



Sustainable Ecosystems Activities, Grade 9

Sustainable Ecosystems Activities for Grade 9 Biology at the Toronto Zoo



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Sustainable Ecosystems Activities, Grade 9

Introduction

Dear secondary school teacher,

The Toronto Zoo is pleased to provide you with this document, a complete field trip resource for use with a grade nine science class. The focus of this resource is sustainable ecosystems from the Biology unit.

Included in this document, you will find two activities that can be completed before your trip to the zoo, two assignments for students to complete at the zoo, and two follow-up activities for after your visit. These can all be completed or you can choose which ones to do based on your class and the time you have available.

We hope your visit to the Zoo is both educational and memorable, and that these resources are a success. In order for us to best serve our visiting school groups, please fill out our feedback form, which can also be found in this package.



Sustainable Ecosystems Activities, Grade 9

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REMINDERS FOR YOUR SCHOOL VISIT



Zoo hours are:

- May 19th to September 3rd
9:00 am—7:30 pm (last admission 6:30 pm)
- September 4th to October 8th
9:00 am—6:00 pm (last admission 5:00 pm)
- October 9th to December 31st
9:30 am to 4:30 pm (last admission 5:30 pm)



Admission for school groups is:

- \$8 per student/supervisor (elementary)
- \$9 per student/supervisor (secondary)
- \$10 per student/supervisor (post-secondary)

***all rates are subject to change without notice. Please visit**

www.torontozoo.com for current rates.



Please call Toronto Zoo Group Sales at **416-392-5932** to book your school group



Supervisor to student ratios are:

- **Grades K-3:** one supervisor per 5 students
- **Grades 4-12:** one supervisor per 10 students



The Toronto Zoo is wheelchair accessible. For more information please visit our website at: <http://www.torontozoo.com/AboutTheZoo/SpecialNeeds.Services.asp>.



On the day of your visit please remember to bring your group confirmation and payment can be made at Guest Services at the main entrance of the Zoo. Payment can be made by cheque payable to "Toronto Zoo", cash, MasterCard, VISA, or American Express.

PRE-ZOO ACTIVITY: ZOO CAREERS

Time Needed: This activity is designed for one 75 minute classroom period.

Type of Activity: This activity is worksheet based and involves searching for educational information. It is intended as an individual activity, however, may be completed in pairs if it is more practical.

Purpose: This activity will give students insight into the background and schooling necessary to become a member of the zoo staff. This lesson should increase a student's interest in science and encourage them to take science courses beyond the grade 10 level as required by the Ministry of Education.

Curriculum Expectations:

COMB_9096656 Identify and describe careers and the essential skills required for those careers that relate to the scientific strand under study

Specific Prior Knowledge: Very little prior knowledge is needed for this activity, as research will be done during class time.

Teacher Preparation Required: Teachers should be somewhat familiar with various zoo-related careers. Teachers must also book a period in the computer room.

Materials Required:

- One worksheet for each student
- Website address for the Toronto Zoo (www.torontozoo.com)
- Course listings for your school (these may be online or paper copies may need to be provided)
- Access to the Internet



Sustainable Ecosystems Pre-Zoo Activities, Grade 9

Teacher's General Introduction (Duration – 1-3 minutes)

Remind students that they will soon be visiting the zoo. Let students know that many people are involved in keeping a zoo running smoothly, and that numerous staff members are not visible, "working behind the scenes." Teachers may also want to ask students how many own pets and to think about their responsibilities in caring for the animals (feeding, cleaning, taking care of ill pets etc.)

Part 1 – ZOO-RELATED CAREERS DISCUSSION (Duration – 5-10 minutes)

- With the class generate a list of careers that are zoo-related. Write this list on the board. The following are some suggestions:

| | | |
|-------------------------|------------------------|--------------------|
| Zoo Keeper (specialist) | Admissions | Exhibit Designer |
| Animal Nutritionist | Train/Ride Operator | Tour Guide |
| Curator | Veterinarian | Maintenance Worker |
| Tour Guide | Assistant Veterinarian | Educator |
| CEO | Graphics Designer | Accountant |
| Marketing | Security | |

- Circle those careers which have been mentioned that require a science background.

Part 2 – CAREER PLANNING (Duration – 45-50 minutes)

- Let the students know that they will be choosing one of the zoo careers which are science-related (and which they are interested in) and researching the education necessary to have that career.
- Give the students the website address for the Toronto Zoo so that they may go on the site and choose a species or group of animals to specialize in if they so desire (ex. Dietician for the primates).
- Direct the students to school-related curriculum booklets or websites and let them know that they are to use the Internet to research additional education required (courses, college, university etc.).
- Read over the Activity Sheet with the class.

Part 3 – GROUP SHARING (Duration – 10-15 minutes)

- Call out each career that was circled on the board and have the students raise their hand if they chose to research that career (ex. all zoo keepers, all vets etc.).
- Organize students into common groups so that they can share their research.
- This portion is optional and time dependent.

Sustainable Ecosystems Pre-Zoo Activity, Grade 9

ZOO CAREER PLANNING

Zoo Career: _____ /1

1. List a minimum of three important factors what you believe you would need to know if you had the above Zoo Career. (For example, to be the orangutan keeper, you would need to know how to safely handle them.) /3

2. Go through your school course offerings. What classes should you take during the next three years of high school that will help you to achieve your chosen Zoo Career? Hint: Look under Sciences, Social Sciences, and Geographies. Complete the table below, choosing at least one course for each year. /6

| | Course Name | Why is this important for the chosen Zoo Career? |
|-----------------|-------------|--|
| Grade 10 | | |
| | | |
| Grade 11 | | |
| | | |
| | | |
| Grade 12 | | |
| | | |
| | | |

3. Using the Internet, choose 1-2 colleges and/or universities anywhere in North America and look at the courses offered. Which science-related courses would help you to find a career at a zoo? Use the following table to help you to organize your findings. List at least four courses. /8

School Name #1: _____ /1

School Location #1: _____ /1

School Name #2: _____ (Optional)

School Location #2: _____ (Optional)



Sustainable Ecosystems Pre-Zoo Activity, Grade 9

| School # | Course Title | Why is this important for the chosen Zoo Career? |
|----------|--------------|--|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

4. Volunteers are a very important part of the Toronto Zoo. As a high school student you must complete 40 hours of community service. If you completed those hours at a zoo, what would you imagine yourself doing? Keep in mind that volunteers never work directly with the animals. List three different ways in which you could contribute. /3

1.

2.

3.

