Wildfires and Schools

Much of this publication has been adapted for schools from the Federal Emergency Management Agency's Wildfires homepage and Wildfire Mitigation Fact Sheet, Rebuilding After a Fire.

The Right Conditions

Conditions must be just right for a wildfire to start and spread. Specifically, fuel, weather, and topography work together to determine how quickly a wildfire travels and at what intensity.

Fuels. The two basic fuel types are vegetation and building materials.

Vegetation. Fuel in its natural form consists of living and dead trees, bushes, and grasses. Typically, grasses burn more quickly and with less intensity than trees. Branches or shrubs between 18 inches and 6 feet are considered to be ladder fuels. Ladder fuels help convert a ground fire to a crown (tree top) fire which moves much more quickly. Check with your local cooperative extension service to get a list of local plants that are less flammable.

Building Density. The closer buildings are together, the easier it is for flames to spread among them.

Weather. High temperatures, low humidity, and swift winds increase the probability of ignition and difficulty of control. Short and long term drought further exacerbates the problem.

Slope. Slope is the upward or downward incline or slant of terrain. A completely flat plain represents a 0 percent slope and a hillside that rises 30 feet for every 100 feet of horizontal distance represents a 30 percent slope. Hot gases rise in front of the fire along the slope face, pre-heating the up-slope vegetation, moving a grass fire up to four times faster, and with flames twice as high, as a fire on level ground.

How a Building Catches Fire

There are three ways a wildfire can transfer itself from the natural vegetation or other burning buildings:

Radiation. Wildfires can spread by radiating heat in the same way a radiator heats rooms in the wintertime. Radiated heat is capable of igniting combustible materials at distances of 100 feet or more.

Convection. Contact with the convection column (flames) may cause the wildfire to ignite buildings. Typically, the convective heat column rises vertically, within the smoke plume.

Firebrands. Firebrands are burning materials blown by fire-generated winds. Firebrands can be carried long distances — more than a mile.

School building materials and design play a significant role in establishing the level of exposure that can be endured before the building's ignition from radiation, convection, firebrands, or any combination of these three.

Determining Your School's Wildfire Risk

Learn about the history of wildfire in your area. Be aware of recent weather. A long period without rain increases the risk of wildfire. Consult with local fire and building officials, and consider having a professional inspect the school and offer recommendations for reducing wildfire risk.

Determine your community's ability to respond to wildfire. Are roads leading to your school wide enough to allow firefighting equipment through? Are there fire hydrants on or near the school site? Is the site on level or sloping land, and does it have flammable vegetation?

National Clearinghouse for Educational Facilities
at the National Institute of Building Sciences www.ncef.org
Prepared under a grant from the U.S. Department of Education, Office of Safe and Drug-Free Schools

The Institute for Business and Home Safety provides the following guidance for determining risk from wildfires:

Low risk areas typically have:

- A humid climate with a short dry season
- Flat terrain with no grades greater than 9 percent
- Limited wildland or conservation area exposure
- Sites that are not crowded by trees
- Manmade fuels located at least 50 feet from the building
- A fire hydrant within 300 feet
- Easy access for fire trucks

Moderate risk areas typically have:

- A dry season that is less than 3 months long
- Hilly terrain with grades averaging between 10 and 20 percent
- A shared border with a wildland or conservation area with light brush, small trees, or grass
- Trees located close to the building
- Manmade fuels located within 50 feet of the building
- A fire hydrant within 500 feet
- Access for fire trucks

High risk areas typically have:

- A dry season that is more than 3 months
- Steep terrain with grades averaging more than 20 percent
- Forested wildland within 100 feet of the school
- Trees that are crowded within 30 feet of the school
- Manmade fuels within 30 feet of the school
- No fire hydrants
- Limited access for fire trucks

Creating a Survivable Space for Your School

A survivable space is an area of reduced fuels between the school and the untouched wildland. It provides enough distance between the building and a wildfire to ensure that the building can survive without extensive effort from either you or the fire department. It also allows the fire department more time to fight the fire before it reaches the school. One of the easiest ways to establish a survivable space is to use the zone concept. Zone 1 is the closest to the school and Zones 2 and 3 move progressively farther away.

Zone 1. Establish an area around the school extending a minimum of 30 feet on all sides that limits plantings to carefully placed indigenous, low-growing species. As much as 50 to 100 feet many be necessary depending on the risk, especially on downhill sides of the site. Keep the roof and gutters clean and free of leaves and debris.

Zone 2. Place low-growing plants, shrubs and carefully spaced trees in this area. Maintain a reduced amount of vegetation. Each tree's foliage should be separated by at least 10 feet from other trees', and all dead or dying limbs should be trimmed. For trees taller than 18 feet, prune lower branches within six feet of the ground. No tree limbs should come within 10 feet of the school.

