United Nations Educational, Scientific and Cultural Organization

MOUNT ARROWSMITH BIOSPHERE REGION

BIOSPHERE BOOKLETS

Lesson Plans & Activities

SUSTAINABLE CITIES

SUMMARY/OVERVIEW

Grades:	Prep Time:	Learning Environment:	Total Lesson Length:
3-5	20 Mins	Indoor	5 Hours

DESCRIPTION:

This booklet introduces the concept of five sustainability themes to students (energy, food, waste, nature, transport), and discusses the importance of these concepts within everyday life. Students will create their own 2-D model of their sustainable city, with the option of creating a 3-D model utilizing information given. Note: the 3-D model and tour can be taken out for a shortened activity.

CURRICULUM EXPECTATIONS:

Processing and analyzing data and information:

- Experience and interpret the local environment
- Sort and classify data and information using drawings or provided tables

Applying and innovating:

- Contribute to care for self, others, and community
- Transfer and apply learning
- Generate new and refined ideas when problem solving

BACKGROUND:

Sustainable cities (also called urban sustainability) are designed with consideration for social, economic, environmental impact (commonly referred to as the triple bottom line), and resilient habitat for existing populations, without compromising the viability of future generations. They are committed to achieving sustainability through design and technology.

LESSON PLAN

TIME	ACTIVITY	LOCATION	MATERIALS
1 Hour	1. Introduction	Indoor	Printed worksheets
1 Hour	2. Designing a 2-D Model	Indoor	Checklist & drawing materials
2 Hours	3. Creating a 3-D Model	Indoor	Materials for 3-D model
1 Hour	4. City Tour and Charter (Optional)	Indoor	Blank paper
15 Mins	5. Conclusion	Indoor	N/A

TIME	ACTIVITY	LOCATION	MATERIALS
1 Hour	1. Introduction	Indoor	Printed worksheets

Introduction: What is a Sustainable City?

GOAL: Provide students with the understanding of how sustainability can be included in city planning.

PREPARATION: Print page 3.

LESSON PLAN:

INTRODUCTION: Initial Discussion

1. Ask students if they have heard the term **"sustainability"** before. If not, explain that it refers to a balance between using natural resources at a rate that does not deplete them, in order to not compromise the natural resources available for future generations.
2. Ask students to name **sustainable measures** they have seen before *(wind turbines, recycling bins, etc.)*
3. Hand out the **SUSTAINABILITY FACT SHEET** (page 3). Review the sheet and ensure students understand the 5 sections that must be supported in a city.
    a. Explain terms:
        i. Renewable/non-renewable - a renewable resource can replenish itself in a finite amount of time, while a non-renewable resource has a limited supply.
        ii. Pollution - is the introduction of harmful materials into the environment. There are many types of pollution such as air, noise, water, light and soil pollution.
4. Have students brainstorm ways that cities can address these issues (either individually or in teams).

HANDS ON: Planning Session

5. Give each team the **CITY PLANNING WORKSHEET** (page 4 and 5). Have them brainstorm ideas on how their city will consider each of the five (5) issues.
   (Refer to fact sheet)
6. OPTIONAL: If available in class they can research ways other cities have implemented sustainable measures, OR they can research methods at home for homework.

Sustainability Fact Sheet

ENERGY

- Most of the world uses non-renewable resources such as oil and coal. These resources create high amounts of CO_2 emissions and contribute to global warming.
- Canada is the world's fourth largest producer of natural gas (non-renewable), and also the second largest producer of hydroelectricity (renewable).
- 67% of Canada's electricity comes from renewable sources, and close to 95% of British Columbia's electricity is renewable. This means less CO_2 emissions.

FOOD

- It is predicted that global food production will need to increase by up to 70% by 2050 to meet the needs of the rising population.
- The cost of transporting food will increase due to climate change and oil prices, so we'll need to grow more food on plots within or closer to our cities.
- People will need to grow more of their own food and waste less food than they do currently.

NATURE

- As global population increases and our cities grow in size, there is a decrease in green spaces in and around our cities.
- How our landscapes connect with large areas of concrete and asphalt can make it really difficult for animals of all shapes and sizes to get around.
- Natural areas in cities reduce pollution and reduce temperature, which means residents will need to use less air conditioning (electricity).
- Cities that have a lot of natural areas have better air quality, lower noise pollution, and happier residents.