ZOO CAREER PLANNING

Zoo Career: **Zoo Keeper for the Bettong (rat kangaroo)** /1

1. List a minimum of three important factors what you believe you would need to know if you had the above Zoo Career. (For example, to be the orangutan keeper, you would need to know how to handle them.) /3

- what they eat
- what other animals they can be housed with
- how long they live
- sicknesses they are susceptible to

2. Go through your school course offerings. What classes should you take during the next three years of high school that will help you to achieve your chosen Zoo Career? Hint: Look under Sciences, Social Sciences and Geography. Complete the table below, choosing at least one course for each year. /6

| | Course Name | Why is this important for the chosen Zoo Career? |
|-----------------|-------------------------------|--|
| Grade 10 | Science | Learn about ecosystems and ecology |
| | Career Studies | Learn about various workplaces, how to apply for jobs, managing work, and life transitions. |
| Grade 11 | Biology | Learn about the diversity of living things |
| | Intro to Anthro., Psych, Soc. | Learn about research methods |
| | Chemistry | Learn about how chemicals can affect animals and chemicals for medicine |
| Grade 12 | Biology | Learn about metabolic processes and genetics |
| | Chemistry | Learn about atomic and molecular structure |
| | Canadian and World Issues | Learn about creating a sustainable and equitable future and to protect the natural environment |

3. Using the Internet, choose 1-2 colleges and/or universities anywhere in North America and look at the courses offered. Which science-related courses would help you to find a career at a zoo? Use the following table to help you to organize your findings. List at least four courses. /8

School Name #1: **University of Waterloo** /1

School Location #1: **Waterloo, Ontario** /1

School Name #2: **McMaster** (Optional)

School Location #2: **Hamilton, Ontario** (Optional)

*Note that this activity is for the most part open-ended and student directed, and that all answers will vary greatly.



Sustainable Ecosystems Pre-Zoo Activity, Grade 9

| School # | Course Title | Why is this important for the chosen Zoo Career? |
|----------|---------------------------------------|--|
| 1 | BIO 250 – Ecology | Interactions between animals and their environment |
| 1 | BIO 110 – Invertebrate Zoology | Introduction to zoology, required for other courses |
| 1 | BIO 370 – Animal Physiology | More background knowledge about animals |
| 1 | BIO 371 – Animal Physiology | Animal physiology part 2, learning about the workings of the animal body |
| 2 | BIO 3KO3 – Animal histology | Learn about structure and function of cells |
| 2 | BIO 1MO3 – Biodiversity and Evolution | Learn about diversity of life |
| 2 | ANTHRO 2BO3 – Primate behaviour | Course contains a zoo observation study |
| 2 | BIO 3SS3 – Population Ecology | Learn about how animals evolve and reproduce |
| 2 | BIO 3FF3 – Evolution | Learn theories on how animals evolved |

4. Volunteers are a very important part of the Toronto Zoo. As a high school student you must complete 40 hours of community service. If you completed those hours at a zoo, what would you imagine yourself doing? List three different ways in which you could contribute. /3

1. Aid in summer education programs
2. Participate in special events
3. Provide interpretation at animal exhibits

*Note that this activity is for the most part open-ended and student directed, and that all answers will vary greatly.

PRE-ZOO ACTIVITY: HUMAN USE OF ANIMALS AND NATURAL RESOURCES

Time Needed: This activity is designed for one 75 minute classroom period.

Type of Activity: This activity is based on a series of statements used to stimulate discussion. It is highly opinion-based, and there is an optional written component.

Purpose: To get students thinking about human use of natural resources and more specifically animals in captivity.

Curriculum Expectations:

BY1.04D identify and explain the natural and human factors (e.g., competing populations, introduction of invasive species, bioaccumulation, acid rain, activity of tent caterpillars) that affect the survival and equilibrium of ecosystems

Specific Prior Knowledge: Very little prior knowledge is needed for this activity, only some exposure to animals in captivity (example: pets).

Teacher Preparation Required: Teachers should be somewhat familiar with various animals in captivity situations such as zoos, farms, aquariums, pets, hospitals, rehabilitation centres and hunting captive game.

Materials Required:

- Handout with statements

Notes:

- This activity involves an optional written component.



Sustainable Ecosystems Pre-Zoo Activity, Grade 9

Teacher's General Introduction (Duration – 2 minutes)

Remind students that they will soon be visiting the Toronto Zoo, a place where animals are kept captive and are displayed in exhibits and aquariums. Tell students that they will be reflecting on their own feelings about human use of natural resources.

Part 1 – Complete Statement Sheet (Duration – 5-7 minutes)

- Give each student a statement/question sheet and have them complete the questions individually, without discussion.

Part 2 – Small Group Discussion (Duration – 15 minutes)

- Have students discuss their responses to the statements, particularly those pertaining to the Zoo.
- Students should make notes on their own ideas/arguments and those of others.

Part 3 – Class-wide Discussion (Duration – 15-20 minutes)

- As a class, discuss the zoo-related statements and questions, putting ideas on the board.
- Students should make notes on their own ideas/arguments and those of others.

Part 4 – Opinion Paper/Journal Entry (Duration – 35 minutes)

- Students will be asked to write a journal entry or opinion paper, one half to one page in length, on one topic from the statement/question sheet that they feel strongly about. Students should support their opinion with logic and knowledge they have acquired through personal experience and material covered thus far in the Sustainable Ecosystem unit of study.
- This is intended as a small assignment and students should be given class time to work on it, and allowed to complete it at home and submitted at the next class if necessary.



Sustainable Ecosystems Pre-Zoo Activity, Grade 9

HUMAN USE OF NATURAL RESOURCES, ANIMALS, AND WILDLIFE

Read each of the statements below and circle whether you agree or disagree with them. Think carefully about your reasoning before making your decision.

1. People should be able to use pesticides on their lawns.
Agree or Disagree
2. It is cruel to raise animals solely for consumption.
Agree or Disagree
3. People should be able to keep abandoned wild animals as pets.
Agree or Disagree
4. Animals should be used to find cures for human diseases.
Agree or Disagree
5. People should be able to alter shorelines on their property (for example: remove trees, plant grass, dump sand for a beach etc.).
Agree or Disagree
6. All forms of hunting and fishing should be illegal.
Agree or Disagree
7. National and Provincial Parks should only be created to protect animals and their ecosystem, not for human recreation.
Agree or Disagree
8. Primates are smarter than other animals, therefore they should get more complex and interesting accommodations (example: more things to do and play with in their cages).
Agree or Disagree
9. Instead of keeping predators, competitors, and prey species separate, zoos should try to recreate realistic ecosystems.
Agree or Disagree
10. Zoos should only be permitted to keep species which are endangered.
Agree or Disagree
11. If animals at a zoo get sick, they should be given medication or medical aid, not allowed to die naturally.
Agree or Disagree
12. The purpose of zoos should be to breed animals to re-introduce to the wild.
Agree or Disagree

ZOO ACTIVITY: SPECIES AT RISK

Time Needed: Actual assignment write-up should take no more than 30 minutes, however, since students are able to choose the species they focus on, this activity may be spread over a couple of hours as the student explores the Zoo.

