

**Summary of outdoor recreation ecology literature:  
peer-reviewed journal articles, reports & student theses**

Yellowstone to Yukon Conservation Initiative  
University of Northern British Columbia

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# 1. Fish and Wildlife

## 1.1 Bears

- Apps, C. D., B. N. McLellan, and C. Servheen. 2014. Modeling human accessibility and remoteness to assist grizzly bear population research. Resource roads in British Columbia: environmental challenges at the site level. Columbia Mountains Institute of Applied Ecology, Nelson, British Columbia, Canada.
- Apps, C. D., B. N. McLellan, J. G. Woods, and M. F. Proctor. 2004. Estimating grizzly bear distribution and abundance relative to habitat and human influence. *The Journal of Wildlife Management* 68: 138–152.
- Apps, C. D., B. N. McLellan, M. F. Proctor, G. B. Stenhouse, and C. Servheen. 2016. Predicting spatial variation in grizzly bear abundance to inform conservation. *The Journal of Wildlife Management* 80: 396–413.
- Apps, C.D., J. L. Weaver, P.C. Paquet, B. Bateman, and B.N. McLellan. 2007. Carnivores in the Southern Canadian Rockies: core areas and connectivity across the Crowsnest Highway. WCS Canada Conservation Report No. 3. Toronto, Ontario, Canada.
- Berland, A., T. Nelson, G. Stenhouse, K. Graham, and J. Cranston. 2008. The impact of landscape disturbance on grizzly bear habitat use in the Foothills Model Forest, Alberta, Canada. *Forest Ecology and Management* 256: 1875–1883.
- Berman, E. E., N. C. Coops, S. P. Kearney, and G. B. Stenhouse. 2019. Grizzly bear response to fine spatial and temporal scale spring snow cover in Western Alberta. *PLoS ONE* 14: e0215243.
- Bourbonnais, M. L., T. A. Nelson, M. R. L. Cattet, C. T. Darimont, and G. B. Stenhouse. 2013. Spatial analysis of factors influencing long-term stress in the grizzly bear (*Ursus arctos*) population of Alberta, Canada. *PLoS ONE* 8: e83768.
- Boyce, M. S., and J. S. Waller. 2003. Grizzly bears for the bitterroot: predicting potential abundance and distribution. *Wildlife Society Bulletin* 31: 670–683.
- Braid, A. C. R., and S. E. Nielsen. 2015. Prioritizing sites for protection and restoration for grizzly bears (*Ursus arctos*) in Southwestern Alberta, Canada. *PLoS ONE* 10: e0132501.
- Carroll, C., R. F. Noss, and P. C. Paquet. 2001. Carnivores as focal species for conservation planning in the Rocky Mountain region. *Ecological Applications* 11: 961–980.
- Coleman, T. H., C. C. Schwartz, K. A. Gunther, and S. Creel. 2013. Influence of overnight recreation on grizzly bear movement and behavior in Yellowstone National Park. *Ursus* 24: 101–110.
- Coogan, S. C. P., and D. Raubenheimer. 2016. Might macronutrient requirements influence grizzly bear–human conflict? Insights from nutritional geometry. *Ecosphere* 7: e01204.
- Costello, C. M., S. I. Cain, R. M. Nielson, C. Servheen, and C. C. Schwartz. 2013. Response of American black bears to the non-motorized expansion of a road corridor in Grand Teton National Park. *Ursus* 24: 54–69.
- Crupi, A. P., D. P. Gregovich, and K. S. White. 2020. Steep and deep: terrain and climate factors explain brown bear (*Ursus arctos*) alpine den site selection to guide heli-skiing management. *PLoS ONE* 15: e0238711.
- Dorresteijn, I., A. I. Milcu, J. Leventon, J. Hanspach, and J. Fischer. 2016. Social factors mediating human–carnivore coexistence: understanding thematic strands influencing coexistence in Central Romania. *Ambio* 45: 490–500.
- Ford, A. T., E. J. Sunter, C. Fauvelle, J. L. Bradshaw, B. Ford, J. Hutchen, N. Phillipow, and K. J. Teichman. 2020. Effective corridor width: linking the spatial ecology of wildlife with land use policy. *European Journal of Wildlife Research* 66: 69.
- Fortin, J. K., K. D. Rode, G. V. Hilderbrand, J. Wilder, S. Farley, C. Jorgensen, and B. G. Marcot. 2016. Impacts of human recreation on brown bears (*Ursus arctos*): a review and new management tool. *LoS ONE* 11: e014198

- Gibeau, M. L., A. P. Clevenger, S. Herrero, and J. Wierzchowski. 2002. Grizzly bear response to human development and activities in the Bow River Watershed, Alberta, Canada. *Biological Conservation* 103: 227–236.
- Gibeau, M., and S. Stevens. 2005. Grizzly bear response to human use. Biology, demography, ecology and management of grizzly bears in and around Banff National Park and Kananaskis Country: The Final Report of the Eastern Slopes Grizzly Bear Project. University of Calgary, Calgary, Alberta.
- Goldstein, M. I., A. J. Poe, L. H. Suring, R. M. Nielson, and T. L. McDonald. 2010. Brown bear den habitat and winter recreation in South-Central Alaska. *The Journal of Wildlife Management* 74: 35–42.
- Goodbody, T. R. H., N. C. Coops, V. Srivastava, B. Parsons, S. P. Kearney, G. J. M. Rickbeil, and G. B. Stenhouse. 2021. Mapping recreation and tourism use across grizzly bear recovery areas using social network data and maximum entropy modelling. *Ecological Modelling* 440: 109377.
- Gunther, K. A., and M. A. Haroldson. 2020. Potential for recreational restrictions to reduce grizzly bear-caused human injuries. *Ursus* 31: 1–17.
- Heim, N., J. T. Fisher, J. Volpe, A. P. Clevenger, and J. Paczkowski. 2019. Carnivore community response to anthropogenic landscape change: species-specificity foils generalizations. *Landscape Ecology* 34: 2493–2507.
- Hojnowski, C. E. 2017. Spatial and temporal dynamics of wildlife use of a human-dominated landscape. Doctoral dissertation, University of California, Berkeley, Berkeley, California, United States.
- Hood, G. A., and K. L. Parker. 2001. Impact of human activities on grizzly bear habitat in Jasper national park. *Wildlife Society Bulletin* 29: 624–638.
- Kaczensky, P., D. Huber, F. Knauer, H. Roth, A. Wagner, and J. Kusak. 2006. Activity patterns of brown bears (*Ursus arctos*) in Slovenia and Croatia. *Journal of Zoology* 269: 474–485.
- Kearney, S. P., N. C. Coops, G. B. Stenhouse, S. E. Nielsen, T. Hermosilla, J. C. White, and M. A. Wulder. 2019. Grizzly bear selection of recently harvested forests is dependent on forest recovery rate and landscape composition. *Forest Ecology and Management* 449: 117459.
- Ladle, A. 2017. Grizzly bear response to linear features and human recreational activity. University of Alberta. Doctoral dissertation, University of Alberta, Edmonton, Alberta, Canada.
- Ladle, A., R. Steenweg, B. Shepherd, and M. S. Boyce. 2018. The role of human outdoor recreation in shaping patterns of grizzly bear-black bear co-occurrence. *PLoS ONE* 13: e0191730.
- Lamb, C. T., G. Mowat, A. Reid, L. Smit, M. Proctor, B. N. McLellan, S. E. Nielsen, and S. Boutin. 2018. Effects of habitat quality and access management on the density of a recovering grizzly bear population. *Journal of Applied Ecology* 55: 1406–1417.
- Lewis, J. S., J. L. Rachlow, J. S. Horne, E. O. Garton, W. L. Wakkinen, J. Hayden, and P. Zager. 2011. Identifying habitat characteristics to predict highway crossing areas for black bears within a human-modified landscape. *Landscape and Urban Planning* 101: 99–107.
- Lyons, A. L., W. L. Gaines, P. H. Singleton, W. F. Kasworm, M. F. Proctor, and J. Begley. 2018. Spatially explicit carrying capacity estimates to inform species specific recovery objectives: grizzly bear (*Ursus arctos*) recovery in the North Cascades. *Biological Conservation* 222: 21–32.
- Merrill, T., D. J. Mattson, R. G. Wright, and H. B. Quigley. 1999. Defining landscapes suitable for restoration of grizzly bears *Ursus arctos* in Idaho. *Biological Conservation* 87: 231–248.
- Muhly, T. B., C. Semeniuk, A. Massolo, L. Hickman, and M. Musiani. 2011. Human activity helps prey win the predator-prey space race. *PLoS ONE* 6: e17050.
- Naidoo, R., and A. C. Burton. 2020. Relative effects of recreational activities on a temperate terrestrial wildlife assemblage. *Conservation Science and Practice* 2: e271.
- Nams, V. O., G. Mowat, and M. A. Panian. 2006. Determining the spatial scale for conservation purposes – an example with grizzly bears. *Biological Conservation* 128: 109–119.
- Nevin, O. T., G., B. K. Gilbert. 2005. Measuring the cost of risk avoidance in brown bears: further evidence of positive impacts of ecotourism. *Biological Conservation* 123: 453–460.

- Nevin, O. T., G., B. K. Gilbert. 2005. Perceived risk, displacement and refuging in brown bears: positive impacts of ecotourism? *Biological Conservation* 121: 611–622.
- Nielsen, S. E., G. B. Stenhouse, and M. S. Boyce. 2006. A habitat-based framework for grizzly bear conservation in Alberta. *Biological Conservation* 130: 217–229.
- Nielsen, S. E., M. S. Boyce, G. B. Stenhouse, and R. H. M. Munro. 2003. Development and testing of phenologically driven grizzly bear habitat models. *Écoscience* 10: 1–10.
- Nielsen, S. E., M. S., Boyce, G. B., Stenhouse, and R. H. M., Munro. 2002. Modeling grizzly bear habitats in the yellowhead ecosystem of Alberta: taking autocorrelation seriously. *Ursus* 13: 45–56.
- Nielsen, S. E., S. Herrero, M. S. Boyce, R. D. Mace, B. Benn, M. L. Gibeau, and S. Jevons. 2004. Modelling the spatial distribution of human-caused grizzly bear mortalities in the Central Rockies ecosystem of Canada. *Biological Conservation* 120: 101–113.
- Northrup, J. M. 2010. Grizzly bears, roads, and human-bear conflicts in southwestern Alberta. Master's of Science, University of Alberta, Edmonton, Alberta, Canada.
- Northrup, J. M., J. Pitt, T. B. Muhly, G. B. Stenhouse, M. Musiani, and M. S. Boyce. 2012. Vehicle traffic shapes grizzly bear behaviour on a multiple-use landscape. *Journal of Applied Ecology* 49: 1159–1167.
- Olson, T. L., and B. K. Gilbert. 1994. Variable impacts of people on brown bear use of an Alaskan river. Ninth International Conference on Bear Research and Management. International Association for Bear Research and Management, Missoula, Montana, United States of America.
- Penteriani, V., J. V. López-Bao, C. Bettega, F. Dalerum, M. del M. Delgado, K. Jerina, I. Kojola, M. Krofel, and A. Ordiz. 2017. Consequences of brown bear viewing tourism: a review. *Biological Conservation* 206: 169–180.
- Proctor, M. F., B. N. McLellan, G. B. Stenhouse, G. Mowat, C. T. Lamb, and M. S. Boyce. 2020. Effects of roads and motorized human access on grizzly bear populations in British Columbia and Alberta, Canada. *Ursus* 30:16–39.
- Proctor, M. F., C. T. Lamb, and A. G. MacHutchon. 2017. The grizzly dance between berries and bullets: relationships among bottom-up food resources and top-down mortality risk on grizzly bear populations in southeast British Columbia. Trans-border Grizzly Bear Project. Kaslo, British Columbia, Canada.
- Proctor, M. F., S. E. Nielsen, W. F. Kasworm, C. Servheen, T. G. Radandt, A. G. Machutchon, and M. S. Boyce. 2015. Grizzly bear connectivity mapping in the Canada–United States trans-border region. *The Journal of Wildlife Management* 79: 544–558.
- Proctor, M. F., W. F. Kasworm, J. E. Teisberg, C. Servheen, T. G. Radandt, C. T. Lamb, K. C. Kendall, R. D. Mace, D. Paetkau, and M. S. Boyce. 2020. American black bear population fragmentation detected with pedigrees in the transborder Canada–United States region. *Ursus* 31: 1–15.
- Proctor, M., B. McLellan, G. Stenhouse, G. Mowat, C. Lamb, and M. Boyce. 2018. Resource roads and grizzly bears in British Columbia and Alberta, Canada. Canadian Grizzly Bear Management Series, Resource Road Management. Trans-border Grizzly Bear Project. Kaslo, British Columbia, Canada.
- Proctor, M., W. Kasworm, K. Annis, A. MacHutchon, J. Teisberg, T. Radandt, and C. Servheen. 2018. Conservation of threatened Canada-USA trans-border grizzly bears linked to comprehensive conflict reduction. *Human–Wildlife Interactions* 12: 348–372.
- Rode, K. D., J. K. Fortin-Noreus, D. Garshelis, M. Dyck, V. Sahanatien, T. Atwood, S. Belikov, K. L. Laidre, S. Miller, M. E. Obbard, D. Vongraven, J. Ware, and J. Wilder. 2018. Survey-based assessment of the frequency and potential impacts of recreation on polar bears. *Biological Conservation* 227: 121–132.
- Sarah, E., and J. Shultis. 2015. Impacts of boat-based wildlife viewing in the K'tzim-a-Deen Inlet on grizzly bear (*Ursus arctos*) behavior. *Natural Areas Journal* 35: 404–415.

- Schwartz, C. C., M. A. Haroldson, and G. C. White. 2010. Hazards affecting grizzly bear survival in the greater Yellowstone ecosystem. *The Journal of Wildlife Management* 74: 654–667.
- Smith, T. S., J. Oyster, S. D. Partridge, I. E. Martin, and A. Sisson. 2012. Assessing American black bear response to human activity at Kenai Fjords National Park, Alaska. *Ursus* 23: 179–191.
- Stenhouse, G., J. Boulanger, I. Phoebus, K. Graham, and A. Sorensen. 2020. Estimates of grizzly bear population size and density for Alberta’s clearwater bear management area (BMA 4) in 2018 with comparisons to 2005. fRI Research, Hinton, Alberta, Canada.
- Stenhouse, G., J. Boulanger, K. Graham, I. Phoebus, C. McClelland, and K. Pigeon. 2021. 2018 grizzly bear population inventory - bear management area 7. fRI Research, Hinton, Alberta, Canada.
- Stoddart, M. C. J. 2011. Grizzlies and gondolas: animals and the meaning of skiing landscapes in British Columbia, Canada. *Nature and Culture* 6: 41–63.
- Stoney Consultation Team and Stoney Tribal Administration. 2015. Stoney Nakoda Nations Cultural Assessment for the “Enhancing grizzly bear management programs through the inclusion of cultural monitoring and traditional ecological knowledge.”
- Summerfield, B., W. Johnson, and D. Roberts. 2004. Trends in road development and access management in the Cabinet-Yaak and Selkirk grizzly bear recovery zones. *Ursus* 15: 115–122.
- Sunter, E. J. 2020. Factors affecting spatial and temporal variation in human-bear interactions. Doctoral Dissertation. University of British Columbia, Vancouver, British Columbia, Canada.
- Wheat, R. E., and C. C. Wilmers. 2016. Habituation reverses fear-based ecological effects in brown bears (*Ursus arctos*). *Ecosphere* 7: e01408.
- Whittington, J., M. Hebblewhite, R. W. Baron, A. T. Ford, and J. Paczkowski. 2022. Towns and trails drive carnivore movement behaviour, resource selection, and connectivity. *Movement Ecology* 10: 17.
- Whittington, J., P. Low, and B. Hunt. 2019. Temporal road closures improve habitat quality for wildlife. *Scientific Reports* 9: 3772.

## 1.2 Birds

- Arlettaz, R., P. Patthey, M. Baltic, T. Leu, M. Schaub, R. Palme, and S. Jenni-Eiermann. 2007. Spreading free-riding snow sports represent a novel serious threat for wildlife. *Proceedings of the Royal Society B: Biological Sciences* 274: 1219–1224.
- Arlettaz, R., S. Nussle, M. Baltic, P. Vogel, R. Palme, S. Jenni-Eiermann, P. Patthey, and M. Genoud. 2015. Disturbance of wildlife by outdoor winter recreation: allostatic stress response and altered activity–energy budgets. *Ecological Applications* 25: 1197–1212.
- Barton, D. C., and A. L. Holmes. 2007. Off-highway vehicle trail impacts on breeding songbirds in northeastern California. *The Journal of Wildlife Management* 71: 1617–1620.
- Bötsch, Y., Z. Tablado, D. Scherl, M. Kéry, R. F. Graf, and L. Jenni. 2018. Effect of recreational trails on forest birds: human presence matters. *Frontiers in Ecology and Evolution* 6: 175.
- Goldenberg, W. P., T. L. George, and J. M. Black. 2016. Steller’s Jay (*Cyanocitta stelleri*) space use and behavior in campground and non-campground sites in coastal redwood forests. *The Condor* 118: 532–541.
- Kangas, K., M. Luoto, A. Ihantola, E. Tomppo, and P. Siikamäki. 2010. Recreation-induced changes in boreal bird communities in protected areas. *Ecological Applications* 20: 1775–1786.
- Marzluff, J. M., and E. Neatherlin. 2006. Corvid response to human settlements and campgrounds: causes, consequences, and challenges for conservation. *Biological Conservation* 130: 301–314.
- Neatherlin, E. A., and J. M. Marzluff. 2004. Responses of American crow populations to campgrounds in remote native forest landscapes. *The Journal of Wildlife Management* 68: 708–718.
- Pauli, B. P., R. J. Spaul, and J. A. Heath. 2017. Forecasting disturbance effects on wildlife: tolerance does not mitigate effects of increased recreation on wildlands. *Animal Conservation* 20: 251–260.

- Perona, A. M., V. Urios, and P. López-López. 2019. Holidays? Not for all. Eagles have larger home ranges on holidays as a consequence of human disturbance. *Biological Conservation* 231: 59–66.
- Rösner, S., E. Mussard-Forster, T. Lorenc, and J. Müller. 2013. Recreation shapes a “landscape of fear” for a threatened forest bird species in Central Europe. *Landscape Ecology* 29: 55–66.
- Spaul, R. J., and J. A. Heath. 2016. Nonmotorized recreation and motorized recreation in shrub-steppe habitats affects behavior and reproduction of golden eagles (*Aquila chrysaetos*). *Ecology and Evolution* 6: 1–13.
- Spaul, R. J., and J. A. Heath. 2017. Flushing responses of golden eagles (*Aquila chrysaetos*) in response to recreation. *The Wilson Journal of Ornithology* 129: 834–845.
- Thiel, D., S. Jenni-Eiermann, V. Braunisch, R. Palme, and L. Jenni. 2008. Ski tourism affects habitat use and evokes a physiological stress response in capercaillie *Tetrao urogallus*: a new methodological approach. *Journal of Applied Ecology* 45: 845–853.
- Van, R. C., J. J. Fontaine, and J. W. van Wagtenonk. 2013. Great gray owls (*Strix nebulosa*) in Yosemite National Park: on the importance of food, forest structure, and human disturbance. *Natural Areas Journal* 33: 286–295.
- White, P. J., and T. Davis. 2007. Wildlife responses to motorized winter recreation in Yellowstone. 2005 Annual Report. The National Park Service.

### 1.3 Fish

- Alberta Sustainable Resource Development and Alberta Conservation Association. 2006. Status of the westslope Cutthroat Trout (*Oncorhynchus clarkii lewisii*) in Alberta. Alberta Sustainable Resource Development, Wildlife Status Report, Edmonton, Alberta, Canada.
- Cleator, H., J. Earle, L. Fitch, S. Humphries, M. Koops, K. Martin, D. Mayhood, S. Petry, C. Pacas, J. Stelfox, and D. Wig. 2009. Information relevant to a recovery potential assessment of pure Native Westslope Cutthroat Trout, Alberta population. Canadian Science Advisory Secretariat Science Advisory Report.
- Erdle, H. M., and D. W. Mayhood. 2014. Anthropogenic effects on the habitat of a critical population of at-risk Westslope Cutthroat Trout assessed using simple monitoring methods. Technical Report. Freshwater Research Limited, Calgary, Alberta, Canada.
- Fluker, S., and D. Mayhood. 2020. Environmental stewardship of public lands? The decline of Westslope Cutthroat Trout along the eastern slopes of the Rocky Mountains in Alberta. *Public Land & Resources Law Review* 42.
- Heckel IV, J. W., M. C. Quist, C. J. Watkins, and A. M. Dux. 2020. Distribution and abundance of Westslope cutthroat trout in relation to habitat characteristics at multiple spatial scales. *North American Journal of Fisheries Management* 40: 893–909.
- Mayhood, D. W. 1992. Approaches to managing freshwater fishes in North American parks and reserves. Part 2 of a fish management plan for Jasper National Park. Freshwater Research Limited, Calgary, Alberta, Canada.
- Mayhood, D. W. 2013. Suspended sediment in Silvester Creek and its potential effects on the westslope cutthroat trout population. Technical Report. Freshwater Research Limited, Calgary, Alberta, Canada.
- Mayhood, D. W., M. Sawyer, and W. Haskins. 1998. British Columbia’s level 1 watershed assessment procedure as a tool for monitoring potential impacts of development on aquatic ecosystems in Canada’s Rocky Mountains. *Science & Management of Protected Areas* 677–686.
- Mayhood, D. W., M. Sawyer, and W. Haskins. 2004. Historical risk analysis of watershed disturbance in the southern east slopes region of Alberta, Canada, 1910–1996. Forest-Land-Fish conference II- Ecosystem Stewardship through Collaboration. Edmonton, Alberta, Canada.

