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**ENVIRONMENTAL SYSTEMS AND SOCIETIES
STANDARD LEVEL
PAPER 2**

Wednesday 3 November 2010 (morning)

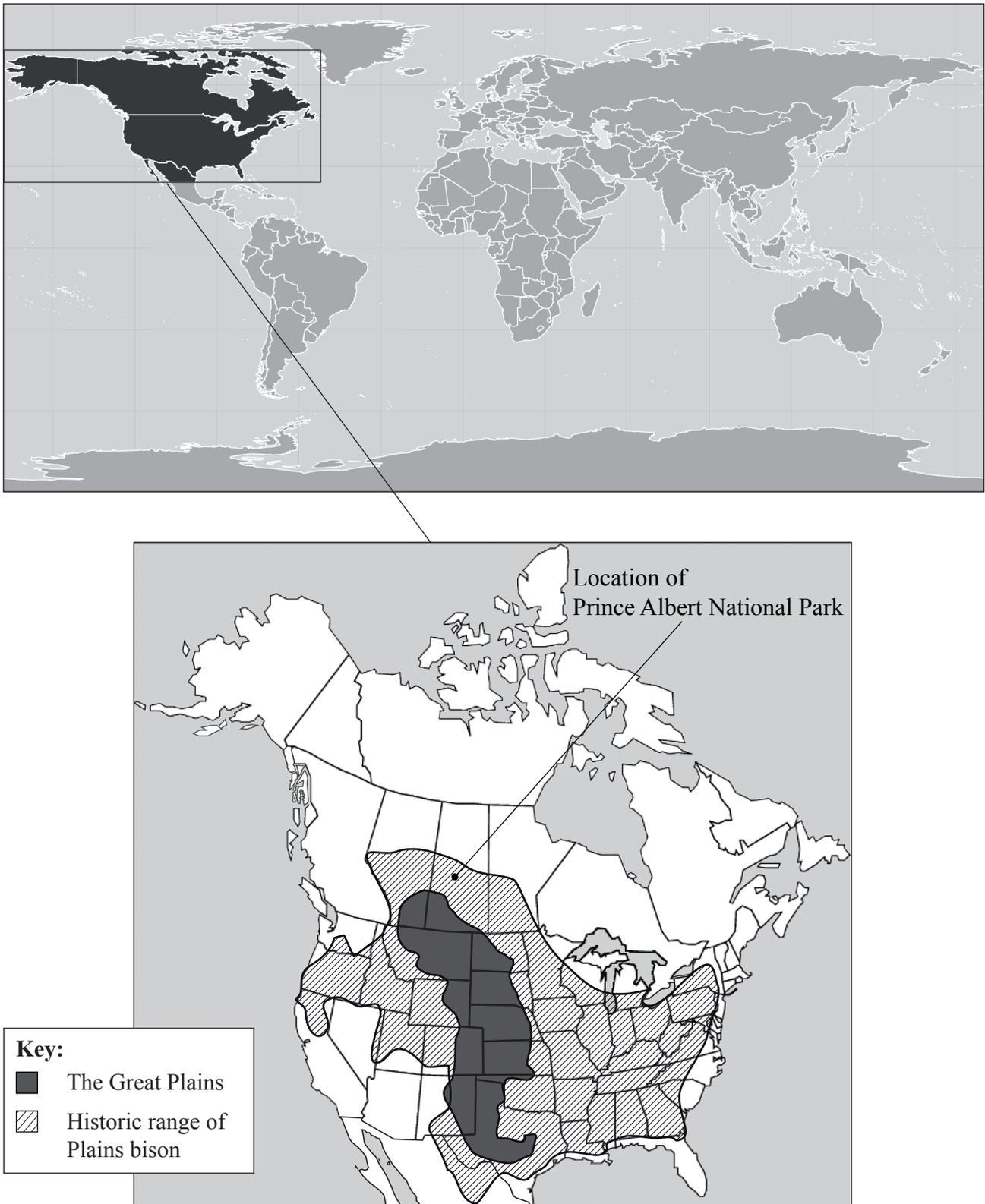
2 hours

RESOURCE BOOKLET

INSTRUCTIONS TO CANDIDATES

- Do not open this booklet until instructed to do so.
- This booklet contains **all** of the resources required to answer question 1.

Figure 1 World map showing the location of Plains bison



[Source: world map adapted from www.un.org/depts/cartographic/map/profile/world.pdf and regional map adapted from www.pc.gc.ca/apprendre-learn/prof/sub/bison/images/etu-stuplan3case7_16_e.jpg]

Figure 2 Background information on the Plains bison

The Plains bison (*Bison bison bison*) is a bovine (cow-like) mammal. Massive herds of these bison once inhabited the Great Plains (temperate grasslands) of the United States and Canada. They originally migrated from Europe and Asia over 10000 years ago.