Type of Activity: Handout, to be completed individually or in partners.

Purpose: To reinforce students' understanding of the importance of each species to its ecosystem and to make the subjects of poaching and habitat loss personally relevant.

Curriculum Expectations:

COMB_9096224 research and assess the impact of a human activity and/or a natural change (e.g., urban sprawl, introduction of invasive species, human interaction with bears, forest fires, floods) that threaten(s) the sustainability of an ecosystem

BY1.04D identify and explain the natural and human factors (e.g., competing populations, introduction of invasive species, bioaccumulation, acid rain, activity of tent caterpillars) that affect the survival and equilibrium of ecosystems

Specific Prior Knowledge: Students should be familiar with the concepts of endangered species and species extinction. Students should understand predator-prey interactions, the general configuration of food webs, and the importance of single species to an ecosystem and biodiversity. The issues of illegal hunting and habitat destruction should have also been touched upon in class.

Teacher Preparation Required: Ensure prior knowledge has been covered in class. Read activity through with the class to ensure complete understanding of the assignment.

Materials Required:

- A photocopy of the Species at Risk Activity Sheet for each student
- Clipboards or hard surfaces
- Writing implements

Notes:

1. Question 3 of the activity may be completed in groups
2. Possible post-visit extensions to this activity may include:
 - a. sharing of suggested governmental strategies for stopping poaching and reducing habitat destruction
 - b. sharing of personal strategies for eliminating poaching and reducing habitat destruction
 - c. further research into the current state of specific species (perhaps locally endangered/at-risk species) and a letter writing "campaign" to persons of authority to express either support for measures taken or urging the government and/or individuals to take action

SPECIES AT RISK

Name: _____

Date: _____

Assignment: Imagine that you are the newly appointed **Minister of Natural Resources** in a country where poaching and habitat loss are greatly affecting native species. You are not completely familiar with the species affected and must educate yourself in order to properly perform your job.

- Find 4 species in the Zoo which are endangered, threatened, or at risk due to poaching or habitat destruction. These species DO NOT all have to be from the same region. Of the 4, at least one of the animals must be hunted illegally (poached) and at least one must be experiencing habitat destruction.

For each of these animals complete the table below:

/8

| Species Name (and <i>Latin name</i>) | Motivation for Poaching? | Cause of Habitat Destruction? |
|--|--------------------------|-------------------------------|
| 1. | | |
| 2. | | |
| 3. | | |
| 4. | | |

- Using 2 species from Question 1, predict what would occur to the ecosystem they currently occupy if these species were to go extinct. HINT: Think in terms of a food web, using your previous knowledge and that provided at the Zoo.

/6

| Species | 1. | 2. |
|---------------------|----|----|
| Effect on Ecosystem | | |

SPECIES AT RISK

Name: _____

Date: _____

Assignment: Imagine that you are the newly appointed **Minister of Natural Resources** in a country where poaching and habitat loss are greatly affecting native species. You are not completely familiar with the species affected and must educate yourself in order to properly perform your job.

- Find 4 species in the Zoo which are endangered, threatened, or at risk due to poaching or habitat destruction. These species DO NOT all have to be from the same region. Of the 4, at least one animals must be hunted illegally (poached) and at least one must be experiencing habitat destruction.

For each of these animals complete the table below:

/8

| Species Name (and Latin Name) | Motivation for Poaching? | Cause of Habitat Destruction? |
|--|---|-------------------------------|
| 1. African Elephant (<i>Laxodonta Africana</i>) | Tusks for ivory – piano keys, jewellery | Deforestation for agriculture |
| 2. Gorilla (<i>Gorilla gorilla gorilla</i>) | Bush meat | Deforestation |
| 3. Muskox (<i>Ovibos moschatus</i>) | Hunting was banned in 1917 | Mineral and oil mining |
| 4. Orangutan (<i>Pongo pygmaeus abelii</i>) | Kill mothers in order to use babies for pet trade | Deforestation for agriculture |

- Using 2 species from Question 1, predict what would occur to the ecosystem they currently occupy if these species were to go extinct. HINT: Think in terms of a food web, using your previous knowledge and that provided at the Zoo.

/6

| Species | 1. Orangutan | 2. African Elephant |
|---------------------|---|---|
| Effect on Ecosystem | <ul style="list-style-type: none"> The orangutan is an herbivore and an important part of the forest ecosystem. Orangutans help to replant the forest by dispersing the seeds in their droppings, if they are to go extinct then the forest may not be able to re-establish itself after clear-cutting and fires. | <ul style="list-style-type: none"> Elephants eat very large amounts of vegetation each day and therefore also ingest many seeds. Elephants travel quite a bit and pass the seeds in their dung, giving rise to new growth. Other species may also look through the dung for their source of food. |

Sustainable Ecosystems Zoo Activity, Grade 9

3. Now that you have become familiar with the species at risk in your country, as the Minister of Wildlife and the Environment you must develop plans to eliminate poaching and habitat loss.
- i. What new laws and enforcement strategies can you put into place? /2
- If the budget allows, hire and train conservation officers to deal specifically with poachers.
 - Create stricter laws with respect to the public being allowed to burn brush.
 - Create stricter laws with respect to building and using land near environmentally significant areas.
 - Create a “snitch” hotline that can be used to catch poachers and those who illegally destroy protected habitat. (already exists in Ontario)
- ii. What alternative sources of income can you suggest (or create) for those exploiting the habitat and the animals? /2
- Create jobs and training programs in already developed areas, encouraging those who make a living illegally to change their ways.
 - Poachers generally have a lot of knowledge about the animals they track – create ecotourism positions and encourage these illegal hunters to use their knowledge to protect the animals.
- iii. What type of public education would you suggest around poaching and habitat destruction? /2
- Bush meat is eaten locally as well as exported, so the international public needs to be informed of where their food is coming from.
 - Start by teaching the importance of environmental sustainability and species protection and respect in schools.

Sustainable Ecosystems Zoo Activity, Grade 9

ZOO ACTIVITY: AMPHIBIANS AS INDICATORS OF ECOSYSTEM HEALTH

Time Needed: The written portion of this activity should take students no more than an hour, however the entire activity may take longer as it may involve observing amphibians at numerous pavilions.

Type of Activity: Handout, to be completed individually, or in partners.

Purpose: To emphasize to students the importance of amphibians as indicators of ecosystem health. Students will also become familiar with the characteristics of amphibians which make them especially susceptible to environmental change.