Zone 3. This farthest zone from the school is a slightly modified natural area. Thin selected trees and remove highly flammable vegetation such as dead or dying trees and shrubs.

The Importance of Maintenance

Once you have created the school's survivable space, you must maintain it or risk losing the benefit of its protection.

The Fire-Resistant School

The next step is to use fire resistant building materials and construction techniques in retrofitting the school.

Keep in mind that a wildfire sees the school as just another fuel source. The survivable space you construct around the school will keep all but the most ferocious wildfires at bay. But if the wildfire does break through this space, an ignition can occur on the school's exterior. The best situation is for exterior materials to prevent flames from entering the school's interior.

Roof. The roof is the most vulnerable part of the school to wildfires. During a wildfire, firebrands can fall on the roof, landing in the roof's nooks and crannies where a fire can easily start. Once the roof covering ignites, chances are good that the rest of the school

Prepared under a grant from the U.S. Department of Education, Office of Safe and Drug-Free Schools

will follow. The best way to avoid this situation is to make sure the roof is free of debris and fire-resistant. The two primary fire resistance tests are ASTM E108 and UL 790, both of which use roof classification levels A, B, and C, with A being the most fire resistant.

Exterior walls. Exterior walls are susceptible to a wildfire's radiant and convective heat. A fire on an exterior wall can 'bridge' to more vulnerable areas such as eaves, soffits, vents and windows. Wall materials that resist heat and flames include stucco and masonry such as stone, brick, and block. Though some materials like vinyl siding will not burn, they may lose their integrity when exposed to high temperature and fall away or melt, providing the fire with a direct path inside the wall's underlayment.

Exterior windows, glass doors, and skylights. Exposure to the heat of the wildfire can cause ordinary window glass (single or double pane) to fracture and fall out, leaving an opening for flames and firebrands to enter the school. Tempered glass is preferable; it typically fractures well above the radiant heat exposures capable of igniting wood.

Eaves, fascias, and soffits. The eaves, fascias, and soffits of roof overhangs are vulnerable to both firebrands and convective exposures. They should be 'boxed' or enclosed with noncombustible materials. Materials that melt or burn in relatively low temperatures, such as PVC and vinyl coverings, should not be used.

Attic and foundation vents. Wind or direct contact with a fire's convective heat can push firebrands through the vents into a school's crawl space or attic. Vent openings should be screened to prevent firebrands or other objects larger than 1/4 inch from entering the school. Both vents and screens should be constructed of materials that will not burn or melt when exposed to radiate or convective heat or firebrands. Vents also should be corrosion-resistant to help minimize rusting and a consequent loss of integrity.

Building attachments. Flammable structures and materials attached to the school such as wood decks, storage areas, and fences are highly vulnerable to convective exposures and can act as fuses, carrying the fire to the building. If the feature in question is attached to or touching the school, it should be considered a part of it.

Meeting Code Requirements

The International Code Council's *International Wildland Urban Interface Code* provides model code requirements for buildings subject to wildfires.[1] To determine if your school meets these requirements, obtain a copy of the code and follow these four steps:

Step 1. Use Table 502.1 to determine the school site's "fire hazard severity" level: ***moderate hazard***, ***high hazard***, or ***extreme hazard***.

These hazard levels are based on the site's slope, the number of days a year it is subject to critical fire weather, and the amount of surrounding vegetation that can act as light, medium, or heavy fuel for a wildfire. See Chapter 2 for the definitions of "critical fire weather," "light fuel," "medium fuel," and "heavy fuel".

Step 2. Use Table 603.2 to determine the amount of "defensible space" ("survivable space" as used elsewhere herein) that must surround the school:

- 30 feet for ***moderate hazard*** sites
- 50 feet for ***high hazard*** sites
- 100 feet for ***extreme hazard*** sites

Within the school's defensible space, only certain kinds of vegetation are permitted:
– groundcovers such as green grass, ivy, succulents, or similar plants;
– trees pruned at least 6 feet off the ground and with foliage ("tree crowns" as defined in Chapter 2) separated at least 10 feet horizontally from buildings, power lines, and the foliage of other trees.

Step 3. Use Table 503.1 to determine the school's required class of "ignition-resistant construction" (***IR Class 1***, ***2***, *or* ***3***) based on the site's hazard level and whether or not there are nearby fire hydrants ("conforming water supply").

Step 4. Compare the school's actual construction to its required class of ignition-resistant construction:

[1] Somewhat similar requirements are found in NFPA 1144, *Standard for Reducing Structure Ignition Hazards from Wildland Fire*.

