



GENETIC DIVERSITY AND FRAGMENTATION (Part III)

GRADE Grade 9

PART 3 of 3

TOPICS Human-wildlife conflict, biodiversity, habitat

CURRICULAR CONNECTIONS

Grade 9 Science

Unit A – Biological Diversity

2. Investigate the nature of reproductive processes and their role in transmitting species characteristics
 - Identify examples of dominant and recessive characteristics and recognize that dominance and recessiveness provide only a partial explanation for the variation of characteristics in offspring
4. Identify impacts of human action on species survival and variation within species, and analyze related issues for personal and public decision making.
 - Describe ongoing changes in biological diversity through extinction and extirpation of native species, and investigate the role of environmental factors in causing these changes
 - Evaluate the success and limitations of various local and global strategies for minimizing loss of species diversity

OVERVIEW

Wrapping up what students learned in Parts I and II, this lesson will look at strategies that are used to maintain genetic diversity and connectivity in fragmented landscapes. Students will evaluate different strategies before delving into their own community education action projects designed to improve human-wildlife coexistence in the Bow Valley.

OBJECTIVES

- Students will critically explore several strategies that are employed to maintain genetic diversity among bear and other wildlife populations
- Students will understand the role that they can play in preventing human-wildlife conflict

KEY TERMS

- **Crossing structure** – structures that allow animals to cross human-made barriers safely
- **Human-wildlife conflict** – the interaction between wild animals and humans that the resulting negative impact on people, animals, resources and habitats
- **Translocation** – the movement of something from one place to another (e.g. wildlife)

GUIDING QUESTIONS

- What are the main threats to biodiversity in the Bow Valley?
- What are some ways to overcome threats to biodiversity?
- How can individuals help to conserve biodiversity and healthy wildlife populations?

BACKGROUND ESSAY

Biodiversity is under threat due to human activities. What the main threats are largely depends on the habitat and species in question. They include population growth and resource consumption, climate change, habitat conversion and urbanisation, invasive alien species, and environmental degradation. As we learned in Part II, one of the most persistent challenges to biodiversity in the Bow Valley is habitat fragmentation. While this can be remedied by good planning and design of wildlife corridors, often we are forced to work within the confines of already fragmented landscapes. Land managers have a number of strategies at their disposal to maintain biodiversity in fragmented landscapes. These strategies include translocation, wildlife crossing structures, and community education.

Translocation

In very extreme cases – such as in the example of the Florida panther from Part I – **translocation** has been proposed and sometimes used to maintain biodiversity and ecosystem function. Translocation involves the movement of one or more individuals from one place to another.



This introduces additional genetic variation from one population into another and may reverse the detrimental effects created by recessive gene versions.

Rates of success for translocations are low however, while the process itself is highly disruptive and potentially dangerous for the wildlife being translocated. This solution is also reactive, meaning that it is responding to the symptoms of the problem rather than addressing the root causes themselves such as habitat fragmentation. Without addressing the circumstances that led to the problem in the first place, it is entirely possible that the population will decline again. It is greatly preferable to use a preventative intervention strategy that avoids a population's number falling so low that inbreeding depression occurs in the first place.

With bears in the Canadian Rockies, translocation has *only* been used to move so-called “problem bears” to new locations where conflict with humans is less likely. Translocation has *not* been used to bolster bear populations in the Rockies.



CASE STUDY

Researchers in Banff conducted a three-year investigation of the effectiveness of crossing structures in Banff National Park in facilitating the movement of genes between different populations of bears. They obtained genetic information by collecting hair samples from grizzly and black bear populations both on highway crossing structures and in surrounding areas. The study provided evidence that bears are able to share their genetic information via crossing structures, thus preventing the complete isolation of populations of both grizzly and black bears.

Among the findings from the study was the discovery that breeding black bear females prefer overpasses, while males prefer underpasses. Furthermore, the researchers were able to determine that the Trans-Canada Highway did not completely isolate grizzly bear nor black bear populations on either side of the highway.

Wildlife Crossing Structures

Maintaining a physical connection between large habitat patches allows genes to flow across the landscape and between subpopulations. Wildlife **crossing structures** such as overpasses and underpasses have been extensively studied and have been shown to be an effective strategy for maintaining habitat connectivity.

In Banff National Park, six overpasses and thirty-eight underpasses facilitate the movement of wildlife across the Trans-Canada Highway. These structures comprise the most extensive network of crossing structures anywhere in the world. The crossing structures were designed to prevent vehicle-wildlife collisions and to maintain habitat connectivity.

When paired with wildlife fencing alongside transportation corridors and the work being done by organizations that prevent **human-wildlife conflict** such as Bow Valley WildSmart and the Bear Conflict Solutions Institute, wildlife crossing structures are a great tool for maintaining genetic diversity.

Community Education

Community education takes many forms but in all cases requires the commitment of local residents to coexisting alongside wildlife. Just as human activities can lead to biodiversity loss, they can also lead to biodiversity conservation and enhancement. Education initiatives promote an awareness of the impacts that people's action may have on wildlife and the adoption of practices that keep wildlife and people safe, both at home and on the trails.



