

EXPLORATION:
Grades 6-8

THE HOW AND WHY OF ALASKA'S WILDFIRES



ENDURING UNDERSTANDING:

We can be more prepared for wildfires and the changes they might bring if we understand what kinds of trees and plants burn, when they are likely to burn, and how fires move and grow.

Part 1 (30 minutes)

STUDENT DIRECTIONS

You will read a brief explanation about how and why fires burn in Alaska. Take notes on how fires start and things people do to stay safe. Afterwards you will answer 3 questions and then write an essay to reflect on how climate change may affect wildfires.

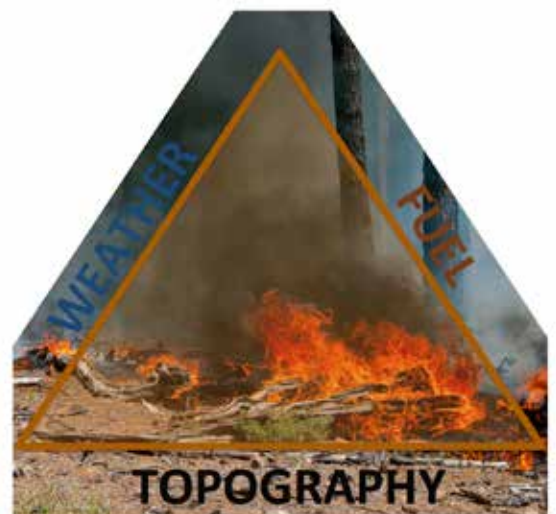
NGSS STANDARDS:

MS-LS2-3	Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem
MS-ESS3-2	Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects
5-ESS3-1	Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment
MS-ESS3-3	Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment

Wildfires are a natural part of summers in Alaska -- just as endless daylight, time to be with friends, and buzzing mosquitoes are all aspects we know we can expect. Every summer hundreds of thousands of acres burn across the state. As the climate changes, we can likely expect even more wildfires.

SCIENTISTS USE THE FIRE ENVIRONMENT TRIANGLE TO LEARN ABOUT WILDFIRE.

The Fire Environment Triangle provides a great framework for understanding all aspects of fire. The three sides of the triangle are FUELS, TOPOGRAPHY and WEATHER. Each of these three sides represents an important factor that determines how a wildfire will burn. Fire scientists spend a great deal of time trying to learn about and measure all of these factors. They put them together to try to predict whether a wildfire will happen, and if so – how big and hot it might be.



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ONE SIDE OF THE FIRE TRIANGLE IS FUELS -- ALL THE LIVING AND DEAD PLANTS AND TREES IN AN AREA.

The FUEL side of the triangle refers to all the natural things in the ecosystem that might burn. In Alaska, the major fuels are trees, shrubs, grasses, mosses and lichens. No, we're not talking about the stuff we put in our cars – only natural fuels! Pretty much anything in the forest or tundra will burn if a fire is hot enough, but some types of fuels are more ready to burn than others!



FUEL MOISTURE REFERS TO THE WETNESS OF PLANTS, TREES AND THE FOREST FLOOR

Water content, or moisture is a major factor that determines whether or not fuels readily burn. Plants and trees are very dry in spring before they get their new leaves. You've probably noticed that in early April you can crumble any remaining leaves on a deciduous tree, and the branches break easily. Sometimes it's even hard to tell whether the shrub or tree is alive! The fuels are crunchy because they have very little water in them – their fuel moisture level is very low. Once green-up happens in early to late June however, fuels suddenly become a lot less flammable. Likewise, if a summer is very hot without rain for weeks on end, fuels dry up and become more flammable.

VOCS MAKE SOME PLANTS SUPER FLAMMABLE.

June and July are often Some trees and plants contain very flammable oils called Volatile Organic Compounds (VOCs). Coniferous trees like spruce, and plants like Labrador Tea contain lots of these VOCs so when fire approaches, if these fuels are dry enough – they take off! If it is a hot day, these fires may quickly spread to the trees.

LADDER FUELS ALLOW FIRES TO SPREAD INTO TREETOPS.

Ladder fuels are another fuel characteristic that help to spread a wildfire. Ladder fuels are trees and shrubs that are short, or branches and lichens that hang close to the ground. They bridge the gap in height between plants on the ground and the tree tops, and essentially allow a fire to “climb the ladder” from the ground (where it probably started) to the crowns (tops) of the trees.



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FUELS WITH HIGH SURFACE AREA CAN CATCH ON FIRE EASILY.

If you've ever tried to start a camp fire, you know that fuels with a high amount of surface area are easiest to catch on fire. That's why you use kindling to start a fire. High surface area gives fire a lot more places to burn, and a lot more oxygen to burn it with. Plants with a high amount of surface area relative to their volume include grasses, mosses, lichens, needles, and small twigs. Large branches and trunks on the other hand have very low surface area relative to their volume, so they don't catch on fire easily. When these large fuels do catch on fire however, they can hold in the heat for a very long time.



The Table below sums up the different fuel characteristics and gives examples of each type.

Fuel Characteristic	High Example (contains lots of the fuel characteristic)	Low Example (contains less of the fuel characteristic)
Moisture	new green leaves	old leaves
		leaves that have changed color and are about to fall off.
	live willow trees and shrubs	any dead trees and shrubs
	live cottonwood trees	spruce trees,
	birch trees	
	mosses right after a rain	lichens and mosses on a hot day
		leaf and tree litter
VOCs	evergreens such as spruce trees	deciduous trees and shrubs
	Labrador Tea	
Surface area	grass	large diameter branches
	lichen	tree trunks
	moss	
	twigs	
	needles	
Ladder fuels	black spruce trees	mature cottonwood and birch trees
	lichens that hang from trees	

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TOPOGRAPHY AFFECTS HOW A FIRE SPREADS.

