THE FORCE OF FIRE

Teacher Resource '04

Lesson plan and support materials

INTERMEDIATE

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THE FORCE OF FIRE

LESSON OVERVIEW

Learning Outcomes - an understanding of:

- ❑ Fire Triangle
- ❑ Urban Interface
- ❑ Protecting your home from wildfire
- ❑ Fire behaviour
- ❑ Life after fire

Questions:

- ❑ What do we need to have fire?
- ❑ What effect can wildfire have on the forest?
- ❑ What effect can wildfire have on urban interface?
- ❑ Can fire have positive and negative effects on the environment?
- ❑ How can we prevent wildfires?

Setting the Stage:

- ❑ Part A: Introduction - Early forests and the role of fire. (5 min.)
- ❑ Part B: What role does fire play when managing our forests? (15 min.)
- ❑ Part C: Fire Smart Protecting our home from wildfire (35 min.)
- ❑ Part D: Forest and community renewal (5 min.)

Materials:

- ❑ Lesson Plan
- ❑ Teacher Background Notes & Glossary
- ❑ Overheads: 1) fire triangle 2) fire guard/controlled burn
  3) fire ranking 4) forest renewal/map of Canada
- ❑ Pictures: a) lightning strike b) fire fighters
  c) calendar pictures of Okanagan Mt. fire
- ❑ Fire Smart CD and/or Fire Smart video
  (this can be a computer or TV presentation)
- ❑ Question Sheet & Answer Key
- ❑ Other Photos - look to websites in background information
- ❑ Graph Paper (optional)

THE FORCE OF FIRE

National Forest Week 2004

INTERMEDIATE LESSON PLAN

Objective:

- ❑ To look at the role fire plays in nature.
- ❑ To develop an awareness and understanding of wildfire as a natural disturbance that can have positive and negative effects.
- ❑ To build an understanding of the relationship between wildfire and the urban interface.
- ❑ To introduce methods of protecting your home and property from wildfire.

Curricular Connections:

- ❑ Gr. 4 The importance of water.
- ❑ Gr. 5 Describe the consequences of extreme weather conditions.
- ❑ Gr. 6 Using science to better understand fire…organize and interpret information in simple tables and graphs.
- ❑ Gr. 7: Determine the limiting factors for local ecosystems.
  Outline the stages of recovery of a damaged ecosystem.

Materials:

- ❑ Fire Smart CD or video - Protect your home from wildfire.
- ❑ BC home owners manual to accompany the video.
- ❑ Graph paper (optional)
- ❑ Teacher binder:
  - lesson plan
  - background info sheets, fire facts, glossary
  - student question sheet, answer key
  - overheads: Fire triangle, fire ranking, fire guards/control burn, forest renewal/map
  - pictures: lightning strike, firefighter
- ❑ Student will need copies of: questions
  - Fire facts & glossary (optional)

Lesson Plan:

A. Introduction: Canada's Forests. Pick a few facts from the Teacher Background Notes to introduce some of the following concepts:

- ❑ Trees have been here for a very long time.
- ❑ There is an abundance of forested land in Canada… Canada has 10% of the world's forests. **Show map of Canada overhead here.**
- ❑ Biogeoclimatic zones determine which trees grow in a region.
- ❑ Wildfires have always played a role in Canada's forests.
- ❑ The early uses of the forest.

B. Part I: A look at fire. Use the information below to discuss "Fire" as a force of nature and the role that it plays in determining how we will manage our forests. As you go through your discussion, define the terms underlined in italics… they are noted in the glossary.

What role does fire play when managing our forests?

We have always had forest fires. BC has approximately 2500 wildfires each year. Fire is a natural occurrence that sometimes cannot be controlled by man. Fire can have positive and negative (good and bad) effects on the health of the forest.

- ❑ Can you think of some bad effects of fire?
- ❑ How can fire be good? {It can prevent the spread of insects like Mountain Pine Beetle and diseases that have gotten out of control; it can bring about a new forest, which some animals require for food and habitat….}

All fires require 3 things before ignition can occur. Do you know what they are?

