The *Grand Challenges for Disaster Reduction* outlines a ten-year strategy crafted by the National Science and Technology Council's Subcommittee on Disaster Reduction (SDR). It sets forth six Grand Challenges that, when addressed, will enhance community resilience to disasters and thus create a more disaster-resilient Nation. These Grand Challenges require sustained Federal investment as well as collaborations with state and local governments, professional societies and trade associations, the private sector, academia, and the international community to successfully transfer disaster reduction science and technology into common use.

To meet these Challenges, the SDR has identified priority science and technology interagency implementation actions by hazard that build upon ongoing efforts. Addressing these implementation actions will improve America's capacity to prevent and recover from disasters, thus fulfilling our Nation's commitment to reducing the impacts of all hazards and enhancing the safety and economic well-being of every individual and community. This is the wildland fire-specific implementation plan. See also **sdr.gov** for other hazard-specific implementation plans.

What is at Stake?

DEFINITION AND BACKGROUND. Unplanned wildland fires (wildfires) impact tens of millions of acres annually around the world. Wildfires burn homes, damage infrastructure and natural resources, kill and injure firefighters and the public, impact local economies and the global environment, and cost billions of dollars per year to manage and control.

IMPACTS. Most of the area burned, cost, and other impacts of wildfire derive from a small number of very large fires.[1] An average of 2 million hectares (5.1 million acres) a year burned in the United States between 1995 and 2004; this is about 135 percent of the average burned area between 1965 and 1994. Federal agencies spend an average of $1.2 billion per year on fire suppression[2] and state and local agencies contribute millions more.

Of the ten events in the United States with the largest fire-related property losses since 1950, five were wildland-urban-interface fires.[3] The number of homes at risk is likely to grow as more people move into wildland-urban interface areas.

Wildfires with uncharacteristically high intensity can also damage natural resources affecting ecosystem recovery, decreasing productivity, and stimulating severe erosion and flooding. Observed increases in fire size and negative resource and societal impacts from wildfire result from a combination of factors, including fire suppression, past logging, grazing and other management activities, climate variability, and changing land use. Almost every wildland ecosystem in North America has a history of fire, but the patterns of fire frequency and fire type (e.g., surface fire vs. crown fire), as well as how these patterns have changed over time, vary greatly.

WILDLAND FIRE

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Grand Challenges for Disaster Reduction: Priority Interagency Wildland Fire Implementation Actions

GRAND CHALLENGE #1: Provide hazard and disaster information where and when it is needed.

- ■ Develop national databases of burn severity and fire perimeters for both wildland and wildland-urban-interface fires;
- ■ Implement continuity missions for moderate-resolution satellite data (15-30 m) for characterizing fuels and burn severity and for active fire remote sensing;
- ➤ More fully integrate across hazards to identify and illustrate interactions, including environmental benefits of natural wildland fires;
- ➤ Develop national geospatial coverage and modeling systems for fuel types, fire regimes, and condition classes appropriate for a new generation of fire models;
- ➤ Use Earth observation systems (ground and remote sensing) to develop and regularly update fuels, weather, and other data bases needed for fire prediction and monitoring;
- ➤ Develop and support analysis, computing, and communication capabilities to improve risk-informed assessments and analysis;
- ◆ Create geospatial data layers and integrated information, decision support systems, and models to support fire management planning and incident response.

GRAND CHALLENGE #2: Understand the natural processes that produce hazards.

- ■ Develop an interagency coordinating group for wildland and wildland-urban-interface fire research and development;
- ➤ Improve understanding of the processes of wildland fire events to accurately model and predict the potential occurrence, behavior, and impacts of wildland fire on resources, the environment, and physical infrastructure;
- ◆ Integrate new process understanding into improved 3-D fire behavior models that incorporate complex fuels (including structures), terrain, and fire/atmosphere interactions into predictions of fire probability, fire behavior, fire severity, fire emissions, smoke transport, and ecosystem fire effects.