In the past, American Indians used fire to deliberately create the large grasslands that provided the bison's ideal habitat but they also kept the bison population regulated through hunting. Bison were a keystone species. This is a species which has a significant effect on the rest of the ecosystem in some way. Through their grazing they helped to preserve the grasslands.

The bison provided the American Indians with meat, leather, sinew for bows, grease, dried dung for fires, and the hooves could be boiled for glue. When food was scarce, bison were even consumed down to the last bit of marrow. The American Indians were sometimes wasteful, but this was not significant as the bison herds easily sustained the small number of animals taken. Bison were the most numerous single species of large wild mammal on Earth.

[Source: adapted from http://en.wikipedia.org/wiki/American_Bison]

Figure 3 Photographs of Plains bison and American Indians

(a) Plains bison



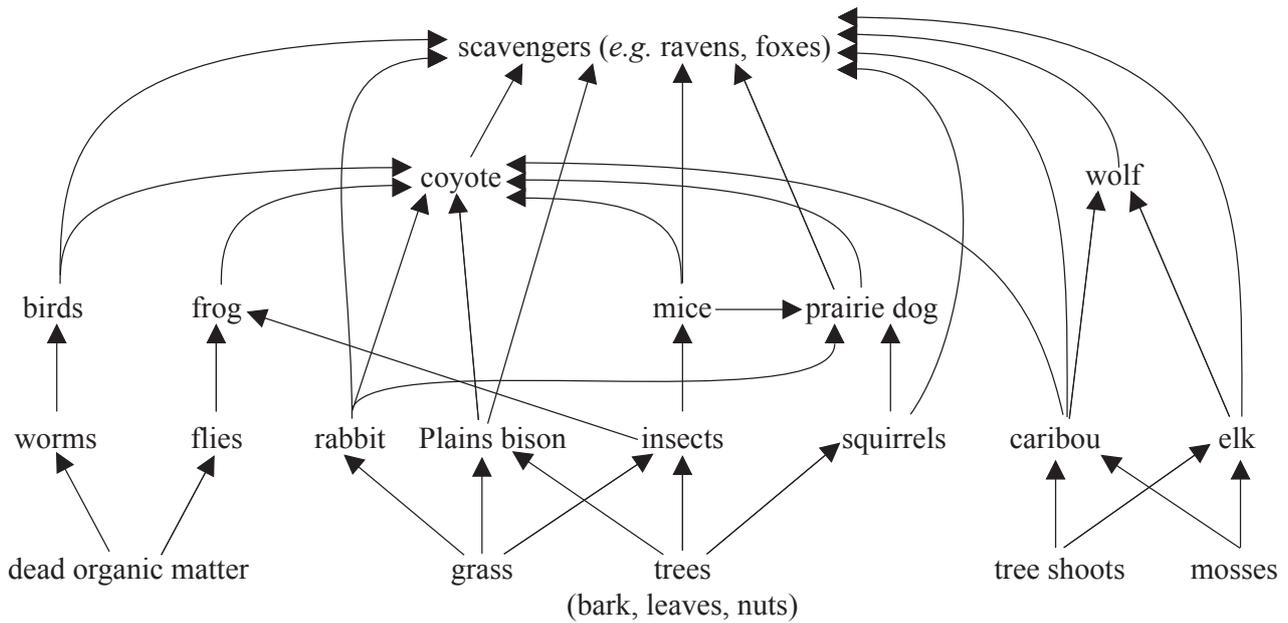
[Source: www.gpnc.org/images/jpegs/animals/bison.jpg]

(b) American Indian couple in bison hide wrap



[Source: www.primitiveways.com/images/buffalo_comanche.jpg]

Figure 4 Diagram to show position of Plains bison in a food web and photographs of some species within this food web



[Source: adapted from <http://lsb.syr.edu/projects/cyberzoo/images/americanbisonfw.gif>]



common raven
(*Corvus corax*)

[Source: www.ravensravensravens.bravehost.com/Raven1b.jpg]



fox
(*Vulpes fulva*)

[Source: <http://library.thinkquest.org/5135/foxWinterRed.jpg>]



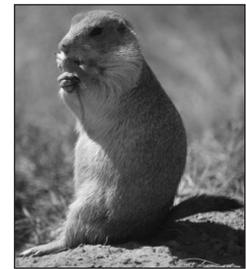
coyote
(*Canis latrans*)