- Sawyer, M., and Mayhood, D. W. 1998. Cumulative effects analysis of land-use in the Carbondale River catchment: implications for fish management. Proceeding Forest-fish Conference, Calgary Alberta, Canada.
- Smith, W., R. Cheng, and S. Elmeligi. 2016. Linear disturbance in the Castle: implications for grizzly bear and trout. A special series on the Castle proposed protected areas: Bulletin 3. Global Forest Watch Canada, Ottawa, Ontario, Canada.
- Stelfox, J. D., D. M. Baayens, A. J. Paul, and G. E. Shumaker. 2001. Quirk Creek brook trout suppression project. Bull trout II conference proceedings. Trout Unlimited Canada, Calgary, Alberta.

## 1.4 Species at Risk

- Alberta Sustainable Resource Development and Alberta Conservation Association. 2006. Status of the Westslope Cutthroat Trout (*Oncorhynchus clarkii lewisii*) in Alberta. Alberta Sustainable Resource Development, Edmonton, Alberta, Canada.
- Canadian Endangered Species Conservation Council. 2016. Wild species 201: the general status of species in Canada. National General Status Working Group.
- Favaro, B., D. C. Claar, C. H. Fox, C. Freshwater, J. J. Holden, A. Roberts, and UVic Research Derby. 2014. Trends in extinction risk for imperiled species in Canada. PLoS ONE 9: e113118.
- McCune, J. L., W. L. Harrower, S. Avery-Gomm, J. M. Brogan, A.-M. Csörgő, L. N. K. Davidson, A. Garani, L. R. Halpin, L. P. J. Lipsen, C. Lee, J. C. Nelson, L. R. Prugh, C. M. Stinson, C. K. Whitney, and J. Whitton. 2013. Threats to Canadian species at risk: an analysis of finalized recovery strategies. Biological Conservation 166: 254–265.
- Naujokaitis-Lewis, I., S. Endicott, and J. M. Guezen. 2022. CAN-SAR: a database of Canadian species at risk information. Scientific Data 9: 289.
- Post, J. R., and F. D. Johnston. 2002. Status of the Bull Trout (*Salvelinus confluentus*) in Alberta. Alberta Sustainable Resource Development, Fish and Wildlife Division, and Alberta Conservation Association. Wildlife Status Report. Edmonton, Alberta, Canada.
- Proctor, M., and M. Mahr. 2020. Kootenay Connect: riparian wildlife corridors for climate change. Prepared for Fish and Wildlife Compensation Program.

## 1.5 Ungulates

- Aastrup, P. 2000. Responses of West Greenland caribou to the approach of humans on foot. Polar Research 19: 83–90.
- Bauduin, S., E. McIntire, M. St-Laurent, and S. G. Cumming. 2018. Compensatory conservation measures for an endangered caribou population under climate change. Scientific Reports 8: 16438.
- Beauchesne, D., J. A. G. Jaeger, and M. St-Laurent. 2014. Thresholds in the capacity of boreal caribou to cope with cumulative disturbances: evidence from space use patterns. Biological Conservation 172: 190–199.
- Beest, F. M. van, E. V. Wal, A. V. Stronen, and R. K. Brook. 2013. Factors driving variation in movement rate and seasonality of sympatric ungulates. Journal of Mammalogy 94: 691–701.
- Blagdon, D., and C. J. Johnson. 2021. Short term, but high risk of predation for endangered mountain caribou during seasonal migration. Biodiversity and Conservation 30: 719–739.
- Borkowski, J. J., P. J. White, R. A. Garrott, T. Davis, A. R. Hardy, and D. J. Reinhart. 2006. Behavioral responses of bison and elk in Yellowstone to snowmobiles and snow coaches. Ecological Applications 16: 1911–1925.
- Brown, C. L., A. R. Hardy, J. R. Barber, K. M. Fristrup, K. R. Crooks, and L. M. Angeloni. 2012. The effect of human activities and their associated noise on ungulate behavior. PLoS ONE 7: e40505.



- Cassirer, E. F., D. J. Freddy, and E. D. Ables. 1992. Elk responses to disturbance by cross-country skiers in Yellowstone National Park. *Wildlife Society Bulletin* 20: 375 – 381.
- Ciuti, S., J. M. Northrup, T. B. Muhly, S. Simi, M. Musiani, J. A. Pitt, and M. S. Boyce. 2012. Effects of humans on behaviour of wildlife exceed those of natural predators in a landscape of fear. *PLoS ONE* 7: e50611.
- Ciuti, S., T. B. Muhly, D. G. Paton, A. D. McDevitt, M. Musiani, and M. S. Boyce. 2012. Human selection of elk behavioural traits in a landscape of fear. *Proceedings of the Royal Society B: Biological Sciences* 279: 4407–4416.
- Côté, S. D., S. Hamel, A. St-Louis, and J. Mainguy. 2013. Do mountain goats habituate to helicopter disturbance? *The Journal of Wildlife Management* 77: 1244–1244.
- Courtemanch, A. 2014. Seasonal habitat selection and impacts of backcountry recreation on a formerly migratory bighorn sheep population in NW Wyoming, USA. Master's thesis. University of Wyoming, Laramie, United States of America.
- Dixon, G., A. S. Marriott, G. Stelfox, C. Dunkerley, and S. P. Batke. 2021. How do red deer react to increased visitor numbers? A case study on human-deer encounter probability and its effect on cortisol stress responses. *Nature Conservation* 43: 55–78.
- Duchesne, M., S. D. Côté, and C. Barrette. 2000. Responses of woodland caribou to winter ecotourism in the Charlevoix Biosphere Reserve, Canada. *Biological Conservation* 96: 311–317.
- Environment Canada. 2012. Recovery strategy for the Woodland Caribou (*Rangifer tarandus caribou*), boreal population, in Canada. *Species at Risk Act Recovery Strategy Series*. Environment Canada, Ottawa.
- Environment Canada. 2012. Recovery strategy for the Woodland Caribou, Southern Mountains population (*Rangifer tarandus caribou*) in Canada. *Species at Risk Act Recovery Strategy Series*. Environment Canada, Ottawa.
- Forest Practices Board. 2014. Helicopter and snowcat skiing in mountain caribou habitat – audit of compliance with reporting requirements. Forest Practices Board, Victoria, British Columbia, Canada
- Freeman, N. L. 2008. Motorized backcountry recreation and stress response in Mountain Caribou (*Rangifer tarandus caribou*). Masters' thesis. University of British Columbia, Vancouver, British Columbia, Canada.
- Gubili, C., S. Mariani, B. V. Weckworth, P. Galpern, A. D. McDevitt, M. Hebblewhite, B. Nickel, and M. Musiani. 2017. Environmental and anthropogenic drivers of connectivity patterns: a basis for prioritizing conservation efforts for threatened populations. *Evolutionary Applications* 10: 199–211.
- Hall, O. 2018. An application of citizen science to study the interactions between recreational hillwalkers and red deer in the Scottish Uplands. Research Dissertation in Geography. University of St. Andrews, St Andrews, Scotland.
- Hamilton, D. and Pasztor, C. 2009. A guide to commercial backcountry skiing standard operating practices for ski run development, helicopter landing and pickup site development, and snow trail development in mountain caribou habitat. Report submitted to Species at Risk Coordination, Ministry of Environment, Victoria, British Columbia, Canada.
- Hansen, B. B., and R. Aanes. 2015. Habituation to humans in a predator-free wild ungulate. *Polar Biology* 38: 145–151.
- Hardy, A. R. 2001. Responses of elk and bison to winter recreation in Yellowstone National Park. Master's thesis. Montana State University, Bozeman, Montana, United States of America.
- Harris, G., R. M. Nielson, T. Rinaldi, and T. Lohuis. 2014. Effects of winter recreation on northern ungulates with focus on moose (*Alces alces*) and snowmobiles. *European Journal of Wildlife Research* 60: 45–58.
- Hebblewhite, M., C. White, and M. Musiani. 2010. Revisiting extinction in national parks: mountain caribou in Banff. *Conservation Biology* 24: 341–344.

- HeliCat Canada. 2018. Economic impacts to HeliCat Canada members associated with changes to caribou management in B.C. HeliCat Canada, Pemberton, British Columbia, Canada.
- Huebel, K. J. 2012. Assessing the impacts of heli-skiing on the behavior and spatial distribution of mountain caribou (*Rangifer tarandus caribou*). Master's thesis. Thompson Rivers University, Kamloops, British Columbia, Canada.
- Johnson, C. A., C. R. Drever, P. Kirby, E. Neave, and A. E. Martin. 2022. Protecting boreal caribou habitat can help conserve biodiversity and safeguard large quantities of soil carbon in Canada. *Scientific Reports* 12: 17067.
- Johnson, C. J., and D. E. Russell. 2014. Long-term distribution responses of a migratory caribou herd to human disturbance. *Biological Conservation* 177: 52–63.
- Kinley, T. 2003. Snowmobile - Mountain caribou interactions: perceptions and trends in caribou displacement. Report. Sylvan Consulting Ltd., Invermere, British Columbia, Canada.
- Kumpula, J., M. Kurkilahti, T. Helle, and A. Colpaert. 2014. Both reindeer management and several other land use factors explain the reduction in ground lichens (*Cladonia spp.*) in pastures grazed by semi-domesticated reindeer in Finland. *Regional Environmental Change* 14:5 41–559.
- Laliberte, A. S., and W. J. Ripple. 2004. Range contractions of North American carnivores and ungulates. *BioScience* 54 :123–138.
- Leblond, M., J. Frair, D. Fortin, C. Dussault, J.-P. Ouellet, and R. Courtois. 2011. Assessing the influence of resource covariates at multiple spatial scales: an application to forest-dwelling caribou faced with intensive human activity. *Landscape Ecology* 26: 1433–1446.
- Leclerc, M., A. Tarroux, P. Fauchald, A. Stien, T. Tveraa, and M.-H. St-Laurent. 2019. Effects of human-induced disturbances and weather on herbivore movement. *Journal of Mammalogy* 100: 1490–1500.
- Lesmerises, F., C. J. Johnson, and M.-H. St-Laurent. 2017. Refuge or predation risk? Alternate ways to perceive hiker disturbance based on maternal state of female caribou. *Ecology and Evolution* 7: 845–854.
- Lesmerises, F., F. Déry, C. J. Johnson, and M. St-Laurent. 2018. Spatiotemporal response of mountain caribou to the intensity of backcountry skiing. *Biological Conservation* 217: 149–156.
- MacNearney, D., K. Pigeon, G. Stenhouse, W. Nijland, N. C. Coops, and L. Finnegan. 2016. Heading for the hills? Evaluating spatial distribution of woodland caribou in response to a growing anthropogenic disturbance footprint. *Ecology and Evolution* 6: 6484–6509.
- Naidoo, R., and A. C. Burton. 2020. Relative effects of recreational activities on a temperate terrestrial wildlife assemblage. *Conservation Science and Practice* 2: e271.
- Nellemann, C., P. Jordhoy, S. Ole-Gunnar, and O. Strand. 2000. Cumulative impacts of tourist resorts on wild reindeer (*Rangifer tarandus tarandus*) during winter. *Arctic* 53: 9–17.
- Nellemann, C., I. Vistnes, P. Jordhøy, O. Støen, B. P. Kaltenborn, F. Hanssen, and R. Helgesen. 2010. Effects of recreational cabins, trails and their removal for restoration of reindeer winter ranges. *Restoration Ecology* 18: 873–881.
- Papouchis, C. M., F. J. Singer, and W. B. Sloan. 2001. Responses of desert bighorn sheep to increased human recreation. *The Journal of Wildlife Management* 65: 573–582.
- Pelletier, F. 2006. Effects of tourist activities on ungulate behavior in a mountain protected area. *Journal Mountain Ecology* 8: 15–19.
- Pelletier, F., G. Turgeon, A. Bourret, D. Garant, and M. St-Laurent. 2019. Genetic structure and effective size of an endangered population of woodland caribou. *Conservation Genetics* 20: 203–213.
- Pigeon, K. E., M. Anderson, D. MacNearney, J. Cranston, G. Stenhouse, and L. Finnegan. 2016. Toward the restoration of caribou habitat: understanding factors associated with human motorized use of legacy seismic lines. *Environmental Management* 58: 821–832.
- Plante, S., C. Dussault, J. H. Richard, and S. D. Côté. 2018. Human disturbance effects and cumulative habitat loss in endangered migratory caribou. *Biological Conservation* 224: 129–143.

- Polfus, J. L., K. Heinemeyer, and M. Hebblewhite. 2014. Comparing traditional ecological knowledge and western science woodland caribou habitat models. *The Journal of Wildlife Management* 78: 112–121.
- Polfus, J. L., M. Hebblewhite, and K. Heinemeyer. 2011. Identifying indirect habitat loss and avoidance of human infrastructure by northern mountain woodland caribou. *Biological Conservation* 144: 2637–2646.
- Powell, T. 2004. Réponse comportementale des caribous des bois au harcèlement par les motoneiges. Master's thesis. Université de Sherbrooke, Sherbrooke, Quebec, Canada.
- Ray, J. 2014. Defining habitat restoration for boreal caribou in the context of national recovery: a discussion paper. Wildlife Conservation Society, Canada, Toronto, Ontario, Canada.
- Reimers, E., S. Eftestøl, and J. E. Colman. 2003. Behavior responses of wild reindeer to direct provocation by a snowmobile or skier. *The Journal of Wildlife Management* 67: 747–754.
- Richard, J. H., and S. D. Côté. 2016. Space use analyses suggest avoidance of a ski area by mountain goats. *The Journal of Wildlife Management* 80: 387–395.
- Ripple, W. J., and R. L. Beschta. 2006. Linking a cougar decline, trophic cascade, and catastrophic regime shift in Zion National Park. *Biological Conservation* 133: 397–408.
- Rogala, J. K., M. Hebblewhite, J. Whittington, C. A. White, J. Coleshill, and M. Musiani. 2011. Human activity differentially redistributes large mammals in the Canadian Rockies National Parks. *Ecology and Society* 16: 16.
- Sawyer, H., M. J. Kauffman, and R. M. Nielson. 2009. Influence of well pad activity on winter habitat selection patterns of mule deer. *The Journal of Wildlife Management* 73: 1052–1061.
- Schuttler, S. G., A. W. Parsons, T. D. Forrester, M. C. Baker, W. J. McShea, R. Costello, and R. Kays. 2017. Deer on the lookout: how hunting, hiking and coyotes affect white-tailed deer vigilance. *Journal of Zoology* 301: 320–327.
- Seip, D. R., C. J. Johnson, and G. S. Watts. 2007. Displacement of mountain caribou from winter habitat by snowmobiles. *The Journal of Wildlife Management* 71: 1539–1544.
- Shanley, C. S., and S. Pyare. 2011. Evaluating the road-effect zone on wildlife distribution in a rural landscape. *Ecosphere* 2: 1–16.
- Simpson, K., and E. Terry. 2000. Impacts of backcountry recreation activities on mountain caribou. Management concerns, interim management guidelines and research needs. Wildlife working report. Ministry of Environment, Lands and Parks, Wildlife Branch, Victoria, British Columbia, Canada.
- Stankowich, T. 2008. Ungulate flight responses to human disturbance: a review and meta-analysis. *Biological Conservation* 141: 2159–2173.
- St-Louis, A., S. Hamel, J. Mainguy, and S. D. Côté. 2013. Factors influencing the reaction of mountain goats towards all-terrain vehicles. *The Journal of Wildlife Management* 77: 599–605.
- Taylor, A. R., and R. L. Knight. 2003. Wildlife responses to recreation and associated visitor perceptions. *Ecological Applications* 13: 951–963.
- van Oort, H. van, B. N. McLellan, and R. Serrouya. 2011. Fragmentation, dispersal and metapopulation function in remnant populations of endangered mountain caribou. *Animal Conservation* 14: 215–224.
- Vistnes, I., and C. Nellemann. 2001. Avoidance of cabins, roads, and power lines by reindeer during calving. *The Journal of Wildlife Management* 65: 915–925.
- White, P., T. Davis, and J. Borkowski. 2007. Wildlife responses to motorized winter recreation in yellowstone: 2005 annual report.
- Whittington, J., M. Hebblewhite, N. J. DeCesare, L. Neufeld, M. Bradley, J. Wilmshurst, and M. Musiani. 2011. Caribou encounters with wolves increase near roads and trails: a time-to-event approach. *Journal of Applied Ecology* 48: 1535–1542.
- Whittington, J., P. Low, and B. Hunt. 2019. Temporal road closures improve habitat quality for wildlife. *Scientific Reports* 9: 3772.

- Wilmshurst, J. 2017. Mountain caribou compliance monitoring: interactions between mountain caribou and helicopter and snowcat skiing operations during the 2016-17 skiing season. Report prepared for Steve Gordon, Resource Management Objectives branch, Ministry of Forests, Lands and Natural Resource Operations, Victoria, British Columbia, Canada.
- Wilson, S. F., and J. F. Wilmshurst. 2019. Behavioral response of southern mountain caribou to helicopter and skiing activities. *Rangifer* 39: 27 – 42.
- Wilson, S. F., C. Nietvelt, S. Taylor, and D. A. Guertin. 2022. Using Bayesian networks to map winter habitat for mountain goats in coastal British Columbia, Canada. *Frontiers in Environmental Science* 10: 958596.
- Wisdom, M. J., H. K. Preisler, L. M. Naylor, R. G. Anthony, B. K. Johnson, and M. M. Rowland. 2018. Elk responses to trail-based recreation on public forests. *Forest Ecology and Management* 411: 223–233.
- Wolfe, S., B. Griffith, and C.A.G. Wolfe. 2000. Response of reindeer and caribou to human activities. *Polar Research* 19: 63–73.

## 1.6 Caribou - Recreation and Tourism

- Aastrup, P. 2000. Responses of West Greenland caribou to the approach of humans on foot. *Polar Research* 19: 83–90.
- Bateman, P. W., and P. A. Fleming. 2017. Are negative effects of tourist activities on wildlife over-reported? A review of assessment methods and empirical results. *Biological Conservation* 211: 10–19.
- Bauduin, S., E. McIntire, M.-H. St-Laurent, and S. G. Cumming. 2018. Compensatory conservation measures for an endangered caribou population under climate change. *Scientific Reports* 8.
- Beauchesne, D., J. A. G. Jaeger, and M. St-Laurent. 2014. Thresholds in the capacity of boreal caribou to cope with cumulative disturbances: evidence from space use patterns. *Biological Conservation* 172: 190–199.
- Beest, F. M. van, E. V. Wal, A. V. Stronen, and R. K. Brook. 2013. Factors driving variation in movement rate and seasonality of sympatric ungulates. *Journal of Mammalogy* 94: 691–701.
- Brown, C. L., A. R. Hardy, J. R. Barber, K. M. Fristrup, K. R. Crooks, and L. M. Angeloni. 2012. The effect of human activities and their associated noise on ungulate behavior. *PLoS ONE* 7: e40505.
- Dangi, T. B., and W. J. Gribb. 2018. Sustainable ecotourism management and visitor experiences: managing conflicting perspectives in Rocky Mountain National Park, USA. *Journal of Ecotourism* 17: 338–358.
- Duchesne, M., S. D. Côté, and C. Barrette. 2000. Responses of woodland caribou to winter ecotourism in the Charlevoix Biosphere Reserve, Canada. *Biological Conservation* 96: 311–317.
- Environment Canada. 2012. Recovery strategy for the Woodland Caribou (*Rangifer tarandus caribou*), boreal population, in Canada. *Species at Risk Act Recovery Strategy Series*. Environment Canada, Ottawa.
- Environment Canada. 2012. Recovery strategy for the Woodland Caribou, Southern Mountains population (*Rangifer tarandus caribou*) in Canada. *Species at Risk Act Recovery Strategy Series*. Environment Canada, Ottawa.
- Gubili, C., S. Mariani, B. V. Weckworth, P. Galpern, A. D. McDevitt, M. Hebblewhite, B. Nickel, and M. Musiani. 2017. Environmental and anthropogenic drivers of connectivity patterns: a basis for prioritizing conservation efforts for threatened populations. *Evolutionary Applications* 10: 199–211.
- Hansen, B. B., and R. Aanes. 2015. Habituation to humans in a predator-free wild ungulate. *Polar Biology* 38: 145–151.
- Hebblewhite, M., C. White, and M. Musiani. 2010. Revisiting extinction in national parks: mountain caribou in Banff. *Conservation Biology* 24: 341–344.

