ECOSYSTEMS AND IMPACTS

IN FISH CREEK PROVINCIAL PARK

A Field Study for Grade 11 Students

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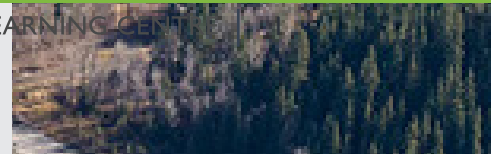

Introduction

Ecosytems and Impacts is a full-day field study directed by park staff. The field study is designed to cover a portion of the requirements for Biology 20, Unit B: Ecosystems and Population Change.

Fish Creek Provincial Park is one of Canada's largest urban provincial parks, stretching from the western edge of the city to the Bow River. The park has a strong vision within its visitor services program plan to support and foster environmental and cultural education.

Alberta Parks acknowledges that Fish Creek Provincial Park is part of the traditional territory of Treaty 7 region in Southern Alberta, which includes the Blackfoot Confederacy (comprising Siksika, Piikani and Kainai First Nations), the Tsuut'ina First Nation, and the Stoney Nakoda First Nation. The City of Calgary is also home to Metis Nation of Alberta, Region III.

Table of Contents

Before the Visit

PREPARATION

It is most important that you, your students and your volunteers/chaperons know and understand that your field study will be an "OUTDOOR" experience. We will have a classroom as a home base over the course of the day, but most of our time will be out in the park. With this in mind, it is important that everyone attending the field study is prepared. Weather conditions can change quickly, we will be moving throughout the park on foot over a variety of trails and off-trail areas, and working with a variety of field equipment.

What to Bring

- Extra clothing (rain gear, warm layers)
- Boots, insulated and waterproof if the weather calls for it
- Food and water for the day (there are no microwaves, coffee shops, vending machines, etc. on-site or close by)
- Cellphones (to take photos or for timing activities, but otherwise off)
- Camera, binoculars (optional)
- Pencils and clipboards

Leave Behind:

- Laptops, earbuds, games etc.
- Designer clothing – we will be doing field work, getting dirty

FROM THE PROGRAM OF STUDIES

Biology 20, Unit B: Ecosystems and Population Change

Overview

In this unit, students become familiar with a range of ecosystems by studying their distinctive biotic and abiotic characteristics. Students are introduced to the concept of populations as a basic component of ecosystem structure and complete the unit by examining population change through the process of natural selection.

Focusing Questions

What are the major biotic and abiotic characteristics that distinguish aquatic and terrestrial ecosystems?
What data would one need to collect in a field study to illustrate the major abiotic characteristics and diversity of organisms?
What mechanisms are involved in the change of populations over time?
In what ways do humans apply their knowledge of ecosystems to assess and limit the impactof human activities?

Key Concepts

The following concepts are developed in this unit and may also be addressed in other units or in other courses. The intended level and scope of treatment is defined by the outcomes.

- ecosystem
- adaptation and variation
- population
- natural selection
- species
- evidence for evolution
- niche
- biotic/abiotic characteristics
- limiting factors
- binomial nomenclature

Taken from the Alberta Education Program of Studies Unit B: Ecosystems and Population Change Grade 11 Biology © Alberta Education, Alberta, Canada

VOCABULARY AND DEFINITIONS

The following is a list of terms and definitions you and your students should be familiar with before your field study.

General Ecosystem Terms

abiotic: ***The non-living components of the environment (physical and chemical), such as air and water.***

adaptation: ***A structure or behaviour that increases an organism's chance of surviving or reproducing in a particular environment.***

biodiversity: ***The variety of life on Earth; most commonly, the genetic variability within individual species, variety of living species; and the variety of different ecosystems.***

biotic: ***The living components of the environment; in other words, all other organisms in the environment.***

community: ***A group of interacting populations of two or more different species that live together in a particular environment.***

ecology: ***The scientific study of the inter-relationships among organisms and between them.***

ecosystem: ***A network or system of interdependent living (biotic) and non-living (abiotic) things.***

environment: ***The complete range of external conditions, physical and biological, in which an organism lives.***

humus: ***The decomposed (or decomposing) organic material (usually by bacteria and fungi) found in soil.***

micro-environment: ***A small area of an environment that has different conditions (such as temperature and/or humidity) compared with the larger environment of which it is a part.***

organism: ***A life form.***

population: ***A group of organisms, all of the same species, which occupies a particular area.***

