Middle School FireWorks Curriculum for the Northern Rocky Mountains and North Cascades.

Lessons with 🔥 symbol use fire.

Lessons with 📦 symbol use materials in FireWorks trunks. Lessons without 📦 symbol have downloadable materials.

15-minute video with overview of the FireWorks program available here.

Unit	Lesson	Overview	Notes
Unit I. Introduction to Wildland Fire	M01. Visiting Wildland Fire in the Northern Rocky Mountains and North Cascades	Students view a narrated photo presentation that shows wildland fires and some of the local plants and animals they are going to learn about. During the presentation, students record observations about fire behavior. Afterwards, they compare & contrast the kinds of fire they observed, and they also describe their feelings about wildland fire.	Students view photo presentation while taking notes and answering questions in handout. Students write two paragraphs about the slide show and a few words describing their feelings about wildland fire.
Unit II. Physical Science of Wildland Fire	M02. Where Does Heat Go? The heat Plume from a Fire	Students observe the heat from a burning candle and a single match so they can describe the shape and size of a heat plume and explain how the energy from a fire is transferred (conduction, convection, radiation). Like all activities that use fire, safety procedures together are reviewed and discussed.	Students role-play 3 types of heat transfer. Students in small groups measure the shape of the heat plume from a single burning match on a stand. They describe where most of the heat goes and describe the types of heat transfer observed. (Okay for most classrooms). 🔥📦
	M03. What Makes Fires Burn? The Fire Triangle 1 – Heat and Fuel	Students learn about the concept of the Fire Triangle (fuel, heat, oxygen), then test it experimentally. This activity focuses on fire's requirement for fuel and a heat source.	Students in small groups measure and record observations about heat and burning time for single burning matches. Students learn about the chemical change that occurs during combustion. (Okay for most classrooms). 🔥📦
	M04. What Makes Fires Burn? The Fire Triangle 2 – Oxygen	Students learn more about the Fire Triangle and continue to test it experimentally. This activity focuses on fire's requirement for oxygen. There are 2 options for doing the experiment: Option 1 uses vinegar and baking soda; Option 2 uses dry ice.	Students in small groups try to light a candle in an oxygen deprived environment. They describe their observations and use the fire triangle to explain them (OK for most classrooms). 🔥📦
Unit III. The Wildland Fire Environment	M05. How Do wildland Fires spread? The Matchstick Forest Model	Students use a physical model to learn how slope and the density of trees (or other kinds of standing fuels) affect fire spread. Short video clip showing stand density and slope	Students work in small groups to create and test hypotheses about how fires will behave on small Masonite boards. They change one variable at a time and record their measurements. (Outside or lab with hood is best). 🔥📦

	M06. Ladder Fuels and Fire Spread: The Tinker Tree Derby	Students use a physical model to learn how the vertical arrangement of fuels affects the potential for fires to spread into tree crowns. It is especially relevant to ponderosa pine/Douglas-fir forests in the northern Rocky Mountains and North Cascades, where surface fires have been excluded for nearly a century. Short video clip	Students work in small groups to create a 'tree' that will survive wildfire using newspaper strips (foliage) and metal support stand. (Outside or lab with hood is best). 
	M07. Fuel Properties: The Campfire Challenge	Students explore how different properties of fuels affect fire behavior - especially how hard it is to ignite fuels and how long they are likely to burn. Students consider various combinations of fuels ("fuel recipes"), predict how they will burn, then test their hypotheses.	Students work in small groups and attempt to burn 4 different fuel recipes in pie plates. Students discuss and record observations of how fuel properties affect how fires burn. (Outside or lab with hood is best). 
	M08. Fire Behavior, Fire Weather, and Climate	Students study the history of a real wildland fire, the Lolo Peak Fire of 2017 in western Montana. They view and discuss a presentation and 2 short videos to learn how managers used information on weather, fuels, and topography to manage the fire. Then they identify patterns in weather data that are correlated with fire behavior. They synthesize day-by-day reports from the official records of the *Incident Command* (*IC*) *Team* and news articles to create podcasts on the fire's progress. Finally, they interpret maps and slides in a presentation that shows the fire's growth and the variety in its severity.	3-4 Class Periods: Students view videos and presentation. Students work in teams to explain why a wildland fire showed rapid spread at times and showed little or no spread at other times, interpret maps and photos that illustrate the fire's growth and severity, synthesize information on the progress of a wildland fire into a podcast for a national audience. 
Unit IV. Fire Effects on the Environment	M09. Smoke from Wildland Fire: Just Hanging Around?	From a lab demonstration or video, students learn how smoke disperses (or doesn't), depending on atmospheric conditions. They learn how smoke affects visibility and human health, especially if it sticks around for days or weeks instead of dispersing into the upper atmosphere. Finally, they apply health guidelines regarding smoke to the issue of protecting students' breathing while planning athletic events on smoky days.	Likely 2 class periods. Students view presentations. Option to conduct demo in class or view video of demo. Students work in teams to plan athletic events given smoke guidelines. 