Curriculum Expectations:

COMB_9096224 research and assess the impact of a human activity and/or a natural change (e.g., urban sprawl, introduction of invasive species, human interaction with bears, forest fires, floods) that threaten(s) the sustainability of an ecosystem

BY1.04D identify and explain the natural and human factors (e.g., competing populations, introduction of invasive species, bioaccumulation, acid rain, activity of tent caterpillars) that affect the survival and equilibrium of ecosystems

Specific Prior Knowledge: Students should have a basic knowledge of aquatic and terrestrial ecosystems, and both natural and human activities which threaten wetlands. Students should be familiar with common amphibian traits/properties.

Teacher Preparation Required: Teachers should have conducted a brief overview of amphibian anatomy. This may or may not be required, depending on the general knowledge base of the individual class.

Materials Required:

- A photocopy of the Amphibians as Indicators of Ecosystem Health for each student
- Clipboards or hard surfaces
- Writing implements

Notes:

1. It is highly recommended that students view the Americas Ponds if they are visiting the Zoo during non-winter months.
2. Possible post-visit extensions to this activity may include:
 - a. Further research into the specifics behind using amphibians as indicators of ecosystem health.
 - b. Local initiatives to protect amphibians, such as the creation of pond areas and public education.
 - c. Discussion/research on the importance of wetlands.
3. Additional Resources:
 - a. FrogWatch Ontario
 - b. Adopt-A-Pond Wetland Conservation, www.torontozoo.com/adoptapond

Sustainable Ecosystems Zoo Activity, Grade 9



AMPHIBIANS AS INDICATORS OF ECOSYSTEM HEALTH

Name: _____

Date: _____

Amphibians (frogs, toads, salamanders etc.) are recognized as being gauges of the condition of an ecosystem. Monitoring of the abundance and diversity of amphibians is conducted in numerous countries to examine the state of health of specific ecosystems.

NOTE: The following questions are to be answered as you journey through the Zoo. Amphibians can be observed at these locations: **Americas Pavilion, Indo-Malaya Pavilion** (crocodile newts), **Australasia Pavilion**, and the **Americas wetlands** (seasonal).

1. Name at least three amphibians that are found at the Zoo, and state where they are located in the Zoo. /6

| Species Name | Species Location |
|--------------|------------------|
| | |
| | |
| | |

2. Choose a frog or toad from the Americas Pavilion or Australasia Pavilion and observe its behaviour and habitat for a minimum of 10 minutes.
 - a. Use your observations, as well as any information provided about your chosen frog or toad, to complete the following:

Species Name _____

Physical Characteristics (colour, skin texture etc.) _____

Habitat/Ecosystem (the Toronto Zoo houses many of its animals in artificially controlled ecosystems) _____

- b. Use the following table to record your observations of your chosen frog or toad's behaviour over the course of 10 minutes. Write an observed behaviour in the numbered boxes (ex. jumping, stationary, blinking, swimming etc.) and place a checkmark in the space provided below if that behaviour was observed during the time interval indicated.

| Time (Minutes) | OBSERVED BEHAVIOUR | | | | |
|----------------|--------------------|----|----|----|----|
| | 1. | 2. | 3. | 4. | 5. |
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |
| 6 | | | | | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | | |

*Note that this activity is for the most part open-ended and student directed, and that all answers will vary greatly.



Sustainable Ecosystems Zoo Activity, Grade 9

3. Many different factors can have a negative effect on amphibians. Choose 3 of the 5 following features and write down how it could negatively impact amphibians. HINT: See the display "It's a Frog's Life" in the Americas Pavilion. /6

Pollution

Deforestation

Climate Change

Agriculture

Infrastructure Development (ex. road construction, housing developments)

4. Based on your observations from Question 2 and your responses to Question 3, list 2 reasons why you believe amphibians are ideal indicators of ecosystem health. HINT: consider their life cycle. /2

Reason 1 –

Reason 2 –

*Note that this activity is for the most part open-ended and student directed, and that all answers will vary greatly.

AMPHIBIANS AS INDICATORS OF ECOSYSTEM HEALTH

Amphibians (frogs, toads, salamanders etc.) are recognized as being gauges of the condition of an ecosystem. Monitoring of the abundance and diversity of amphibians is conducted in numerous countries to examine the state of health of specific ecosystems.

NOTE: The following questions are to be answered as you journey through the Zoo. Amphibians can be observed at these locations: **Americas Pavilion, Indo-Malaya Pavilion** (crocodile newts), **Australasia Pavilion**, and the **Americas wetlands** (seasonal).

- Name at least three amphibians that are found at the Zoo, and state where they are located in the Zoo. /6

| Species Name | Species Location |
|-----------------|----------------------------|
| Bullfrog | Americas Pavilion |
| Crocodile Newts | Indo-Malaya Pavilion |
| American Toad | Outdoor Ponds/Wetland Area |

- Choose a frog or toad from the Americas Pavilion or Australasia Pavilion and observe its behaviour and habitat for a minimum of 10 minutes.
 - Use your observations, as well as any information provided about your chosen frog or toad, to complete the following:

Species Name Dyeing Arrow Poison Frog

Physical Characteristics (colour, skin texture etc.) wet/moist skin, brightly coloured: green and black, very small (approx. 4.5 cm), little webbing of feet

Habitat/Ecosystem (the Toronto Zoo houses many of its animals in artificially controlled ecosystems) lots of vegetation, water and terrestrial, running and stagnant water, very moist/humid, soft/mossy ground

- Use the following table to record your observations of your chosen frog or toad's behaviour over the course of 10 minutes. Write an observed behaviour in the numbered boxes (ex. jumping, stationary, blinking, swimming etc.) and place a checkmark in the space provided below if that behaviour was observed during the time interval indicated.

| Time (Minutes) | OBSERVED BEHAVIOUR | | | | |
|----------------|--------------------|---------------|------------------------------|---------------------|--------------------------------|
| | 1. stationary | 2. "crawling" | 3. climbing on other frog(s) | 4. doing "push-ups" | 5. moves aside for other frogs |
| 1 | yes | | | | |
| 2 | yes | | | | |
| 3 | | yes | yes | | |
| 4 | yes | | | yes | |
| 5 | yes | | | | |
| 6 | yes | yes | | | yes |
| 7 | | yes | yes | | |
| 8 | yes | yes | | | yes |
| 9 | yes | | | | |
| 10 | yes | | | | |

*Note that this activity is for the most part open-ended and student directed, and that all answers will vary greatly.