Measurement Terms

aspect: ***The directional orientation of a slope which creates differing situations of heat, light and amount of sunshine.***

quadrat: ***A basic ecological sampling unit, ranging in size from one square metre in grasslands, to 10 square metres in forested areas. These smaller units of measure are used for making accurate estimates of the biotic and abiotic features within an ecosystem.***

slope: ***The angle of an area of land.***

transect: ***(1) A line used in ecological study to provide a means of measuring and representing, geographically, the distribution of organisms. Recordings are made at regular intervals. Transects are particularly useful for exploring transitions and the distribution of living and non-living things across an ecosystem. (2) A technique for estimating populations that involves running a straight line of string through the area being studied. At regular intervals along the string, every organism that touches the string, or grows directly above or below it is identified and counted.***

Food Web Terms

decomposer: ***An organism that feeds (to gain energy and nutrients) on material that had once been alive.***

deciduous: ***Plants whose leaves fall off annually, usually in the autumn.***

coniferous: ***Seed-bearing plants that produce cones and bear leaves all year round.***

consumer: ***An organism that obtains its food (to gain energy and nutrients) by eating other organisms.***

fauna: ***All the animal species of a given area.***

flora: ***All the plant species that make up the vegetation of a given area.***

producer: ***An organism that is able to manufacture food from simple inorganic substances.***

Land Use Terms

aesthetic features:	*Sensory aspects of a landscape associated with its natural beauty and wonder.*
conservation:	*The process of managing human use of the environment to ensure that heritage values are considered and such uses are sustainable.*
indicator species:	*A species whose ecological requirements are well understood and where changing population numbers will indicate a particular environmental condition or set of conditions. Indicator species can also give a good indication of how other organisms may be surviving.*
land-use:	*Any behaviour or activity that occurs on a parcel of land.*
protected area:	*Protected areas are natural landscapes that are explicitly legislated to preserve natural heritage values. Management guidelines and monitoring programs must ensure the long term preservation of biodiversity. Environmental diversity (biodiversity) is understood to include all species of plants, animals and other organism, and the habitat, and ecological processes upon which they depend. Protected areas are internationally recognized as one of the cornerstones of biodiversity preservation.*
stewardship:	*Management of the heritage of our natural spaces, species and culture in such a way that it can be passed on, intact, to future generations.*
sustainable:	*Management that ensures that the present uses (human and otherwise) of an area and its resources, do not compromise the future health, availability and prospects for future generations.*

FISH CREEK PROVINCIAL PARK: Key Messages

Please review and be sure everyone understands the following information before your visit the park.

- Our vision: Alberta's parks inspire people to discover, value, protect, and enjoy the natural world and the benefits it provides for current and future generations.

- Alberta Parks acknowledges that Fish Creek Provincial Park is part of the traditional territory of Treaty 7 region in Southern Alberta, which includes the Blackfoot Confederacy (comprising Siksika, Piikani and Kainai First Nations), the Tsuut'ina First Nation, and the Stoney Nakoda First Nation. The City of Calgary is also home to Metis Nation of Alberta, Region III.

- Alberta's parks and protected areas belong to all Albertans and contain many different natural landscapes that are home to numerous plant and animal species as well as significant cultural and historic resources. The province's network of parks and protected areas helps to ensure that Alberta's natural and cultural heritage is preserved for future generations.

- There are a wide variety of visitors and users of our parks. Everyone must respect and share the park and its facilities and resources.

- Stay on designated trails while moving through the park and participating in group activities. Staying on designated trails reduces impact to the natural habitats of the park. Please share the trail with other users.

- Feeding wildlife is prohibited. The park's ecosystems provide all the food and habitat wildlife require for their basic needs. Feeding wildlife can cause wildlife to associate humans with food. Quietly observe wildlife from a safe and comfortable distance so as not to disturb them or put them or you at risk.

- Everything in the park – living and non-living is protected. Students are welcome to share their discoveries, but must remember to leave everything as they found it. Do not remove anything natural from the park.

- Litter must be placed in garbage cans or packed out.

- Use only designated fire pits. The collecting and burning of park vegetation is not permitted. You must ensure fires are fully extinguished before leaving them.

Alberta Alberta Parks

PRE-FIELD TRIP PREPARATION AND DISCUSSION

Scales of study in Ecosystems:

If scientists are going to conduct a study then they need to know at what level to conduct it at.

Biome Level:

- Cover large geographical regions with a specific range of temperatures and precipitation and organisms that are adapted to those conditions.
- Canadian terrestrial ecosystems can be grouped into four main biomes: tundra, taiga, temperate deciduous forest and grassland .
- Global warming is an example of a mechanism of change at this scale.
- This scale is too large for us to study in this field study.

