Kortello to assess the impacts of trapping harvest. They were interested in habitat use, population and genetic connectivity and the impacts of human disturbance. With the advent of heli-skiing and new snowmobile and ski technology, human use of the winter landscape in our area was increasing dramatically.

We decided that the way to achieve such broad study goals was to sample wolverines using baited sites that removed a few hairs when individuals accessed the bait. This sampling method would allow us to identify individuals and enable us to answer questions about habitat use and connectivity among the many mountain ranges that shape our landscape in the Kootenay region of B.C. Identifying individuals would also allow us to calculate abundance, which was a necessity if we were going to dig deeper into the sustainability of trapping.

Spatial capture-recapture methods offer a framework to analyze multiple independent capture-recapture datasets if the field methods used to collect the datasets are similar. They also offer a framework for mapping density and extrapolating it to areas beyond the sampling area. We began by sampling manageable-sized study areas each winter.

Joining forces

Wolverines (*Gulo gulo*) are a rare beast. Some winters we only caught two animals, despite sampling for the best part of the winter using dozens of sites over several thousand square kilometers. Realizing the power of our analysis was based on the sum of the parts, we soon joined forces with other researchers.

Tony Clevenger, Mirjam Barrueto and Mike Sawaya had been sampling wolverine in national parks in the east Kootenays before we began our work (Sawaya et al. 2019, Barrueto et al. 2020). Michael Lucid and Lacy Robinson of the Idaho Department of Fish and Game were using multi-species bait stations in their state (Robinson et al. 2017). We also partnered with national park biology staff members in Revelstoke, in the northwest Kootenays. They had been sampling wolverines to look at movement across the highway that ran through both Mount Revelstoke and Glacier national parks. Collectively we sampled about 55,000 square kilometers in British Columbia, Alberta and Idaho.

A single unified analysis of all these studies produced a mean density estimate of two animals per 1,000 square kilometers in Canada, which suggested that the trapping harvest rate for wolverine was high even when examined at a scale that included many untrapped parks (Mowat et al. 2020). We built a population model that estimated sustainable harvest rates of 6-8%. Our work suggested that the sustainable wolverine harvest was small — very small — less than 10 wolverines per year across an area greater than 100,000 square kilometers.

Managing such a small harvest is complicated by the fact that some wolverines are captured unintentionally in wolf (*Canis lupus*) and lynx (*Lynx canadensis*) sets. Given the level of risk and the management complications, the trapping season in the Kootenay region was closed to allow the wolverine population to recover. In the future, biologists will need to follow up and examine whether this has happened.

Where are the wolverines?

Both scavengers and predators, wolverines are strongly connected to Arctic, taiga and montane environments (Copeland et al. 2010, Inman et al. 2012), though the causal reasons for this are debated (Copeland et al. 2017). Intuitively, habitat selection for obligate meat-eaters should be driven more by the distribution of prey than land cover. Habitat studies of wolverine find varied or little selection for biotic communities but strong association with abiotic variables, such as predictable snow cover, which are likely more correlated with constraints on their distribution than habitat choice.

We found this too (Kortello et al. 2019), but we also found a positive association between habitat occupancy and the amount of marmot (*Marmota spp.*) habitat in winter, which points to the link between food and place. These models were even stronger for female wolverines, which den in late winter and early spring. In other places, wolverines appear reliant on one or more large ungulates that co-occur in their environment. In North America, those large ungulates are caribou *(Rangifer tarandus*) and mountain goats (*Oreamnos americanus*). In Europe and Asia, they are reindeer.

▼ **A wolverine appears at a bait station in winter 2012.**

Credit: Andrea Kortello

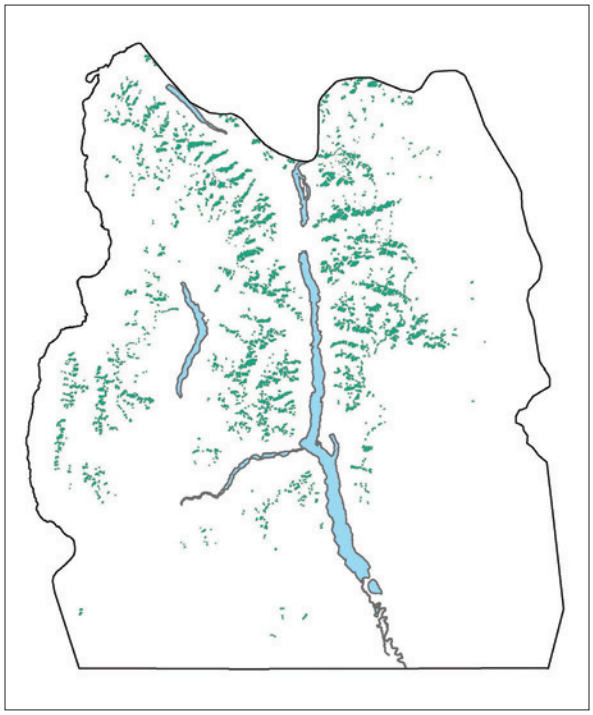
Our study area had almost no caribou, and mountain goats were few and scattered (Kortello et al. 2019). Our work suggested that maps of prey distribution may be the best mid-scale habitat maps for wolverines in suitable landscapes, and we hope to test this further in the near future.