Sustainable Ecosystems Zoo Activity, Grade 9

3. Many different factors can have a negative effect on amphibians. Choose 3 of the 5 following features and write down how it could negatively impact amphibians. HINT: See the display "It's a Frog's Life" in the Americas Pavilion. /6

Pollution

- Amphibians have very porous skin which is susceptible to absorbing the pollutants (chemicals etc.) around them.

Deforestation

- The clearing of trees and/or vegetation can cause a pond (or wetland) to lose water and possibly dry up. Vegetation also provides a barrier to pollutants. Vegetation removal can affect the terrestrial habitat.

Climate Change

- Global warming may affect an amphibian's habitat and cause exotic species to invade. Temperatures may also become too warm for amphibian survival in some areas.

Agriculture

- Fertilizers and pesticides used in agriculture can flow/seep into nearby ponds/wetlands and pollute amphibian habitat. Runoff from animal waste may do the same. In some cases water from ponds/wetlands may be taken and used to irrigate crops.

Infrastructure Development (ex. road construction, housing developments)

- Wetlands and ponds may be drained or filled to make room for subdivisions. Silt from construction may pollute waterbodies. Salt and dust suppressant from roads may pollute waterbodies. Roadways can be a major hazard for migrating frogs.

4. Based on your observations from Question 2 and your responses to Question 3, list 2 reasons why you believe amphibians are ideal indicators of ecosystem health. HINT: consider their life cycle. /2

Possible answers may include:

- Amphibians have very porous skin and can absorb toxins in the environment.
- Most amphibians spend part of their life cycle in an aquatic environment and part in a terrestrial environment so they are exposed to numerous conditions.
- Frogs and toads are already counted for other purposes (such as regular wetland inventories) and these population numbers can also be used for ecosystem health.
- You can study many different stages of the amphibians life cycle (egg, aquatic larvae, adult)
- Because amphibians are extra sensitive, they may be an early warning system of problems that can go on to affect other wildlife

*Note that this activity is for the most part open-ended and student directed, and that all answers will vary greatly.

POST-ZOO ACTIVITY: GREAT LAKES INVADERS

Time Needed: One 75 minute classroom period.

Type of Activity: Cooperative, group activity; poster creation.

Purpose: To familiarize students with provincially local invasive species. This activity deals with the impact of exotic species on ecosystems and the government measures being taken to lessen their impact. The purpose of the poster creating activity is to encourage group cooperation and information organization. Most importantly students will learn to choose to prioritize and discriminate between essential and non-essential information. This activity can be linked to the Zoo activity "Species at Risk!"

Curriculum Expectations:

BY2.03D Demonstrate the skills required to research through locating and selecting information from various sources, including electronic and print resources, community resources, and personally collected data to solve problems, make decisions, and evaluate issues

COMB_9096224 research and assess the impact of a human activity and/or a natural change (e.g., urban sprawl, introduction of invasive species, human interaction with bears, forest fires, floods) that threaten(s) the sustainability of an ecosystem

COMB_9096170 evaluate Canadian governmental initiatives (federal, provincial, municipal), or efforts of citizens including First Nation communities regarding an environmental issue related to the sustainability of a terrestrial or aquatic ecosystem (e.g., wetland restoration, recycling)

BY1.04D identify and explain the natural and human factors (e.g., competing populations, introduction of invasive species, bioaccumulation, acid rain, activity of tent caterpillars) that affect the survival and equilibrium of ecosystems

Specific Prior Knowledge: Students should be familiar with the concept of an invasive species and the effects of invasive species on sensitive ecosystems.

Teacher Preparation Required: Ensure prior knowledge has been covered in class. The teacher must download pre-made fact sheet on individual species. Fact sheets on invasive species are readily available on the following websites: www.invadingspecies.com and <http://www.glc.org/ans/>. A complete listing of Great Lakes Area invasive species can be found at: <http://www.glerl.noaa.gov/res/Programs/invasive>. You may want to tailor the species you use to your particular area of the province.

Materials Required:

- Sets of markers and sheets of Bristol board or flipchart paper (1-2 for each group of 4-5 students)
- A copy of the Invasive Species Activity Sheet for each student
- Copies of assigned species fact sheets for each student

Notes:

- As an extension the teacher may wish to focus on specific government initiatives to prevent the initial entry and subsequent spread of exotic species

Sustainable Ecosystems Post-Zoo Activity, Grade 9

Teacher's General Introduction (Duration – 1 minute)

The Great Lakes are home to over one hundred invasive species. Exotic species can negatively affect local species through predation, and competition for resources. Have students recall that the Toronto Zoo housed a snakehead in the Indo-Malaya Pavilion. This fish is highly invasive and has already been spotted in many U.S. states. Although the buying and selling of these fish is prohibited in the U.S. and Ontario, it is possible that in the future the fish could become a serious problem.

Part 1- BRAINSTORMING (Duration – 10-15 minutes)

- Have the students brainstorm and come up with as many species non-indigenous to Canada as possible (not limited to the aquatic environment). Do this as a class, generating a list on the chalkboard or flipchart paper. A short list of non-indigenous species is provided below:

| | | | |
|--------------------|-----------------------|-----------------|-------------|
| Purple loosestrife | Rainbow smelt | Eurasian ruffe | Coho salmon |
| Alewife | Eurasian watermilfoil | Round goby | Black alder |
| Rainbow trout | Zebra mussel | Spiny waterflea | Rudd |
| Common carp | Quagga mussel | Goldfish | |
| Brown trout | Rusty crayfish | Chinook salmon | |

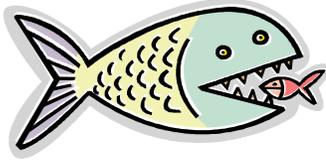
- Have students share stories if they have seen these species in the wild.

Part 2 – FOCUS ON INDIVIDUAL SPECIES (Duration – 45 minutes)

- Materials Required:
 - One set of markers per group
 - 1-2 Bristol boards or flipchart sheets per group
 - 5 copies of species-specific information per group (one for each student)
- The class will be split into groups of 4-5 students and each group will be assigned a specific invasive species.
- The teacher will provide the students with some background information in the form of fact sheets and students will follow the instructions on the Invasive Species Activity sheet to create an informative poster.
- It is recommended that the teacher reads through the Activity Sheet with the students to ensure complete understanding. It should be emphasized that these posters are not to be great works of art and the focus is on being informative.

Part 3 – PRESENTATION OF POSTER (Duration – 15 minutes)

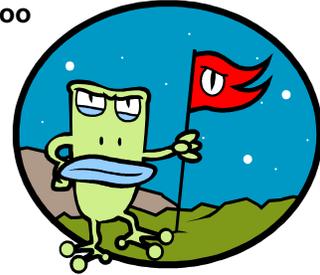
- Each group spends approximately 2-3 minutes presenting the information on their poster to the class.
- This part of the activity is optional and time dependent. If time does not permit classroom presentation, then as an alternative the posters can be posted around the classroom for later viewing.