[Source: www.nationalgeographic.com/lewisandclark/images/species/high_222.jpg]



wolf
(*Canis lupus*)

[Source: www.glaciermt.com/pub/wildlife/images/wolf.jpg]



prairie dog
(*Cynomys ludovicianus*)

[Source: www.angio.net/~lukesos/Pictures/Wyoming/Prarie_Dog_1.jpg]



squirrel
(*Sciurus carolinensis*)

[Source: www.sogoodblog.com/wp-content/uploads/2008/01/best-squirrel-shot.JPG]



caribou
(*Rangifer tarandus*)

[Source: www.cbc.ca/sevenwonders/images/pic_wonder_porcupine_caribou_herd_lg.jpg]



elk
(*Cervus elaphus*)

[Source: <http://wdfw.wa.gov/wlm/living/graphics/elk1.jpg>]

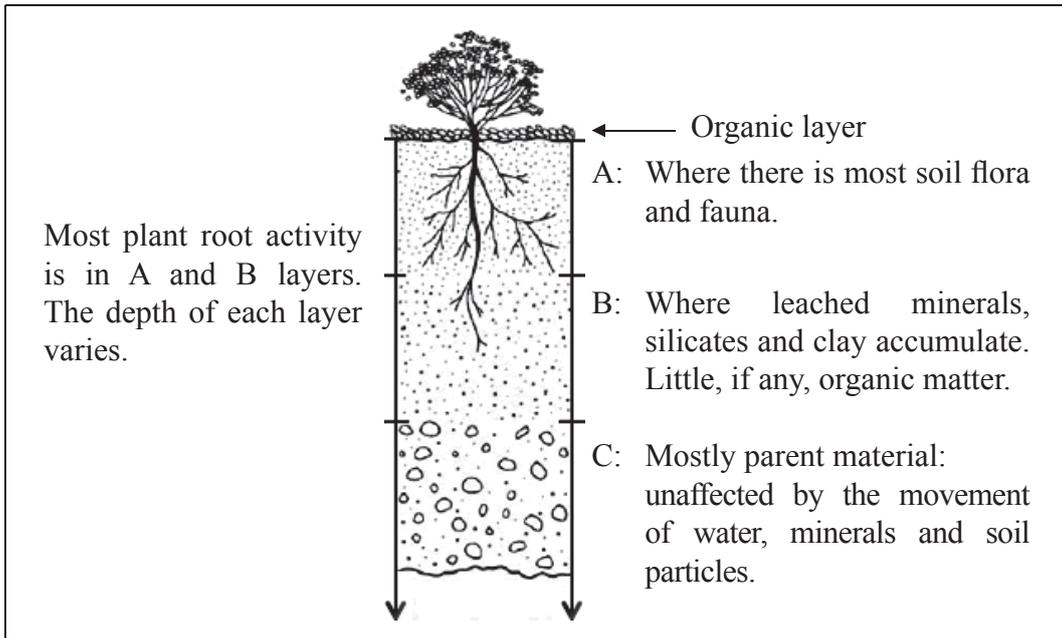


mosses
(*Sphagnum sp.*)

[Source: www.highlandguides.com/images/mosses.jpg]

