

Weathering **CHANGE**

Policy Reforms

That Save Money and
Make Communities Safer



American Rivers
Thriving By Nature

Weathering CHANGE

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Written by Will Hewes and Andrew Fahlund.

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Weathering CHANGE

Confronting Change

Larger and more frequent floods. More severe droughts. Shrinking snowpack and dwindling water supplies. Increased water pollution. Communities nationwide are already feeling the impacts of climate change.¹ We don't know exactly what the "new normal" will look like in every corner of the country, but when it comes to managing water resources and ensuring public health and safety, we know that the past is no guide for the future. Communities large and small, urban and rural, are all facing greater uncertainty and volatility, which translates to greater risk. We must take immediate steps to dramatically reduce carbon pollution if we are to keep these changes to a manageable level, but we also must rethink how we interact with our land and water resources in order to minimize the risk of future catastrophes.

As an editorial in the *Des Moines Register* recently put it,

"[T]he state must begin shaping policies around the reality of increased flooding, soil erosion, pollution and stream degradation. Unless the process of adaptation begins soon, Iowa faces a future in which its cities are perpetually recovering from floods and its farms are losing topsoil faster than it can be restored. That's a future of decline and chronic disaster."

Learning from the Past, Preparing for the Future

We are poorly equipped to deal with the challenges climate change is bringing because of how we have managed land and water in the past. We have built houses and planted crops right up to the river's edge, causing stubborn pollution problems and leaving ourselves vulnerable to floods. We have wasted water as if it were an infinite resource. We have filled in wetlands and leveled forests that control floods and provide clean water for free. We rely on expensive built infrastructure that consistently fails, has little capacity to adjust to



changing conditions, and is designed to serve one narrow purpose. In short, we have embraced the most expensive and least effective options when building communities, managing landscapes, designing infrastructure, and using water supplies. Many of these practices never made much sense, but in an era of scarce resources and growing volatility, they are even more problematic.

¹ For more information on how climate change will impact water resources, see *Global Climate Change Impacts in the United States* (U.S. Global Change Research Program, 2009).

Fortunately, we know how to spend our money more responsibly by planning for the future and building in flexibility that will help us deal with changing conditions. We can protect and restore the wetlands, forests, and rivers that slow floods and provide clean water. We can use water more efficiently at home, in factories, and on farms. And we can install green roofs, rain gardens, and green streets in our cities to decrease polluted runoff, improve air quality, and lower temperatures. Cities like Philadelphia, Milwaukee, Portland, and New York are already embracing these cost-effective, 21st century solutions to save money and address immediate problems they face. These cities are demonstrating that to survive and thrive in an era of more volatile and extreme weather, we must invest in the solutions that do the most good for the least amount of money. At the same time, they are showing that we can simultaneously create community amenities like parks and trails, along with healthier fish and wildlife populations by making smarter choices. Spending less money to solve

more problems and prepare for the future is the responsible thing to do.

Bringing Federal Policy into the 21st Century

Many federal policies still encourage the same backward-looking water management approaches that didn't work in the past and are even less suited to the future. Federal funding and policies reward wasteful water use and support destructive, inflexible infrastructure projects, while important programs that would help save water or preserve valuable wetlands and floodplains fall woefully short of what is needed. There is a widespread failure to plan for and address the changing conditions we know are coming. Taxpayer dollars are being wasted on infrastructure that won't work very well as the "new normal" takes hold. Too many federal policies are moving us in the wrong direction and making communities and wildlife more vulnerable.



HORICON MARSH, WI | Ryan Hagerty, U.S. Fish and Wildlife Service

10 Policy Reforms

That Save Money and Make Communities Safer

The following ten reforms are some of the best ways we can change outdated federal policies and embrace a forward-looking approach to water management. They represent proactive steps Congress and the Executive Branch can take to address climate change. Even better, all of these policies make sense even in the absence of climate change. No matter what happens in the future, we'll be better off by not building in floodplains, wasting water, or destroying forests and wetlands.

- 1. National Flood Insurance Program:** Change flood insurance rates and maps to ensure they reflect risk and discourage construction and reconstruction in vulnerable areas
- 2. Farm Policy:** Reward farmers for being responsible stewards of land and water resources and encourage better flood management practices on agricultural lands
- 3. Bureau of Reclamation:** Develop comprehensive water management plans for Reclamation projects to create greater flexibility and improve the health of rivers
- 4. Energy Policy:** Integrate water management and energy planning and ensure that energy and water are being used as efficiently as possible
- 5. Clean Water Act:** Restore protections to wetlands and streams and improve implementation and enforcement of protections for all waters
- 6. Water Resources Development Policy:** Reform the principles that guide construction of federal water infrastructure projects to minimize damages to rivers, wetlands, and floodplains and prioritize more cost-effective, flexible projects
- 7. Clean Water and Drinking Water Infrastructure Funding:** Reform funding criteria to ensure that funded projects embrace green infrastructure and can adapt to changing conditions
- 8. National Forest Management:** Diversify Forest Service management practices to prioritize effective water management
- 9. Transportation Policy:** Ensure that funded projects minimize impacts on surrounding water resources and wildlife populations
- 10. Wildlife Management:** Better coordinate federal actions and invest in climate change planning to help maintain healthy fish and wildlife populations

As federal policymakers take up these issues in coming years, they must seize the opportunity to correct the mistakes of the past and prepare communities and wildlife for the defining challenge of the future. By injecting common sense into these areas of federal policy, the nation can become safer and more financially secure, ready to deal with greater volatility and uncertainty. It is a challenge that we cannot afford to ignore.



National Flood Insurance Program



National Oceanic and Atmospheric Administration

The future holds great challenges for the nation's water resources. Shifting weather patterns, more damaging floods, and rising water shortages will threaten communities, the economy, and the environment. This chapter is part of a larger report, ***Weathering Change: Policy Reforms That Save Money and Make Communities Safer***, which shows what the federal government must do to help the nation confront these looming challenges.

To see the entire report, visit www.americanrivers.org

Introduction:

The National Flood Insurance Program (NFIP), created by Congress in 1968 and managed by the Federal Emergency Management Administration (FEMA), allows property owners in participating communities to purchase flood insurance from the federal government. It currently covers about 5.5 million properties nationwide with a value of \$1.25 trillion. While the program has helped Americans recover from devastating floods for over four decades, it also has a number of shortcomings that encourage risky behavior, waste taxpayer money, and make communities more vulnerable to floods. By ensuring that flood maps and insurance rates reflect flood risk, we can save lives and money. These reforms make sense today, and they are especially important as climate change brings more severe storms and floods.



I. Today's Policy

The National Flood Insurance Program encourages people to live in flood-prone areas and creates a costly burden on taxpayers.

Artificially low insurance rates: Many properties covered under the National Flood Insurance Program pay below-market rates that hide the true risk of living in vulnerable areas and encourage homeowners to reside in places that will become more prone to flooding in a changing climate. The NFIP was designed to provide flood insurance to people and properties that private insurance was unwilling to cover. It was believed that the number of eligible structures would gradually be reduced as they reached the end of their life. However, this has taken longer than anticipated, and nearly a quarter of property owners currently receive subsidized insurance, primarily covering older structures that were built prior to the creation of NFIP and Flood Insurance Rate Maps (pre-FIRM). These subsidies encourage homeowners to continuously rebuild in hazardous areas, placing a drain on the program's finances and perpetuating a cycle of risk.

Even rates that aren't subsidized understate the risk of flooding in many places.¹ FEMA uses average historical flood data to set rates, but the agency does not factor in damages from catastrophic loss years and ignores potential changes in flood risk due to land use changes or climate change.^{2,3} As a result, even these supposed "full risk" rates encourage development in vulnerable areas. The rates constitute a significant subsidy from taxpayers to those that live in harm's way. NFIP has about \$19 billion of debt, largely due to damages from the 2005 hurricane season, and is unlikely to ever repay the federal government.⁴

Outdated floodplain maps: The Flood Insurance Rate Maps that are used to identify flood risk and establish insurance rate zones are based on the historical 100-year flood. Using this measure, the flood zone is the area where there is greater than a 1 percent chance of flooding in a given year. There are several problems with this measure of risk. First, considerable flood risk exists beyond the line of the 100-year flood. Parts of the Midwest have received

two 500-year floods in less than 15 years.⁵ In reality, floods do not stop at this line, and basing flood maps on this standard can give people a false sense of security that they are safe as long as they are not located in the 100-year floodplain. Second, many maps are outdated and do not incorporate significant changes in flood risk since they were drawn. FEMA is undertaking efforts to digitize these maps and improve their quality, but the updated maps frequently fail to incorporate future development, coastal erosion, or changes to the climate, leaving them outdated shortly after they are revised.⁶

Finally, flood maps do not identify potential inundation zones behind flood control structures and below dams. These structures can and do fail, often to catastrophic effect. The American Society of Civil Engineers gives the nation's dams a grade of 'D' and levees a 'D-'.⁷ There are thousands of miles of aging levees throughout the country, and many states know little to nothing about their condition or even where they are located. Dam safety programs are almost universally underfunded, and the number of high hazard and structurally deficient dams has increased steadily in recent years.⁸

Inadequate risk reduction requirements: One of the primary goals of NFIP is to reduce the long-term vulnerability to floods. To that end, communities are required to implement and enforce floodplain ordinances to restrict development in vulnerable areas as a condition of participating in NFIP. There are also a number of programs such as the Community Rating System and the Flood Mitigation Assistance Program that encourage communities to take proactive steps to reduce their vulnerability. However, throughout the program's history, development of hazardous and environmentally-sensitive areas has continued. In many places floodplain ordinances are inadequate or poorly enforced. Structures that have been repeatedly damaged by floods have been continually rebuilt, contrary to the stated goals of the program. These "repetitive loss properties" (RLP) make up one percent of NFIP policies but are responsible for 25-30 percent of losses.⁹ The number of RLPs increased more than 50 percent between 2000 and 2009.¹⁰ As a result of these multiple failures, vulnerability in many places has continued to grow and will only become worse in a changing climate.

II. Risks and Consequences

As temperatures rise, the atmosphere can hold more moisture. This causes precipitation to fall in more concentrated bursts.¹¹ There has already been a noticeable increase in severe storms in recent years. The amount of rain falling in the heaviest downpours increased 20 percent over the course of the 20th century.¹² This trend is expected to continue in the future. By the end of the century, extreme precipitation events that occur once every 20 years on average at present could occur every six to eight years.¹³

This increase in severe storms is especially troubling in light of the shortcomings of the nation's flood insurance system. By reducing the cost and financial risk of living in flood prone areas, artificially low rates encourage homeowners to move into or continue living in hazardous areas along rivers and coastlines that will only become more vulnerable to floods in an increasingly volatile climate. Masking flood risk also discourages homeowners from taking steps to reduce their vulnerability by elevating struc-

tures or undertaking other mitigation measures. Meanwhile, the flood maps we use to assess and communicate flood risk are becoming increasingly obsolete. Although FEMA is updating maps, they continue to rely on historical precipitation patterns. The historical 100-year floodplain will be an even less accurate measure of vulnerability as precipitation patterns shift, and there will be greater risk of inundation for those behind dams and levees.

Living in flood-prone areas will lead to greater loss of life and property and lock tax-payers into an expensive cycle of subsidizing insurance and rebuilding dams and levees. Continued development of floodplains, wetlands, and coastal areas also degrades the landscape's natural ability to reduce floods. One FEMA study, for example, found that planned development in Harris County, Texas would increase flood risk for existing buildings by more than 1,200 percent.¹⁴ This approach makes little sense today, but it is even more irresponsible in a changing climate.

III. Preparing for the Future

By improving flood insurance rates and maps and moving people out of harm's way, we can trim wasteful spending and better prepare communities for a more volatile climate.

Establish risk-based rates: FEMA must begin moving all NFIP policies toward actuarial or risk-based rates. This will better communicate the true risk of locating structures in vulnerable areas and discourage risky behavior. Implementing risk-based rates will also put NFIP on a sound financial footing and allow it to continue to help Americans recover from floods in the future.

Some methods for achieving risk-based rates include eliminating or phasing out the subsidies for pre-FIRM buildings, especially non-primary residences, non-residential buildings, and repetitive loss structures. FEMA should also stop the practice of grandfathering existing rates when maps are updated. In order to allow FEMA to raise rates in a timely fashion, Congress should lift the 10 percent cap on annual rate increases. Flood insurance should also be encouraged for properties located behind flood control structures and below dams. Finally, creating flood insurance rate maps with more gradation and detail will allow FEMA to create a rate structure that more accurately communicates risk, reflects current and future conditions, and addresses environmentally sensitive areas.

Implementing risk-based rates will require sensitivity to the financial impacts on policy holders, especially low-income communities. FEMA should evaluate options such as a community-based group



Extreme storms and risky development have caused rising flood damages.

insurance rate on a watershed basis and direct grant assistance to qualifying communities and residences to address the affordability issue while also assisting these communities with reducing flood risk.

Improve Flood Insurance Rate Maps: FEMA must move beyond flood maps that rely on the 100-year flood and instead ensure that flood maps communicate actual risk. Maps should not only identify a broader area of risk such as the 500-year floodplain and high hazard areas but should also include more gradation to reflect variations of risk within individual zones. Floods do not obey the lines drawn on flood insurance rate maps, and maps should incorporate as much detail on local conditions as possible to reflect that. In addition, residual risk areas behind levees and dams should be identified on maps.

FEMA should use the best available science including identification of reasonably foreseeable future conditions to guide assessments of flood risk. FEMA should work with communities, states, and the private sector to improve the quality of maps through advanced mapping technologies. Congress should provide FEMA with additional funding to speed the map revision process, as a lack of resources has been one of the major obstacles to updating obsolete maps.¹⁵ This mapping also needs to be shielded from political pressures. There have been frequent objections to flood maps when they expand insurance requirements to new structures located in flood-prone areas. Science, not the political process, should guide flood risk assessments.



When levees fail, they can take people and homes with them.

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Risk-based insurance rates encourage people to reduce their vulnerability to floods.

PREPARING FOR THE FUTURE CONTINUED

Strengthen flood mitigation programs: Congress must significantly strengthen flood mitigation measures under NFIP and the Robert T. Stafford Disaster Relief and Emergency Act to ensure that federal grant programs reduce long-term flood vulnerability and restore the environment. Stronger land use regulations, building codes, and building elevation requirements should be included as a condition for participation in NFIP. Flood insurance subsidies should be phased out for all repetitive loss structures to discourage continued rebuilding of at-risk structures. Funding for programs that reduce flood risk such as the Flood Mitigation Assistance Program should be increased to reduce long-term vulnerability to floods. However, these programs need to place a stronger emphasis on reducing flood risk through non-structural approaches such as floodplain and wetland restoration and removal of the most vulnerable structures. The Community Rating System (CRS), which offers discounted insurance rates to communities that voluntarily adopt and implement policies that exceed

FEMA requirements, should similarly be revised to include greater incentives for the implementation of projects that protect or restore natural flood control functions. FEMA should consider providing incentives to municipalities, in addition to individuals, by offering better cost-share ratios for federal infrastructure grants to those communities that implement these policies, particularly the protection and restoration of natural floodplain functions.

IV. Benefits of Being Prepared

For decades, we have subsidized and encouraged development in flood-prone areas. It is time to embrace common sense reforms that make those that live in risky areas take responsibility for their decisions. Especially in a changing climate, the federal government cannot afford to foot the bill for this unsafe behavior. More accurately assessing and communicating risk will save taxpayers money and encourage people to decrease their vulnerability to floods, both now and in an uncertain future. ■



Jerry Guebe

Soldiers Grove, WI was destroyed several times by floods but has avoided major damages since it relocated the downtown to higher ground.

FOOTNOTES

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Farm Policy



Natural Resources Conservation Service

The future holds great challenges for the nation's water resources. Shifting weather patterns, more damaging floods, and rising water shortages will threaten communities, the economy, and the environment. This chapter is part of a larger report, ***Weathering Change: Policy Reforms That Save Money and Make Communities Safer***, which shows what the federal government must do to help the nation confront these looming challenges.

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Introduction:

Agriculture is central to everything we do. American farmers have created unprecedented advances in food production and greatly improved our quality of life. Farming also has extensive impacts on land, water, and wildlife, however. The extent of the impact is heavily influenced by federal farm policy. Crop subsidies affect the quantity and type of crops farmers grow, the amount of water farmers use, and the health of surrounding waterways. Conservation programs can reduce agriculture's impact and contribute to sustainability if properly designed. One early example of this is the Soil Conservation Service, which was instrumental in solving the widespread erosion problems that caused the Dust Bowl in the 1930s. American agriculture is now faced with perhaps its greatest challenge since that time: climate change. Congress must ensure that federal farm policy — which is set in the Farm Bill that is passed roughly every five years — protects and restores the forests, wetlands, and floodplains that buffer farms and surrounding communities from extreme droughts and floods. Federal farm policy must lead the way toward a more sustainable future for agriculture so that farmers, communities, and wildlife can thrive in a changing climate.