Insert fire triangle overhead here: show only the top half at first and then uncover as you discuss the following.

They need heat, fuel and oxygen.

- ❑ What are some examples of a heat source for fire? (Lightning - **show picture** - matches, cigarette butt, untended camp fire, spark from passing train/ truck)
- ❑ What are some examples of fuel for fire? (dead or very dry trees, branches, needles, underbrush, etc. **or** trees under stress from a bug attack)
- ❑ Where does the oxygen come from? (the air)

Weather conditions and *topography* will determine the force to which a fire will build. Some fires will get out of control and run wild. Such fires are called *wildfires*. They can reach temperatures that will destroy everything in their path. Even the soil can burn. They can build their own weather system, creating winds that will make them uncontrollable by man. These fires will occur only if the situation is right. ie. there is a heat source, a fuel source and oxygen. If you remove any one of these, the fire cannot burn.

Picture of firefighters & overhead- building a fireguard to remove fuel.

Other fires will burn slowly and "coolly" in that they don't reach temperatures that create total destruction. They may burn along the ground, taking out the underbrush

and weaker trees. This type of fire can be good for the health of a forest. In fact, some trees, like lodgepole pine, need a fire to open their cones so that they can release their seeds. A cool fire clears out the undergrowth and removes competition that might be fighting the younger trees for nutrients, sunlight and water from the soil. Other trees, like Douglas fir, have such thick bark, that a cooler fire may not harm them.

At times, man may use fire as part of managing a forest. A *controlled burn* may be prescribed to mimic a "cool" fire as mentioned above. Weather and site conditions have to be right for such a burn to be sure that the fire won't get out of control. At times, it may be used as a tool to fight a wildfire by burning the fuels off prior to the wildfire reaching the area.

Show picture of a controlled burn - lighting with a drip torch.

Controlled burns may be used on a recently logged site to help prepare the soil for planting. The burning of a site helps:

- ❑ release nutrients from the ground matter, to return to the soil
- ❑ blackens the soil thereby offering a chance for the sun to build up heat in the soil which is beneficial to the seedlings
- ❑ clears the site making it easier to plant seedlings & removes the competition

How are fires ranked? **Insert overhead of Fire Intensity Rank.**

Rank one - smouldering ground or creeping surface fire
Rank two - low vigour surface fire
Rank three - moderately vigorous surface fire
Rank four - highly vigorous surface fire, torching (or passive crown fire)
Rank five - extremely vigorous surface or active crown fire
Rank six - blow-up conflagration, extreme fire behaviour

B. Part II: Video or CD

"Fire Smart - Protecting your home from wildfire"

(both are provided in the resource binder… 11 min.)

Question : When a fire occurs close to communities, the damage can be catastrophic. Watch the video to learn what can happen when fire meets the "*urban interface*"?

Note: You may want to review the questions prior to the video and/or break the class into small groups with each group being responsible for one question. #1-8 are answered in the video, #9/10 can be researched on the Internet or the teacher may provide the answers from the answer key and teacher background notes provided.

View the CD/video then answer the questions. Follow up with stats on BC fires as found at the bottom of the Glossary sheet.

C. Closing: *Overhead of forest renewal*

Brainstorm: What must happen to have forest renewal? (salvage logging, reforestation, tending the young stands)

Fire Triangle

Sources of heat include:

- ❑ Lightning
- ❑ Matches
- ❑ Discarded cigarettes
- ❑ Untended camp fire
- ❑ Spark from a passing truck or train

Sources of fuel include any material that can burn:

- ❑ Dry vegetation
- ❑ Dead branches, needles, brush on the forest floor
- ❑ Standing dead trees
- ❑ Wooden structures
- ❑ Trees stressed by drought or insects

Air provides the oxygen that is needed to have fire.

Remove any of the 3 requirements (fuel, heat, air) and a fire cannot occur.