INVASIVE SPECIES ACTIVITY

You are taking on the role of a Summer Student working for the Zoo and Aquarium Partnership for the Great Lakes. Part of your job is to educate the public about invasive species in the area.

In groups of 4-5 you will read over the invasive species information sheets that you have received (each group should have information on one species). Using the information on these sheets your group will create a poster.



Group Expectations

- Each group member will read in its entirety the species information sheet(s) they are assigned.
- The group will work cooperatively to create the poster and each member will write on the poster.
- Ensure that the wording on the poster is your own and you do not copy directly from the information sheets.
- HINT: It may help to (1) use headings and (2) assign one or two people to each poster component listed under the “Poster Expectations.”

Poster Expectations

- 1) Name of species (and Latin name) and indicate whether it is a plant or animal.
- 2) BRIEF history of introduction to Great Lake/Great Lake area (when, where, how). OR, if the species has the potential to invade give its history of introduction to other areas of North America.
- 3) Why has the invasion of this species been successful? (ex. no natural predators, how they spread)
- 4) How has the invasion of this species negatively impacted the ecosystem? Explain this in terms of a food web and other species affected (ex. through competition).
- 5) Measures that are being taken to minimize the impact of invasive species and/or prevent further entry of the invasive species (by the government and/or the public).
- 6) Additional information your group thinks is important for people to know. This might include: biological information (physical description, behaviour, reproduction, habitat etc.), statistics or interesting facts.

REMEMBER TO CHOOSE ONLY THE MOST IMPORTANT POINTS FOR YOUR POSTER.

Also, include the names of your group members at the bottom or on the back of the poster.

POST-ZOO ACTIVITY: NATURE AREA CREATION AND AWARENESS

Time Needed: This activity is designed for 1-2, 75 minute classroom period.

Type of Activity: Cooperative, worksheet-based, group activity.

Purpose: To have students develop a plan for a “nature area,” using their school property or other nearby area as a starting point. To encourage students to actively participate in stewardship activities and to open them up to the actions they can take to enrich the environment. This activity can be linked to the Zoo activity “Amphibians as Indicators of Ecosystem Health,” since in the assignment students were asked to make notes on species habitat/ecosystem.

Curriculum Expectations:

BY1.01D identify and describe the characteristics of biotic and abiotic components of terrestrial and aquatic ecosystems

NEW_9097194 compare and contrast the characteristics of aquatic and terrestrial ecosystems

BY1.07D describe the characteristics of a sustainable ecosystem

Specific Prior Knowledge: Students should be familiar with the importance of having adequate species habitat and the basic components of terrestrial and aquatic ecosystems. Some knowledge of local native species is advisable.

Teacher Preparation Required: Teachers should familiarize themselves with the local area/school area that will be used as inspiration, as well as species native to Ontario.

Materials Required:

- Copies of the attached activity sheets for each group
- Nature Area Creation Lists sheet for each student or group
- Flipchart paper and coloured markers to sketch food web
- Books/literature from the library/personal collection on ecology, local animals and plants, as additional resources (optional)
- Students will likely want to use their textbooks and class notes as resources

Notes:

- This activity can easily be extended to span numerous classes or partially given as a take-home assignment. Here are some suggestions:
 - Instead of using the Nature Area Lists sheet, students are given library time to research their proposed species, habitat, and ecosystem.
 - Each individual in the group must sketch the proposed Nature Area, including all of the components that the group has listed.
- Depending upon the circumstances it may be possible to implement some of the suggestions that come out of this planning activity. For additional support:
 - FrogWatch Ontario
 - Adopt-A-Pond Wetland Conservation, www.torontozoo.com/adoptapond



Sustainable Ecosystems Post-Zoo Activity, Grade 9

Teacher's General Introduction (Duration – 3 minutes)

Introduce students to the idea of either rehabilitating a nearby existing nature area or wetland or creating a nature-friendly space on school property. Remind the students that at the Zoo they may have passed by the Americas Wetlands ponds which includes habitat for birds, amphibians, reptiles, fish and many invertebrates. Also, that the living spaces for the majority of the animals at the Zoo are setup to mimic their natural habitat.

Part 1 – Class Discussion (Duration – 10 minutes)

- Discuss, as a class, what is known about the area in question. Ask the students the following questions:
 - What species of animals are observed?
 - What species of plants/vegetation are observed?
 - Describe the terrain, soil, and/or water.
 - What is the state of the area? (ex. presence of garbage?)
 - Is the area accessible to the public?

Part 2 – Nature Area Rehab/Creation Planning (Duration – 45 minutes)

- Let the students know that they will be split into groups of 4-5 and each group will be in charge of creating a plan for a nature area on or near the school property. With the help of the attached worksheets each group will:
 - Develop a habitat (ex. what plant species/type of plants are present as producers, terrain/soil/water composition) for the location;
 - Create a food web, using animals that would be suited to the proposed nature area; and
 - Develop a plan to allow controlled use of the area

Part 3 – Discussion of Pros and Cons of Creating a Nature Area (Duration – 15 minutes)

- Briefly discuss with the class whether or not it is a good idea to create a nature area on school property. What are the pros and cons? List these on the board as they are mentioned.
- If time permits, discuss how these areas differ from a zoo.

Sustainable Ecosystems Post-Zoo Activity, Grade 9

NATURE AREA CREATION LISTS

PRODUCERS

Algae
 Apple Trees
 Cattails
 Dandelions
 Duckweed
 Grass
 Milkweed Plants
 Moss
 Phytoplankton
 Plantain
 Pondweed
 Queen Anne's Lace
 Raspberries
 Sumac Trees
 Waterlilies
 Wildflowers
 Wild Strawberries

DECOMPOSERS

Bacteria
 Fungi
 Molds
 Mushrooms
 Worms

CONSUMERS

Crustaceans

Crayfish (O)
 Freshwater Shrimp (H)
 Zooplankton (H)

Insects

Ants (H,O, or C)
 Aphids (H)
 Backswimmers (C)
 Blowflies (H,D)
 Cicadas (H)
 Cricket (O,S)
 Damselflies (nymphs) (C)
 Dragonflies (nymphs) (C)
 Giant Waterbeetles (C)
 Grasshoppers (H)
 Honeybees (H)
 Ladybugs (C)
 Monarch Butterfly (H)
 Mosquitoes (H,C)
 Moths (H)
 Praying Mantis (C)
 Swallowtail Butterfly (H)
 Wasps (O)
 Water Boatmen (C)
 Water Striders ©

