JR HIGH

FOREST INVENTORY

Inside education

MY COMMUNITY FOREST

NAME:

FIELD JOURNAL

SECTION 1

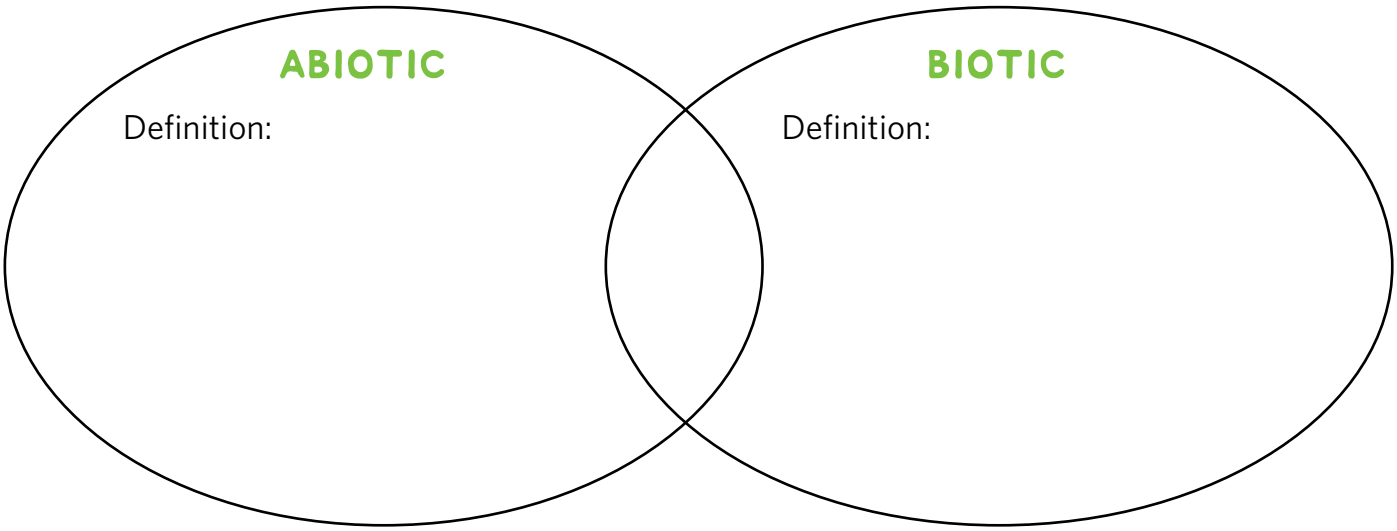
GET TO KNOW YOUR COMMUNITY FOREST

SITE ASSESSMENT

Look around you and use the table to indicate the study area and conditions.
Use the *anemometer* to measure the temperature and wind speed.

Natural Region	Weather conditions	Sources of Water	Type of Disturbance	Forest Type
☐ Canadian Shield ☐ Boreal Forest ☐ Aspen Parkland ☐ Grasslands ☐ Foothills ☐ Rocky Mountains	☐ Clear Sky ☐ Partial Cloud ☐ Overcast ☐ Precipitation *(rain/snow/other)* _____ Temperature: _____C Wind: _____m/s	☐ Creek ☐ Storm pond ☐ Wetland ☐ Lake ☐ Other: _____	☐ Fire ☐ Wind ☐ Heavy foot traffic ☐ Insects/ disease ☐ Flooding ☐ Other: _____	☐ Few individual trees spread far apart ☐ Trees in spread out clumps ☐ Large area of continuous forest ☐ Deciduous ☐ Coniferous ☐ Mixedwood ☐ Young ☐ Mature

In the diagram below, define abiotic and biotic, and then make a list of the elements of each that you see in the ecosystem.



In your lists above, underline the elements that have been put there by humans.

