RENEWABLE RESOURCES JOURNAL

VOLUME 31 NUMBER 2

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The Rising Cost of Wildfire Protection

Headwaters Economics

Wildfires generally are getting larger and causing more damage. The past decade has seen the six worst fire seasons of the past half-century, with three of them—2006, 2007, and 2012—exceeding 9 million acres.[1] Bigger wildfires are likely the result of a widespread build-up of fuels, due to historic management practices, and changing climatic conditions, with resulting hotter, drier weather.

Wildfire protection is also getting more costly. Bigger fires cost more to control, but an additional factor is contributing significantly to the cost of wildfire protection—the development of homes on or near fire prone lands. The expansion of this Wildland-Urban Interface (WUI) increases the pressure to control wildfires, even in areas where fires are natural and ecologically beneficial. Houses in the WUI also divert firefighting resources to protecting structures instead of controlling damaging wildfires.

The responsibility for wildfire protection and development of private lands in the WUI lies with state and local governments, but the federal government bears a significant amount of the costs of protecting homes in the WUI from wildfires, with limited efforts or authority to control those costs.

This report was adapted from The Rising Costs of Wildfire Protection, authored by Ross Gorte. He is a retired senior policy analyst with the Congressional Research Service, and currently serves as an Affiliate Research Professor for the Earth Systems Research Center of the Earth, Oceans, and Space Institute, University of New Hampshire. This report was produced by Headwaters Economics, Bozeman, Montana.

Wildfire Seasons are Becoming More Severe

Many reports have been written on the increasing extent and severity of wildfires. Most generally conclude that there are two primary contributors to the more severe fire seasons.

One contributor is the widespread build-up of forest fuels from historic levels. Many forests have become overgrown, particularly those that historically experienced natural, relatively frequent, low severity wildfires. These so-called "frequent-fire" forests have become choked with dead and dying vegetation, with too many trees, with an understory of trees that differ from the overstory and more.

This excess biomass is largely a result of three historic practices. First, heavy grazing in the past reduced grass cover and allowed more tree growth; the loss of grass cover removed many of the fine fuels that substantially contributed to the frequent, low-intensity fires.

Another contributor is past logging practices, which favored cutting the large pines and allowing other, less fire-tolerant conifers (notably Douglas-fir and the true firs) to expand in the understory. This both added more woody biomass for more intense fires and further reduced the grass cover, since many western pine forests sustained extensive grasslands under the canopies.

Perhaps most significantly for the fuel build-up in frequent-fire forests, is the 20th century fire suppression policies that sought to eliminate all wildfires. The vision of eliminating wildfires grew from the severe 1910 fire season in northern Idaho and western Montana, where three million acres of heavy timberlands, and a significant number of towns, burned in fire storms that lasted for a few weeks.[2] This vision and the resulting efforts eliminated many of the natural, low-intensity wildfires that eliminated excess biomass (grass, needles and leaves, twigs, many tree seedlings, etc.).

The second contributor to the increasingly severe fire seasons is changing climatic conditions. There are three well-documented aspects of climate change that are exacerbating wildfire severity. The most obvious, but probably least important, is higher temperatures. When air temperatures are higher, fires burn hotter and are more difficult to control. Related to the higher temperatures is the earlier snowmelt and spring growth. Regional fire seasons commonly begin in the dry period that follows spring growth— early spring in the South; April and May in the Southwest; midsummer in the Northern Rockies and Pacific Northwest.[3] With less snow and more rain, and earlier snowmelt for the snow that does fall, western fire sea-

sons are starting earlier and ending later, thus leading to more wildfires. Finally, climate change has caused years of drought for much of the West, making the vegetation drier, and thus more flammable.

Climate change is also indirectly exacerbating the fuel situation by affecting the spread of insects and diseases. The most significant pest in U.S. forests is currently the mountain pine beetle, which was the cause of 59 percent of all tree mortality in 2011.[4] The current epidemic of this native insect has been far more extensive than the epidemic 30 years ago, especially in Canada; this is largely attributable to the warmer climate.[5] Various authors have noted that insects are far more adaptable to changing climate conditions than are trees, and thus climate change is likely to lead to more extensive, more damaging infestations in the future, thus literally adding more fuel to the fires.[6]

Fighting Wildfires is Becoming More Expensive

Not surprisingly, more severe fire seasons have increased the cost of wildfire protection. Another factor driving costs is the development of homes on and near lands that are increasingly prone to severe wildfires. More people are moving to homes and communities that are near or in forests, the Wildland Urban Interface (WUI). Beautiful scenery, a forested setting, nearby wildlife, and relative isolation from neighbors are increasingly desired for private homes.

However, some of these desirable aspects, such as dense forests and isolation, also make these homes and their residents more vulnerable to wild-fires at a time when the risk of severe wildfires is already rising. This exacerbates the economic and political pressures to control wildfires in the WUI, further increasing fire protection costs.

Wildfire Protection Cost Trends

Forest Service and Department of the Interior

The primary federal agencies responsible for fire protection are the Forest Service (FS), in the U.S. Department of Agriculture; and the Bureau of Land Management (BLM), National Park Service (NPS), Fish and Wildlife Service (FWS), and Bureau of Indian Affairs (BIA) in the U.S. Department of the Interior (DOI).

Historically, more than 70 percent of federal fire protection funding has been appropriated to the FS, with the other third appropriated to DOI (through the BLM until 2009 and through a department-wide account since). The FS has traditionally received the lion's share of federal fire protection funding because (a) it is the oldest of the four federal land management agencies;[7] (b) it has emphasized fire protection since the early years; and (c) it manages more forest land than all the DOI agencies combined.[8]

Annual federal wildfire management appropriations in the past decade have been more than triple the annual funding in the 1990s. In real dollar terms (adjusted for inflation), annual wildfire protection funds for the FS and DOI averaged $1.39 billion from FY1991 through FY 1999, and $3.51 from FY2002 through FY 2012. The annual appropriations, in real terms, are shown in figure 1, below.

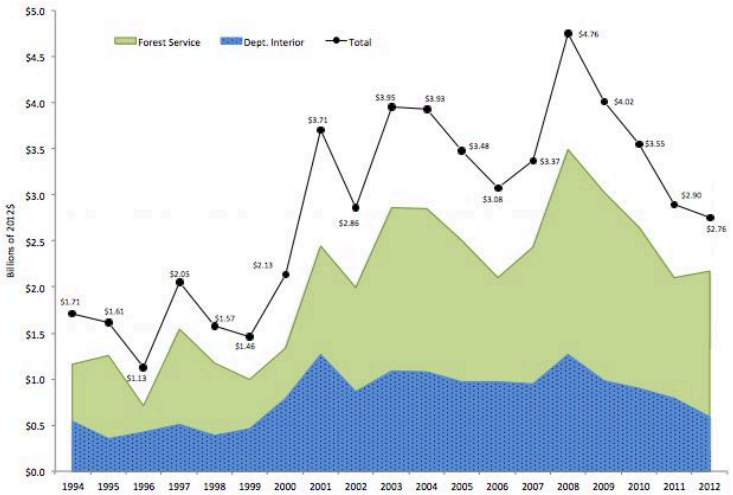
Federal Emergency Management Agency

In addition, the federal government, through the Federal Emergency Management Agency and other agencies, has paid substantial amounts for disaster recovery in the aftermath of the large wildfires that have occurred with increasing frequency over the past decade.

Prior to 2000, FEMA had responded to 11 major or emergency wildfire disaster declarations, with two in the 1950s, three in the 1970s, three in the 1980s, and three in the 1990s.[10] From 2000 through 2012, FEMA responded to 19 major or emergency wildfire disaster declarations.

Fire management assistance declarations have risen similarly in both number and grant amounts. There were 11 declarations in 1998, 12 in 2000, and 9 in 2001; from 2002 through 2012, there were 599 fire management assistance declarations.

Figure 1. Federal Wildfire Appropriations to the Forest Service and Department of the Interior, 1994 – 2012[9]



These government expenditures do not even count the substantial costs borne by state and local agencies to deal with wildfires. The states are responsible for wildfire protection on far more land than the federal government—1.44 billion acres of state-protected lands, compared to 650 million acres of federal land.[11] States spent $1.43 billion on wildfire programs in 2010, down from $1.68 billion in 2008. While less than the federal appropriations, state expenditures on wildfire protection are still significant. There is no tabulation of wildfire protection expenditures by local governments, although spending is also likely to be substantial.

Home Development Helps Drive Wildfire Costs

As noted above, the expanding Wildland-Urban Interface (WUI) has contributed to the high and rising costs of wildfire protection. The WUI is generally defined as where homes are built in or near forests or other wildlands, such that they are at risk from wildfires.

The WUI increases total wildfire protection costs compared to undeveloped wildlands. Since residential development does not occur on federal lands, fire protection in the WUI is largely a state and local responsibility. Also, many state and local governmental decisions not directly related to wildfire protection affect the cost of fire protection. For example, state and local decisions and regulations about structures (e.g., housing density requirements, building codes) and about access (e.g., road standards and design) affect fire protection.

Effects of the WUI on the Federal Government

Fire protection in the WUI imposes costs on the federal agencies. The federal government provides financial and technical assistance to states, and through the states to local agencies, for wildfire protection. More significantly, however, the existence and expansion of the WUI also imposes direct and indirect costs on the federal agencies in wildfire control efforts and in fuel reduction treatments. The existing and expanding WUI affects fire control efforts on federal lands.

Federal wildfire suppression policy explicitly states that protecting human lives is the priority, and that protecting private property and natural resources are equal as the second priority. However, the political reality is that protecting people's homes is given priority over protecting lands and resources. The Government Accountability Office (GAO) has noted that structures adjacent to federal lands can significantly alter fire control strategies and raise costs, because protecting structures commonly requires additional, special firebreaks and because fire managers often rely on expensive aircraft to drop fire retardant on and around the structures.[12] In a survey of FS land managers, some estimated that 50 to 95 percent of firefighting costs were attributable to protection of private property.[12]

In 2008, a study for the Montana State Legislature reported that suppression costs were highly correlated with the

Renewable Resources Journal

Renewable Resources Journal (ISSN0738-6532) is quarterly of Renewable Natural Resources Foundation, 6010 Executive Blvd, 5th Floor, North Bethesda, MD 20852-3827, USA Tel: +1 301 770 9101. Email: info@rnrf.org.Website: http://www.rnrf.org © RNRF 2017.

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Editorial Staff: Robert D. Day, editor; Amber Lee Todoroff, assistant editor

number of houses threatened by wildfire and the pattern of those houses (e.g., a dense subdivision added less cost than the same number of houses dispersed over a wider area).[14] Another study by in 2011 found that fire control costs in the Sierra Nevada Mountains of California were correlated to the number and location of houses.[15]

In Oregon, building new homes in otherwise undeveloped areas has the greatest potential to increase firefighting costs, and an increase in average summer temperature of 1°F is associated with an increase of 420 wildfires.[16] Such federal efforts to protect private property in the WUI not only add to the cost of federal fire control, they also divert federal efforts from protecting natural resources.

Impact of Increased Fire Protection Funding to Protect Homes

The high and rising cost of wildfire protection on federal lands, including the costs of protecting homes in the WUI, has affected other federal land programs. Firefighting costs commonly exceed wildfire appropriations. While normally it is illegal for agencies to spend more than is appropriated, the annual Interior appropriations acts[17] have included provisions authorizing the agencies to borrow unobligated funds from other accounts for emergency firefighting once wildfire appropriations have all been spent. Such transfers of funds among accounts (called reprogramming) without direct congressional approval of each transfer are relatively rare among federal agencies.

Historically, this borrowing authority was not a significant problem. First, Congress commonly provided supplemental emergency funds to repay the borrowed funds, although this has not always been the case. For example, in 2004, the FS borrowed $50 million from the Forest Land Enhancement Program (FLEP), a mandatory spending program for FS forestry assistance to private landowners, but Congress chose not to reimburse the borrowed funds, effectively terminating the FLEP funding.

Traditionally, the FS borrowed funds from the Knutson-Vandenberg (K-V) Fund, a trust fund for reforestation with funds from timber sale revenues. Since the K-V Fund balance of about $500 million was for reforestation for up to three years after timber harvesting, Congress had time to provide the supplemental funding. However, as firefighting costs have risen and timber sale revenues have fallen, the FS has had to borrow from other accounts to pay for firefighting.