FIRE RANK

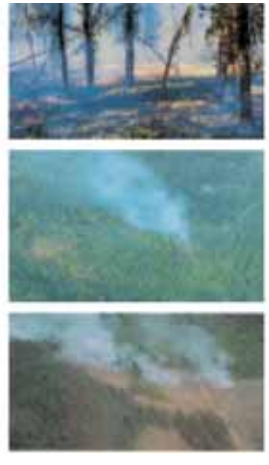
A Fire Description

RANK 1

NO OPEN FLAME
WHITE SMOKE
SMOULDERING GROUND FIRE

RANK 2

VISIBLE OPEN FLAME
SURFACE FIRE ONLY
UNORGANIZED FLAME FRONT
LITTLE OR NO SPREAD



RANK 3

ORGANIZED SURFACE FLAME FRONT
MODERATE RATE OF SPREAD
VIGOROUS SURFACE FIRE

RANK 4

ORGANIZED SURFACE FLAME FRONT
MODERATE TO FAST ROS ON THE GROUND
SHORT AERIAL BURSTS
GREY TO BLACK SMOKE

RANK 5

ORGANIZED CROWN FIRE FRONT
MODERATE TO LONG RANGE SPOTTING
INDEPENDANT SPOT FIRE GROWTH
BLACK TO COPPER SMOKE

RANK 6

ORGANIZED CROWN FIRE FRONT
MODERATE TO LONG RANGE SPOTTING
INDEPENDANT SPOT FIRE GROWTH
PRESENCE OF FIRE BALLS AND WHIRLS

DEFINITIONS:

Ground Fire - A fire that burns in the ground fuel layer.

Surface Fire - A fire that burns in the surface fuel layer, excluding the crown of trees.

Crown Fire - A fire that advances throughout the crown fuel layer.

Head - The portion of the fire having the greatest rate of spread and frontal intensity.

Flanks - Those portions of the fire that are between the head and the base.

Base - That portion of the fire perimeter opposite the head; the slowest spreading part of the fire.

Rate of Spread - The speed at which a fire extends its horizontal dimensions, expressed in terms of distance per unit time.

Candling - A single tree or a small clump of trees is said to candle when its foliage ignites and flares up, usually from bottom to top.

Spotting - A fire producing firebrands carried by the surface wind.
A fire whirl and/or convection column that falls beyond the main fire perimeter, and results in spot fires.

Flame Front - The strip of primarily flaming combustion along the fire perimeter; a particularly active fire edge.

Organized Front - A flame front exhibiting all the same characteristics, ROS (Rate of Spread), flame height and length.

Building a Fire Guard

A Controlled Burn


Forest Renewal


Canada's Forests
BOREAL FOREST
GREAT LAKES–ST. LAWRENCE FOREST
ACADIAN FOREST
CAROLINIAN FOREST
SUBALPINE FOREST
COLUMBIA FOREST
MONTANE FOREST
COASTAL FOREST

Questions re "Fire Smart Protecting your home from wildfire"

1. Alberta has approximately _____ wildfires per year.

2. What is a crown fire?

3. A wildfire traveling through heavy forest can reach speeds of _____ km/hr.
   A wildfire traveling through open areas or grasslands can reach up to 17 km/hr.

4. If fire breaks out, what disadvantage exists when living in rural areas?

5. _____ _____ is the first thing considered by the first fire crew (initial attack crew) that arrives at a fire.

6. What can happen if you are found to be responsible for starting a wildfire?

7. What 3 things can you do to help protect your home from fire when you live near a forest? A)

   B)

   C)

8. 1997, 1999 and 2001 were bad fire seasons for Alberta. What conditions helped create a "high" fire hazard rating?

9. BC has approximately _____ wildfires each year. (www.for.gov.bc.ca/protect/
   Click: learn about fire in the left hand column, then click: reporting forest fires)

10. Optional: Read about the fire situation for BC between 1992-2002. Make chart showing the information. (Graph the results.)
    www.for.gov.bc.ca/protect/reports/HistoricalAverages.htm Find reports **and** click on Average hectares, fires $ Dollars & scroll down to Historical Averages.

Year **# Fires** **# Hectares**

Answer Key to questions re the video:

1. Alberta has approximately 1,000 wildfires per year.

2. What is a crown fire? A fire that travels through the crowns of the trees and doesn't require ground fuel.
3. A wildfire traveling through heavy forest can reach speeds of 7 km/hr. A wildfire traveling through open areas or grasslands can reach up to 17 km/hr.

