



The True Costs of Wildfires: A Global Look at Cost-Plus-Losses Over Time

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What are the actual costs of a wildfire?

US wildfire events have become increasingly large, destructive, and costly during the past 20 years, and particularly since the turn of the century. During this time wildfire suppression costs have also increased dramatically. Suppression costs, however, represent only a small fraction of over-all wildfire cost-plus-loss. Other concurrent direct and indirect losses together with long-term post-fire losses can total 10 to 50 times (or more) the suppression costs. A more comprehensive economic and risk analysis and awareness on the part of decision-makers and the public of wildfire cost- plus-losses is needed, as are land and property management reforms, to help reverse these trends.

Our one-page checklist is intended to make initial estimates of total fire costs, and to ultimately be used in conjunction with a more comprehensive ledger for better tracking costs and losses over time. We believe that the use of these tools will better inform land and resource managers in the management of fuels and wildfires by identifying true costs of decisions, and by allowing better judgment in the establishment of resource use priorities.

Table 1. Wildfire 'Cost-Plus-Loss' Ledger Checklist Form

Fire Name _____ County _____ State _____ Country _____
 Ignition Date _____ Containment Date _____ Total Acres _____
 Cause: Human ____, Lightning ____, Operation ____, Prescription ____, Maintenance ____, Other ____,
 Major Landowner(s) _____ Human Fatalities _____ Homes Lost _____

Cost-Plus-Loss Category	A. Direct	B. Indirect	C. Post Fire	Totals
1. Suppression Costs				
a. Public				
b. Tribal/Private				
2. Property Damage				
a. Public				
b. Tribal/Private				
3. Health Effects				
a. Public				
b. Tribal/Private				
4. Vegetation				
a. Public				
b. Tribal/Private				
5. Wildlife				
a. Public				
b. Tribal/Private				
6. Water				
a. Public				
b. Tribal/Private				
7. Air and Atmospheric				
a. Public				
b. Tribal/Private				
8. Soil-Related				
a. Public				
b. Tribal/Private				
9. Recreation				
a. Public				
b. Tribal/Private				
10. Energy				
a. Public				
b. Tribal/Private				
11. Heritage				
a. Public				
b. Tribal/Private				
Totals				

Name _____ Title _____ Affiliation _____

Date _____

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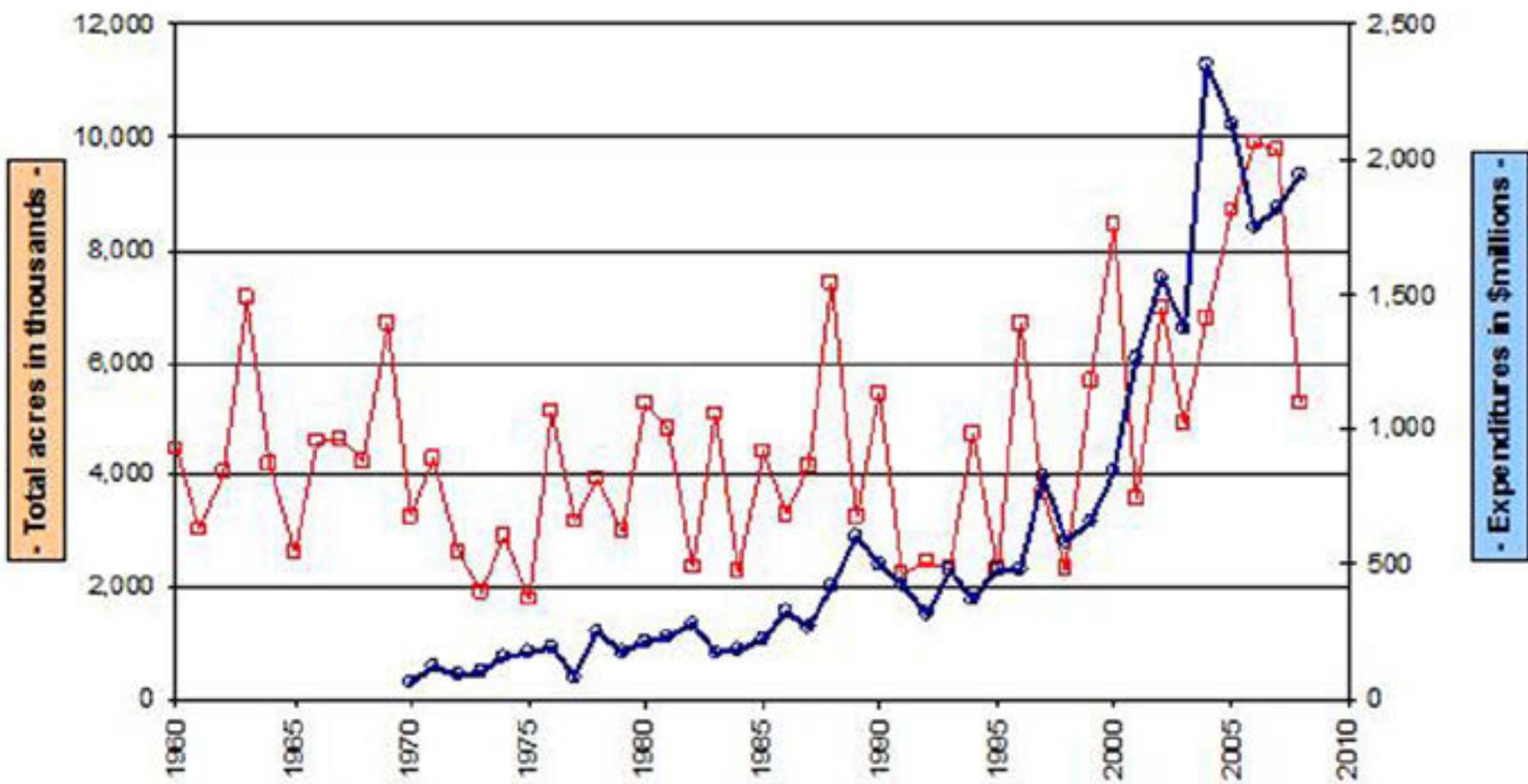
THE "ONE-PAGER"