Second, fire protection funding was a much smaller proportion of total agency appropriations prior to 2000. From 1993 to 2000, FS fire protection funding was 25 percent of total FS discretionary appropriations. However, since 2001, fire protection funding has been 47 percent of total FS discretionary appropriations, and reached 56 percent of total FS discretionary appropriations in 2008 (This is less of an issue for DOI, since DOI fire protection funding is only a third to a half of FS fire protection funding, while available DOI discretionary funding is roughly double FS discretionary appropriations.).

Borrowing by FS of an increasing proportion of non-fire funds has affected numerous other programs. The effect has been to delay land acquisitions, defer needed road and building maintenance, and reduce other resource management activities, such as recreation and wildlife habitat programs. Thus, the increasing fire protection costs are affecting many of the individuals and groups interested in FS lands and uses.

In 2010, Congress enacted the Federal Land Assistance, Management and Enhancement (FLAME) Act, in Public Law 111-88. It established FLAME Wildfire Suppression Reserve Funds for the FS and DOI, to be funded from annual appropriations, with conditions on the use of these reserve funds.

The FLAME funds were intended to insulate federal land and resource management programs from the financial impacts of borrowing to pay for fire control. However, there can still be lost resource management time when agency personnel are assigned to wildfire efforts. In addition, FLAME provides no incentives to reduce or constrain the firefighting costs and reduces the linkage between funding and fire protection activities.

In addition, while Congress enacted appropriations for the FLAME reserve funds, it has also enacted rescissions, taking funds from the accounts to pay for other federal programs. Thus, the "assurance" of reserve funding, to avoid borrowing from other accounts and affecting federal land users, is less assured than it appeared when the FLAME funds were created.

Fuel Reduction on Federal Lands

Programs to protect the WUI also affect fuel reduction on other federal lands. First, the Healthy Forests Restoration Act directed that half of federal fuel reduction funds were to be used in the WUI. As a result, the proportion of fuel treatments in the WUI increased after FY2001 (the first year for which such data are available), from 37 percent (45% for the FS, 22% for DOI) to about 60 percent from FY2003 to FY2006 (73% for the FS, 42% for DOI), and 70 percent in FY2008 (83% for the FS, 47% for DOI). More recent comparable data are not available, because the FS has modified the way fuel treatments are reported and has proposed shifting non-WUI fuel treatment funding to land and resource management accounts (instead of wildfire protection accounts).

This shift in fuel treatments to the WUI has two effects on federal fuel reduction efforts:

1. It raises the average costs of reducing fuels on an acre of land. Treatments in the WUI are closer and more visible to humans and thus the public involvement process commonly takes longer and costs more. Mechanical treatments may require additional steps to reduce the visual impacts of removing biomass. Also, prescribed burning is, in many ways, the most effective means of reducing fuels, but the higher values and closer proximity of humans necessitate more personnel and more oversight to try to prevent the prescribed fires from becoming wildfires.[18] One study found per-acre fuel reduction in the WUI costs 43 percent more for prescribed burning and nearly three times more for mechanical fuel reduction than in non-WUI areas.[19]

2. It results in less fuel reduction on other lands. The level of fuel reduction over the past decade has remained relatively stable—averaging about 3 million acres annually according to the agency budget justifications. Because efforts are increasingly being focused on the WUI, the level of fuel reduction on non-WUI lands is probably declining. Furthermore, as discussed in more detail in other reports,[18] the 3 million-acre effort is insufficient to treat the 230 million acres of federal lands at high or moderate risk of ecological damage from wildfires in a timely manner. Thus, wildfire fuel levels are currently increasing, and shifting more fuel reduction to the WUI will exacerbate the current situation. This is likely to lead to more severe wildfire seasons in the future.

Federal Wildfire Assistance to Communities

Most federal assistance for fire protection has been provided through two FS programs: state fire assistance and volunteer fire assistance. State fire assistance was first authorized in the Clarke-McNary Act of 1924; this authority was revised and updated in the Cooperative Forestry Assistance Act of 1978 (Pub.L. 95-313; 16 U.S.C. 2106). The funds are provided to the state agencies responsible for wildfire protection on a 50-50 cost-share (i.e., the state must match the federal grant). Many types of activities are feasible, such as fuel reduction, equipment acquisition, fire training for state and other firefighters, community fire protection planning, and more.[21] The projects are planned and completed by each state, and are not chosen or controlled by the FS.

Volunteer fire assistance was originally established as the Rural Community Fire Protection Program in 1973. The program authorization was terminated in 1996, but Congress transferred the activities to the FS and has continued appropriating funds for the program. The FS provides funds in grants to the states, again with a 50-50 cost share, for equipment, training, and other support for fire departments in rural areas and communities.

The federal agencies have supported two particular programs aimed at fire protection in the WUI: Firewise, and Community Wildfire Protection Planning. Firewise is a program of the nonprofit National Fire Protection Association with funding from the FS, DOI, and the National Association of State Foresters. The program website was created in 1997, after the loss of nearly 1,400 homes in 1985 led to discussions of how to protect homes from wildfires.[22]

Firewise is substantially a community and homeowner education program of strategies and actions for communities and individuals to protect homes, such as fire-safe roofing and decking materials and landscaping. Many communities have also adopted the Firewise program to encourage, or even to require, homeowner actions.

The 2002 farm bill (Pub.L. 110-246) created a Community and Private Land Fire Assistance Program to assist communities and private landowners in planning and other activities to protect themselves from wildfires. Congress has not appropriated funds explicitly for this program, but the FS has included such activities in state fire assistance. Community Wildfire Protection Planning was authorized in the Healthy Forests Restoration Act of 2003 (Pub.L. 108-148; 16 U.S.C. 6501-6591), and also has been funded through state fire assistance. These are local plans, developed in consultation with state and federal agencies and with interested parties, to identify and prioritize areas and methods of fuel reduction for protecting structures and communities, and to recommend measures to reduce the ignitability of structures.

FEMA, in the Department of Homeland Security, also provides wildfire assistance to state and local governments. FEMA can provide Fire Management Assistance Grants to state, local, or tribal agencies for firefighting expenses when a state declares that the threat of a major disaster exists. FMAGs can cover up to 75 percent of the costs for a single fire or for a group of fires, when the total costs exceed the FEMA threshold levels.

The Expanding WUI Wildfire Problem

The threat and cost of wildfire protection in the WUI is growing, and could expand rapidly. There is no definitive measure of the current extent or the growth rate of the WUI, in part because there is no universally accepted definition of the WUI. Nonetheless, one study in 2009 reported that, despite the sub-

stantial emphasis on the WUI in wildfire protection, only 14 percent of the available private land in the WUI is developed.[23] More recently, in 2013, the same researchers calculated that 16 percent of the WUI is developed, leaving 84 percent undeveloped but available for development.[24] Thus, the WUI could expand by six times its current extent, and various reports have suggested that the expansion is continuing rapidly.

A contributing factor in the ex-panding problem is that the WUI is almost entirely a state and local responsibility. Federal expenditures are significantly affected by the extent and expansion of the WUI but the federal government has almost no authority to directly influence that growth. State and local governments have a variety of tools available to affect the expansion of the WUI and its impacts on wildfire protection costs. For example, some states require fuel treatments on private lands.[25]

Some argue that current federal wildfire policies and practices effectively subsidize development in the WUI, and make state and local action to constrain WUI expansion unnecessary. As noted in the USDA OIG report:

> The increase in homes and lack of wildfire defense for them are significant in the WUI because FS bears a disproportionate share of protection costs. As the number of private homes in the WUI increase, FS costs rise.... Assigning the financial responsibility for WUI wildfire protection to State and local government is critical because Federal agencies do not have the power to regulate WUI development.
>
> Zoning and planning authority rests with State and local government...Homeowner reliance on the Federal government to provide wildfire suppression services places an enormous financial burden on FS, as the lead Federal agency providing such services. It also removes incentives for landowners moving into the WUI to take responsibility for their own protection and ensure their homes are constructed and landscaped in ways that reduce wildfire risks.... In addition to bearing an in-equitable portion of fire suppres-sion costs for protecting private property, FS continues to prioritize private property over natural resource protection with little to no consideration of their relative values.[26]

Others have suggested that FEMA disaster assistance reduces the incentives for the state-regulated private insurance industry to reflect the risk to homes in the WUI.[27]

State and local governments must become partners with the federal government, willingly or unwillingly, to control the burgeoning cost of wildfire protection in the WUI.

Finally, the WUI fire problem will likely continue to expand as long as efforts to address the problem continue to focus primarily on fuel reduction and fire-safe structures. Reducing fuels and modifying structures are necessary parts of fire protection in the WUI. However, individual actions only protect individual homes and lands. The decisions of others not to act also affect the threat to those that do act, as well as the fire control and other costs of federal, state, and local agencies. Furthermore, as noted briefly above, many community and state and local agency decisions (e.g., zoning regulations, building codes, access standards, and more) also affect fire protection in the WUI and wildfire protection costs generally.

Possible Solutions To Escalating Wildfire Costs

The wildfire problem in the United States is large and growing. Biomass fuels continue to accumulate faster than they are being removed, increasing the wildfire threat. Climate change is causing earlier, longer, hotter, and drier summer conditions throughout the West, making for more severe fire seasons. And the WUI continues to expand—84 percent of the WUI in the West is not yet developed—increasing the demand for wildfire protection even as the threat of wildfire increases. These changes will all contribute to escalating wildfire protection costs for all levels of government.

What can be done about it? Ameliorating climate change is, in many ways and for many reasons, highly desirable, but such efforts are beyond the scope of efforts to control wildfire protection costs.

Fuel treatment efforts must be expanded, both in the WUI and also in other parts of the forest. This includes mechanical treatments to remove biomass, for wood products and/or for energy production, as well as much more prescribed burning, despite the risks inherent in such burning. Incentives and protections for government employees,[28] as well as early and open dialogue with WUI interests, might assist in expanding fuel reduction efforts.

Several basic approaches are feasible for addressing WUI fire costs.[29] One is development and dissemination of better information. Firewise needs to be continued and expanded, to assure that existing and potential WUI homeowners understand the risks and actions needed to minimize those risks. Addi-

tional information is needed at the community level, such as maps of current and anticipated fire prone areas, information on access routes, a warning system to alert residents of fire-related evacuations, and real-time data on the location and availability of water and other firefighting resources. Research can also provide information on firefighting techniques, assessment of fire control technologies, and documentation of the financial and ecological consequences of construction in fire-prone areas.

Another approach focuses on incentives and disincentives to reduce the costs related to WUI fire protection. Federal assistance for community wildfire protection plans is a start, but such assistance could be extended to local land use planning. States could be encouraged to work with the insurance industry to authorize higher insurance premiums for houses in the WUI. The federal tax code could be modified to reduce or eliminate the mortgage interest deduction for houses in the WUI. Federal, state, and private funds could be used to acquire easements that could be managed to provide a firebreak/buffer for WUI communities. Federal fire control efforts or funding assistance could be withheld from state and local governments that do not sign firefighting cost-share agreements.

A third approach is through state and local requirements for the WUI, such as through local zoning ordinances, building codes, easements and setbacks, and the like. State and local governments can act independently, and many have done so. The federal government cannot require state and local government action, but can make grants and other federal assistance contingent upon state and local actions, incentives, regulations, and more to control the costs of WUI fire protection.

Finally, unilateral federal action to reduce WUI fire costs may be feasible. A national wildfire insurance program, akin to the National Flood Insurance Program, could be required for all construction in the WUI that has a federal nexus (e.g., permit approval, financing assistance) or for post-fire disaster assistance. It might even be possible, with real-time mapping, to withhold federal fire control efforts (unless withholding the efforts would increase federal costs or reduce the overall effectiveness of fire control) where no federal-local cost-share agreement exists or where WUI landowners do not have national or some form of state wildfire insurance.

The rising costs of wildfire protection can only be addressed by reducing biomass fuels on all lands and by constraining the development of the WUI

In sum, wildfires continue to burn more acres, damage more resources, and threaten more people and houses. The rising costs of wildfire protection can only be addressed by reducing biomass fuels on all lands and by constraining the development of the WUI. Because the WUI is private property, the primary responsibility lies with state and local governments, but the federal government has borne a disproportionate share of the cost of WUI fire protection. State and local governments must become partners with the federal government, willingly or unwillingly, to control the burgeoning cost of wildfire protection in the WUI.