4. If fire breaks out, what disadvantage exists when living in rural areas?
   Fire fighting equipment/crews or services are often far away and therefore the fire has more chance to build and spread before any attack is made on the fire. (Often, there's only one access route to the site which can create transportation problems and make escape difficult.)

5. Public safety is the first thing considered by the initial attack crew.

6. What can happen if you are found to be responsible for starting a wildfire?
   You may be held financially responsible for the costs you incur as well as those of your neighbors.

7. What 3 things can you do to help protect your home from fire when you live near the forest?
   A) remove fuel for fire from around your home
   B) build your home with fire resistant materials
   C) protect your property from being the source of a fire

8. 1997, 1999 and 2001 were bad fire seasons for Alberta. What conditions, mentioned in the video, helped to create a high fire hazard rating?
   Wind & drought.

9. BC has approximately 2500 wildfires each year.

10.

Year	# Fires	# Hectares
2002	1 781	8 581
2001	1 266	9 677
2000	1 539	17 673
1999	1 207	11 581
1998	2 665	76 574
1997	1 175	2 960
1996	1 358	20 669
1995	1 474	48 080
1994	4 088	30 310
1993	1 497	5 183
1992	3 805	25 316
Total	21 855	261 741 hectares

Teacher Background Notes

Lesson Intro.

Canada's Forests: **(use a few of these facts to introduce the lesson.)**

Almost one half of Canada, 4.2 million km^2, is covered by forest. This represents 10 % of the world's forested land. These forests differ from one region to the next, the determining factors being the climate, biology and geography of the region. British Columbia's forest types include: Boreal Forest, Subalpine Forest, Columbia Forest, Montane Forest and Coastal Forest.

What are the different forest types in Canada? (map overhead)

Acadian Forest - red spruce, balsam fir, yellow birch
Boreal Forest - white spruce, black spruce, balsam fir, jack pine, white birch, trembling aspen, tamarack, willow
Great Lakes - St. Lawrence Forest - red pine, eastern white pine, eastern hemlock, yellow birch, maple, oak
Carolinian Forest - beech, maple, black walnut, hickory, oak
Coastal Forest - western red cedar, western hemlock, Sitka spruce, Douglas-fir
Columbia Forest - western red cedar, western hemlock, Douglas-fir
Montane Forest - Douglas-fir, lodgepole pine, ponderosa pine, trembling aspen
Subalpine Forest - Engelmann spruce, subalpine fir, lodgepole pine

Has Canada always had forests?

About 18 000 years ago, Canada was covered with ice. The first area to emerge from the ice was the most southern part of Canada... Ontario's southwestern peninsula. This happened over 13 000 years ago. By 11 000 years ago, the glaciers had retreated from the Maritimes. British Columbia was much slower to thaw but by 7,000 years ago, the lower mainland coast of BC had a forest of pines and Douglas-fir. 6 000 years ago, saw the western hemlock and western red cedar emerge as the dominant species of BC's temperate forest.

Wildfires have always played a role in Canada's forests. In fact, the boreal forest has retreated southward by about 300 km compared to its spread of 3000 years ago. Because of a change in climate and past fires, some of the northern stretches can no longer support the boreal forest like it did after the ice first retreated. Today, tundra covers the area.

How has Canada's history, development and economy been influenced by its' forests?

Early settlers and aboriginals used the forests to build homes, ships, canoes, and tools. Cultural and spiritual values influenced the location of settlements. Areas were cleared to support communities and agriculture at a subsistence level.

During the 18th and 19th centuries, colonial growth brought a rise in commercial use of the forest resource. The harvesting of trees, although poorly organized, took on economic importance in eastern Canada in the early 19th century. It wasn't until the middle of the century that BC's harvesting started in earnest.

By the end of the 19th century, a concern about the sustainability of the white pine led to the creation of a federal forest service, which later became the Canadian Forest Service (CFS) that we have today. Provincial governments also began to develop agencies to oversee timber cutting. Forest conservation, protection and propagation became important issues to be considered.