Subsidies encourage unsustainable farming practices that cause water pollution and destroy sensitive landscapes.

I. Today's Policy

Federal farm policy encourages degradation of the nation's water resources, increases flood risk, and makes communities and wildlife less prepared for a changing climate.

Crop Subsidies: Farm subsidies were first introduced in the 1930s to help struggling farmers, but today they largely benefit a few corporate producers and encourage unsustainable farming practices. Between 1995 and 2009, the federal government paid out \$250 billion in farm subsidies.¹ These subsidies come in a variety of forms. There are direct payments regardless of crop prices. There are counter-cyclical and market-loss payments, which kick in when the price of crops falls below a certain level. Subsidized crop insurance provides 50 percent coverage for catastrophic crop losses at no cost to producers.

Some level of subsidy may be desirable in order to maintain a secure food supply or to preserve real family farms. However, the vast majority of subsidies go to the largest and wealthiest corporate producers that are already profitable without government handouts. Sixty-two percent of farm subsidies go to large commercial farms, while less than 30 percent of small farms receive any payments.² What's more, much of the aid is targeted to low-value crops such as corn, cotton, rice, and soybeans. Those crops, in addition to wheat, received more than 70 percent of all crop subsidies totaling \$170 billion in the past 15 years.³ In effect,

most farm subsidies encourage large monoculture of field crops, precisely the type of agriculture that has the greatest impact on the surrounding land and water. It creates large volumes of nutrient- and pesticide-laden runoff, which cause widespread water quality problems in lakes, streams, and coastal waters. These crops also use a substantial amount of water and compete with a growing number of people and industries in the arid West.

Conservation Programs: Conservation programs first became a major part of the Farm Bill in 1985 with the establishment of the Conservation Reserve Program (CRP), which focused on removing highly erodible land from production. Since then, the scope and funding of conservation programs have expanded significantly.⁴ The 2008 Farm Bill authorized \$24 billion in conservation program funding, which makes it the largest single source of funding for conservation on private lands.⁵ These funds are administered through a wide range of conservation programs that focus on preserving different types of landscapes such as grasslands, forests, and wetlands by retiring sensitive lands from production or improving practices on working lands. The Wetlands Reserve Program, for example, funds purchases of easements to retire former or converted wetlands and provides technical and financial assistance to restore farmed wetlands.

USDA conservation programs have had considerable success in reducing the impacts of agriculture

on the American landscape. The Conservation Reserve Program alone currently covers approximately 34 million acres and has reduced soil erosion and improved water quality, flood storage, and wildlife habitat. However, inadequate funding and a lack of effective targeting limit the impact of these programs and their ability to buffer farmers, communities, and ecosystems from a more volatile climate. Conservation programs cover only a small fraction of the agricultural lands in the country, and many vital landscapes are not being managed as sustainably as they could be. There is a backlog of 300,000 applications for the Wetland Reserve Program alone.⁶ There could be cuts to these programs in the next Farm Bill. The Wetland Reserve Program, in particular, does not have baseline funding beyond 2012, and if it is to continue, it will have to be offset by decreases in other programs.⁷

In addition, existing funding levels do not achieve the maximum benefit because of the failure to prioritize funding to the most vulnerable areas or coordinate with other conservation efforts. A single farmer improving practices or retiring land can have a small local impact, but a critical number of producers must implement conservation practices in order to achieve meaningful improvements throughout a watershed.⁸ Currently, many conservation programs target resources to a list of top priorities within a given area, but this does not ensure that the most critical areas within priority watersheds are being addressed. Failing to ensure that all conservation programs focus on the most critical landscapes and reach a sufficient threshold to have a meaningful impact will mean that scarce funding is not being used to maximum benefit.

Increased Flood Risk: Farming has a dramatic impact on the landscape and its ability to manage floods. The conversion of land to agricultural use and the construction of dams and levees to protect crops play a central role in determining how water flows across the landscape and affects downstream communities. Americans have drained and cleared countless acres of wetlands and forests in order to grow crops. This landscape transformation has increased the rate and magnitude of runoff as it traded natural landscapes for fields that were less effective at absorbing rainfall. Farmers transitioned to more intensive production of row crops such as soy and corn in the second half of the 20th century — spurred in part by U.S. farm policy — which further decreased the landscape's ability to hold water and increased downstream flood risk.

As agriculture has expanded, many farmers have installed drainage systems under the soil — known as tile drains — to more effectively remove water from their fields and increase yields. These systems have a large impact on hydrology and water

quality, although the link between tile drainage and flooding is complex and difficult to separate from the long-term conversion of land to crop production.⁹ Tile drainage can either increase or decrease peak flows depending on a number of factors such as soil type.¹⁰ However, tile drainage can contribute to wetland loss and open up new lands to production. To the extent that tile drainage contributes to the conversion of these natural landscapes, it can increase flood risk. Tile drainage also contributes significantly to downstream nutrient pollution. Heavily tile-drained parts of the Corn Belt contribute the greatest amount of nitrate to the dead zone in the Gulf of Mexico.¹¹

Agricultural levees have also had a profound impact on flood risk throughout agricultural lands. Farmers have built levees for centuries to protect their fields from floods. On the Upper Mississippi alone there are 2,200 miles of levees and floodwalls.¹² Levees strait-jacket rivers and disconnect them from their floodplains. During large storms, levees send water rapidly downstream instead of allowing it to spread over the floodplain. This puts additional pressure on downstream flood defenses and increases the risk of inundation in heavily populated areas. Levees can and do fail during large events, often to catastrophic effect. Agricultural levees are frequently designed to a lower protection standard than those that protect communities despite the fact that development has sprung up behind many of them. The failure of these levees in extreme events can inundate downstream areas, as occurred in the 1993 Mississippi River floods.¹³ Even worse, in many cases, little to nothing is known about where agricultural levees exist or what their condition is.

Small watershed dams present a further challenge to managing flood waters on agricultural lands. Since 1948, the Natural Resources Conservation Service (NRCS) has helped to construct over 11,000 watershed dams. These structures were intended to reduce erosion, control floods, and provide



Agricultural dams and levees have left communities vulnerable to floods.

water supply. In many cases, these dams have created a hazard to public safety due to downstream development after construction of the dam.¹⁴ While NRCS requires communities to limit development in these hazardous areas, sponsoring communities have often not enforced floodplain easements, resulting in hazardous conditions. Many of these structures are now at or near the end of their 50-year life expectancy and need expensive upgrades. Small watershed dams have also had a range of negative impacts on native fish and wildlife.¹⁵ Few communities can afford to fix these aging structures, and although NRCS has been offering assistance through its Watershed Rehabilitation Program, the need far outweighs available resources. In addition, most of the funding in this program is used to extend the life of dams. While removal is considered in each case, it is rarely chosen, and removal is not seriously analyzed as a viable alternative in many cases.

II. Risks and Consequences

No other sector of the economy is more vulnerable to climate change than agriculture. Farming is deeply affected by changes in precipitation, temperatures, and other climate-driven factors. At the same time, agriculture and the federal policies that influence it have a large impact on the ability of the environment and communities to withstand climate change. Right now, many federal farm policies are moving us in the wrong direction. Subsidies encourage additional production, which facilitates encroachment onto wetlands and floodplains, affecting everything from flood management to water quality to wildlife habitat. The conversion of natural landscapes to row crop production increases flood risk and creates new sources of polluted runoff even as the changing climate brings more extreme storms. Increased irrigation in water stressed regions lowers water levels and reduces available water supplies as droughts are becoming more frequent and severe. The stresses farming puts on waterways, wetlands, and forests makes them less resilient to the additional pressures climate change will bring. This in turn limits these landscapes' ability to slow floodwaters and provide clean water, making communities less prepared to deal with a more volatile and uncertain climate.

Levees and dams also present a significant challenge in a changing climate. As storms grow more intense, agricultural levees will continue to push damaging floodwaters toward downstream population centers. The risk of failure will also grow and present an increasing threat to public safety in a more volatile climate. Many communities do not have sufficient funds to maintain these structures,

and it is unlikely that federal funding will be available to assist with necessary improvements in the future. Communities may be stuck with unsafe infrastructure and few resources to make needed improvements even as climate change exacerbates the problem.

III. Preparing for the Future

The Farm Bill offers a valuable opportunity to correct the wasteful practices of the past and help farmers, communities, and wildlife prepare for the challenges of a changing climate.

Reform farm subsidies: Farm subsidies must be shifted away from large corporate producers and low-value, water-intensive crops. The overall amount of subsidies should be reduced considerably. A smaller amount of direct payments should be targeted to small farmers that demonstrate financial need and prove to be responsible stewards of land and water resources. In general, commodity subsidies should be phased out in favor of “green payments” or incentives through existing conservation programs.

At the very least, there needs to be a greater effort to strengthen environmental protections on lands that receive farm payments. Farmers that receive federal assistance are required to avoid the conversion of wetlands and to reduce erosion from highly erodible lands. Unfortunately, these conditions do not apply to crop insurance. Overall, conservation requirements have been successful in improving environmental performance, but they have not been adequately enforced and could be further improved.¹⁶ USDA should increase inspections and impose penalties on farmers that fail to comply with these requirements. Congress should expand existing protections to crop insurance and implement new stream buffer requirements on all lands receiving federal assistance.

Fully fund and more effectively target conservation programs: Congress must make conservation programs a priority in future farm bills. It is essential that these programs receive funding at levels that are closer to existing need. The Wetland Reserve Program (WRP), which could be cut due to the lack of expected funding in the next Farm Bill, is particularly important, as it promotes both community and ecosystem sustainability in a number of ways. Wetlands provide a number of free community services including clean water and flood management, both of which will be increasingly important in a changing climate. Congress must maintain robust funding for WRP in the next Farm Bill. Similarly, programs such as the Agricultural Water Enhancement Program,

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which addresses a critical need by encouraging more efficient water management, should be expanded.

In addition, conservation programs must be better targeted to the most ecologically valuable lands and the most pressing natural resources concerns in order to ensure that there are measurable achievements in overall watershed health and resilience. NRCS should increase place-based targeting that concentrates resources in priority watersheds to protect the most ecologically valuable lands. Water quality, water quantity, and flood reduction should be a primary concern throughout conservation programs in light of the increases in floods and droughts that a changing climate will bring. Projected climate impacts should be considered in the design of all conservation program goals and targets in order to ensure that expected benefits are not undermined by changing conditions. If properly targeted, NRCS conservation programs can make vital improvements in the resilience of the nation's water resources and prepare human and natural communities for a changing climate.

Reduce long-term flood risk: Congress and the USDA must work to ensure that federal farm policy decreases long-term flood risk from agricultural landscapes. NRCS should establish an overarching flood management strategy based on a watershed scale to help farmers naturally increase flood storage and reduce flood risk downstream. In particular, this means better understanding the link between tile drainage and flooding in different landscapes and reforming programs that support this practice based on those results. There must be a concerted effort to ensure that federal programs are not encouraging tile drainage where it might increase flood risk by accelerating water transport or opening new, environmentally sensitive lands to production. Tile drainage must also be assessed in light of the consequences that rising temperatures and greater runoff from tile drained fields could have for water quality. NRCS must reassess any programs that support this practice to avoid exacerbating existing nutrient pollution problems.

We also need to address the risk that agricultural levees pose to farmers and communities. First and foremost there needs to be a better understanding of the location and condition of these levees. Congress should fund a national inventory and inspection of all levees and create state-level levee safety programs to continue inspections and reduce long-term risk from these structures.¹⁷ This effort should also focus on examining how agricultural levees affect the vulnerability of downstream flood defenses that protect municipalities. In addition,

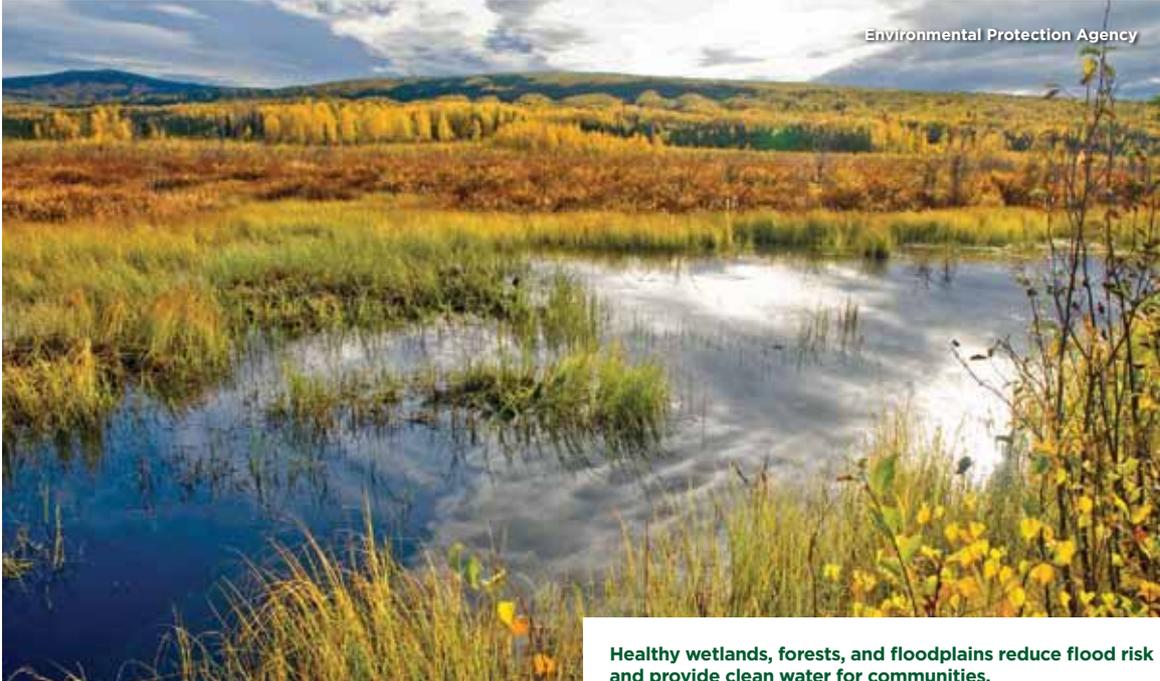
Congress should create a grant program that will allow communities to address these risks by reconnecting rivers to floodplains, obtaining easements, planting more flood tolerant crops, and removing or setting back levees where possible.

Finally, NRCS must ensure that its watershed protection and rehabilitation activities are contributing to resilience in a changing climate. Congress should provide additional funding to the Watershed Rehabilitation Program to reduce the risk that aging dams pose to farmers and downstream communities. It is essential, however, that this program fund projects that promote resilience for both human and natural communities. Leaving these structures in place may not always be the best strategy for reducing long-term risk. The Principles and Guidelines (P&G) for federal water infrastructure projects, which are currently under revision, can help guide these projects toward non-structural alternatives that are more cost effective and provide multiple benefits (see Water Resources Development Policy chapter). By requiring agencies to prioritize non-structural alternatives and give more weight to ecosystem services and climate change impacts, the Administration can ensure that the Watershed Rehabilitation Program adopts a strategic approach that better incorporates decommissioning as a viable alternative and reduces long-term risk. NRCS should also work with communities to ensure better enforcement of floodplain easements and prevent future development in breach inundation areas.

IV. Benefits of Being Prepared

Reducing flood risk and minimizing agriculture's impacts on the environment and surrounding communities makes sense no matter what the future holds. We should not waste scarce resources to support wealthy corporate producers that degrade land and water resources. Nor should we settle for conservation programs that achieve anything less than the maximum benefit. In an era when we face changing conditions, greater water stress, and more frequent floods, these reforms become even more important.

