High 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	H01. Introduction to Wildland Fire in the Northern Rocky Mountains and North Cascades	Students consider their thoughts and feelings about wildland fire before and after a photo presentation. Then, using a reading activity, students read and analyze a chapter from a book about the fires of 1988 in Yellowstone National Park.	
Unit II. Physical Science of Wildland Fire	H02. The Fire Triangle: Fuel, Heat, Oxygen	Students explore the shape of the heat plume and the three components of the Fire Triangle (fuel, heat, oxygen). The lesson includes a total of 3 experiments and 1 technical reading activity.	3 ~20-minute experiments. Student groups use individual matches and a votive candle to investigate the fire triangle, heat transfer, and combustion. (Okay for most classrooms). 🔥🟫
	H03. The Fire Triangle, Combustion, and the Carbon Cycle	Students use an experiment, a presentation, and a technical article to explore how the Fire Triangle relates to the chemical equation (model) for combustion and the carbon cycle.	Burning activity uses a votive candle and a hot plate (not in trunk) (PREP: Freeze water in fence caps 1 day prior to lesson). 🔥🟫
	H04. Heat Transfer	Students work in small groups to create demonstrations that show the three ways (radiation, conduction, convection) that heat can be transferred.	Have various props (e.g., candy, yarn, balls, etc.) available.
Unit III. The Wildland Fire Environment	H05. Fuel Properties	Students explore the properties of wildland fuels through reading, a fuel scavenger hunt, and by designing and conducting experiments with fuels.	Student groups ignite newspaper manipulated in different ways in pie tin. PREP: H05-1 Handout/outdoor scavenger hunt prior to lesson. (Conduct outdoors or under a hood) 🔥🟫
	H06. Pyrolysis	Students learn the steps of combustion and pyrolysis through videos, class discussions, and an optional activity.	Students watch 30-sec video and may conduct this demonstration (using a votive candle, optional) and describe their observations. Students watch another short video or teacher demonstrates pyrolosis (as shown in video). 🔥 optional (Okay for most classrooms).

	H07. Fire Spread Processes: Putting it all together: Heat transfer, fuel properties, and pyrolysis	This culminating lesson on the physical science of wildland fire challenges students to expand their understanding and link their knowledge of heat transfer processes, fuel properties, pyrolysis, and ignition through a series of thought-provoking videos and a presentation about current research - in particular, research currently underway at the Missoula Fire Sciences Laboratory on heat transfer and ignition.	Presentation with class discussion followed by handout questions. This lesson is quite advanced.
	H08A. Fire Environment Triangle and Fire Spread: The Matchstick Model	Students design and conduct an experiment to investigate how slope and the density of trees (or other kinds of standing fuels) affect fire spread. Video clips of matchstick boards with different stand densities and slope are available.	Student groups use matchsticks on Masonite boards to test their hypotheses. Outside or lab with hood is best. 
	H08B. Fire Environment Triangle and Fire Spread: The Landscape Matchstick Model	Students design a model landscape to investigate the relationships among fuels, topography, weather, and fire spread.	Student groups design a model landscape using various materials (e.g., clay, matches, toothpicks, foil, cardboard-not in trunk) and ignite it. Outside or lab with hood is best. 
	H09. Ladder Fuels and Fire Spread	Students create a physical model to learn how the vertical arrangement of fuels affects the potential for fires to spread into tree crowns. Short video clip	Student groups to create a 'tree' that will survive wildfire using newspaper strips (foliage) and metal support stand. PREP: Complete H09-1 one day prior or as homework. Outside or lab with hood is best. 
	H10. 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 read excerpts from an official planning document to learn how fire managers predicted fire spread. Then they use weather data to make their own predictions of fire spread. Finally, they synthesize day-by-day reports from the official records of the Incident Command (IC) Team and other sources to create 'Weather Channel'-type reports on the fire's progress for a national audience. In a closing section of the activity, students review the IC Team's use of models and a map that shows the variety in fire severity in the area burned.	Homework and 2-3 class periods  M08 is a somewhat simpler version of this activity.

Unit IV. Fire Effects on the Environment	H11. Smoke from Wildland Fire: Just Hanging Around?	Students learn how smoke from wildland fires can reduce visibility, degrade air quality, and threaten human health. They look for patterns in data on weather and air quality from a wildland fire that occurred in 2017. They explain patterns in the data by applying the concepts of inversions and stable vs. unstable air. Then they use their knowledge to develop an editorial for a newspaper or news blog that makes recommendations to specific groups (citizens, health experts, fire managers, etc.) about what to do regarding smoke from wildland fires.	2-3 class periods. Presentation, optional demonstration  or short video, short writing assignment.
	H12. Fire, Soil, and Water Interactions	Students discuss a presentation that describes fire's effects on soils and how these effects are measured. 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.	2 class periods. Presentation, option to conduct experiment or watch video of experiment, reading assignment with questions.
Unit V. Fire's Relationship with Organisms and Communities	H13. Tree Identification: Create a Dichotomous Key	Students use photographs and botanical specimens to create a dichotomous key for 10 tree species native to forests of the northern Rocky Mountains and the North Cascades.	Student groups create dichotomous key for 10 tree species using photographs and specimens. Groups then identify all 'mystery trees' using another groups keys.
	H14. Researching a Plant, Animal, or Fungus	Each student selects a plant, animal, or fungus to study. He/she writes a research paper on this species and shares the results with the class in a multimedia presentation. During presentations, classmates take notes to be used later for an open-note book quiz.	Homework and 2-3 class periods for student presentations.
	H15. Forest Communities and Climate Change	Students assemble a graphical model of the forest communities on a mountainside in the northern Rocky Mountains/North Cascades region. They use the model to describe specific forest communities and to assess the potential for tree distributions to change in response to climate change. Then they read and take a stand on the use of assisted migration to conserve species.	1-3 class periods depending on how you teach it. Presentation with class discussion, handout, reading assignment, and short class activity.

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. 
	H19. History of Mixed-severity Fire	Students use the stand history diagrams that they assembled in the 2 previous activities to learn about mixed-severity fire regimes. They check their skill in identifying historical fire regimes by interpreting stand history diagrams. Finally, in the assessment, they describe or depict the appearance of a forest that has had a historical regime of low-, mixed-severity, or stand-replacing fire.	Class discussion using stand history diagram created in previous two lessons along with presentation. Students complete a handout and create a visual (art), written, or verbal description of a forest stand in a particular year. Builds on previous two lessons. 
	H20. Why Do Historical Fire Regimes Matter?	Students apply their knowledge about fire regimes (low-, mixed-, and stand-replacement) to 3 forest types that occur from the northern Rocky Mountains to the North Cascades - forests historically dominated by ponderosa, lodgepole, and whitebark pine. Students read a technical article about 1 of these forest types and summarize it for a high -school science blog.	Slide presentation to review fire regimes. Student groups write a blog about a fire regime in 1 of 3 and forest types using handouts and provided articles. Students describe contemporary changes about their forest type.

	H21. 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).
	H22. Changing Landscapes, Changing Fires	Students envision how they would like a wildland area to look in the future and how that might be achieved. First, they study photos and read articles that describe changes over the past 100 years in landscapes, fire regimes, fire management, and other issues. Then they create artwork that shows their own vision of a future landscape, and they write an editorial explaining their vision and what should be done (or not done) to achieve it.	2-3 Class Periods. Day 1: Class views historical and contemporary images and describes the changes they see. Day 2-3: Students read assigned articles and present information to class in groups.