Ultimately the best approach to conserving biodiversity will be some combination of the strategies discussed here, as well as others such as additional legal protections and the establishment of more protected habitat.

DURATION 15-20 minutes

MATERIALS

- Scrap paper
- Writing utensils

ACTIVITY – PROS AND CONS

Students are tasked with evaluating a variety of strategies that can be used to enhance or maintain genetic diversity, considering the strengths, weakness and limitations of each.

1. Divide students into small groups. Introduce some of the possible strategies that can be used to maintain or enhance genetic diversity and explain how they accomplish this goal. Strategies to consider: *translocation*, *crossing structures*, and *community education*. Students may also want to explore a strategy that is not included here.
2. Ask each group to brainstorm and record as many advantages and disadvantages of these strategies as they can think of. If the students require additional direction, ask them to consider cost, animal behaviours, effectiveness or practicality for the local region.
3. Once the students have had a chance to brainstorm options, partner groups together who were looking at the same strategy. Ask students to share with each other what they have written and to create a comprehensive list of all their ideas.
4. Invite one or two students from each group to share their thoughts with the entire class.

BACKGROUND ESSAY

As wildlife and people compete for a finite amount of space, numerous interactions between humans and wildlife occur. Although most are harmless, some can pose a serious threat to both people and wildlife, resulting in human injury, property damage, and/or dead or relocated animals. While populations may be resilient to the death of a single bear, the loss of numerous individuals from the landscape could jeopardize that population. People can help to maintain genetic diversity of bears near high human use areas like the Bow Valley through their choices. For this to happen, the cooperation and participation of every single resident and visitor is necessary.

Bow Valley WildSmart leads diverse education and outreach efforts to raise public awareness and empower citizens to coexist safely with wildlife. These education efforts include bear spray training sessions, wildlife awareness talks, and interactive booths for youth, families, outdoor educators, outdoor recreationalists and people employed in the recreation and tourism industry. These events arm participants



with the knowledge and skills to be WildSmart in the Bow Valley and beyond.

WildSmart also trains enthusiastic volunteers to share their knowledge with their peers by becoming Wildlife Ambassadors and they undertake attractant management to help keep wild animals out of areas heavily used by humans. There are many ways that students can help to reduce negative human-wildlife interactions. The ideas listed below are just a few but students and teachers may want to put their own spin on these or come up with entirely new ideas. You can reach out to WildSmart for additional information or support by email at info@wildsmart.ca.

ACTIVITY – GET INVOLVED!

Students share what they have learned about the importance of protecting wildlife in order to maintain biodiversity and ecosystem function through a variety of different action projects.

Community Attractant Audit

Communities in the Bow Valley have made huge strides to manage their wildlife through bear-proof garbage bins, voluntary fruit removal programs and birdfeeder bylaws. Despite these successes, there still remain many garbage bins in the Bow Valley that don't meet these standards and residences with fruit trees in their backyards. Students can perform an audit of attractants in their neighbourhood or community, then share what they have learned and come up with strategies to address the problems.

Weekly Bear Report

WildSmart publishes a weekly summary of bear activity between the Banff Park East Gate and Bow Valley Provincial Park. The information in the Bear Report is intended to help the public make informed decisions about where and how to recreate based on recent wildlife movement patterns. Students can contribute to this bear report by sharing stories, photography, lessons, artwork, or success stories for the "*Paws-itive News*" section. Brainstorm other ways to create a Bear or Wildlife Report at your school such as through a school newspaper or morning announcements.

Junior Wildlife Ambassadors

Each year WildSmart and Alberta Parks staff train a number of dedicated volunteer Wildlife Ambassadors in wildlife ecology, how to avoid and handle wildlife encounters and effective public engagement. Ambassadors use animal artifacts and other educational resources to engage people in conversations about wildlife habitat needs and safe trail use. Adopting the same strategies used by the Wildlife Ambassadors, students can work with WildSmart staff to develop presentations for younger students in local elementary schools. Students may even want to pursue becoming Junior Wildlife



Ambassadors, joining the team to share their knowledge on local trails throughout the summer.

Public Service Announcements

Students can explore different creative ways to share what they have learned about biodiversity conservation and how people can participate in meaningful solutions through a newsletter, podcast, radio spot or video. The Biosphere Institute has audiovisual equipment that students can use to record and edit their projects as well as a platform to host this work at www.biosphereinstitute.org/student-work.

REFERENCES

- Peters, J. et al. (2018). *Human-Wildlife Coexistence: Recommendations for Improving Human-Wildlife Coexistence in the Bow Valley*. Bow Valley Human-Wildlife Coexistence Technical Working Group.
- Sawaya, M. A., Kalinowski, S. T., & Clevenger, A. P. (2014). Genetic connectivity for two bear species at wildlife crossing structures in Banff National Park. *Proceedings: Biological Sciences*, 281(1780), 1-10.
- Weeks, A. R. et al. (2011). Assessing the benefits and risks of translocations in changing environments: A genetic perspective. *Evolutionary Applications*, 4(6), 709-725.