What level of human influence do you think there is in the ecosystem you are in? *(circle below)*

NONE **LOW** **SOME** **HIGH**

SECTION 2

FROM THE GROUND UP

SOIL HEALTH

Soil plays a critical role in our ecosystems - it makes nutrients available for plants, helps plants stay rooted, provides habitat for important fungi, bacteria, insects and more! Foresters, scientists, researchers and others examine soil to learn more about the health and history of the sites they're working in.

Through a series of observations and measurements, we will determine the quality of our soil, its ability to grow plants and support forest ecosystems.

SKIMMING THE SURFACE

Go for a walk around your site and observe the ground.
Rate each of the following elements of soil quality on the following scales.

Compaction or erosion:
High human usage — Low human usage

Moisture:
Very wet OR Very dry — Moist

Suitability for plants:
Low plant diversity — High plant diversity

Organic material:
Little organic material *eg. leaves, sticks* — Lots of organic material

Nutrients and minerals:
Light in colour — Dark in colour

Did you notice anything else? Write down any other observations here:

What is your impression of soil quality on your site? Why?

SECTION 2 FROM THE GROUND UP

WHAT NUTRIENTS ARE FOUND IN SOIL?

Like humans, plants require nutrients in order to grow and develop. Plants typically absorb nutrients found in the soil through their roots that get distributed to the rest of the plant

We are going to test the soil for specific plant nutrients: nitrogen, phosphorus and potassium *(NPK)*.
We will also test the pH of the soil.

One person/group in your class can use the *trowel* to dig up about 1 cup of soil and remove any debris.

Put the soil in the *bag* from your kit and bring it back to the classroom.

SOIL TESTING

Use the soil *test kit* and the following instructions to test your soil for pH and the three nutrients.
The 4 tests are colour coordinated as shown below:

GREEN - pH test	**PURPLE** - nitrogen (**N**) test
BLUE - phosphorous (**P**) test	**ORANGE** - potassium (**K**) test

step 1 From the 1 cup of soil you collected

1. Use approximately **¼ tsp** to fill to the soil line on the **pH test chambe**r *(skinnier chamber - see Figure)* — If you want to conduct more than 1 pH test, reserve soil for these.
2. With the rest of the soil, create a solution of **1 part soil : 5 parts distilled water** in a clean container *(the amount of soil does not matter as long as the ratio is correct)*. This solution will be used in Step 2 for the N,P and K tests.

step 2 N, P and K Tests

1. Stir/shake the soil and distilled water solution for at least **1 minute.**
2. Allow the mixture to sit undisturbed until it settles. This can take anywhere from **30 minutes** to **24 hours** depending on the particle size of your soil sample *(more clay means longer settling time)*.
3. Once the solution has settled *(the solution may still be cloudy and that's ok)*, select the soil test that you want to conduct.
4. With the dropper provided, fill the test and reference chambers with the water from the solution - avoid disturbing the sediment at the bottom.
   - The reference chamber is filled so that any discolourations in your water can be taken into account in the colour chart.
5. Take a test capsule of the **same colour** as your test container. Holding the capsule horizontally above the test chamber, separate the two halves. If the capsule will not open, use scissors to cut a small hole in one end and pour powder out.
6. Put the lid back on the test container, make sure it is sealed. Shake thoroughly.
7. Set a timer for **10 minutes** - the colour in the solution should not be allowed to develop for any longer.
8. If flakes of the **BLUE** colour have settled to the bottom of the **phosphorous test container**, shake the container to suspend in the solution.
9. If flakes of the **ORANGE/BROWN** accumulate at the top of the solution in the potassium test, **DO NOT** reshake the container. Just read the colour of the solution as is.
10. Compare the colour of the solution to the colour chart. For best results, do this in daylight *(not direct sunlight)* to illuminate the solution in both chambers.
11. Follow the above steps for each of the nutrient tests.

step 3 **pH test (GREEN)**

1. Fill test chamber to soil fill line.
2. Take a **GREEN** test capsule. Holding the capsule horizontally above the test chamber, separate the two halves. If the capsule will not open, use scissors to cut a small hole in one end and pour powder out.
3. Using the dropper provided, add distilled water to the water fill line of both chambers.
4. Cap the container and ensure it is sealed. Shake thoroughly.
5. Allow the soil to settle and the colour to develop for about a **minute.**
6. Compare the colour of the solution to the colour chart. For best results, do this in daylight *(not direct sunlight)* to illuminate the solution in both chambers.