SUPPRESSION COSTS



Suppression costs. These costs are the ones most commonly reported by media (to the exclusion of other costs and losses) and are often under-reported at that. **Typical costs** include wages, transportation, equipment, services, supplies, etc. Special costs, such as equipment depreciation, communications interruptions, and emergency evacuations, need to be accounted for, as well. **Indirect suppression costs** include emergency preparedness measures, supply purchases, crew training, and equipment maintenance. **Post-fire costs and losses** include equipment repair, supplies replacement, formal reviews, and possible medical treatments and hospitalization of personnel.

Total US Wildfire Acres 1961-2008, and USFS Fire Expenditures 1970-2008



■ In 2002, the National Association of Forest Service Retirees issued a report, “Forest Health and Fire: An Overview and Evaluation,” that documented and analyzed recent historic increases in US wildfire occurrences and severity. The NAFSR report called for a detailed accounting of “total losses associated with fire and other forest health situations,” specifically mentioning homes, evacuations, insurance claims, natural resources, recreation, water, forest health, timber, habitat, wildlife, management costs, insects, and disease (Pfilf et al., 2002).

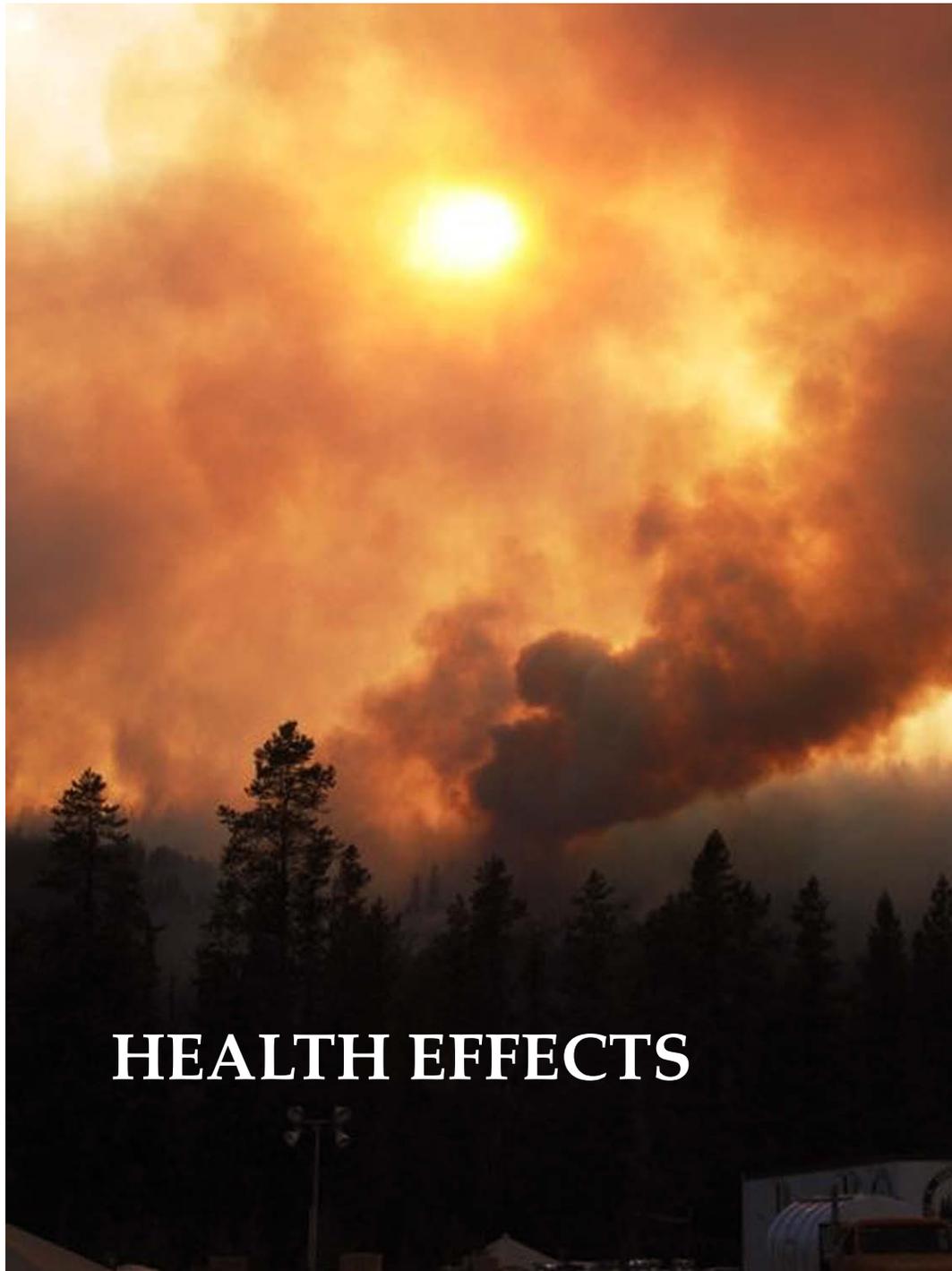
■ The 2002 Hayman Fire burned across 138,000 acres and cost \$42.3 million to suppress. Professor Dennis Lynch of Colorado State University estimated an additional \$187.5 million in losses had also accrued within one year. Suppression costs were just 18% of the total, causing Lynch to state: “I recognized the need to follow costs into subsequent years to more completely identify a fire’s true impact” (Lynch, 2004).

■ The 2003 fires in San Diego and Southern California resulted in 24 fatalities and over 3,700 homes destroyed. Suppression costs were more than \$43 million. However, Matt Rahn, a research economist with San Diego State University, recently presented findings that this figure is will likely be less than 2% of the fires’ total long-term costs (Rahn, 2009).

PROPERTY DAMAGE



Property Damage and destruction to federal, state, county, private, and municipal structures and facilities are major losses attributed to wildfires, particularly when transportation networks and communications systems are considered. Damage to timber and agricultural crops are other **direct property losses**. Some structural losses to private property may be insured; these can include business properties and homes, vehicles, and livestock. Capital goods and equipment damage and depreciation, evacuation expenses, and other losses are directly related to fire and smoke damage. **Indirect losses** include pre-fire insurance premium payments, building and landscape maintenance expenses, firefighting equipment purchases, and fire-related business closures. **Post-fire losses** include salvage, clean-up, rehabilitation, and repair expenses, equipment and capital goods replacement, drinking water pollution, smoke damage, deflated real estate values, lost sales tax revenues, and fire insurance premium increases.