	M10. Fire, Soil, and Water Interactions	Students view and take notes on a presentation. Then they either observe or conduct an experiment that illustrates how wildland fires affect the potential for soil erosion. They learn that soil burn severity varies greatly and that when fires remove the litter, duff, and plant cover on the ground, the risk of soil erosion increases.	Option to conduct experiment or watch video of experiment. **Prep:** If doing the demonstration in class, you need a container containing young grass stems that were started from seed 4-8 weeks before. You may be able to use a cut piece of sod instead.
Unit V. Fire's Relationship with Organisms and Communities	M11. Who Lives Here? Adopting a Plant, Animal or Fungus	Introduces a suite of organisms that live in forests of northern Rocky Mountains and North Cascades. It features species representative of 3 forest communities: those dominated by ponderosa pine, lodgepole pine, and whitebark pine. Each student "adopts" an organism, learns about its characteristics and its relationship to fire from essays in the FireWorks Encyclopedia, and gives a presentation on it to the class - illustrated by some form of art work.	Students learn about an organism, then create relevant artwork. They give 3-4 min presentation about their organism while class takes notes. This will take a few class periods for student to give presentations.
	M12. Tree parts and Fire: "Working Trees" Jeopardy-style Game	Students learn to name the parts of a tree, describe their functions, and describe how some of these plant parts can help the tree survive fire, avoid the effects of severe fire, or reproduce after fire.	Each student presents 1-2 tree terms to class. The class then competes in a Jeopardy-style game.
	M13. Tree Identification: Figure out the "Mystery Trees"	Students observe and record information on botanical specimens, then use each other's observations to identify 10 tree species of the northern Rocky Mountains and North Cascade range.	2 class periods. Teacher needs to photocopy handouts from the first period to use in the second period. **Another version** of the mystery trees activity that uses a dichotomous key and takes 1 class period is available here.
	E11. (Appropriate for Middle School) Recipe for a Lodgepole Pine Forest: Serotinous Cones	Students extract seeds from serotinous cones of Rocky Mountain lodgepole pine, count the seeds, report their results, and analyze their pooled data. Then they calculate the number of seeds from serotinous cones that might germinate in a small forest after a crown fire has swept through.	Cones are heated so that seeds can be extracted. **Cones are heated at least 1 day before seeds will be extracted**. Students can heat the cones in hot water as part of the activity or teachers can heat cones in oven at home. As a class, students create a histography of the number of seeds extracted per cone.

	M14. Who Lives Here and Why? Modeling Forest Communities	The class assembles a graphic model of forest communities in the northern Rocky Mountains and the North Cascades. They use feltboard materials from the trunk to show illustrate the optimal environmental conditions for each species and show how individual tree species are associated with each other in ecological communities. Then they use the model to predict the effects of changing climate conditions on the distribution of species.	After assembling the graphic model on the feltboard. Students answer handout questions either individually or as a class. 
	M15. Bark and Soil: Nature's Insulators	This activity explores the use of insulation to slow the transfer of heat through materials. Bark (on stems of trees and shrubs) and soil are two kinds of materials that insulate living things from the heat of fires.	Students use a physical model of either a tree trunk or soil and test how quickly the cambium or buried seeds/roots heat up with various layers of insulation when heated with a blow dryer. Students take measurements, graph data, and test hypotheses. **There is only one set of materials in the trunk, so this activity can be done as a class demonstration or has a station with a few students at a time.** 
	M16. Buried Treasures: Identifying Plants by their Underground Parts	Students examine specimens of nine plant species - grasses, wildflowers, and shrubs - and use a dichotomous key to identify them based on their "buried treasures" - underground parts that can sprout after fire and grow new plants.	Students draw and define terms for underground plant parts. They identify plant species from specimens of underground parts using a dichotomous key. 
Unit VI. Fire History and Succession	M17-H16. Dating Fires using Dendrochronology.	Students discuss the current prevalence of wildfires in their region and ways to find out if those fires are typical for the 3 forest types they have been studying - forests historically dominated by ponderosa, lodgepole, and whitebark pine. Then they either view a presentation or complete an electronic tutorial covering 10 terms that are important for understanding fire history.	Photo presentation (digital or print) and class discussion followed by optional handout with matching exercise using terms learned during presentation.
	M18-H17. History of Stand-replacing Fire	Students use information from 11 cross-dated increment cores to figure out the approximate age of a forest stand that originated after stand-replacing fire.	Students work in teams and use increment cores (photos) to determine the age of individual trees. Collectively, they assemble a stand history diagram to estimate the forest age and its possible fire history. 