Agriculture is central to all we do, and we can continue to support farmers in ways that accomplish multiple goals like using water more efficiently, maintaining healthy wetlands and streams, and creating an agricultural landscape that reduces flooding. American farmers know better than anyone how to be good stewards of their land, but they also respond to financial incentives. The federal government must move away from policies that promote unsustainable behavior and provide incentives to help farmers prepare the nation for a more volatile and uncertain climate. ■

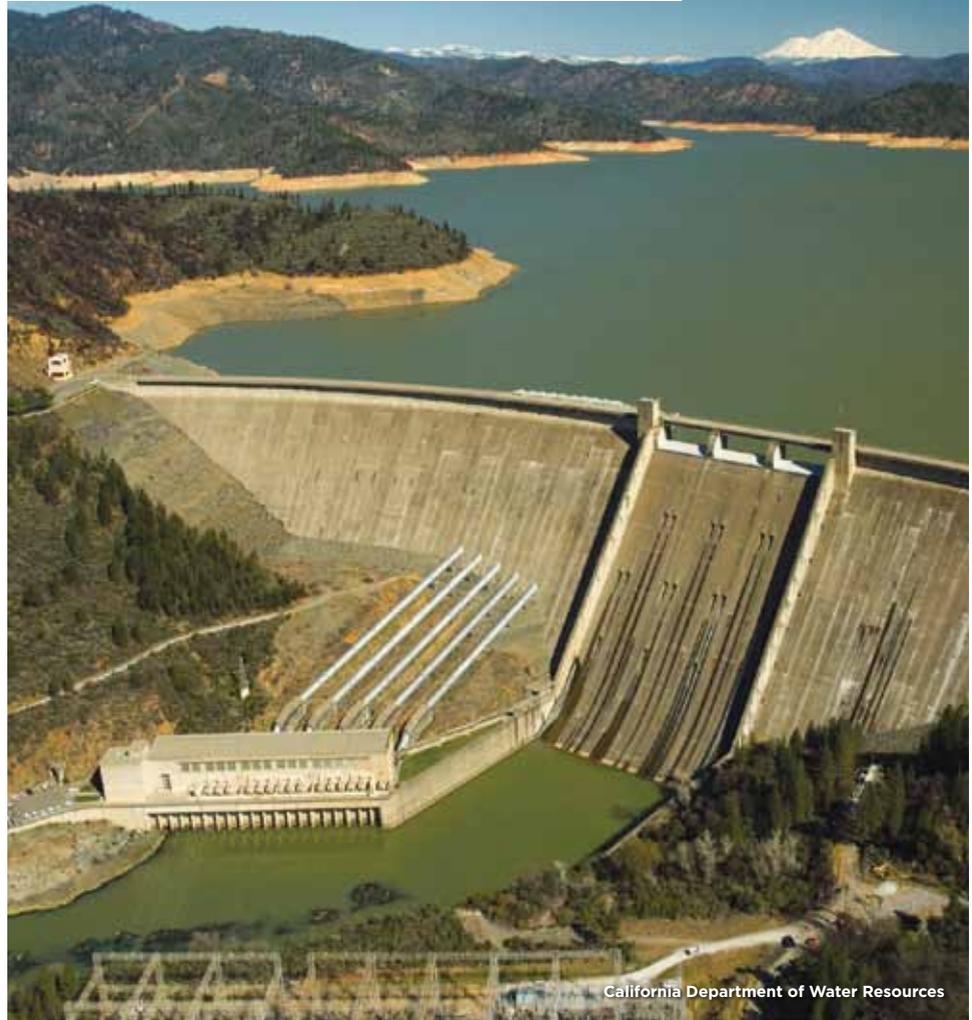


Healthy wetlands, forests, and floodplains reduce flood risk and provide clean water for communities.

FOOTNOTES

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Bureau of Reclamation



The future holds great challenges for the nation's water resources. Shifting weather patterns, more damaging floods, and rising water shortages will threaten communities, the economy, and the environment. This chapter is part of a larger report, ***Weathering Change: Policy Reforms That Save Money and Make Communities Safer***, which shows what the federal government must do to help the nation confront these looming challenges.

To see the entire report, visit www.AmericanRivers.org

Introduction:

Over the past hundred years, the Bureau of Reclamation (Reclamation) has fundamentally reshaped the landscape of the American West. Reclamation was established in 1902 in order to construct large-scale irrigation projects that would encourage settlement and the growth of irrigated agriculture in sparsely populated western areas. The Bureau took this mission to heart and spent the next hundred years damming nearly every major river in the West. Today, Reclamation is the largest wholesale water supplier in the world, providing irrigation water to a fifth of western farmers while operating about 180 projects in 17 states. The Bureau's success in expanding irrigated agriculture has come at a significant and growing cost, however. Below market rates and entrenched water rights create an inflexible and inefficient system of water use that causes shortages for communities and ecosystems and leaves little room to adapt to a changing climate. There must be a comprehensive effort within each Reclamation basin to create greater flexibility and ensure that the needs of all water users, including the environment, are being met.



Agriculture consumes huge quantities of water in the West even as scarcity grows.

I. Today's Policy

An inflexible system of water use makes it difficult to meet the needs of communities, farmers, and the environment in increasingly water-scarce western states.

Growing competition over water: Many parts of the western U.S. face a looming water crisis. A growing population, inefficient water use, and increasing recognition of environmental water needs present a daunting challenge that will only grow in a changing climate. Water use already outstrips renewable supply in many places. The southwestern U.S. is making up for shortages by pumping groundwater faster than it can be replenished. The region currently exceeds renewable supply by 260 million acre-feet¹ every year, and the annual overdraft could increase to 2,253 million acre-feet over the next 100 years based on projected growth and climate change.² Such unsustainable water use cannot continue indefinitely.

Agriculture figures prominently in any discussion of western water use. Farming is an indispensable element of the western economy and western culture, but it is also by far the largest water user. In many cases this water is used to grow relatively low value crops. In California, field crops such as rice, cotton,

and alfalfa currently use about 63 percent of the state's irrigation water but account for only 17 percent of crop revenue.³ Meanwhile many cities are struggling to maintain a consistent water supply, and rivers are often left without sufficient water.

The Bureau of Reclamation controls huge quantities of water throughout the western U.S., — 40-85 percent of the annual flow in many western river basins — and 85 percent of the developed water it controls is used for agriculture.⁴ Reclamation sells water to irrigation districts under water contracts that can last up to 40 years.⁵ From the beginning, there were subsidies built into these contracts, and farmers were able to pay back the cost of irrigation projects over 50 years with no interest. These payments have often been reduced even further where it was determined that farmers were unable to pay the full costs. Much of the remaining costs for constructing and delivering water have been covered by proceeds from the sale of hydroelectric power generated at Reclamation facilities.

The Central Valley Project (CVP) in California provides one example of how this system works. Reclamation built an extensive system of dams, canals, and aqueducts starting in the 1930s to

collect water from northern California and deliver it to the San Joaquin Valley in the central part of the state. Irrigation water is sold to state-established water districts which in turn sell the water to farmers. Roughly 85 percent of the water delivered through the CVP is used for irrigation.⁶ The cost of the CVP was supposed to be recovered 50 years after the first water delivery contracts were signed in the late 1940s, but due to extremely low rates, only 18 percent of the original project cost had been repaid by 2005, despite the fact that no interest was charged.⁷ This constitutes a subsidy of up to \$416 million each year.⁸ The water is heavily discounted compared to the cost that other sectors in the region pay. Westlands Water District, for example, received water from the CVP at one fifth of its market value in 2005.⁹

While this system is only one part of the larger water problem the West faces, it has established a dependency on subsidized water and encouraged the expansion of irrigated agriculture to the point that there is little flexibility to meet rising needs in other sectors. A complex patchwork of water rights has entrenched these inefficient water use practices and created a system that is rigid and resistant to the change that is needed to adapt to growing water demand, a changing climate, and an increasing awareness of ecosystem needs.

II. Risks and Consequences

Climate change will greatly exacerbate the water challenges facing the West, a region that is uniquely vulnerable to rising temperatures and shifting precipitation patterns. In coming years, the Southwest will experience the greatest declines in precipitation. The region could lose 10 percent or more of its annual rainfall by the end of the century¹⁰ and transition to a climate similar to dust bowl conditions.¹¹ There will also be significant changes in the timing of precipitation. Many areas will receive less summer rainfall as precipitation shifts increasingly to winter months.¹² Declining snowpack will further exacerbate this problem by reducing the natural reservoir that has historically fed western rivers throughout drier summer months. Between 1950 and 1999 the amount of water stored in snowpack decreased in eight of nine western mountain regions.¹³ Losses ranged from 10 percent in the Colorado Rockies to 40 percent in the Oregon Cascades. Rising volatility will make precipitation less

dependable at all times of the year and could cause extended droughts with increasing frequency.

Farmers, cities, and the environment are all at risk due to this combination of climate change and an inflexible water management system. The status quo entrenches the vast majority of the region's water in one sector and leaves little room to adjust to changing conditions. Rivers are left with a fraction of their normal flow, which makes the environment and wildlife more vulnerable to climate change. This system makes all water users less prepared to adapt to the "new normal" and increases the risk of economic losses, environmental damage, and endless conflict over scarce resources.

III. Preparing for the Future

New basin-wide planning and reform efforts are needed to create a more flexible and efficient water system that can address existing shortages and prepare farmers, communities, and the environment for a changing climate.

Develop comprehensive, basin-wide water management strategies: Climate change is fundamentally altering when and where water is available in the West, and management approaches must adapt to these changes. A sustainable solution must bring about more efficient water use in all sectors and create a system that can respond to greater volatility and uncertainty. Shifting some water from low value agricultural uses during droughts may be one of the more economically efficient responses to shortages, but cities must also invest in conservation and efficiency. These changes must be done in a fair and equitable fashion that creates a viable future for western agriculture while also ensuring that reasonable needs of cities and the environment can be met. Clearly, there are no easy answers. Reclamation controls much of the water throughout the West, but the quantity and price of water it delivers are constrained by existing water contracts, federal and state laws, and a complex patchwork of state water rights. Even if it were politically feasible or desirable, Reclamation could not simply charge market rates for the water it delivers.¹⁴ Similarly, mandating larger water allocations for the environment could pose legal difficulties. This makes it difficult to reform existing practices, and there is no one-size-fits-all solution.

A comprehensive reform process is needed to ensure that the water resources under Reclamation's jurisdiction are being managed in a manner that will meet human and ecosystem needs in the future. A combination of voluntary water markets, investments in efficiency, increased allocations for the environment, drought planning, and periodic reviews of operations can help create a more flexible system that will meet multiple needs. In most cases this will require action by Congress and agreement from multiple stakeholders to navigate the complex legal questions surrounding western water. One example of a comprehensive reform process is the Central Valley Project Improvement Act (CVPIA) passed by Congress in 1992. This legislation authorized water transfers, implemented tiered water prices, created a fish and wildlife restoration fund, required water conservation measures, and shortened the length of water contracts. While differences in state water laws make elements of the CVPIA less feasible in other states, it nonetheless provides an example of a comprehensive attempt to move toward a more flexible system that better meets the needs of multiple users and the environment.

Congress has recently taken promising steps toward ensuring sustainable western water supplies through the SECURE Water Act.¹⁵ The Act instructs Reclamation to collaborate with other agencies to study the impact of climate change on water supplies, conduct analyses of future water availability and strategies for ensuring sufficient supply in each major river basin, and provide grants to improve water management. Reclamation has begun implementing the law through the WaterSMART Program and has already distributed millions of dollars in grants and provided funding for the first three basin studies.¹⁶ The studies in particular are an essential first step to crafting a sustainable long term solution. There is huge variation in available supply, demand, current water prices, and state water law that will significantly impact the mix of needed policy changes in different areas. Careful consideration of these variables is needed to ensure effective reform.

While the WaterSMART Program is an essential first step, there is clearly much more action needed to secure a sustainable water supply in the western U.S. For one, a limited number of basin studies are currently underway. Additional funding is needed to begin planning processes for all Bureau of

Reclamation project areas. Reclamation must also ensure that these plans meet the co-equal goals of securing a reliable water supply and protecting and restoring ecosystems. The Yakima Basin Study, for example, proposes actions that would enhance instream flows, fish habitat, and fish passage into climate resilient high elevation areas. Initial documents from the Colorado River Basin Study, however, did not incorporate consideration of ecological water needs, although there has been some progress in changing that.¹⁷ In any long-term planning effort, there also needs to be a stronger effort to define and quantify environmental water needs. A better understanding of how altered water flows can support overall ecosystem health is essential to ensuring a healthy environment and wildlife populations.

Most importantly, these plans must be turned into meaningful reform. For each basin, Reclamation must work together with Congress and local stakeholders to enact a suite of measures that will encourage efficient irrigation systems, ensure sufficient water for ecosystems, and create a more flexible system that can respond to changing climatic conditions. There should be periodic review and reoperation of all Reclamation projects in order to respond to these changes. Any new infrastructure constructed under basin planning processes must be subject to strict conditions: Beneficiaries must pay the full cost of any water distributed from new systems; users must meet water use efficiency requirements; there must be market mechanisms to ensure that water can more easily be shifted among different users; and the project must minimize environmental damages and set aside sufficient water to support ecosystem health.

In the near term, Reclamation should begin studies for other basins under its jurisdiction, and Congress should provide additional funding to support their completion. Even as these plans are being completed, Congress can take steps to improve water management practices. Increasing appropriations for WaterSMART grants can encourage farmers to install more efficient irrigation equipment. Reclamation could also encourage voluntary water markets under existing authorities and coordinate with other government agencies to prioritize additional water efficiency funds to the areas that face the greatest water shortages.

IV. Benefits of Being Prepared

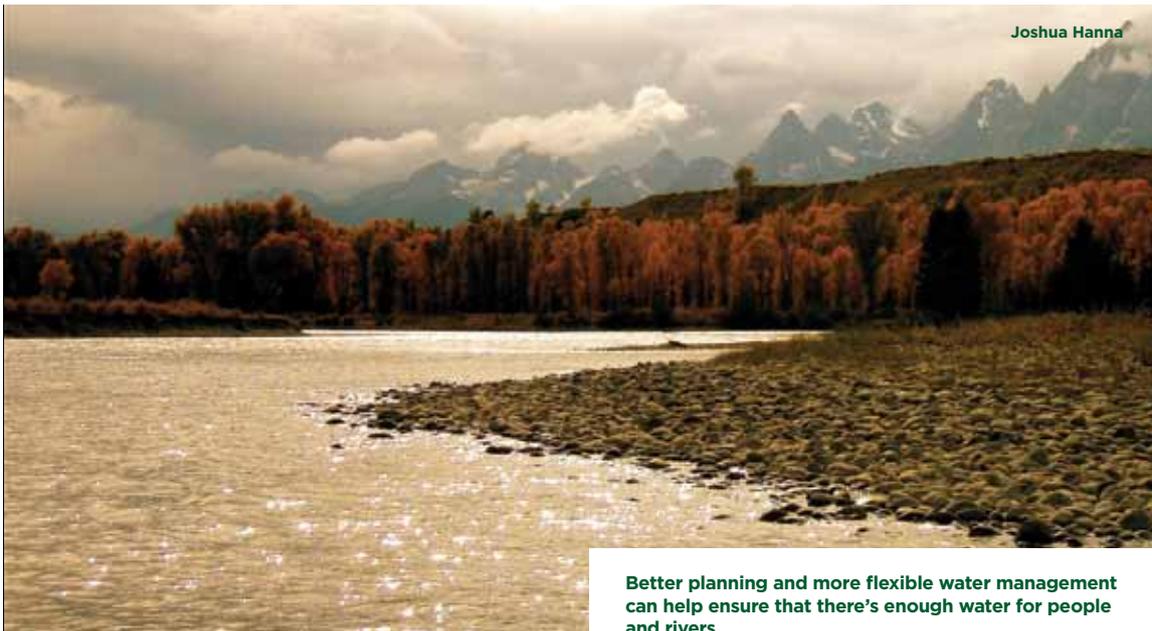
Water systems in the West must become more flexible and more efficient in order to deal with a volatile and uncertain future. As the largest distributor of water in the West, the Bureau of Reclamation must be at the center of this shift. Voluntary water markets and drought planning can help create a system that is able to respond to changing conditions. In addition, more efficient water use can help reduce the region's vulnerability to rising shortages. Implementing several irrigation efficiency technologies throughout California would reduce agricultural water use by 17 percent or 6 million acre-feet.¹⁸ Already, Reclamation's WaterSMART grants have generated 700,000 acre-feet of water at a fraction of the cost of constructing water supply infrastructure.¹⁹ Water developed through the Blackrock Reservoir project in Washington state, for instance, cost 35 times more per acre-foot than the water gained from Reclamation's efficiency investments.²⁰ Clearly, more efficient irrigation is not the only answer, in part because excess irrigation water not absorbed by crops flows elsewhere and in some

cases is put to beneficial use by downstream users. However, increasing efficiency across all sectors is an important strategy for addressing rising water scarcity.