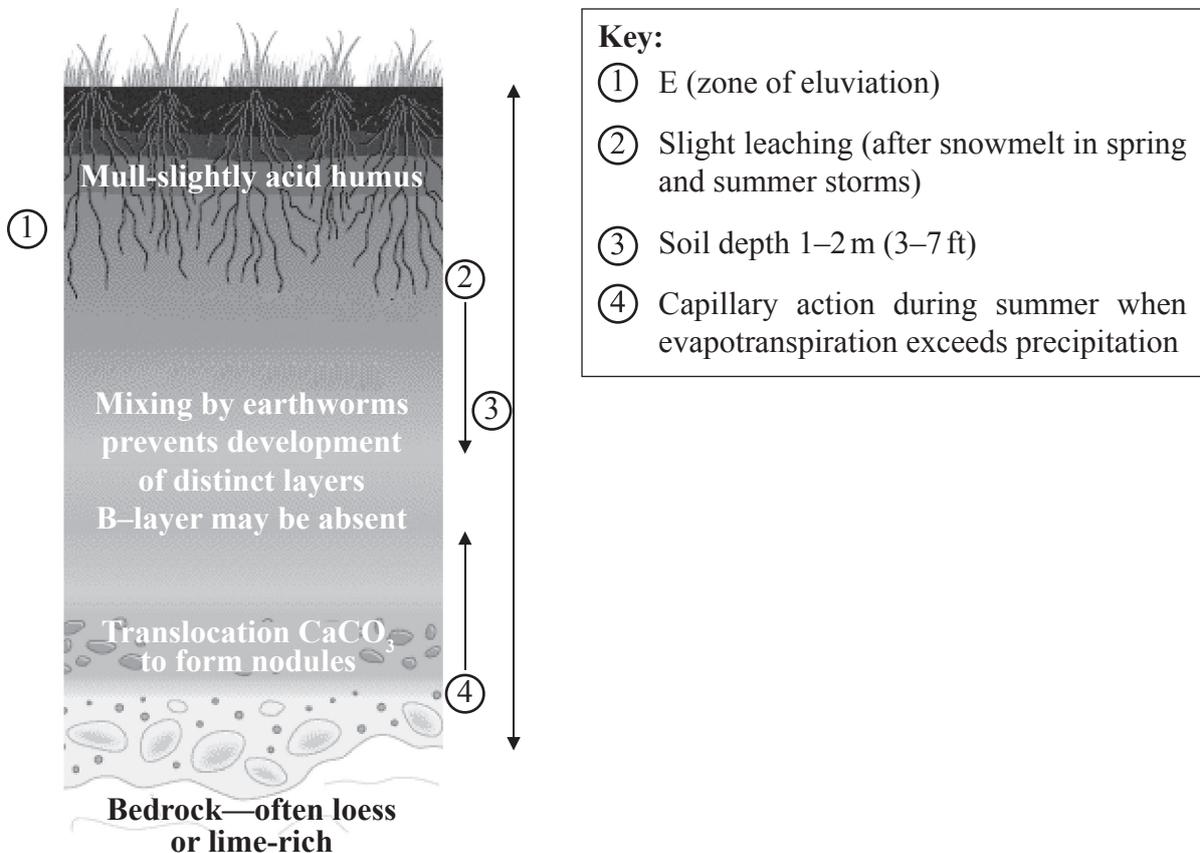
Figure 5 Soil profiles

(a) Generalized soil profile



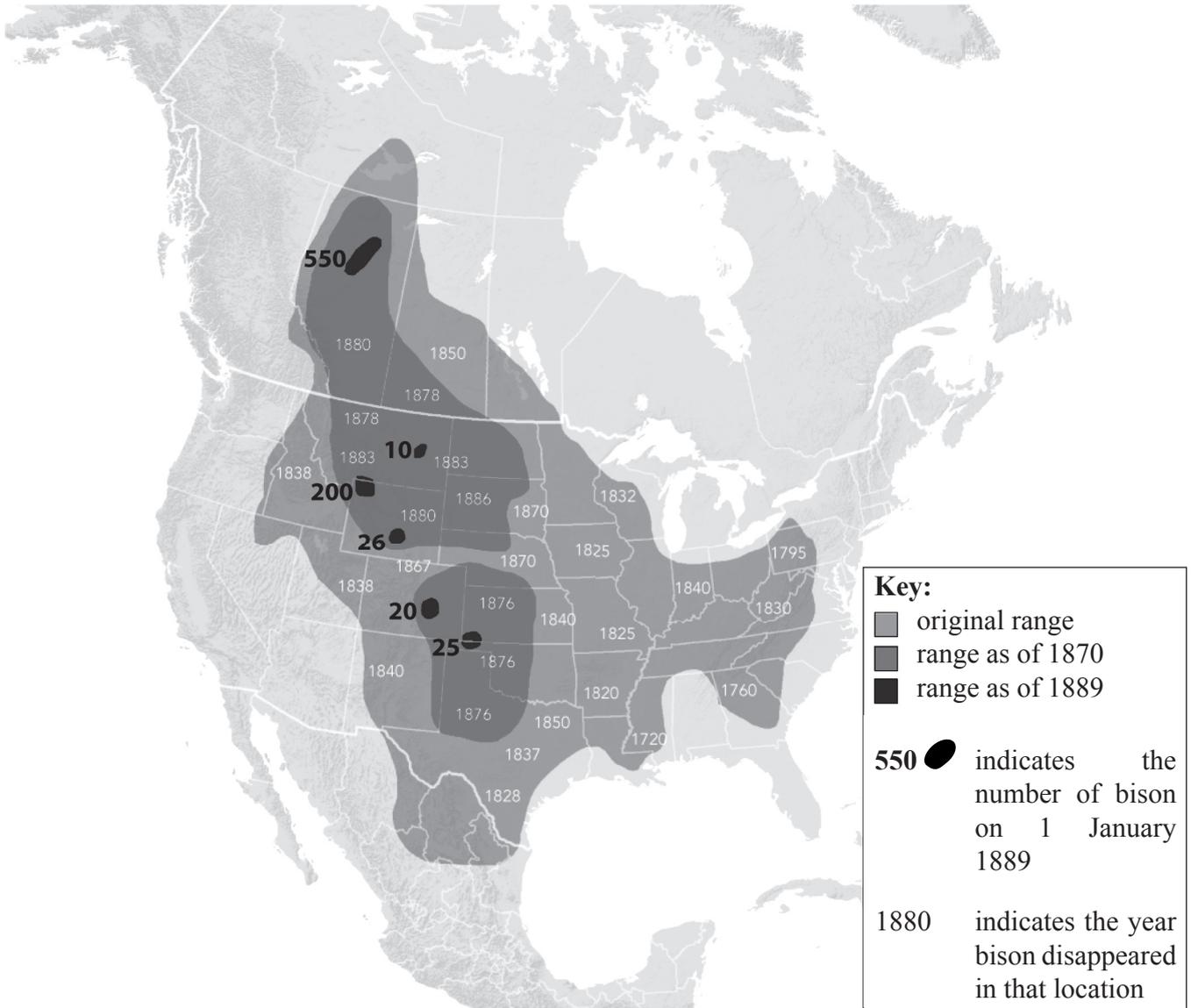
[Source: adapted from www.cmhc-schl.gc.ca/en/co/maho/images/Fig1_E.gif]