Record your results in the table below

Variable	Test result
pH	
nitrogen (N)	
phosphorous (P)	
potassium (K)	

WHAT DO YOUR RESULTS MEAN?

PH:
A high pH indicates alkaline soil, low pH indicates acidic soil and 7 is neutral in pH. Different plants prefer or are able to tolerate different soil pH levels.

PHOSPHORUS:
This nutrient supports plant reproduction. If your soil is low in phosphorus, plant leaves may become purple.

NITROGEN:
This is an important plant nutrient that supports plant growth, metabolism of sugars and the creation of chlorophyll. If your soil is low in nitrogen, this may result in stunted growth or yellowing plant leaves.

POTASSIUM:
This nutrient helps plants defend themselves against pests and disease. A plant low in potassium may have white spots on its leaves.

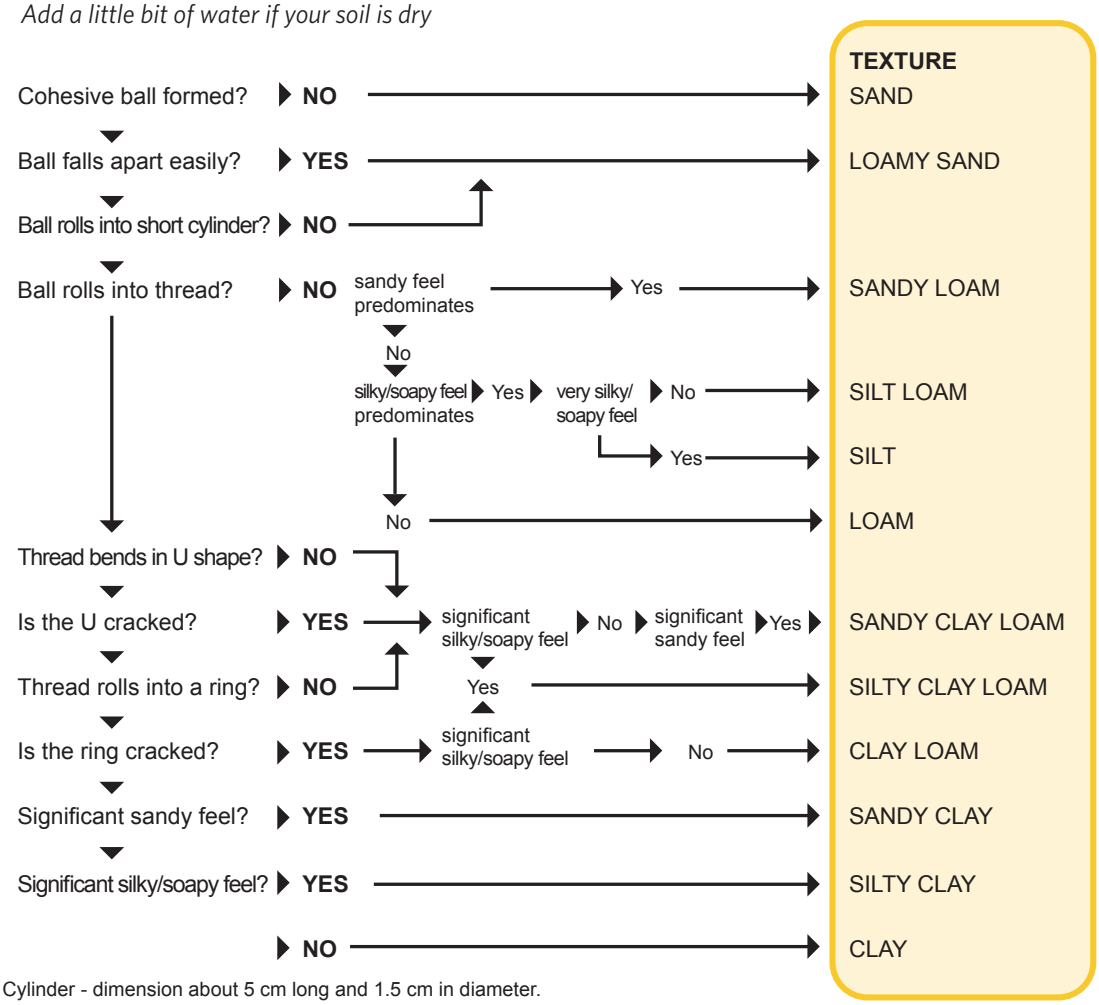
Take a look at the plants in your area. Do you see any indicators of plant nutrient deficiencies?