- Honda, T., N. Yamabata, H. Iijima, and K. Uchida. 2019. Sensitization to human decreases human-wildlife conflict: empirical and simulation study. *European Journal of Wildlife Research* 65:71.
- Hornseth, M. L., K. E. Pigeon, D. MacNearney, T. A. Larsen, G. Stenhouse, J. Cranston, and L. Finnegan. 2018. Motorized activity on legacy seismic lines: a predictive modeling approach to prioritize restoration efforts. *Environmental Management* 62: 595–607.
- Huebel, K. J. 2012. Assessing the impacts of heli-skiing on the behavior and spatial distribution of mountain caribou (*Rangifer tarandus caribou*). Master's thesis. Thompson Rivers University, Kamloops, British Columbia, Canada.
- Johnson, C. J., and D. E. Russell. 2014. Long-term distribution responses of a migratory caribou herd to human disturbance. *Biological Conservation* 177: 52–63.
- Johnson, J., and J. Hendrikx. 2021. Using citizen science to document terrain use and decision-making of backcountry users. *Citizen Science: Theory and Practice* 6: 8.
- Kumpula, J., M. Kurkilahti, T. Helle, and A. Colpaert. 2014. Both reindeer management and several other land use factors explain the reduction in ground lichens (*Cladonia spp.*) in pastures grazed by semi-domesticated reindeer in Finland. *Regional Environmental Change* 14: 541–559.
- Leblond, M., J. Frair, D. Fortin, C. Dussault, J.-P. Ouellet, and R. Courtois. 2011. Assessing the influence of resource covariates at multiple spatial scales: an application to forest-dwelling caribou faced with intensive human activity. *Landscape Ecology* 26: 1433–1446.
- Leclerc, M., A. Tarroux, P. Fauchald, A. Stien, T. Tveraa, and M.-H. St-Laurent. 2019. Effects of human-induced disturbances and weather on herbivore movement. *Journal of Mammalogy* 100: 1490–1500.
- Lesmerises, F., C. J. Johnson, and M.-H. St-Laurent. 2017. Refuge or predation risk? Alternate ways to perceive hiker disturbance based on maternal state of female caribou. *Ecology and Evolution* 7: 845–854.
- Lesmerises, F., F. Déry, C. J. Johnson, and M.-H. St-Laurent. 2018. Spatiotemporal response of mountain caribou to the intensity of backcountry skiing. *Biological Conservation* 217: 149–156.
- MacNearney, D., K. Pigeon, G. Stenhouse, W. Nijland, N. C. Coops, and L. Finnegan. 2016. Heading for the hills? Evaluating spatial distribution of woodland caribou in response to a growing anthropogenic disturbance footprint. *Ecology and Evolution* 6: 6484–6509.
- Nelleman, C., P. Jordhoy, S. Ole-Gunnar, and O. Strand. 2000. Cumulative impacts of tourist resorts on wild reindeer (*Rangifer tarandus tarandus*) during winter. *Arctic* 53: 9–17.
- Nellemann, C., I. Vistnes, P. Jordhøy, O.-G. Støen, B. P. Kaltenborn, F. Hanssen, and R. Helgesen. 2010. Effects of recreational cabins, trails and their removal for restoration of reindeer winter ranges. *Restoration Ecology* 18: 873–881.
- Olson, L. E., J. R. Squires, E. K. Roberts, A. D. Miller, J. S. Ivan, and M. Hebblewhite. 2017. Modeling large-scale winter recreation terrain selection with implications for recreation management and wildlife. *Applied Geography* 86: 66–91.
- Olson, L. E., J. R. Squires, E. K. Roberts, J. S. Ivan, and M. Hebblewhite. 2018. Sharing the same slope: behavioral responses of a threatened mesocarnivore to motorized and nonmotorized winter recreation. *Ecology and Evolution* 8: 8555–8572.
- Pelletier, F., G. Turgeon, A. Bourret, D. Garant, and M. St-Laurent. 2019. Genetic structure and effective size of an endangered population of woodland caribou. *Conservation Genetics* 20: 203–213.
- Pigeon, K. E., M. Anderson, D. MacNearney, J. Cranston, G. Stenhouse, and L. Finnegan. 2016. Toward the restoration of caribou habitat: understanding factors associated with human motorized use of legacy seismic lines. *Environmental Management* 58: 821–832.
- Plante, S., C. Dussault, J. H. Richard, and S. D. Côté. 2018. Human disturbance effects and cumulative habitat loss in endangered migratory caribou. *Biological Conservation* 224: 129–143.
- Ray, J. 2014. Defining habitat restoration for boreal caribou in the context of national recovery: a discussion paper. Wildlife Conservation Society, Canada, Toronto, Ontario, Canada.
- Reimers, E., S. Eftestøl, and J. E. Colman. 2003. Behavior responses of wild reindeer to direct provocation by a snowmobile or skier. *The Journal of Wildlife Management* 67: 747–754.

- Seip, D. R., C. J. Johnson, and G. S. Watts. 2007. Displacement of mountain caribou from winter habitat by snowmobiles. *The Journal of Wildlife Management* 71: 1539–1544.
- Simpson, K., and E. Terry. 2000. Impacts of backcountry recreation activities on mountain caribou. Management concerns, interim management guidelines and research needs. Wildlife working report. Ministry of Environment, Lands and Parks, Wildlife Branch, Victoria, British Columbia, Canada.
- Stankowich, T. 2008. Ungulate flight responses to human disturbance: a review and meta-analysis. *Biological Conservation* 141: 2159–2173.
- van Oort, H. van, B. N. McLellan, and R. Serrouya. 2011. Fragmentation, dispersal and metapopulation function in remnant populations of endangered mountain caribou. *Animal Conservation* 14: 215–224.
- Vistnes, I., and C. Nellemann. 2001. Avoidance of cabins, roads, and power lines by reindeer during calving. *The Journal of Wildlife Management* 65: 915–925.
- Vistnes, I., and C. Nellemann. 2008. The matter of spatial and temporal scales: a review of reindeer and caribou response to human activity. *Polar Biology* 31: 399–407.
- Whittington, J., M. Hebblewhite, N. J. DeCesare, L. Neufeld, M. Bradley, J. Wilmshurst, and M. Musiani. 2011. Caribou encounters with wolves increase near roads and trails: a time-to-event approach. *Journal of Applied Ecology* 48: 1535–1542.
- Wilson, S. F., and J. F. Wilmshurst. 2019. Behavioural responses of southern mountain caribou to helicopter and skiing activities. *Rangifer* 39: 27–42.
- Wolfe, S., B. Griffith, and C.A.G. Wolfe. 2000. Response of reindeer and caribou to human activities. *Polar Research* 19: 63–73.

## 1.7 Wolverines

- Apps, C., J. Weaver, P. Paquet, B. Bateman, and B. McLellan. 2007. Carnivores in the southern Canadian Rockies: core areas and connectivity across the Crowsnest Highway. Wildlife Conservation Society Canada Conservation Report No. 3. Toronto, Ontario, Canada.
- Aubry, K. B., K. S. McKelvey, and J. P. Copeland. 2007. Distribution and broadscale habitat relations of the wolverine in the contiguous United States. *The Journal of Wildlife Management* 71: 2147–2158.
- Austin, M. 1998. Wolverine winter travel routes and response to transportation corridors in Kicking Horse Pass between Yoho and Banff National Parks. Master's thesis. University of Calgary, Calgary, Alberta, Canada.
- Banci, V. 1987. Ecology and behavior of wolverine in Yukon. Master's thesis. Simon Fraser University, Burnaby, British Columbia, Canada.
- Barrueto, M., and A. Forsher. 2021. Effects of human activities and natural processes on wolverine reproduction and connectivity. 2020 Summary Report. University of Calgary and Parks Canada Agency.
- Bonamy, M., A. B. Harbicht, and T. M. Herrmann. 2019. Children's perception of wolverine in the North Slave region of the Northwest Territories, Canada. *Arctic* 72: 229–244.
- Bonamy, M., A. B. Harbicht, and T. M. Herrmann. 2020. How children in northern Canada represent the wolverine through drawings. *Polar Record* 56: 1–2.
- Bonamy, M., A. B. Harbicht, T. M. Herrmann, and C. Gagnon. 2020. Public opinion toward a misunderstood predator: what do people really know about wolverine and can educational programs promote its conservation? *Écoscience* 27: 77–92.
- Bonamy, M., T. M. Herrmann, and A. B. Harbicht. 2020. 'I think it is the toughest animal in the North': human-wolverine interactions among hunters and trappers in the Canadian Northwest Territories. *Polar Geography* 43: 1–24.

- Carroll, C., R. F. Noss, and P. C. Paquet. 2001. Carnivores as focal species for conservation planning in the Rocky Mountain region. *Ecological Applications* 11: 961–980.
- Copeland, J. P., J. M. Peek, C. R. Groves, W. E. Melquist, K. S. Mckelvey, G. W. McDaniel, C. D. Long, and C. E. Harris. 2007. Seasonal habitat associations of the wolverine in central Idaho. *The Journal of Wildlife Management* 71: 2201–2212.
- Copeland, J., and F. Edelmann. 1999. Wolverine distribution in the northwestern United States and a survey in the Seven Devils Mountains of Idaho. *Northwest Science* 73: 295 – 300.
- COSEWIC. 2014. Assessment and status report on the Wolverine *Gulo gulo* in Canada. Committee on the status of endangered wildlife in Canada. Ottawa, Canada.
- Dalerum, F., J. Loxterman, B. Shults, K. Kunkel, and J. A. Cook. 2007. Sex-specific dispersal patterns of wolverines: insights from microsatellite markers. *Journal of Mammalogy* 88: 793–800.
- Danzinger, L. J. 2011. Using GIS to examine potential wolverine habitat in Colorado: an analysis of habitat fragmentation and wildlife corridors. *Papers in Resource Analysis* 13: 1–11.
- Emmet, R. L., R. A. Long, and B. Gardner. 2021. Modeling multi-scale occupancy for monitoring rare and highly mobile species. *Ecosphere* 12: e03637.
- Gardner, C. L. 1985. The ecology of wolverines in southcentral Alaska. Master's thesis. University of Alaska, Fairbanks, Alaska, United States of America.
- Heim, N. A. 2015. Complex effects of human-impacted landscapes on the spatial patterns of mammalian carnivores. Master's thesis. University of Victoria, Victoria, British Columbia, Canada.
- Heim, N., J. T. Fisher, J. Volpe, A. P. Clevenger, and J. Paczkowski. 2019. Carnivore community response to anthropogenic landscape change: species-specificity foils generalizations. *Landscape Ecology* 34: 2493–2507.
- Heinemeyer, K. 2019. Use of aerial surveys to monitor backcountry winter recreation and predict associated wolverine habitat use. Report to Idaho Department of Fish and Game. Round River Conservation Studies.
- Heinemeyer, K., J. Squires, M. Hebblewhite, J. J. O'Keefe, J. D. Holbrook, and J. Copeland. 2019. Wolverines in winter: indirect habitat loss and functional responses to backcountry recreation. *Ecosphere* 10: e02611.
- Heinemeyer, K., J. Squires, M. Hebblewhite, J. S. Smith, J. D. Holbrook, and J. P. Copeland. 2017. Wolverine-winter recreation research project: investigating the interaction between wolverines and winter recreation. Final Report.
- Hornocker, M. G., and H. S. Hash. 1981. Ecology of the wolverine in northwestern Montana. *Canadian Journal of Zoology* 59: 1286–1301.
- Krebs, J., E. C. Lofroth, and I. A. N. Parfitt. 2007. Multiscale habitat use by wolverines in British Columbia, Canada. *The Journal of Wildlife Management* 71: 2180–2192.
- Krebs, J., E. Lofroth, J. Copeland, V. Banci, D. Cooley, H. Golden, A. Magoun, R. Mulders, and B. Shults. 2004. Synthesis of survival rates and causes of mortality in North American wolverines. *The Journal of Wildlife Management* 68: 493–502.
- Kyle, C. J., and C. Strobeck. 2002. Connectivity of peripheral and core populations of north American wolverines. *Journal of Mammalogy* 83: 1141–1150.
- Landa, A., O. Strand, J. E. Swenson, and T. Skogland. 2011. Wolverines and their prey in southern Norway. *Canadian Journal of Zoology* 75: 1292–1299.
- Lofroth, E. C., and J. Krebs. 2007. The abundance and distribution of wolverines in British Columbia, Canada. *The Journal of Wildlife Management* 71: 2159–2169.
- Lofroth, E. C., J. A. Krebs, W. L. Harrower, and D. Lewis. 2007. Food habits of wolverine *Gulo gulo* in montane ecosystems of British Columbia, Canada. *Wildlife Biology* 13: 31–37.
- Magoun, A. J. 1985. Population characteristics, ecology, and management of wolverines in northwestern Alaska (*Gulo-Gulo*). Doctoral dissertation. University of Alaska, Fairbanks, Alaska, United States of America.
- Magoun, A. J., and J. P. Copeland. 1998. Characteristics of wolverine reproductive den sites. *The Journal of wildlife management* 62: 1313–1320.

- Mattisson, J. M., J. P. Persson, H. A. Andrén, and P. S. Segerström. 2011. Temporal and spatial interactions between an obligate predator, the Eurasian lynx (*Lynx lynx*), and a facultative scavenger, the wolverine (*Gulo gulo*). *Canadian Journal of Zoology* 82: 79–89.
- May, R., A. Landa, J. van Dijk, J. D. C. Linnell, and R. Andersen. 2006. Impact of infrastructure on habitat selection of wolverines *Gulo gulo*. *Wildlife Biology* 12: 285–295.
- Murphy, K., J. Wilmot, J. Copeland, D. Tyers, J. Squires, R. M. Inman, M. L. Packila, and D. McWhirter. 2011. Wolverine Conservation in Yellowstone National Park: Final Report. National Park Service, Yellowstone National Park, Yellowstone Center for Resources, Yellowstone National Park, Wyoming, United States of America.
- Persson, J. 2011. Female wolverine (*Gulo gulo*) reproduction: reproductive costs and winter food availability. *Canadian Journal of Zoology* 83: 1453–1459.
- Persson, J., A. Landa, R. Andersen, and P. Segerström. 2006. Reproductive characteristics of female wolverines (*Gulo gulo*) in Scandinavia. *Journal of Mammalogy* 87: 75–79.
- Rowland, M. M., M. J. Wisdom, D. H. Johnson, B. C. Wales, J. P. Copeland, and F. B. Edelman. 2003. Evaluation of landscape models for wolverines in the interior northwest, United States of America. *Journal of Mammalogy* 84: 92–105.
- Ruggiero, L. F., K. S. McKelvey, K. B. Aubry, J. P. Copeland, D. H. Pletscher, and M. G. Hornocker. 2007. Wolverine conservation and management. *The Journal of Wildlife Management* 71: 2145–2146.
- Schwartz, M. K., J. P. Copeland, N. J. Anderson, J. R. Squires, R. M. Inman, K. S. McKelvey, K. L. Pilgrim, L. P. Waits, and S. A. Cushman. 2009. Wolverine gene flow across a narrow climatic niche. *Ecology* 90: 3222–3232.
- Scraftford, M. A., T. Avgar, R. Heeres, and M. S. Boyce. 2018. Roads elicit negative movement and habitat-selection responses by wolverines (*Gulo gulo luscus*). *Behavioral Ecology* 29: 534–542.

## 1.8 Wolves

- Anton, C. B., D. W. Smith, J. P. Suraci, D. R. Stahler, T. P. Duane, and C. C. Wilmers. 2020. Gray wolf habitat use in response to visitor activity along roadways in Yellowstone National Park. *Ecosphere* 11: e03164.
- Carricondo-Sanchez, D., B. Zimmermann, P. Wabakken, A. Eriksen, C. Milleret, A. Ordiz, A. Sanz-Pérez, and C. Wikenros. 2020. Wolves at the door? Factors influencing the individual behavior of wolves in relation to anthropogenic features. *Biological Conservation* 244: 108514.
- Ford, A. T., E. J. Sunter, C. Fauvelle, J. L. Bradshaw, B. Ford, J. Hutchen, N. Phillipow, and K. J. Teichman. 2020. Effective corridor width: linking the spatial ecology of wildlife with land use policy. *European Journal of Wildlife Research* 66: 69.
- Heim, N., J. T. Fisher, J. Volpe, A. P. Clevenger, and J. Paczkowski. 2019. Carnivore community response to anthropogenic landscape change: species-specificity foils generalizations. *Landscape Ecology* 34: 2493–2507.
- Jędrzejewski, W., M. Niedziałkowska, S. Nowak, and B. Jędrzejewska. 2004. Habitat variables associated with wolf (*Canis lupus*) distribution and abundance in northern Poland. *Diversity and Distributions* 10: 225–233.
- Muhly, T. B., C. A. Johnson, M. Hebblewhite, E. W. Neilson, D. Fortin, J. M. Fryxell, A. D. M. Latham, M. C. Latham, P. D. McLoughlin, E. Merrill, P. C. Paquet, B. R. Patterson, F. Schmiegelow, F. Scurrah, and M. Musiani. 2019. Functional response of wolves to human development across boreal North America. *Ecology and Evolution* 9: 10801–10815.
- Muhly, T. B., C. Semeniuk, A. Massolo, L. Hickman, and M. Musiani. 2011. Human activity helps prey win the predator-prey space race. *PLoS ONE* 6: e17050.



- Muhly, T. B., M. Hebblewhite, D. Paton, J. A. Pitt, M. S. Boyce, and M. Musiani. 2013. Humans strengthen bottom-up effects and weaken trophic cascades in a terrestrial food web. *PLoS ONE* 8: e64311.
- Musiani, M., Sk. Morshed Anwar, G. J. McDermid, M. Hebblewhite, and D. J. Marceau. 2010. How humans shape wolf behavior in Banff and Kootenay National Parks, Canada. *Ecological Modelling* 221: 2374–2387.
- Pigeon, K. E., D. MacNearney, M. Hebblewhite, M. Musiani, L. Neufeld, J. Cranston, G. Stenhouse, F. Schmiegelow, and L. Finnegan. 2020. The density of anthropogenic features explains seasonal and behaviour-based functional responses in selection of linear features by a social predator. *Scientific Reports* 10: 11437.
- Rogala, J. K., M. Hebblewhite, J. Whittington, C. A. White, J. Coleshill, and M. Musiani. 2011. Human activity differentially redistributes large mammals in the Canadian Rockies National Parks. *Ecology and Society* 16: 16.
- Whittington, J., M. Hebblewhite, R. W. Baron, A. T. Ford, and J. Paczkowski. 2022. Towns and trails drive carnivore movement behaviour, resource selection, and connectivity. *Movement Ecology* 10: 17.
- Whittington, J., P. Low, and B. Hunt. 2019. Temporal road closures improve habitat quality for wildlife. *Scientific Reports* 9: 3772.

## 2 Recreation

### 2.2 Motorized Recreation

- Alberta Wilderness Association. 2007. The Bighorn wildland recreational trail monitoring project: an interim research summary from 2004 – 2006. Alberta Wilderness Association, Calgary, Alberta, Canada.
- Alberta Wilderness Association. 2009. Is the access management plan working? Monitoring recreational use in the Bighorn backcountry. Final report 2004 - 2008. Alberta Wilderness Association, Calgary, Alberta, Canada.
- Albritton, R., T. Stein, and B. Thapa. 2009. Exploring conflict and tolerance between and within off-highway vehicle recreationists. *Journal of Park and Recreation Administration* 27: 54–72.
- Anton, C. B., D. W. Smith, J. P. Suraci, D. R. Stahler, T. P. Duane, and C. C. Wilmers. 2020. Gray wolf habitat use in response to visitor activity along roadways in Yellowstone National Park. *Ecosphere* 11: e03164.
- Arp, C. D., and T. Simmons. 2012. Analyzing the impacts of off-road vehicle (ORV) trails on watershed processes in Wrangell-St. Elias National Park and Preserve, Alaska. *Environmental management* 49: 751–766.
- Barton, D. C., and A. L. Holmes. 2007. Off-highway vehicle trail impacts on breeding songbirds in Northeastern California. *The Journal of Wildlife Management* 71: 1617–1620.
- Bateman, P. W., and P. A. Fleming. 2017. Are negative effects of tourist activities on wildlife over-reported? A review of assessment methods and empirical results. *Biological Conservation* 211: 10–19.
- Bath, A., J. W. Enck., National Park Service, and U.S. Department of the Interior. 2003. Wildlife-human interactions in national parks in Canada and the USA. *NPS Social Science Research Review* 4: 1 – 32.
- Borkowski, J. J., P. J. White, R. A. Garrott, T. Davis, A. R. Hardy, and D. J. Reinhart. 2006. Behavioral responses of bison and elk in Yellowstone to snowmobiles and snow coaches. *Ecological Applications* 16: 1911–1925.