Landscape Level:

- At this level researchers can study areas the size of the Fish Creek valley (100 km2). At this level it's possible to see forest communities such as Aspen or White spruce within a region.
- Important factors that scientists can study are climate (average temperature, wind, sunlight etc.) and biogeography (why things tend to grow where they do).
- Changes at this scale include both natural and human disturbances such as fire, disease, floods, clear cutting.
- Maps are made using aerial photos taken from airplanes or satellites.
- This scale is too large for us to study in this field study.

Community Level:

- Researchers look for patterns in forest communities that are 1-10 km. They are interested in understanding how different populations (i.e. grasslands, Aspen, Spruce) interact within a community.
- At this level scientists study elevation, aspect, temp., precipitation, light, wind etc.
- Changes at this level include succession, inter and intra specific competition.
- **Today we will be studying 2 different ecosystems at this scale.**

Population Level:

- A forest population is made up of one dominant species that tends to have a similar age and distribution pattern
- At this level scientists study factors such as density, abundance and distribution.
- Changes that occur at this level include intra specific competition and natural selection.

Organism: i.e. investigate one aspen tree.

Cellular & Molecular: mutation, recombination, reproduction.

Scientific Teams – Preparing Students to Work Together

The field study you are preparing for is a full-day of exploration and data collection in an outdoor, natural environment setting. It is important that your students understand what they are responsible for and what your expectations are. Be sure to review the Key Messages and your own expectations with them before coming to the Park.
Review the data forms that students are expected to complete while on the field study. Reflect and think about the personalities of your students. Take all of this information into account and develop the student groups that will work together on the field study. You can have a maximum 6 groups of students.
Review with your students the data sheets and try to explain the variety of information they are expected to collect. Students usually do better if they can try a variety of equipment and exercises in each quadrat survey; rarely will they be happy doing the same thing in each survey.
Review their responsibilities regarding:

- Care of equipment
- Respect for the Park
- Respect for their classmates, teachers, volunteers
- Importance of making careful and complete observations and recordings of data and information

Discuss sampling techniques students will be engaged in as you review the data forms and equipment to be used during the field study. Emphasize the data they collect, and the methods used, will be the same for both sites. Discuss why scientists use transects and quadrat studies (systematic process to collect data that is representative of a larger area.) Discuss how groups will set up their 3m x 3m quadrat. Discuss all the tests and data students will collect. Not all students will collect the same data; however, groups will work cooperatively and share data for each study site.

Data To Be Collected In The Field:

Refer to the data sheets and information below to discuss with students the information they will be collecting on the field study.

Abiotic Components:

- Temperatures
- Moisture,
- Soil Profile
- Soil pH
- Soil Potassium and Phosphorous
- Slope
- Aspect

Potassium and Phosphorus – a little more information

In a natural setting, plants grow without the benefit of artificial fertilizers. The continuous recycling of nutrients between decomposing matter and growing plants, and the species of plants growing in the soil, ensures the soil remains productive. In this investigation you will determine the relative amounts of dissolved potassium and phosphorus; two key nutrients needed for plant growth.

- Park Staff will enlist one group to do the soil Potassium and Phosphorus tests
- Test results will be shared with all other working groups

Potassium:

- Absorbed by plants in larger amounts than many other mineral elements
- Required in the building of proteins and photosynthesis
- Supplied to plants by soil minerals and organic materials

Phosphorus:

A Key element in:

- cell membranes
- molecules that help release chemical energy
- the making of DNA
- the calcium phosphates of bones

Biotic Components

Birds (using a point count):

A point count is a count undertaken from a fixed location for a fixed time. It can be undertaken at any time of year, and is not restricted to the breeding season. Point counts are used by biologists to provide estimates on the relative abundance of each species or, if coupled with distance estimations, can yield absolute densities, too (Buckland et al. 2001). For the purposes of this ecosystem study, all students will conduct a point count and will document presence/absence (if name of species is known) and relative abundance of different species. Since it will be used only as an index, no distance band will be incorporated. Often, a distance band of 30 m in forest communities, and 50 m in more open habitat are used in studies which can be incorporated into calculating the densities of species (Sutherland, 2006).

Evidence of Animals (using a line transect):

Line transects involve an observer moving along a pre-determined route through a study area recording the distances at which each individual/track/sign is seen. In protected areas, this study method is used to identify habitat use, as an index of activity, and to determine long-term trends on the movement of wildlife through corridors and the affects of human use. You can also use transects to determine population densities.

- To investigate the presence or absence of wildlife, students will walk the entire length of the line transect, observing all signs approximately one metre on either side of the transect.
- Document any wildlife sign, such as tracks, scat, burrows, scratch marks, browsing, food caches etc.