The entire The Rising Costs of Wildfire Protection report can be found online at: https://headwaterseconomics.org/wp-content/uploads/fire-costs-background-report.pdf

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The U.S. Government's Federal Environmental Liability

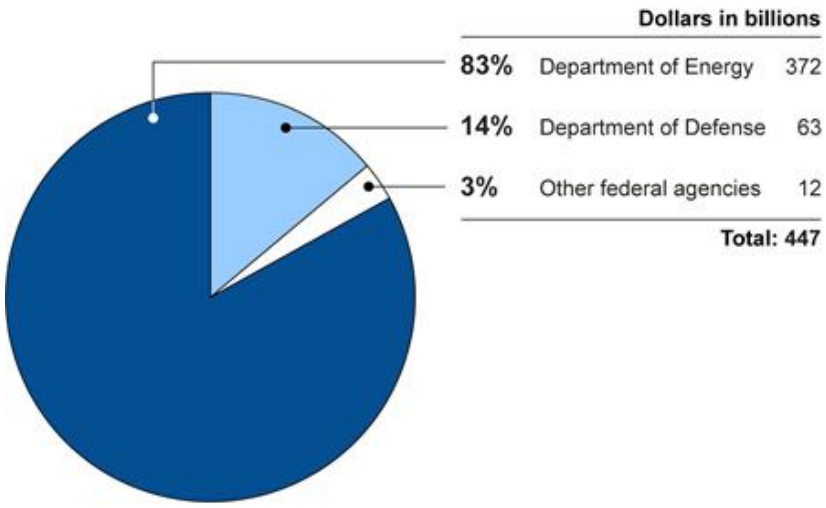
U.S. Government Accountability Office

The federal government's environmental liability has been growing for the past 20 years and is likely to continue to increase. For fiscal year 2016, the federal government's estimated environmental liability was $447 billion—up from $212 billion for fiscal year 1997.[1] However, this estimate does not reflect all of the future cleanup responsibilities federal agencies may face. Because of the lack of complete information and the often inconsistent approach to making cleanup decisions, federal agencies cannot always address their environmental liabilities in ways that maximize the reduction of health and safety risks to the public and the environment in a cost effective manner.

The federal government is financially liable for cleaning up areas where federal activities have contaminated the environment. Various federal laws, agreements with states, and court decisions require the federal govern-ment to clean up environmental hazards at federal sites and facilities—such as nuclear weapons production facilities and military installations. Such sites are contaminated by many types of waste.

Federal accounting standards require agencies responsible for cleaning up contamination to estimate future cleanup and waste disposal costs and to report such costs in their annual financial statements as environmental liabilities. Per federal accounting standards, federal agencies' environmental liability estimates are to include probable and reasonably estimable costs of cleanup work. Where the federal government is not legally responsible for environmental cleanup, but acknowledges that it will assume financial responsibility for

Figure 1: Total Reported U.S. Environmental Liability, Fiscal Year 2016



Source: GAO analysis of the Financial Report of the U.S. Government, fiscal year 2016. | GAO-17-317

Note: The environmental liability estimates were not adjusted for inflation because information about the amount of the liability applicable to each fiscal year was not available.

This article is derived from GAO's 2017 High-Risk Series Report. The report is updated every two years, at the start of each new Congress. GAO's high-risk program identifies government operations with greater vulnerabilities to fraud, waste, abuse, and mismanagement or the need for transformation to address economy, efficiency, or effectiveness challenges. The Environmental Liabilities section was added to the series this year.
Access the entire report here: http://www.gao.gov/assets/690/682765.pdf

the cleanup, a liability is recorded for unpaid amounts due, not necessarily the full cost of cleanup.

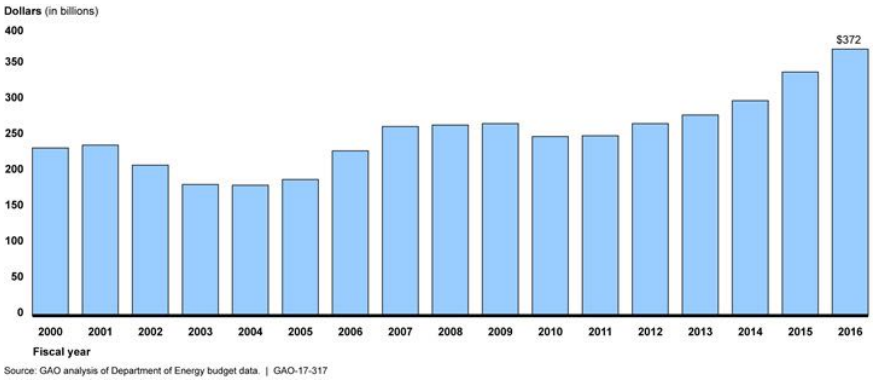
Federal accounting standards require agencies responsible for cleaning up contamination to estimate future cleanup and waste disposal costs and to report such costs in their annual financial statements as environmental liabilities. Per federal accounting standards, federal agencies' environmental liability estimates are to include probable and reasonably estimable costs of clean-up work.

Also, where the government is legally responsible for environmental cleanup but there is no known tech-nology to clean up a particular site, then known costs for which the entity is responsible, such as a remedial investigation, feasibility studies, and costs to contain the contamination, are recorded as a liability. Further, federal agencies' environmental liability estimates do not include cost estimates for work for which reasonable estimates cannot currently be generated. Consequently, the ultimate cost of addressing the U.S. government's environmental cleanup is likely greater than $447 billion. Federal agencies' approaches to addressing their environmental liabilities and cleaning up the contamination from past activities are often influenced by numerous site-specific factors, stakeholder agreements, and legal pro-visions.

GAO has also found that some agencies do not take a holistic, risk-informed approach to environmental cleanup that aligns limited funds with the greatest risks to human health and the environment.

Since 1994, GAO has made at least 28 recommendations related to addressing the federal government's environmental liability. These include 22 recommendations to the Department of Energy (DOE) or the Department of Defense (DOD), one recommendation to the Office of Management and Budget to consult with Congress on agencies' environmental cleanup costs, one recommendation to the Department of Agriculture (USDA), and four recommendations to Congress tochange the law governing cleanup activities. Of these, 13 recommendations remain unimplemented. If implemented, these steps would improve the completeness and reliability of the estimated costs of future cleanup responsibilities and lead to more risk-based management of the cleanup work.

Figure 2: Total Reported Department of Energy Environmental Liability, Fiscal Years 2000 to 2016



Note: The environmental liability estimates were not adjusted for inflation because information about the amount of the liability applicable to each fiscal year was not available.

Findings

Of the federal government's estimated $447 billion environmental liability—up from $212 billion for fiscal year 1997[2]—DOE is responsible for by far the largest share of the liability and DOD is responsible for the second largest share. The rest of the federal government makes up the remaining 3 percent of the liability with agencies such as the National Aeronautics and Space Administration (NASA) and the Departments of Transportation, Veterans Affairs, USDA, and Interior holding large liabilities (see figure 1).

Department of Energy

DOE was responsible for over 80 percent ($372 billion) of the U.S. government's fiscal year 2016 reported environmental liability, mostly related to nuclear waste cleanup.[3] DOE's total reported environmental liability has generally increased since fiscal year 2000 (see figure 2). According to audit documentation related to DOE's fiscal year 2016 financial statements, 50 percent of the DOE's environmental liability resides at two cleanup sites: the Hanford Site in Washington State and the Savannah River Site in South Carolina.

Since 1989, DOE's Office of Environmental Management (EM) has spent over $164 billion to retrieve, treat, and dispose of nuclear and hazardous waste and to date has completed cleanup at 91 of 107 sites across the country. (The 91 sites were generally viewed by the department as the smallest and least contaminated sites to address.)

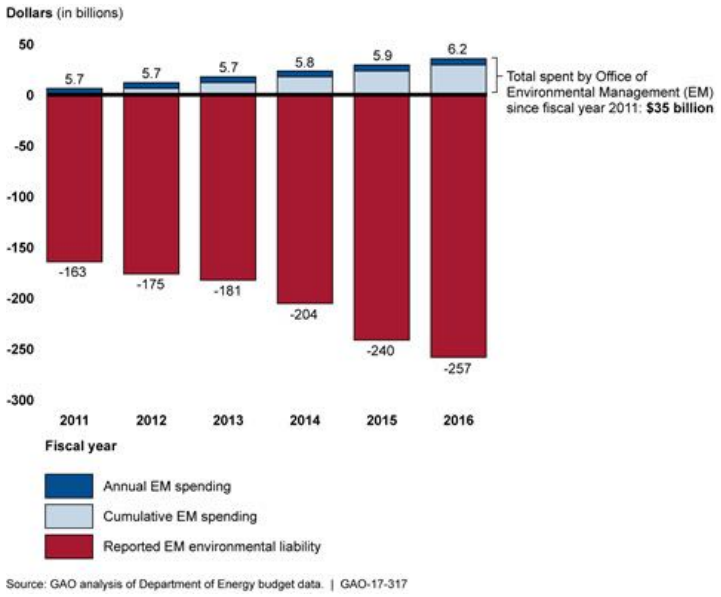
Despite billions spent on environmental cleanup, DOE's environmental liability has roughly doubled from a low of $176 billion in fiscal year 1997 to the fiscal year 2016 estimate of $372 billion. In the last 6 years alone, EM has

spent $35 billion, primarily to treat and dispose of nuclear and hazardous waste and construct capital asset projects to treat the waste, while EM's portion of the environmental liability has grown over this same time period by over $90 billion, from $163 billion to $257 billion (see figure 3).

In its fiscal year 2016 financial statement, DOE attributed recent environmental liability increases to (1) inflation adjustments for the current year; (2) improved and updated estimates for the same scope of work, including changes resulting from deferral or acceleration of work; (3) revisions in technical approach or scope for cleanup activities; and (4) regulatory and legal changes. Notably, in recent annual financial reports, DOE has cited other significant causes for increases in the liability. Other causes have included the lack of a disposal path for high-level radioactive waste—because of the termination of the Yucca Mountain repository program—and delays and scope changes for major construction projects at the Hanford and Savannah River sites.[4]

GAO testified in February 2016 that DOE's estimated liability does not include billions in expected costs. According to government accounting standards, environmental liability estimates include costs that are probable and reasonably estimable, meaning that costs that cannot yet be reasonably estimated are not included in total environmental liability.[5] Examples of costs that DOE cannot yet estimate include the following:

Figure 3: Department of Energy's Office of Environmental Management's Annual Spending and Growing Environmental Liability



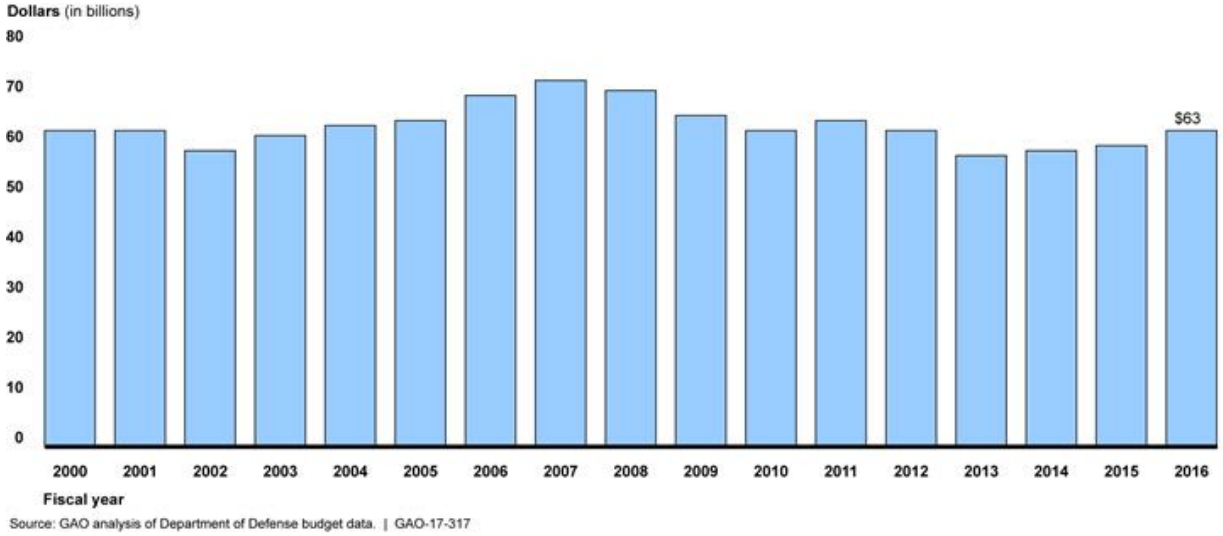
Note: EM is the organization within the Department of Energy responsible for managing environmental cleanup and is responsible for cleaning up 107 sites across the country. To date, EM has completed cleanup at 91 of these sites. EM spending includes money to treat and dispose of nuclear and hazardous waste and to construct capital asset projects to treat the waste. The environmental liability estimates were not adjusted for inflation because information about the amount of the liability applicable to each fiscal year was not available.