Key: ■ Short Term Action (1-2 years) ➤ Medium Term Action (2-5 years) ◆ Long Term Effort (5+ years)

GRAND CHALLENGE #3: **Develop hazard mitigation strategies and technologies.**

- ■ Assess the benefits of fuel treatments, other preparedness activities, societal attitudes, and decision-making processes in reducing potential impacts;
- ➤ Improve understanding of costs and benefits of wildland fire and fuel management;
- ➤ Develop and implement integrated landscape and larger-scale modeling and analysis systems for wildland fire planning and wildland-urban-interface community design that incorporate risk mitigation, fuels, fire behavior, smoke transport, resource and social values;
- ➤ Use remote sensing and burn severity mapping to monitor fuel treatment effects and effectiveness;
- ◆ Develop risk-based methods for deciding on the best strategies for mitigating the negative effects of wildland fire on ecosystems and communities;
- ◆ Understand the factors that motivate individuals to undertake risk mitigation activities.

GRAND CHALLENGE #4: **Reduce the vulnerability of infrastructure.**

- ➤ Assess the fire safe characteristics of community designs, including layout, landscaping, and structure design and building materials, and make recommendations for improved fire safety. Improve information and tools for homeowners and planners on fire-safe construction, landscaping, and community planning;
- ➤ Develop data and validated models to assess how well different community and landscape designs and post-fire restoration activities mitigate fire risk and damage, including offsite effects such as flooding and erosion, and damage to transportation and energy infrastructure;
- ◆ Develop improved approaches to increase the resistance of infrastructure and communities to damage from wildland fire and its aftereffects.

GRAND CHALLENGE #5: **Assess disaster resilience.**

- ■ Assess logistical needs and evacuation plans for a variety of fire scenarios, including wildland and wildland-urban-interface fires;
- ■ Understand why individuals evacuate or choose to stay;
- ➤ Link fire safe community information with geospatial data for evaluating and predicting local to national impacts of fuel and fire management and community design;
- ➤ Establish methods to assess the adequacy of community resources for a successful response to a likely fire hazard;
- ◆ Improve and apply validated methods to enable consistent, rapid, and accurate fire severity mapping and assessment of the benefits of natural wildland fire and the risk of severe erosion, flooding, and other ecosystem damage;
- ◆ Develop methods to model recovery of fire-impacted ecosystems under various climate change scenarios;
- ◆ Develop improved systems to assist homeowners and communities to recover from impacts of wildland fire;
- ◆ Create common tools for assessing impacts of wildland fire as well as validated methods to enhance resilience to wildland fire and restore fire-impacted ecosystems and communities.