The TOPOGRAPHY side of the fire environment triangle refers to the shape of the land. Slopes, aspects (whether or not a hillside faces towards the sun), valleys, ravines, canyons, etc. all are very important to fire fighters. For example, fire travels much more quickly up a hill than it does on flat ground so you never want to be up-hill from a wildfire! Narrow canyons are complicated because if one side of the canyon burns, it can heat up and dry out the fuels on the other side – making them even more flammable! Hillsides that face the sun are drier and ignite



WEATHER CAN MAKE OR BREAK A FIRE DAY!

The WEATHER side of the fire triangle should be nothing new! You've most likely experienced rain, thunderstorms, wind, hot sunny days, and cool cloudy ones, so you can probably guess how weather might affect a wildfire. On a hot day things catch on fire more quickly, and thunderstorms mean lightening can start new fires. Wind can make a fire spread very quickly, while a good soaking rain can help to put a fire out. Fire scientists measure the temperature, wind and the amount of moisture in the air (Relative Humidity or RH) to help determine the risk of wildfire.

ALASKA'S WEATHER PATTERNS ARE CHANGING.

What is new is weather patterns are changing in response to changing climate. Alaska is getting hotter! In the years between 1950 and 2015, Alaska warmed up year round by an average of over 3 degrees (Alaska Climate Research Center). This may not sound like a lot but for every one degree increase in temperature, Alaska sees a 15% increase in lightening. Alaska already gets thousands of lightning strikes in a week every summer.

CHANGING WEATHER CHANGES HOW AND WHERE WILDFIRES BURN.

Hotter weather also means drier fuels for all fuel types – not just spruce trees. In recent summers, some wildfires have burned into forests with mostly willow and cottonwood – trees usually considered too wet to burn! Hotter weather also sometimes means less snow pack in the winter. (Much of Alaska experienced the lowest snow fall in record for both the 2015-2016 and 2014-2015 winters). With less snow on the ground, fuels are drier in spring – already the riskiest time of year for fire.

As Alaska continues to heat up, fire scientists expect to see a lot more fires. In the mean time, they have a lot of work to do to measure all of the changing factors of the fire environment triangle!

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MY NOTES

How does the changing climate affect fires in Alaska?

Benefit	Details

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Use the remaining time to answer the questions below. Your answers to these questions will be scored. Also, they will help you think about the information you read and reviewed, which will also help you write your essay. Answer the questions in the spaces provided below them.

QUESTIONS:

1. List each side of the fire environment triangle and explain what each side means.

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2. What are four factors that will affect how a fuel burns? Give at least two examples for each.

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3. What are three ways that weather could affect wildfires?

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Part 2 (30 minutes)

STUDENT DIRECTIONS

You will now have 30 minutes to review your notes and sources, plan, draft and revise your essay, which will be based on the essay topic below. You may use your notes and refer to your sources, but please work on your own! You may also refer to the answers you wrote to earlier questions, but you cannot change those answers. Now read your assignment and the information about how your essay will be scored, and then begin your work!

ESSAY TOPIC:

Alaska's climate is changing. Since 1949, average-year round temperatures have increased by over 3 degrees Fahrenheit, and winter time temperatures have increased by 6 degrees. Climate scientists predict that Alaska's average temperature could increase by 11 degrees by the end of the century. You can read the Climate Research Center's article about this at <http://climate.gi.alaska.edu/ClimTrends/Change/TempChange.html>.

How do you think this warming climate might affect wildfires in Alaska? To answer the question you must use the three sides of the fire triangle as well as the four different fuel characteristics introduced in the article. Before you start writing, you may want to think carefully about how warmer temperatures might affect each, and map it out on a piece of scratch paper.

Part 3 (15 minutes)

SCORING YOUR ESSAY

Your essay will be evaluated based on:

1. **Organization:** How well you included an introduction, reasons that are supported with details, and a clear conclusion.
2. **Use of examples to support your opinion:** How well you used various examples and scientific information to explain your opinion and new concepts.
3. **Scientific accuracy:** How accurate the facts were that you presented.
4. **Language and vocabulary:** how well you used precise language and vocabulary to explain your opinion.

How well did you think you did? Score yourself by giving yourself 1-5 (5 is highest and 1 is lowest) for each of the above evaluations.

1. Organization	_____
2. Examples	_____
3. Accuracy	_____
4. Language and Vocab.	_____
TOTAL	_____

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Follow-up activity:

What is the wildfire risk around your home or school?

1. Using the table of fuel characteristics in the article, evaluate the fuels around your school, or home. To help guide your investigations, you can take the table outside with you and circle the fuel types that you see. (Note – not everything will be in the table, you will need to take notes and do some thinking on your own).
2. You can then determine whether each fuel characteristic might be considered high or low. Based on your evaluations, write down whether you think the fuels in the area are very flammable, moderately flammable, or not that flammable on the day that you evaluate them.
3. Evaluate the other two sides of the fire triangle (topography and weather). Write down descriptions for each.
4. Be sure to write down the date and time of your field investigations.
5. Using your evaluations of each side of the fire triangle, give a prediction for how easy it will be for a potential wildfire around your home or school to spread. Will it be hard for fire fighters to fight?

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Part 4

OTHER RESOURCES

Funding for this project was made possible by a partnership with the USDA Forest Service