A survey of studies conducted in the Crown of the Continent Ecosystem from 2000-2015 reveals areas of data deficiencies and suggests future research priorities

Victoria J. Cox, Georgina R. Fox, Ashlee B. Jacobsen, Riah J. Kelly, & Alice E. Liboiron
Department of Biology
Mount Royal University
Calgary, AB, Canada

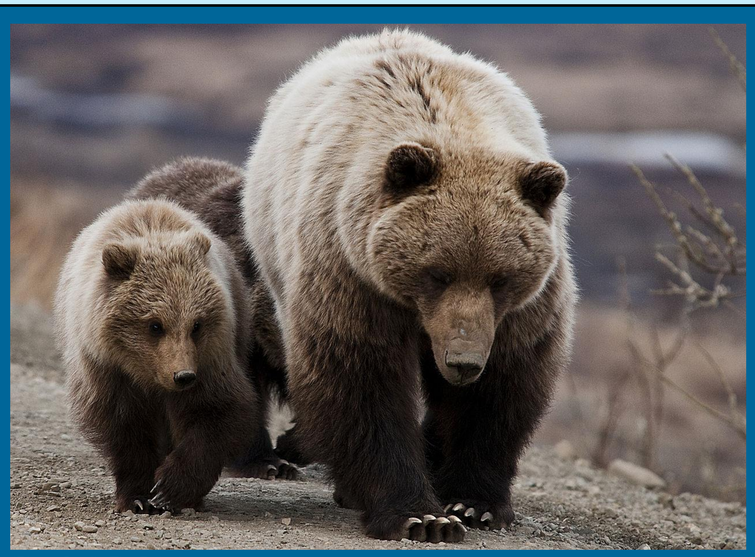
Introduction:

The Crown of the Continent Ecosystem (CCE) is situated along the continental divide of the Rocky Mountains and encompasses portions of the provinces of Alberta and British Columbia and the state of Montana. This 72 000 km2 ecologically significant area is rich in biodiversity and is home to a complete complement of native carnivores (Crown Managers Partnership, 2011). It also is home to the headwaters of the Saskatchewan, Columbia, and Missouri watersheds (Crown Managers Partnership, 2011).

Many forms of land use exist in the CCE including First Nations lands, national, state, and provincial parks and protected areas, agriculture, and resource extraction. Maintaining the integrity of this transboundary ecosystem faces challenges such as monitoring research being conducted by various levels of government, not-for-profits, and academic institutions. To fulfill this need, we located and annotated more than 200 ecological studies conducted between 2000-2015, and analyzed this collection to identify knowledge gaps.

Methods:

- Using the physical and digital resources of Mount Royal University and the Parks Canada library at Waterton Lakes National Park, we collected more than 200 studies, reports, and management plans produced in the CCE between 2000-2015.
- We annotated these studies, producing a research directory for the CCE.
- Keywords were assigned to each study to indicate its location, type (e.g., monitoring), and focal species based on its title and annotation.
- We tallied the number of studies with the same keywords in each of the three categories.
- We identified underrepresented topics within each of the categories (location, type, focal species).



(Photo Credit: Tim Rains)

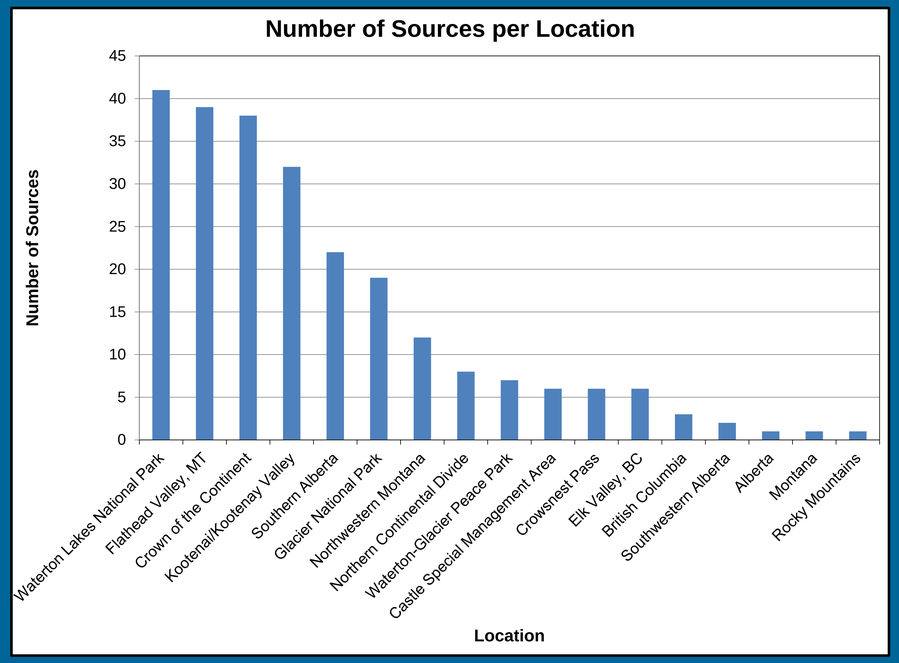


Figure 2: Number of sources collected per location. Note that some sources covered large geographical areas (Cox et al., 2016).