TRANSPORT

- People who travel into cities for work are spending more time commuting. This leads to problems including stress, isolation, and obesity.
- In Canada, cars produce about one-third of all Canadian air pollution.
- In 2016, only 33% of Canadians used a mode of sustainable transportation such as buses and bicycles.

WASTE

- A recent study stated that Canadians produce more waste per capita than any other country
  - Approximately 31 million tons of garbage every year
  - Only about 30% of that is recycled
- Canada has over 2,400 landfill sites across the country.
- Paper takes up well over 40% of landfill space. Newspapers alone average about 13% (both of which are recyclable).

City Planning Sheet

You have just been elected mayor to a new city and your job is to plan the city in a sustainable way. This means your sustainable city must include plans to produce **energy**, provide your citizens with **food**, minimize **waste**, **transport** people around the city, ensure there are lots of **natural** areas, and also ensure your citizens are happy and healthy. Use the questions below to help guide you in planning your city.

1. **Energy** – All of the devices we use today use a lot of energy. We now know that resources like oil and coal are unsustainable. **Brainstorm ways you can power your city sustainably**!

Think about possible renewable energy sources, how to stop using non-renewable energy, how energy can be produced in the city, how people can use less energy, etc.

2. **Food** – Our food production and consumption methods are unsustainable. We often transport food long distances which pollutes the environment, and we throw away lots of food. **How and where will you grow enough food for your citizens? How will you reduce food waste in your city?**

Think about ways to encourage people to buy locally, to grow their own food. What would your city look like if it grew its own food?

Planning sheet originally designed by the Architecture Centre (www.architecturecentre.co.uk)

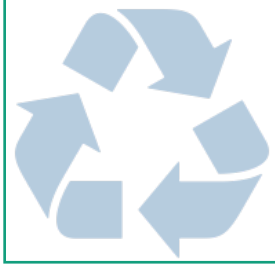
3. **Nature** – Our planet and people need plants and animals to survive. Consider why you might need different plants and animals in your city. **How will you make sure nature is encouraged in your city?**

Think about how you will get nature into the city. How can parks and nature areas fit together? What do animals and plants need to be happy? How do the nature areas in the city interact with the areas outside of the city?

4. **Transport** – Having too many cars on the road pollutes the environment and causes traffic and noise, which is frustrating to your citizens. Transportation may include cars, buses, trains and trams, boats, as well as walkways for pedestrians and lanes for cyclists. You need to make sure a perfect balance of each. **How will you help your citizens move around the city?**

Think about modes of transportation besides cars. What do other forms of transportation need to get around easily? What makes you want to take the bus or ride your bike? What method of transportation should be prioritized, or should all methods be focused on?

5. **Waste** – Waste in landfills decomposes and produces harmful gases which contribute to global warming. Landfills also pollute the local environment through the water, soil, and air. **How will you encourage your city to reduce their garbage?**



Think about what are alternatives to throwing something in the garbage. What else can be done with products people don't want anymore? How would you motivate people to change?

TIME	ACTIVITY	LOCATION	MATERIALS
1 Hour	2. Creating a 2-D City Plan	Indoor	Drawing materials

Creating a 2-D City Plan

GOAL: Have students incorporate 5 sustainability themes into a scaled drawing of their city plan.

PREPARATION: Ensure students have paper (graph paper if available), pencils, a ruler, eraser, and pencil crayons. Page 7 can be printed for the students to use as a worksheet.

LESSON PLAN:

Necessary

- Energy Sources
- Recycling Center
- Food Growing areas
- Natural Spaces
- Transportation facilities
- Houses

Other Ideas

- Restaurants
- Bank
- Hospital
- Police Station
- Fire Station
- Movie Theatre
- Factories
- Grocery Stores
- Factories
- Library

PLANNING: Initial Discussion (30 minutes)

1. Ask students to review their city plan from previous activity.
2. Have students determine what buildings and areas they think are essential for their city. See boxes to the right for some helpful hints.
    i. If students are going to create a 3-D model (activity 3), ask them to choose what they want to include carefully, as time and materials may not allow students to have a large city.
3. Introduce students to creating a **scale drawing** (e.g. a house not being larger than a recycling centre) of buildings, along with **how to make a legend**. The legend should show the types of buildings in their city plan, based on what they have decided to include in their city.