Vegetation:

Ground Cover Assessment and Tree and Shrub Identification

- Students will identify and record the dominant trees and shrubs in their 3m x 3m quadrat using the tree and shrub key provided.
- Identify and record the common and scientific name (Genus species).
- Identify and record major plant types observed using the 50 cm X 50 cm grid square and do basic ground cover calculations

Human Impact Observations and Ratings

Students are to observe the Park around their quadrat and record on the Impacts Data Sheet any and all human impacts they observe:

- Visual Impacts
- Auditory Impacts
- Other Human Impacts

Students will then discuss with their team whether these impacts are positive, negative or neutral, come up with arguments to justify their ratings and finally choose one impact that their group will present and discuss at the wrap-up

Impacts Discussion and Presentation

Back in the classroom, students work in their groups to develop and present discussions and rationalizations on one Human Impact they observed.

Groups need to discuss and present on:

- Identify the impact observed
- State whether the impact has a positive, negative or neutral impact on the Park in regards ecosystem health, the Park in general, visitor experience in the Park
- How could the Park better manage this impact?

Students need to present their arguments to the rest of the class and answer questions regarding their views and justifications.

Your Day In The Field

SCHEDULE

The following outdoor field trip activities are curriculum-connected and intended to connect learning in an experiential way to the natural world.

Program Start and End

The field study is covered in a 4 – 5 hour time frame, but can be modified to fit other schedules. A typical time frame is 9:30 a.m. to 2:00 p.m.

Groups are dropped off at the Fish Creek Environmental Learning Centre (see map in appendices). Park staff will meet and direct your group to your classroom base for the day.

What to Expect

The major portion of your field study will be doing quadrat, transect and point count surveys. Students will be collecting information on the biotic and abiotic features of two distinct ecosystems in the park- grassland, aspen parkland.

Please ensure that each student has a copy of the "Data Forms" (pages 14 - 31) and that you have students separated into working groups. You can have a maximum of six groups of students.

Field Trip at a Glance

Park and Field Study Introduction – Classroom (60 minutes)	• Introduction to Fish Creek and the provincial park system, park rules and behavioural expectations for the day • Review the day's agenda including field study procedures and field equipment • Historic photo analysis activity
Washroom/Snack Break (10-15 minutes)	
Grassland Study (60 – 90 minutes)	• The morning is spent examining the grassland ecosytem
LUNCH BREAK (30 minutes)	
Aspen parkland study (60 - 90 minutes)	• The afternoon is spent examining the aspen parklnad ecosystem
Return to the Learning Centre for Program Wrap-up	• Inventory field equipment • Review data • Group prsentation/ discussion on human impacts

Schools are responsible to pay for lost equipment or equipment broken due to misuse

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STUDENT DATA FORMS

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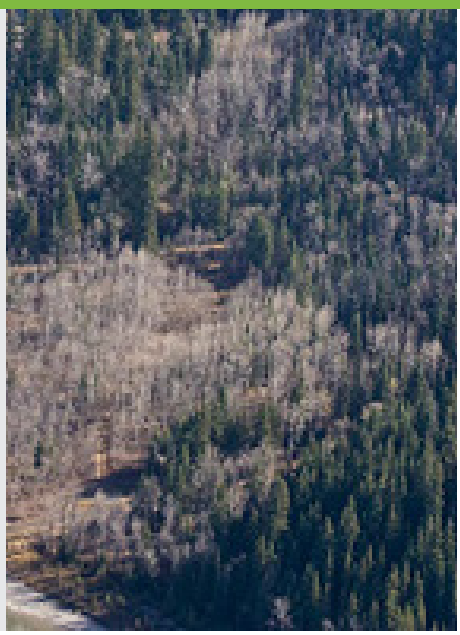