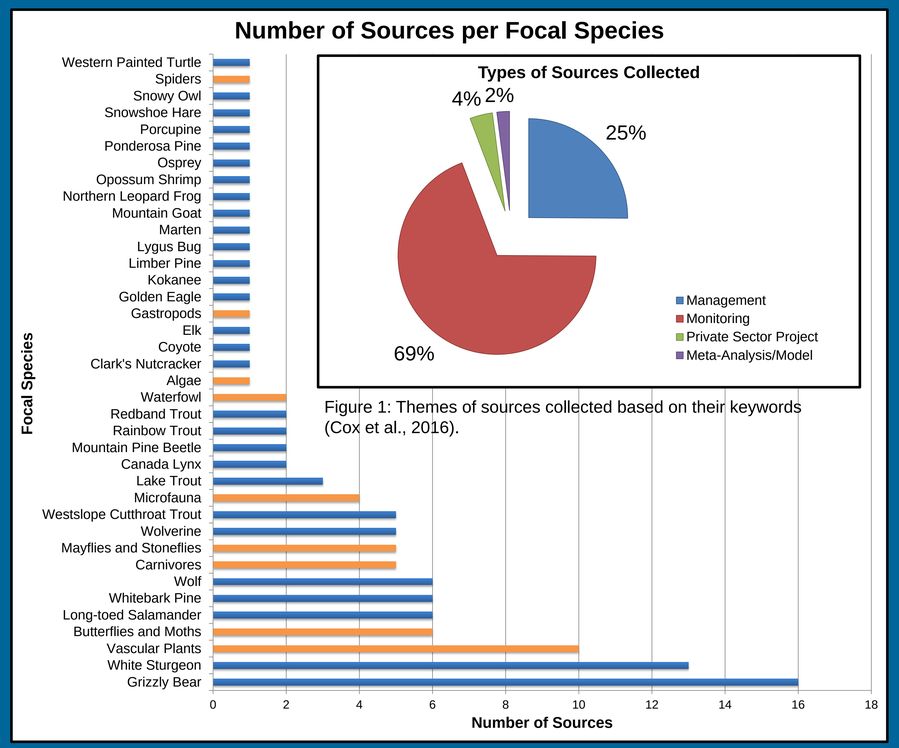


Figure 1: Themes of sources collected based on their keywords (Cox et al., 2016).

Figure 3: Focal species of reviewed sources and the overall number of sources that involved those species. Orange bars indicate multi-species categories (Cox et al., 2016).

Results:

- Type (Figure 1): Most sources focused on monitoring populations and changes to the landscape in the CCE. There were few that focused on management of the area and none in our sample that discussed mitigation of human impacts in the CCE.
- Location (Figure 2): Well-represented locations included Waterton Lakes National Park (AB), the Flathead Valley (MT), and the greater CCE. Underrepresented locations included the Castle Special Management Area (AB), Crowsnest Pass and Elk Valley regions (BC), and the Bob Marshall Wilderness (MT). There were also fewer studies from British Columbia compared to Alberta and Montana.
- Focal Species (Figure 3): Some Species-at-Risk, such as grizzly bears and white sturgeon, were well represented. Less charismatic vertebrates were underrepresented, regardless of their risk status or role within the ecosystem. Invertebrate animals were also underrepresented compared to vertebrate animals.

Discussion:

- We acknowledge that our sample of studies was biased towards Waterton Lakes Park because we used Parks Canada's library within the park. However, we do think that our sample has identified underrepresented locations. The Elk Valley and Crowsnest Pass in B.C. are of particular concern because they are underrepresented, despite these areas being under increasing pressure from resource development. The data gaps associated with these locations of study impacts the completeness of our understanding of the region.
- While ecological monitoring is important within the CCE, more studies are needed to assess management policies and mitigation strategies.
- A research bias towards charismatic Species-at-Risk was identified. Additionally, there were several small scale studies on some species (e.g., westslope cutthroat trout), but no synthesis of the data that would help inform management. The data gaps that exist in studies pertaining to less charismatic species could be an indication of a research funding deficit.
- Focusing future research efforts and funding to eliminate these data gaps is essential to sustaining the health and function of the CCE as a whole.

Acknowledgements:
A special thank you to Dr. Dorothy Hill, Dr. Kathy Rettie, Dr. Len Broberg, the staff at Waterton Lakes National Park, and the Crown Managers Partnership. Jackie Henderson participated in the annotated bibliography portion of this project.

References:
Cox, V. J., Fox, G. R., Jacobsen, A. B., Kelly, R. J., Liboiron, A. E., Henderson, J. R., & Hill, D. P. (2016). *Crown of the Continent Ecosystem (CCE) State of Research: 2000-2015*. Retrieved from http://crownmanagers.org/crown-research/

Crown Managers Partnership. (2011). *Crown of the Continent Ecosystem*. Retrieved September 20, 2016, from http://crownmanagers.org/crown-of-the-continent-ecosyst/

Rains, T. (2010). Image Retrieved October, 6, 2016 from https://commons.wikimedia.org/wiki/File:Grizzly_Bear-_Sow_and_cubs_(5728173840).jpg