

**White Paper**  
**U.S. Water and Climate Change Policy**

Draft January 20, 2021  
Rev. March 17, 2021

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## Climate Change is Water Change

In Barcelona during the November 2009 negotiations for the Copenhagen climate conference, the executive director of the Stockholm Water Institute said precisely that “climate change is water change.” This is explained in thermodynamics by the Clausius-Clapeyron relationship that for every 2 degrees F rise in temperature the atmosphere can hold 7% more water vapor. That is, global warming causes more evaporation, higher humidity, and water saturation in the atmosphere resulting in more wild fires, damaging storms and floods, searing drought, burying blizzards, and melting of the glaciers leading to dwindling water supplies and sea level rise. With a new President on January 20, 2021 and the 117<sup>th</sup> Congress, climate change is once again a top priority of the Federal government and we are about to see a brand new age - a 4<sup>th</sup> era of environmentalism - in the United States. The actions and deliberations on climate change ought to be apolitical and nonpartisan because after all to adapt an adage from my colleague at the University of Minnesota Water Resources Center: “clean water (and air) is neither red or blue, it is clear.”

In this dawn of a new decade the four great challenges of the day are: (1) fight the pandemic, (2) revive the economy, (3) combat climate change, (4) and achieve racial justice. All of these issues are intertwined in the disciplines of sustainable water and environmental policy. Clean water provides necessary hygiene to control the spread of coronavirus. Clean water programs stimulate the economy and support high paying green jobs. Innovative economic investment in clean low carbon energy combats climate change. Investment in polluted neighborhoods provides the environmental justice to fight racism and provide good jobs for people of all races, creed, or color. The following white paper on U.S. water and climate change policy recommends priority actions in (1) science, (2) policy, (3) governance, and (4) finance to restore the economy and environment of America.

## White House Water Summit

Five years ago on March 22, 2016, we were 200 scientists invited by President Obama to the White House Water Summit at 1600 Pennsylvania Avenue in Washington, D.C (Figure 1). On UN World Water Day, the White House hosted this first-ever national water summit to shine a spotlight on cross-cutting, creative solutions to solving the water problems of the day and announced \$4 billion in private capital committed to investment in water-infrastructure projects nationwide, over \$1 billion from the private sector to conduct research and develop new technologies, and nearly \$35 million a year in Federal grants from EPA, NOAA, NSF, and USDA to support cutting-edge water science. We heard from WH officials such as Ali Zaidi, Associate Director for Natural Resources, Energy, and Science at OMB and five U.S. Congress members that water science and policy research at universities such as the University of Delaware is especially pertinent because water is one of America's top domestic public policy challenges and the push is on to invest more in this economic and environmental resource to reduce the chances of future disasters on the Flint River, the California drought, or coastal Delaware flood emergencies. It's been five years now and we're looking forward to the next White House summit that could be a “Bretton Woods” of water and climate modeled on the 1944 economic summit where the 75 allied nations assembled in the White Mountains of New Hampshire to plan a new world order.



## The Delaware Way

Constitutionally, Delaware is the First State and so it is in water. Sitting on the Delmarva Peninsula and surrounded on three sides by water, it is one of just three *peninsular* states and with the C&D Canal many consider it to be technically an island. At a mean elevation of only sixty feet above sea level, Delaware is also the lowest state in the United States with 1/5 of its landmass in the floodplain and a beautiful and bounteous 130-mile coastline with the cleanest ocean beaches in the nation (Kauffman 2020). But this profile leaves the state vulnerable to worsening coastal storms and accelerating sea level rise, perhaps more than other states. The Diamond State is fortuitously situated by geography and hydrology between two great estuary systems in America, the Chesapeake and the Delaware, that support abundant ecology and a \$6 billion water economy (Narvaez and Kauffman 2012).