- DOE has not yet developed a cleanup plan or cost estimate for the Nevada National Security Site and, as a result, the cost of future cleanup of this site was not included in DOE's fiscal year 2015 reported environmental liability. The nearly 1,400-square-mile site has been used for hundreds of nuclear weapons tests since 1951. These activities have resulted in more than 45 million cubic feet of radioactive waste at the site. According to DOE's financial statement, since DOE is not yet required to establish a plan to clean up the site, the costs for this work are excluded from DOE's annually reported environmental liability.

- DOE's reported environmental liability includes an estimate for the cost of a permanent nuclear waste repository, but these estimates are highly uncertain and likely to increase. In response to the termination of the Yucca Mountain repository program, DOE proposed separate repositories for defense high-level and commercial waste in March 2015. In January 2017, GAO reported that the cost estimate for DOE's new approach excluded the costs and time frames for key activities. As a result, the full cost of these activities is likely more than what is reflected in DOE's environmental liability.[6]

There are several possible causes for the large and growing amount of money that DOE will need to meet its cleanup responsibilities. First, as our and other organizations' reports issued over the last two decades have found, DOE's environmental cleanup decisions are not risk-based and its risk-based decision making is sometimes impeded by selection of cleanup remedies that are not appropriately tailored to the risks present-

Figure 4: Total Reported Department of Defense Environmental Liability, Fiscal Years 2000 to 2016



Note: The environmental liability estimates were not adjusted for inflation because information about the amount of the liability applicable to each fiscal year was not available.

ed, and inconsistencies in the regulatory approaches followed at different sites. GAO and others have pointed out that DOE needs to take a nationwide, risk-based approach to cleaning up these sites, which could reduce costs while also reducing environmental risks more quickly. Examples include the following:

- In 1995, GAO found that DOE's cleanup strategy had been shaped by site-specific environmental agreements whose priorities and requirements had not always been consistent with technical or fiscal realities and that, under severe budgetary constraints, using many separately negotiated agreements is not well suited to setting priorities among sites.[7] GAO recommended that DOE set national priorities for cleaning up its contaminated sites. DOE responded at that time that because of limitations on the science of risk assessment, it had no intention of developing national, risk-based priorities for its cleanup work. In a later report, GAO found that DOE's compliance agreements did not provide a means of prioritizing among sites and, therefore, DOE had not developed a comprehensive, relative ranking of the risks that it faces across its sites. DOE has been unsuccessful in its attempts to develop such a methodology in the past and, as a result, DOE has no systematic way to make cleanup decisions among sites based on risk.

- In 2006, the National Academy of Sciences (the Academy) reported that the nation's cleanup approach—primarily carried out by DOE among other agencies—was complex, inconsistent, and not systematically risk-based. For example, the Academy noted that the current regulatory structure for low activity waste is based primarily on the waste's origins rather than on its actual radiological risks. The Academy concluded that by working with regulators, public authorities, and local citizens to implement risk-informed practices, waste cleanup efforts can be done more cost-effectively. The report also suggested that statutory changes were likely needed. In 2011, the Academy also reported that DOE could realize significant benefits by providing more realistic safety- and risk-informed analyses. In 2015, a review organized by the Consortium for Risk Evaluation with Stakeholder Participation reported that DOE is not optimally using available resources to reduce risk.[8] According to the report, factors such as inconsistent regulatory approaches and certain requirements in federal facility agreements cause disproportionate resources to be directed at lower priority risks. The report called for a more systematic effort to assess and rank risks within and among sites, including through head-quarters guidance to sites, and to allocate federal taxpayer monies to remedy the highest priority risks through the most efficient means.

Second, DOE's cleanup approach is based primarily on a series of compliance agreements and consent orders between DOE, the Environmental Protec-

tion Agency (EPA), and state regulators. According to one DOE official, 40 such agreements establish the requirements for DOE's cleanup work. GAO has reported in the past that these agreements include thousands of associated milestones. Some of the 40 agreements were made decades ago and may be based on outdated information about the effectiveness of certain cleanup technologies.

Third, DOE may have insufficient controls in place to accurately account for its environmental liabilities. In January 2017, the DOE Inspector General reported a significant deficiency in internal control related to the reconciliation of environmental liabilities.

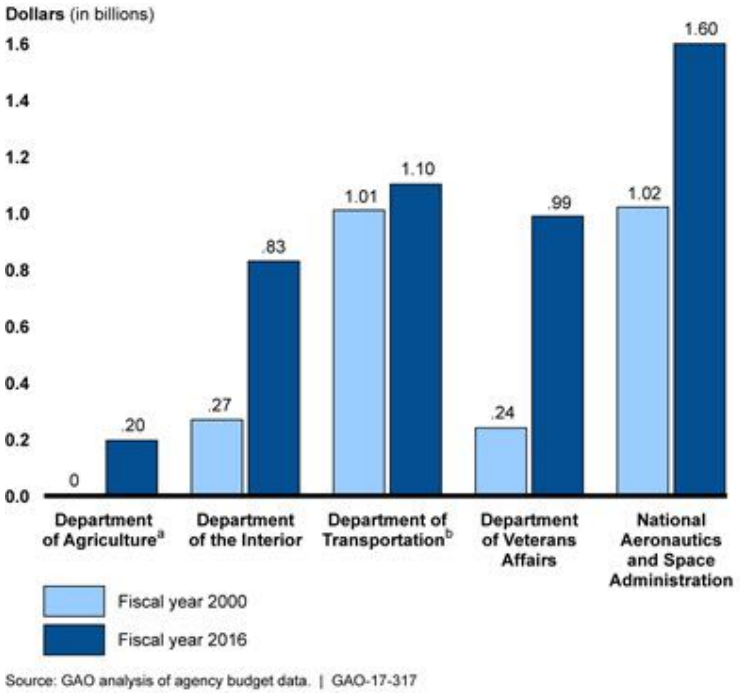
Department of Defense

DOD was responsible for the second largest share of the federal government's reported environmental liability—$63 billion in fiscal year 2016. DOD's total reported environmental liability has remained relatively constant since fiscal year 2000 (see figure 4). GAO found in the past that DOD has spent billions on environmental cleanup and restoration at its sites. In July 2010, GAO reported that DOD spent almost $30 billion from 1986 to 2008 across its environmental cleanup and restoration activities at its installations.[9] More recently, in its July 2016 annual report to Congress on environmental cleanup, DOD reported spending an average of about $1.8 billion each year for its environmental cleanup activities from fiscal years 2011 to 2016.

DOD's $63 billion reported environmental liability includes cleanup responsibilities for base realignment and closure (BRAC), disposal of weapon systems, and environmental cleanup and restoration of DOD sites. Our recent work found that DOD's environmental liability is likely to exceed its current estimate because a number of activities are not fully included in the estimate; the activities are not included because their scopes are not yet known. Notably, GAO reported in February 2014 that our audit of the government's consolidated financial statements found that DOD's inability to estimate with assurance key components of its environmental liabilities was a material weakness. GAO reported in January 2017 that this weakness still exists. Examples of uncertainties in DOD reported environmental liabilities include the following:

- DOD's current environmental liability estimate does not include additional costs that will likely be needed for DOD to complete the cleanup for BRAC activities. GAO reported in January 2017 that DOD estimates it will need about $3.4 billion in addition to the $11.5 billion it has already spent to manage and complete environmental cleanup of BRAC installations.[10] GAO also found that DOD's annual report on its environmental cleanup program does

Figure 5: Change in Reported Environmental Liability for Selected Agencies, Fiscal Years 2000 to 2016



Note: The environmental liability estimates were not adjusted for inflation because information about the amount of the liability applicable to each fiscal year was not available.

a) In fiscal year 2000, the Department of Agriculture did not include any estimated environmental liability in its financial statement but did include a note indicating that the Forest Service estimates cleanup for sites on National Forest System lands could cost $2.5 billion.

b) The figures used for the Department of Transportation are reported environmental liabilities for fiscal years 2001 and 2016 since the department's fiscal year 2000 reported environmental liability of $2.28 billion was incorrect according to a department official.

not include significant costs associated with cleanup of contaminants at its installations, including those closed under BRAC.

- DOD's estimate does not include the total costs associated with cleaning up weapons sites. According to DOD's fiscal year 2015 Agency Financial Report (AFR), DOD is unable to estimate and report a liability for the environmental restoration that is needed to clean up buried chemical munitions and agents at certain sites, among other things, because the extent of the buried chemical munitions and agents is unknown.[11]

- DOD may also incur costs not currently included in its envi-ronmental liability estimate for restoration initiatives in con-junction with returning overseas DOD facilities to host nations. According to DOD's fiscalyear 2015 AFR, DOD is unable to provide a reasonable estimate because the extent of required restoration is unknown.

Other Federal Agencies

The remainder of the U.S. government's estimated environmental liability (about $12 billion in fiscal year 2016) was managed by numerous departments and agencies and, similar to the DOE and DOD portions, is likely to increase. Federal agencies with large reported environmental liabilities in fiscal year 2016 included NASA, USDA, and the Departments of Transportation, Veterans Affairs, and Interior. Since 2000, the reported environmental liability for these agencies has also increased (see figure 5).

GAO found in January 2015 that the environmental liabilities for USDA and Interior do not include many contaminated and potentially contaminated sites —primarily abandoned mines—and that the ultimate costs of future cleanup are therefore likely much higher than what is currently reported in the these departments' environmental liability estimates.[12] Further, the extent to which the federal government will pay cleanup costs may depend on whether or not financially viable responsible parties, including current and former mine owners and operators, can be identified. Additionally, neither department has a complete inventory of its cleanup responsibilities. For example:

- USDA: For fiscal year 2016, USDA reported an environmental liability of $196 million. As of April 2014, USDA had identified 1,491 contaminated sites but this list is incomplete as many more potentially contaminated sites, including abandoned mines, have not yet been identified. In 2015, GAO found that USDA does not have a reliable, centralized site inventory or plans and procedures for completing one, in particular for abandoned mines. For example, in fiscal year 2013, USDA reported $3 million for the Forest Service's environmental liability. In 2015, GAO found that this figure did not include any cleanup costs for abandoned mines. The Forest Service estimates that there could be from 27,000 to 39,000 abandoned mines on its lands—approximately 20 percent of which may pose some level of risk to human health or the environment—and the federal government may have to pay for cleanup of some of these mines. USDA's Forest Service has not developed a complete, consistent, or usable inventory of abandoned mines and had no plans and procedures for developing such an inventory. Without a reliable inventory, USDA cannot effectively estimate its ultimate cost to cleanup these sites.

...the ultimate costs of future cleanup are therefore likely much higher than what is currently reported in the these departments' environmental liability estimates.

- Interior: For fiscal year 2016, Interior reported an environmental liability of about $830 million. GAO found in 2015 that Interior had an inventory of 4,722 sites, including 85 aban-doned mines, with confirmed or likely contamination. However, Interior may have future cleanup responsibilities and, as a result, ultimate cleanup costs may exceed the currently reported environ-mental liability. Specifically, Interior's Bureau of Land Management (BLM) has identified over 30,000 abandoned mines—some of which the federal government may have to pay to clean up—that have not yet been assessed for contamination. Furthermore, this inventory is not complete as BLM estimated that there are at least 100,000 abandoned mines that have not yet been inventoried. While cost estimates for addressing these mines are not currently included in Interior's liability, information for certain types of mines indicates that the ultimate cost of Interior's future cleanup responsibilities are greater than what is reflected in the reported environmental liability. BLM is working to improve the completeness and accuracy of its inventory.

What Remains to be Done

Future progress in addressing the U.S. government's environmental liabilities depends, among other things, on

how effectively federal departments and agencies set priorities, under increasingly restrictive budgets, that maximize the risk reduction and cost-effectiveness of cleanup approaches. As a first step, some departments and agencies may need to improve the completeness of information about long-term cleanup responsibilities and their associated costs so that decision makers, including Congress, can consider the full scope of the federal government's cleanup obligations. As a next step, certain departments, such as DOE, may need to change how they establish cleanup priorities. For example, DOE's current practice of negotiating agreements with individual sites without considering other sites' agreements or available resources may not ensure that limited resources will be allocated to reducing the greatest environmental risks, and costs will be minimized.

