

Project Design Overview	
Name of Project: <b>Biome Energy Flow</b>	Duration: <b>2 days in quarter system</b>
Primary Subject/Course: <b>Science 10</b>	Grade Level: <b>10</b>

Project Details
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**Significant Content (curricular outcomes):**

**Unit D: Energy Flow in Global Systems.**

**Science, Technology, Society, and Knowledge General Learning Outcome #3: Relate climate to the characteristics of the world’s major biomes, and compare biomes in different regions of the world**

- 3.2 relate the characteristics of two major biomes (i.e., grassland, desert, tundra, taiga, deciduous and rain forest) to net radiant energy, climatic factors (temperature, moisture, sunlight and wind) and topography (mountain ranges, large bodies of water)
- 3.3 analyze the climatographs of two major biomes (i.e., grasslands, desert, tundra, taiga, deciduous and rain forest) and explain why biomes with similar characteristics can exist in different geographical locations, latitudes and altitudes
- 3.4 identify the potential effects of climate change on environmentally sensitive biomes (e.g., impact of a reduction in the Arctic ice pack on local species and on Aboriginal societies that rely on traditional lifestyles)

**Performing and Recording Skills**

- PR4 use library and electronic research tools to collect information on a given topic (*e.g., research sources of greenhouse gases; research protocols to control human sources of greenhouse gases*)

**Analysing and Interpreting Skills**

- AI2 identify and apply criteria for evaluating evidence and sources of information, including identifying bias (*eg. investigate the issue of global climate change*)
- AI3 interpret patterns and trends in data
- AI4 identify limitations of data, evidence or measurement
- AI5 state a conclusion based on experimental data, and explain how evidence gathered supports or refutes the initial hypothesis (*e.g., summarize an analysis of the relationship between human activity and changing biomes*)

**Communication and Teamwork Skills**

- CT4 identify multiple perspectives that influence a science-related decision or issue (*e.g., consult a wide variety of electronic sources that reflect varied viewpoints and economic, social, scientific and other perspectives on global warming and climate change*)
- CT5 develop, present and defend a position or course of action, based on findings (*e.g., a strategy to reduce greenhouse gas emissions caused by the transportation of*

people and goods)

Attitudes: Scientific Inquiry, Collaboration, Environmental Stewardship

**21<sup>st</sup> Century Competencies (to be taught and assessed):**

Collaboration

Communication

Critical Thinking

Creativity and Innovation

*Note: while creativity and innovation are not directly taught or assessed, they are encouraged through student choice in presentation and creative solutions to climate change problems.*

**Project Summary:**

In pairs, students will define the characteristics of two biomes, analyze their climatographs, identify potential effects of climate change, and propose solutions to any problems that may arise due to climate change.

**Driving Question:**

Considering the characteristics of any two of the world's major biomes that may exist in very different locations, how can we identify the effects of climate change and solve any problems that arise from them?

**Entry Event:**

Class discussion: Did you know that the Arctic tundra and Sahara deserts are related? How could forests in British Columbia be related to those in the Amazon?

Introduce biomes as a definition. How do you think that biomes can be described as an open system? Recall a cell is also an open system, how is a biome similar? Ask students to fill out a SEE-I strategy for describing a biome: State the definition, Explain it, Exemplify, and Illustrate with an analogy.

How can biomes with similar characteristics exist in different geographical locations? How can grasslands occur in the North American interior, in South America, and across Europe and Asia? Have students brainstorm ideas as these will help in their coming project.

Now instead of the teacher telling students about biomes, climatographs, and climate change, each student will work with a partner to find their own answers using the textbook and online resources.

**Products:**

Individual	Specific content and competencies to be assessed: None
Individual	Specific content and competencies to be encouraged/addressed: ● Collaboration and leadership

	<ul style="list-style-type: none"> <li>● Critical thinking, problem-solving, and decision making</li> <li>● Creativity and innovation</li> <li>● Environmental responsibility</li> <li>● Communication</li> <li>● Digital and technological fluency</li> </ul>
Team	<p>Specific content and competencies to be assessed:  STSK GLO #3  Communication and Teamwork Skills  Critical thinking marks assess Scientific Inquiry and Stewardship</p>

Public Audience:

Projects or images of the projects can be posted to the class website accessible through the school login.

Resources

On-site people, facilities:

Teacher/Instructor, Librarian, Library

Equipment:

Internet Access; computer, laptop, or tablet access; functioning printer

Materials:

Poster paper if desired

Online Resources:

<http://www.geoknow.net/pages/climategraphs.html>

Google or other search engine like Ecosia

Community Resources:

None required, Library optional

Reflection Method

Journal/Learning Log

Whole-class discussion

Survey

Focus Group

Notes:

Differentiate the entry event according to student interests.

Differentiate the grading scheme if students with exceptionalities require certain academic accommodations.

## **Science 10 Unit D Biomes Project**

**Driving Question:** *Considering the characteristics of any two of the world's major biomes that may exist in very different locations, how can we identify the effects of climate change and solve any problems that arise from them?*

### **#1. Characteristic information (/10 marks - individual)**

A) Choose any TWO (2) of the world's major biomes to investigate. Show this with a clear title and image or images (2 marks). The major world biomes are:

grassland, desert, tundra, taiga, deciduous forest, and rainforest.

B) Describe the characteristics of the two biomes including (8 marks):

- Net radiant energy
- Climatic factors (temperature, moisture, sunlight, wind, etc.)
- Topography (elevation, terrain, mountain ranges, large bodies of water, etc.)

### **#2. Climatographs (/6 marks - 4 individual, 2 group)**

**Individual:**

A) Search (2 marks): Use online resources to find climatographs of 2 areas within each of your chosen biomes. Searching for two particular cities' climatographs may be useful, such as with the following link:

<http://www.geoknow.net/pages/climategraphs.html>

B) Analyze (2 marks): What do the climatographs tell you about each biome?