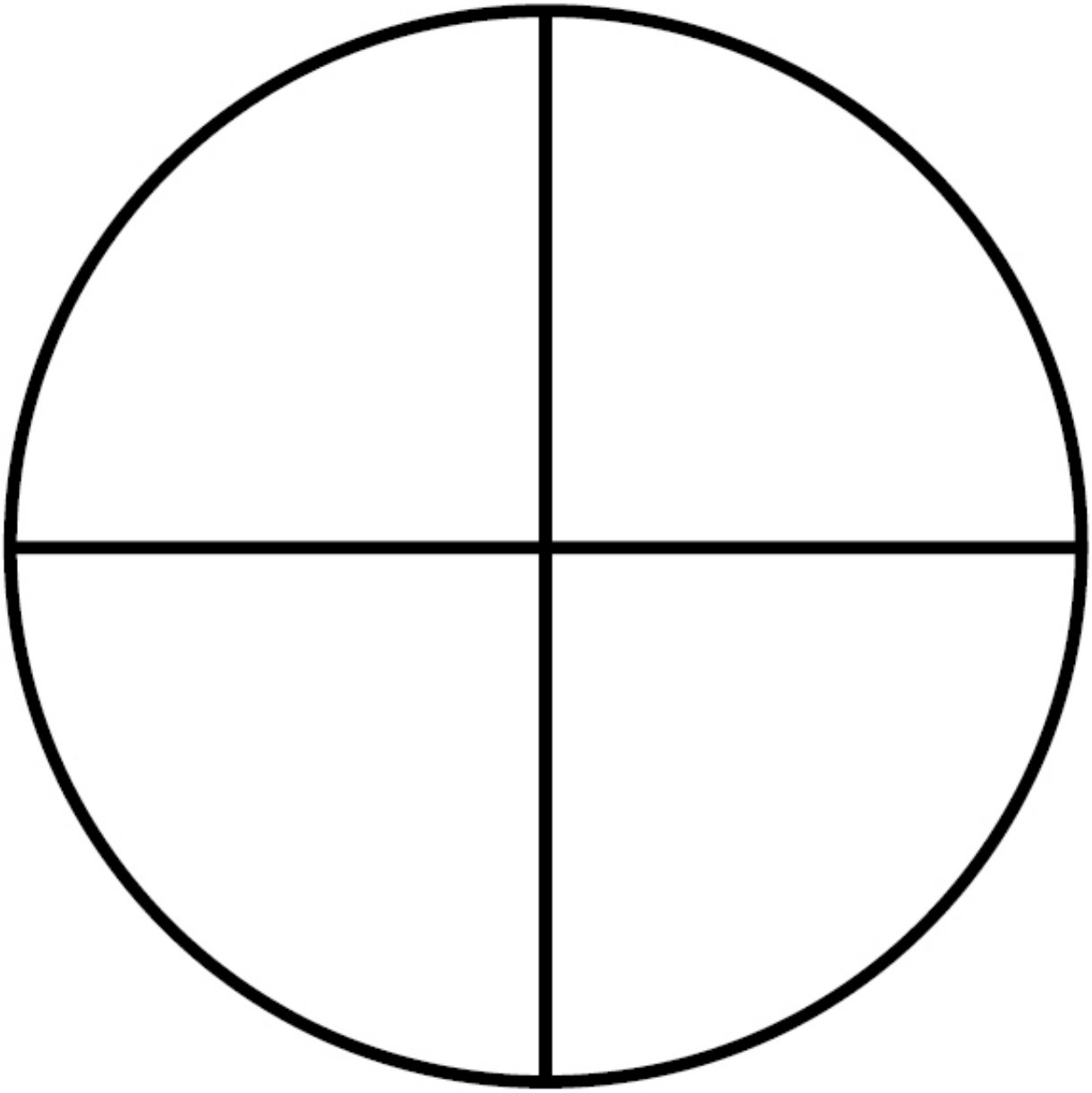
Name: _____

Date: _____

Group Members: _____

_____

BIRD POINT COUNT #1: GRASSLAND



Birds Seen_____ # Birds Heard_____ Total # of Species_____

Total # Birds_____

Can you identify any species?

ABIOTIC DATA: GRASSLAND

Sample #	1	2	3	Average
Air Temp. One Metre Above Ground				
Air Temp. Ground Level				

Wind (Slight, Moderate, Strong)	
Slope (Slight, Moderate, Steep)	
Aspect (Direction of Slope)	

NOTES:

ABIOTIC DATA: GRASSLAND

Soil Profile	Labelled Sketch of Soil Layers
O Horizon Litter or Humus Decomposing organic material, leaves, grasses, etc. **A Horizon** Topsoil Usually dark brown to black in colour **B Horizon** Mineral layer, Often light brown to bronze or orange in coulour **C Horizon** Contains weathered parent rock material not consolidated into soil.	
Soil Chemistry	
pH (1 - 14)	
Potassium (L - M - H)	
Phosphorous (L - M - H)	

Sample	1	2	3	Average
Soil Temp.				
Soil Moisture				

BIOTIC DATA: GRASSLAND

Evidence of Animals and Insects

In the square below sketch and label all evidence of animal (bird, mammal, insect) activity in your quadrat. Include as much detail and information as possible.

BIOTIC DATA: GRASSLAND

Line Transect

Walk the full 10 metre line transect recording all evidence of wildlife (mammals) approximately one metre on both sides of the transect.