HOW WELL CAN WATER MOVE THROUGH THE SOIL ?

Soil is made up of a combination of different sized mineral particles - sand, silt and clay. The mixture of these particles make up soil texture. Soil texture can help us understand how well water is held or moves through the soil. Soils that are more sandy drain water well, while soils that have more clay content can hold water really well - sometimes, too well!

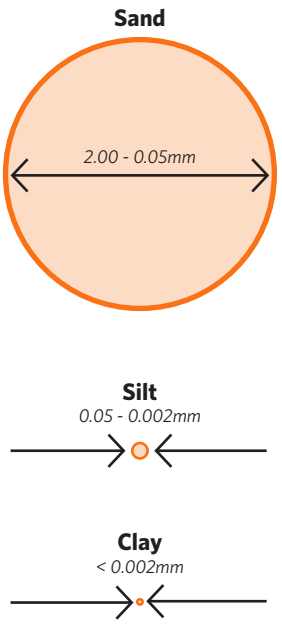
Take a small handful of soil from your study site. Follow the instructions in the chart below to determine the texture of your soil. Circle the texture you determine for your soil on the diagram.

Start with a 2.5 cm diameter mass of soil that is sticky enough to adhere to fingers.
Add a little bit of water if your soil is dry



Cylinder - dimension about 5 cm long and 1.5 cm in diameter.
Thread - about 13 cm long and 0.6 cm in diameter.
Ring - a circle about 2.5 cm in diameter formed from an 8 cm section of thread.

PARTICLE SIZE COMPARISON



*Note: Loam is soil that is a mixture of almost equal parts sand, silt and clay.

Based on your observations, nutrient tests and soil texture, how well suited for plants is your soil? What types of plants do you think would do well in the soil of your site?

SECTION 3

ANIMAL DIVERSITY

Soil provides nutrients for plants, and plants provide nutrients for animals, but what are some other things that animals require for survival? In this section, we are going to assess how well your site is suited for different types of wildlife.

Step 1: Complete the habitat checklist.

Step 2: Choose a species from the ***Wildlife Species Cards*** and record the species name: _____

Step 3: Read the card and complete the species needs checklist.

HABITAT ELEMENT	HABITAT CHECKLIST *Are these elements present at your field site?*	SPECIES NEEDS CHECKLIST
Shrubs	☐	☐
Coniferous trees	☐	☐
Deciduous trees	☐	☐
Agricultural field	☐	☐
Natural grassland /meadow	☐	☐
Pond/Lake	☐	☐
Wetland	☐	☐
River/Stream	☐	☐
Rocky areas/cliffs	☐	☐
Mountains	☐	☐
Human-made park *(cleared land, trails, benches)*	☐	☐
Buildings	☐	☐
Roads	☐	☐
	☐	☐
	☐	☐

Is your site a good habitat for the species you selected? YES / NO

Look around - do you see any evidence of wildlife? What species do you think might live in your forest?

SECTION 4

PLANT USES

Knowing the size and species of tree can tell us a lot about how humans might use the tree. We are going to focus on forestry products that we might make from trees native to Alberta that are found on our site.

Choose a tree you would like to study.