These reforms will benefit communities and the environment. Where conserved water is allowed to remain in the waterbodies from which it would otherwise be withdrawn, the resulting increase in water levels will improve ecosystem health and reduce stress on aquatic species. This in turn will make rivers systems better able to withstand the impacts of a changing climate. These reforms can also help avoid costly and damaging attempts to adapt to melting snowpack and lower summer flows. A smarter, more responsive water management system that provides for the environment, farmers, and communities can reduce the need for large-scale new infrastructure and save money in a time of rising budget shortages. In the process, we can ensure a more sustainable water supply and salvage some degree of predictability from an uncertain future. ■



More efficient water use can help buffer communities and farmers from more frequent droughts



Better planning and more flexible water management can help ensure that there's enough water for people and rivers.

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- ¹⁷ Hearing before the Water and Power Subcommittee on the Bureau of Reclamation's WaterSMART Program and Implementation of the SECURE Water Act. 111th Congress. 2010 (testimony of Melinda Kassen).
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- ²⁰ *Ibid*.

Energy Policy



The future holds great challenges for the nation's water resources. Shifting weather patterns, more damaging floods, and rising water shortages will threaten communities, the economy, and the environment. This chapter is part of a larger report, ***Weathering Change: Policy Reforms That Save Money and Make Communities Safer***, which shows what the federal government must do to help the nation confront these looming challenges.

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Introduction:

Often lost in the debate over the nation's energy future is the limit that water will place on how and where we develop new energy sources. With very few exceptions, water is a key input to the production of the energy we use. Power plants withdraw large amounts of water to drive turbines and provide cooling. Emerging energy technologies such as solar thermal energy, biofuels, and carbon capture and sequestration similarly require vast quantities of water. The extraction of fossil fuels such as natural gas and coal has dramatic impacts on surrounding water resources. At the same time, the transport and use of water consumes large quantities of energy. With rising energy demands, shifting precipitation patterns, and more frequent droughts, many parts of the country lack sufficient water to meet projected water needs. Better planning and increased investment in energy and water efficiency are essential to ensuring a reliable energy system and clean water for the future.



Power plants use huge amounts of water, which is a growing concern as droughts become more common.

I. Today's Policy

Inefficient water and energy use and a lack of coordinated planning make it more difficult to secure clean water for the future and prepare for the challenges of a changing climate.

Water use of energy: Coal, natural gas, nuclear, and petroleum power plants generate 90 percent of the nation's electricity, and they require tremendous amounts of water to operate.¹ Thermoelectric power plants withdraw 143 billion gallons of freshwater every day — 41 percent of the nation's total.² Most use "once-through" cooling systems that withdraw large quantities of water to cool their turbines and then discharge the water back to the source. Water discharged from coal and nuclear power plants is on average 17°F warmer than when it is withdrawn,³ and many coal plants discharge water at temperatures of over 100 degrees in the summer.⁴ These discharges can decrease water quality, cause algal blooms and bacterial growth, and harm or kill fish and wildlife. A number of states including California, New York, and New Jersey have taken initial steps to ban once-through cooling systems due to their water quality impacts.⁵ Many more modern facilities use closed loop cooling systems that recycle cooling water. These plants withdraw substantially less water but lose more to evaporation, resulting in a higher overall consumptive use of water.

Electricity demand is expected to increase 30 percent by 2035, but finding water for new power plants will be increasingly difficult.⁶ In many places, water use already exceeds the renewable supply, and 70 percent of U.S. counties could be at risk of water shortages by 2050 as a result of climate change.⁷ In these places, there is simply not enough water to add significant new power generation capacity and continue to meet existing needs. In addition, thermal pollution from once-through cooling systems present a growing challenge for power plants and surrounding ecosystems. In the summer of 2010, high river temperatures caused the Tennessee Valley Authority to reduce power production at the Browns Ferry nuclear facility for over 40 consecutive days, resulting in a loss of \$50 million.⁸ While planners originally assumed that the river would only rarely pass the 90°F threshold, elevated temperatures have been common in recent years, causing energy bills to spike for local residents.

Finally, hydroelectric power, which supplies about 7 percent of the nation's electricity, has a significant impact on water resources and is uniquely vulnerable to climate change. Large dams and reservoirs fundamentally change the hydrology of a river, altering water quality, changing downstream flows, and blocking fish migration. These changes place

considerable stress on ecosystems and aquatic species. In addition, the energy production potential of many hydroelectric facilities will change in a warming climate. Evaporation from reservoirs will increase, and shifting precipitation patterns will leave some facilities unable to generate electricity at current levels. Water levels in Lake Mead, for example, have been dropping steadily in recent years, and there is a 50 percent chance that they could fall enough to largely stop power generation by 2017.⁹ Climate change will exacerbate the negative impacts of hydropower and make it a less reliable source of electricity.

Despite the complex interdependency between water and energy and the looming problems that climate change presents to both, planning for the resources operates largely independently.¹⁰ Energy and water planning and permitting are generally not conducted in an integrated manner, leading to energy infrastructure that has dramatic impacts on surrounding ecosystems and is poorly equipped to deal with changing water availability.

Emerging energy technologies: America's energy landscape is changing rapidly due to emerging technologies and growing demand for clean energy sources. These shifts present a new set of challenges for water management. Some solar thermal power plants (though not photovoltaics) can consume up to four times more water per megawatt hour than natural gas plants and 60 percent more than coal-fired facilities.¹¹ What's more, the areas with the most consistent sunshine such as the southwestern U.S. have the least amount of available water. A number of proposed solar projects in the western U.S. have switched to less water-intensive designs in order to win approval from regulators and the public. Similarly, carbon capture technology could more than double the water consumption of coal-fired power plants per unit of energy produced.¹² Finally, biofuels have the potential to dramatically affect the quantity and quality of water supplies across the country. It takes, on average, 100 gallons of water to make a single gallon of ethanol in the U.S., although in certain regions that rely on irrigated agriculture, it can take several times that amount.¹³ Water used in ethanol production in the U.S. increased by 246 percent from 2005 and 2010.¹⁴

Energy extraction: The process of extracting energy resources from the earth has long had negative impacts on water supplies. In recent years

some of the most damaging extraction processes have become more widespread and now pose a growing threat to water resources. Since the 1990s, mountaintop removal coal mining has rapidly expanded across Appalachia. The process involves clearing away vegetation, blowing the tops off of mountains, and dumping the resulting fill material in adjacent river valleys. It is difficult to overstate the devastation this process causes. Nearly two thousand miles of streams have been buried.¹⁵ Flooding in surrounding communities has increased as mountains are stripped of vegetation.¹⁶ Contamination of streams and water supplies can cause dire health problems for nearby residents.¹⁷ Decreased water quality in downstream waterways also harms fish and wildlife.¹⁸

Another damaging practice that has witnessed explosive growth in recent years is natural gas extraction through a process known as "hydraulic fracturing." The process involves injecting chemical-laden fluids into wells at high pressures to create fractures in rock formations and release natural gas. It requires vast quantities of water and exposes aquifers to hundreds of chemicals, many of them toxic. The chemical contents are often kept secret. Thousands of cases of contamination have been documented thus far.¹⁹ Drinking water has been contaminated with benzene and other chemicals, houses have exploded due to the build-up of methane, and numerous cases of life-threatening illnesses have been recorded.²⁰ New York City has concluded that the process poses an unacceptable risk to their drinking water supply and should be banned throughout the watershed.²¹ Unfortunately natural gas extraction is exempt from the Safe Drinking Water Act and numerous other environmental protections,²² meaning that there is little the federal government can do to regulate the process.

II. Risks and Consequences

Energy and water are inseparable. Water is already a limiting factor for energy extraction and electricity generation. As precipitation patterns shift and drought becomes more frequent, it will be even more difficult to meet the needs of existing activities, much less secure vast quantities of water for a rapid expansion of traditional and emerging energy technologies. The water quality impacts of energy activities will also be an increasing concern. Cooling water discharges from power plants will place a growing stress on waterways and wildlife

as temperatures continue to rise. Power plants may have to shut down with increasing frequency to avoid violating permit requirements. Failure to consider this complex relationship between water and energy will lead to worsening water problems as the climate continues to shift.

The consequences of unsustainable mining and drilling practices are very worrisome in light of climate change. While the effects are localized, they pose a dire and unnecessary threat to communities and ecosystems. The loss of vegetation from mountaintop removal greatly increases the risk of flooding especially as climate change brings more extreme storms. The contamination of surface and groundwater resources is also troubling at a time when water supplies are becoming less reliable due to shifting precipitation patterns and rising drought. Degrading existing water resources only exacerbates the risk of water shortages in an uncertain future.

III. Preparing for the Future

By better integrating planning of water and energy resources, embracing more efficient technologies, and curtailing the most damaging energy extraction processes, we can reform wasteful practices and help secure water and energy for years to come.

Integrate energy and water management: Growing energy needs, over allocated water resources, and a changing climate present a looming crisis that cannot be ignored. There are many steps we can take in the short-term to avoid this conflict. First, we must better integrate energy production and water resources planning. In a future defined by less reliable water supply, it is essential that water is a primary consideration in the development of new energy sources and production facilities. This requires a better understanding of the link between energy production and water availability in different regions of the country. The Department of Energy (DOE) has spent several years developing an Energy-Water Research Roadmap that is intended to identify key challenges and an integrated approach to addressing them through coordinated action among state and federal agencies. Unfortunately, the Department has repeatedly refused to release the report.²³ DOE should release it immediately.

Based on this research, the federal government should take the lead in promoting meaningful integrated planning for energy development across

the country. Water managers and planners should be involved in energy development decisions at all levels of government to ensure that new energy facilities will not place an unmanageable burden on local water resources. Many permitting decisions occur at the state level, but the federal government can influence energy installations on federal lands, nuclear and hydropower projects that require federal licenses, and projects that receive financial backing from the federal government. In these cases, the federal government should require energy developers to first demonstrate that all reasonable efforts have been taken to meet energy needs by increasing efficiency. Where new energy facilities cannot be avoided, federal agencies should require water assessments to demonstrate that the project will have sufficient water for future operations (including projected climate change impacts) and that it will not have substantial negative impacts on other water users including ecosystems. Any new facility must be required to employ the most water-efficient energy technologies. Federal agencies should also work with states to encourage them to implement similar measures in energy permitting at the state level.

Congress can play an important role in promoting integrated planning. Future energy legislation should instruct federal agencies to incorporate these requirements into their operations and funding decisions. In addition, Congress should revisit energy incentives it has enacted and ensure that federal funding is not supporting emerging technologies that cause unmanageable impacts on water resources.

Second, there must be a national effort to use energy and water more efficiently. Congress should authorize and appropriate additional funding for the WaterSense program, which educates consumers about water efficient products. The EPA should step up its efforts to work with state and local governments to implement water conservation and efficiency programs across the country. The federal government can also significantly reduce water use in its operations by strengthening efficiency requirements in federal facilities and better integrating water efficiency and reuse into guidelines under the National Environmental Policy Act and federal Principles and Standards.²⁴ Finally, the federal government can establish nationally consistent metrics for assessing water use efficiency and work to make the data available to the public.²⁵

CONTINUED

PREPARING FOR THE FUTURE CONTINUED

Energy efficiency efforts should be similarly expanded given the potential benefits for water resources. Congress should increase funding for a broad suite of existing energy efficiency programs including EnergyStar, research and development efforts, and grant programs. The Department of Energy should expand its existing work with state and local governments to improve energy efficiency, building on successful state-level demand management programs. Aggressive investments in energy efficiency could eliminate the need to build 1,300 power plants in the next twenty years.²⁶ California is now projecting that demand-side measures will cause the net peak demand for electricity generated in power plants to decrease between 2011 and 2020 under every one of a variety of scenarios.²⁷

Finally, there is an urgent need to reduce water use at new and existing power plants. These efforts must be carefully balanced, as efforts to reduce withdrawals can increase water consumption. If new power plants are built with closed loop cooling systems, for example, water consumption for electrical energy production could double by 2030.²⁸ At the same time, continued use of once-through cooling systems will have increasing impacts on water quality and aquatic species as temperatures rise and could cause power plants to shut down with increasing frequency. Sandia National Laboratories and the National Energy Technology Laboratory are researching advanced cooling technologies and the use of alternative water sources for cooling. Congress should significantly increase funding for this research to more rapidly bring these technologies to market.²⁹ At the same time, EPA must continue to work with states to encourage adoption of the most water-efficient technology under Section 316(b) of the Clean Water Act. New power plants are currently required to use closed loop cooling at a minimum, but rules for existing plants have been stalled due to lawsuits. Existing plants should be required to retrofit once-through cooling systems, and EPA should continue to drive movement toward the most efficient cooling technologies as they become commercially viable.

Improve oversight of damaging extraction

practices: Hydraulic fracturing and mountaintop removal pose an unacceptable threat to water resources and will severely undermine communities' ability to adapt to a changing climate. Congress should pass legislation to regulate natural



gas extraction under the Safe Drinking Water Act and other environmental laws to ensure that drilling does not continue to threaten drinking water supplies and harm surrounding communities. Congress should also require companies to reveal the chemicals that they use in the fracturing process. Members of Congress have introduced legislation that would have accomplished both of these goals, but it has thus far failed to become law.³⁰ Likewise, action is needed to put an end to mountaintop removal operations. While EPA has issued regulations that would strengthen scrutiny of this practice,³¹ the agency has continued to approve new mountaintop removal projects under the new rules.³² Legislation clarifying that the material blasted from the tops of mountains cannot be dumped into surrounding waterways has failed to win passage in Congress thus far.³³

IV. Benefits of Being Prepared

Our current system of managing water and energy puts us on an unsustainable path that will inevitably lead to shortages and economic disruptions. By using both resources more efficiently and planning new energy projects with future water availability in mind, we can make responsible and cost-effective investments that will prepare us for the daunting water challenges that we face. Reforming the most egregious mining and drilling practices will likewise protect increasingly valuable water resources and preserve the natural landscapes that buffer communities from extreme floods. Degrading water and land resources as we face the looming threat of climate change is clearly moving in the wrong direction. Addressing these problems in the near term, as difficult as it may be, will better prepare us for a more volatile and uncertain future. ■

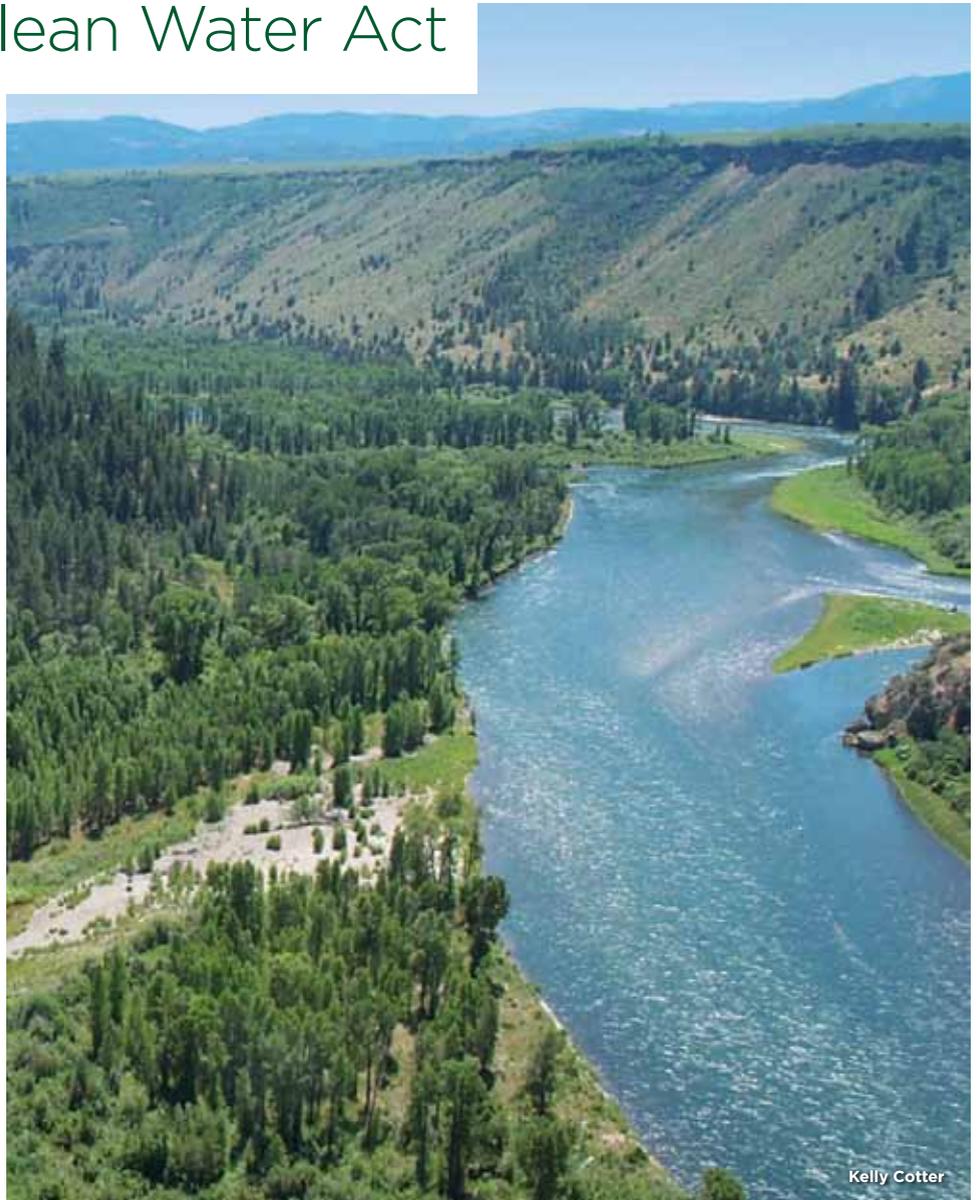
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Clean Water Act

The future holds great challenges for the nation's water resources. Shifting weather patterns, more damaging floods, and rising water shortages will threaten communities, the economy, and the environment. This chapter is part of a larger report, ***Weathering Change: Policy Reforms That Save Money and Make Communities Safer***, which shows what the federal government must do to help the nation confront these looming challenges.