Total # of Wildlife Species Observed

Wildlife Observed That Was Not Within the Transect Location

BIOTIC DATA: GRASSLAND

Plants

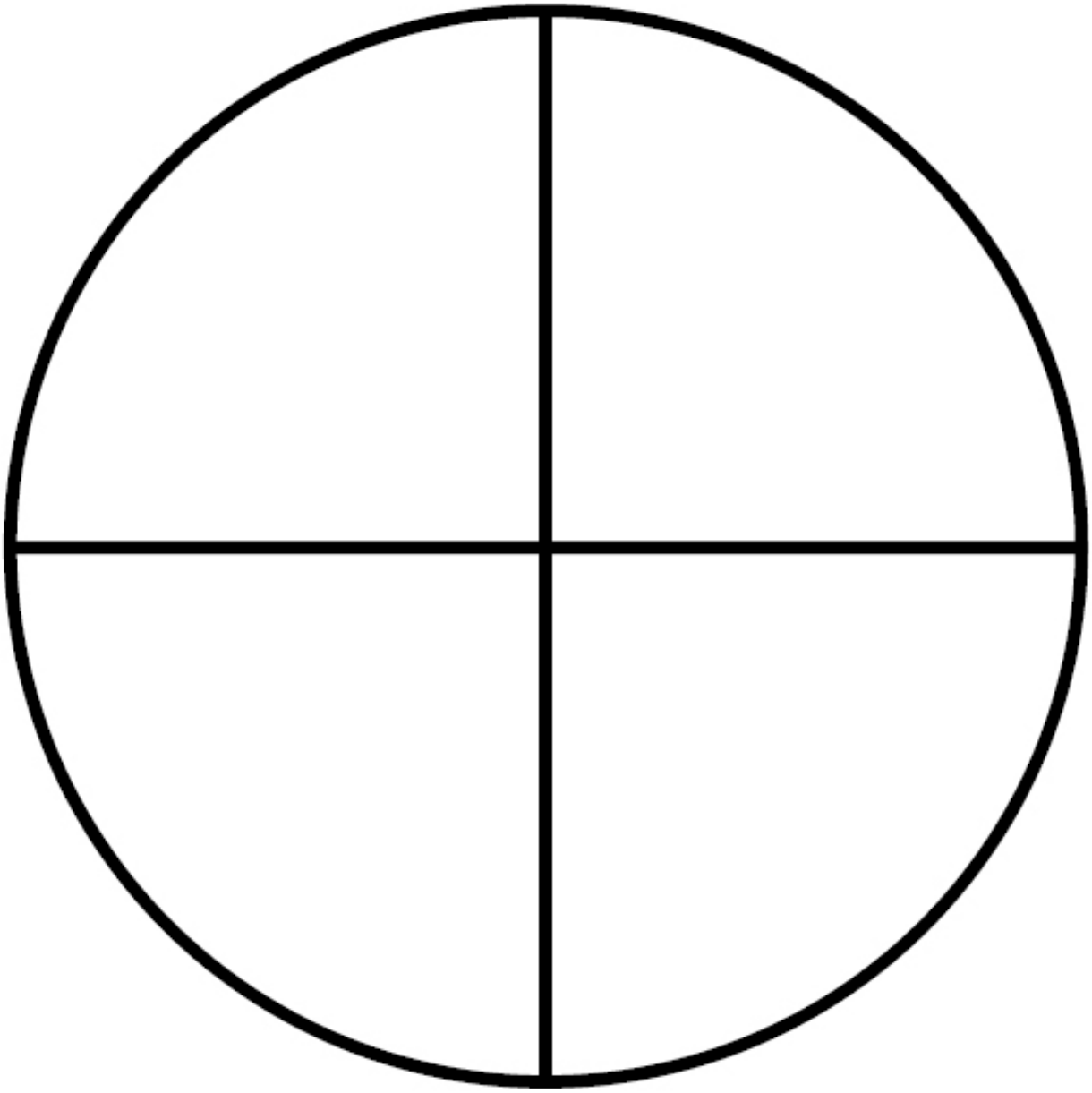
Randomly place your 50 cm x 50 cm grid square into your quadrat. In the grid below, do a detailed drawing of the plants found in your grid square. You may include labels or codes to identify different types of plants (G = Grass, M = Moss, F = Flower, S = Shrub) and do cover percentage calculations.

IMPACTS EXPLORATION: GRASSLAND

Count, record, and give a rating to each impact you observe.