Forest management has evolved with *sustained-yield* management becoming the main goal. Canada is steward to 10% of the world's forest resource. It takes this role seriously. Environmental, economic, social and cultural aspects must, by law, be part of forest development plans of Canada. BC has some of the most stringent rules and regulations for managing its' forests compared to anywhere in the world.

Today, BC is a world leader in fighting wildfire. Many countries turn to BC for help and direction in preparing for fire. (View the flashpoint presentation at **www.for.gov.bc.ca/protect/)**

Summary of Video
Fire Smart - Protecting your home from fire

Although this video takes a look at wildfire and urban interface in Alberta, the information is generic and often contains information supplied by the BC Ministry of Forests. Websites have been suggested to allow the students to learn the stats for BC and those stats have also been provided in the teacher background notes.

NOTE: *This video suggests home construction materials that are "Fire Smart" for homes in the forest setting which are often far away from any fire support system. It is not suggesting that all homes should follow these guidelines.*

Video Summary: (Also see the accompanying manual for more information.)

- Approximately 1000 fires start in Alberta each year
- The fires burn thousands of hectares of land
- People lose homes, businesses, food, clothing, pictures…
- The picture at the beginning of the video is of a *crown fire*
- Wildfires leave no time for preparation
- Fires traveling through heavy forested area can gain speeds of up to 7 km/hr
- Fires traveling through open grass areas, can gain speeds of up to 17 km/hr
- **Fire support for rural areas is often far away**
- The initial suppression crews (*initial attack crews*) that arrive, hold public safety as the first priority
- People are responsible for being fire smart and having their property prepared for the possibility of fire. If you are found to be the cause of a wildfire, you may be held financially responsible for costs incurred by yourself and your neighbors
- Today, many people are choosing a rural lifestyle, close to forests. This tendency raises the risk of fires started by man

- Precautions you can take: (For more information, see the accompanying manual.)
    1. Reduce the fuel around your home
    2. Choose building materials wisely…use fire resistant materials
    3. Don't be the source of fire. Chimneys must meet code, burn barrels should be well away from buildings, vegetation should be kept away from power lines, have tools to assist fighting fire.
- Prepare your site: there are 3 priority zones.
  Zone 1 is the area up to 10 m. around your home. It is the most critical and should be clear of fuel for fire. Remove shrubs, trees, deadfall, and woodpiles and keep your grass cut and watered.
  Zone 2 is from 10-30 meters from your home. Here you must reduce and manage potential fuel sources. Reduce the number of pine and spruce, which are more combustible than deciduous trees, to prevent fire traveling through the crowns. Remove deadfall, mature trees, thick shrubbery.
  Zone 3 is from 30-100 m. around your home. Here you must thin the forest so fires will remain at a low intensity and be more easily extinguished.
- **It is important to maintain these protective measures**.
- 2001: 22 homes were lost to wildfire in Alberta
- 1997: a prairie fire started in a burn barrel 34 km. away

Extensions:

- Graph Question #10.
- Go on line to learn about BC's fire history.
- Locate on a map, where the largest BC fire took place.

www.for.gov.bc.ca/protect/

http://envweb.env.gov.ab.ca/env/forests/fpd/external/new_QT.html

www.for.gov.bc.ca/protect/ Look under "About Protection", click on the flash presentation. View the presentation: 'Protection" by BC Forest Service to learn about BC as a leader in fighting fires.

http://www2.news.gov.bc.ca/nrm_news_releases/2003OTP0090-000870-Attachment1.htm

http://www.for.gov.bc.ca/pscripts/protect/WildfireNews/index.asp

www.canadianforestry.com - contains teacher lesson plans

Glossary

Biogeoclimatic Classifications - an ecosystem classification based of vegetation, soils, topography, and climate

Controlled Burn or Prescribed Fire - a controlled fire ignited for land use improvements (for habitat, reforestation, etc.) or to reduce fuel

Crown fire - an extremely intense wildfire that has taken hold in the crowns (tops) of trees and can spread very quickly with the wind.