To see the entire report, visit www.AmericanRivers.org



Kelly Cotter

Introduction:

Since its passage in 1972, the Clean Water Act (CWA) has spurred major improvements in the health of the nation's waterways. The law created a number of powerful tools designed to eliminate water pollution and make all waters safe for fishing and swimming. While we have not reached those lofty goals, many waters have grown dramatically cleaner and safer. As the result of recent court decisions, however, a significant number of streams and wetlands are at risk of losing the protections afforded under federal law. In addition, even protected waters remain at risk due to weak enforcement and implementation of existing policies. With the increased threat of floods and droughts due to a changing climate, the small streams and wetlands in question become all the more important to supply clean water, protect our communities from volatile weather, and provide refuge to vulnerable wildlife.



The loss of small streams and wetlands means less clean water for downstream communities.

I. Today's Policy

Inadequate protections of U.S. waters degrade the natural landscapes that protect people and wildlife from floods and droughts, both of which are becoming more common in a changing climate.

Loss of CWA protections: For three decades following the passage of the Clean Water Act, a wide range of U.S. waters, including small streams and wetlands, were given full protection under the law. However, Supreme Court decisions in 2001¹ and 2006² were interpreted to mean that, absent clarification by legislation or agency rulemaking, protections applied categorically only to relatively permanent waters and adjacent wetlands. Smaller, intermittent streams, many lakes, and wetlands were found to be protected only where they had a significant connection to larger, traditionally navigable waters. As a result, millions of acres of wetlands, many lakes, and up to 60 percent of the nation's stream miles are at risk of losing CWA protections and being filled or polluted.³ The court decisions and subsequent guidance by the Environmental Protection Agency (EPA) require regulators to conduct resource-intensive hydrological studies to determine whether a water body is protected, resulting in the unnecessary loss of historical protections nationwide.⁴ EPA's enforcement of CWA cases has declined dramatically as a result,

allowing polluters to degrade U.S. waters without repercussion.⁵

Ineffective enforcement of existing CWA

protections: Even waters that remain covered by the Clean Water Act are not being protected and restored as envisioned by the authors of the law. Section 404 of the Clean Water Act regulates the discharge of dredged or fill materials into regulated waters. Those seeking to fill in wetlands, culvert streams, construct a dam, or undertake a development project that dumps gravel, dirt, cement, or other material into a jurisdictional water body must obtain a permit. The permittee must avoid damage to aquatic areas where possible and minimize and compensate for those impacts where they are unavoidable. However, a number of shortcomings in the program have reduced its effectiveness and enabled the continued loss and degradation of vital streams, lakes, and wetlands. First, the CWA does not regulate the draining of wetlands unless it involves a discharge of dredged material back into regulated waters.⁶ Under this loophole, land owners can destroy wetlands without a permit, environmental review, or any mitigation. In addition, a variety of exemptions for agricultural and other activities allow certain categories of landowners to degrade waters with little oversight.

For activities that require a 404 permit, there are also a number of shortcomings. The alternatives analysis, which requires permittees to demonstrate that less-damaging options are not available, is often flawed. There is little to no enforcement to ensure that permittees have thoroughly considered alternative options. Water efficiency is not consistently evaluated as a viable alternative to water supply projects. Similarly, less environmentally damaging residential and commercial development sites and designs are often not critically evaluated. In addition, there are numerous problems with the mitigation projects meant to compensate for the destruction of streams and wetlands under the §404 program. In many cases, projects are only partially completed or not carried out at all, and there is very little monitoring and enforcement to ensure compliance.⁷ Even completed mitigation projects rarely provide comparable functions to the natural streams and wetlands they are designed to replace.⁸ These shortcomings in the law's implementation greatly reduce the effectiveness of CWA protections.

II. Risks and Consequences

The health of small streams and wetlands has dramatic implications for the ability of communities and wildlife to withstand the impacts of a changing climate. All ecosystems have a limit to the stress that they can absorb before they undergo fundamental changes and lose essential functions.⁹ Reducing the health of ecosystems makes them more likely to suffer serious consequences from climate change impacts such as increasing floods, droughts, and water pollution. Degrading small streams and wetlands in turn has far reaching effects beyond the immediate impact on those waters. Small streams make up over half of the total length of streams and rivers nationwide and play a crucial role in protecting clean water, controlling floods, and providing critical wildlife habitat.¹⁰ Destruction of these headwaters, intermittently flowing streams, and associated wetlands will make the environment more vulnerable to the impacts of a changing climate and will greatly reduce the resilience of downstream ecosystems and the communities that rely on their flood control, water supply, fish and wildlife habitat, outdoor recreation, and tourism benefits.

III. Preparing for the Future

Congress and federal agencies must reaffirm and strengthen CWA protections to protect and restore the natural systems that are essential to human health, abundant wildlife, and the economy.

Pass legislation to restore CWA protections:

Congress urgently needs to pass legislation to restore protections to the full range of waters that have long been protected by the Clean Water Act. Congress has considered a number of such bills in previous sessions, but none have been passed into law.¹¹ In the interim, EPA should withdraw the guidance it issued following the 2006 *Rapanos* decision, which restricted application of the Clean Water Act well beyond even what was prescribed by the Supreme Court. The agency should issue new guidance that more faithfully tracks the court decisions and should also consider a rulemaking to further clarify and restore CWA protections.¹² Restoring these protections would help ensure that the small streams and wetlands that are the core of our natural water supply and flood control infrastructure will continue to benefit communities and protect them from more extreme floods and droughts. Protecting small streams, lakes, and wetlands will particularly help ensure clean water for the 117 million Americans who rely on surface water for their drinking water.¹³ Restoring and clarifying CWA protections will also reduce permit costs and delays by reestablishing certainty as to which waters are protected.

Reform the 404 Program: Restoring the original scope of the Clean Water Act is a key first step, but this will have a limited impact if permitting programs are not carried out effectively. Ideally, Congress would work to reform the least effective elements of the 404 program.¹⁴ Though Congressional reforms are unlikely, many necessary changes can be accomplished through administrative action. First, EPA and the Army Corps of Engineers should direct field staff to enforce unpermitted wetland ditching and drainage activities that result in more than incidental fallback. Second, EPA and the Corps should direct field staff to diligently promote less damaging project alternatives where possible and only permit compensatory mitigation as a last resort. The Army Corps of Engineers, which administers the program with oversight from EPA, must ensure that the functions of the wetlands and other waters to be impacted are not undervalued, that less damaging proposals are diligently analyzed

and pursued, and that mitigation credits are credibly counted and priced so they create an incentive to avoid and minimize impacts. Water efficiency must also be considered among the alternatives for water supply projects. Along these lines, EPA Region 4 recently issued new guidelines requiring that water efficiency measures be thoroughly considered before a §404 permit for new water supply reservoirs or water withdrawals is issued.¹⁵

Major reform is also needed to improve the effectiveness of compensatory mitigation under the §404 program. To ensure that compensatory projects are replacing the functions that are being lost when a stream or wetland is filled or otherwise degraded under §404 permits, the Corps and EPA should direct field staff to rigorously apply and enforce the mitigation standards set forth in the 2008 mitigation rule. They should ensure that the functions of the wetlands and other waters to be impacted are fully recognized and that the increased functions attributable to mitigation projects are not inflated by requiring the use of a scientifically sound assessment methodology to account for functions both lost and gained. The Corps should also exercise greater oversight under existing law. To that end, Congress should provide the Corps with additional resources to track and inspect mitigation projects, make data publically available, and to enforce §404 permits, including long-term protection of mitigation sites. New resources and rigorous enforcement are essential for ensuring effective implementation of this important program.

Finally, Congress should amend the CWA, or the Corps and EPA should amend their regulations, to require consideration of climate change in the permitting process. The impacts of climate change on the proposed project as well as its effects on the resilience of surrounding ecosystems and communities (e.g., increased flood risk) should be considered in order to protect public health, safety, and welfare.

IV. Benefits of Being Prepared

Small streams, lakes, and wetlands are central to improving the nation's capacity to adapt to climate change. By protecting and restoring these vital landscapes, we can avoid costly and ineffective

attempts to buffer our communities from climate impacts through structural measures. In the process, we can secure healthy and abundant fish and wildlife populations that are resilient in the face of changing conditions. It is only through broad application and effective enforcement of the Clean Water Act that we can ensure a strong natural infrastructure that is equal to the task of withstanding a more volatile and uncertain climate. ■

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Water Resources Development Policy



The future holds great challenges for the nation's water resources. Shifting weather patterns, more damaging floods, and rising water shortages will threaten communities, the economy, and the environment. This chapter is part of a larger report, ***Weathering Change: Policy Reforms That Save Money and Make Communities Safer***, which shows what the federal government must do to help the nation confront these looming challenges.

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Introduction:

Over the past century, the federal government has altered and reshaped many of the nation's waterways. The U.S. Army Corps of Engineers (Corps) has played a major role in this process by carrying out a wide variety of dam, levee, and river dredging projects. Congress authorizes these projects through periodic passage of Water Resources Development Act (WRDA) legislation. While these projects have benefited certain segments of society, the decision-making process and economic justifications behind them are often fundamentally flawed. As a result, Corps projects frequently degrade natural resources and undermine the ecosystems that buffer communities from floods and droughts. Congress must place greater scrutiny on the Corps and fund projects that protect communities and the environment, particularly as climate change causes a rise in severe weather and flood risk. The Corps also must fundamentally change its approach to water infrastructure by adopting a more holistic assessment of costs and benefits and prioritizing non-structural solutions that are cheaper, provide a wider array of benefits, and are better suited to the greater extremes of climate change.



When levees fail, catastrophic flooding can result as it did in New Orleans during Hurricane Katrina.

I. Today's Policy

Many federal water infrastructure projects increase flood risk, waste taxpayer money, and harm the environment.

Costly and environmentally-damaging projects:

The history of the Corps of Engineers is littered with politically-driven, environmentally-damaging projects that have done little to help surrounding communities. While some projects have satisfied narrow economic goals or provided a degree of temporary flood protection, too often they have failed to produce the promised benefits and have destroyed environmentally valuable ecosystems, increased downstream flood risk, and reduced water quality. One of the key factors that has enabled this dubious track record is a fundamentally flawed process for planning water resources projects. Current guidelines require projects to promote economic development over all other objectives.

Perhaps the most devastating example of this failed approach is the Mississippi River Gulf Outlet (MRGO). The Corps completed the 76-mile canal in 1956 in order to shorten the journey from New Orleans to the Gulf of Mexico, which previously required a 120 mile trip via the meandering Mississippi River. The canal never attracted the levels of

traffic the Corps predicted, and only one ocean-bound ship was using the canal on an average day by 2005.¹ The costs, however, were very real. The project was completed in 1968 at a cost of \$92 million (about \$550 million in 2009 dollars²) and cost \$13 million per year to maintain on average.³ The project directly destroyed over 20,000 acres of barrier wetlands and caused salt water intrusion into many more, impacting over 600,000 acres of wetlands in all.⁴ The canal and associated destruction of wetlands also created a flood hazard that raised the height and velocity of the storm surge and overwhelmed New Orleans' levees during Hurricane Katrina in 2005, leading to over 1,800 deaths and \$81 billion in damages. Without MRGO, the levees and wetlands would have provided stronger protection from the storm, and the destruction likely would have been far less.⁵

Rising flood risk: Over the years, the Corps has spent over \$123 billion to build and operate flood control structures throughout the U.S.⁶ Despite these considerable costs, flood damages have continued to rise steadily. Corps projects have relied primarily on levees and floodwalls to quickly pass water downstream, a process which elevates the height of floodwaters and can lead to cata-

strophic consequences when these structures fail. In effect, these structures decrease the frequency of small flood events but increase the risk of larger disasters. In addition, structural flood defenses have added to flood risk by providing a false sense of security and encouraging additional development in at-risk areas.⁷ Levee construction in New Orleans, for instance, encouraged development in low-lying areas that home-owners assumed were protected by the Corps' flood defenses. This pattern is being repeated as the city recovers from Hurricane Katrina. Similarly, ongoing floodplain development behind the extensive levee system in California's Central Valley — constructed by the Corps and local reclamation districts — has led to extremely high flood risk with the potential for catastrophic damages in the event of a large flood or earthquake.⁸

Failure to consider climate change: As poorly as many Corps projects have fared in recent decades, they face an even greater challenge as the climate changes. Projects that were designed to accommodate historical precipitation patterns will be at increased risk of failure as conditions shift. Unfortunately the Corps is not required to consider projected climate impacts in the siting or planning of its projects. An amendment offered by Senator John Kerry during the 2007 Senate WRDA debate would have required consideration of climate change in Corps projects. The amendment received more than 50 votes but was unable to overcome a filibuster.⁹

II. Risks and Consequences

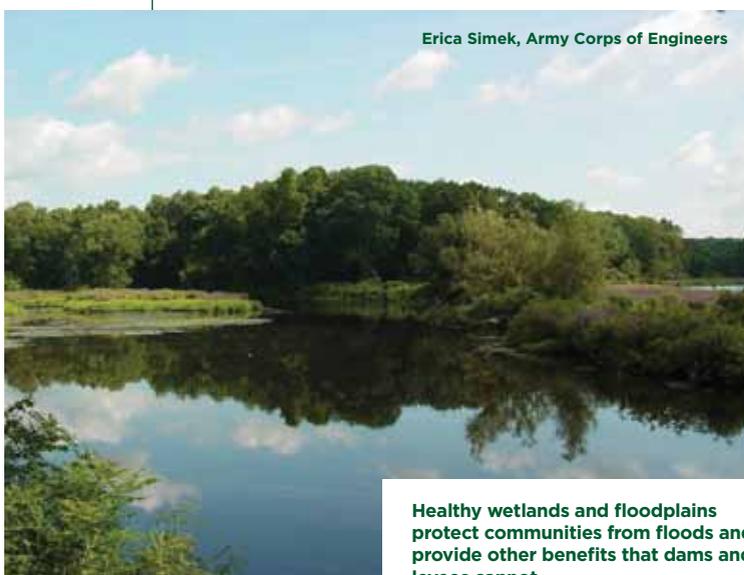
This backward-looking approach to water infrastructure planning and construction is poorly suited for a future climate defined by greater volatility and uncertainty. Destroying nature's ability to absorb rainfall and putting people in harm's way was never a sound strategy, but it is particularly dangerous as climate change increases the likelihood of extreme storms and floods. Flood control projects that rapidly move water downstream will exacerbate the consequences of a more volatile climate and will be at greater risk of failure. Projects designed and constructed based upon old climate models and data are not likely to achieve their intended goals. These structures will make surrounding communities and ecosystems more vulnerable to climate change and require further investments of taxpayer money to adapt to shifting conditions.

III. Preparing for the Future

A more rational and cost-effective approach to water infrastructure will reduce vulnerability to climate change and lower the long-term costs of adapting to greater volatility.

Prioritize nonstructural projects: The Corps of Engineers must fundamentally change how it plans, evaluates, and carries out projects. Fortunately reform has already begun. As instructed by Congress in WRDA 2007, the Obama Administration is developing new Principles and Guidelines (P&G) for all federal water resources projects to ensure that they protect the environment and promote sustainable economic development.¹⁰ These new standards, expected to be released in 2011, have the potential to correct many of the historical shortcomings detailed above.