Twenty years ago at the turn of the century, Delaware took actions to address the critical water issues of the day in a collaborative manner of getting along known as the “Delaware Way.” In 2000 the Governor and General Assembly appointed the Water Supply Coordinating Council and a State Water Master that transformed water supply management in Delaware after the crippling drought of 1995-2002. The same year a state law was passed creating the Delaware Nutrient Management Commission a voluntary program that allows farmers to modernize farms and reduce nutrient loads to the Delaware, Chesapeake, and Inland bays without overbearing regulation. Also in 2000, Bill Clinton signed the White Clay Creek National Wild and Scenic River Act advanced by Senator Joe Biden (D-DE) and Congressman Joe Pitts (R-PA) as a bipartisan interstate approach to preserve the watershed in Delaware and Pennsylvania that supplies drinking water to 200,000 people or a full 1/5 of the population of the First State. Since then Delaware has created a Division of Climate Change and Energy in the DNREC (one of the first in the nation) with a focus on climate change, sea level rise, and clean energy. Delaware enacted these water and climate programs a generation ago and this cooperative way of cleaning up the environment is a model available to the greater United States.

## The Watershed Approach

Water is a renewable resource as the most essential chemical in society present in all three phases (solid, liquid, and gas) and is one of the few substances in nature without an economic substitute. The nation’s water supply exceeds 260 billion gallons per day with an annual market value of \$21.4 billion (Kenny et al. 2009). Over 80% of Americans surveyed by the Gallup Poll (2017) identify water pollution as the top environmental problem and climate change is the next most concerning issue. But in the U.S where the Constitution is based on the principles of Federalism or shared power between the Federal government and the states, water policy is a complicated mix as the hydrologic cycle flows without regard to political boundaries (Mandarano et al. 2008).

One of the fundamental tools in addressing the water and climate change challenges of our age is the watershed approach (Kauffman 2015). Watersheds and rivers in the U.S. often don’t coincide with state boundaries and this often results in inefficient and contentious use of the water resource and this becomes a problem of not geopolitics but hydro-politics (Figure 2). Because watershed and political boundaries often do not overlap, water managers face complex institutional and governance challenges and competition for scarce water supplies. The National Academy of Sciences (1999) recognized twenty years ago that the watershed approach is beneficial because it: (1) balances competing uses between upstream and downstream stakeholders, (2) balances institutional objectives at the Federal, State and local levels, (3) utilizes a multidisciplinary science and policy approach, and (4) provides for cost sharing among watershed stakeholders.

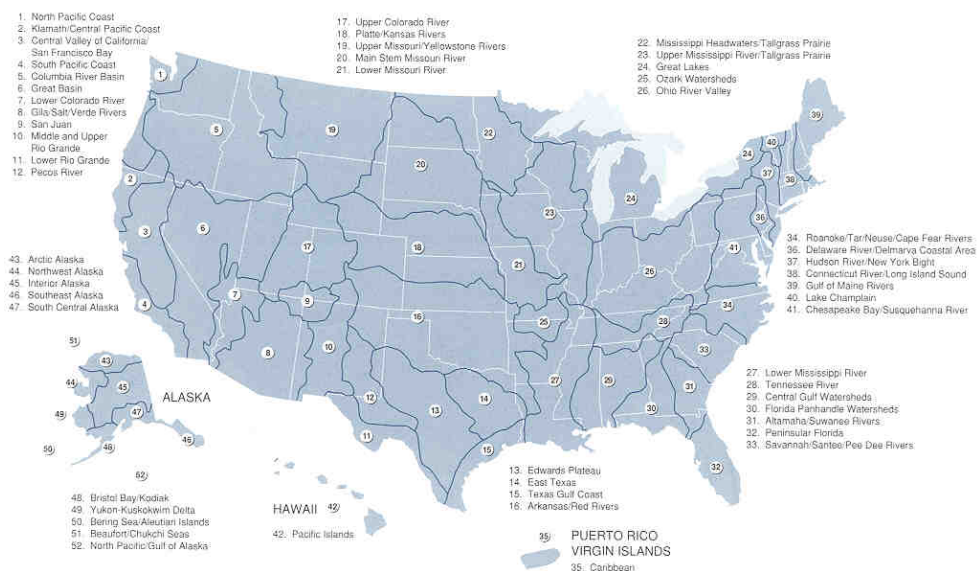


Figure 2. Watershed and political boundaries in the United States (Kauffman 2002)