HANDS ON: Drawing Scaled 2-D City Plan (30 minutes)

4. Have students work together or individually to create the 2-D drawing of their sustainable city along with a name for their city. If working in a group, students can draw areas individually, cut them out, and secure to the final city plan.
    i. Start by "zoning" areas (space for the houses, where roads will go, etc.) by outlining, colour coding, or other methods. Again, ensure the necessary elements are incorporated in the drawing.
    ii. If there is space, students may then add other ideas into the 2-D model.

City Name: _____

TIME	ACTIVITY	LOCATION	MATERIALS
2 Hours	3. Creating a 3-D Model	Indoor	See list below

Creating a 3-D Model

GOAL: Have students incorporate 5 sustainability themes into a 3-D model of a sustainable city.

PREPARATION: Gather necessary materials. Students can also bring materials from home.

MATERIAL IDEAS: Glue, paper, markers, cardboard, paper towel rolls, construction paper, tape, plastic containers. *Use recycled materials when possible.*

LESSON PLAN:
HANDS ON: Creating the 3-D Model

1. Gather students back into their groups (if applicable), ask them to review their 2-D design and collect materials they need to create their 3-D model.

2. Students should follow their 2-D design plan; however, they may not be able to fit everything in. Ensure they include an example of energy, food, natural areas, transport, and waste collection.
    I. Starting with a flat sheet of cardboard as the city base, students can map out roads and place buildings and other elements in the city (creating them from recycling products and securing them to the base).
    II. Some examples include creating a wind turbine from straws, houses from a small cardboard box, or trees from cardboard tubes.
    III. Students may draw a building on paper, cut it out and secure it to the base of the city.
    IV. If you want to use templates of different forms of buildings students can cut out, download the "Templates for City Building" PDF from the MABR Teaching Resources Page
    V. For more ideas, please visit the following links:
        i. https://www.youtube.com/watch?v=VqwSHTOpvOY
        ii. https://www.youtube.com/watch?v=HyBG0OFYY80
        iii. https://www.pinterest.ca/pin/205687907953801293/
        iv. https://i.pinimg.com/originals/b6/35/ea/b635eacc17ce4d3a75789c8ee7cfb4e0.jpg

3. Depending on time available – this activity may need to be broken up into two sessions.

TIME	ACTIVITY	LOCATION	MATERIALS
1 Hour	4. City Tour and Charter	Indoor	Paper

City Tour and Charter (Optional)

GOAL: Have students review what they have learned and create a city charter that reflects each of the sustainability themes in their city. They also will have the opportunity to share their cities with the class by taking them on a "city tour."

PREPARATION: None

LESSON PLAN:

Planning Session: Creating a City Charter

1. Ask students to review their city plans (and 3-D model if applicable) and think of how their population might live in the city. Can they remember the meaning of sustainability?
2. Ensure they remember the 5 sustainability themes their cities address *(Energy, Food, Nature, Transport, and Waste)*.
3. Introduce students to the idea of a charter, explain that this document will be put together for their city's inhabitants to follow.
    I. A charter is a written grant by a country's legislative power, by which a body such as a city is founded, and its rights and privileges defined. Example: Canada's Charter of Rights and Freedoms.
4. Look again at the 5 sustainability themes, and have each group create one goal per sustainability theme for their city (e.g., CITY NAME will be the first city to use 100% renewable energy).

Presentation Session: Presenting the Charter and Giving a "Tour" of their City

5. After they have completed their city charters, they are ready to present.
6. For the presentation, students will announce their city's name, charter, and take the rest of the class on a "city tour". Students will verbally walk the class through their 2-D or 3-D model of their city and highlight the 5 areas that address the themes in their planning document.

Conclusion

Wrap-Up Discussion (15 mins)

1. Ask students what sustainability means to them now.
2. Have students reflect on their experience of designing a sustainable city.
   Consider asking:
   a. What was their favourite part of designing a sustainable city?
   b. What were some of the challenges?
   c. How could their own community make changes to be more sustainable?

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Show us your results! Snap a picture and share it with us on social media,
or email it to the MABR Coordinator at
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