Coniferous OR Deciduous

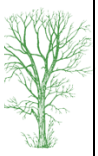
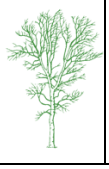
(Circle ONE)

Cones
Needleleaf
Evergreen

Loses Leaves,
Broadleaf,
Flowers, Catkins,
or Fruit

COMMON ALBERTA TREE SPECIES

Use the chart below to decide which of the Alberta tree species is most like yours. You can confirm your answer using the ***Guide to Common Native Trees and Shrubs of Alberta.***

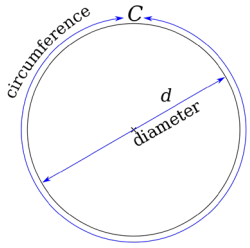
☐ **Black Spruce** *or* **White Spruce**		Cones Needleleaf Single Needles Square Needles
☐ **Lodgepole Pine** *or* **Jack Pine**		Cones Needleleaf Needle Pairs
☐ **Balsam Fir**		Cones Needleleaf Single Needles Flat Needles
☐ **Tamarack/ Larch**		Cones Needleleaf Clustered Needles
☐ **Balsam Poplar**		Broadleaf Alternate Fine Curved Teeth Oval Shape
☐ **Aspen Poplar**		Broadleaf Alternate Fine Curved Teeth Ovate Shape
☐ **White Birch**		Broadleaf Alternate Coarse Teeth Ovate Shape

TREE MEASUREMENTS

Measuring Diameter

Imagine the trunk of a tree cut horizontally through the middle as a flat circle. The diameter of a tree trunk is the distance across that circle. This is hard to measure on a living tree, so instead we can measure the circumference of the tree, and use a mathematical formula to calculate the diameter.

Foresters use a tool called a diameter tape that eliminates the need to do this math in the field because the calculations are built in!



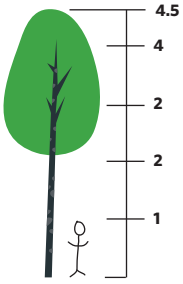
1. **Wrap the *string* all the way around the tree at 1.3m above the ground. Mark where the string meets itself.**
2. **Measure the marked length using a metre stick or measuring tape. This is your *circumference*.**
3. **Follow the formula to calculate *diameter* .**
4. **Record your answers in the table below.**

$$C = \pi d$$

$$d = \frac{C}{\pi}$$

Measuring Height

Measuring the height of a tree is no easy task. Unless you have a special tool, it is easier to estimate the height of a tree using your partner as a reference.



1. **Find a partner and measure their height in meters.**
2. **Have your partner stand next to the tree, and move back far enough so you can see the top and bottom of your tree easily.**
3. **Estimate how many times your partner could fit into the height of the tree.**
4. **Complete the calculation and record the estimate the height of your tree.**
5. **Record your answers in the table below.**

Diameter calculation	
Circumference	_____ cm
Diameter = circumference / π	_____ cm / π = _____ cm

Height Calculation	
Height of my partner	_____ m
Number of times my partner fits into the height of the tree	
Tree height = Height of partner x Number of times they fit into tree	_____ m x _____ = _____ m

VOLUME OF WOOD

Using the height and diameter we calculated, we can now estimate the volume of a tree. Foresters use species specific *Tree Volume Tables* to figure out tree volumes. To simplify, we have provided you with only Deciduous and Coniferous tables.

To estimate the volume of your tree, select the appropriate table *(Deciduous or Coniferous)*.
Find your Tree Height row and Diameter column and see where they meet up. This is your volume.