HEALTH EFFECTS

Public health. These are some of the most overlooked and potentially costly areas associated with wildfire (and resultant smoke) damage. In addition to fatalities, wildfire smoke inhalation is known to cause and exacerbate a wide range of human health problems, including asthma, emphysema, and heart disease. Medical equipment, health-related evacuations, ambulance charges, and hospitalization are some of the **direct health losses** related to wildfire. **Indirect losses** include health insurance premiums, pre-fire medical equipment purchases, and medical personnel training. **Post-fire losses** include long-term health effects and increased health care expenses, insurance premium adjustments, health-related work absenteeism, survivor benefits, and even funeral and burial costs.



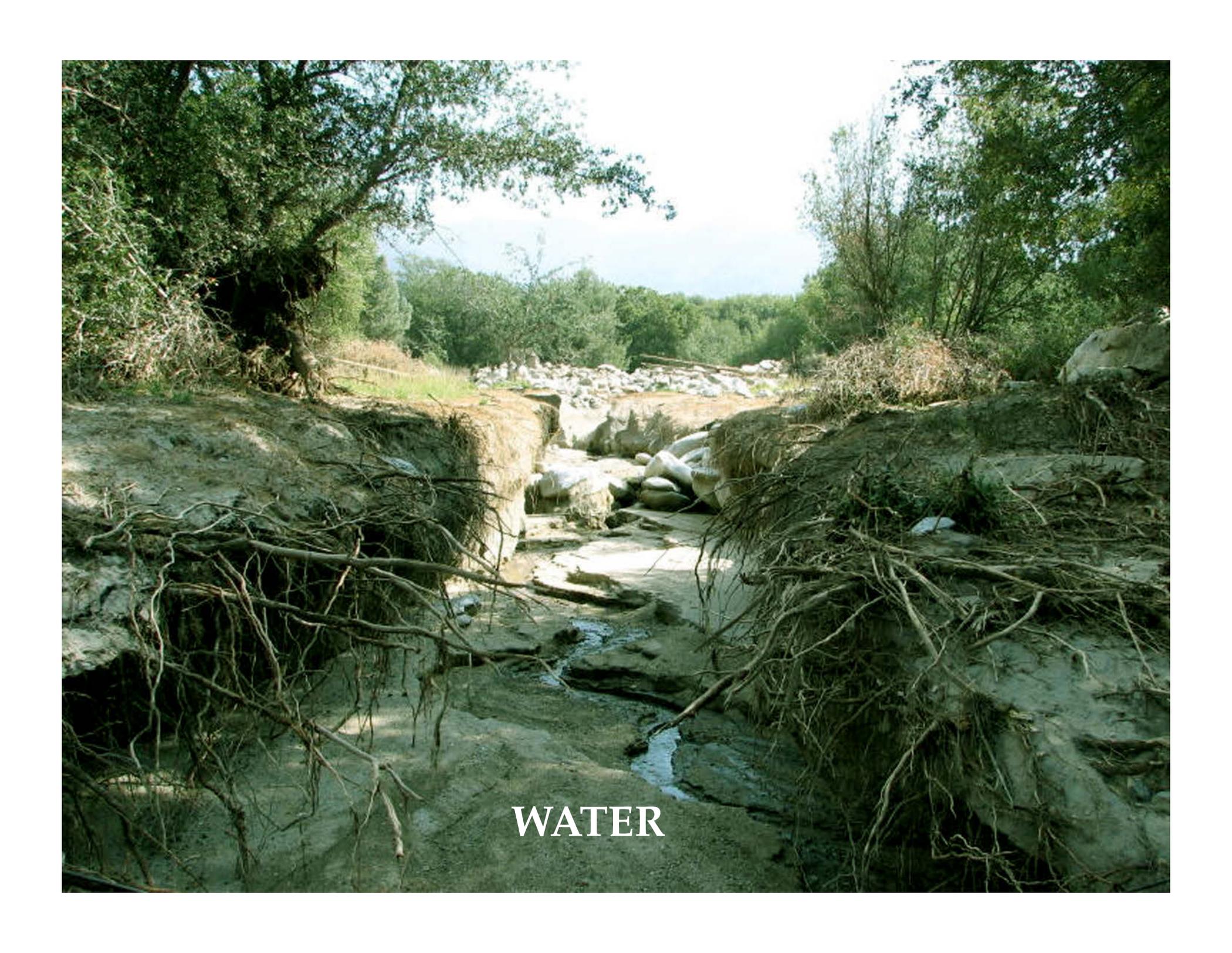
VEGETATION

Vegetation. Standing timber losses have often been considered in wildfire damage estimates, but loss of future harvests from destruction of growing stock has been less frequently accounted for. On public lands, **direct losses** include destruction of forage on grazing lands, secondary forest products destruction and/or degradation, and loss or degradation of wildlife habitat (including endangered species populations and protected habitats). On private land vegetation losses include timber and agricultural crops burned or impacted by wildfire smoke, *such as wine grapes*. **Indirect losses** include mortality of growing stock, the pre-fire investments used to establish or maintain such stock (such as nursery or planting costs and fencing), and irrigation systems. **Post-fire losses** include seeding, planting, and other revegetation costs, landscape rehabilitation, lost timber growth, and related product sales, business, job, and tax losses.



WILDLIFE

Wildlife. In addition to mortality of forest, range, and aquatic wildlife populations, **direct losses** include damage and destruction to a wide variety of common or protected habitats and to such amenities as viewing areas and feeding stations. **Indirect losses** include damage and destruction to pre-fire habitat improvement projects, population enhancement costs, and investments in wildlife research. **Post-fire costs** include reduced population productivity, foregone game management income, habitat restoration expenses, and related business, job, and tax losses. The loss of listed endangered animals and their habitat is included here.

A photograph of a stream flowing through a rocky, eroded landscape. The stream is narrow and shallow, with water flowing over light-colored, layered rock formations. The banks are steep and eroded, with numerous tree roots exposed and hanging over the water. The surrounding area is lush with green trees and vegetation. In the background, there are more trees and a clear sky. The word "WATER" is written in white, serif capital letters at the bottom center of the image.