Prepared under a grant from the U.S. Department of Education, Office of Safe and Drug-Free Schools

- ***IR Class 1*** (Section 504)
  - Class A roof covering or assembly, per ASTM E108 or UL 790,
  - noncombustible gutters and downspouts
  - noncombustible or 1-hour-rated exterior walls
  - enclosed underfloor spaces
  - noncombustible or 1-hour-rated appendages and projections (such as wood decks and fences)
  - 20-minute-rated windows and skylights
  - 20-minute-rated doors
  - vents not over 144 square inches and covered with ¼-inch or smaller mesh

- ***IR Class 2*** (Section 505)
  - Same as Class 1, except:
  - Class B roof covering or assembly, per ASTM E108 or UL 790
  - enclosure of eaves and soffits with solid ¾-inch thick materials

- ***IR Class 3*** (Section 506)
  - Class C roof covering or assembly, per ASTM E108 or UL 790
  - enclosed underfloor spaces
  - vents not over 144 square inches and covered with ¼-inch or smaller mesh

If the school does not meet the appropriate ignition-resistant construction requirements, meet with local fire and building officials to discuss what to do.

Alternatives are to make the school's exterior construction more ignition resistant, further reduce the amount of vegetation around the school, or both.

Beware of Increased Flood and Mudslide Risks

One of the lesser known but critical considerations following a wildfire is the increased risk of floods and mudslides, even in areas far away from the fire.

Charred ground, where all plant material has burned away and cannot absorb water, can result in mudflows and floods. Properties directly affected by fires, as well as those located below or downstream from burned areas, are most at risk, including many properties not previously considered as having a moderate or high flood risk. It may take three to five years for the vegetation to regain the ability to intercept and retain water. Without vegetation and ground cover, rainfall can cause soil on slopes to become saturated, liquefy, and flow downhill as a devastating mudflow. Schools in or below burned areas should prepare for possible flooding.

To mitigate against potential flood damage in burned areas:

- Use a rototiller to break up the soil surface so more water can be absorbed, especially in charred areas.

- Build channels or deflection walls to direct water around buildings in potential mudflow areas. You can use silt fencing, filled bags (like sandbags), rock and straw bales, check dams, log grade stabilization structures, and sediment basins to control and slow water flow. Remember, however, if you divert a mudflow or any water and it crosses to a neighbor's property, the school may be liable for damages.

- Control soil erosion with straw mulch, hydraulic mulch, or other erosion control measures.

- Plant perennial plants and flowers for long-term soil stabilization. Use seed mixtures composed of native plant materials selected to complement indigenous plants. Plant ground cover on slopes and build retaining walls.

- Before the threat of flooding is imminent, evaluate the risk of flooding. Consult with your local planning, zoning, or city or county engineer's office to determine if the school is a high risk for flooding.

Be Prepared

- Wildfire-proof your school and its site, as described above.

- Review existing school insurance policies to ensure their limits adequately protect buildings and personal belongings. Become familiar with what is and is not covered.

- Working with local fire officials and emergency responders, make a wildfire emergency plan. Mark evacuation routes and keep important school records in a safe, fireproof, and waterproof place. Back up electronic records off-site.

Prepared under a grant from the U.S. Department of Education, Office of Safe and Drug-Free Schools

- Include the wildfire emergency plan in your school's crisis response plan and ensure both are current; see Practical Information on Crisis Planning: A Guide for Schools and Communities by the U.S. Department of Education, Office of Safe and Drug-Free Schools

- Refer to the National Clearinghouse for Educational Facilities publication Mitigating Hazards in Schools for information about hazard assessment, mitigation planning, and project funding.

- Plan for wildfires as part of a larger community process. The Society of American Foresters provides a concise, step-by-step guide for such a process, *Preparing a Community Wildfire Protection Plan: A Handbook for Wildland-Urban Interface Communities*. Another good community planning source is Firewise Communities.

- Ensure your school monitors its ***public alert radio,*** tuned to NOAA Weather Radio All Hazards, a nationwide network of radio stations broadcasting all-hazards information 24 hours a day, 7 days a week. Broadcasts include alerts and safety steps on a wide range of emergencies and hazards, including wildfires.

- For current wildfire information, visit the National Incident Information Center.

- During a wildfire, follow the directions of local emergency response officials.