GAO has recommended actions to federal agencies that, if implemented, would improve the completeness and reliability of the estimated costs of future cleanup responsibilities and lead to more risk-based management of the cleanup work.

Completeness of Environmental Liability Estimates

- In 1994, GAO recommended that Congress amend certain legislation to require agencies to report annually on progress in implementing plans for completing site inventories, estimates of the total costs to clean up their potential hazardous waste sites, and agencies' progress toward complet-ing their site inventories and on their latest estimates of total clean-up costs. GAO believes these re-commendations are as relevant, if not more so, today.

- In 2015, GAO recommended that the USDA develop plans and procedures for completing their inventories of potentially contaminated sites. USDA disagreed with this recommendation. However, GAO continues to believe that USDA's inventory of contami-nated and potentially contaminated sites —in particular, abandoned mines, primarily on Forest Service land— is insufficient for effectively managing USDA's overall cleanup program. Interior is also faced with an incomplete inventory of abandoned mines that they are working to improve.

Reliability of Environmental Liability Estimates

- In 2006, GAO recommended that DOD develop, document, and implement a program for financial management review, assessment, and monitoring of the processes for estimating and reporting environmental liabilities. This recommendation has not been implemented.

Risk-Based Decision-Making

- GAO found in the past that DOE's cleanup strategy is not risk-based and should be re-evaluated. DOE's decisions are often driven by local stakeholders and certain requirements in federal facilities agreements and consent decrees. In 1995, GAO recommended that DOE set national priorities for cleaning up its contaminated sites using data gathered during ongoing risk evaluations. This recommendation has not been implemented.

- In 2003, GAO recommended that DOE ask Congress to clarify its authority for designating certain waste with relatively low levels of radioactivity as waste incidental to reprocessing, and therefore not managed as high-level waste. In 2004, DOE received this specific authority from Congress for the Savannah River and Idaho Sites,[13] thereby allowing DOE to save billions of dollars in waste treatment costs. The law, however, excluded the Hanford Site.

More recently, in 2015 GAO found that DOE is not comprehensively integrating risks posed by National Nuclear Security Administration's (NNSA) non-operational contaminated facilities with EM's portfolio of cleanup work.[14] By not integrating non-operational facilities from NNSA, EM is not providing Congress with complete information about EM's current and future cleanup obligations as Congress deliberates annually about appropriating funds for cleanup activities. GAO recommended that DOE integrate its lists of facilities prioritized for disposition with all NNSA facilities that meet EM's transfer requirements, and that EM should include this integrated list as part of the Congressional Budget Justification for DOE. DOE neither agreed nor disagreed with this recommendation.

References

[1]As used herein, environmental liabilities includes environmental and disposal liabilities.
[2] The environmental liability estimates were not adjusted for inflation because information about the amount of the liability applicable to each fiscal year was not available.
[3] The majority of DOE's annual environmental cleanup funding—over 80 percent in fiscal year 2016—comes from annual defense authorization spending.
[4] In June 2008, DOE submitted a license application to the NRC seeking authorization to construct a high-level nuclear waste repository at Yucca Mountain. In the application, DOE stated that it planned to open the

repository in 2017. DOE later delayed the date to 2020. In March 2009, however, the Secretary of Energy announced plans to terminate the Yucca Mountain repository program and instead study other nuclear waste options. The President's fiscal year 2011 budget proposal, released in February 2010, proposed eliminating all funding for the Yucca Mountain repository program. For more information, see GAO, *Commercial Nuclear Waste: Effects of a Termination of the Yucca Mountain Repository Program and Lessons Learned*, GAO-11-229 (Washington D.C.: Apr. 8, 2011).

[5] Federal Accounting Standards Advisory Board, *FASAB Handbook of Federal Accounting Standards and Other Pronouncements*, as Amended (Washington, D.C.: June 30, 2016).

[6] GAO, *Nuclear Waste: Benefits and Costs Should Be Better Understood Before DOE Commits to a Separate Repository for Defense Waste*, GAO-17-174 (Washington, D.C.: Jan. 31, 2017).

Waste, GAO-17-174 (Washington, D.C.: Jan. 31, 2017).

[7] GAO, *Department of Energy: National Priorities Needed for Meeting Environmental Agreements*, GAO/ RCED-95-1 (Washington, D.C.: Mar. 3, 1995).

[8] The Consortium for Risk Evaluation with Stakeholder Participation is a multi-university consortium organized in 1995 that provides several types of independent, multi-disciplinary reviews of DOE documents, projects, and reports.

[9] GAO, *Superfund: Interagency Agreements and Improved Project Management Needed to Achieve Cleanup Progress at Key Defense Installations*, GAO-10-348 (Washingt on, D.C.: July 15, 2010).

[10] GAO, *Military Base Realignments and Closures: DOD Has Improved Environmental Cleanup Reporting but Should Obtain and Share More Information*, GAO-17-151 (Washingto n, D.C.: Jan. 19, 2017).

[11] DOD had not yet issued a fiscal year 2016 financial statement at the time of publication.

[12] GAO, *Hazardous Waste: Agencies Should Take Steps to Improve Information on USDA's and Interior's Potentially Contaminated Sites*, GAO-15-35 (Washington, D.C.: Jan. 16, 2015).

[13] Pub. L. No. 108-375, § 3116 (2004).

[14] NNSA has identified 83 contaminated facilities for potential transfer to EM for disposition over a 25-year period, 56 of which are currently nonoperational. NNSA is maintaining these facilities for future transfer to EM, but the condition of nonoperational facilities continues to degrade, resulting in increasing costs to NNSA to maintain them to prevent the spread of contamination.

New Federal Toxics Law Could Have Future Implications for States

California Legislative Analyst's Office

On June 22, 2016, the president signed the Frank R. Lautenberg Chemical Safety for the 21st Century Act.[1] The new law implements significant reforms to the federal Toxic Substances Control Act (TSCA). Created in 1976, TSCA provided the U.S. Environmental Protection Agency (EPA)[2] with the authority to evaluate and regulate chemicals used in industrial processes and consumer products. Policymakers, environmental advocates, and industry representatives have discussed the need for reform in this program for years. Environmental advocates,[3] for example, were concerned that under the prior law, EPA had little authority to evaluate and restrict the use of chemicals that had the potential to harm people or the environment. In addition, industry advocates[4] raised concerns that states were enacting their own restrictions, resulting in varying policies across the country.

The Legislative Analyst's Office is the California Legislature's nonpartisan fiscal and policy advisor. This report was compiled in response to the federal government's 2016 chemical safety reform. The report can be accessed here: http://www.lao.ca.gov/Publications/Report/3504

Under the new law, EPA will have greater authority to evaluate and regulate existing chemicals, as well as new chemicals proposed to be brought to the market. In general, the process for evaluating the safety of chemicals will have four steps:

- ***Prioritization.*** EPA is required to develop a risk-based screening process to identify high-priority chemicals to be evaluated.
- ***Assessment.*** For each chemical identified as high-priority, EPA will have three years (with a possible six-month extension) to scientifically assess the chemical's safety. Within a few years, EPA must be evaluating at least 20 chemicals. (The legislation allows that some of these chemicals can be ones requested by companies, in which case the requesting companies would pay some or all of the evaluation costs.)
- ***Determination.*** For each chemical assessed, EPA will have to make a determination as to whether the chemical is generally safe to people and the environment or if its use would fail to meet safety standards. The agency could determine that a particular chemical is safe to use in certain circumstances but unsafe in others, such as when used in specific ways or by sensitive populations.
- ***Rulemaking.*** For chemicals it finds do not meet safety standards, EPA will have two years to issue regulations on the chemical so that the chemical would no longer present an unreasonable risk. Those regulations could ban or otherwise restrict the chemical's use, establish safety requirements, or require additional reporting or labeling by the manufacturer.

In addition, the federal law increases EPA's authority in a few ways. It clarifies the standard by which EPA is to evaluate the risk of chemicals. Specifically, the agency's risk evaluation is required to focus on a chemical's potential

[1] https://www.congress.gov/bill/114th-congress/house-bill/2576/text
[2] https://www.epa.gov/laws-regulations/summary-toxic-substances-control-act
[3] http://blogs.edf.org/health/2016/06/13/resources-for-understanding-the-lautenberg-act/
[4] https://www.americanchemistry.com/LCSA-Learn-More.pdf

compliance costs. This could have the effect of making it more likely for EPA to evaluate a chemical as posing an unreasonable risk if the agency does not have to demonstrate that those risks are outweighed by the potential costs of addressing the risks. (Costs are supposed to be taken into consideration during rulemaking.) In addition, the new law allows EPA to charge fees on manufacturers (up to $25 million in revenue annually) to offset evaluation costs and requires the agency to evaluate new chemicals before they can be brought to the market. The law also includes provisions that would make chemical information provided by businesses to EPA more accessible to the public, including state agencies.

Preemption Under New Federal TSCA Law

Status of EPA Chemical Review	Preemption of States
Not designated as high-priority chemical.	States are free to enact laws and regulations regarding chemical and its use.
Under review as high-priority chemical.	No new state restrictions can be enacted unless waiver is secured. Existing restrictions can be enforced.
Determination is made:	
(1) Chemical is determined to meet safety standard.	(1) States may not enforce restrictions on that chemical for the scope of EPA's review unless waiver is secured.
(2) Chemical is determined to not meet safety standard.	(2) States may continue to enforce their laws until final EPA rulemaking.
Regulatory rulemaking completed.	States can enforce restrictions consistent with federal rules. States cannot enforce different restrictions for same scope without securing waiver.

[a]Some existing state laws and regulations are "grandfathered" and, hence, will continue to be enforceable.

TSCA = Toxic Substances Control Act and EPA = U.S. Environmental Protection Agency.

Reform Includes Significant Preemption of States.

In addition to providing EPA with more authority to enforce restrictions on chemicals, the new law places greater limits on the authority of states to enforce their own laws and regulations restricting the use of chemicals. For any specific chemical, the limits on states depends on whether the chemical has been designated by EPA as high-priority and is under active review, whether a safety determination has been made and what that determination is, and the scope of the final EPA regulation when implemented. The following table summarizes those preemption requirements.

There are, however, some exceptions to these federal preemption requirements. First, states can still implement restrictions on chemicals in accordance with other federal laws, such as the Clean Air Act and Clean Water Act.

Second, the new law "grandfathers" in some existing legislation—such as California's Proposition 65[5]—as well as state laws and regulations already implemented prior to April 22, 2016 (The National Conference of State Legislatures provides a useful summary[6] of existing state laws.).

Third, federal preemption only applies to restrictions on uses included in the scope of EPA's review and rules. In other words, states would still be able to implement new laws and regulations that covered a different scope related to the use or affected populations of a studied chemical. Fourth, states can seek waivers to federal preemption.

California's Safer Consumer Products Program.

Chapters 559 of 2008 (AB 1879, Feuer) required the California Department of Toxic Substances Control (DTSC) to establish a process to identify and prioritize chemicals in consumer products that have the potential to have adverse impacts to public health and the environment and to establish a process for evaluating safer alternatives. The law was meant to establish a more systematic approach to regulating potentially unsafe chemicals and products. The previous approach has been described as a "piecemeal" one in which the use of chemicals—such as lead, arsenic, and mercury—and products were restricted through separate pieces of legislation.

In 2013, DTSC completed its regulations for the Safer Consumer Products program.[7] This program requires DTSC to identify consumer products containing potentially hazardous chemicals. Responsible entities—generally product manufacturers—will have to identify and evaluate alternatives that reduce adverse impacts of the chemicals in those products. This would entail evaluating whether the chemical is necessary, if there is a safer alternative, and whether all relevant impacts throughout the products lifecycle are considered.

After the responsible entity's alternatives analysis, DTSC may impose regulations to improve the protection of public health and the environment. Regulatory requirements could include restricting the sale of the product; end-of-life product stewardship; requiring in-

[5]http://oehha.ca.gov/proposition-65/general-info/proposition-65-plain-language
[6] http://www.ncsl.org/research/environment-and-natural-resources/ncsl-policy-update-state-statutes-on-chemical-safety.aspx#toxic

creased safety measures in the production, use, or disposal of the product; or increased information to the department or consumers.

In 2013, DTSC identified its initial list of three priority products for review: (1) paint, varnish, and surface cleaners containing methylene chloride; (2) spray polyurethane foam systems containing unreacted diisocyanates; and (3) children foam-padded sleeping products containing polyurethane foam and tris phosphate. Regulations to officially list these as priority products subject to alternatives analysis has not been finalized. When they are, responsible entities will have up to 180 days to complete their analyses.

