

Bears of Banff

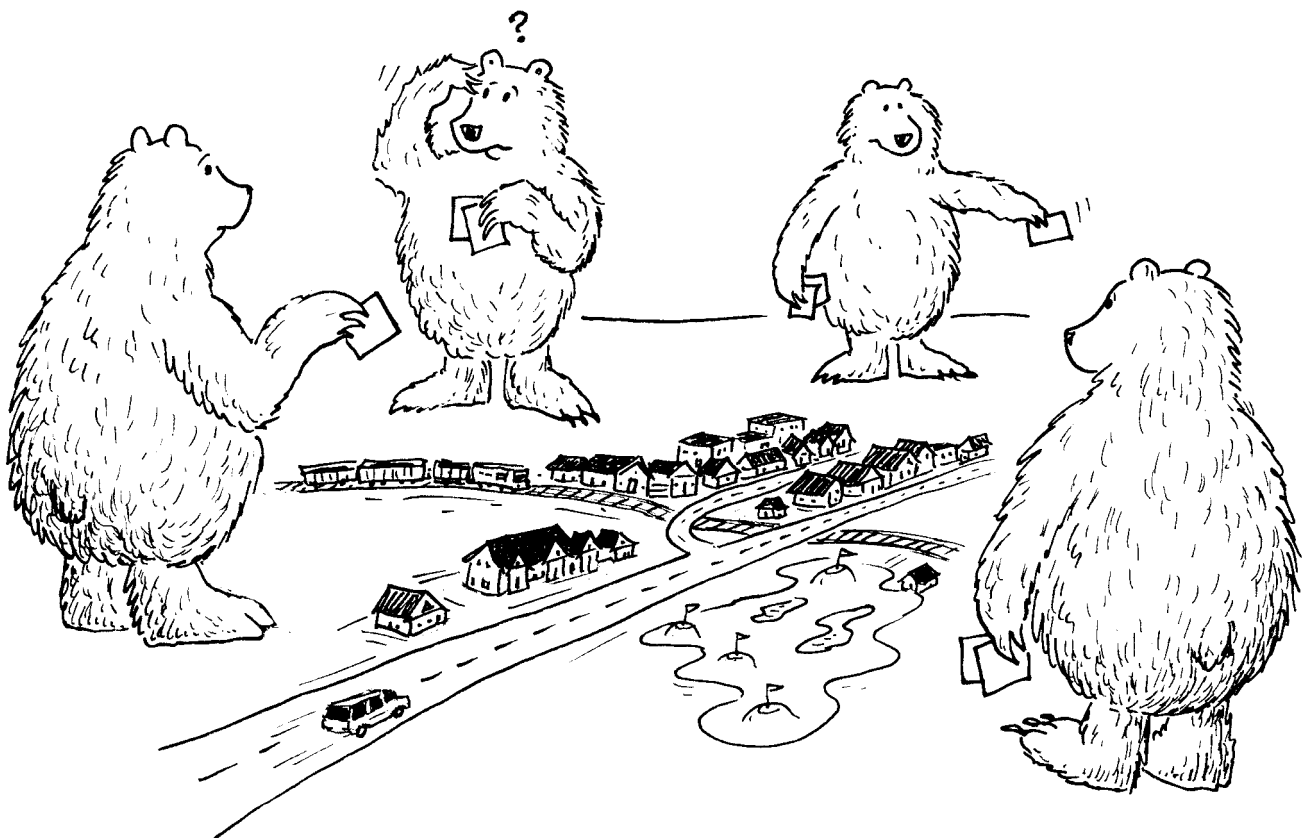
In this active simulation activity students assume the role of Grizzly bears as they try to survive and pass on their genes in Banff, Canada's flagship national park - and find out how human activities can sometimes "get in the way" of a bear's procreation plans...

Materials

To do this activity you'll need the following: several large sheets of fabric, several ropes or lengths of brightly coloured twine, two short (30 cm) board, and enough brightly coloured cards so that each student has a set of five cards (i.e. in a class of 30 students you'll need 30 blue, 30 green, 30 red, 30 yellow, and 30 black cards).

Instructions for the Teacher

1. Begin this activity by inviting students into a large area that can comfortably hold the entire group: this could be as simple as moving all desks in the classroom to one end, leaving half the classroom for this activity.
2. Tell students that they have just entered a national park, and show them the boundaries of the park. Tell them that the park borders are all impassable mountains, that all activities must occur within the park area you have defined and that, in this activity, they will play the role of Grizzly bears!