Resources

How a California community used wildfire mitigation to avoid catastrophe, http://www.fema.gov/mitigationbp/bestPracticeDetail.do?mitssId=4166

The International Code Council's webpage, *Protecting Lives and Property from Wildfire*, http://www.iccsafe.org/safety/wildfire/community.html

For information about returning to the school or rebuilding after a wildfire, see http://www.fema.gov/rebuild/repair.shtm

For children's health risks associated with wildfires, see *Health Risks of Wildfires for Children: Acute Phase*, http://www.coeh.uci.edu/PEHSU/Wildfires%20-%20Acute%20Phase.pdf

and *Environmental Hazards for Children in the Aftermath of Wildfires*, http://www.coeh.uci.edu/PEHSU/Wildfires%20-%20Recovery%20Phase.pdf

The following web resources are hyperlinked in the text of this document:

FEMA Wildfire homepage, http://www.fema.gov/hazard/wildfire/index.shtm

FEMA Wildfire Mitigation Fact Sheet, *Rebuilding After a Fire*, http://www.fema.gov/library/viewRecord.do?id=3026

Institute of Business and Home Safety, *Assessing Your Wildfire Risk*, http://www.disastersafety.org/projects/?id=2360&category=1136

UL, *Roof Covering Materials*, http://www.cornellcorporation.com/pdfs/UL_Listings__790__1256.PDF

International Wildland-Urban Interface Code, http://www.iccsafe.org/dyn/prod/3850S06.html

NFPA 1144, *Standard for Reducing Structure Ignition Hazards from Wildland Fire*, 2008 edition, http://www.nfpa.org/aboutthecodes/AboutTheCodes.asp?DocNum=1144&cookie%5Ftest=1

U.S. Department of Education, Office of Safe and Drug-Free Schools, *Practical Information on Crisis Planning: A Guide for Schools and Communities*, http://www.ed.gov/admins/lead/safety/emergencyplan/crisisplanning.pdf

National Clearinghouse for Educational Facilities, *Mitigating Hazards in School Facilities*, http://www.edfacilities.org/pubs/mitigating_hazards.pdf

Firewise Communities, http://www.firewise.org

Preparing a Community Wildfire Protection Plan: A Handbook for Wildland-Urban Interface Communities, http://www.safnet.org/policyandpress/cwpphandbook.pdf

NOAA Weather Radio All Hazards Fact Sheet, http://www.crh.noaa.gov/Image/lot/nwr/NWR-FactSheet.pdf

National Incident Information Center, http://www.fs.fed.us/news/fire

Publication Notes

First published October 2008; updated March 2009.

Prepared under a grant from the U.S. Department of Education, Office of Safe and Drug-Free Schools

Appendix A, Wildfire Response

Always Be Ready for an Emergency Evacuation

Early evacuation is the best way to protect school occupants in a wildfire. Know where to go and what to bring with you. Plan several escape routes in case roads are blocked. If evacuation procedures are not a part of your school crisis plan, add them.

If you see a wildfire, call 9-1-1. Don't assume that someone else has already called. Describe the location of the fire, speak slowly and clearly, and answer any questions asked by the dispatcher.

Before the Fire Approaches Your School

- Evacuate everyone, with special attention to those with medical or physical limitations.
- Shut off any natural gas, propane or fuel oil supplies at their source.
- Lights. Turn on outside lights and leave a light on in every room to make the school more visible in heavy smoke.
- Don't lock up. Leave doors and windows closed but unlocked. It may be necessary for firefighters to gain quick entry into the school to fight fire. The entire area will be isolated and patrolled by sheriff's deputies or police.

Survival in a School Bus or Other Vehicle

You can survive the firestorm in a vehicle. It should only be done in an emergency, but it is much less dangerous than trying to run from a fire on foot. Roll up windows, turn off the hearer and A/C fan, and close any air vents. Drive slowly with headlights on. Watch for other vehicles and pedestrians. Do not drive through heavy smoke. If you have to stop, park away from the heaviest trees and brush. Keep the headlights on and ignition off. Roll up windows and close air vents.

Get on the floor and cover up with a blanket or coat. Stay in the vehicle until the main fire passes. Air currents may rock the vehicle and some smoke and sparks may get inside. The temperature inside will increase, but metal gas tanks and containers rarely explode.

If You Are Trapped in the School

Stay calm. As the fire front approaches, go inside. You can survive inside. The fire will pass before the school burns down, or possibly even catches fire.

If You Are Caught in the Open

The best temporary shelter is in a sparse fuel area. On a steep mountainside, the back side is safer. Avoid canyons, natural "chimneys," and saddles. If a road is nearby, lie face down along the road cut or in the ditch on the uphill side. Cover yourself with anything that will shield you from the fire's heat.

What to Do After a Wildfire

Check the school's roof and its overhangs immediately. Make sure there are no fires, sparks, or embers. Check for broken windows and other possible ways fire may have entered the building. For several hours after the fire, maintain a "fire watch." Periodically re-check for smoke and sparks throughout the school.

Real-life Lessons

See "California Wildfires Highlight Importance of Preparedness" in the January/February 2009 issue of Campus Safety magazine, http://www.campussafetymagazine.com/News/Default.aspx?NewsID=2598

Prepared under a grant from the U.S. Department of Education, Office of Safe and Drug-Free Schools