Uncertain How Federal Changes Will Ultimately Affect California Program in Long Run

While the federal reforms are significant, they are unlikely to have a major impact on California's chemical safety laws and regulations in the short term. U.S. EPA is still in the early phases of developing its regulations to implement the new TSCA law. Moreover, while EPA was required to identify the first ten high-priority products by December of 2016 [they did], the new law specifically excludes those products from triggering pre-emption while they are under review by EPA.

In the long run, however, it is quite possible that the new federal law—and specifically the preemption provisions—could significantly affect the state's chemical safety programs and the implementation of current and future state restrictions. Yet, it is difficult to predict the extent to which such pre-emption will occur because it will depend on several factors related to EPA's final program regulations and future implementation decisions. These factors include:

- ***High-Priority Chemicals Selection and Scope of Review:*** It is unknown which chemicals EPA will identify as high-priority subject to analysis or the extent to which those chemicals will overlap with chemicals addressed under state law. Nor do we know the extent to which EPA will focus the scope of its analyses broadly or narrowly. If for a particular product EPA intends to review the full range of chemical applications and potential human and environmental harms, then it is more likely that a state restriction could be preempted if it conflicts with the ultimate federal rulemaking. A more narrow scope of EPA evaluation might leave more opportunity for states to enforce restrictions in place that target other uses or harms.

- ***How Exceptions Are Implemented:*** EPA has the authority to issue waivers to states, which would reduce the effect of the preemption provisions. However, it is unclear how often waivers will be granted, as well as the scope of those waivers. In addition, based on our conversations with experts on the federal reforms, there is some uncertainty about how the grandfathering provisions will work in the future. Specifically, it is unclear the extent to which laws and restrictions implemented by states before April 2016 can be updated or modified in the future if they would conflict with EPA determinations and regulations.

Given the potential impacts on state programs, it will be important for DTSC to stay engaged in the current federal rulemaking process and offer comments on behalf of the state's interests. In the longer run, DTSC may need to be strategic in its selection of chemical/product combinations selected for alternatives analysis to reduce the likelihood that efforts are spent evaluating and restricting the use of chemicals already—or likely to become—subject to EPA review. On the other hand, it is important to note that the new federal law does not affect the ability of the state to require alternative analyses or implement certain other changes, such as reporting of additional safety information or increasing biomonitoring activities, even when the chemical has been reviewed by EPA.

News and Announcements

Renewable Natural Resources Foundation

Amber Todoroff Joins Staff as Program Manager

Amber Lee Todoroff of Venice, Florida has joined RNRF's staff as program manager. She is a 2015 summa cum laude graduate of the University of Florida with a B.A. in geography and English, and a minor in sustainability studies. She received an M.Sc. in nature, society and environmental governance from Oxford University (UK) on full scholarship in 2016. Todoroff has worked as a researcher at the Environmental Change Institute at Oxford, interned at the Stennis Space Center in Mississippi (satellite wildfire detection), worked as a NSF Fellowship researcher at Clark University (invasive insect disaster response policy), and a NSF Fellowship researcher at the University of Northern Iowa (remote sensing methods to assess impacts on arctic tundra).

Amber Todoroff

Todoroff works with RNRF committees in developing and implementing programs such as public policy conferences, congressional forums, RNRF's Washington Round Table on Public Policy, and the annual awards program. She also has editorial responsibilities for the *Renewable Resources Journal*, The Renewable Resources Report (RNRF's blog) and RNRF's website.

RNRF 2017 Award Announcements

RNRF congratulates the winners of its annual awards in Sustained Achievement, Outstanding Achievement, and Excellence in Journalism. The awards will be presented at the annual meeting of the RNRF Board of Directors in Potomac, Maryland, on November 15, 2017.

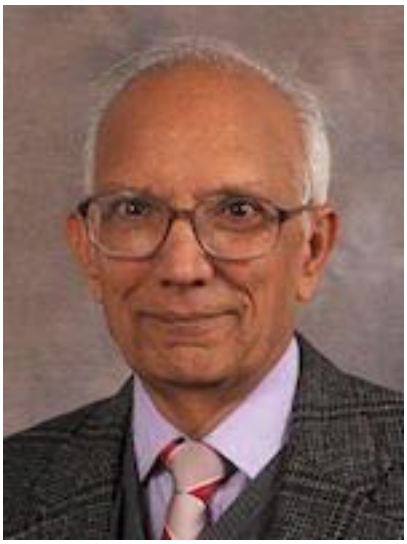
Rattan Lal is the Recipient of the 2017 Sustained Achievement Award

Dr. Rattan Lal is the recipient of RNRF's 2017 Sustained Achievement Award. The award recognizes a long-term contribution and commitment to the protection and conservation of natural resources by an individual.

During his 50-year career, Lal studied sustainable intensification and climate resilience of agroecosystems, working to advance global food and nutritional security through soil health management, carbon sequestration, and erosion control.

Lal has advanced soil resources science through his extensive accomplishments as a researcher and mentor. He has written 818 journal articles, 485 book chapters, 16 books, and has given 425 keynote presentations on the sustainable management of world soils. In addition to teaching two classes at Ohio State University, he has mentored 106 graduate students, 55 post-doctoral researchers, and 156 visiting scholars from around the world.

He has promoted the application of sound scientific practices to soil research and policy over the years by serving as lead author of the Special Report of IPCC on Land Use, Land Change and Forestry (2000), as science advisor to the Institute for Advanced Sustainability Studies, Potsdam, to initiate the Global Soil Week (2010- 2015), and as Chair of Advisory Board of UNU-FLORES, in Dresden, Ger-many. He has worked with the U.S. Senate to approve Soil



Dr. Rattan Lal

Resolution 208 (2008) and has witnessed six congressional hearings (2000s) regarding soil resources and carbon sequestration. Furthermore, He has worked with several heads of state, including the President of Bangladesh (2007-2008), the President of Iceland (2006-2010), Vice President Al Gore (2010-2015), the former Secretary of the Environment of Germany (2010-2015) and the French Minister of Agriculture (2015) to help translate soil science to actionable policies.

Lal is currently a Distinguished University Professor of Soil Science at Ohio State University and serves as the president of the International Union of Soil Sciences, representing 60,000 scientists.

He holds a B.Sc. in agriculture from Punjab Agricultural University, a M.Sc. in soil science from the Indian Agricultural Research Institute, and a Ph.D. in soil science from Ohio State University.

The USA National Phenology Network's Start of Spring Maps and Access Tools is the Recipient of the 2017 Outstanding Achievement Award

The USA National Phenology Network's (USA-NPN) Start of Spring Maps and Access Tools is the recipient of RNRF's 2017 Outstanding Achievement Award. This award recognizes a project, publication, piece of legislation, or similar concrete accomplishment in the natural resources field.

USA-NPN is a national-scale science and monitoring initiative focused on phenology – the study of seasonal lifecycle events such as leafing, flowering, reproduction and migration – as an approach to better understand how plants, animals, and landscapes respond to environmental variation and change. Their objective is to collect, organize and distribute phenological data, data products and information. The data is distributed to stakeholders who make decisions about resource management and societal adaptation to variable and changing climates and environments.

In early 2017, USA-NPN released two new data products that describe and forecast the biological start of spring across the nation: daily maps of the onset of spring and of accumulated growing degree days. To enable a wide range of users to explore and to access these products, USA-NPN enhanced its existing online data visualization tool to enable all map layers to be viewed either alone or in concert with ground-based plant or animal observational data. The USA-NPN website was further updated to provide daily maps, graphical summaries and non-technical inter-pretation to increase accessibility to the public.

These products fill gaps in the availability of phenological information at national scales, and are delivered with spatial (kilometer) and temporal (daily) resolution that can support informed natural resource management decision-making while advancing natural resource science and broadly informing and engaging the public.

More information about USA-NPN's Start of Spring project is available at https://www.usanpn.org/

Anthropocene Magazine is the Recipient of the 2017 Excellence in Journalism Award

Anthropocene magazine, published by Future Earth, is the recipient of RNRF's 2017 Excellence in Journalism Award. The award honors and encourages excellence in print journalism about natural resources, part of RNRF's goal to advance public education and understanding of important natural resources issues through the dissemination of accurate and scientifically-based information about the environment.

Anthropocene is a digital and print magazine that brings together writers, designers, scientists, and entrepreneurs to investigate innovative solutions to environmental and development chal-lenges and craft in-depth stories about the people and technologies behind those innovations.

The magazine's mission is to curate a global conversation about data, technology, and innovation that can lead to solutions to persistent environmental challenges. The editors of *Anthropocene* aim to build a thought-leading publication for the sustainability and development world.

Anthropocene is an initiative of research platform Future Earth, and will be built in partnership with the Future Earth Media Lab based at the Stockholm Resilience Center. The first issue launched in October 2016 at the UN Habitat III Summit in Quito, Ecuador. The second is due out in August 2017. The inaugural issue featured insightful articles and an engaging overall design which complemented the magazine's overarching mission and editorial concept.

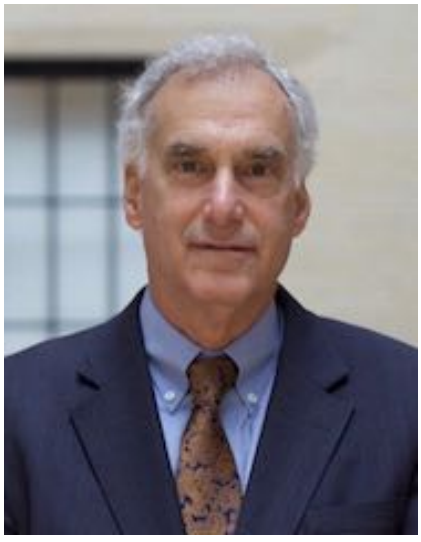
More information about *Anthropocene* magazine can be found at http://www.anthropocenemagazine.org/

David Goldston Meets with RNRF Washington Round Table on Public Policy

The RNRF Washington Round Table on Public Policy met with David Goldston, director, Washington Office, Massachusetts Institute of Technology, on July 19, 2017. Goldston spoke about how universities can most effectively engage with policymakers about scientific information relevant to complex public policy challenges. He also spoke about strategies for advancing funding and the application of science in the current, unprecedented political environment.

Goldston became director of the MIT Washington Office in May 2017. Prior to that for eight years, he was director of government affairs at the Natural Resources Defense Council, a leading environmental group where he helped shape NRDC's federal political strategy, policies, and communications. Before his time at NRDC he spent more than 20 years on Capitol Hill, working primarily on science and environmental policy, including serving as chief-of-staff of the U.S. House Committee on Science from 2001 through 2006.

After retiring from government service, Goldston was a visiting lecturer at Princeton University's Woodrow Wilson School of Public and International Affairs, and at Harvard University Center for the Environment. He is currently an adjunct professor at Georgetown University. He holds a B.A. (1978) from Cornell University and completed course work for a Ph.D. in American history at the University of Pennsylvania.



David Goldston

RNRF Leaders Discuss Advocating for Science

The American Society of Landscape Architects hosted the Spring Meeting of RNRF leaders and guests on May 12, to discuss their recent activities to sustain and strengthen the use of science to inform public policy and management. While specific organizational activities varied, all focused on improving communications within the scientific and professional community, and improving outreach to and among scientists, government officials, congressional members and the public. Everyone observed that their organizations' individual members had been supportive of efforts to advocate for science, design and management in furtherance of sustainability practices and goals.

Participating were:

Joanne Carney (American Association for the Advancement of Science), **Tom Chase** (American Society of Civil Engineers), **Robert Day** (RNRF), **Lisa Engelman**(Amer-ican Water Resources Associa-tion), **Paul Higgins** (American Meteo-rological Society), **Nicolas Kozak** (RNRF), **Lu Gay Lanier** (American Society of Landscape Architects), **Howard Rosen** (Society of Wood Science and Technology), **Nancy Somerville** (American Society of Land-scape Architects), **Barry Starke** (Public Interest Member of the RNRF Board), **Kasey White** (Geological Society of America), and ASLA staff member **Mark Cason**.

Remembering Margaret Davidson

Former RNRF Board Member Margaret Davidson died on May 24, 2017, following a long illness. Throughout the time of her association with RNRF, Margaret was employed by the U.S. National Oceanic and Atmospheric Administration, first as director of the Coastal Services Center in Charleston, South Carolina, then as acting assistant administrator of the National Ocean Service from 2000 to 2002, and thereafter as acting director of the Office of Ocean and Coastal Resource Management.