- Boyer, L., and D. W. Mayhood. 2018. Erosion & suspended sediment delivery from off-highway vehicle trails & roads in the McLean Creek watershed, Alberta. Technical Report. Freshwater Research Limited, Calgary, Alberta, Canada.
- Boyle, S. A., and F. B. Samson. 1985. Effects of nonconsumptive recreation on wildlife: a review. *Wildlife Society Bulletin* 13: 110–116.
- Butler, D., N. Holmes-Smith, B. Harley, B. McCorquodale, C. Jenkins, G. Smith, and D. Williamson. 2003. The BC helicopter and snowcat skiing operators association - stewardship of mountain ecosystems, best practices for sustainability. BC Helicopter and Snowcat Skiing Operators Association.
- Buxton, R. T., M. F. McKenna, D. Mennitt, E. Brown, K. Frstrup, K. R. Crooks, L. M. Angeloni, and G. Wittemyer. 2019. Anthropogenic noise in US national parks– sources and spatial extent. *Frontiers in Ecology and the Environment* 17: 559–564.
- California Department of Fish and Wildlife. 2020. California Fish and Wildlife Journal. Recreation Special Issue 2020– Effects of non-consumptive recreation on wildlife in California. 1 – 128.
- Côté, S. D., S. Hamel, A. St-Louis, and J. Mainguy. 2013. Do mountain goats habituate to helicopter disturbance? *The Journal of Wildlife Management* 77: 1244–1244.
- Crupi, A. P., D. P. Gregovich, and K. S. White. 2020. Steep and deep: terrain and climate factors explain brown bear (*Ursus arctos*) alpine den site selection to guide heli-skiing management. *PLoS ONE* 15: e0238711.
- D’Amico, M., F. Ascensão, M. Fabrizio, R. Barrientos, and C. Gortázar. 2018. Twenty years of road ecology: a topical collection looking forward for new perspectives. *European Journal of Wildlife Research* 64: 26.
- Dertien, J., C. Larson, and S. Reed. 2018. Adaptive management strategy for science-based stewardship of recreation to maintain wildlife habitat connectivity. A report to the Sonoma Land Trust. Wildlife Conservation Society, Americas Program, Bronx, New York, United States of America.
- Dertien, J., C. Larson, and S. Reed. 2021. Recreation effects on wildlife: a review of potential quantitative thresholds. *Nature Conservation* 44: 51 – 68.
- Farr, D., A. Braid, A. Janz, B. Sarchuk, S. Slater, A. Sztaba, D. Barrett, G. Stenhouse, A. Morehouse, and M. Wheatley. 2017. Ecological response to human activities in southwestern Alberta: scientific assessment and synthesis. Environmental Monitoring and Science Divisions, Alberta Environment and Parks, Edmonton Alberta, Canada.
- Farr, D., A. Braid, and S. Slater. 2018. Linear disturbances in the Livingstone-Porcupine hills of Alberta: review of potential ecological responses. Environmental Monitoring and Science Divisions, Alberta Environment and Parks, Edmonton Alberta, Canada.
- Farr, D., C. Mortimer, F. Wyatt, A. Braid, C. Loewen, C. Emmerton, and S. Slater. 2018. Land use, climate change and ecological responses in the upper north Saskatchewan and Red Deer river basins: a scientific assessment. Government of Alberta, Ministry of Environment and Parks, Edmonton, Alberta, Canada.
- Forest Practices Board. 2014. Helicopter and snowcat skiing in mountain caribou habitat – audit of compliance with reporting requirements. Forest Practices Board, Victoria, British Columbia, Canada.
- Forman, R. T., D. Sperling, J. A. Bissonette, A. P. Clevenger, C. D. Cutshall, V. H. Dale, L. Fahrig, R. L. France, K. Heanue, and C. R. Goldman. 2003. Road ecology: science and solutions. Island Press, Washington DC, United States of America.
- Freeman, N. L. 2008. Motorized backcountry recreation and stress response in Mountain Caribou (*Rangifer tarandus caribou*). Master’s thesis. University of British Columbia, Vancouver, British Columbia, Canada.
- Frey, E. C. 2016. Influences on off-highway vehicle (OHV) recreation use patterns within a complex trail system in southwest Idaho. Master’s thesis. Boise State University, Boise, Idaho, United States of America.

- Gaines, W. L., P. H. Singleton, and R. C. Ross. 2003. Assessing the cumulative effects of linear recreation routes on wildlife habitats on the Okanogan and Wenatchee National Forests. Technical Report. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, Oregon, United States of America.
- Gaynor, K. M., C. E. Hojnowski, N. H. Carter, and J. S. Brashares. 2018. The influence of human disturbance on wildlife nocturnality. *Science* 360: 1232–1235.
- Gibeau, M. L., A. P. Clevenger, S. Herrero, and J. Wierzchowski. 2002. Grizzly bear response to human development and activities in the Bow River watershed, Alberta, Canada. *Biological Conservation* 103: 227–236.
- Goossen, M., B. Elands, and R. van Marwijk. (eds). 2010. Recreation, tourism and nature in a changing world. Proceedings of the fifth international conference on Monitoring and Management of Visitors flows in recreational and protected areas, Wageningen, Netherlands.
- Graziano, S. J. 2018. Impacts of off-road vehicle (ORV) stream crossings: turbidity, sediment distribution, and management. Master's thesis. Alaska Pacific University, Anchorage, Alaska, United States of America.
- Hamilton, D., and Pasztor, C. 2009. A guide to commercial backcountry skiing standard operating practices for ski run development, helicopter landing and pickup site development, and snow trail development in mountain caribou habitat. Report prepared for Species at Risk Coordination, Ministry of Environment, Victoria, British Columbia.
- Hardy, A. R. 2001. Responses of elk and bison to winter recreation in Yellowstone National Park. Master's thesis. Montana State University, Bozeman, Montana, United States of America.
- Harris, G., R. M. Nielson, T. Rinaldi, and T. Lohuis. 2014. Effects of winter recreation on northern ungulates with focus on moose (*Alces alces*) and snowmobiles. *European Journal of Wildlife Research* 60: 45–58.
- Heinemeyer, K. 2019. Use of aerial surveys to monitor backcountry winter recreation and predict associated wolverine habitat use. Report to Idaho Department of Fish and Game. Round River Conservation Studies, Bozeman, Montana, United States of America.
- Heinemeyer, K., J. Squires, M. Hebblewhite, J. J. O'Keefe, J. D. Holbrook, and J. Copeland. 2019. Wolverines in winter: indirect habitat loss and functional responses to backcountry recreation. *Ecosphere* 10: e02611.
- Heinemeyer, K., J. Squires, M. Hebblewhite, J. S. Smith, J. D. Holbrook, and J. P. Copeland. 2017. Wolverine-winter recreation research project: Investigating the interaction between wolverines and winter recreation. Final Report.
- Heli Cat Canada. 2016. A social and economic impact assessment of helicopter and snowcat skiing in British Columbia – elevating adventures. Heli Cat Canada, Revelstoke, British Columbia, Canada.
- Heli Cat Canada. 2019. A three year update on the economic impact of helicopter and snowcat skiing in British Columbia – elevating adventure. Heli Cat Canada, Revelstoke, British Columbia, Canada.
- HeliCat Canada. 2018. Economic impacts to HeliCat Canada members associated with changes to caribou management in B.C. Heli Cat Canada, Revelstoke, British Columbia, Canada.
- Hermanssen, L., L. Mikkelsen, J. Tougaard, K. Beedholm, M. Johnson, and P. T. Madsen. 2019. Recreational vessels without automatic identification system (AIS) dominate anthropogenic noise contributions to a shallow water soundscape. *Scientific Reports* 9: 15477.
- Jackson, S. A., W. Haider, and T. Elliot. 2003. Resolving inter-group conflict in winter recreation: Chilkoot Trail National Historic Site, British Columbia. *Journal for Nature Conservation* 11: 317–323.
- Jones, C., D. Newsome, and J. Macbeth. 2016. Understanding the conflicting values associated with motorized recreation in protected areas. *Ambio* 45 :323–330.
- Kinley, T. 2003. Snowmobile - mountain caribou interactions: perceptions and trends in Caribou displacement. Sylvan Consulting Ltd., Invermere, British Columbia, Canada.

- Ladle, A., R. Steenweg, B. Shepherd, and M. S. Boyce. 2018. The role of human outdoor recreation in shaping patterns of grizzly bear-black bear co-occurrence. *PLoS ONE* 13: e0191730.
- Larson, C. L. 2019. Implications of outdoor recreation for wildlife conservation in protected areas. Master's thesis. Colorado State University, Fort Collins, Colorado.
- Larson, C. L., S. E. Reed, A. M. Merenlender, and K. R. Crooks. 2016. Effects of recreation on animals revealed as widespread through a global systematic review. *PLoS ONE* 11: e0167259.
- Lucas, E. 2020. Recreation-related disturbance to wildlife in California—better planning for and management of recreation are vital to conserve wildlife in protected areas where recreation occurs. *California Fish and Wildlife, Recreation Special Issue* 29-51.
- Mayhood, D. W. 2013. Suspended sediment in Silvester Creek and its potential effects on the westslope cutthroat trout population. Technical Report. Freshwater Research Limited, Calgary, Alberta, Canada.
- McClure, C., T. Davis, D. Reinhart, and P.J. White. 2008. Wildlife responses to motorized winter recreation in Yellowstone. 2008 Annual Report. The National Park Service.
- Meyer, U. 2002. Managing degraded off-highway vehicle trails in wet, unstable, and sensitive environments. USDA Forest Service, Missoula Technology and Development Center, Missoula Montana, United States of America.
- Miller, A. B., D. King, M. Rowland, J. Chapman, M. Tomosy, C. Liang, E. S. Abelson, and R. L. Truex. 2020. Sustaining wildlife with recreation on public lands: a synthesis of research findings, management practices, and research needs. General Technical Report. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, Oregon.
- Miller, A. D., J. J. Vaske, J. R. Squires, L. E. Olson, and E. K. Roberts. 2017. Does zoning winter recreationists reduce recreation conflict? *Environmental Management* 59: 50–67.
- Mitterwallner, V., M. J. Steinbauer, A. Besold, A. Dreitz, M. Karl, N. Wachsmuth, V. Zügler, and V. Audorff. 2021. Electrically assisted mountain biking: riding faster, higher, farther in natural mountain systems. *Journal of Outdoor Recreation and Tourism* 36: 100448.
- Morrison, C. D., M. S. Boyce, S. E. Nielsen, and M. M. Bacon. 2014. Habitat selection of a re-colonized cougar population in response to seasonal fluctuations of human activity. *The Journal of Wildlife Management* 78: 1394–1403.
- Musiani, M., Sk. Morshed Anwar, G. J. McDermid, M. Hebblewhite, and D. J. Marceau. 2010. How humans shape wolf behavior in Banff and Kootenay National Parks, Canada. *Ecological Modelling* 221: 2374–2387.
- Neumann, P., and C. W. Mason. 2022. The influence of transportation and digital technologies on backcountry tourism and recreation in British Columbia, Canada. *Tourism Geographies* 1–20.
- Olson, L. E., J. R. Squires, E. K. Roberts, J. S. Ivan, and M. Hebblewhite. 2018. Sharing the same slope: behavioral responses of a threatened mesocarnivore to motorized and nonmotorized winter recreation. *Ecology and Evolution* 8: 8555–8572.
- Ouren, D., C. Haas, C. Melcher, S. Stewart, P. Ponds, N. Sexton, L. Burris, T. Fancher, and Z. Bowen. 2009. Environmental effects of off-highway vehicles on bureau of land management lands: a literature synthesis, annotated bibliographies, extensive bibliographies, and internet resources. Open-File Report. U.S. Geological Survey.
- Papouchis, C. M., F. J. Singer, and W. B. Sloan. 2001. Responses of desert bighorn sheep to increased human recreation. *The Journal of Wildlife Management* 65: 573–582.
- Pauli, B. P., R. J. Spaul, and J. A. Heath. 2017. Forecasting disturbance effects on wildlife: tolerance does not mitigate effects of increased recreation on wildlands. *Animal Conservation* 20: 251–260.
- Powell, T. 2004. Réponse comportementale des caribous des bois au harcèlement par les motoneiges. Master's thesis. Université de Sherbrooke, Sherbrooke, Quebec, Canada.
- Proctor, M. F., B. N. McLellan, G. B. Stenhouse, G. Mowat, C. T. Lamb, and M. S. Boyce. 2019. Effects of roads and motorized human access on grizzly bear populations in British Columbia and Alberta, Canada. *Ursus* 30:16–39.

- Reed, Sarah E, C. L. Larson, Crooks, Kevin R., and Merenlender, Adina M. 2014. Wildlife response to human recreation on NCCP reserves in San Diego County. Wildlife Conservation Society. Agreement No P1582100. Final Report.
- Reimers, E., S. Eftestøl, and J. E. Colman. 2003. Behavior responses of wild reindeer to direct provocation by a snowmobile or skier. *The Journal of Wildlife Management* 67: 747–754.
- Research Resolutions & Consulting Ltd. 2003. Canadian soft outdoor adventure enthusiasts - a special analysis of the travel activities and motivation survey (TAMS).
- Rode, K. D., J. K. Fortin-Noreus, D. Garshelis, M. Dyck, V. Sahanatien, T. Atwood, S. Belikov, K. L. Laidre, S. Miller, M. E. Obbard, D. Vongraven, J. Ware, and J. Wilder. 2018. Survey-based assessment of the frequency and potential impacts of recreation on polar bears. *Biological Conservation* 227: 121–132.
- Schroeder, S. A., D. C. Fulton, L. Cornicelli, and L. E. McInenly. 2020. Recreation conflict, coping, and satisfaction: minnesota grouse hunters’ conflicts and coping response related to all-terrain vehicle users, hikers, and other hunters. *Journal of Outdoor Recreation and Tourism* 30: 100282.
- Seip, D. R., C. J. Johnson, and G. S. Watts. 2007. Displacement of mountain caribou from winter habitat by snowmobiles. *The Journal of Wildlife Management* 71: 1539–1544.
- Shanley, C. S., and S. Pyare. 2011. Evaluating the road-effect zone on wildlife distribution in a rural landscape. *Ecosphere* 2: 1–16.
- Shilling, F., J. Boggs, and S. Reed. 2012. Recreational system optimization to reduce conflict on public lands. *Environmental Management* 50: 381–395.
- Simpson, K., and E. Terry. 2000. Impacts of backcountry recreation activities on mountain caribou. Wildlife working report. Ministry of Environment, Lands and Parks, Wildlife Branch, Victoria, British Columbia, Canada.
- Smith, W., and R. Cheng. 2016. Anthropogenic disturbance and intactness in the Castle. A special series on the Castle proposed protected areas: Bulletin 1. Global Forest Watch Canada, Ottawa, Ontario, Canada.
- Smith, W., and R. Cheng. 2016. Linear disturbance in the Castle. A special series on the Castle proposed protected areas: Bulletin 2. Global Forest Watch Canada, Ottawa, Ontario, Canada.
- Smith, W., R. Cheng, and S. Elmeligi. 2016. Linear disturbance in the Castle: Implications for grizzly bear and trout. A special series on the Castle proposed protected areas: Bulletin 3. Global Forest Watch Canada, Ottawa, Ontario, Canada.
- Spaul, R. J., and J. A. Heath. 2016. Nonmotorized recreation and motorized recreation in shrub-steppe habitats affects behavior and reproduction of golden eagles (*Aquila chrysaetos*). *Ecology and Evolution* 6: 8037–8049.
- Spaul, R. J., and J. A. Heath. 2017. Flushing responses of golden eagles (*Aquila chrysaetos*) in response to recreation. *The Wilson Journal of Ornithology* 129: 834–845.
- Stankowich, T. 2008. Ungulate flight responses to human disturbance: a review and meta-analysis. *Biological Conservation* 141: 2159–2173.
- St-Louis, A., S. Hamel, J. Mainguy, and S. D. Côté. 2013. Factors influencing the reaction of mountain goats towards all-terrain vehicles. *The Journal of Wildlife Management* 77: 599–605.
- Stokowski, P. A., and C. B. LaPointe. 2000. Environmental and social effects of ATVs and ORVs: an annotated bibliography and research assessment. Report. University of Vermont, School of Natural Resources, Burlington, Vermont, USA.
- van der Marel, R. C., P. C. Holroyd, and P. N. Duinker. 2020. Managing human footprint to achieve large-landscape conservation outcomes: establishing density limits on motorized route-user networks in Alberta’s eastern slopes. *Global Ecology and Conservation* 22: e00901.
- van Rensen, C. K., S. E. Nielsen, B. White, T. Vinge, and V. J. Liefvers. 2015. Natural regeneration of forest vegetation on legacy seismic lines in boreal habitats in Alberta’s oil sands region. *Biological Conservation* 184: 127–135.
- Villanueva, G. 2019. What are the attitudes of off-highway vehicle users towards their environmental impacts? Doctoral dissertation. Royal Roads University, Victoria, British Columbia, Canada.

- Vittersø, R., Chipeniuk, M., Skår, and O.I. Vistad. 2004. Recreational conflict is affective: the case of cross-country skiers and snowmobiles. *Leisure Sciences* 26: 227–243.
- White, P., T. David, and J. Borkowski. 2007. Wildlife responses to motorized winter recreation in Yellowstone: 2005 Annual Report.
- Wilmshurst, J. 2017. Mountain caribou compliance monitoring: interactions between mountain caribou and helicopter and snowcat skiing operations during the 2016-17 skiing season. Report prepared for Steve Gordon, Resource Management Objectives branch, Ministry of Forests, Lands and Natural Resource Operations, Victoria, British Columbia, Canada.
- Wilson, S. F., and J. F. Wilmshurst. 2019. Behavioural responses of southern mountain caribou to helicopter and skiing activities. *Rangifer* 39: 27–42.
- Winter, P. L., S. Selin, L. Cervený, and K. Bricker. 2019. Outdoor recreation, nature-based tourism, and sustainability. *Sustainability* 12: 1 – 12.
- Wisdom, M. J., H. K. Preisler, L. M. Naylor, R. G. Anthony, B. K. Johnson, and M. M. Rowland. 2018. Elk responses to trail-based recreation on public forests. *Forest Ecology and Management* 411: 223–233.
- Wolf, I. D., D. B. Croft, and R. J. Green. 2019. Nature conservation and nature-based tourism: a paradox? *Environments* 6: 104.
- Wolf, I. D., G. Brown, and T. Wohlfart. 2018. Applying public participation GIS (PPGIS) to inform and manage visitor conflict along multi-use trails. *Journal of Sustainable Tourism* 26: 470–495.