3. Ask the students to name three very basic things that every animal needs to survive. They should answer 'food, water, and shelter.' Tell students that in this game, it is assumed that they can meet these basic needs - what they will be tested on is their ability to *mate*!
4. Once the excited chatter has died down, distribute the cards so that every student has five identical cards (e.g. in a class of 30, six students will have all blue cards, 6 students will have all yellow cards, etc.). Tell the students that the long-term *sustainability* of animal populations requires the mixing of *genes* to keep the population healthy, and that normally individuals ensure proper genetic mixing by *dispersing*: travelling long distances from their birthplace and mating with individuals from other families.
5. Tell students that the cards they are holding represent their genes, and that when you give the word to "Disperse" their task is to trade cards with other bears from across the room until they have five differently coloured cards.
6. Say "Disperse!" It should only take a minute until all trading ceases. Ask students to put up their hands if they were able to achieve the task; you should see all or the vast majority of students put up their hands. Congratulate them on their ability to disperse and their good genetic prospects.
7. Next, find out who was not able to fill their hand with five differently coloured cards. Tell these unfortunate individuals that they are the victims of *inbreeding*, a genetic phenomenon in which mating with related animals results in not enough genetic mixing. (Students who have studied genetics can be told the whole truth: that inbreeding means that recessive alleles may occur homozygously). Tell students that any bears who suffer from inbreeding in three successive rounds will be diagnosed as suffering from incurable *inbreeding depression*, where individuals are so harmed by generations of inbreeding that they can no longer reproduce, and suffer from mutations and a lowered resistance to disease. These bears will be forced to leave the game. The graph on the next page illustrates how small populations lose genetic diversity over a number of generations.

Remind students that inbreeding depression is one of the more obvious reasons our human society has *taboos* against incest and inbreeding.

8. Tell students:
"Great news! Humans have finally come to live in the valley, and will be located in a modest townsite in the centre of the park, with a simple road crossing through the park to supply essential services to the town." (**place a large sheet in the centre of the space, and a rope through the sheet that bisects the park area**). "Sorry, bears, but as you know towns and roads are dangerous for bears; bears are asked not to step onto the sheet, and any bear seen stepping across the road will be killed by myself, who today will also playing the role of a Mack truck."
9. Tell students that when you say "Disperse" this time, their task is to fill their hand with

five identical cards (i.e. it will look like the hand they started off with). Say “Disperse” and let the next round proceed.

10. Play nine or ten more rounds with the students: after each “Disperse!” their task is to fill their cards either with five identical cards or five differently coloured cards. Have students give a show of hands so that you can all monitor the onset of deadly inbreeding depression!
11. The main intent of this game is to demonstrate how incremental development in this park makes genetic mixing more difficult. Scientists have noticed the first signs of inbreeding depression in the park’s Grizzly populations, which might eventually lead to the extinction of the species within - and south of - Banff.

Add the following changes to the park after each round:

- Round 3: add a railway track at right angles to the road (divides the game area into quarters).
- Round 4: double the size of the town by adding commercial shopping area “to give people something to do when they come to the national park.”
- Round 5: build a large oil refinery just outside the park boundary - the “halo” around this development creates a large area inside the park where bears will not go (put a sheet here).
- Round 6: build an affordable housing unit and an airfield in two different places, reaching from the townsite to the boundary, causing yet more habitat fragmentation.
- Round 7: Pause here and tell the bears that there has been a proposal by an environmental group to build a wildlife overpass that would allow animals to cross the highway (place the board over the highway to show them what it would look like). Ask the bears if they are in favour of this proposal - but then tell them, “Who ever asks bears for their opinion?!” Tell the bears that the proposal has been turned down, and say “Disperse!”
- Round 8: Pause again and tell students that the government has twinned the highway, but to make up for it has built two wildlife overpasses over the highway (put these two boards in place). Also, the Banff Bow Valley Study just spent two years (and two million dollars) and has come up with a set of recommendations that include closing the airfield. Ask the bears again if they are in favour of these changes; there may be some dangerously inbred populations that are very happy about this restoration! Take out the airfield, put overpasses on the highway in two places, and find out if these changes help cure any bad cases of inbreeding depression.

12. Have the students return to their seats and collect all cards. Ask them:

- *In future rounds of this game, do you think it would get easier or more difficult for the bears?*

Things could go either way, but one thing is for sure: even in a national park, humans have a hard time saying "That's enough". Incremental development, in which human structures advance in tiny increments year after year, is a major threat to our remaining natural areas.

13. Place an empty box on the end of your desk so that all the students can see it. Tell the students that this box represents an intact ecosystem, but that your hand represents the hand of the human, who manages and impacts on the natural ecosystem. With your hand, push the container closer to the edge of the desk; each time you do this, give an example of an incremental impact on ecosystems (from twinning highways to air pollution).

Continue until the box is partially overhanging the desk edge. Point out that the box is still intact - but that it is at risk. Ask students if the ecosystem will survive unchanged if incremental development continues indefinitely within the ecosystem. Could it be that even human activities should have their limits?

14. Banff has been a fascinating forum of discussion between people and groups who feel that "Parks are for People"; and people and groups who believe that the first job of a national park is to protect the animals that live in it.

As a follow-up activity you may wish to play the Y2Y activity "Take a Stand" with your students.

15. (Advanced level only) As a last activity, show students the graph entitled *Genetic Diversity of Small Populations*. Ask students to interpret this graph. They should be able to state: "The smaller a population is, the faster its genetic diversity decreases - in some cases leading to extinction".