Whirligig Beetles (C,S)

Other Invertebrates

Freshwater mussels
 Leeches (S,C)
 Slugs (H,S)
 Snails (land or water) (O)

Birds/Waterfowl

Blue Jays (O)
 Canada Geese (H)
 Cardinals (O)
 Chickadees (O)
 Crow (S,H)
 Grackles (O)
 Great Blue Herons (C)
 Hummingbirds (H)
 Loons (C)
 Mallard Ducks (O)
 Nuthatches (O)
 Owls (C)
 Quails (O)
 Raven (O,S)
 Red-Tailed Hawks (C)
 Red-wing Blackbirds (O)
 Robins (O)
 Sparrow (O)
 Starlings (O)
 Swallows (C)
 Turkey Vultures (S)
 Woodpeckers (C)

Reptiles

Brown Snake (C)
 Eastern Painted Turtle (O)
 Garter Snake (C)
 Red-Bellied Snakes (C)
 Snapping Turtles (C)
 Water Snakes (C)

Amphibians*

American Toads (C)
 Bullfrogs (C)
 Green Frogs (C)
 Newts (C)
 Northern Leopard Frogs (C)
 Salamanders (C)
 Spring Peepers (C)
 Woodfrogs (C)

Mammals

Bats (C)

Beavers (H)
 Black Bear (O)
 Chipmunk (O)
 Cottontail Rabbits (H)
 Cougar (C)
 Coyotes (C)
 Deer (H)
 Eastern Grey Squirrels (O)
 Lynx (C)
 Mice (O)
 Minks (C)
 Moose (H)
 Muskrat (O)
 Porcupine (H)
 Raccoons (O)
 Red Foxes (O)
 Skunks (O)
 Snowshoe Hare (H)
 Vole (O)
 Wolves (C)

Fish

Bass
 Carp
 Minnows
 Pumpkinseed
 Rock bass
 Salmon
 Sticklebacks
 Trout
 Yellow Perch

HABITAT COMPONENTS

Dead Bark
 Fallen Leaves, Branches
 Holes
 Logs
 Pebbles
 Rocks
 Stones
 Trees (misc. conifers and/or deciduous)
 Vegetation (other)

*Most immature amphibians (ex. tadpoles) are herbivores



Sustainable Ecosystems Post-Zoo Activity, Grade 9

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NATURE AREA CREATION ACTIVITY

You have been hired as a consultant by the local school board to determine the feasibility of creating nature areas at some of the local schools. You would like to develop a draft plan for creating a nature area.

In groups of 4-5 you will develop a plan for creating a nature area at your school, by completing the following pages.

Name of Nature Area: _____ /1

Group Members: _____

Our nature area is (circle one): aquatic terrestrial aquatic and terrestrial /1

Species you would like to attract to the nature area

Remember that you are trying to make this realistic – use species that can be found in your general area (i.e., a wolf in downtown Toronto may not be realistic). The attached list is a suggestion only and you should not limit yourself to it.

Species of Producers in the Nature Area (list at least 4): /4

Species of Decomposers in the Nature Area (list at least 2): /2

Species of Consumers in the Nature Area – HERBIVORES (list at least 3): /3

Species of Consumers in the Nature Area – OMNIVORES (list at least 3): /3

Species of Consumers in the Nature Area – Carnivores (list at least 2): /2



Sustainable Ecosystems Post-Zoo Activity, Grade 9

Species of Scavengers in the Nature Area (list at least 1): /1

Habitat Components

These may be items that have already been included under species of producers and may also contain other vegetation and abiotic components (list at least 3). /3

Food Web

Use the attached pre-formatted sheet to create your food web using the species you have listed above. You may add to the sheet or omit some spaces – it is simply a starting point. Interspecies relations should be made evident by your food web. Use arrows showing the direction of energy consumption and use different colours to label your producers and consumers. /7

Public Use of the Area

List 2 measures that will be taken to ensure people do not interfere with the nature area ecosystem? /2

1. _____

2. _____

Maintenance of the Area

Although you are trying to create an ecosystem independent of humans, having Nature Areas in urban or suburban centres can cause issues. List 2 measures that will be taken to ensure that the area is maintained as a balanced ecosystem (example: garbage pick-up). /2

1. _____

2. _____



Sustainable Ecosystems Post-Zoo Activity, Grade 9

NATURE AREA FOOD WEB

**Scavengers and
Decomposers**

Carnivores

Omnivores

Herbivores

Producers

NATURE AREA CREATION ACTIVITY

You have been hired as a consultant by the local school board to determine the feasibility of creating nature areas at some of the local schools. You would like to develop a draft plan for creating a nature area.

In groups of 4-5 you will develop a plan for creating a nature area at your school, by completing the following pages.

NAME OF NATURE AREA: Green Forest High School Conservation Area (Toronto)* /1

Group Members: Julie Apple, Jimmie Orange, Jonathan Carrot, and Jennie Celery

Our nature area is (circle one): aquatic terrestrial aquatic and terrestrial /1

Species you would like to attract to the Nature Area

Remember that you are trying to make this realistic – use species that can be found in your general area (i.e., a wolf in downtown Toronto may not be realistic). The attached list is a suggestion only and you should not limit yourself to it.

Species of Producers in the Nature Area (list at least 4): /4

| | |
|-------------------|--------------------|
| <u>Algae</u> | <u>Wildflowers</u> |
| <u>Maple Tree</u> | <u>Grass</u> |
| _____ | _____ |
| _____ | _____ |

Species of Decomposers in the Nature Area (list at least 2): /2

| | |
|-----------------|-------|
| <u>Bacteria</u> | _____ |
| <u>Worms</u> | _____ |

Species of Consumers in the Nature Area – HERBIVORES (list at least 3): /3

| | |
|---------------------------|---------------------|
| <u>Cottontail Rabbits</u> | <u>Hummingbirds</u> |
| <u>Zooplankton</u> | <u>Aphids</u> |

Species of Consumers in the Nature Area – OMNIVORES (list at least 3): /3

| | |
|------------------------------|--------------------|
| <u>Robins</u> | <u>Chipmunk</u> |
| <u>Eastern Grey Squirrel</u> | <u>Pumpkinseed</u> |

Species of Consumers in the Nature Area – Carnivores (list at least 2): /2

| | |
|--------------------------|-------------------------|
| <u>Great Blue Herons</u> | <u>Red-Tailed Hawks</u> |
| <u>Ladybugs</u> | <u>Bullfrogs</u> |

*Note that this activity is for the most part open-ended and student directed, and that all answers will vary greatly.