## 2.3 Motorized Recreation – methods

- Apps, C., J. Weaver, P. Paquet, B. Bateman, and B. McLellan. 2007. Carnivores in the Southern Canadian Rockies: core areas and connectivity across the Crowsnest Highway. Wildlife Conservation Society Canada Conservation Report. Wildlife Conservation Society, Toronto, Ontario, Canada.
- Arp, C. D., and T. Simmons. 2012. Analyzing the impacts of off-road vehicle (ORV) trails on watershed processes in Wrangell–St. Elias National Park and Preserve, Alaska. *Environmental management* 49: 751–766.
- Braunisch, V., P. Patthey, and R. Arlettaz. 2011. Spatially explicit modeling of conflict zones between wildlife and snow sports: prioritizing areas for winter refuges. *Ecological Applications* 21: 955–967.
- Cessford, G., and A. Muhar. 2003. Monitoring options for visitor numbers in national parks and natural areas. *Journal for nature conservation* 11: 240–250.
- Goodbody, T. R. H., N. C. Coops, V. Srivastava, B. Parsons, S. P. Kearney, G. J. M. Rickbeil, and G. B. Stenhouse. 2021. Mapping recreation and tourism use across grizzly bear recovery areas using social network data and maximum entropy modelling. *Ecological Modelling* 440: 109377.
- Gregoire, T. G., and G. J. Buhyoff. 1999. Sampling and estimating recreational use. General Technical Report. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, Oregon, United States of America.
- Hornseth, M. L., K. E. Pigeon, D. MacNearney, T. A. Larsen, G. Stenhouse, J. Cranston, and L. Finnegan. 2018. Motorized activity on legacy seismic lines: a predictive modeling approach to prioritize restoration efforts. *Environmental Management* 62: 595–607.
- Itami, R., R. Raulings, G. MacLaren, K. Hirst, R. Gimblett, D. Zanon, and P. Chladek. 2003. RBSim 2: simulating the complex interactions between human movement and the outdoor recreation environment. *Journal for Nature Conservation* 11: 278–286.
- Larson, Courtney L. 2015. Implications of outdoor recreation for wildlife conservation in protected areas. Master's thesis. Colorado State University, Fort Collins, Colorado, United States of America.
- Muñoz, L., V. H. Hausner, and C. A. Monz. 2019. Advantages and limitations of using mobile apps for protected area monitoring and management. *Society & Natural Resources* 32: 473–488.
- Northrup, J. M. 2010. Grizzly bears, roads, and human-bear conflicts in southwestern Alberta. Master's thesis. University of Alberta, Edmonton, Alberta, Canada.

- Northrup, J. M., J. Pitt, T. B. Muhly, G. B. Stenhouse, M. Musiani, and M. S. Boyce. 2012. Vehicle traffic shapes grizzly bear behaviour on a multiple-use landscape. *Journal of Applied Ecology* 49: 1159–1167.
- Olson, L. E., J. R. Squires, E. K. Roberts, A. D. Miller, J. S. Ivan, and M. Hebblewhite. 2017. Modeling large-scale winter recreation terrain selection with implications for recreation management and wildlife. *Applied Geography* 86: 66–91.
- Pauli, B. P., E. R. Sun, Z. K. Tinkle, J. S. Forbey, K. E. Demps, and J. A. Heath. 2019. Human habitat selection: using tools from wildlife ecology to predict recreation in natural landscapes. *Natural Areas Journal* 39: 142–149.
- Pigeon, K. E., M. Anderson, D. MacNearney, J. Cranston, G. Stenhouse, and L. Finnegan. 2016. Toward the restoration of caribou habitat: understanding factors associated with human motorized use of legacy seismic lines. *Environmental Management* 58: 821–832.
- Teles da Mota, V., and C. Pickering. 2020. Using social media to assess nature-based tourism: current research and future trends. *Journal of Outdoor Recreation and Tourism* 30: 100295.
- White, R. A., B. C. Dietterick, T. Mastin, and R. Strohman. 2010. Forest roads mapped using LiDAR in steep forested terrain. *Remote Sensing* 2: 1120–1141.
- Witztum, E. R., and D. A. Stow. 2004. Analysing direct impacts of recreation activity on coastal sage scrub habitat with very high resolution multi-spectral imagery. *International Journal of Remote Sensing* 25: 3477–3496.
- Wolf, I. D. 2012. Visitor monitoring along roads and hiking trails: how to determine usage levels in tourist sites. *Tourism Management* 33: 16–28.

## 2.4 Non-Motorized Recreation

- Aastrup, P. 2000. Responses of west Greenland caribou to the approach of humans on foot. *Polar Research* 19: 83–90.
- Anderson, A. K., J. S. Waller, and D. H. Thornton. 2023. Partial COVID–19 closure of a national park reveals negative influence of low–impact recreation on wildlife spatiotemporal ecology. *Scientific Reports* 13: 687.
- Arlettaz, R., P. Patthey, M. Baltic, T. Leu, M. Schaub, R. Palme, and S. Jenni-Eiermann. 2007. Spreading free-riding snow sports represent a novel serious threat for wildlife. *Proceedings of the Royal Society B: Biological Sciences* 274: 1219–1224.
- Arlettaz, R., S. Nussle, M. Baltic, P. Vogel, R. Palme, S. Jenni-Eiermann, P. Patthey, and M. Genoud. 2015. Disturbance of wildlife by outdoor winter recreation: allostatic stress response and altered activity–energy budgets. *Ecological Applications* 25: 1197–1212.
- Arocena, J. M., S. K. Nepal, and M. Rutherford. 2006. Visitor-induced changes in the chemical composition of soils in backcountry areas of Mt Robson Provincial Park, British Columbia, Canada. *Journal of Environmental Management* 79: 10–19.
- Bateman, P. W., and P. A. Fleming. 2017. Are negative effects of tourist activities on wildlife over-reported? A review of assessment methods and empirical results. *Biological Conservation* 211: 10–19.
- Bath, A., and J. W. Enck. 2003. Wildlife–human interactions in national parks in Canada and the USA. *Social Science Research Review* 4: 1 – 32.
- Baur, B., A. Baur, and D. Schmera. 2017. Impact assessment of intense sport climbing on limestone cliffs: response of rock-dwelling land snails. *Ecological Indicators* 72: 260–267.
- Blahna, D. J., K. S. Smith, and J. A. Anderson. 1995. Backcountry llama packing: visitor perceptions of acceptability and conflict. *Leisure Sciences* 17: 185–204.
- Bötsch, Y., Z. Tablado, D. Scherl, M. Kéry, R. F. Graf, and L. Jenni. 2018. Effect of recreational trails on forest birds: human presence matters. *Frontiers in Ecology and Evolution* 6.

- Boyle, S. A., and F. B. Samson. 1985. Effects of nonconsumptive recreation on wildlife: a review. *Wildlife Society Bulletin* 13: 110–116.
- Brambilla, M., D. Rubolini, and F. Guidali. 2004. Rock climbing and Raven *Corvus corax* occurrence depress breeding success of cliff-nesting Peregrines *Falco peregrinus*. *Ardeola* 51: 425–430.
- California Fish and Wildlife. 2020. California Fish and Wildlife Journal. Recreation special issue effects of non-consumptive recreation on wildlife in California 1: 128.
- Camp, R. J., and R. L. Knight. 1998. Effects of rock climbing on cliff plant communities at Joshua Tree National Park, California. *Conservation Biology* 12: 1302–1306.
- Camp, R. J., and R. L. Knight. 1998. Rock climbing and cliff bird communities at Joshua Tree national park, California. *Wildlife Society Bulletin* 26: 892–898.
- Campelo, M. B., and R. M. N. Mendes. 2016. Comparing webshare services to assess mountain bike use in protected areas. *Journal of outdoor recreation and tourism* 15: 82–88.
- Carothers, P., J. J. Vaske, and M. P. Donnelly. 2001. Social values versus interpersonal conflict among hikers and mountain bikers. *Leisure Sciences* 23: 47–61.
- Cassirer, E. F., D. J. Freddy, and E. D. Ables. 1992. Elk responses to disturbance by cross-country skiers in Yellowstone National Park. *Wildlife Society Bulletin* 20: 375–381.
- Clark, P., and A. Hessel. 2015. The effects of rock climbing on cliff-face vegetation. *Applied Vegetation Science* 18: 705–715.
- Cole, D. N., and D. R. Spildie. 1998. Hiker, horse and llama trampling effects on native vegetation in Montana, USA. *Journal of environmental management* 53: 61–71.
- Coleman, T. H., C. C. Schwartz, K. A. Gunther, and S. Creel. 2013. Influence of overnight recreation on grizzly bear movement and behavior in Yellowstone National Park. *Ursus* 24: 101–110.
- Costello, C. M., S. I. Cain, R. M. Nielson, C. Servheen, and C. C. Schwartz. 2013. Response of American black bears to the non-motorized expansion of a road corridor in Grand Teton National Park. *Ursus* 24: 54–69.
- Courtemanch, A. 2014. Seasonal habitat selection and impacts of backcountry recreation on a formerly migratory bighorn sheep population in NW Wyoming, USA. Master's thesis. University of Wyoming, Laramie, United States of America.
- Covy, N., L. Benedict, and W. H. Keeley. 2019. Rock climbing activity and physical habitat attributes impact avian community diversity in cliff environments. *PLoS ONE* 14: e0209557.
- Cremer-Schulte, D., M. Rehnus, A. Duparc, C. Perrin-Malterre, and L. Arneodo. 2017. Wildlife disturbance and winter recreational activities in Alpine protected areas: recommendations for successful management. *Journal on Protected Mountain Areas Research* 9: 66–73.
- Croft, D. B. 2019. Walking in each other's footsteps: do animal trail makers confer resilience against trampling tourists? *Environments* 6: 83.
- D'Antonio, A., C. Monz, P. Newman, S. Lawson, and D. Taff. 2012. The effects of local ecological knowledge, minimum-impact knowledge, and prior experience on visitor perceptions of the ecological impacts of backcountry recreation. *Environmental Management* 50: 542:554.
- D'Antonio, A., C. Monz, P. Newman, S. Lawson, and D. Taff. 2013. Enhancing the utility of visitor impact assessment in parks and protected areas: a combined social-ecological approach. *Journal of Environmental Management* 124: 72–81.
- Deluca, T. H., W. A. Patterson IV, W. A. Freimund, and D. N. Cole. 1998. Influence of llamas, horses, and hikers on soil erosion from established recreation trails in western Montana, USA. *Environmental Management* 22: 255–262.
- Dertien, J., C. Larson, and S. Reed. 2018. Adaptive management strategy for science-based stewardship of recreation to maintain wildlife habitat connectivity a report to the Sonoma Land Trust. *Wildlife Conservation Society, Americas Program, Bronx, New York, United States of America.*
- Dertien, J., C. Larson, and S. Reed. 2021. Recreation effects on wildlife: a review of potential quantitative thresholds. *Nature Conservation* 44: 51–68.
- Duchesne, M., S. D. Côté, and C. Barrette. 2000. Responses of woodland caribou to winter ecotourism in the Charlevoix Biosphere Reserve, Canada. *Biological Conservation* 96: 311–317



- Duffus, D. A., and P. Dearden. 1990. Non-consumptive wildlife-oriented recreation: a conceptual framework. *Biological Conservation* 53: 213–231.
- Farr, D., A. Braid, A. Janz, B. Sarchuk, S. Slater, A. Sztaba, D. Barrett, G. Stenhouse, A. Morehouse, and M. Wheatley. 2017. Ecological response to human activities in southwestern Alberta: scientific assessment and synthesis. Alberta Environment and Parks, Government of Alberta, Edmonton, Alberta, Canada.
- Farr, D., A. Braid, and S. Slater. 2018. Linear disturbances in the livingstone-porcupine hills of Alberta: review of potential ecological responses. Government of Alberta, Environment and Parks, Government of Alberta, Edmonton, Alberta, Canada.
- Fortin, J. K., K. D. Rode, G. V. Hilderbrand, J. Wilder, S. Farley, C. Jorgensen, and B. G. Marcot. 2016. Impacts of human recreation on brown bears (*Ursus arctos*): a review and new management tool. *PLoS ONE* 11: e0141983.
- Gaines, W. L., P. H. Singleton, and R. C. Ross. 2003. Assessing the cumulative effects of linear recreation routes on wildlife habitats on the Okanogan and Wenatchee National Forests. Technical Report. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, Oregon, United States of America.
- Gaynor, K. M., C. E. Hojnowski, N. H. Carter, and J. S. Brashares. 2018. The influence of human disturbance on wildlife nocturnality. *Science* 360: 1232–1235.
- Geng, D. C., J. L. Innes, W. Wu, W. Wang, and G. Wang. 2021. Seasonal variation in visitor satisfaction and its management implications in Banff National Park. *Sustainability* 13: 1681.
- Geng, D., J. Innes, W. Wu, and G. Wang. 2021. Impacts of COVID-19 pandemic on urban park visitation: a global analysis. *Journal of Forestry Research* 32: 553–567.
- Giuliano, W. 1994. The impact of hiking and rock-climbing in mountain areas. *Environmental Conservation* 21: 278–279.
- Goldstein, M. I., A. J. Poe, L. H. Suring, R. M. Nielson, and T. L. McDonald. 2010. Brown bear den habitat and winter recreation in South-Central Alaska. *The Journal of Wildlife Management* 74: 35–42.
- Goossen, M., Elands, B., Marwijk, R. van (eds.). 2010. Recreation, tourism and nature in a changing world. Proceedings of the fifth international conference on Monitoring and Management of Visitor flows in recreational and protected areas, Wageningen, The Netherlands.
- Government of British Columbia. 2013. Authorizing recreational mountain bike trails on provincial crown land operational policy. Ministry of Forests, Lands and Natural Resource Operations, British Columbia, Canada.
- Hall, O. 2018, May. An application of citizen science to study the interactions between recreational hillwalkers and red deer in the Scottish Uplands. Research Dissertation in Geography. University of St. Andrews, St. Andrews, Scotland.
- Hansen, B. B., and R. Aanes. 2015. Habituation to humans in a predator-free wild ungulate. *Polar Biology* 38: 145–151.
- Harris, N. C., K. L. Mills, Y. Harissou, E. M. Hema, I. T. Gnoumou, J. VanZoeren, Y. I. Abdel-Nasser, and B. Doamba. 2019. First camera survey in Burkina Faso and Niger reveals human pressures on mammal communities within the largest protected area complex in West Africa. *Conservation Letters* 12: e12667.
- Havlick, D. G., E. Billmeyer, T. Huber, B. Vogt, and K. Rodman. 2016. Informal trail creation: hiking, trail running, and mountain bicycling in shortgrass prairie. *Journal of Sustainable Tourism* 24: 1041–1058.
- Heinemeyer, K., J. Squires, M. Hebblewhite, J. J. O’Keefe, J. D. Holbrook, and J. Copeland. 2019. Wolverines in winter: indirect habitat loss and functional responses to backcountry recreation. *Ecosphere* 10: e02611.
- Heinemeyer, K., J. Squires, M. Hebblewhite, J. S. Smith, J. D. Holbrook, and J. P. Copeland. 2017. Wolverine-winter recreation research project: investigating the interaction between wolverines and winter recreation. Final Report.

- Hennings, L. 2017. Hiking, mountain biking and equestrian use in natural areas: a recreation ecology literature review. *Metro Parks and Nature*, Portland, Oregon, United States of America.
- Holzschuh, A. 2016. Does rock climbing threaten cliff biodiversity? - a critical review. *Biological Conservation* 204: 153–162.
- Hrnčiarová, T., P. Kenderessy, J. Špulerová, M. Vlachovičová, V. Piscová, and M. Dobrovodská. 2018. Status and outlook of hiking trails in the central part of the Low Tatra Mountains in Slovakia between 1980–1981 and 2013–2014. *Journal of Mountain Science* 15: 1615–1632.
- Jackson, S. A., W. Haider, and T. Elliot. 2003. Resolving inter-group conflict in winter recreation: Chilkoot Trail National Historic Site, British Columbia. *Journal for Nature Conservation* 11: 317–323.
- Johnson, J., and J. Hendrikx. 2021. Using citizen science to document terrain use and decision-making of backcountry users. *Citizen Science: Theory and Practice* 6: 8.
- Kangas, K., M. Luoto, A. Ihantola, E. Tomppo, and P. Siikamäki. 2010. Recreation-induced changes in boreal bird communities in protected areas. *Ecological Applications* 20: 1775–1786.
- Kays, R., A. W. Parsons, M. C. Baker, E. L. Kalies, T. Forrester, R. Costello, C. T. Rota, J. J. Millspaugh, and W. J. McShea. 2017. Does hunting or hiking affect wildlife communities in protected areas? *Journal of Applied Ecology* 54: 242–252.
- Kirkland, J., E. White, and J. Kline. 2018. How much fun? Evaluating economic implications of recreation in national forests. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, Oregon, United States of America.
- Kubo, T., and Y. Shoji. 2014. Trade-off between human–wildlife conflict risk and recreation conditions. *European Journal of Wildlife Research* 60: 501–510.
- Kuntz, K. L., and D. W. Larson. 2006. Influences of microhabitat constraints and rock–climbing disturbance on cliff-face vegetation communities. *Conservation Biology* 20: 821–832.
- Kux, S., and W. Haider. 2014. Non–motorized outdoor recreation in British Columbia in 2012: participation and economic contributions. Simon Fraser University Burnaby, British Columbia, Canada.
- Ladle, A., R. Steenweg, B. Shepherd, and M. S. Boyce. 2018. The role of human outdoor recreation in shaping patterns of grizzly bear–black bear co-occurrence. *PLoS ONE* 13: e0191730.
- Larson, C. L. 2019. Effects of outdoor recreation on wildlife in protected areas. Doctoral dissertation. Colorado State University, Fort Collins, Colorado, United States of America.
- Larson, C. L., S. E. Reed, A. M. Merenlender, and K. R. Crooks. 2016. Effects of recreation on animals revealed as widespread through a global systematic review. *PLoS ONE* 11: e0167259.
- Larson, C. L., S. E. Reed, and K. R. Crooks. 2020. Increased hiking and mountain biking are associated with declines in urban mammal activity. *California Fish and Wildlife, Recreation* 52: 61.
- Lesmerises, F., C. J. Johnson, and M. St-Laurent. 2017. Refuge or predation risk? Alternate ways to perceive hiker disturbance based on maternal state of female caribou. *Ecology and Evolution* 7: 845–854.
- Li, W., X. Ge, and C. Liu. 2005. Hiking trails and tourism impact assessment in protected area: Jiuzhaigou Biosphere Reserve, China. *Environmental Monitoring and Assessment* 108: 279–293.
- Lucas, E. 2020. Recreation-related disturbance to wildlife in California– better planning for and management of recreation are vital to conserve wildlife in protected areas where recreation occurs. *California Fish and Wildlife* 29.
- Mann, C., and J. D. Absher. 2008. Recreation conflict potential and management implications in the northern/central Black Forest Nature Park. *Journal of Environmental Planning and Management* 51: 363–380.
- Marion, S., A. Davies, U. Demšar, R. J. Irvine, P. A. Stephens, and J. Long. 2020. A systematic review of methods for studying the impacts of outdoor recreation on terrestrial wildlife. *Global Ecology and Conservation* 22: e00917.