In order to achieve these critical goals and prevent more ill-conceived and poorly justified projects, the new P&G must ensure that water project planning is driven by federal law and national priorities. The status quo approach of using benefit-cost analysis as the primary driver of project selection does not address whether a project meets national needs and priorities, unnecessarily damages the environment, increases risk for communities downstream, or complies with federal law. There must be a clear directive that all water projects protect and restore the environment, avoid the unwise use of flood-



Erica Simek, Army Corps of Engineers

Healthy wetlands and floodplains protect communities from floods and provide other benefits that dams and levees cannot.

plains, and rely on factors beyond a strict benefit-cost analysis in order to meet a broader range of societal goals. There must be a requirement for the use of nonstructural and restoration measures where those approaches are possible and cost effective.

Consider climate change in project planning:

Climate change must be a key consideration in the siting and design of proposed infrastructure projects. The P&G should require all new projects to address risk and uncertainty, including the effects of climate change. Planners should be required to demonstrate that a given project will increase community and ecosystem resilience to climate change impacts. Decades of WRDA bills have created a long list of authorized Corps projects that have never been built due to lack of funding. With the Corps' \$2 billion annual construction budget, it could take over 40 years to complete all the currently authorized projects. Whether through the ongoing P&G revision or future legislation, the Corps must be required to prioritize projects that maximize public benefits, protect natural resources, and build resilience to climate change. Before moving forward with any of these older projects, to be compliant with the National Environmental Policy Act (NEPA), the Corps is required to update its analysis and incorporate climate change in evaluating the project.

The new Principles and Guidelines also need to address the operations of existing facilities. The new P&G must direct agencies to periodically review operations plans for federal projects such as dams to ensure that they are responsive to shifting precipitation patterns and other changes. There must be a clear directive to manage projects in a manner that responds to the threat of rising floods and droughts and simultaneously helps make communities, fish, and wildlife more resilient to climate change.

IV. Benefits of Being Prepared

The past century has taught us many lessons about how to build and operate water infrastructure. We now know that there are more cost-effective and sustainable ways to secure clean water and manage floods than with large, single-purpose infrastructure projects. By prioritizing nonstructural solutions, keeping people out of harm's way, and planning for changing conditions, we can save taxpayer money, maintain a healthy environment, and reduce our vulnerability to climate change. Failure to embrace a more sustainable approach to water infrastructure will force us to repeat the mistakes of the past. ■

FOOTNOTES

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Clean Water & Drinking Water Infrastructure Funding



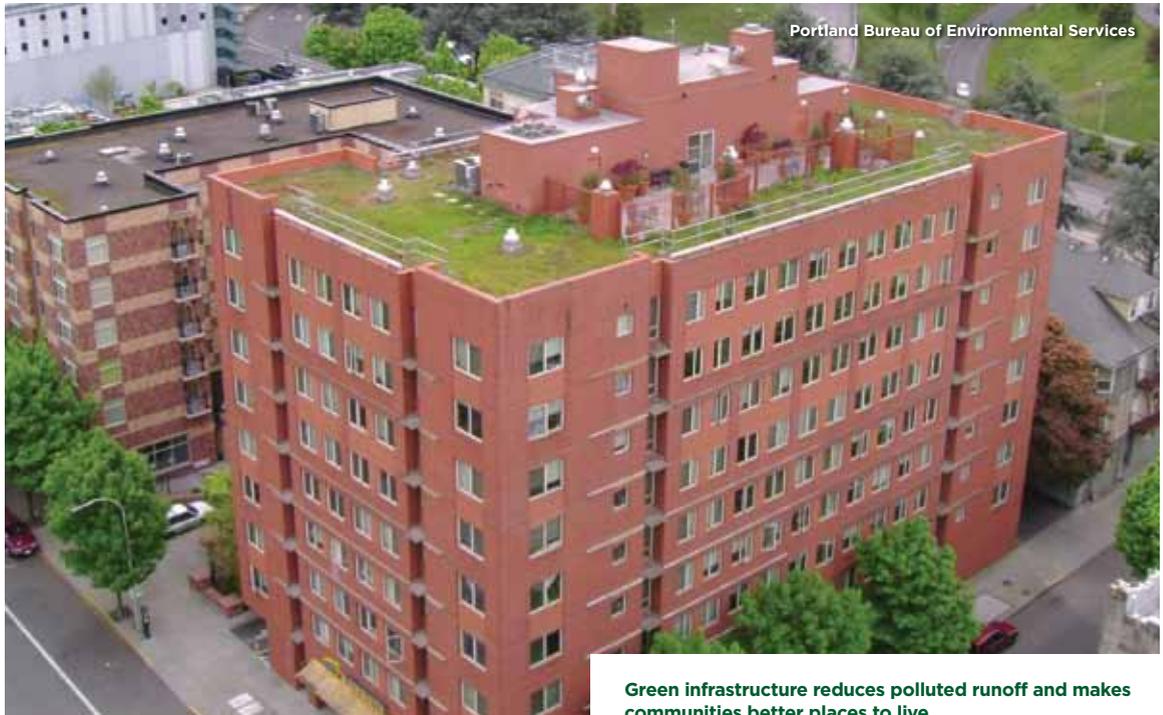
Mike Hensdill

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Introduction:

When Congress passed the Clean Water Act (CWA) in 1972, it significantly expanded federal funding for water infrastructure. The law created a grant program for the construction of wastewater treatment plants and collection systems in order to help communities reduce sewage pollution and comply with the CWA. In 1987 the grants were phased out in favor of a loan program called the Clean Water State Revolving Fund (SRF). The funding that Congress appropriates to these programs every year is distributed to states, which provide low-interest loans to communities to undertake wastewater and stormwater infrastructure projects. In 1996, Congress created the parallel Drinking Water State Revolving Fund as part of the Safe Drinking Water Act (SDWA) to help communities expand and repair drinking water infrastructure. While these funds have greatly improved public health and the quality of the nation's waterways, they do not require consideration of climate change or adequately encourage innovative, flexible infrastructure approaches. As a result, these funds may be supporting infrastructure that is poorly adapted to shifting precipitation patterns and will leave people and ecosystems more vulnerable to a changing climate.



I. Today's Policy

Federal infrastructure programs fail to adequately promote flexible and cost-effective projects that will function in a changing climate, wasting scarce resources and leaving people at risk.

Failure to consider climate change in funding decisions: Climate change presents an extraordinary risk to the nation's water infrastructure.¹ Sea level rise, heightened storm surge, and more extreme storms will damage infrastructure in low-lying coastal areas and floodplains. Reduced snowpack, shifting precipitation patterns, and declining reservoir levels will render obsolete water supply infrastructure that is designed to accommodate historical patterns of water availability. In many places, climate change will exacerbate existing vulnerabilities. Heavier downpours, for example, will have the greatest impact where stormwater systems are undersized or streets and parking lots already generate polluted runoff. At the other extreme, declining flows in the Colorado River are lowering water levels in Lake Mead, the primary water source for Las Vegas, and the city is being forced to spend billions of dollars to build a new water intake.

Given this considerable challenge, it is essential that new construction or upgrades to existing infrastruc-

ture incorporate projected climate change impacts. Unfortunately, the Clean Water and Drinking Water State Revolving Funds, two of the largest sources of federal water infrastructure funding, do not require applicants to undertake such an analysis. Projects must meet a range of state and federal requirements but none related to the climate change impacts that will play a significant role in determining the effectiveness of infrastructure systems in the future.

Federal support for costly, inflexible infrastructure: Over the course of the last century, local, state, and federal governments have spent hundreds of billions of dollars on wastewater and drinking water infrastructure. Much of that money was invested in pipes, treatment plants, and pumping stations. In recent years, however, there have been significant developments in our understanding of water infrastructure, especially the role that green infrastructure systems and water efficiency can play in controlling stormwater and ensuring a consistent water supply. These strategies have been shown to reduce costs and provide far greater benefits than traditional systems.² Green infrastructure is also better adapted to a more volatile and uncertain climate, as it is able to accommodate

both wetter and drier conditions.^{3,4} Wetlands, for example, buffer against both flood and drought by absorbing rainfall and releasing it gradually.

While green infrastructure and water efficiency have long been eligible for SRF funding, the majority of this funding continues to support costly, single-purpose gray infrastructure projects. As existing systems reach the end of their expected life span, there is an opportunity to integrate these innovative, climate-adapted technologies into the nation's water infrastructure. Congress took initial steps in this direction by dedicating 20 percent of the Clean Water and Drinking Water funds for green infrastructure and water efficiency in the American Recovery and Reinvestment Act (ARRA) and the FY 2010 budget. However, these set asides did not promote sustainable water management strategies as well as they could have due to an overly broad definition of "green" projects.⁵ In addition, the demand for the dedicated green project funding was oversubscribed, reflecting the interest in using these innovative approaches.

II. Risks and Consequences

Failure to invest in flexible infrastructure that is adapted to changing conditions will leave people and the environment at greater risk as the climate shifts. While we don't know exactly what the climate of the future will look like, we know that the past will not be an accurate guide for what lies ahead. Investments being made today could be inundated by more frequent floods or rising sea levels in a matter of decades. The life span of infrastructure investments can reach 100 years,⁶ and systems that are not adapted to projected changes may need to be upgraded or rebuilt at great cost.



More extreme weather will make it harder to manage water.



Green infrastructure provides flexibility to respond to climate change.

Few communities are able to replace these costly systems before the end of their useful life, making it vital that they be designed and sited properly in the first place. In short, much of our existing water infrastructure is likely to perform poorly in a changing climate, and this will put people, the economy, and ecosystems at risk if we do not adapt to these changes.

III. Preparing for the Future

Federal funds should be targeted to the most cost-effective and flexible infrastructure that makes communities safer and prepares them for changing conditions.

Consider climate change in project planning: The Environmental Protection Agency (EPA) should revise the SRF funding criteria to require consideration of climate change impacts in the siting and design of projects. New construction should not be located in areas that will be significantly affected by climate change. For example, a new treatment plant should not be built in vulnerable low-lying coastal areas or high velocity floodways. Similarly, major upgrades to existing facilities located in vulnerable areas should not be eligible for SRF funding. In addition, projected impacts should be considered in project design to ensure that the proposed facility will continue to provide the expected benefits even as the climate shifts.⁷ Stormwater systems should accommodate existing runoff patterns as well as projected increases due to more extreme precipitation.

Incorporating projected climate scenarios in infrastructure planning will improve public safety, help ensure more effective management of water resources, and provide significant cost savings. With fewer critical assets in vulnerable areas, communities will be able to avoid damages and recover

more rapidly after extreme events. It is far cheaper to make adjustments during the planning process than to rebuild or alter water infrastructure after the fact. One study showed that incorporating adaptation into infrastructure management reduced costs 10-45 percent by 2080.⁸ Requiring adaptation planning in federally funded projects can also provide a model for effective infrastructure management and help make climate impacts a central consideration in the planning process throughout the country.

Direct federal funding to innovative, climate-adapted infrastructure: Congress and the EPA should work to promote greater funding of green infrastructure and water efficiency in the State Revolving Funds. As a primary source of federal funding for water infrastructure, it is important that the SRF program encourage the most innovative and cost-effective solutions. Congress should reauthorize the Clean Water and Drinking Water SRF and maintain or increase the dedicated funds directed to green infrastructure and water efficiency within those programs. EPA should ensure that only the highest quality projects are being funded under the “green” set aside. Energy efficiency projects made up a significant portion of the green set aside under ARRA.¹⁰ These projects, while beneficial, do not necessarily improve water quality or enhance water supply. The EPA should revise its guidance to ensure that projects funded under these set asides are achieving the core goals of the Clean Water and Drinking Water SRF. EPA should also clarify that dedicated funds should not be used for water meter replacement but rather for first-time meter installation or other water efficiency projects that will achieve real water savings.

Congress should provide additional incentives for green projects by waiving the matching funds requirement in the states that provide the greatest funding to green projects and allowing states to provide additional subsidies for the most innovative green projects. Finally, applicants for SRF funding should be required to incorporate green infrastructure and water efficiency to the maximum extent practicable before receiving funding for conventional gray infrastructure projects. These changes will push federal funding toward the most well-adapted, cost-effective solutions and provide a model that other communities can follow as they prepare for a changing climate.

IV. Benefits of Being Prepared

Planning for the future is a responsible and prudent response to an uncertain climate. Building climate-adapted infrastructure will help buffer communities from the impacts of more extreme floods and droughts and avoid costly fixes to systems that don't work due to changing conditions. Investments in green infrastructure, while an effective adaptation strategy, also provide immediate benefits regardless of climate change, as they are often more cost-effective and provide a wider range of benefits than traditional gray infrastructure. Congress and the EPA have the opportunity to lead a national shift toward a more efficient and innovative approach to building water infrastructure. Policymakers must seize this opportunity and help move the nation's water infrastructure into the 21st century. ■

FOOTNOTES

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National Forest Management



Allen Peterson

The future holds great challenges for the nation's water resources. Shifting weather patterns, more damaging floods, and rising water shortages will threaten communities, the economy, and the environment. This chapter is part of a larger report, ***Weathering Change: Policy Reforms That Save Money and Make Communities Safer***, which shows what the federal government must do to help the nation confront these looming challenges.

To see the entire report, visit www.AmericanRivers.org

Introduction:

Forests in the U.S. cover 651 million acres and supply 180 million people with drinking water. Clean water is the most valuable resource that these lands provide. The value of water flowing from National Forest lands alone has been valued at \$7.2 billion annually.¹ Private forests contribute additional value. Healthy forests provide a range of water-related “services” essentially for free. They slow floodwaters, provide natural water storage in wetlands and in the ground, and filter pollutants. Increasingly, communities are improving forest management practices and protecting and restoring forests as a low cost way to preserve sustainable supplies of clean water. Unfortunately, harmful activities on forest lands and climate change are placing this reliable source of water at risk. To meet these growing challenges, the U.S. Forest Service (USFS) must recognize its valuable role as a water service provider and adopt policies and practices that manage forests to protect and enhance sustainable flows of clean water.



Forest lands in the U.S. suffer from continued degradation and fragmentation due to logging, mining, and development.

I. Today's Policy

The failure to prioritize the water-related benefits of National Forest lands leaves communities and ecosystems more vulnerable to the impacts of climate change.

Failure to fully value clean water: Forests provide a wide range of essential goods and services including flood protection, clean water, timber, and fish and wildlife. The water and climate regulation benefits of forests alone are worth \$36 billion annually, nearly double the value derived from timber.^{2,3} On numerous occasions, Congress has passed laws requiring the Forest Service to manage National Forests for multiple and sustained uses such as outdoor recreation, range, timber harvest, water supply, and fish and wildlife conservation.⁴ Unfortunately, the Forest Service continues to focus on resource extraction to the detriment of other, more valuable services.

All decisions on National Forests are governed by the National Forest Management Act (NFMA) of 1982. Several revisions to the planning rule that guides implementation of the act were rejected by courts as a result of lawsuits over the past ten years. A new revision of the rule was released in

early 2011 and has the potential to update the way the Forest Service manages its lands.⁵ The goal of this revision is to set priorities at a regional and local level for each National Forest. Currently, forest supervisors are encouraged to consider all relevant benefits when conducting economic evaluations,⁶ but a 2006 court ruling determined that economic valuations of non-timber resources are not required during the planning process.⁷ Additionally, individual forest supervisors have the authority to decide which economic costs and benefits need to be considered. This creates confusion as to what parameters must be incorporated into economic evaluations of management practices.

This approach to planning has significant impacts on forests and the water supplies they provide. For example, in the Payette and Boise National Forests, logging of 70 square miles led to the construction of 1,000 miles of road, which sent 1.5 million cubic yards of sediment into prime salmon streams, enough to fill 375,000 full-size pickup truck beds. Additionally, one of the world's largest open pit mines is now being proposed in Boise National Forest despite potential risks to drinking water for downstream communities.⁸ The watershed in ques-

tion is the source of 1/5th of Boise's water supply. This is not an isolated problem. Development, logging, grazing, and mining pressures continue to destroy and fragment intact forests, undermining their water quality, wildlife habitat, and flood protection benefits. Failure to properly value these services in Forest Service planning efforts will continue to place our public waters at risk of degradation.