GRAND CHALLENGE #6: **Promote risk-wise behavior.**

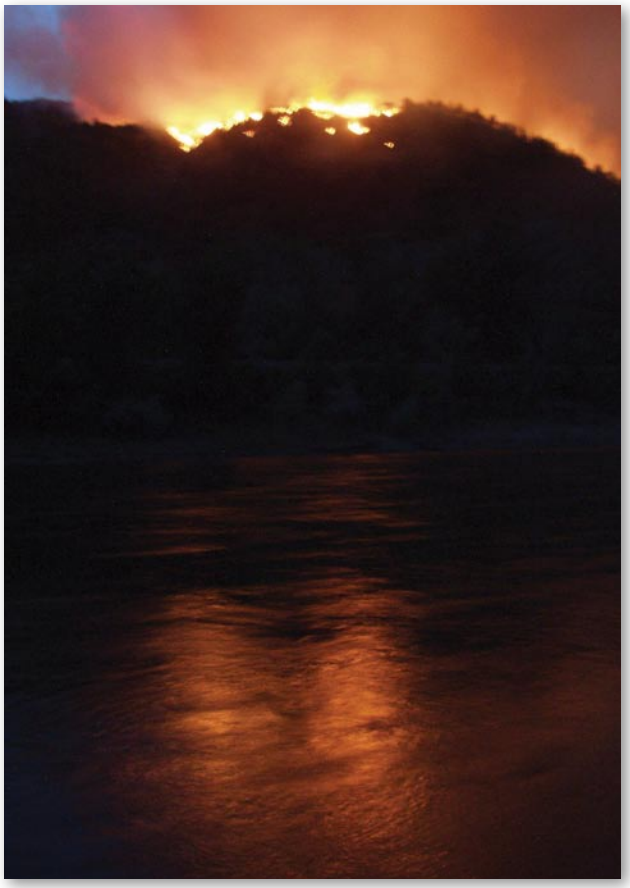
- ■ Evaluate effectiveness of alternative approaches to risk communication, emergency warning, and decision-making on fire management, prevention, and mitigation;
- ➤ Study the effectiveness of resource management and firefighter response and alternative management strategies at altering outcomes, including benefits to safety, costs, natural resources, and communities;
- ➤ Develop and deliver real-time decision support tools during fire incidents to help managers identify wildlands, communities, and structures most at risk and the most appropriate tactical responses;
- ◆ Develop national and global capabilities and tools to effectively illustrate and communicate immediate to long-term risks from wildland and wildland-urban-interface fires to managers, decision-makers and individuals;
- ◆ Integrate with multi-hazard risk communication systems for emergency warning.

Key: ■ Short Term Action (1-2 years) ➤ Medium Term Action (2-5 years) ◆ Long Term Effort (5+ years)

Expected Benefits: Creating a More Disaster-Resilient America

Fulfilling this wildland fire-specific implementation plan will create a more disaster-resilient America. Specifically:

Relevant hazards are recognized and understood. Integrated regional-to-global monitoring systems, predictive models, and decision support tools yield accurate information on potential wildland fire severity, extent, and effects to emergency managers and other decision makers. Fire behavior, fire effects, and smoke transport models support planning to minimize the negative impacts of fire on ecosystems and the environment (water and air). Better understanding and ability to predict the factors controlling wildfire patterns, risks to human health and infrastructure, and socioeconomic impacts will produce appropriate and cost-effective management responses for suppression, hazard mitigation, and recovery.



Communities at risk know when a hazard event is imminent. Improved warning systems will use state-of-the art models of fuel condition, fire behavior, smoke transport, and fire/weather interactions to provide communities with both long-term and timely and accessible short-term information on predicted hazard events.

Individuals at risk are safe from hazards. Decreases in uncharacteristically severe wildland fires and the development of fire-resistant structures and communities lead to reduced negative impacts of fire on property, human life and human health. Reduction of hazardous fuels, better community planning, and improved decision support tools support appropriate management response to wildfires through improved planning, mitigation, and preparedness.

Disaster-resilient communities experience minimum disruption to life and economy after a hazard event has passed. Wildland fire is managed to benefit wildland ecosystems and cause minimal resource damage; public awareness and fire-safe planning and construction have led to greatly decreased property loss from wildland-urban-interface fires; and costs of unnecessary fire suppression have been reduced. Synthesized wildland fire mapping and characterization, community planning, building codes, zoning regulations, and community/agency partnerships combined into a land-use decision-making tool resulting in decreased structural losses and economic impacts from wildland-urban-interface fires. Fire-affected ecosystems are restored and managed to support multiple values and societal benefits, consistent with maintaining healthy, sustainable forests and rangelands. Restoration and maintenance decisions are science-based. Improved fuel and fire management decrease the negative ecosystem and resource impacts of uncharacteristically severe wildland fire.

References

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2. IBID
3. NFPA. 2005. 25 largest fire losses in U.S. history (in 2003 dollars). Historical Research and Reports. National Fire Protection Association. Quincy, Massachusetts. Accessed 16 December 2005 at: **http://www.nfpa.org/itemDetail.asp?categoryID=954&itemID=23352&URL=Research%20&%20 Reports/Fire%20statistics/Historical**