Visual Impacts	Houses	Roads	Bridges	Vehicles	Power Poles	Utility Lines	Traffic Signs	Other	Total
# of Each									
Positive									
Negative									
Neutral									
Auditory Impacts	Traffic	Construction	Music	People	Dogs	Lawn-mowers	Equipment/ Machines	Other	Total
# Of Each									
Positive									
Negative									
Neutral									
Human Impacts	Built Trails	Desire Trails	Litter	Pets	Pet Waste	Graffiti/ Vandalism	Fences/ Signs	Other	Total
# of Each									
Posaitive									
Negative									
Neutral									

BIRD POINT COUNT #2: ASPEN PARKLAND



Birds Seen_____ # Birds Heard_____ Total # of Species_____

Total # Birds_____

Can you identify any species?

ABIOTIC DATA: ASPEN PARKLAND

Sample #	1	2	3	Average
Air Temp. One metre Above Ground				
Air Temp. Ground Level				

Wind (Slight, Moderate, Strong)	
Slope (Slight, Moderate, Steep)	
Aspect (Direction of Slope)	

NOTES:

ABIOTIC DATA: ASPEN PARKLAND

Soil Profile	Labelled Sketch of Soil Layers
O Horizon Litter or Humus Decomposing organic material, leaves, grasses, etc. **A Horizon** Topsoil Usually dark brown to black in colour **B Horizon** Mineral layer, Often light brown to bronze or orange in coulour **C Horizon** Contains weathered parent rock material not consolidated into soil.	
Soil Chemistry	
pH (1 - 14)	
Potassium (L - M - H)	
Phosphorous (L - M - H)	

Sample	1	2	3	Average
Soil Temp.				
Soil Moisture				

Evidence of Animals and Insects

In the square below sketch and label all evidence of animal (bird, mammal, insect) activity in your quadrat. Include as much detail and information as possible.

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# of Each									
Posaitive									
Negative									
Neutral									

Simplified Key to Common Native Trees and Shrubs of Fish Creek Provincial Park

1. A. Leaves needle-like, coniferous	Go to #2
B. Leaves not needle-like, broad, deciduous	Go to #3
2. A. Needle-like leaves borne singly, needles 4 sided	White Spruce (Picea glauca)
B. Needle-like leaves flat and scaly	Juniper (Juniperus sp.)
3. A. Tree, single stem or trunk	Go to #4
B. Shrub, multiple stems or trunks	Go to #6
4. A. Bark papery, white, peeling, black scars	Paper Birch (Betula papyrifera)
B. Bark not papery or peeling	Go to #5
5. A. Leaves have a flat stem (petiole), powder covered bark	Trembling Aspen (Populus tremuloides)
B. Leaves have a round stem (petiole) Bark is deeply furrowed	Balsam Poplar (Populus balsamifera)
6. A. Leaves grow opposite	Go to #7
B. Leaves grow alternate	Go to #9
7. A. Branches have deep red colour	Red – Osier Dogwood (Cornus sericea)
B. Branches not red coloured	Go to #8
8. A. White hairs on underside of leaf	Western Snowberry (Symphoriocarpus occidentalis)
B. Brown dots on underside of leaf	Canada Buffaloberry (Sheperdia Canadensis)
9. A. Plant stem prickly	Go to #10
B. Plant stem smooth	Go to #11
10. A. Lobed simple leaves	Wild Gooseberry (Ribes oxyacanthoides)
B. Compound Leaves (5 – 11 leaflets)	Wild Rose (Rosa acicularis)
11. A. Leaf Margins entirely toothed/serrated	Go to #12
B. Leaf margins not entirely toothed/serrated	Go to #13
12. A. Leaf margin irregularly toothed, teeth/serrations of different depth	Water Birch (Betula occidentalis)
B. Entire leaf margin finely and regularly toothed/serrated	Chokecherry (Prunus virginiana)
13. A. Leaf margin lacks teeth/serrations, entirely smooth	Go to #14
B. Leaf margin partly serrated mostly near tip	Saskatoon (Amelanchier alnifolia)
14. A. Plant forms a ground-hugging mat, leaves shiny green	Common Bearberry (Arctostaphylos uva-ursi)
B. Plant an upright shrub with simple leaves	Go to #15
15. A. Leaves silvery green with wavy margins, sometimes have rusty scales underneath	Wolf Willow (Elaegnus commutata)
B. Leaves pale to shiny green, sometimes hairy	Willow (Salix sp.)

Focusing Questions

Which ecosystem studied had the greatest diversity of life? Explain your reasoning.

What was the most negative of the Human Impacts you observed and why?

What was the most positive of the Human Impacts you observed and why?