- Martínez-Abraín, A., D. Oro, J. Jiménez, G. Stewart, and A. Pullin. 2010. A systematic review of the effects of recreational activities on nesting birds of prey. *Basic and Applied Ecology* 11: 312–319.
- McMillan, M. A., J. C. Nekola, and D. W. Larson. 2003. Effects of rock climbing on the land snail community of the Niagara escarpment in southern Ontario, Canada. *Conservation Biology* 17: 616–621.
- Miller, A. B., D. King, M. Rowland, J. Chapman, M. Tomosy, C. Liang, E. S. Abelson, and R. L. Truex. 2020. Sustaining wildlife with recreation on public lands: a synthesis of research findings, management practices, and research needs. General Technical Report. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, Oregon, United States of America.
- Miller, A. D., J. J. Vaske, J. R. Squires, L. E. Olson, and E. K. Roberts. 2017. Does zoning winter recreationists reduce recreation conflict? *Environmental Management* 59: 50–67.
- Morrison, C. D., M. S. Boyce, S. E. Nielsen, and M. M. Bacon. 2014. Habitat selection of a re-colonized cougar population in response to seasonal fluctuations of human activity. *The Journal of Wildlife Management* 78: 1394–1403.
- Mosedale, J. 2001. Mountain biking in the Canadian Rocky Mountains: a situational analysis. The Canadian Environmental Network, Canada.
- Mueller, J. T., and A. R. Graefe. 2018. Testing the relationships between conflict, specialization, and place attachment among members of the American Alpine Club. *Journal of Outdoor Recreation and Tourism* 24: 26–34.
- Musiani, M., Sk. Morshed Anwar, G. J. McDermid, M. Hebblewhite, and D. J. Marceau. 2010. How humans shape wolf behavior in Banff and Kootenay National Parks, Canada. *Ecological Modelling* 221: 2374–2387.
- Naidoo, R., and A. C. Burton. 2020. Relative effects of recreational activities on a temperate terrestrial wildlife assemblage. *Conservation Science and Practice* 2: e271.
- Neatherlin, E. A., and J. M. Marzluff. 2004. Responses of American crow populations to campgrounds in remote native forest landscapes. *The Journal of Wildlife Management* 68: 708–718.
- Nevin, O.T., and B. K. Gilbert. 2005. Measuring the cost of risk avoidance in brown bears: further evidence of positive impacts of ecotourism. *Biological Conservation* 123: 453–460.
- Norman, P., and C. M. Pickering. 2019. Factors influencing park popularity for mountain bikers, walkers and runners as indicated by social media route data. *Journal of Environmental Management* 249.
- Olson, L. E., J. R. Squires, E. K. Roberts, J. S. Ivan, and M. Hebblewhite. 2018. Sharing the same slope: behavioral responses of a threatened mesocarnivore to motorized and nonmotorized winter recreation. *Ecology and Evolution* 8: 8555–8572.
- Olson, T. L., and B. K. Gilbert. 1994. Variable impacts of people on brown bear use of an Alaskan river. *Bears: Their Biology and Management* 9: 97–106.
- Papouchis, C. M., F. J. Singer, and W. B. Sloan. 2001. Responses of desert bighorn sheep to increased human recreation. *The Journal of Wildlife Management* 65: 573–582.
- Quinn, M., C., and G. Chemoff. 2010. Mountain biking: a review of the ecological effects. A literature review for Parks Canada – National Office (Experience Branch). Final Report. Miistakis Institute, Faculty of Environmental Design, University of Calgary, Calgary, Alberta, Canada.
- Reed, S. E., and A. M. Merenlender. 2008. Quiet, non-consumptive recreation reduces protected area effectiveness. *Conservation Letters* 1: 146–154.
- Reilly, M. L., M. W. Tobler, D. L. Sonderegger, and P. Beier. 2017. Spatial and temporal response of wildlife to recreational activities in the San Francisco Bay ecoregion. *Biological Conservation* 207: 117–126.
- Reis, A. C., and J. E. S. Higham. 2009. Recreation conflict and sport hunting: moving beyond goal interference towards social sustainability. *Journal of Sport & Tourism* 14: 83–107

- Richardson, H. 1999. Threats posed by rock-climbers to birds nesting on cliffs in the south Okanagan. Proceedings of Biology and Management of Species and Habitats at Risk, Kamloops, British Columbia, Canada.
- Rode, K. D., J. K. Fortin-Noreus, D. Garshelis, M. Dyck, V. Sahanatien, T. Atwood, S. Belikov, K. L. Laidre, S. Miller, M. E. Obbard, D. Vongraven, J. Ware, and J. Wilder. 2018. Survey-based assessment of the frequency and potential impacts of recreation on polar bears. *Biological Conservation* 227: 121–132.
- Rodríguez, B., A. Rodríguez, F. Siverio, and M. Siverio. 2018. Factors affecting the spatial distribution and breeding habitat of an insular cliff-nesting raptor community. *Current Zoology* 64: 173–181.
- Rusterholz, H., S. W. Miiller, and B. Baur. 2004. Effects of rock climbing on plant communities on exposed limestone cliffs in the Swiss Jura mountains. *Applied Vegetation Science* 7: 35–40.
- Schmera, D., H. Rusterholz, A. Baur, and B. Baur. 2018. Intensity-dependent impact of sport climbing on vascular plants and land snails on limestone cliffs. *Biological Conservation* 224: 63–70.
- Schneider, I. E., J. Earing, and K. Martinson. 2013. Revealing Motivations for and conflicts associated with recreational horseback trail riding. *Journal of Forestry* 111: 282–286.
- Schroeder, S. A., D. C. Fulton, L. Cornicelli, and L. E. McInenly. 2020. Recreation conflict, coping, and satisfaction: Minnesota grouse hunters' conflicts and coping response related to all-terrain vehicle users, hikers, and other hunters. *Journal of Outdoor Recreation and Tourism* 30: 100282.
- Schuttler, S. G., A. W. Parsons, T. D. Forrester, M. C. Baker, W. J. McShea, R. Costello, and R. Kays. 2017. Deer on the lookout: how hunting, hiking and coyotes affect white-tailed deer vigilance. *Journal of Zoology* 301: 320–327.
- Shannon, G., C. L. Larson, S. E. Reed, K. R. Crooks, and L. M. Angeloni. 2017. Ecological consequences of ecotourism for wildlife populations and communities. Pages 29–46 in D. T. Blumstein, B. Geffroy, D. S. M. Samia, and E. Bessa, editors. *Ecotourism's Promise and Peril: A Biological Evaluation*. Springer International Publishing, Cham.
- Showler, G. Stewart, W. Sutherland, and A. Pullin. 2010. What is the impact of public access on the breeding success of ground-nesting and cliff-nesting birds? *Collaboration for Environmental Evidence*.
- Simic, J. 2007. Moraine Lake - 2007 group access study: visitor experience, compliance, and awareness. Parks Canada Agency, Parks Canada, Canada.
- Smith, T. S., J. Oyster, S. D. Partridge, I. E. Martin, and A. Sisson. 2012. Assessing American black bear response to human activity at Kenai Fjords National Park, Alaska. *Ursus* 23: 179–191.
- Spaul, R. J., and J. A. Heath. 2016. Nonmotorized recreation and motorized recreation in shrub-steppe habitats affects behavior and reproduction of golden eagles (*Aquila chrysaetos*). *Ecology and Evolution* 6: 8037–8049.
- Spaul, R. J., and J. A. Heath. 2017. Flushing responses of golden eagles (*Aquila chrysaetos*) in response to recreation. *The Wilson Journal of Ornithology* 129: 834–845.
- Stankowich, T. 2008. Ungulate flight responses to human disturbance: a review and meta-analysis. *Biological Conservation* 141: 2159–2173.
- Steinbauer, M. J., J. Kreyling, C. Stöhr, and V. Audorff. 2018. Positive sport–biosphere interactions? — Cross-country skiing delays spring phenology of meadow vegetation. *Basic and Applied Ecology* 27: 30–40.
- Stoddart, M. C. J. 2011. Grizzlies and gondolas: animals and the meaning of skiing landscapes in British Columbia, Canada. *Nature and Culture* 6: 41–63.
- Strong, A. M., C. A. Dickert, and R. T. Bell. 2002. Ski trail effects on a beetle (*Coleoptera: Carabidae, Elateridae*) community in Vermont. *Journal of Insect Conservation* 6: 149–159.
- Taff, B. D., J. Benfield, Z. D. Miller, A. D'Antonio, and F. Schwartz. 2019. The role of tourism impacts on cultural ecosystem services. *Environments* 6: 43.
- Taylor, A. R., and R. L. Knight. 2003. Wildlife responses to recreation and associated visitor perceptions. *Ecological Applications* 13: 951–963.

- Tessler, M., and T. A. Clark. 2016. The impact of bouldering on rock-associated vegetation. *Biological Conservation* 204: 426–433.
- Thomsen, J. M., R. B. Powell, and C. Monz. 2018. A systematic review of the physical and mental health benefits of wildland recreation. *Journal of Park and Recreation Administration* 36: 123–148.
- Thorsen, N. H., R. Bischof, J. Mattisson, T. R. Hofmeester, J. D. C. Linnell, and J. Odden. 2022. Smartphone app reveals that lynx avoid human recreationists on local scale, but not home range scale. *Scientific Reports* 12: 4787.
- Tomczyk, A. M. 2011. A GIS assessment and modelling of environmental sensitivity of recreational trails: the case of Gorce National Park, Poland. *Applied geography* 31: 339–351.
- Tumes, K. 2007. Out of my way: using qualitative methods to understand recreation conflict between bushwalkers and mountain bike riders. *Anthropological Notebooks* 13: 45–55.
- Vandeman, M. J. 2004. The impacts of mountain biking on wildlife and people— a review of the literature. Page Society for Conservation Biology meeting, Columbia University, New York, New York.
- Vaske, J. R. Dyar, and N. Timmons. 2004. Skill level and recreation conflict among skiers and snowboarders. *Leisure Sciences* 26: 215–225.
- Vistnes, I., and C. Nellemann. 2001. Avoidance of cabins, roads, and power lines by reindeer during calving. *The Journal of Wildlife Management* 65: 915–925.
- Vittersø, J., R. Chipenuk, M. Skår, and O. I. Vistad. 2004. Recreational conflict is affective: the case of cross-country skiers and snowmobiles. *Leisure Sciences* 26: 227–243.
- Winter, P. L., S. Selin, L. Cerveny, and K. Bricker. 2019. Outdoor recreation, nature-based tourism, and sustainability. *Sustainability* 12: 1–12.
- Wisdom, M. J., H. K. Preisler, L. M. Naylor, R. G. Anthony, B. K. Johnson, and M. M. Rowland. 2018. Elk responses to trail-based recreation on public forests. *Forest Ecology and Management* 411: 223–233.
- Wolf, I. D., G. Brown, and T. Wohlfart. 2018. Applying public participation GIS (PPGIS) to inform and manage visitor conflict along multi-use trails. *Journal of Sustainable Tourism* 26: 470–495.
- Wolf, I. D., T. Wohlfart, G. Brown, and A. B. Lasa. 2015. The use of public participation GIS (PPGIS) for park visitor management: a case study of mountain biking. *Tourism Management* 51: 112–130.

## 2.5 Non-Motorized Recreation – methods

- Ancin-Murguzur, F. J., L. Munoz, C. Monz, and V. H. Hausner. 2020. Drones as a tool to monitor human impacts and vegetation changes in parks and protected areas. *Remote Sensing in Ecology and Conservation* 6: 105–113.
- Beeco, J. 2013. Integrating spatial modeling into recreational planning in parks and protected areas. Doctoral dissertation. Clemson University, Clemson, South Carolina, United States of America.
- Beeco, J. A., J. C. Hallo, and M. T. J. Brownlee. 2014. GPS Visitor tracking and recreation suitability mapping: tools for understanding and managing visitor use. *Landscape and Urban Planning* 127: 136–145.
- Braunisch, V., P. Patthey, and R. Arlettaz. 2011. Spatially explicit modeling of conflict zones between wildlife and snow sports: prioritizing areas for winter refuges. *Ecological Applications* 21: 955–967.
- Cessford, G., and A. Muhar. 2003. Monitoring options for visitor numbers in national parks and natural areas. *Journal for nature conservation* 11: 240–250.
- D’Antonio, A., C. Monz, S. Lawson, P. Newman, D. Pettebone, and A. Courtemanch. 2010. GPS-based measurements of backcountry visitors in parks and protected areas: examples of methods and applications from three case studies. *Journal of Parks and Recreation Administration* 28: 42–60.

- Geneletti, D., and D. Dawa. 2009. Environmental impact assessment of mountain tourism in developing regions: a study in Ladakh, Indian Himalaya. *Environmental Impact Assessment Review* 29: 229–242.
- Goodbody, T. R. H., N. C. Coops, V. Srivastava, B. Parsons, S. P. Kearney, G. J. M. Rickbeil, and G. B. Stenhouse. 2021. Mapping recreation and tourism use across grizzly bear recovery areas using social network data and maximum entropy modelling. *Ecological Modelling* 440: 109377.
- Gregoire, T. G., and G. J. Buhyoff. 1999. Sampling and estimating recreational use. General Technical Report. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, Oregon.
- Gutzwiller, K. J., A. L. D'Antonio, and C. A. Monz. 2017. Wildland recreation disturbance: broad-scale spatial analysis and management. *Frontiers in Ecology and the Environment* 15: 517–524.
- Headwaters Economics, and M. Lawson. 2021. Innovative new ways to count outdoor recreation: using data from cell phones, fitness trackers, social media and other novel data sources. *Headwater Economics*, Bozeman, Montana, United States of America.
- Itami, R., R. Raulings, G. MacLaren, K. Hirst, R. Gimblett, D. Zanon, and P. Chladek. 2003. RBSim 2: simulating the complex interactions between human movement and the outdoor recreation environment. *Journal for Nature Conservation* 11: 278–286.
- Kaiser, J. V., D. A. Stow, and L. Cao. 2004. Evaluation of remote sensing techniques for mapping transborder trails. *Photogrammetric Engineering & Remote Sensing* 70: 1441–1447.
- Korpilo, S., T. Virtanen, and S. Lehvävirta. 2017. Smartphone GPS tracking— inexpensive and efficient data collection on recreational movement. *Landscape and Urban Planning* 157: 608–617.
- Larson, C. L., S. E. Reed, A. M. Merenlender, and K. R. Crooks. 2018. Accessibility drives species exposure to recreation in a fragmented urban reserve network. *Landscape and Urban Planning* 175: 62–71.
- Lesmerises, F., C. J. Johnson, and M. St-Laurent. 2017. Refuge or predation risk? Alternate ways to perceive hiker disturbance based on maternal state of female caribou. *Ecology and Evolution* 7: 845–854.
- Monz, C. A., C. M. Pickering, and W. L. Hadwen. 2013. Recent advances in recreation ecology and the implications of different relationships between recreation use and ecological impacts. *Frontiers in Ecology and the Environment* 11: 441–446.
- Norman, P., and C. M. Pickering. 2019. Factors influencing park popularity for mountain bikers, walkers and runners as indicated by social media route data. *Journal of Environmental Management* 249.
- Norman, P., C. M. Pickering, and G. Castley. 2019. What can volunteered geographic information tell us about the different ways mountain bikers, runners and walkers use urban reserves? *Landscape and Urban Planning* 185: 180–190.
- Olson, L. E., J. R. Squires, E. K. Roberts, A. D. Miller, J. S. Ivan, and M. Hebblewhite. 2017. Modeling large-scale winter recreation terrain selection with implications for recreation management and wildlife. *Applied Geography* 86: 66–91.
- Pauli, B. P., E. R. Sun, Z. K. Tinkle, J. S. Forbey, K. E. Demps, and J. A. Heath. 2019. Human habitat selection: using tools from wildlife ecology to predict recreation in natural landscapes. *Natural Areas Journal* 39: 142–149.
- Riungu, G. K., B. A. Peterson, J. A. Beeco, and G. Brown. 2018. Understanding visitors' spatial behavior: a review of spatial applications in parks. *Tourism Geographies* 20: 833–857.
- Wolf, I. D. 2012. Visitor monitoring along roads and hiking trails: how to determine usage levels in tourist sites. *Tourism Management* 33: 16–28.

## 2.6 Recreation Use Levels

- Anderson, A. K., J. S. Waller, and D. H. Thornton. 2023. Partial COVID-19 closure of a national park reveals negative influence of low-impact recreation on wildlife spatiotemporal ecology. *Scientific Reports* 13: 687.
- Beeco, J. 2013. Integrating spatial modeling into recreational planning in parks and protected areas. Doctoral dissertation. Clemson University, Clemson, South Carolina, United States of America.
- Boyle, S. A., and F. B. Samson. 1985. Effects of nonconsumptive recreation on wildlife: a review. *Wildlife Society Bulletin* 13: 110–116.
- Braunisch, V., P. Patthey, and R. Arlettaz. 2011. Spatially explicit modeling of conflict zones between wildlife and snow sports: prioritizing areas for winter refuges. *Ecological Applications* 21: 955–967.
- Corradini, A., M. Randles, L. Pedrotti, E. van Loon, G. Passoni, V. Oberosler, F. Rovero, C. Tattoni, M. Ciolli, and F. Cagnacci. 2020. Effects of cumulated outdoor activity on wildlife habitat use. *Biological Conservation* 253: 108818.
- D’Antonio, A., C. Monz, S. Lawson, P. Newman, D. Pettebone, and A. Courtemanch. 2010. GPS-based measurements of backcountry visitors in parks and protected areas: examples of methods and applications from three case studies. *Journal of Parks and Recreation Administration* 28: 42–60.
- Deuell, and T. M. Lillesand. 1982. An aerial photographic procedure for estimating recreational boating use on inland lakes. *Photogrammetric Engineering and Remote Sensing* 48: 1713–1717.
- Gregoire, T. G., and G. J. Buhyoff. 1999. Sampling and estimating recreational use. General Technical Report. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, Oregon, United States of America.
- Hall, O. 2018. An application of citizen science to study the interactions between recreational hillwalkers and red deer in the Scottish Uplands. Research Dissertation in Geography. University of St. Andrews, St Andrews, Scotland.
- Herrero, J. 2016. Using big data to understand trail use: three Strava tools TRAFx Research Ltd., Canmore, Alberta, Canada.
- Hill, S. 2015. Comparison of methods for mapping forested trails using remote sensing at Umstead State Park. Master’s thesis. North Carolina State University, Raleigh, North Carolina, United States of America.
- Hojnowski, C. E. 2017. Spatial and temporal dynamics of wildlife use of a human-dominated Landscape. Doctoral dissertation. University of California, Berkeley, California, United States of America.
- Hood, G. A., and K. L. Parker. 2001. Impact of human activities on grizzly Bear habitat in Jasper National Park. *Wildlife Society Bulletin* 29: 624–638.
- Jäger, H., U. Schirpke, and U. Tappeiner. 2020. Assessing conflicts between winter recreational activities and grouse species. *Journal of Environmental Management* 276: 111194.
- Job, H., L. Majewski, M. Engelbauer, S. Bittlingmaier, and M. Woltering. 2021. Establishing a standard for park visitation analyses: insights from Germany. *Journal of Outdoor Recreation and Tourism* 35: 100404.
- Kux, S., and W. Haider. 2014. Non-motorized outdoor recreation in British Columbia in 2012: participation and economic contributions. Simon Fraser University, Burnaby, British Columbia, Canada.
- Ladle, A. 2017. Grizzly bear response to linear features and human recreational activity. Doctoral Dissertation. University of Alberta, Edmonton, Alberta, Canada.
- Ladle, A., P. Galpern, and P. Doyle-Baker. 2018. Measuring the use of green space with urban resource selection functions: an application using smartphone GPS locations. *Landscape and Urban Planning* 179: 107–115.

- Larson, C. L., S. E. Reed, A. M. Merenlender, and K. R. Crooks. 2018. Accessibility drives species exposure to recreation in a fragmented urban reserve network. *Landscape and Urban Planning* 175: 62–71.
- Lindsey, G., J. Wilson, E. Rubchinskaya, J. Yang, and Y. Han. 2007. Estimating urban trail traffic: methods for existing and proposed trails. *Landscape and Urban Planning* 81: 299–315.
- Lindsey, P., and G. Lindsey. 2004. Using pedestrian count models to estimate urban trail traffic. *Journal of Regional Analysis and Policy* 34: 1.
- Lynch, J., C. Vogt, S. Cindrity, and D. Nelson. 2002. Measuring and monitoring trail use: a nationwide survey of state and federal trail managers. Department of Park, recreation and Tourism Resources. Michigan State University, Michigan, United States of America.
- Miller, A. 2016. Impacts of trail building on wildlife: a before-after control-impact experimental study using camera traps. Doctoral dissertations. North Carolina State University, Raleigh, North Carolina, United States of America.
- Miller, A. B., R. Kays, and Y. Leung. 2020. Wildlife response to recreational trail building: an experimental method and Appalachian case study. *Journal for Nature Conservation* 56: 125815.
- Miller, A. B., Y.-F. Leung, and R. Kays. 2017. Coupling visitor and wildlife monitoring in protected areas using camera traps. *Journal of Outdoor Recreation and Tourism* 17: 44–53.
- Monz, C. A., C. M. Pickering, and W. L. Hadwen. 2013. Recent advances in recreation ecology and the implications of different relationships between recreation use and ecological impacts. *Frontiers in Ecology and the Environment* 11: 441–446.
- Monz, C., M. Mitrovich, A. D’Antonio, and A. Sisneros-Kidd. 2019. Using mobile device data to estimate visitation in parks and protected areas: an example from the nature reserve of Orange County, California. *Journal of Park and Recreation Administration* 2327-0187.
- Monz, Christopher, D’Antonio, Ashley L., and K. Hesslip. 2014. Moose-Wilson corridor use levels, types, patterns and impacts in Grand Teton National Park. Technical Report. Utah State University, Logan, Utah, United States of America.
- Mucha, D. A. 2013. Acquiring an improved understanding of Willmore wilderness park visitors, Alberta, Canada. Master’s degree. University of Alberta. Edmonton, Alberta, Canada.
- Muhly, T. B., C. Semeniuk, A. Massolo, L. Hickman, and M. Musiani. 2011. Human activity helps prey win the predator-prey space race. *PLoS ONE* 6: e17050.
- Naidoo, R., and A. C. Burton. 2020. Relative effects of recreational activities on a temperate terrestrial wildlife assemblage. *Conservation Science and Practice* 2: e271.
- Nichols Applied Management Inc. 2018. Economic impact of non-motorized outdoor recreation in Alberta. Nichols Applied Management Inc., Management and Economic Consultants, Edmonton, Alberta, Canada.
- Norman, P., and C. M. Pickering. 2017. Using volunteered geographic information to assess park visitation: comparing three on-line platforms. *Applied Geography* 89: 163–172.
- Northrup, J. M. 2010. Grizzly bears, roads, and human-bear conflicts in southwestern Alberta. Master’s thesis. University of Alberta, Edmonton, Alberta, Canada.
- Northrup, J. M., J. Pitt, T. B. Muhly, G. B. Stenhouse, M. Musiani, and M. S. Boyce. 2012. Vehicle traffic shapes grizzly bear behaviour on a multiple-use landscape. *Journal of Applied Ecology* 49: 1159–1167.
- Olson, L. E., J. R. Squires, E. K. Roberts, J. S. Ivan, and M. Hebblewhite. 2018. Sharing the same slope: behavioral responses of a threatened mesocarnivore to motorized and nonmotorized winter recreation. *Ecology and Evolution* 8: 8555–8572.
- Orellana, D., A. K. Bregt, A. Ligtenberg, and M. Wachowicz. 2012. Exploring visitor movement patterns in natural recreational areas. *Tourism Management* 33: 672–682.
- Orsi, F., and D. Geneletti. 2013. Using geotagged photographs and GIS analysis to estimate visitor flows in natural areas. *Journal for Nature Conservation* 21: 359–368.