Lack of national riparian management standards:

Riparian zones are the lands located along the banks of rivers and streams. These areas serve an important role in maintaining water quality and providing wildlife habitat. They absorb floodwaters, filter and trap nutrients and sediment, and are home to many plant and animal species. Unfortunately, nearly 70 percent of riparian habitat in the United States has been lost. These areas should be the first to be restored and protected in any management plan for National Forests. However, current policy allows for disruptive activities within riparian zones. Grazing, logging, and mining activities may occur as close as 20 feet from streams on nearly 27 million acres within National Forests. The resulting loss of water quality, environmental flows, and habitat within and downstream of this zone far outweighs the benefits of these activities. The roads associated with extractive practices such as mining and logging also take a toll on riparian areas. The average road density in riparian areas is 2 miles of road per square mile,⁹ nearly double the threshold needed to protect biodiversity and water quality.¹⁰ Though the new Forest Planning Rule proposes standards for riparian protection, loopholes in the language allow forest supervisors to adjust these standards as they feel necessary.

Conversion of forest lands: One of the greatest threats to the nation's forests and the clean water they supply is the conversion of these lands for agricultural or development purposes. In many western states, this results in a patchwork of Forest Service and private land, while in eastern states, private development threatens high quality forests. By 2050, 23 million acres of forestland could be lost to development without intervention.¹¹ A recent Forest Service report warns that conversion and development is damaging the ability of ecosystems to provide vital services such as clean water, timber, wildlife habitat, and carbon sequestration.¹² Even piecemeal forest conversions of smaller forest parcels can generate larger, cumulative watershed ef-

fects.¹³ An increasing abundance of smaller parcels creates a complex management scenario and limits conservation opportunities for private landowners through traditional Forest Service programs.

II. Risks and Consequences

The combined effects of misguided forest management practices and climate change will put communities and the natural resources they depend on at risk in future years. The current approach to management of our National Forests increases their vulnerability to climate change and makes it more likely that the many benefits they provide will continue to erode. Fragmented forests have less capacity to recover from disturbances such as extreme storms and droughts — events that will become more common due to shifts in the climate. The conversion of forests and loss of stream buffers can increase runoff, degrade water quality, and destroy wildlife habitat. This will put additional stress on wildlife species that will already be under increasing pressure due to shifting climate conditions. The Forest Service protects and improves habitat for over 550 rare, threatened, or endangered aquatic species, making it a critical link in the process of helping wildlife adapt to climate change.¹⁴

These losses in forest function will in turn have far-reaching consequences for communities' ability to withstand the impacts of a changing climate. Healthy forests absorb rainfall, recharge groundwater, and help maintain flows in rivers and streams. During heavy storms, this prevents downstream floods and reduces runoff and water pollution. The ability of forests to regulate the timing of water



availability will be increasingly important as rainfall becomes more intermittent and concentrated in heavy events and reduced snowpack lowers summer streamflows. Forest Service lands are the largest source of drinking water in the continental U.S., and they provide up to 80 percent of water supply in some Western states.¹⁵ The degradation and loss of these natural landscapes will make downstream communities more vulnerable to rising levels of floods and droughts and increase the costs of responding to climate change.

III. Preparing for the Future

The Forest Service must embrace a management approach that prioritizes clean water benefits to ensure safe and healthy communities and ecosystems as the climate changes.

Protect water resources on Forest Service lands:

The Forest Service Planning Rule is the road map for management of all National Forests under the National Forest Management Act. The ongoing effort to update this rule provides an opportunity to better balance management of these lands and enhance their ability to provide important water-related benefits to downstream communities. In the proposed revision of the rule released in early 2011, the Forest Service has begun to focus on improving the health of its watersheds to restore ecosystem function, increase forest resilience to climate change, and help create vibrant local economies downstream. Though a good first step, the Forest Service needs to do more to establish management guidelines and monitoring plans that will ensure that all National Forests meet these goals. All forest plans place a real dollar value on timber, grazing, and resource extraction but frequently fail to properly appreciate the more valuable ecological benefits of forests. Any new rule must set a baseline standard for assessing the net present value of the flood control, water supply, and other benefits that forests provide and managing to preserve these essential functions. Forest managers should have a degree of freedom to manage lands according to local circumstances and the needs of surrounding communities, but the national rule must also include specific requirements for preserving the water-related benefits of forests. History has shown that too much autonomy can lead to imbalanced management approaches that fail to prioritize the most valuable services forests provide.

Improving riparian protection is perhaps the single best strategy the USFS can adopt to protect watershed health and water quality for downstream communities. While the proposed rule requires the establishment of a national riparian buffer width standard, it creates a loophole by stating that the actual width may be more or less than the national standard based on local conditions, giving forest managers a great degree of flexibility in implementing these guidelines. While each river and stream is unique, scientific studies show that a buffer of at least 100 feet effectively traps many pollutants and provides sufficient habitat for aquatic and terrestrial species.^{16,17} The USFS should adopt a national mandatory minimum stream buffer standard of 100 feet for all streams on National Forest lands and recommend the implementation of a 300 foot buffer for rivers and streams important to wildlife and downstream communities. It is essential that these guidelines protect healthy riparian areas and their ability to support groundwater infiltration, naturally remove pollutants, and reduce stormwater costs to downstream communities.

USFS must also ensure that management approaches adapt to changing conditions and preserve important water-related benefits even as the climate becomes more volatile and uncertain. While individual land management plans for forests have typically been revised every 15 years, more frequent review and revision may be necessary as climate change brings about more rapid ecological shifts. The new planning rule proposes that plan objectives be revised every 3-5 years or more frequently if necessary. If implemented, this will be a strong first step in the right direction. However, managers will also need better data on physical changes to the landscape in order to preserve healthy watersheds in a changing climate. An accounting system for water is needed to assess the impacts of climate change and management practices on the watershed, wildlife, and downstream water resources. Without a nationally standardized monitoring system, there will be little consistency across forests, and taxpayer money could be wasted on ill-informed management approaches that do not respond to on-the-ground changes. Setting scientifically based guidelines at the national level will help ensure that our ecosystems are resilient in the face of increasing temperatures and more intense storms and droughts.

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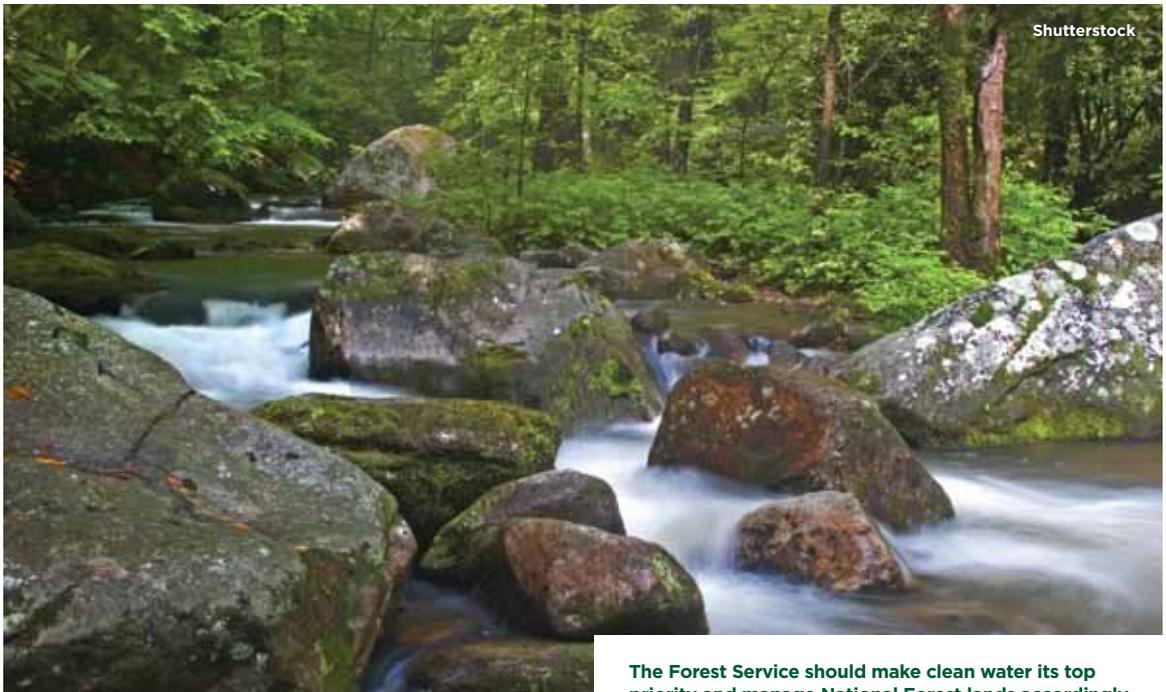
Reduce forest conversion: The Forest Legacy Program preserves private forest lands by purchasing conservation easements and acquiring properties threatened by development. Since it was established in the 1990 Farm Bill, this program has protected more than 2 million acres of land. However, even with this program's success, it is fighting a losing battle against a rapid rate of forest conversion at current funding levels. In order to improve its effectiveness, USFS should support funding for this program at \$100 million annually. This level of funding will protect an additional 300,000 acres of forest, and although it will likely not offset all the water quality impacts of ongoing forest conversion, it can have important benefits for a number of communities.

The USFS should also update guidelines for project funding to ensure that we are maximizing benefits for every dollar invested. Funding criteria should ensure that projects will protect and/or restore the capacity of forests to maintain clean water and flood control services to benefit both the land owners and the local community. The guidelines for Forest Legacy projects already include selection factors based on watershed health in 37 of the states involved in the program. Given the important role that forests play in water supply,

however, these guidelines should be strengthened. The program should prioritize rankings to focus its funds on source water protection projects that will help secure clean drinking water supplies in a given watershed. The USFS should also update its project criteria to incentivize collaborative projects consisting of multiple adjacent landowners in sourcewater protection areas. This should be focused on smaller land owners (< 250 acres) in these critical areas, since these are the lands that are at the greatest risk of conversion.

IV. Benefits of Being Prepared

Better managing Forest Service lands and increasing efforts to reduce the loss of private forests are essential strategies for securing the nation's water supply system and preparing for a changing climate. Forests have always been a critical part of our water infrastructure, but these lands will be even more valuable in the future. Failure to manage these vital landscapes sustainably will only increase the consequences of rising levels of floods and droughts and lead to the loss of lives and property and reduced economic activity. Protecting and restoring forests will help people and wildlife weather a more volatile and uncertain climate and reduce the costs of securing clean water and managing floods. ■



The Forest Service should make clean water its top priority and manage National Forest lands accordingly.



Maintaining healthy forests will help ensure a clean water supply for downstream communities even as droughts become more frequent.

FOOTNOTES

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Transportation Policy



The future holds great challenges for the nation's water resources. Shifting weather patterns, more damaging floods, and rising water shortages will threaten communities, the economy, and the environment. This chapter is part of a larger report, ***Weathering Change: Policy Reforms That Save Money and Make Communities Safer***, which shows what the federal government must do to help the nation confront these looming challenges.

To see the entire report, visit www.AmericanRivers.org

Introduction:

The nation's extensive system of streets and highways is central to many facets of life in America, but it also has serious impacts on the health of nation's water resources. Millions of miles of roads have caused widespread water pollution, increased flooding, harmed wildlife, and destroyed forests and wetlands. These impacts make communities and the environment more vulnerable to the impacts of a changing climate. To this point, federal transportation policy has failed to seriously address the effects of streets and highways on the nation's water resources or consider how this infrastructure increases vulnerability to climate change. Congress has an opportunity to build a more sustainable federal transportation infrastructure with the next transportation bill. Roughly every six years, Congress passes comprehensive transportation legislation, which establishes infrastructure priorities for the coming years. The most recent transportation bill expired in 2009, and Congress has so far failed to enact new legislation. Congress must ensure that the next transportation authorization includes improved protections for water resources and builds resilience to the impacts of a more volatile climate.



Poorly designed roads will increase water pollution and flood risk as storms grow more powerful.

I. Today's Policy

Federal transportation funding primarily supports roads and highways that degrade surrounding water resources, promote sprawl, and make people and wildlife more vulnerable to a changing climate.

Inadequate stormwater controls: There are over four million miles of roads and streets in the U.S.¹ These surfaces have far-reaching effects on water resources. Roads collect a wide range of pollutants including motor oil, heavy metals, tire and brake dust, tailpipe emissions, and salt. Rather than absorbing into the ground, rain and snowmelt run across these surfaces and wash pollutants into surrounding wetlands, streams, and lakes.² Stormwater runoff is the fastest growing source of water pollution in the U.S., and highways and roads are a major contributor to this problem. Polluted runoff lowers water quality and makes waterbodies unsafe for human use. Elevated pollution levels raise the cost of treating water in downstream communities that use the sources for public water supply, adding to the significant financial difficulties many municipalities are facing. Stormwater also has serious consequences for ecosystems and wildlife.³ Paved surfaces disrupt natural water flows, causing higher and more damaging peak flows and lower “base flows,” the natural groundwater seepage that

comprises a large portion of stream flow, especially during dry periods. These disruptions, combined with the pollutants listed above, can harm fish and wildlife populations and make it difficult for them to survive in affected waters.

Unfortunately, there are only minimal requirements that federally funded road projects reduce stormwater runoff. There are nearly a million miles of federal aid highways in the U.S.⁴ Currently, many of them are constructed with little or no consideration for the considerable impacts that they have on surrounding water resources or for how these shortcomings will interact with a more volatile and uncertain climate.

Poorly designed stream crossings: While roads and highways greatly increase human mobility, they can be a formidable barrier to fish and wildlife. Oftentimes they hinder migration and contribute to habitat fragmentation. Free flowing streams provide a natural travel corridor, which fish and wildlife use to find food, spawn, or seek refuge from hot or cold temperatures. Poorly designed stream crossings associated with roads make these migrations difficult. Many culverts are too shallow or are “perched”, meaning that one end rests

above the stream bed. Other culverts have excessive water velocity that prevents fish from swimming upstream. In all of these cases, improperly designed structures can block migration and keep fish and wildlife from moving to more favorable habitat.⁵ Undersized culverts can also present a risk to surrounding communities. Many are too small to accommodate heavy rain storms. As a result, they restrict the flow of the river during extreme events, which can cause erosion, flooding, and the collapse of the road and culvert.

Destruction of sensitive landscapes: For decades, federal transportation funding has primarily supported the construction of roads and highways. This choice of investment has had a large influence on how we have developed our communities and chosen where to live and work. In many cases it has led to the construction of low-density housing developments and demand for yet more roads to meet the rising number of cars. While often justified as a response to rising congestion, highways have in fact been a major cause of the migration to suburbia.⁶ This has led to an escalating cycle of new road construction and housing development that creates an unsustainable maintenance burden for future years. Highways and the sprawl that accompanies them have also been a leading contributor to the loss of forests, wetlands, and other natural systems that buffer communities from floods and droughts. The destruction of these natural protections has increased water pollution, runoff, and flooding and has necessitated costly investments in stormwater and flood control infrastructure. Beginning with the transportation bill of 1991, transportation funding began to shift to transit and other non-highway projects. This allows communities to fund transportation projects that encourage more compact and less destructive development patterns. However, the vast majority of federal

funding continues to support traditional highway projects. Even with environmental reviews and other protections in place, highway projects contribute to the loss of important landscapes and the benefits they provide.

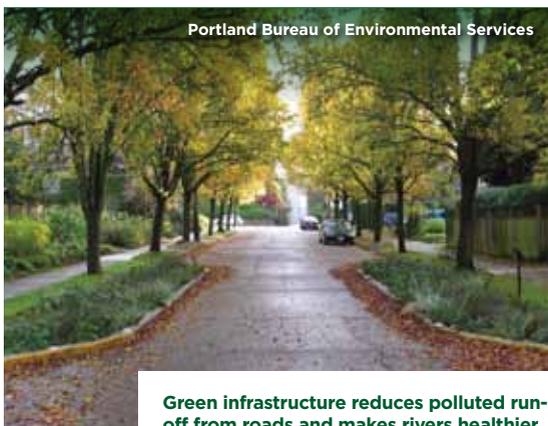
II. Risks and Consequences

This short-sighted approach to transportation infrastructure has not served people or the environment well. It has proven hugely expensive both in terms of taxpayer dollars and the loss of natural capital. Poorly planned transportation infrastructure poses an even greater threat in a changing climate. Increasingly powerful storms will wash greater amounts of runoff from roads and highways, resulting in higher flood risk and water pollution levels. Already under stress from stormwater runoff and other sources of pollution, many streams and the species that depend on them have limited ability to cope with these additional stresses. In addition, undersized culverts will be at greater risk of failure in a more volatile climate, which will result in downstream flooding, the collapse of roadways, costly emergency repairs, and the loss of productivity due to disruptions of traffic flows. They will also make it more difficult for wildlife to move to cooler habitat or adjust to other changes. Finally, the continued loss of wetlands and forests to sprawl will undermine the natural systems that would otherwise provide a buffer against greater floods and droughts.