Dealing with roads

We also found a negative relationship between wolverine space use and human use of the landscape. While some of this relationship may be explained by the fact that trappers use roads to trap, we found a very strong negative relationship with roads across the entire study area, which included many protected areas where trapping was not allowed.

Some of this road avoidance was likely due to behavioral decisions by individual wolverines to avoid areas frequented by people, which has been documented elsewhere (Heinemeyer et al. 2019). This link to roads points to a way to improve habitat for wolverine beyond managing prey numbers.

Human disturbance and the need for access management has been examined in great detail for grizzly bears (*Ursus arctos horribilis*) in British Columbia (Lamb et al. 2020, Proctor et al. 2020). Human disturbance on ungulate winter ranges has long been recognized as a management issue across the province, too. Coordinated access management has the potential to improve habitat for many species, and tools are needed to support the planning and consultation process.



Credit: Andrea Kortello

Modelled marmot habitat in the south Columbia Mountains was positively related to wolverine site occupancy.

One tool from our work on wolverine is the map of modelled marmot habitat. Presumably, reducing access near this key food source would benefit wolverine more than random access closures. This may be true for mountain goat habitat, too. One of our goals, now that our broad-scale research is done, is to provide tools such as our maps of marmot and goat habitat, spring snow cover and predicted wolverine density to land managers to assist with land management decisions. This is not a simple exercise. The Natural Resource Ministries in British Columbia have more than 20,000 employees, and other land managers, such as First Nation governments, also need this information to participate in the decision-making process.

A busy backcountry

Investigations into grizzly bear genetic and demographic connectivity (Proctor et al. 2012), and the very high numbers of highway and railway collisions with animals in southern British Columbia (Lee et al. 2019, St. Clair et al. 2019), have led to calls to increase connectivity across highways, railways and through or around human settlements.

Highways have been shown to limit gene flow in our study area (Sawaya et al. 2019), and movement is important because the sub-populations in southern Canada and the U.S. are more resilient when connected to populations throughout western Canada. One of our next research goals is to better understand wolverine connectivity in southeastern British Columbia and beyond in hopes this information can be considered during plans to improve connectivity, some of which are currently in implementation.

With the increasing human use of the Canadian backcountry in both summer and winter, wolverines will need to live in environments shared with people because snowmobiles and helicopters provide access to previously inaccessible areas. We were concerned that human disturbance near den sites, or in preferred denning habitat, may impact wolverines more than other parts of their range, but we had few documented den sites and

no clear picture of whether denning habitat was constrained by specific topographic, abiotic or site-level conditions.

We do know that denning habitat tends to be reused in subsequent years, even by different females. Numerous authors have stressed the importance of these areas for population persistence. If we could map denning habitat, we could prioritize these areas for protection.

Eyes on the ground and in the air

Our current research involves locating den sites through a combination of female habitat mapping, female locations at bait stations and reports of wolverine tracks or sightings recorded on our citizen science website, www.wolverinewatch.org. Citizen science allows the general public, including backcountry recreationalists, guides and trappers, to get involved in this research by being eyes on the ground and providing a much wider search area than we could accomplish on our own. We also occasionally use helicopter surveys to identify areas where dens might be found, which we then survey in greater detail using a drone.

Dens are characterized by a concentration of wolverine tracks during the denning period that persist for greater than two weeks. Wolverines generally don't stay in one place that long unless there is a den. Helicopters are great for covering ground but they are noisy. Since female wolverine are known to abandon dens if disturbed by people on foot, we were concerned that the prolonged low-elevation hovering by the helicopter near den sites, which is required to pinpoint den locations, could have unintended negative impacts on females and their young.

Instead, we decided to use unmanned aerial vehicles — drones — to systematically photograph areas of interest. Flying at a constant 100 meters above ground, we can photograph approximately 4 square kilometers of rugged, avalanche-prone terrain from a safe vantage, leaving our motorized transport — either helicopter or snow machine — over a kilometer away from the suspected denning area. Noise from the drones is minimal, and we assume our impact on denning females is negligible.

From drone photos, we are able to distinguish hare (*Lepus americanus*), red squirrel (*Tamiasciurus hudsonicus*), marten (*Martes americana*), porcupine (*Erethizon dorsatum*), lynx and wolverine tracks in the snow. During three winters of searching, we identified 10 wolverine denning areas, with repeated use in four of these areas, at a fraction of the time or cost of traditional radio-collaring programs.

Credit: Yellowstone to Yukon Conservation Initiative

▲ **An outreach poster puts out a call for community scientists.**

Verified den locations are coming in slowly, but we are hopeful that in a few years we will be able to create a model to map denning habitat. There is other research and management work going on in British Columbia on wolverines, and we are hopeful that all this work will benefit wolverine conservation in the province. ■

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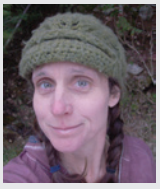

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