- Pauli, B. P., E. R. Sun, Z. K. Tinkle, J. S. Forbey, K. E. Demps, and J. A. Heath. 2019. Human habitat selection: using tools from wildlife ecology to predict recreation in natural landscapes. *Natural Areas Journal* 39: 142–149.
- Pelletier, F. 2006. Effects of tourist activities on ungulate behavior in a mountain protected area. *Journal Mountain Ecology* 8: 15–19.
- Pettebone, D., P. Newman, and S. R. Lawson. 2010. Estimating visitor use at attraction sites and trailheads in Yosemite National Park using automated visitor counters. *Landscape and Urban Planning* 97: 229–238.
- Pouwels, R., M. van Eupen, D. J. J. Walvoort, and R. Jochem. 2020. Using GPS tracking to understand the impact of management interventions on visitor densities and bird populations. *Applied Geography* 116: 102154.
- Reed, Sarah E, C. L. Larson, Crooks, Kevin R., and Merenlender, Adina M. 2014. Wildlife response to human recreation on NCCP reserves in San Diego County. Wildlife Conservation Society. Final Report Wildlife Society Agreement No: P1182112.
- Rogala, J. K., M. Hebblewhite, J. Whittington, C. A. White, J. Coleshill, and M. Musiani. 2011. Human activity differentially redistributes large mammals in the Canadian Rockies National Parks. *Ecology and Society* 16:16.
- Rupi, F., C. Poliziani, and J. Schweizer. 2019. Data-driven bicycle network analysis based on traditional counting methods and GPS traces from smartphone. *ISPRS International Journal of Geo-Information* 8: 322.
- Sessions, C., S. A. Wood, S. Rabotyagov, and D. M. Fisher. 2016. Measuring recreational visitation at U.S. National Parks with crowd-sourced photographs. *Journal of environmental management* 183: 703–711.
- Shanley, C. S., and S. Pyare. 2011. Evaluating the road-effect zone on wildlife distribution in a rural landscape. *Ecosphere* 2: 1–16.
- Staab, J., E. Udas, M. Mayer, H. Taubenböck, and H. Job. 2021. Comparing established visitor monitoring approaches with triggered trail camera images and machine learning based computer vision. *Journal of Outdoor Recreation and Tourism* 35: 100387.
- Walden-Schreiner, C., S. D. Rossi, A. Barros, C. Pickering, and Y.-F. Leung. 2018. Using crowd-sourced photos to assess seasonal patterns of visitor use in mountain-protected areas. *Ambio* 47: 781–793.
- Watson, A. E., D. N. Cole, D. L. Turner, and P. S. Reynolds. 2000. Wilderness recreation use estimation: a handbook of methods and systems. General Technical Report. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Ogden, Utah, United States of America.
- Weitowitz, D. C., C. Panter, R. Hoskin, and D. Liley. 2019. Parking provision at nature conservation sites and its implications for visitor use. *Landscape and Urban Planning* 190: 103597.
- Wilkins, E. J., S. A. Wood, and J. W. Smith. 2021. Uses and limitations of social media to inform visitor use management in parks and protected Areas: a systematic review. *Environmental Management* 67: 120–132.
- Willibald, F., M. J. van Strien, V. Blanco, and A. Grêt-Regamey. 2019. Predicting outdoor recreation demand on a national scale – the case of Switzerland. *Applied Geography* 113: 102111.
- Witztum, E. R., and D. A. Stow. 2004. Analysing direct impacts of recreation activity on coastal sage scrub habitat with very high resolution multi-spectral imagery. *International Journal of Remote Sensing* 25: 3477–3496.
- Wolf, I. D. 2012. Visitor monitoring along roads and hiking trails: how to determine usage levels in tourist sites. *Tourism Management* 33: 16–28.
- Wood, S. A., A. D. Guerry, J. M. Silver, and M. Lacayo. 2013. Using social media to quantify nature-based tourism and recreation. *Scientific Reports* 3: 2976.

## 2.7 Recreation User Conflicts

- Albritton, R., T. Stein, and B. Thapa. 2009. Exploring conflict and tolerance between and within off-highway vehicle recreationists. *Journal of Park and Recreation Administration* 27: 54–72.
- California Fish and Wildlife. 2020. The California Fish and Wildlife Journal. Recreation Special Issue 2020.
- Carothers, P., J. J. Vaske, and M. P. Donnelly. 2001. Social values versus interpersonal conflict among hikers and mountain bikers. *Leisure Sciences* 23: 47–61.
- Cooper, L. A. 1995. Evaluating the susceptibility to conflict of outdoor recreation activities: a case study of backcountry skiing, helicopter skiing, and snowmobiling in the Revelstoke region of British Columbia, Canada. Master's thesis. University of British Columbia, Vancouver, British Columbia, Canada.
- Dangi, T. B., and W. J. Gribb. 2018. Sustainable ecotourism management and visitor experiences: managing conflicting perspectives in Rocky Mountain national park, USA. *Journal of Ecotourism* 17: 338–358.
- Gamborg, C., and F. S. Jensen. 2017. Attitudes towards recreational hunting: a quantitative survey of the general public in Denmark. *Journal of Outdoor Recreation and Tourism* 17: 20–28.
- Ghoddousi, A., E. K. Buchholtz, A. M. Dietsch, M. A. Williamson, S. Sharma, N. Balkenhol, T. Kuemmerle, and T. Dutta. 2021. Anthropogenic resistance: accounting for human behavior in wildlife connectivity planning. *One Earth* 4: 39–48.
- Jackson, S. A., W. Haider, and T. Elliot. 2003. Resolving inter-group conflict in winter recreation: Chilkoot Trail national historic site, British Columbia. *Journal for Nature Conservation* 11: 317–323.
- Kainzinger, S., R. C. Burns, and A. Arnberger. 2015. Whitewater boater and angler conflict, crowding and satisfaction on the north Umpqua River, Oregon. *Human Dimensions of Wildlife* 20: 542–552.
- Mann, C., and J. D. Absher. 2008. Recreation conflict potential and management implications in the northern/central Black Forest Nature Park. *Journal of Environmental Planning and Management* 51: 363–380.
- Manning, R. E., and W. A. Valliere. 2001. Coping in outdoor recreation: causes and consequences of crowding and conflict among community residents. *Journal of Leisure Research* 33: 410–426.
- Mayhood, D. W. 2014. Guerrilla ecology: toward an effective strategy for monitoring Alberta's Trout in a hostile climate. *Wild Trout Symposium XI-Looking Back and Moving forward*. West Yellowstone, Montana, United States of America.
- Miller, A. B., D. J. Blahna, W. C. Morse, Y. Leung, and M. M. Rowland. 2021. From recreation ecology to a recreation ecosystem: a framework accounting for social-ecological systems. *Journal of Outdoor Recreation and Tourism* 38: 100455.
- Miller, A. D., J. J. Vaske, J. R. Squires, L. E. Olson, and E. K. Roberts. 2017. Does zoning winter recreationists reduce recreation conflict? *Environmental Management* 59: 50–67.
- Mueller, J. T., and A. R. Graefe. 2018. Testing the relationships between conflict, specialization, and place attachment among members of the American Alpine Club. *Journal of Outdoor Recreation and Tourism* 24: 26–34.
- Reis, A. C., and J. E. S. Higham. 2009. Recreation conflict and sport hunting: moving beyond goal interference towards social sustainability. *Journal of Sport & Tourism* 14: 83–107.
- Schneider, I. E., J. Earing, and K. Martinson. 2013. Revealing motivations for and conflicts associated with recreational horseback trail riding. *Journal of Forestry* 111: 282–286.
- Schroeder, S. A., D. C. Fulton, L. Cornicelli, and L. E. McInenly. 2020. Recreation conflict, coping, and satisfaction: Minnesota grouse hunters' conflicts and coping response related to all-terrain vehicle users, hikers, and other hunters. *Journal of Outdoor Recreation and Tourism* 30: 100282.

- Shilling, F., J. Boggs, and S. Reed. 2012. Recreational system optimization to reduce conflict on public lands. *Environmental Management* 50: 381–395.
- Taff, B. D., J. Benfield, Z. D. Miller, A. D’Antonio, and F. Schwartz. 2019. The role of tourism impacts on cultural ecosystem services. *Environments* 6: 43.
- Taff, B. D., W. L. Rice, B. Lawhon, and P. Newman. 2021. Who started, stopped, and continued participating in outdoor recreation during the COVID-19 pandemic in the United States? Results from a National Panel Study. *Land* 10: 1396.
- Thomas, S. L., and S. E. Reed. 2019. Entrenched ties between outdoor recreation and conservation pose challenges for sustainable land management. *Environmental Research Letters* 14: 115009.
- Tumes, K. 2007. Out of my way: using qualitative methods to understand recreation conflict between bushwalkers and mountain bike riders. *Anthropological Notebooks* 13: 45–55.
- Vaske, J., R. Dyar, and N. Timmons. 2004. Skill level and recreation conflict among skiers and snowboarders. *Leisure Sciences* 26: 215–225.
- Vittersø, J., R. Chipeniuk, M. Skår, and O. I. Vistad. 2004. Recreational conflict is affective: the case of cross-country skiers and snowmobiles. *Leisure Sciences* 26: 227–243.
- Watkins, C. E., and N. C. Poudyal. 2020. Recreation group encounters and impacts on satisfaction in Tennessee wildlife management areas. *Human Dimensions of Wildlife* 1–16.
- Wolf, I. D., G. Brown, and T. Wohlfart. 2018. Applying public participation GIS (PPGIS) to inform and manage visitor conflict along multi-use trails. *Journal of Sustainable Tourism* 26: 470–495.
- Yoon, J. I., G. Kyle, Y.-C. Hsu, and J. Absher. 2021. Coping with crowded recreation settings: a cross-cultural investigation. *Journal of Leisure Research* 52: 1–21.
- Zeppel, H. 2010. Managing cultural values in sustainable tourism: conflicts in protected areas. *Tourism and Hospitality Research* 10: 93–115.
- Ziener, K. 2002. Types of conflicts between recreational use and Nature Conservation in National Parks and Biosphere Reserves. *Monitoring and Management of Visitor Flows in Recreational and Protected Areas Conference*, Bodenkultur University Vienna, Austria.

## 2.8 Recreation User Generated Content

- Barros, C., B. Moya-Gómez, and J. Gutiérrez. 2020. Using geotagged photographs and GPS tracks from social networks to analyse visitor behaviour in national parks. *Current Issues in Tourism* 23: 1291–1310.
- Beeco, J. 2013. Integrating spatial modeling into recreational planning in parks and protected areas. Doctoral dissertation. Clemson University, Clemson, South Carolina, United States of America.
- Darvill, R., and Z. Lindo. 2015. Quantifying and mapping ecosystem service use across stakeholder groups: Implications for conservation with priorities for cultural values. *Ecosystem Services* 13: 153–161.
- Elwood, S., M. F. Goodchild, and D. Z. Sui. 2012. Researching volunteered geographic information: spatial data, geographic research, and new social practice. *Annals of the Association of American Geographers* 102: 571–590.
- Filazzola, A., G. Xie, K. Barrett, A. Dunn, M. T. J. Johnson, and J. S. MacIvor. 2022. Using smartphone–GPS data to quantify human activity in green spaces. *PLoS Computational Biology* 18: e1010725.
- Fisher, D. M., S. A. Wood, E. M. White, D. J. Blahna, S. Lange, A. Weinberg, M. Tomco, and E. Lia. 2018. Recreational use in dispersed public lands measured using social media data and on-site counts. *Journal of Environmental Management* 222: 465–474.
- Fortin, J. K., K. D. Rode, G. V. Hilderbrand, J. Wilder, S. Farley, C. Jorgensen, and B. G. Marcot. 2016. Impacts of human recreation on brown bears (*Ursus arctos*): a review and new management tool. *PLoS ONE* 11: e0141983.

- Galpern, P., A. Ladle, F. A. Uribe, B. Sandalack, and P. Doyle-Baker. 2018. Assessing urban connectivity using volunteered mobile phone GPS locations. *Applied Geography* 93: 37–46.
- Geng, D. C., J. L. Innes, W. Wu, W. Wang, and G. Wang. 2021. Seasonal variation in visitor satisfaction and its management implications in Banff national park. *Sustainability* 13: 1681.
- Goodbody, T. R. H., N. C. Coops, V. Srivastava, B. Parsons, S. P. Kearney, G. J. M. Rickbeil, and G. B. Stenhouse. 2021. Mapping recreation and tourism use across grizzly bear recovery areas using social network data and maximum entropy modelling. *Ecological Modelling* 440: 109377.
- Goodchild, M. F., and J. A. Glennon. 2010. Crowdsourcing geographic information for disaster response: a research frontier. *International Journal of Digital Earth* 3: 231–241.
- Goodchild, M. F., and L. Li. 2012. Assuring the quality of volunteered geographic information. *Spatial Statistics* 1: 110–120.
- Hamstead, Z. A., D. Fisher, R. T. Ilieva, S. A. Wood, T. McPhearson, and P. Kremer. 2018. Geolocated social media as a rapid indicator of park visitation and equitable park access. *Computers, Environment and Urban Systems* 72: 38–50.
- Hardy, A., J. Aryal, and M. P. Wells. 2019. Comparing techniques for tracking: the case of tourism tracer in Tasmania, Australia. *E-review of Tourism Research* 16: 84–94.
- Harris, A. 2020. Search (and rescue) for the ultimate selfie: how the use of social media and smartphone technology have affected human behaviour in outdoor recreation scenarios. Master's thesis. Simon Fraser University, Burnaby, British Columbia, Canada.
- Hausmann, A., T. Toivonen, R. Slotow, H. Tenkanen, A. Moilanen, V. Heikinheimo, and E. Di Minin. 2018. Social media data can be used to understand tourists' preferences for nature-based experiences in protected areas. *Conservation Letters* 11: e12343.
- Headwaters Economics, and M. Lawson. 2021. Innovative new ways to count outdoor recreation: using data from cell phones, fitness trackers, social media and other novel data sources. Bozeman, Montana, United States of America.
- Herrero, J. 2016. Using big data to understand trail use: three Strava tools. TRAFx Research, Canmore, Alberta, Canada.
- Horst, L., K. Taczanowska, F. Porst, and A. Arnberger. 2023. Evaluation of GNSS-based volunteered geographic information for assessing visitor spatial distribution within protected areas: a case study of the Bavarian Forest National Park, Germany. *Applied Geography* 150: 102825.
- Johnson, J., and J. Hendrikx. 2021. Using citizen science to document terrain use and decision-making of backcountry users. *Citizen Science: Theory and Practice* 6: 8.
- Ladle, A., P. Galpern, and P. Doyle-Baker. 2018. Measuring the use of green space with urban resource selection functions: an application using smartphone GPS locations. *Landscape and Urban Planning* 179: 107–115.
- Larson, C. L., S. E. Reed, A. M. Merenlender, and K. R. Crooks. 2018. Accessibility drives species exposure to recreation in a fragmented urban reserve network. *Landscape and Urban Planning* 175: 62–71.
- Marteinson, D. 2012. The future of the Ghost watershed exploring solutions. Ghost Watershed Alliance Society, Cochrane, Alberta, Canada.
- McCune, J. L., A. M. Carlsson, S. Colla, C. Davy, B. Favaro, A. T. Ford, K. C. Fraser, and E. G. Martins. 2017. Assessing public commitment to endangered species protection: a Canadian case study. *FACETS* 2: 178 – 194.
- McIntosh, D., and P. A. Wright. 2017. Emotional processing as an important part of the wildlife viewing experience. *Journal of Outdoor Recreation and Tourism* 18: 1–9.
- Monkman, G. G., M. J. Kaiser, and K. Hyder. 2018. Text and data mining of social media to map wildlife recreation activity. *Biological Conservation* 228: 89–99.
- Monz, C., M. Mitrovich, A. D'Antonio, and A. Sisneros-Kidd. 2019. Using mobile device data to estimate visitation in parks and protected areas: an example from the nature reserve of Orange County, California. *Journal of Park and Recreation Administration* 37.

- Mucha, D. A. 2013. Acquiring an improved understanding of Willmore wilderness park visitors, Alberta, Canada. Master's thesis. University of Alberta, Edmonton, Alberta, Canada.
- Norman, P., and C. M. Pickering. 2017. Using volunteered geographic information to assess park visitation: comparing three on-line platforms. *Applied Geography* 89: 163–172.
- Norman, P., and C. M. Pickering. 2019. Factors influencing park popularity for mountain bikers, walkers and runners as indicated by social media route data. *Journal of Environmental Management* 249.
- Orsi, F., and D. Geneletti. 2013. Using geotagged photographs and GIS analysis to estimate visitor flows in natural areas. *Journal for Nature Conservation* 21: 359–368.
- Papafitsoros, K., A. Panagopoulou, and G. Schofield. 2021. Social media reveals consistently disproportionate tourism pressure on a threatened marine vertebrate. *Animal Conservation* 24: 568–579.
- Powell, T. 2004. Réponse comportementale des caribous des bois au harcèlement par les motoneiges. Master's thesis. Master's thesis. Université de Sherbrooke, Sherbrooke, Quebec, Canada.
- Rode, K. D., J. K. Fortin-Noreus, D. Garshelis, M. Dyck, V. Sahanatien, T. Atwood, S. Belikov, K. L. Laidre, S. Miller, M. E. Obbard, D. Vongraven, J. Ware, and J. Wilder. 2018. Survey-based assessment of the frequency and potential impacts of recreation on polar bears. *Biological Conservation* 227: 121–132.
- Rout, A., and P. Galpern. 2018. Using personal smartphone location histories in public engagement: locating a new campus amenity. *Applied Geography* 100: 68–77.
- Rupi, F., C. Poliziani, and J. Schweizer. 2019. Data-driven bicycle network analysis based on traditional counting methods and GPS traces from smartphone. *ISPRS International Journal of Geo-Information* 8: 322.
- Senaratne, H., A. Mobasheri, A. L. Ali, C. Capineri, and M. (Muki) Haklay. 2017. A review of volunteered geographic information quality assessment methods. *International Journal of Geographical Information Science* 31: 139–167.
- Sessions, C., S. A. Wood, S. Rabotyagov, and D. M. Fisher. 2016. Measuring recreational visitation at U.S. national parks with crowd-sourced photographs. *Journal of environmental management* 183: 703–711.
- Shanley, C. S., and S. Pyare. 2011. Evaluating the road-effect zone on wildlife distribution in a rural landscape. *Ecosphere* 2: 1–16.
- Sinclair, M., M. Mayer, M. Woltering, and A. Ghermandi. 2020. Using social media to estimate visitor provenance and patterns of recreation in Germany's national parks. *Journal of Environmental Management* 263: 110418.
- Song, X. P., D. R. Richards, P. He, and P. Y. Tan. 2020. Does geo-located social media reflect the visit frequency of urban parks? A city-wide analysis using the count and content of photographs. *Landscape and Urban Planning* 203: 103908.
- Squires, J. R., L. E. Olson, E. K. Roberts, J. S. Ivan, and M. Hebblewhite. 2019. Winter recreation and Canada lynx: reducing conflict through niche partitioning. *Ecosphere* 10: e02876.
- Teles da Mota, V., and C. Pickering. 2020. Using social media to assess nature-based tourism: current research and future trends. *Journal of Outdoor Recreation and Tourism* 30: 100295.
- Thomas, S. L., and S. E. Reed. 2019. Entrenched ties between outdoor recreation and conservation pose challenges for sustainable land management. *Environmental Research Letters* 14: 115009.
- Venter, Z. S., V. Gundersen, S. L. Scott, and D. N. Barton. 2023. Bias and precision of crowdsourced recreational activity data from Strava. *Landscape and Urban Planning* 232: 104686.
- Villanueva, G. 2019. What are the attitudes of off-highway vehicle users towards their environmental impacts? Master's thesis. Royal Roads University, Victoria, British Columbia, Canada.
- Vistnes, I., and C. Nellemann. 2008. The matter of spatial and temporal scales: a review of reindeer and caribou response to human activity. *Polar Biology* 31: 399–407.
- Walden-Schreiner, C., S. D. Rossi, A. Barros, C. Pickering, and Y.-F. Leung. 2018. Using crowd-sourced photos to assess seasonal patterns of visitor use in mountain-protected areas. *Ambio* 47: 781–793.