Volume of wood: _____m³

Deciduous
Individual Tree Volume in m³

Total Tree Height (m)	Diameter (cm)							
	1.1 - 11.0	11.1 - 21.0	21.1 - 31.0	31.1 - 41.0	41.1 - 51.0	51.1 - 61.0	61.1 - 71.0	71.1 - 81.0
3.1 - 5.0	0.0047	0.0315	0.0785	0.1435	0.2254	0.3247	0.4422	0.5794
5.1 - 7.0	0.0071	0.0491	0.1230	0.2240	0.3490	0.496	0.6639	0.8525
7.1 - 9.0	0.0096	0.0667	0.1679	0.3060	0.4755	0.6723	0.8935	0.1368
9.1 - 11.0	0.0121	0.0844	0.2131	0.3889	0.6042	0.8527	1.1297	1.4312
11.1 - 13.0	0.0146	0.1021	0.2584	0.4724	0.7342	1.0358	1.3704	1.7326
13.1 - 15.0	0.0171	0.1198	0.3039	0.5563	0.8652	1.2206	1.6142	2.0389
15.1 - 17.0	0.0196	0.1375	0.3495	0.6405	0.9968	1.4068	1.8603	2.3487
17.1 - 19.0	0.0221	0.1553	0.3952	0.7249	1.1290	1.5938	2.108	2.6612
19.1 - 21.0	0.0246	0.1730	0.4408	0.8094	1.2615	1.7818	2.3570	2.9756
21.1 - 23.0	0.0270	0.1908	0.4866	0.8940	1.3942	1.9702	2.6069	3.2915
23.1 - 25.0	0.0295	0.2085	0.5323	0.9788	1.5272	2.1590	2.8576	3.6087
25.1 - 27.0	0.0320	0.2263	0.5781	1.0636	1.6604	2.3482	3.1090	3.9269
27.1 - 29.0	0.0345	0.2441	0.6239	1.1485	1.7937	2.5377	3.3608	4.2459
29.1 - 31.0	0.0370	0.2619	0.6697	1.2334	1.9272	2.7274	3.6131	4.5656
31.1 - 33.0	0.0395	0.2796	0.7156	1.3184	2.0607	2.9173	3.8657	4.8858
33.1 - 35.0	0.0420	0.2974	0.7614	1.4034	2.1944	3.1074	4.1187	5.2066
35.1 - 37.0	0.0445	0.3152	0.8073	1.4885	2.3281	3.2977	4.3718	5.5277
37.1 - 39.0	0.0470	0.3330	0.8531	1.5736	2.4619	3.4881	4.6253	5.8492

Coniferous
Individual Tree Volume in m³

Total Tree Height (m)	Diameter (cm)							
	1.1 - 11.0	11.1 - 21.0	21.1 - 31.0	31.1 - 41.0	41.1 - 51.0	51.1 - 61.0	61.1 - 71.0	71.1 - 81.0
3.1 - 5.0	0.0048	0.0306	0.0772	0.1470	0.2453	0.3799	0.5609	0.8009
5.1 - 7.0	0.0074	0.0479	0.1193	0.2212	0.3563	0.5295	0.7476	1.0189
7.1 - 9.0	0.1000	0.0654	0.1625	0.2982	0.4725	0.6879	0.9482	1.2588
9.1 - 11.0	0.0126	0.0831	0.2066	0.3774	0.5935	0.8548	1.1631	1.5214
11.1 - 13.0	0.0152	0.1009	0.2512	0.4583	0.7178	1.0279	1.3883	1.8000
13.1 - 15.0	0.0178	0.1188	0.2962	0.5402	0.8446	1.2055	1.6209	2.0902
15.1 - 17.0	0.0205	0.1368	0.3415	0.623	0.9731	1.3863	1.8589	2.3887
17.1 - 19.0	0.0231	0.1548	0.3870	0.7063	1.1030	1.5696	2.1011	2.6937
19.1 - 21.0	0.0257	0.1728	0.4326	0.7901	1.2338	1.7549	2.3465	3.0037
21.1 - 23.0	0.0284	0.1908	0.4784	0.8743	1.3655	1.9416	2.5944	3.3177
23.1 - 25.0	0.0310	0.2089	0.5243	0.9588	1.4978	2.1296	2.8445	3.6348
25.1 - 27.0	0.0337	0.2270	0.5702	1.0435	1.6307	2.3186	3.0962	3.9547
27.1 - 29.0	0.0363	0.2451	0.6163	1.1284	1.7640	2.5084	3.3494	4.2768
29.1 - 31.0	0.0389	0.2633	0.6624	1.2135	1.8977	2.6990	3.6038	4.6007
31.1 - 33.0	0.0416	0.2814	0.7086	1.2988	2.0318	2.8901	3.8592	4.9263
33.1 - 35.0	0.0442	0.2996	0.7548	1.3842	2.1661	3.0818	4.1155	5.2532
35.1 - 37.0	0.0469	0.3178	0.8010	1.4697	2.3007	3.2740	4.3726	5.5814
37.1 - 39.0	0.0495	0.3359	0.8473	1.5553	2.4355	3.4666	4.6303	5.9107