Fireguard - a physical barrier of earth constructed to halt or impede the spread of wildfire

Initial Attack - fast response to a wildfire report, first crew to attack the fire

Sustained yield - a method of forest management that calls for an approximate balance between net growth and amount harvested and includes balancing social, economic and ecological values.

Topography - the physical features of the land… slope, waterways, roads, etc.

Urban-interface - the point at which urban dwellers and the forest meet

Wildfire - a forest fire that is burning out of control

Fire Stats for BC and Firestorm 2003

Details on Firestorm 2003:

number of homes burned - 334
number of businesses burned - 10
number of people evacuated - 50 000+
number of people involved in emergency response - 10 000+
number of hectares burned in the fire nearest you - answers will vary.

Number of hectares involved in:
http://www.for.gov.bc.ca/pscripts/protect/WildfireNews/index.asp

OK Mountain fire: 25 912	McLure fire: 26 420
Vaseux fire: 3 300	McGillivray fire: 11 400

Report on large fires in BC: www.for.gov.bc.ca/protect/reports/LargeFires.htm
The largest fire in BC was the WISP fire in 1950. It was 1 400 000 hectares in size. The BC portion was 90 000 hectares. It burned from north of the Fort St. John area into Alberta along the Chinchaga River.

FIRE FACTS

- Fires have played a major role in the ecology of the Interior for a long time.
- Fires in the forests of B.C. have been a major influence since the glaciers receded which was about 7,000 years ago.
- Many of the mature forest stands around us in the Okanagan, resulted from large stand replacing fires that occurred in the late 1880's.
- The word “fire” has its roots in the Greek word “pyra” which means glowing embers (pyromaniac, pyrotechnics, pyroclastic flows).
- There is evidence that the First Nations who lived in the interior of B.C. used fire to alter the forest in their traditional territories for hunting and berry picking purposes.
- **B.C. is a world leader in fire fighting technology and techniques.**
- Fires come in different sizes and intensities, from cool slow ground fires to hot, fast and explosive crown fires. These fires can move at speeds up to 100 metres per minute. They can travel from 7 kilometers an hour and in open grassy areas can reach speeds up to 17 kilometers per hour.
- The behaviour and severity of the fires is linked to the type of fuels the fire is burning, the topography of the area and the weather.
- Once a forest fire begins to burn, you can tell a lot by the color of the smoke:
  - The darker the smoke, the hotter the fire. Smoke that is billowing or boiling means a hot active unpredictable fire.
  - White/blue smoke that is floating in the air means a cooler less active fire.
- Fires can burn both uphill (heat of the day, upslope winds) and downhill (evening downdrafts, downslope winds from cold fronts).
- Fires are like living things - they want to expand and grow.
- Sparks or firebrands can ignite spot fires up to 3km. away.

FIRE FACTS continued…

- ❑ Large fires can create their own wind and weather patterns that can include mini-tornadoes within the fire.

- ❑ Fires can burn in the roots and stumps for many months and in some cases for many years.

- ❑ Fires can open cones and allow seeds to germinate.

- ❑ Fires renew the forest and landscape
  - o help to recycle nutrients back into the soil
  - o diversify vegetation and animal habitat
  - o balance insect populations and forest age distribution

- ❑ Without fire, our forests become overstocked and susceptible to insects and disease and the quality of habitat is reduced for many animal species.

- ❑ Two types of fires:
  - o Stand maintaining - occur frequently (3-15 years) and they are usually cooler ground fires
  - o Stand replacing - tend to occur more infrequently (once every 100 years) and consume large areas of forest this starts a new forest cycle

- ❑ The cooler, stand maintaining fires are fires that burn mostly along the ground, consuming grasses, shrubs, small trees and some of the duff layer. They rarely burn hot enough to kill the larger and older trees.

- ❑ The hotter stand replacing fires are fires that burn along the ground and in the canopies of the trees consuming grasses, shrubs, small and large trees and a large amount of the duff layer. These fires usually destroy all the vegetation and trees providing the opportunity for a new stand to begin to establish itself. On occasion, these fires will burn up all of the forest floor duff, exposing mineral soil and rock**.** This intensity of fire may take many years or decades to recover from.