- Wilkins, E. J., S. A. Wood, and J. W. Smith. 2021. Uses and limitations of social media to inform visitor use management in parks and protected areas: a systematic review. *Environmental Management* 67: 120–132.
- Wilson, S. F., and J. F. Wilmshurst. 2019. Behavioural responses of southern mountain caribou to helicopter and skiing activities. *Rangifer* 39: 27–42.
- Wilson, S. F., C. Nietvelt, S. Taylor, and D. A. Guertin. 2022. Using Bayesian networks to map winter habitat for mountain goats in coastal British Columbia, Canada. *Frontiers in Environmental Science* 10.
- Wolf, I. D. 2012. Visitor monitoring along roads and hiking trails: how to determine usage levels in tourist sites. *Tourism Management* 33: 16–28.
- Wood, S. A., A. D. Guerry, J. M. Silver, and M. Lacayo. 2013. Using social media to quantify nature-based tourism and recreation. *Scientific Reports* 3: 2976.

### 3 Economic Impacts

- Destination British Columbia. 2014. Outdoor adventure tourism sector profile. Destination British Columbia – Research, Planning & Evaluation.
- Heli Cat Canada. 2019. Elevating adventure – a three year update on the economic impact of helicopter and snowcat skiing in British Columbia. HeliCat Canada, Revelstoke, British Columbia, Canada.
- HeliCat Canada. 2016. Elevating adventure – socio-economic impact assessment of heli and snowcat skiing in BC. HeliCat Canada, Revelstoke, British Columbia, Canada.
- HeliCat Canada. 2018. Economic impacts to HeliCat Canada members associated with changes to caribou management in B.C. HeliCat Canada, Revelstoke, British Columbia, Canada.
- Kirkland, J., E. White, and J. Kline. 2018. How much fun? Evaluating economic implications of recreation in national forests. *Science Findings*. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. Portland, Oregon, United States of America.
- Kux, S., and W. Haider. 2014. Non-motorized outdoor recreation in British Columbia in 2012: participation and economic contributions. School of Resource and Environmental Management, Simon Fraser University, Burnaby, British Columbia, Canada.
- Mayers Norris Penny LLP. 2011. The social and economic impacts of BC recreation sites and trails. Prepared for the Ministry of Forests, Lands and Natural Resource Operations. Mayers Norris Penny LLP., Vancouver British Columbia, Canada.
- Miller, A. B., L. R. Larson, J. Wimpey, and N. Reigner. 2020. Chapter 16: outdoor recreation and environmental stewardship: the sustainable symbiosis. In: Selin, Steven; Cerveny, Lee K.; Blahna, Dale J.; Miller, Anna B., eds. 2020. Igniting research for outdoor recreation: linking science, policy, and action. General Technical Report. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, Oregon, United States of America.
- Nichols Applied Management Inc. 2018. Economic impact of non-motorized outdoor recreation in Alberta. 2018. Nichols Applied Management Inc. Management and Economic Consultants, Edmonton, Alberta, Canada.
- Outdoor Industry Association. 2017. The outdoor recreation economy. Outdoor Industry Association, Boulder, Colorado, United States of America.
- Rasker, R. 2012. West is best – how public lands in the west create a competitive economic advantage. Headwaters Economics, Bozeman, Montana, United States of America.
- Scott, D., J. Dawson, and B. Jones. 2007. Climate change vulnerability of the northeast US winter tourism sector. *Mitigation and Adaptation Strategies for Global Change* 13: 577–596.
- Thomas, C. C., and L. Koontz. 2010. 2019 national park visitor spending effects – economic contributions to local communities, states, and the nation. 2019. Natural Resource Report. U.S. Department of the Interior, National Park Service, Natural Resource Stewardship and Science, Fort Collins, Colorado, United States of America.

- Travel Alberta. 2021. Alberta's crown land outdoor recreation economy. Technical report. Tourism Industry Association Alberta.
- Travel Alberta. 2021. Alberta's crown land outdoor recreation economy – driving sustainable economic growth diversification & job creation. Full report. Tourism Industry Association Alberta.
- Williams, J., and G. Q. Bull. 2019. Emerging economic opportunities in the Columbia river headwaters region of British Columbia. Final Report. Arborvitae Environmental Services LTD., Ontario, Canada.

## 4 Impact Assessments

- Alberta Wilderness Association. 2007. The Bighorn Wildland recreational trail monitoring project: an interim research summary from 2004 – 2006. Alberta Wilderness Association, Calgary, Alberta, Canada.
- Alberta Wilderness Association. 2009. Is the access management plan working? Monitoring recreational use in the Bighorn Backcountry. Final report 2004 - 2008. Alberta Wilderness Association, Calgary, Alberta, Canada.
- ALCES, and Alberta Chapter of the Wildlife Society. 2020. Cumulative effects of land uses and conservation priorities in Alberta's Southern East Slope Watersheds.
- Ballantyne, M., and C. M. Pickering. 2013. Tourism and recreation: a common threat to IUCN red-listed vascular plants in Europe. *Biodiversity and Conservation* 22: 3027–3044.
- Barros, A., C. Pickering, and Ori Guides. 2015. Desktop analysis of potential impacts of visitor use: a case study for the highest park in the Southern Hemisphere. *Journal of Environmental Management* 150: 179–195.
- Boyer, L., and D. W. Mayhood. 2018. Erosion & suspended sediment delivery from off-highway vehicle trails & roads in the McLean Creek watershed, Alberta. Technical Report, Freshwater Research Limited, Alberta, Canada.
- D'Antonio, A., C. Monz, P. Newman, S. Lawson, and D. Taff. 2013. Enhancing the utility of visitor impact assessment in parks and protected areas: a combined social-ecological approach. *Journal of Environmental Management* 124: 72–81.
- Dertien, J., C. Larson, and S. Reed. 2021. Recreation effects on wildlife: a review of potential quantitative thresholds. *Nature Conservation* 44: 51–68.
- Díaz, S., J. Settele, E. S. Brondízio, H. T. Ngo, J. Agard, A. Arneth, P. Balvanera, K. A. Brauman, S. H. M. Butchart, K. M. A. Chan, L. A. Garibaldi, K. Ichii, J. Liu, S. M. Subramanian, G. F. Midgley, P. Miloslavich, Z. Molnár, D. Obura, A. Pfaff, S. Polasky, A. Purvis, J. Razzaque, B. Reyers, R. R. Chowdhury, Y.-J. Shin, I. Visseren-Hamakers, K. J. Willis, and C. N. Zayas. 2019. Pervasive human-driven decline of life on Earth points to the need for transformative change. *Science* 366.
- Ford, A. T., E. J. Sunter, C. Fauvelle, J. L. Bradshaw, B. Ford, J. Hutchen, N. Phillipow, and K. J. Teichman. 2020. Effective corridor width: linking the spatial ecology of wildlife with land use policy. *European Journal of Wildlife Research* 66: 69.
- Gaynor, K. M., C. E. Hojnowski, N. H. Carter, and J. S. Brashares. 2018. The influence of human disturbance on wildlife nocturnality. *Science* 360: 1232–1235.
- Ghost Watershed Alliance Society. 2012. Ghost River watershed cumulative effects study phase 2: beneficial management practices. Ghost Watershed Alliance Society, Cochrane, Alberta, Canada.
- Heim, N., J. T. Fisher, J. Volpe, A. P. Clevenger, and J. Paczkowski. 2019. Carnivore community response to anthropogenic landscape change: species-specificity foils generalizations. *Landscape Ecology* 34: 2493–2507.
- Kearney, S. P., N. C. Coops, G. B. Stenhouse, and T. A. Nelson. 2019. EcoAnthromes of Alberta: an example of disturbance-informed ecological regionalization using remote sensing. *Journal of Environmental Management* 234: 297–310.

- Lee, P., and J. D. Gysbers. 2008. Recent anthropogenic changes within the inland temperate rainforest of Southeastern British Columbia: interim report. Global Forest Watch Canada, Edmonton, Alberta, Canada.
- Lynn, N., and R. Brown. 2003. Effects of recreational use impacts on hiking experiences in natural areas. *Landscape and Urban Planning* 64: 77–87.
- Mayhood, D. W. 1992. Approaches to managing freshwater fishes in North American parks and reserves. Part 2 of a fish management plan for Jasper National Park. Freshwater Research Limited, Calgary, Alberta, Canada.
- Mayhood, D. W. 2013b. Suspended sediment in Silvester creek and its potential effects on the westslope cutthroat trout population. Technical Report. Freshwater Research Limited, Calgary, Alberta, Canada.
- Mayhood, D. W. 2015. Upper Silvester Creek sediment source survey, 5 August 2013. Technical Report. Freshwater Research Limited, Calgary, Alberta, Canada.
- Mayhood, D. W., M. Sawyer, and W. Haskins. 1998. British Columbia's level 1 watershed assessment procedure as a tool for monitoring potential impacts of development on aquatic ecosystems in Canada's Rocky Mountains. *Science & Management of Protected Areas* 677–686.
- Mayhood, D. W., M. Sawyer, and W. Haskins. 2004. Historical risk analysis of watershed disturbance in the southern east slopes region of Alberta, Canada, 1910–1996. Forest-Land-Fish conference II- Ecosystem Stewardship through Collaboration. Edmonton, Alberta, Canada.
- Miller, A. B., D. King, M. Rowland, J. Chapman, M. Tomosy, C. Liang, E. S. Abelson, and R. L. Truex. 2020. Sustaining wildlife with recreation on public lands: a synthesis of research findings, management practices, and research needs. General Technical Report. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, Oregon, United States of America.
- Pigeon, K. E., D. MacNearney, M. Hebblewhite, M. Musiani, L. Neufeld, J. Cranston, G. Stenhouse, F. Schmiegelow, and L. Finnegan. 2020. The density of anthropogenic features explains seasonal and behaviour-based functional responses in selection of linear features by a social predator. *Scientific Reports* 10: 11437.
- Sawyer, M., D. Mayhood, P. Paquet, C. Wallis, R. Thomas, and W. Haskins. 1997. Southern east slopes cumulative effects assessment. Hayduke and Associates Ltd., Calgary, Alberta, Canada.
- Smith, W., and R. Cheng. 2016. Anthropogenic disturbance and intactness in the Castle. A special series on the Castle proposed protected areas. Bulletin 1. Global Forest Watch Canada, Ottawa, Ontario, Canada.
- Smith, W., and R. Cheng. 2016. Linear disturbance in the Castle. A special series on the Castle proposed protected areas: Bulletin 2. Global Forest Watch Canada, Ottawa, ON.
- Smith, W., R. Cheng, and S. Elmeligi. 2016. Linear disturbance in the Castle: Implications for grizzly bear and trout. A special series on the Castle proposed protected areas: Bulletin 3. Global Forest Watch Canada, Ottawa, Ontario, Canada.
- Strong, A. M., C. A. Dickert, and R. T. Bell. 2002. Ski trail effects on a beetle (*Coleoptera: Carabidae, Elateridae*) community in Vermont. *Journal of Insect Conservation* 6: 149–159.
- Westwood, A. R., M. Olszynski, C. H. Fox, A. T. Ford, A. L. Jacob, J. W. Moore, and W. J. Palen. 2019. The role of science in contemporary Canadian environmental decision making: the example of environmental assessment. *UBC Law Review* 52: 243 - 292.
- Yarmoloy, C., and B. Stelfox. 2011. An assessment of the cumulative effects of land uses within the Ghost River Watershed, Alberta, Canada. Ghost Watershed Alliance, Cochrane, Alberta, Canada.

## 5 Systematic Review & Meta -Analysis

- Ballantyne, M., and C. M. Pickering. 2013. Tourism and recreation: a common threat to IUCN red-listed vascular plants in Europe. *Biodiversity and Conservation* 22: 3027–3044.



- Bateman, P. W., and P. A. Fleming. 2017. Are negative effects of tourist activities on wildlife over-reported? A review of assessment methods and empirical results. *Biological Conservation* 211: 10–19.
- Börger, L. 2016. Stuck in motion? Reconnecting questions and tools in movement ecology. *Journal of Animal Ecology* 85: 5–10.
- Brennan, A., R. Naidoo, L. Greenstreet, Z. Mehrabi, N. Ramankutty, and C. Kremen. 2022. Functional connectivity of the world's protected areas. *376*: 1101–1104.
- Coetzee, B. W. T., and S. L. Chown. 2016. A meta-analysis of human disturbance impacts on Antarctic wildlife. *Biological Reviews* 91: 578–596.
- Dertien, J., C. Larson, and S. Reed. 2021. Recreation effects on wildlife: a review of potential quantitative thresholds. *Nature Conservation* 44: 51–68.
- Doherty, T. S., G. C. Hays, and D. A. Driscoll. 2021. Human disturbance causes widespread disruption of animal movement. *Nature Ecology & Evolution* 5: 513–519.
- Farr, D., A. Braid, A. Janz, B. Sarchuk, S. Slater, A. Sztaba, D. Barrett, G. Stenhouse, A. Morehouse, and M. Wheatley. 2017. Ecological response to human activities in southwestern Alberta: scientific assessment and synthesis. Alberta Environment and Parks, Government of Alberta, Alberta, Canada.
- Farr, D., A. Braid, and S. Slater. 2018. Linear disturbances in the Livingstone-Porcupine hills of Alberta: review of potential ecological responses. Page pp.57. Government of Alberta, Environment and Parks, Alberta, Canada.
- Favaro, B., D. C. Claar, C. H. Fox, C. Freshwater, J. J. Holden, A. Roberts, and UVic Research Derby. 2014. Trends in extinction risk for imperiled species in Canada. *PLoS ONE* 9: e113118.
- Gaines, W. L., P. H. Singleton, and R. C. Ross. 2003. Assessing the cumulative effects of linear recreation routes on wildlife habitats on the Okanogan and Wenatchee National Forests. Technical Report, U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, Oregon, United States of America.
- Hardy, A., J. Aryal, and M. P. Wells. 2019. Comparing techniques for tracking: the case of tourism tracer in Tasmania, Australia. *E-review of Tourism Research* 16: 84–94.
- Hill, J. E., T. L. DeVault, G. Wang, and J. L. Belant. 2020. Anthropogenic mortality in mammals increases with the human footprint. *Frontiers in Ecology and the Environment* 18: 13–18.
- Kirkland, J., E. White, and J. Kline. 2018. How much fun? Evaluating economic implications of recreation in national forests. *Science Findings* 208. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, Oregon, United States of America.
- Kunc, H. P., and R. Schmidt. 2019. The effects of anthropogenic noise on animals: a meta-analysis. *Biology Letters* 15: 20190649.
- Larson, C. L., S. E. Reed, A. M. Merenlender, and K. R. Crooks. 2016. Effects of recreation on animals revealed as widespread through a global systematic review. *PLoS ONE* 11: e0167259.
- Larson, C. L., S. E. Reed, A. M. Merenlender, and K. R. Crooks. 2019. A meta-analysis of recreation effects on vertebrate species richness and abundance. *Conservation Science and Practice* 1: e93.
- Lindenmayer, D. B., and M. J. Westgate. 2020. Are flagship, umbrella and keystone species useful surrogates to understand the consequences of landscape change? *Current Landscape Ecology Reports* 5: 76–84.
- Lucas, E. 2020. Recreation-related disturbance to wildlife in California—better planning for and management of recreation are vital to conserve wildlife in protected areas where recreation occurs. *California Fish and Wildlife Recreation, Special Issue* 29–51.
- Marion, J. L., Y.-F. Leung, H. Eagleston, and K. Burroughs. 2016. A review and synthesis of recreation ecology research findings on visitor impacts to wilderness and protected natural areas. *Journal of Forestry* 114: 352–362.
- Marion, S., A. Davies, U. Demšar, R. J. Irvine, P. A. Stephens, and J. Long. 2020. A systematic review of methods for studying the impacts of outdoor recreation on terrestrial wildlife. *Global Ecology and Conservation* 22: e00917

- Mazor, T., C. Doropoulos, F. Schwarzmüller, D. W. Gladish, N. Kumaran, K. Merkel, M. Di Marco, and V. Gagic. 2018. Global mismatch of policy and research on drivers of biodiversity loss. *Nature Ecology & Evolution* 2: 1071–1074.
- McCune, J. L., W. L. Harrower, S. Avery-Gomm, J. M. Brogan, A.-M. Csörgő, L. N. K. Davidson, A. Garani, L. R. Halpin, L. P. J. Lipsen, C. Lee, J. C. Nelson, L. R. Prugh, C. M. Stinson, C. K. Whitney, and J. Whitton. 2013. Threats to Canadian species at risk: an analysis of finalized recovery strategies. *Biological Conservation* 166: 254–265.
- Miller, A. B., D. King, M. Rowland, J. Chapman, M. Tomosy, C. Liang, E. S. Abelson, and R. L. Truex. 2020. Sustaining wildlife with recreation on public lands: a synthesis of research findings, management practices, and research needs. General Technical Report. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, Oregon, United States of America.
- Morris, L. R., K. M. Proffitt, and J. K. Blackburn. 2016. Mapping resource selection functions in wildlife studies: concerns and recommendations. *Applied Geography* 76: 173–183.
- Nakagawa, S., A. G. Dunn, M. Lagisz, A. Bannach-Brown, E. M. Grames, A. Sánchez-Tójar, R. E. O’Dea, D. W. A. Noble, M. J. Westgate, P. A. Arnold, S. Barrow, A. Bethel, E. Cooper, Y. Z. Foo, S. R. Geange, E. Hennessy, W. Mapanga, K. Mengersen, C. Munera, M. J. Page, V. Welch, Evidence Synthesis Hackathon 2019 Participants, and N. R. Haddaway. 2020. A new ecosystem for evidence synthesis. *Nature Ecology & Evolution* 4: 498–501.
- Northrup, J. M., E. Vander Wal, M. Bonar, J. Fieberg, M. P. Laforge, M. Leclerc, C. M. Prokopenko, and B. D. Gerber. 2022. Conceptual and methodological advances in habitat-selection modeling: guidelines for ecology and evolution. *Ecological Applications* 32: e02470.
- Ouren, D., C. Haas, C. Melcher, S. Stewart, P. Ponds, N. Sexton, L. Burris, T. Fancher, and Z. Bowen. 2009. Environmental effects of off-highway vehicles on bureau of land management lands: a literature synthesis, annotated bibliographies, extensive bibliographies, and internet Resources. Open-File Report, U.S. Geological Survey.
- Proctor, M. F., B. N. McLellan, G. B. Stenhouse, G. Mowat, C. T. Lamb, and M. S. Boyce. 2020. Effects of roads and motorized human access on grizzly bear populations in British Columbia and Alberta, Canada. *Ursus* 30: 16–39.
- Reed, Sarah E, C. L. Larson, Crooks, Kevin R., and Merenlender, Adina M. 2014. Wildlife response to human recreation on NCCP reserves in San Diego County. Report. Wildlife Conservation Society.
- Sato, C. F., J. T. Wood, and D. B. Lindenmayer. 2013. The effects of winter recreation on alpine and subalpine fauna: a systematic review and meta-analysis. *PLoS ONE* 8: e64282.
- Schulze, K., K. Knights, L. Coad, J. Geldmann, F. Leverington, A. Eassom, M. Marr, S. H. M. Butchart, M. Hockings, and N. D. Burgess. 2018. An assessment of threats to terrestrial protected areas. *Conservation Letters*. 11: e12435.
- Senaratne, H., A. Mobasher, A. L. Ali, C. Capineri, and M. Haklay. 2017. A review of volunteered geographic information quality assessment methods. *International Journal of Geographical Information Science* 31:139–167.
- Stankowich, T. 2008. Ungulate flight responses to human disturbance: a review and meta-analysis. *Biological Conservation* 141: 2159–2173.
- Stokowski, P. A., and C. B. LaPointe. 2000. Environmental and social effects of ATVs and ORVs: an annotated bibliography and research assessment. Report, University of Vermont, School of Natural Resources, Burlington, Vermont, United States of America.
- Sumanapala, D., and I. Wolf. 2019. Recreational ecology: a review of research and gap analysis. *Environments* 6: 81.
- Vandeman, M. J. 2004. The impacts of mountain biking on wildlife and people – a review of the literature. *ARPN Journal of Science and Technology* 4: 418–426.
- Vistnes, I., and C. Nellemann. 2008. The matter of spatial and temporal scales: a review of reindeer and caribou response to human activity. *Polar Biology* 31: 399–407.

## Systematic Review & Meta - Analysis

Wright, P., and C. Matthews. 2015. Building a culture of conservation: state-of-knowledge report on connecting people to nature in parks. *PARKS, the International Journal of Protected Areas and Conservation* 21: 11–24.