WHAT WOOD I MAKE ?

Different tree species make different types of products. The Alberta forest industry produces 4 main types of products. Table 1 shows the tree species used to produce each forest product.

Using table 1, determine what type of forest product can be made with the tree you measured. Choose one and write it here

Type of forest product I can make with my tree _____

Using table 2, calculate the amount of that product you can make.

Number of items I can make _____

Hint: Number of items **=** *Volume of tree ÷ Amount of wood per item*

Table 1. Forest products produced from various tree species

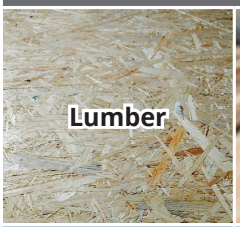
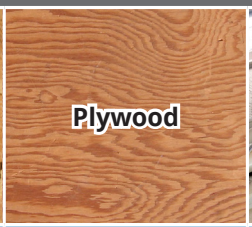
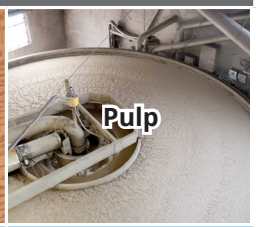
		Forest Products			
		 Lumber	OSB	 Plywood	 Pulp
Native Boreal Forest Trees	White Spruce	×		×	×
	Black Spruce	×			×
	Jack Pine	×			×
	Lodgepole Pine	×			×
	Balsam Fir	×			
	Tamarack				×
	Aspen Poplar		×		×
	Balsam Poplar		×		
	White Birch	×		×	×

Table 2. Examples of items made from different forest products

Forest Product	What can I make?	Amount of wood per item
Lumber	Picnic Table	0.51m^3
OSB	Dog House	0.12 m^3
Plywood	Dresser	0.25 m^3
Pulp	One roll of Toilet Paper	0.0007 m^3

TREES, CARBON AND CLIMATE CHANGE

Carbon dioxide is a greenhouse gas that contributes to climate change. Trees take in carbon dioxide during photosynthesis and store the carbon in their wood. We can estimate the amount of carbon stored in a tree using our tree measurements.

Use your circumference *(not diameter!)* and tree height to estimate the amount of carbon taken up, or sequestered by your tree, and record it below.

Carbon sequestered: _____kg

CARBON SEQUESTERED BY TREE *(kg)*

Total Tree Height (m)	Circumference of tree at chest height (m) ***make sure to change your circumference from centimetres to metres!*								
	0.25	**0.5**	**0.8**	**1**	**1.2**	**1.5**	**1.75**	**2**	**2.5**
2	3.54	14.15	36.22	56.6	81.5	127.34	173.32	226.38	353.72
4	7.07	28.3	72.44	113.19	162.99	254.68	346.65	452.76	707.44
6	10.61	42.45	108.66	169.79	244.49	382.02	519.97	679.14	1061.16
8	14.15	56.6	144.88	226.38	325.99	509.36	693.29	905.53	1414.88
10	17.69	70.74	181.11	282.98	407.49	636.7	866.62	1131.91	1768.61
12	21.22	84.89	217.33	339.57	488.98	764.04	1039.94	1358.29	2122.33
14	24.76	99.04	253.55	396.17	570.48	891.38	1213.26	1584.67	2476.05
16	28.3	113.19	289.77	452.76	651.98	1018.72	1386.59	1811.05	2829.77
18	31.83	127.34	325.99	509.36	733.48	1146.06	1559.91	2037.43	3183.49
20	35.37	141.49	362.21	565.95	814.97	1273.4	1733.23	2263.82	3537.21

The things we do in our daily lives contribute to the carbon that is released into the atmosphere. The table below shows the carbon emissions of a few common activities.