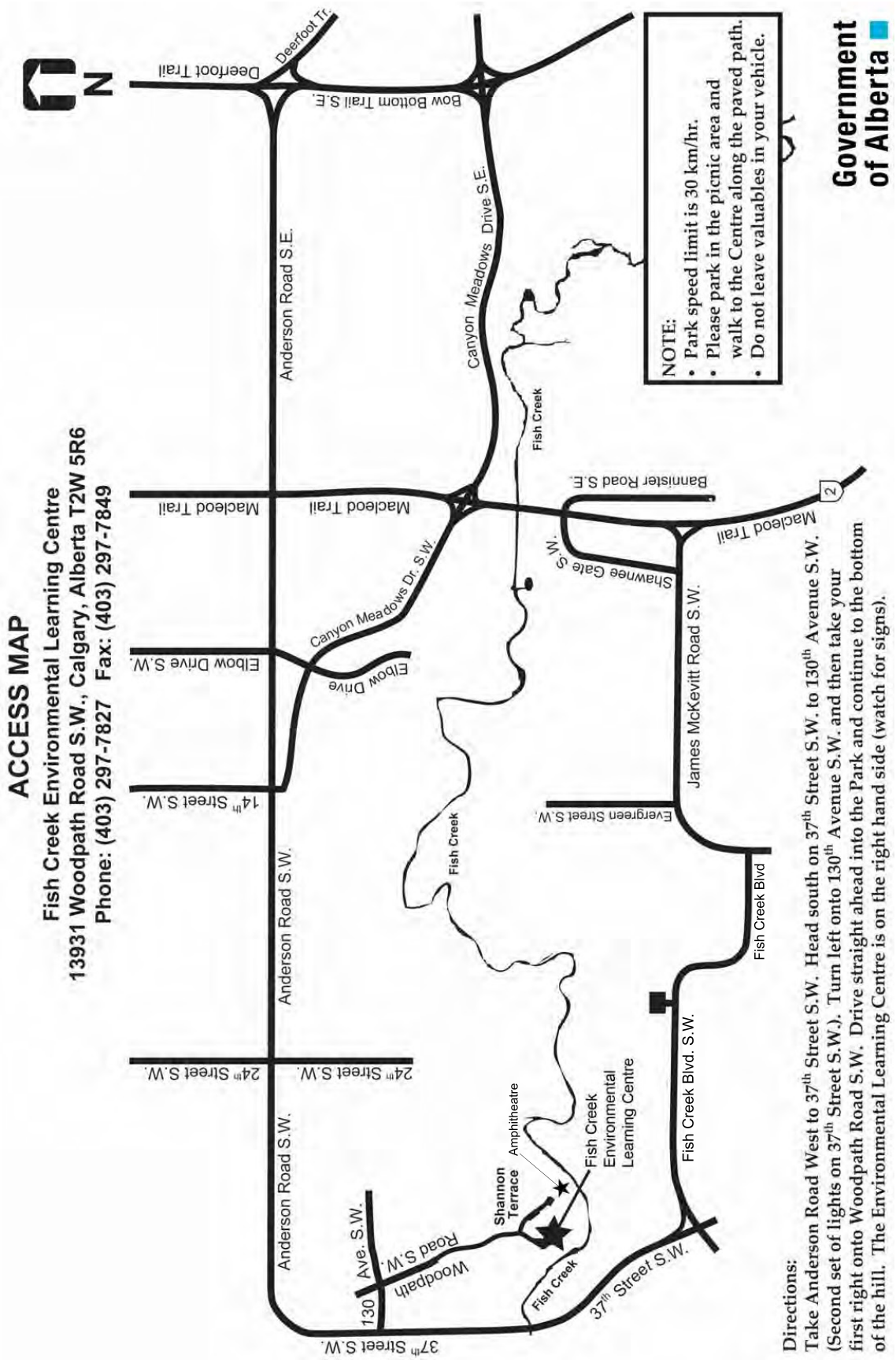
What effects could these impacts have on the ecosystems you studied today?

Getting Critical – Interpreting the Data

After examining your group's data, what factor/s do you think are the most significant in defining the ecosystems you investigated?

How could you test your hypothesis?

Can you think of other factors that could be shaping the ecosystems you observed today?



Directions:
Take Anderson Road West to 37th Street S.W. Head south on 37th Street S.W. to 130th Avenue S.W. (Second set of lights on 37th Street S.W.). Turn left onto 130th Avenue S.W. and then take your first right onto Woodpath Road S.W. Drive straight ahead into the Park and continue to the bottom of the hill. The Environmental Learning Centre is on the right hand side (watch for signs).