	M19-H18. History of Low-severity Fire	Students create a living model to demonstrate how fire scars form. They use dendrochronology to describe the history of low-severity fire for a single tree and then a whole forest. They assemble a stand history diagram and use it to identify years when low-severity fire occurred and to describe the spatial uniformity of past fires. Then they use information from the stand history diagram to discuss the policy of full fire suppression.	This lesson builds on previous lesson, but **you can only do the living model (role play) to demonstrate how fire scars form** and how trees with thick bark can survive surface fire. In the second part of the lesson, teams of students examine tree cross-sections (posters) to identify fire scars and then collectively assemble a stand history diagram. 
	M20. Fire History in Ponderosa, Lodgepole, and Whitebark Pine Forest Communities	Students use the stand history diagrams that they assembled in the 2 previous activities to learn about mixed-severity fire regimes. They interpret stand history diagrams for plots from each of the 3 forest types they've been studying. Then they read articles about fire regimes in these forest types and summarize an article in a news blog.	After examining the mixed severity fire regimes from the stand history diagram created in the previous 2 lessons, students view a presentation where they further examine and interpret stand histories from research in several plant communities. Students read short articles on fire regimes of the 3 forest types and summarize it in a blog. The articles could probably be a stand-alone lesson. 
	M21. Drama in the Forest: Fire and Succession, a Class Production	Students prepare and produce three short plays. Each play depicts the role of fire, succession, and other changes over time in one of 3 ecosystems: forests dominated by ponderosa pine and Douglas-fir; lodgepole pine and subalpine fir; and whitebark pine and subalpine fir.	Students work in three teams to produce/present a drama depicting 3 forest ecosystems. Builds on concepts learned in previous lessons. Great if you can use student projects from M11. Who Lives Here? Adopting a Plant, Animal or Fungus.
	M22. Fire Ecology Puzzler	Uses a set of jigsaw puzzles (printed on laminated paper) to review species interactions and the role of fire in 3 forest ecosystems of the northern Rocky Mountains and the North Cascades (dominated by ponderosa pine/Douglas-fir, lodgepole pine/subalpine fir, and whitebark pine/subalpine fir).	Students use their knowledge of fire behavior, species adaptations, fire history, etc. to assemble 3 puzzles describing the 3 forest communities they've been learning about. The activity can be done in 2 ways (at least): as a classroom "grab-bag" competition among student teams, or as a quiet activity to be done singly or in small groups at stations.

Unit VII. People in Fire's Homeland	M23. Carrying Fire the Pikunni Way	Learn about how and why the Pikunii (Blackfeet) people transported fire from one camp to another as they traveled along historical migration routes. This activity includes a complete lesson plan, examination of a Fire Carrier model, and a 12-minute video interview with Pikunii elder Marvin Weatherwax as he describes the importance, technology, and use of the Fire Carrier.	This activity has several parts. You can do all parts or only watch the video. **The video can stand alone.** You can borrow a model fire carrier from the Missoula Fire Lab (it is not part of the trunk).
	M24. Homes in the Forest: An Introduction to Firewise Practices	Students use their knowledge about vegetation, fuels, and fire behavior to develop some rules that can help people protect their homes from wildland fire. Then they apply their rules by assessing photos of wildland homes, making recommendations to the home owners, and justifying their recommendations. Finally, they assess fire safety in a photo of a whole neighborhood.	This lesson *may* be okay to use even if you didn't do the rest of the curriculum (but it would be better with previous knowledge).
	M25. Revisiting Wildland Fire	Students return to the presentation that they viewed in Activity M01. This time, they narrate the presentation themselves. Then they compare and contrast their current feelings about wildland fire with their earlier ones. Finally, they assess the difficulty of a fire manager's job.	This activity should only be done if students did M01 and then several other activities in the curriculum.