Research to Advance Community Resilience

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Examples of EPA research, resources, and tools to advance community resilience in the event of a natural disaster.

The number and cost of natural disasters are increasing as part of changing conditions and weather patterns. The years 2016–2018 were historic years for the number of billion-dollar disaster events in the United States.[1] Wildfires and tropical cyclones were among the most damaging events during that time. Over the last two years, losses from wildfire damage exceeded US$40 billion.[2] Severe floods like those that devastated the Midwest earlier this year will also continue to present challenges for infrastructure and land-use planning.

Increasing community resilience is one way to adapt to and prepare for this new reality. Decisions made today can influence community resiliency for years to come, and U.S. Environmental Protection Agency (EPA) researchers are working to support communities with tools and resources for strategic planning. Examples of EPA research, resources, and tools to advance resilience are highlighted below.

Wildfire Smoke Resilience Resources

Smoke and direct chemical releases from fire can impact ecosystems and human health, even at great distances from the burned area. To assist with the growing concerns and risks associated with wildfire smoke, EPA's Air and Energy Program is pushing forward with research to build resilience at the regional, state, local, and individual levels to reduce the negative public health and ecosystem effects of wildland fires and the associated smoke and ash.

One tool, the Community Health Vulnerability Index (CHVI; https://www.epa.gov/air-research/community-health-vulnerability-index-provides-public-health-tool-protect-vulnerable), developed by EPA scientists, can be used to help mitigate health impacts of wildfire smoke events. The CHVI can be used to help identify communities at higher health risk from wildfire smoke. Health officials can use the tool, in combination with air quality models, to focus public health strategies

on vulnerable populations living in areas where air quality is impaired by wildfire smoke.

The smoke sense app (www.epa.gov/air-research/smoke-sense-study-citizen-science-project-using-mobile-app) is another tool to help communities become smoke-ready and more resilient to wildfire smoke. The free app is being used in the Smoke Sense study, a research endeavor that relies on the use of an interactive mobile application by the public to collect information and user engagement. The project also serves as an educational tool and resource to increase awareness and encourage people to take steps to protect their health from smoke during a wildfire or prescribed burn.

EPA's Community Multiscale Air Quality (CMAQ; www.epa.gov/cmaq) model, which was originally developed to support air quality regulations, is being improved to study wildfire smoke and evaluate its impact on air quality. New approaches and methods developed for the model are making it possible to more accurately simulate and track emissions from wildfires. As model sophistication improves, this tool could be used to help forecast smoke events from prescribed burns for land management and reduce human health impacts from smoke exposure during controlled fires for land management.

To assist individuals living in a community impacted by wildfire smoke, EPA has designed a suite of resources that aim to improve public health outcomes when smoke occurs. These resources are accessible through the EPA's Smoke-Ready Toolbox for Wildfires (www.epa.gov/smoke-ready-toolbox-wildfires). Outreach materials are available on how to prepare for wildfire smoke and reduce exposure.

Preparing for Extreme Events at Contaminated Sites

Recent studies have shown that extreme weather conditions, including high-flow events, can induce the undesired transport of contaminated sediments into surrounding areas (e.g., rivers, water reservoirs, etc.). A priority of EPA's Sustainable and Healthy Communities (SHC) Program is to support communities in assessing their vulnerabilities and preparedness to hazards, including unintended releases of toxic chemicals from Superfund, hazardous waste disposal, storage and treatment sites, and industrial sites due to flooding or other extreme events.

Contaminated sites such as Brownfields, Resource Conservation and Recovery Act and Superfund sites often contain legacy pollution from multiple industrial sources or landfills. They require complex and resource-intensive remediation, which can take years to complete. Communities living in close proximity to contaminated sites may be affected by environmental stressors such as soil, surface water or groundwater contamination, which can pose health risks. The potential for extreme event-induced contaminant transport might increase the potential risk for exposure.

EPA researchers, along with their state, regional, and community partners, are conducting research to better understand the risks and vulnerabilities posed by extreme events at contaminated sites for community resiliency planning. As part of an EPA SHC Regional Sustainability and Environmental Sciences research project (www.epa.gov/research/reses), researchers and partners are assessing contaminant transport in surface water and soil/sediment during flooding at contaminated sites in Pennsylvania.

There are several residential areas in close proximity to the contaminated sites, including areas where multiple environmental justice factors are present. Multiple contaminants of concern, including, but not limited to, polycyclic aromatic hydrocarbons (PAHs), lead, and polychlorinated biphenyls (PCBs) in creek sediment and soil were found on the sites. Both contaminated sites and the surrounding neighborhoods have a history of flooding under various conditions. Historically community members have raised concerns about the potential for contaminant transport from the sites into their properties and homes.

The team will quantify the potential flood-induced contaminant transport from the site across multiple flood return periods (i.e., 10-, 50-, 100-, and 500-year floods) using hydrodynamic coupled environmental fate-and-transport model simulations of flood inundation and contaminants in surface water, soils, and sediment. They will use contaminant sampling data from the study site to initiate, validate, and quantify uncertainty in the model output.

As communities raise additional concerns, EPA researchers are planning for subsequent research phases. Research would expand the study to include coastal areas, developing a better understanding of the impacts of extreme weather conditions such as hurricanes, storm surges and tidal changes on sediment accumulation and erosion in streambanks. They also plan to examine associated contaminants transport in the watershed system where contaminated sites are located to further understand nearby communities' potential vulnerabilities.

Ultimately, the researchers plan to produce an interactive map depicting contaminant transport across space and time for various flood and contaminant scenarios. The results of this research can be used to inform remedial planning and emergency preparedness in the face of increasing extreme weather events.

Tools Supporting Community Revitalization and Resilience

Revitalizing communities can improve their capacity to absorb impacts and recover from disruptive events. EPA

researchers created a collection of Tools to Support Community Revitalization (www.epa.gov/land-research/tools-partnerships-community-revitalization) and promote campus-community partnerships. The tools and partnerships facilitate strategic planning across a breadth of topic areas—including improving public health, reducing flooding, and improving infrastructure—all of which can advance community resiliency.

One of the tools featured in the collection, EPA's EnviroAtlas, is an interactive online mapping tool that helps planners understand and visualize potential impacts of policy decisions. It can also help communities incorporate ecosystem services and related human health impacts into decision making as they prioritize areas for revitalization or restoration.

Researchers catalogued EPA tools and resources available to communities for preventing, mitigating, responding to, and recovering from disasters in the Inventory of EPA's Tools for Enhancing Community Resilience to Disasters.[3] The resources range from available grants, reports, and guidelines to online mapping systems and can be used to prepare for many potential adverse events. The inventory also includes analysis of resource gaps and future research needs. **em**

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More Information

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