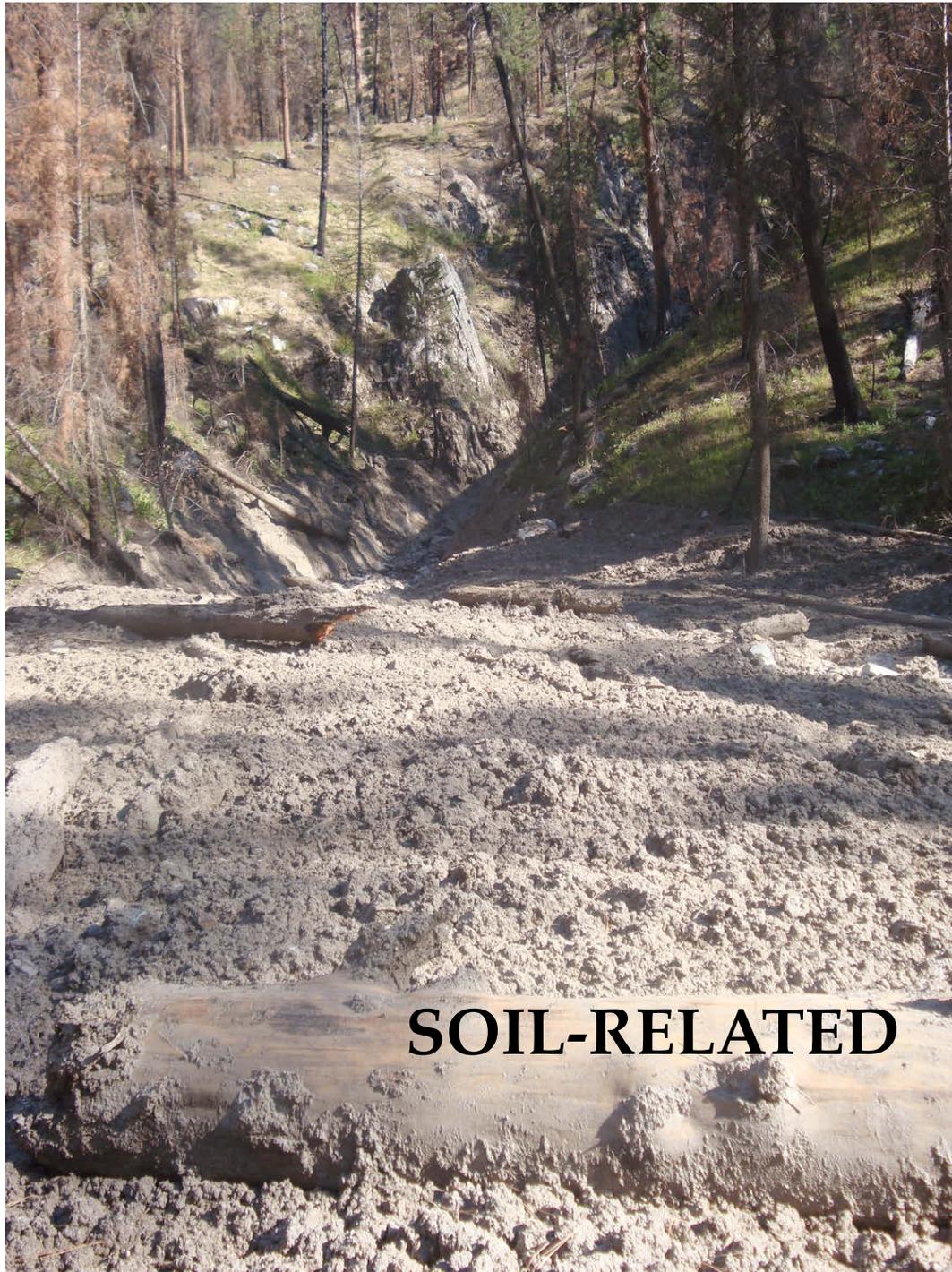
WATER

Water. Direct losses include water usage for suppression action, local water system shutdowns, and reductions in drinking water, hydropower, and irrigation supplies and sales. Indirect losses are related to pre-fire planning, system investments, and wildfire- related pollution control devices. Post-fire losses include degradation of domestic water, irrigation, and hydropower supplies, system repairs, administrative costs, sediment and pollution controls and mitigation, and long-term changes in water yield and watershed ability to collect and store water.



AIR & ATMOSPHERICS

Air and atmospheric effects. Direct losses are related to air pollution, including particulate, noxious gases, and CO2 emissions, and visibility impacts to road and air transportation, especially if delays and / or accidents result. Indirect losses are related to public health effects, property damage, and compromised recreational opportunities. Post-fire losses include additional air pollution controls, carbon mitigation costs, added administrative overhead, and future reductions in business, job, and tax revenues.