Activity	CO_2 emissions (kg)
Running a Dishwasher	1.896
Driving a car 5 km	1.024
Using the lights in your home for 1 day	0.647
Watching Netflix for 1 hour	0.39
Playing an Xbox for 1 hour	0.141

How many trees would it take to offset one of these activities in your own lifestyle over a week? A month?

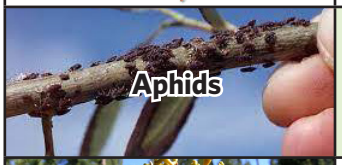
CO_2 emissions calculated based on average wattage, fuel economy, and carbon intensity
***see page 14 for sources of informaiton*

SECTION 5

PESTS AND DISEASES

We're going to look more closely at some common forest pests and diseases in Alberta and determine the impact they're having on your community forest.

Take a look at the table below to learn about some of the common forest pests and diseases. Search around your community forest and check off any of the ones you find

Name	Type *(Insect, fungus, bacteria, virus, other)*	Tree Species Affected	Signs/Symptoms	Present?
Spruce budworm	Insect	White spruce	Appear in May, Damaged buds, Larvae *(in strands of silk on branches)*, rust coloured trees	☐
Forest tent caterpillar	Insect	Deciduous trees	Holes in leaves, larvae, dead branches	☐
Dutch elm disease	Fungus	Elm trees	Drooping, yellow leaves, no leaves	☐
Mountain pine beetle	Insect	Pine trees	Red and grey needles, globs of pitch on the outer bark	☐
 Aphids	Insect	All - including shrubs	Galls *(small round deformities on leaves)*, small white "flakes", the aphids themselves	☐
Dwarf mistletoe	Plant *(parasitic plant)*	Coniferous trees	Swollen branches and stems, abnormal growth of infected branches *("witches brooms")*	☐
Black knot fungus	Fungus	Various cherry and plum trees	Black swellings on branches	☐

Pests and diseases have parasitic relationships with their hosts.
Can you see any examples of the other types of symbiosis *(mutualism, commensalism)* in your community forest?

SECTION 6

HUMAN USE OF THE LANDSCAPE

Humans interact with and influence forest ecosystems. Landscapes are defined by both their natural and human features. Consider how your community forest is shaped by people.

Draw an aerial view of your study site, including main natural features *(eg. treed areas, obvious trees, rocks, water bodies, other plant clumps, etc)* as well as human features *(eg. paths, roads, tables, etc.)*.
Be sure to include a legend for the different features.

Legend

What is the percentage of the area covered in:

Human-influenced elements _____%

Natural elements _____%

Based on the human features you identified, talk with your group about potential actions that you could take as individuals/as a class to help reduce negative human impacts on this space.
Record your answers on the Notes page

NOTES

REFERENCES

These values are calculated with the following formula $Mco_2=3.67(0.5(0.55(1.2(a(D2h)))))$. Mco_2 is the mass of CO_2 sequestered by the tree. 3.67 represents the ratio of atomic mass for carbon and CO_2. 0.5 represents the knowledge that approximately 50% of the biomass of a tree is carbon atoms. 0.55 represents an assumption that 45% of the mass of the tree is water. 1.2 represents an assumption that the roots make up 20% of the mass of a tree. a is a coefficient that varies on growing conditions and tree species, a value of 0.1 was chosen based on a comparison of results with values of known trees. D represents diameter (in inches) and h represents the height in feet. Mco_2 converted from lbs to kg.
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