III. Preparing for the Future

Federal transportation policy needs to fundamentally shift away from the damaging practices of the past to protect the natural resources that support the economy, wildlife, and community health.

Improve stormwater management: In any future transportation bill, Congress should require all federally funded road projects to incorporate more effective stormwater controls. Congress should enact new standards for stormwater control requiring new construction or major rehabilitation projects to maintain or restore the hydrology that existed beforehand. Projects should first attempt to minimize damages to the surrounding landscape and preserve natural features such as trees wherever possible. They should treat runoff on-site with green infrastructure techniques such as stream buffers, swales, and infiltration trenches. Congress has already required large federal buildings that are being newly constructed or renovated to maintain



the same volume of runoff as before development.⁷ Communities around the country are also starting to incorporate this approach by building “green streets” as part of local projects. Proposed legislation such as the Safe Treatment of Polluted Stormwater Runoff Act provides a strong model for the type of stormwater controls that are needed to reduce the negative impacts of new and existing roads.⁸

There have been some promising steps in the right direction at the Department of Transportation recently. Projects funded with TIGER Grants, which were included in the 2009 economic stimulus package, had to meet a number of criteria, including requirements for livability and sustainability. A number of these projects included green infrastructure techniques and focused on treating stormwater on site. The Department of Transportation is proposing to continue these grants in future years and maintain the emphasis on environmental benefits and sustainability. While a positive first step, this is a small subset of transportation funding, and all federal funds should incorporate sound stormwater management.

Improve stream crossings: Congress should require that all federally funded road and highway projects incorporate more advanced culverts and stream crossings to facilitate migration for fish and wildlife. Stream crossings should mimic natural stream conditions, both in terms of the streambed and water flow. They should be at least 1.2 times the “bankfull” width, or the width of the stream channel at the point that water begins to overflow onto a floodplain. The goal should be to allow unrestricted movement of fish and wildlife along a stream corridor and to reduce the risk of failure. With climate change predicted to bring higher flows during certain times of year, these larger culverts will be better prepared to handle storm events that might otherwise impact roads and public safety. During low flows, which will also become more common in a changing climate, these culverts will also be better at maintaining a natural channel and continuing to allow fish passage. Greater mobility for fish and wildlife will help them respond to rising temperatures and other changing conditions.

Protect sensitive landscapes: In the next transportation bill, Congress must shift federal transporta-

tion funding away from projects that encourage sprawl and undermine the natural resources that provide critical protection from climate change. A greater portion of the funding needs to be directed to transit and other projects that encourage compact development and do not subsidize damaging developments. There should also be stronger protections of critical landscapes for all projects. New construction should not be sited in highly vulnerable coastal areas or floodplains, both to ensure that new infrastructure functions under changing conditions and to protect surrounding communities. Environmental protections should be strengthened in the planning process and during reviews under the National Environmental Protection Act.

IV. Benefits of Being Prepared

For decades, the American public has shouldered the high cost of roads and highways that undermine natural landscapes and create a financial burden for the future. The result has been a decline in fish and wildlife populations, poor water quality, and the destruction of forests and wetlands. By embracing a sustainable approach to transportation infrastructure that prioritizes protection of natural resources, we will avoid the escalating costs of this short-sighted approach and be better prepared for the challenges that a changing climate will bring. ■

FOOTNOTES

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Wildlife Management



The future holds great challenges for the nation's water resources. Shifting weather patterns, more damaging floods, and rising water shortages will threaten communities, the economy, and the environment. This chapter is part of a larger report, ***Weathering Change: Policy Reforms That Save Money and Make Communities Safer***, which shows what the federal government must do to help the nation confront these looming challenges.

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Introduction:

Fish and wildlife populations are at great risk in a changing climate. Rising temperatures, shifting precipitation patterns, and more extreme weather events present a serious threat to a wide range of species, many of which are poorly equipped to adapt to changing conditions due to existing stresses. Dammed rivers, destruction of forests and wetlands, and water pollution have already put wildlife in danger. Many federal activities contribute to the continued decline of wildlife populations and the habitat on which they rely. While a number of agencies are taking promising steps toward adapting fish and wildlife management to changing conditions, the lack of funding for improving science and carrying out conservation work at the state level is undermining these efforts. Federal agencies need to better coordinate their activities to minimize impacts on wildlife, and Congress needs to provide additional funding to help state and federal wildlife managers develop management approaches consistent with the challenges of a changing climate.



The loss of wetlands, free-flowing rivers, and healthy forests makes it more difficult for wildlife to respond to changing conditions.

I. Today's Policy

A lack of coordination among federal agencies and inadequate funding for wildlife management contribute to the continued decline of many fish and wildlife species.

Continued degradation of fish and wildlife populations: For centuries, fish and wildlife in the U.S. have been subjected to a wide range of threats due to human activity. We have harvested animals at an unsustainable rate, leading to the collapse of fisheries and other populations. We have dumped a dizzying array of pollutants onto the land and into waterways, causing a wide range of diseases and developmental and reproductive problems in wildlife. The destruction and degradation of forests, wetlands, and rivers have undermined critical habitat and been a major cause of decline for many species.

Today, we have corrected some of the worst abuses, but the challenge of maintaining healthy fish and wildlife populations is an ongoing and growing problem. Congress has passed legislation to regulate harvests of certain species, slow the loss of habitat, and reduce water pollution. The Endangered Species Act has worked to nurse vulnerable species back to health. Various federal agencies are dedicated to implementing these laws and reversing the declines in wildlife populations. Despite

these efforts, many fish and wildlife species are still at risk. Freshwater animals are particularly vulnerable. Their rate of extinction throughout North America is five times higher than that of land-based animals.¹ Dams and levees continue to prevent fish and wildlife from migrating to more favorable habitat to find food, spawn, or nest. Development still destroys important landscapes like forests and wetlands and contributes to the loss and fragmentation of habitat at an alarming pace.

Existing federal wildlife protections often fail to sufficiently respond to current threats, let alone provide an adequate response to a changing climate. While some parts of the government work to protect wildlife, other agencies and programs continue the same destructive practices that have undermined plant and animal life in the past. Agencies like the Corps of Engineers continue to permit, construct, and operate infrastructure in ways that destroy habitat and hinder migration. New federally-funded roads break up wildlife habitat into smaller, isolated pieces. Protections such as the Fish and Wildlife Coordination Act (FWCA) and Section 7 of the Endangered Species Act require federal agencies to consider fish and wildlife in decisions about constructing and operating infrastructure. Despite the improvements they

have made, these protections have at times suffered from ineffective implementation. On the Coosa River, for example, the Federal Energy Regulatory Commission has been complicit in downplaying the wildlife consequences of seven hydroelectric dams being considered for relicensing despite their ongoing impacts on numerous endangered species. It remains to be seen whether scientists from the Fish and Wildlife Service (FWS) will insist on a more complete consideration of the threats to endangered species in the basin.

Inadequate funding for wildlife management:

The challenges facing fish and wildlife populations make strong federal stewardship of these resources more important than ever. A number of agencies have begun to examine how climate change impacts wildlife management, but in many cases a lack of funding is endangering progress. In 2009, the Secretary of the Interior, Ken Salazar, issued a secretarial order designed to better integrate climate change impacts into the department's operations and strengthen the science available to fish and wildlife managers.² The order established a network of Landscape Conservation Cooperatives (LCC) to help coordinate the management of natural resources among federal, state, local, and private partners.³ The LCCs will help develop goals and strategies for wildlife management within and across landscapes and provide scientific and technical assistance to inform management decisions. The order also established eight regional Climate Science Centers (CSCs) to provide climate data and management tools to wildlife managers and other partners through the LCCs.

These efforts are a promising step in the right direction. Unfortunately, they are being slowed by a lack of funding. Interior has received funding to start the Climate Science Centers and Landscape Conservation Cooperatives. Three of the eight CSCs have been established and received funding in the FY2010 budget. Each center needs \$4 million annually to operate. Interior announced the selection of two other CSCs they were planning to open in FY2011, but Congress' failure to pass a budget means that the centers have not been formally established. Interior's plan to establish the three remaining CSCs in FY2012 depends on additional congressional appropriations. If funds are not made available, the Department of the Interior will be faced with a choice between operating a smaller number of CSCs and reducing the resources dedi-

cated to each center. Similarly, a subset of the LCCs has opened, and additional funding is needed to allow the entire system to operate at full capacity. Ongoing uncertainty over the federal budget could put these vital new resources at risk and reduce their ability to produce the data needed to plan effective conservation strategies.

There are also critical funding shortfalls for the implementation of conservation projects. Fish and wildlife management takes place primarily at the state level through state wildlife agencies. Historically most conservation funding has been used to benefit species that are important for hunting and fishing and has neglected the remaining 90 percent of species. As a result, many have experienced continued declines due to development and other human activities. In 2000, Congress took steps to address this problem by establishing the State Wildlife Grant Program, which has since provided over \$600 million to state fish and wildlife agencies for the protection and restoration of non-game species most in need of conservation.⁴ While it is difficult to pinpoint how much funding is needed to protect fish and wildlife populations from existing threats — let alone the additional stress from climate change — it is clear that current levels fall woefully short of what is needed. A 1998 report found that funding for non-game species totaled \$135 million annually, compared to an estimated need of over \$1 billion.⁵ A more recent study estimated it would cost \$350 billion to establish a comprehensive national habitat conservation system.⁶

II. Risks and Consequences

Despite the considerable challenges that fish and wildlife have faced in the past due to human activities, the greatest threat may still lie ahead. Climate change has a wide range of implications for wildlife from the immediate and acute to the long-term.⁷ More extreme floods, droughts, and heat waves can kill, injure, or weaken fish and wildlife. Severe storms can also degrade water quality by washing sediment, nutrients, and other pollutants from the landscape, with negative consequences for aquatic species. Long-term shifts in temperature and precipitation will change when and where food is available and force many species to migrate to areas that are suited to their needs. Warmer water will reduce habitat for cold water fish such as trout and salmon.

While plants and animals have adapted to changing conditions in the past, there are two factors working against them at present. First, the rate of climatic change is expected to be very rapid, which will leave less time for species to adjust to changing conditions. Rapid shifts in climate have historically been linked to mass extinctions.⁸ Human activity is another major barrier to effective adaptation for fish and wildlife. The cities, highways, dams, levees, and other infrastructure that divide the American landscape will prevent wildlife from moving to more favorable habitat. The loss of natural landscapes and persistent pollution problems have also weakened many species and made them less able to respond to additional stresses from climate change.

These changes fundamentally question many assumptions about how we build our communities, use water, and manage the environment. Continuing to destroy forests and wetlands, build barriers to migration, and use water unsustainably will leave wildlife with little capacity to adjust to changing climate conditions. However, we cannot simply try to restore the environment to earlier conditions, because baseline conditions will be fundamentally different. Failure to adopt management approaches that account for climate change impacts could result in the waste of scarce resources and continued decline of vulnerable wildlife populations.

III. Preparing for the Future

Improved coordination of federal activities and larger investments in state and federal wildlife management can reduce waste and better prepare people and wildlife for a changing climate.

Improve federal protections of fish and wildlife:

While the threat to fish and wildlife is daunting, there are many things we can do in the near term to correct the mistakes of the past and reduce the severity of the consequences from a changing climate.



First, we must address the federal activities that are currently undermining fish and wildlife and making them more vulnerable to climate change. Virtually all of the policy recommendations from the other chapters of this report will help reduce the impact of federal activities on the environment, especially the sections on revising the Principles and Guidelines for federal water infrastructure projects (Water Resources Development Policy chapter), strengthening protections of U.S. waters (Clean Water Act chapter), and reducing the impacts of transportation infrastructure (Transportation Policy chapter). Many of these proposed changes can help both people and wildlife adjust to shifting conditions. Agencies can also improve coordination to ensure that they are not working at cross purposes. Agencies that permit, construct, and operate infrastructure projects should better incorporate the recommendations of FWS and the National Marine Fisheries Service, which they are required to consult on certain projects under the Fish and Wildlife Coordination Act and Section 7 of the Endangered Species Act. All agencies should rigorously apply the requirements of these laws and ensure that their intent of minimizing impacts on wildlife is met.

There are some promising steps in this direction already. An interagency group is developing a national fish and wildlife adaptation strategy. They are focusing not only on improving the use of resources in wildlife-focused programs but also how interagency cooperation can ensure that a broader segment of the federal government can adopt approaches that strengthen fish and wildlife populations. This type of coordinated approach is essential to ensuring healthy and resilient wildlife that can withstand the impacts of climate change.

Invest in and adapt fish and wildlife management:

Federal agencies focused on fish and wildlife management must adapt to changing conditions and be given the necessary resources to carry out their work. Improving habitat connectivity is among the most important efforts. Removing dams and creating migration corridors will provide avenues for species to migrate to cooler regions as temperatures rise. Protecting the most pristine remaining landscapes will create refugia for species and maintain biodiversity. Fortunately, a number of agencies are already embracing these approaches and planning for changing conditions. The bureaus and offices in the Department of Interior are creating plans to adapt their activities and operations to the shift

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ing baseline as a result of climate change. The Fish and Wildlife Service, for example, has developed a comprehensive plan for changing its operations to prepare for the impacts of climate change and is using this framework to direct and prioritize conservation actions.⁹

In order to truly address the threat to fish and wildlife, however, additional resources are needed. Congress must appropriate sufficient funds to meet the enormity of the challenges facing the nation's fish and wildlife populations. Legislators should first strengthen the foundation for sound wildlife management by increasing funding for the Landscape Conservation Cooperatives and regional Climate Science Centers. These institutions will allow wildlife managers to undertake coordinated and proactive efforts to strengthen the resilience of wildlife populations and set goals to improve their health in a changing climate. Congress should appropriate sufficient funds for these centers to start operating at full capacity within the next three years. The Climate Science Centers should receive annual appropriations of \$34 million in FY 2012, \$4 million for each regional center and \$2 million for the national center. Congress should also ensure that fish and wildlife managers have resources to carry out projects on the ground. Congress should maintain funding for the State Wildlife Grants at \$90 million for the FY2012 budget. This is a fraction of the needed funding, but it is a significant federal commitment that can help continue critical programs already in place.

While the efforts discussed above form the core of an effective strategy to preserve fish and wildlife in a changing climate, a number of other programs offer similar promise and should be part of a comprehensive wildlife adaptation strategy. The National Wildlife Refuge System (NWRS) is a crucial lifeline that will provide increasingly vital habitat as conditions shift. The system is comprised of 150 million acres of land and provides some of the highest quality wildlife habitat in the nation. However, effective management of these lands is hampered by a \$3.7 billion operations and maintenance backlog.¹⁰ Parts of the system are being overrun with non-native species or suffering from wildlife poaching and other illegal activities. Congress should commit to correcting these problems and maintaining these high quality habitats by bringing the system's budget closer to

the \$900 million that is needed annually to operate the reserve system.¹¹ There is also an opportunity to use existing NWRS resources more efficiently. The Conte National Wildlife Refuge is a promising model that uses a unique mix of strategies to involve private land owners and protect natural resources throughout the 7.2 million acre Connecticut River Watershed. This approach could be used in other areas to cost-effectively reduce stress on fish and wildlife even in more developed basins.

Finally, the Open Rivers Initiative, which funds removal of aging dams, is an effective tool to facilitate migratory corridors. The nation's rivers are plugged with millions of dams, many of which no longer provide the benefits for which they were built. Removing these structures helps fish species migrate to cooler waters as temperatures rise and also opens corridors for land-based wildlife to move between ecosystems. Congress should appropriate \$20 million annually for the Open Rivers Initiative split between the Community Based Restoration Center and the Fish and Wildlife Service's Fish Passage Program.¹²

IV. Benefits of Being Prepared

For too long, we have wasted taxpayer money on programs that work at cross purposes. Investments in fish and wildlife protection have been outweighed by infrastructure construction and permitting decisions that have destroyed and fragmented vital habitat. By addressing the federal programs that most seriously undermine fish and wildlife, we can save money and make wildlife less vulnerable to the impacts of a changing climate. At the same time, incorporating climate change into wildlife management will help ensure that we're not investing in efforts that will be ineffective as conditions shift. By embracing more proactive policies, we can avoid costly efforts to save species once they are endangered.

These reforms will also have large benefits for people. Protecting wetlands and floodplains will help maintain water quality and prevent downstream flooding. Clean water and healthy ecosystems are essential inputs to economic activity throughout the U.S. Protecting and restoring these systems will help ensure long-term economic growth and prepare people and wildlife for a more volatile and uncertain future. ■



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Dam removal allows fish and wildlife to migrate to more suitable habitat and can eliminate safety hazards for communities.

FOOTNOTES

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