(b) Chernozem (temperate grassland) soil profile



[Source: adapted from www.encyarta.co.uk/media_121627774/Chernozem_Soil_Profile.html]

Figure 6 Map showing change in range of Plains bison over time



[Source: http://en.wikipedia.org/wiki/Image:Extirmination_of_bison_to_1889.png]

Figure 7 Extract from a newspaper article

Plains bison once numbered in the tens of millions but were wiped out by commercial hunting and habitat loss. By 1889 fewer than 1100 animals survived. In 1905 the American Bison Society began efforts to repopulate reserves on the Great Plains with animals from zoo herds. Of the estimated 500 000 Plains bison existing today, 20 000 are considered wild; the rest live on private ranches.

[Source: adapted from www.sciencedaily.com/releases/2008/04/080429130927.htm]

Figure 8 Wildlife Conservation Society report on the restoration potential of Plains bison

Plains bison can thrive again, study says

Plains bison could repopulate large areas from Alaska to Mexico over the next 100 years provided a series of conservation and restoration measures are taken, according to the Wildlife Conservation Society (WCS).

Mountain forests and grasslands across Canada and the United States and parts of the desert in Mexico could also again support herds that once lived there. Ecological restoration would occur when large herds of bison could move freely across large, open landscapes within major habitats of their historic ranges. It would also include bison interacting with a wide range of other native species. The WCS say it is also important that the bison are able to inspire, sustain and connect human cultures.

The researchers evaluated a range of factors, including the availability of existing habitat; potential for interaction with other native species (such as elk, prairie dogs and grassland birds); and the socio-economic and cultural factors in each location. The higher the score of these factors, the more likely restoration could take place. This is referred to as “restoration potential”.

Ecological restoration could take up to 100 years, and will only happen through collaboration with a broad range of people.

[Source: adapted from www.sciencedaily.com/releases/2008/04/080429130927.htm]

Figure 9 Plains bison and human interactions in Prince Albert National Park, Canada

There is a herd of 400 wild Plains bison in the Prince Albert National Park in Canada. The herd is not fenced in, and so can come in and out of the park at will. The herd brings benefits to the ecosystem but causes problems for landowners near the park.

The positive impacts of bison:

- they create trails through the forest that are used by other animals and people
- they modify vegetation through grazing
- they disperse seeds caught in their fur and through their droppings
- they are a food source for predators (*e.g.* wolves) and scavengers (*e.g.* ravens)
- birds eat insects on bison, and use underfur for nests
- their wallows (mud baths) allow for establishment of new plants
- their droppings provide nutrients to soil
- visitors come to the park to see them (ecotourism).

The negative impacts of bison:

- they damage/destroy farmland crops by grazing and wallowing
- they can transmit disease to domestic livestock
- they may damage fences so that domestic animals escape
- they may wander on roads causing vehicle collisions.

[Source: adapted from www.pc.gc.ca/apprendre-learn/prof/itm3-guides/vraie-true/etu-stuplan3case7_e.asp]