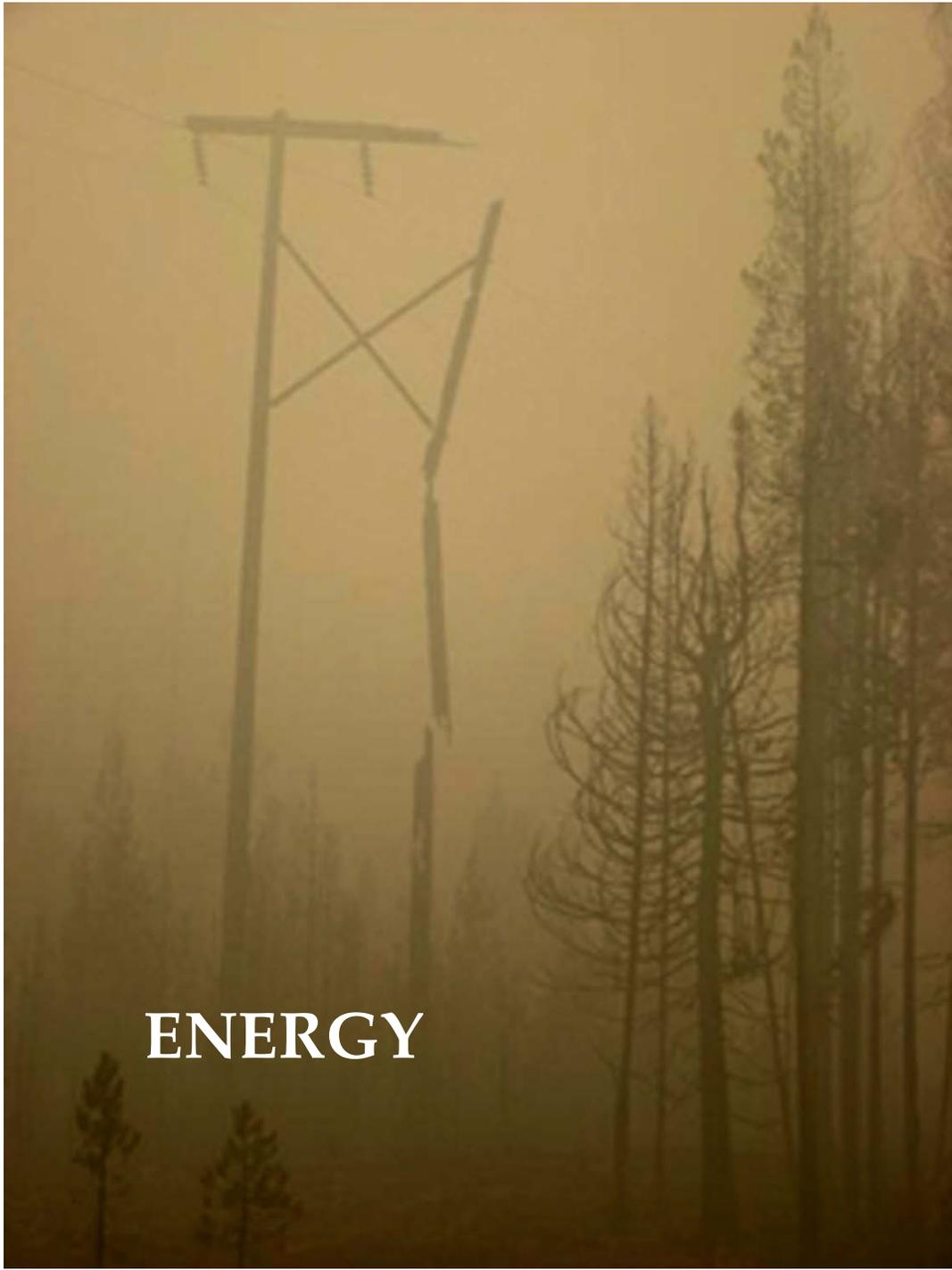
SOIL-RELATED

Soil-related effects. Direct losses in soil and soil productivity can result when erosion occurs during a wildfire due to fire-induced wind or from suppression actions. Soils can be baked, as well. Indirect losses include investments in fertilization, scientific research, and planning. Post-fire losses include decreased soil productivity, increased soil erosion, and post-fire soil rehabilitation, erosion and sediment mitigation, and project administration.



RECREATION

Recreation and aesthetics. Campground closures, evacuations, recreation-related business shutdowns, and structural assets damages and destruction are **direct recreation losses** attributable to wildfires. **Indirect losses** include pre-fire recreation-related investments by agencies, businesses, and individuals. **Post-fire losses** include recreational activity decline, degradation of scenic values, compromised hunting, fishing, hiking, camping, and wildlife viewing experiences, recreation-related structural repair or rehabilitation, and reduced business income, jobs, and tax revenues.



ENERGY

Energy. Direct losses include transmission line shutdowns and resultant loss of metered power sales, destruction and damage to energy production and transmission systems, and loss of biomass energy supplies. Indirect losses include pre-fire investments in energy production facilities and transmission systems and power planning costs. Post-fire losses include energy sales reductions, equipment repair, added sediment control, and future business, job, and tax revenue losses.

HERITAGE RESOURCES



Heritage (cultural and historical) Resources. Direct losses include damage and destruction of historical resources and pre-contact archaeological sites, loss or damage to historic cultural trail systems, ceremonial sites, and sacred sites, and heritage-related business shutdowns. Indirect losses include pre-fire public and private investments in heritage resources, including formal evaluations, research, and structural improvements. Post-fire losses include heritage site rehabilitation and repair costs, devaluation of cultural and spiritual assets, the loss of traditional uses and heritage, lost research opportunities to gather limited and fragile information, and heritage-related business, job, and tax revenue declines.

SUMMARY

U.S. forests have been experiencing an escalating number of catastrophic scale wildfires during the past 20 years. During the same time, federal, state, and local wildfire suppression outlays have also escalated dramatically, from less than \$500 million to nearly \$2 billion/year.

These costs, when coupled with simultaneous agency reductions of active timber and recreational resources management, have caused wildfire suppression to become “the big business” of the USFS.

However, preliminary research indicates that wildfire agencies' suppression costs may represent only 2% to 10% of the total cost-plus-loss damages to burned forests and adjacent areas – that is, recent public losses attributable to major U.S. forest wildfires may likely, and more accurately, total anywhere from \$20 billion to more than \$100 billion per year (Zybach et al., 2009).

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