Margaret was elected to the RNRF Board of Directors as a Public Interest Member on December 23, 2002, and served until April 25, 2006. She attended RNRF's first congress on "Critical Issues and Concepts for the Twenty-first Century" as a delegate in 1992. She spoke at RNRF's 2002 "Congress on Control of Nonpoint Source Water Pollution: Options and Opportunities." As a board member, she co-chaired the program committee of the 2003 "Conference on Agency Personnel Trends, Budget Stringencies, Challenges to Higher Education, and Evolving Roles of Natural Resources Agencies" — conducted in association with the American Association for the Advancement of Science. She both chaired, and spoke at RNRF's 2004 "Congress on Building Capacity for Coastal Solutions." Margaret also spoke at RNRF's 2012 "Congress on Sustaining Natural Resources and Conservation Science: What is at Stake in the Years Ahead," and RNRF's 2013 "Congress on Coastal Resilience and Risk."

She was a truly skilled and effective advocate of interdisciplinary science and management.

American Geophysical Union

American Geophysical Union Coalition Receives Grant to Advance Open and Fair Data Standards in the Earth and Space Sciences

Open, accessible, and high-quality data and related data products and software are critical to the integrity of published research. They ensure transparency and support reproducibility and are necessary for accelerating the advancement of science. In many cases, the data are one-time observations that cannot be repeated. Unfortunately, not all key data are saved and even when they are, their curation is uneven and discovery is difficult, thus making it difficult for other researchers to understand and use the data sets.

To address this critical need, the Laura and John Arnold Foundation has awarded a grant to a coalition of groups representing the international Earth and space science community, convened by the American Geophysical Union (AGU), to develop standards that will connect researchers, publishers, and data repositories in the Earth and space sciences to enable FAIR (findable, accessible, interoperable, and reusable) data – a concept first developed by Force11.org – on a large scale. This will accelerate scientific discovery and enhance the integrity, transparency, and reproduci-bility of this data. The resulting set of best practices will include: metadata and identifier standards; data services; common taxonomies; landing pages at repositories to expose the metadata and standard repository information; standard data citation; and standard integration into editorial peer review workflows.

"AGU's commitment to open data and data stewardship started in 1997 when we developed one of the first society position statements on open data. We developed that position statement because we recognized properly documented, credited, and preserved, data would help future scientists understand the Earth, planetary, and heliophysics systems, and that is an integral responsibility of scientists, data stewards, and sponsoring institutions to ensure the preservation of that data," said Chris McEntee, AGU's executive director/CEO. "Today, with the generous support of the Laura and John Arnold Foundation, our community is working together to ensure that the Earth and space sciences, including more than 50,000 publications, will then be the first scientific field to have open and well-described data as a default, making that data discoverable and freely accessible across our sciences, as well as other scientific disciplines and the public."

The partnership currently includes AGU, the Earth Science Information Partners and Research Data Alliance, and has support from the Proceedings of the National Academy of Sciences, *Nature*, *Science*, AuScope, the Australian National Data Service, and the Center for Open Science. This effort will build on the work of The Coalition on Publishing Data in the Earth and Space Sciences (COPDESS.org), ESIP, RDA, the scientific journals, and domain repositories to ensure that well documented data, preserved in a repository with community agreed-upon metadata, and supporting persistent identifiers becomes part of the expected research products submitted in support of each publication. It is expected that the broader community will play a key role in the recommended guidelines and approach. A key goal is to make a process that is efficient and standard for researchers and thus supports their work from grant application through to publishing.

Scientific results are increasingly dependent on large complex data sets and models that transform these data. This is particularly true in the Earth and space sciences, where critical data increasingly provide diverse and important societal benefits and are used in critical real-time decisions. The partners will work with major Earth and space science data repositories, publishers, editorial workflow vendors, researchers, and allied stakeholders to develop common standards and work-flows for submission of data, connect repositories and publishers, develop and implement tools needed for search and discovery, and enhance quality peer review. This process will help: 1) researchers understand and follow expectations regarding data curation; 2) publishers adopt and implement standard and best practices around data citation; and 3) make data discoverable and accessible, including to the public.

Read AGU's position statement on data here: https://news.agu.org/press-release/agu-coalition-receives-grant-to-advance-open-and-fair-data-standards/

American Society of Landscape Architects

ASLA Opposes Elimination of the Federal Flood Risk Management Standard (FERMS)

In response to President Trump's executive order intended to streamline the environmental approval process for major infrastructure projects, Nancy Somerville, Hon. ASLA, executive vice president and CEO of the American Society of Landscape Architects (ASLA), released the following statement:

"ASLA is deeply concerned with the executive order's roll back of the Federal Flood Risk Management Standard (FFRMS). This order ignores both existing risks of flooding and future impacts of climate change, thereby increasing the risk of loss of property and lives. Responsible planning and development must address issues of floodplain management and incorporate green infrastructure in order to improve the resilience and security of our communities.

"We need the kind of infrastructure plan that helps our nation thrive, grows jobs and improves community health and resilience. ASLA priorities for the nation's infrastructure, outlined in "Landscape Architects Leading Community Infrastructure Design and Development," center on green infrastructure solutions in four areas:

- fixing our nation's water management systems;
- upgrading to a multimodal transportation network;
- recognizing public lands, parks and recreation as critical infrastructure; and
- designing for resiliency.

"We will continue to work at the intersection of design and smart policy, working with legislators and stakeholders on green solutions that work. ASLA intends to remain at the forefront of this conversation, especially through our upcoming Blue Ribbon Panel on Climate Change and Resilience, which will take place September 21-22 at the ASLA Center for Landscape Architecture in Washington, D.C."

Read more at: https://www.asla.org/NewsListingDetails.aspx?id=51319

American Society of Civil Engineers

Board Adopts New Canon for ASCE Code of Ethics

The ASCE Board of Direction voted unanimously at its July meeting to adopt new language in the Society's Code of Ethics that expresses a professional obligation to provide fair and equal treatment for all.

The ASCE Code of Ethics, adopted in 1914, lays out the model for professional conduct for ASCE members. The newly adopted canon – Canon 8 in the Code of Ethics – states:

> Engineers shall, in all matters related to their profession, treat all persons fairly and encourage equitable participation without regard to gender or gender identity, race, national origin, ethnicity, religion, age, sexual orientation, disability, political affiliation, or family, marital, or economic status.
>
> a. Engineers shall conduct themselves in a manner in which all persons are treated with dignity, respect, and fairness.
>
> b. Engineers shall not engage in discrimination or harassment in connection with their professional activities.
>
> c. Engineers shall consider the diversity of the community, and shall endeavor in good faith to include diverse perspectives, in the planning and performance of their professional services.

"ASCE has been working to advance diversity and inclusion within the engineering profession for many decades, and the Board's recent action of codifying its longstanding policy in the Code of Ethics reflects our collective responsibility to promote a diverse and inclusive profession," said ASCE Executive Director Tom Smith, ENV SP, CAE, F.ASCE.

ASCE's Committee on Diversity and Inclusion and Committee on Ethical Practice began collaborating on the new canon in 2016, seeking to provide a basis for enforcing ASCE's commit-ment to diversity and inclusion.

Quincy Alexander, M.ASCE, chair of CDI, presented the rationale for Canon 8 to the Board of Direction in March, citing the number of government agencies, engineering societies, and private engineering companies with similar provisions already in their bylaws.

"This was a case where we wanted to make ASCE's position bold and visible," Alexander said. "This is what our peer organizations are doing, and what our clients and employers expect of us. This is why there is a need for this."

The addition of Canon 8 marks the first revision to the ASCE Code of Ethics since 2006.

"With this support, our Society is pledging to professionally treat everyone fairly and promote equitable involvement," said Board member Melissa Wheeler, M.ASCE, Region 5 Director. "I'm honored to be part of a Board of Direction that would un-animously support adding Canon 8 to our Code of Ethics."

Read the entire ASCE Code of Ethics here:
http://www.asce.org/code-of-ethics/

Geological Society of America

GSA Welcomes Continental Scientific Drilling Community

The Geological Society of America is pleased to announce the formation of a new Interdisciplinary Interest Group (IIG) to serve as an intellectual hub for scientists who use continental scientific drilling to understand fundamental geological processes.

The new IIG aims to (1) promote research using continental scientific drilling, (2) foster collaboration among scientists in continental scientific drilling projects from all divisions of GSA, (3) present and publish continental scientific drilling project results, and (4) involve students and early career scientists in continental scientific drilling projects.

These goals will be met through cooperation with other Divisions, IIGs, Sections, and officers and committees research pertaining to continental scientific drilling. The IIG will help to facilitate presentation, discussion, education, and public outreach of the results of con-

tinental scientific drilling and coring projects.

"GSA is very excited to provide a home for the continental drilling sciences and researchers. This interdisciplinary group is an excellent fit with GSA's Divisions and mission," said GSA Executive Director, Vicki McConnell.

Dr. James Russell, from the Dept. of Earth, Environmental, and Planetary Sciences at Brown University, is the Designated Chair, serving an initial term of 1 year (until 2018) until elections for the full slate of officers can be held at a meeting of the membership at a GSA Annual Meeting.

"Continental scientific drilling is rapidly growing and diversifying," said Russell. "We look forward to working with the Society to continue this growth."

The IIG will be seeking a member to be appointed to the GSA Joint Technical Program Committee (JTPC) — the body that helps shape the GSA Annual Meeting technical program — to ensure the science is well represented.

For more information visit: http://www.geosociety.org/GSA/News/Releases/GSA/News/pr/2017/17-36.aspx

Society of Environmental Toxicology and Chemistry

SETAC Africa's 8th Biennial Conference

Register by 29 September for SETAC Africa 8th Biennial Conference which will be held from 17–19 October in Calabar, Nigeria.

The theme for the SAF 2017 conference is "Quality of African Environment; The Roles of Science, Industry and Regulators.'' This meeting promises stimulating lectures and presentations on landmark scientific researches, professional training opportunities, and lots of time to connect with colleagues for new collaborations.

SETAC will provide a forum for novel discoveries and approaches related to environmental research for Africans and by Africans. The conference shall be a mixture of participants from academia, industries and government agencies.

The conference topics are:

- African environment – Aquatic and terrestrial ecotoxicology
- Effect of pesticide use and quarrying over time, space and level of biological organization
- Emerging and re-emerging contaminants: fate, effect and environmental risks
- Environmental fate and transport of contaminants
- Environmental "omics" and adverse outcome pathways of toxic substances and risk assessment
- Life cycle assessment and sustainable natural gas development
- Modeling approaches for chemicals' fate and exposure; risk assessment of chemical
- Risk assessment, mitigation and monitoring
- Special sessions

For more information and to register, visit: https://saf2017.setac.org/registration/register/

American Water Resources Association

AWRA's Annual Conference

AWRA's Annual Conference will be held in Portland, Oregon, November 5-9, 2017. The conference will feature almost 300 abstracts received, 70 oral sessions, posters, workshops, and other special events.

Sunday preceding the conference will feature three events unique to the Pacific Northwest: a drone workshop on the banks of the Columbia River, a field trip to Clean Water Services' renowned Landscape Conservation Program in the Tualatin River Watershed, and a field trip to historic Willamette Falls in Oregon City.

Monday's plenary will commence with a look at current events, re-affirming AWRA's commitment to science, transparency, and inclusivity in the management of our treasured water resources. With five concurrent sessions and 17 topical (special) sessions throughout the week, this conference will address emerging issues related to technology, flowing waters, future risk, public policy, and more. Back by popular demand, "lightning talks" will give participants a fascinating glimpse into the newest web-based and field-based technologies in the water resources arena. In addition, look for sessions designated as "The Road to Brasilia: Preparation for the 8th World Water Forum." The 8th World Water Forum will convene in March 2018 in Brazil and AWRA will host discussions and presentations in the areas of water and energy, climate change adaptation, and integrated water resources management.

The 2017 conference committee has developed a program with a focus on students, young professionals, and the young at heart. A fun run along the Columbia River is scheduled before the Tuesday sessions. The conference will also have a student competition and the free young professionals' speed networking event. Water as portrayed in art and photography will be on display (oils and photography) on Monday and Tuesday of the conference. April Waters, conference artist-in-residence will exhibit her oil paintings of water scenes in the Pacific Northwest. Photographers Timothy Palmer (a guest speaker), Kevin Coulton and Gary Whitton will be displaying their photography as well. AWRA's main social event will take place in downtown at the newly opened Portland Food Hall, featuring Portland's famous food carts and local beverages.