**Group:**

C) Search, Think, and Answer (1 mark for direct answer, 1 mark critical thinking): How can biomes with similar characteristics exist in different geographical locations?

### **#3. Climate Change (/6 marks - group)**

A) Think and/or Search (4 marks): Identify the potential effects of climate change on each of your chosen biomes. Think about temperature, precipitation, sea levels, growing season, carrying capacity, local species, endangered species, Aboriginal peoples, etc. Your task is to objectively identify what the possible changes could be; not all effects are necessarily bad.

B) Possible Solutions (2 marks for direct answer, 2 marks critical thinking): How can we attempt to solve any problems that arise from the potential effects of climate change in the two different biomes of your choice? Which biome is impacted the most?

### **#4. Communication Skills (/5 marks - 2 group, 2 individual)**

**Group:** The clearly communicated presentation is easily understood with neatness, syntax, and clarity (1 mark). The format is your choice but some ideas include: essay, poster, video, song, PowerPoint, skit, or class presentation. A bibliography of multiple sources consulted, such as websites and your textbook (1 mark).

**Individual:** Reflection forms must be filled out (1 mark).

Participation in the class discussion about which of earth's biomes is being affected most by global warming (1 mark).

## Textbook Reference

Sandner, L., Schaeffer, H., Lacy, D., & Sosnowski, C. (2004). *Science 10*. Ontario: Addison Wesley, Pearson Education Canada Inc.

## Textbook Quotes

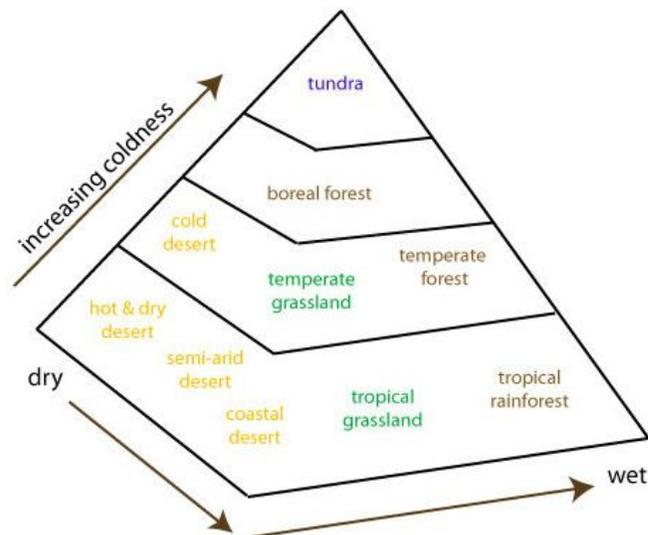
Page 367: “net radiation budget = incoming radiation – outgoing radiation”

Page 368: “Net Radiation Budget and Latitude Although the net radiation budget is balanced for Earth as a whole, some regions on Earth have an unbalanced net radiation budget. Latitude is an important factor in predicting whether the net radiation budget of a region will be out of balance.”

Page 391: “Biomes function as a system, or a set of interconnected parts. The surroundings of a system is everything that is outside the system. Any system that exchanges matter and energy with its surroundings is an open system. Biomes are open systems because they exchange both matter and energy with their surroundings.”

## Know the graph on page 400 for tests! Figure D 2.40 is IMPORTANT!

Page 400: “The climate of each of Earth’s biomes plays a major role in determining the plants and animals that can survive in a region, and the types of adaptations they need. Figure D2.40 summarizes the relationship between the six biomes and average temperature and precipitation. On the horizontal axis, precipitation levels increase from left to right. On the vertical axis, temperature levels increase from bottom to top. Each biome is placed on the graph according to its average yearly precipitation and temperature range.”



### **Reflection Survey for Unit D Biome Project**

During your project working time, what was the **LEAST** useful piece of information you found?

During your project working time, what was the **MOST** useful piece of information you found?

Rank the following categories from **LEAST** to **MOST** interesting or valuable to you:

- biome characteristics
- climatographs
- climate change
- computer research
- putting together the final product
- working in partners

The attitude outcome of **stewardship** says students will “demonstrate sensitivity and responsibility in pursuing a balance between the needs of humans and a sustainable environment.”

How well did this project address this outcome for you?

How well were you able to work on your **communication, critical thinking, and collaboration** skills during this project?

## Assessment Marking Sheet: Biomes Project

### Individual mark

Name: \_\_\_\_\_ Biome: \_\_\_\_\_

#### #1. Characteristic information (/10 marks)

- /1 Project has clear subtitle for student's biome
- /1 Project has relevant images of selected biome
- /1 Net radiant energy described
- /4 Climatic factors (temperature, moisture, sunlight, wind, etc.)
- /3 Topography (terrain, mountain ranges, large bodies of water, etc.)

#### #2. Climatographs (/4 marks)

- /2 Climatographs (two locations within chosen biome)
- /2 What does the climatograph tell you about your biome?

### Group mark

Partners: \_\_\_\_\_ Other Biome: \_\_\_\_\_

#### #2. Climatographs (/2 marks)

- /1 How can biomes with similar characteristics exist in different locations?
- /1 Critical thinking exemplified

#### #3. Climate Change (/10 marks)

- /4 Four potential effects of climate change identified
- /4 Solutions for any problems of climate change
- /2 Critical thinking exemplified

#### #4 Communication (/2 marks)

- /1 neatness, organization, clarity
- /1 bibliography

### Individual mark

#### #4 Communication (/2 marks)

- /1 reflection form
- /1 participation in class discussion: "Which of earth's biomes is being affected most by global warming?"

/30 total = \_\_\_\_\_ %