Sustainable Ecosystems Post-Zoo Activity, Grade 9

Species of Scavengers in the Nature Area (list at least 1): /1

Turkey Vultures

Habitat Components

These may be items that have already been included under species of producers and may also contain other vegetation and abiotic components (list at least 3). /3

Logs (submerged)

Bark on the ground

Rocks

Cedar trees

Hole in the ground

Logs (above ground)

Food Web

Use the attached pre-formatted sheet to create your food web using the species you have listed above. You may add to the sheet or omit some spaces – it is simply a starting point. Interspecies relations should be made evident by your food web. Use arrows showing the direction of energy consumption and use different colours to label your producers and consumers. /7

Public Use of the Area

List 2 measures that will be taken to ensure people do not interfere with the Nature Area ecosystem? /2

1. A volunteer will walk by the area each day to ensure that nothing is disturbed.
2. A sign will be posted asking people to observe only and to respect nature.

Maintenance of the Area

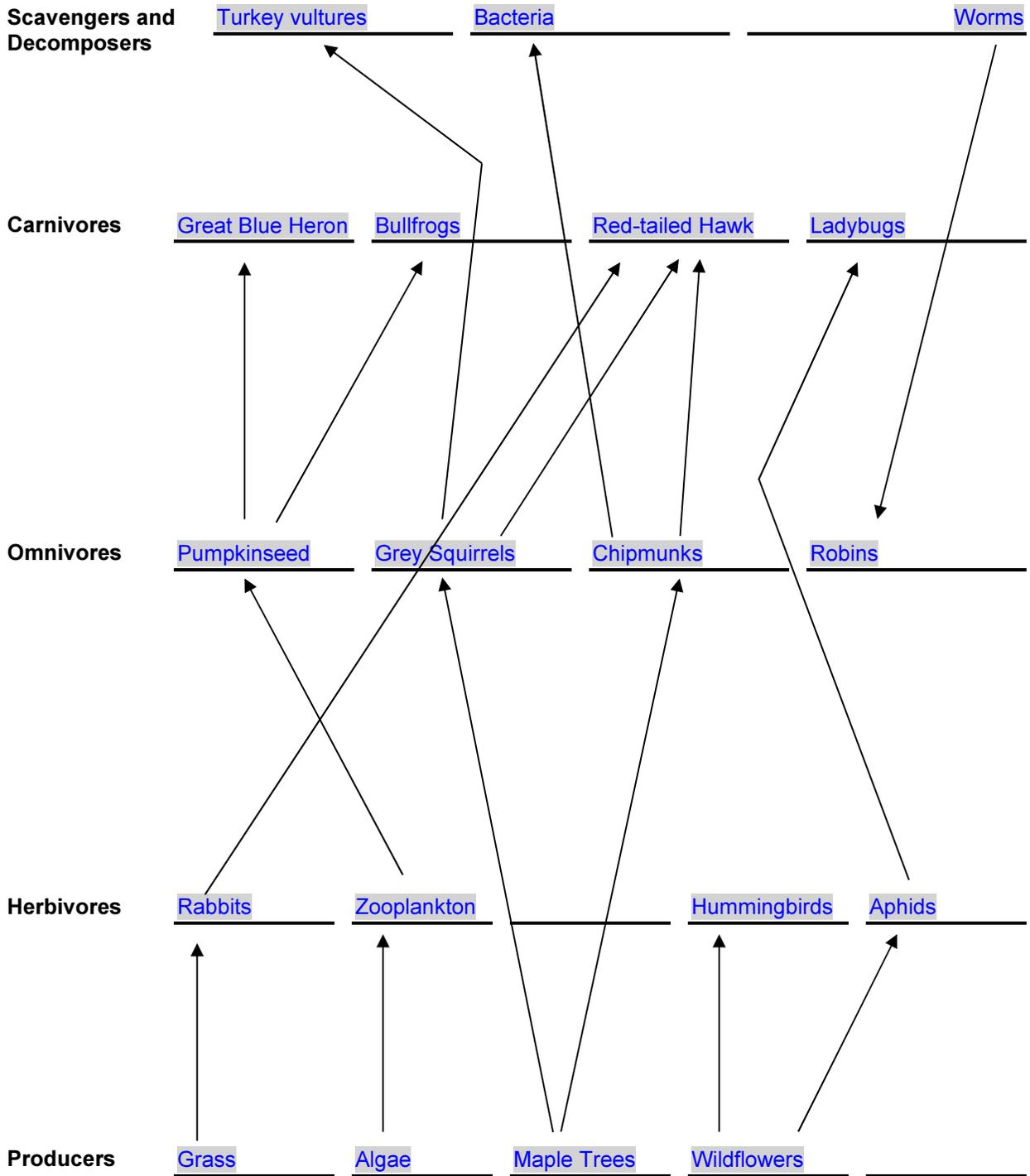
Although you are trying to create an ecosystem independent of humans, having Nature Areas in urban or suburban centres can cause issues. List 2 measures that will be taken to ensure that the area is maintained as a balanced ecosystem (example: picking up garbage). /2

1. A garbage can will be provided a short distance from the boundary of the Nature Area so that people will not pollute.
2. Each month 1-2 volunteers will take an observational inventory of the Nature Area and estimate the species population numbers and state.

*Note that this activity is for the most part open-ended and student directed, and that all answers will vary greatly.

Sustainable Ecosystems Post-Zoo Activity, Grade 9

NATURE AREA FOOD WEB



*Note that this activity is for the most part open-ended and student directed, and that all answers will vary greatly. Also, in this particular example note that the energy from the mortality of all consumers could potentially go to the decomposers.



Sustainable Ecosystems Zoo Activities, Grade 9

Student Activity Evaluation Form

Please let us know how useful you found these activities. When you return a completed evaluation to us we will send you an attractive poster.

Please return to:

Education, Toronto Zoo
361A Old Finch Ave.
Toronto, ON M1B 5K7
FAX: 416-392-5948

Date of visit: _____ Grade Level: _____

Subject: _____ Your Name: _____

School: _____

Activities Used: _____

Please rate the following on a scale of 1 to 5 : 1 poor; 2 fair; 3 satisfactory, 4 good, 5 excellent

1. The activities were appropriate for the curriculum. 1 2 3 4 5
2. The language level was suitable for your students. 1 2 3 4 5
3. The tasks were clearly explained and easily understood by the students. 1 2 3 4 5
4. Did you use this activity as part of your evaluation process for students? (Y / N)
5. Did you or will you be visiting the Toronto Zoo with your students? (Y / N)
6. Would you use these activities again? (Y / N)
7. How would you change the activity to be more useful?

8. Did you use any other Zoo teaching resource material? (Y / N) (What?)

9. Are there any other kinds of resources you would like the Zoo to provide to support your visit?

10. Do you have any other comments?