During Tuesday's Lunch 'n' Learn, celebrated authors Bill and Rosemarie

Alley will share their new book, *High and Dry: Meeting the Challenges of the World's Growing Dependence on Groundwater*. Join us for their lecture, Q&A, and book signing. During Thursday's Lunch 'n' Learn, Professors Adell Amos and Bill Jaeger will present findings from a multi-year NSF-grant project *Willamette Water 2100*. See what some of the brightest lights in Pacific Northwest water predict our region will look like in the year 2100.

For more information visit AWRA's 2017 conference website at: http://www.awra.org/meetings/Portland2017/

American Meteorological Society

AMS Policy Statement on Water Resources in the 21st Century

The provision of adequate fresh-water resources for people and ecosystems will be one of the most critical and potentially contentious issues facing society and governments at all levels during the 21st century. Water is fundamental for all life on Earth — for agriculture, energy production, sanitation, ecosystem health, transportation, and recreation. Yet, the demands upon water resources are ever increasing from population growth and migration, land use changes, and pollution on the local, national, and global levels — problems likely to be exacerbated over the next several decades by hydrologic change.

UN-Water, 2013, defines water security as "*the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability*." As such, we understand that water security is a leading element of U.S. National Security.

In light of these challenges, the American Meteorological Society (AMS) issues this statement and is committed to work with public, commercial, and academic organizations at all levels, and seeks the support of the Congress, the Administration, and international partners in pursuing sustainable solutions. The broader water resource community must be engaged with the atmospheric science community using collaborative and integrative methods to identify key priorities and to meet information needs. Two grand challenges are identified below:

Quantifying and Adapting to Hydrologic Change

Hydrologic Change is the combined result of climate change and human modifications of the water cycle including local- to regional-scale water management and uses and landscape change. These influences introduce both variability over time and long-term trends by altering the statistical properties of key hydrologic variables, from surface water to deep aquifers, on multiple timescales.

It is increasingly clear that traditional water planning approaches, developed under the assumption of hydrologic stationarity, are no longer adequate. Current (and projected) levels of hydrologic change severely diminish the value of the historical hydrologic record as a guide to what the future may hold. Further complexity is added when balancing multiple and changing human and environmental demands.

New approaches to incorporating information about water-related risks will be needed to support adaptation. The AMS community can contribute by providing insights on the likelihood of near-term extreme weather as well as water resource impacts that will result from hydrologic changes. Given that precipitation is a primary forcing in hydrologic models, an increased focus on improving quantitative precipitation forecasts is needed; improving the reliability of short-term to seasonal hydrologic forecasts, through better computational and data resources, and new space- and ground-based observations must also be a priority.

The capacity to project the hydrologic impacts of anthropogenic climate change at spatial scales important for water resource management remains limited. Current global climate models cannot explicitly resolve many hydrologically important processes including orographic or convective precipitation and most land surface feedbacks. However, improved regional projections from statistical or physically based downscaling techniques and the development of higher resolution global climate models are helping to clarify the uncertainties surrounding future hydrologic change and to quantify plausible scenarios of climate change impacts.

Planning under Multifaceted Uncertainty

Emerging hydrologic and socio-ecological changes lead to a high degree of uncertainty regarding the future of hydrologic systems and human and ecological impacts, creating a need for new water resource management strategies. Planning activities now need to incorp rate adaptive risk management as a response to large and persistent uncertainties.

An emerging paradigm shift in water resource planning gives explicit attention to the robustness of management options under uncertainty. One approach adopts a structured decision-making framework, which focuses on quantitatively identifying options that will perform adequately under a broad range of plausible future conditions, while meeting the need to incorporate flexibility when designing long-lived

infrastructure or negotiating operating agreements. Flexibility can involve designs that reduce the costs of future modifications, or simply that are engineered to avoid catastrophic failure.

To be effective, robust planning requires a sound understanding of what is and is not known about future hydrologic change at specific locations. The AMS community can contribute by identifying hydrologic scenarios that adequately represent both natural variability and climate change uncertainties, while the water management community can provide guidance on the relevance of those efforts. A two-way exchange between the atmospheric science and water resource management communities will allow mutual learning and close collaborative exploration of potential solutions. This coupling and synthesizing of comprehensive interdisciplinary scientific information will be critical for successful planning and adaptations in the 21st Century.

For more information visit: https://www.ametsoc.org/ams/index.cfm/about-ams/ams-statements/statements-of-the-ams-in-force/water-resources-in-the-21st-century1/

Society of Wood Science and Technology

2017 COST Action FP1407 Conference

SWST is co-hosting the 3rd conference of the COST Action FP1407, entitled "Wood Modification and Research Applications," which will take place from September 14-15, 2017 at the Salzburg University of Applied Sciences in Kuchl, Austria .

The conference will focus on presenting innovative materials and process developments for various wood modification technologies, ecologic solutions and further related challenges with the focus of improving the properties of timber to guarantee a more sustainable usage of wood. Special emphasis will be given to innovative bio-friendly wood protection techniques and preservatives.

The conference committee is also open to accept a variety of contributions with the target objective in line with "green" principles and with particular interest for studies that deal with timber quality enhancements.

For more information contact Gianluca Tondi at gianluca.tondi@fh-salzburg.ac.at

International News

United Nations Environment

World Comes Together to Tackle Mercury Poisoning

The Minamata Convention on Mercury came into force August 16, 2017. The Convention commits its 74 Parties to reducing the risks to human health and the environment from the harmful release of mercury and mercury compounds. This is the first international Convention in nearly a decade to protect environmental and human health.

Governments that are party to the Convention are now legally bound to take a range of measures to protect human health and the environment by addressing mercury throughout its lifecycle. This includes banning new mercury mines, phasing-out existing ones, and regulating the use of mercury in artisanal and small-scale gold mining, manufacturing processes, and the production of everyday items such as cosmetics, light bulbs, batteries and teeth fillings.

The convention also seeks to reduce emissions as side effects from other industrial processes, such as coal-fired power stations, waste incineration, cement clinker production, and contains measures on the interim storage of mercury, on mercury waste and on measures to reduce the risks of contaminated sites.

"The Minamata Convention shows that our global work to protect our planet and its people can continue to bring nations together. We did it for the Ozone layer and now we're doing it for mercury, just as we need to do it for climate change – a cause that the Minamata Convention will also serve. Together, we can clean up our act," said Erik Solheim, head of UN Environment.

There is no safe level of exposure to mercury nor are there cures for mercury poisoning, which at high levels causes irreversible neurological and health damage. Unborn children and babies are the most vulnerable, along with populations who eat fish contaminated with mercury, those who use mercury at work, and people who live near a source of mercury pollution or in colder climates, where the dangerous heavy metal tends to accumulate.

A 2017 study comparing mercury levels among women of child-bearing age in the Asia and Pacific regions revealed high traces of mercury in 96 percent of the women tested from Pacific communities who have high fish diets.

"As part of the Financial Mechanism of the Convention, the Global Environment Facility (GEF) has been charged with raising and disbursing grants for projects and programs to reduce and eliminate mercury pollution. On behalf of the GEF, I am delighted to join others in the international community and celebrate the entry into force of the Minamata Convention on Mercury. It is an honor for the Global Environment Facility (GEF) to be tasked with providing grants for projects and programs to reduce and eliminate the use of mercury. We are ready to continue to help countries conducting inventories, implementation plans, and investments in technology to make mercury history," said Naoko Ishii, GEF CEO and Chairperson.

Up to 8,900 tons of mercury are emitted each year. It can be released naturally through the weathering of mercury-

containing rocks, forest fires and volcanic eruptions, but significant emissions also come from human processes, particularly coal burning and artisanal and small-scale gold mining. Mining alone exposes up to 15 million workers in 70 different countries to mercury poisoning, including child laborers.

Other human activities that may be sources of mercury pollution include the production of chlorine and some plastics, waste incineration and use of mercury in laboratories, pharmaceuticals, preservatives, paints and jewelry. Since the element is indestructible, the Convention also stipulates conditions for interim storage and disposal of mercury waste.

Like other heavy metals, mercury persists in the environment and builds up in human and animal tissue, particularly in fish. Because it is easily vaporized, mercury can be transported through the air over long distances far removed from its original emission source, polluting air, water and soil.

Signed by 128 countries, the Convention takes its name from the most severe mercury poisoning disaster in history, which came to light in Minamata, Japan in May 1956, after sustained dumping of industrial wastewaters into Minamata Bay, beginning in the 1930s. Local villages who ate fish and shellfish from the bay started suffering convulsions, psychosis, loss of consciousness and coma. In all, thousands of people were certified as having directly suffered from mercury poisoning, now known as Minamata disease.

For more information visit: http://www.unep.org/newscentre/world-comes-together-tackle-mercury-poisoning

Meetings

September 2017

American Society of Civil Engineers Congress on Technical Advancement. September 10-13, 2017. Duluth, MN. http://www.asce.org/templates/conferences-events-event-detail.aspx?id=22250

Association of Fish & Wildlife Agencies Annual Meeting. September 10-13, 2017. Snowbird, UT. http://fishwildlife.org/?section=upcoming-meeting-sites

Association of Environmental & Engineering Geologists 60th Annual Meeting. September 10-16, 2017. Colorado Springs, CO. https://www.aegannualmeeting.org/

Society of Wood Science and Technology COST Action FP1407 Annual Conference. September 14-15, 2017. Salzburg, Austria. http://costfp1407.iam.upr.si/en/events/cost-fp1407-3rd-conference

The Wildlife Society's 24th Annual Conference. September 23-27, 2017. Albuquerque, NM. http://wildlife.org/tws-24th-annual-conference/

October 2017

Society of Environmental Journalists Annual Conference. October 4-8, 2017. Pittsburgh, PA. http://www.sej.org/initiatives/sej-annual-conferences/AC2017-main

American Society of Civil Engineers 2017 Convention. October 8-11, 2017. New Orleans, LA. http://2017.asceconvention.org/

Climate Change 2017. October 9-10, 2017. London, UK. https://www.chathamhouse.org/conferences/climate-change-2017?utm_source=conference-alerts&utm_medium=Referral

10th International Conference on Energy and Climate Change. October 11-13, 2017. Athens, Greece. http://www.promitheasnet.kepa.uoa.gr

Renewable Energy and Sustainability Center's International Energy and Sustainability Conference. October 19-20. Farmingdale, NY. http://www.farmingdale.edu/resc

American Society of Landscape Architects Annual Meeting. October 20-23, 2017. Los Angeles, CA. https://www.asla.org/annualmeetingandexpo.aspx

International Association for Environmental Philosophy Annual Meeting. October 21-23, 2017. Memphis, TN. https://enviroethics.org/2017/01/08/call-for-papers-international-association-for-environmental-philosophy-annual-meeting/#more-12532

Geological Society of America 2017 Annual Meeting. October 22-25, 2017. Seattle, WA. http://community.geosociety.org/gsa2017/home

10th World Conference of Science Journalists. October 26-30. San Francisco, CA. http://wcsj2017.org/

International Conference on Sustainable Infrastructure. October 26-28, 2017. Brooklyn, NY. http://www.icsiconference.org/

November 2017

6th International Conference on Renewable Energy Research and Applications. November 5-8. San Diego, CA. http://www.icrera.org

2017 Annual American Water Resources Association Conference. November 5-9, 2017. Portland, OR. http://www.awra.org/meetings/Portland2017/

Operation and Maintenance of Stormwater Control Measures. November 6-9, 2017. Denver, CO. http://www.omswconference.org/about

Society of Environmental Toxicology and Chemistry North America 38th Annual Meeting. November 12-16, 2017. Minneapolis, MN. https://msp.setac.org/

Meetings Information

Visit http://www.rnrf.org/ for a list of meetings relevant to natural resources and environmental policy and management. Submit meeting notices to info@rnrf.org.

December 2017

7th International Conference on Innovations in Chemical, Agricultural, Biological & Environmental Sciences. December 4-6, 2017. London, UK. http://cecabs.org/conference/183

American Geophysical Union Fall Meeting. December 11-15, 2017. New Orleans, LA. http://fallmeeting.agu.org/2017/

American Society of Civil Engineers India Conference on Urbanization Challenges in Emerging Economies. December 12-14, 2017. New Delhi, India. http://asceindiaconference.org/

Renewable Resources Journal
Renewable Natural Resources Foundation
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North Bethesda, Maryland 20852-3827 USA
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