Webster's lists that the English word for watershed first appeared in 1800 and is derived from the 14<sup>th</sup> century German *wasserscheide* or water parting. Also meaning a crucially important event, a watershed is the region draining to a water body. In the late 19<sup>th</sup> century John Wesley Powell, the Colorado River explorer, spoke to the Idaho convention as the territory was considered for admission to the Union and lost his job as second director of the USGS for proposing that state and county lines conform to watersheds in the American west. U.S. water governance dates to the turn of the 20<sup>th</sup> century and the 1899 Rivers and Harbors Act in the first era of environmentalism, resurfaced during the Roaring Twenties and Great Depression (second era) with the Colorado River Compact and TVA, reemerged after the Second World War with the 1948 Clean Water Act, and peaked in the third and golden era of environmentalism in the 60s, 70s, and 80s with the Wild and Scenic Rivers Act, NEPA, Clean Water Act, and Safe Drinking Water Act (Table 1). Now with a new White House and 117<sup>th</sup> Congress, a fourth era of environmentalism is imminent presaged by the \$900 million Land and Water Conservation Fund Act of 2020 passed by 73 to 25 majority in the Senate.

**Table 1.** Water governance and legislative initiatives in the United States

Date	Action	Description
1899	Rivers and Harbors Act	Corps of Engineers regulate dumping and dredging along navigable rivers in the U.S.
1902	Reclamation Act	Theodore Roosevelt created Bureau of Reclamation to construct irrigation projects in west.
1909	Boundary Waters Treaty	U.S. and Great Britain establish International Joint Commission in Great Lakes.
1922	Colorado River Compact	Pres. Harding and governors sign interstate accord in CO, NM, UT, WY, AZ, CA, NV.
1933	Tennessee Valley Authority	Generates hydropower in Appalachia as first river based regional development agency.
1948	Water Pollution Control Act	First water quality law in 50 years. Funded states to reduce water pollution.
1961	DRBC Compact	Signed by JFK, governors of DE, NJ, NY, PA as first shared Federal-state water accord.
1965	Water Res. Planning Act	Formed Water Res. Council in White House and Title II interstate river basin commissions.
1968	Nat'l. Wild & Scenic River Act	LBJ signed law to protect and free flowing rivers as wild, scenic, or recreational.
1969	National Environ. Policy Act	President's Council on Environmental Quality and required EIS for federal projects.
1970	EPA	Nixon issues EO consolidating air, water, land protection under one cabinet office.
1972	Clean Water Act amendments	Required fishable/ swimmable waters by 1983, elimination of pollutant discharges by 1985.
1973	Endangered Species Act	Federal protections by the USFWS that brought the bald eagle back from extinction
1986	Safe Drinking Water Act	Sets drinking water standards and oversees source water protection program.
1987	Water Quality Act	CWA amendment controls nonpoint pollution and states establish watershed based TMDLs.
1987	National Estuary Program	Congress authorized EPA to establish NEP with 28 programs such as Del. Estuary Program.
2020	Land and Water Conservation Fund	\$900 million LWCF Act of 2020 passed 73 to 25 in the Senate.

Since Congress approved the 1972 and 1977 Clean Water Act amendments the watershed approach evolved to balance economic, environmental, and social interests of governments and stakeholders that benefit from a river. Congress commissioned a National Academy of Sciences (1999) study that concluded watersheds provide a logical framework for regional water management by integrating water science and policy. In 2009, the Congressional Research Service (CRS) called for forming a nation-wide network of river basin commissions to resolve the challenges of water management (Cody and Carter 2009). Tracy Meehan (2010), former EPA Administrator for Water, wrote the problems of complying with the Clean Water Act are not those of science but rather of governance and maintained a new "symphonic" watershed approach could balance interests of governments and stakeholders. In 2010, the White House introduced a bill to establish an Office of Sustainable Watershed Management with ten regional river basin boards filled by interstate agencies, tribes, local governments, and industries. In 2011, Philadelphia's William Penn Foundation embarked on a symphonic \$100 million program that works with over 60 nonprofit environmental organizations to protect and restore the Delaware River Watershed that supplies drinking water to 15 million people in Delaware, New Jersey, New York, and Pennsylvania and the first (New York City) and sixth (Philadelphia) largest metropolitan economies in America.

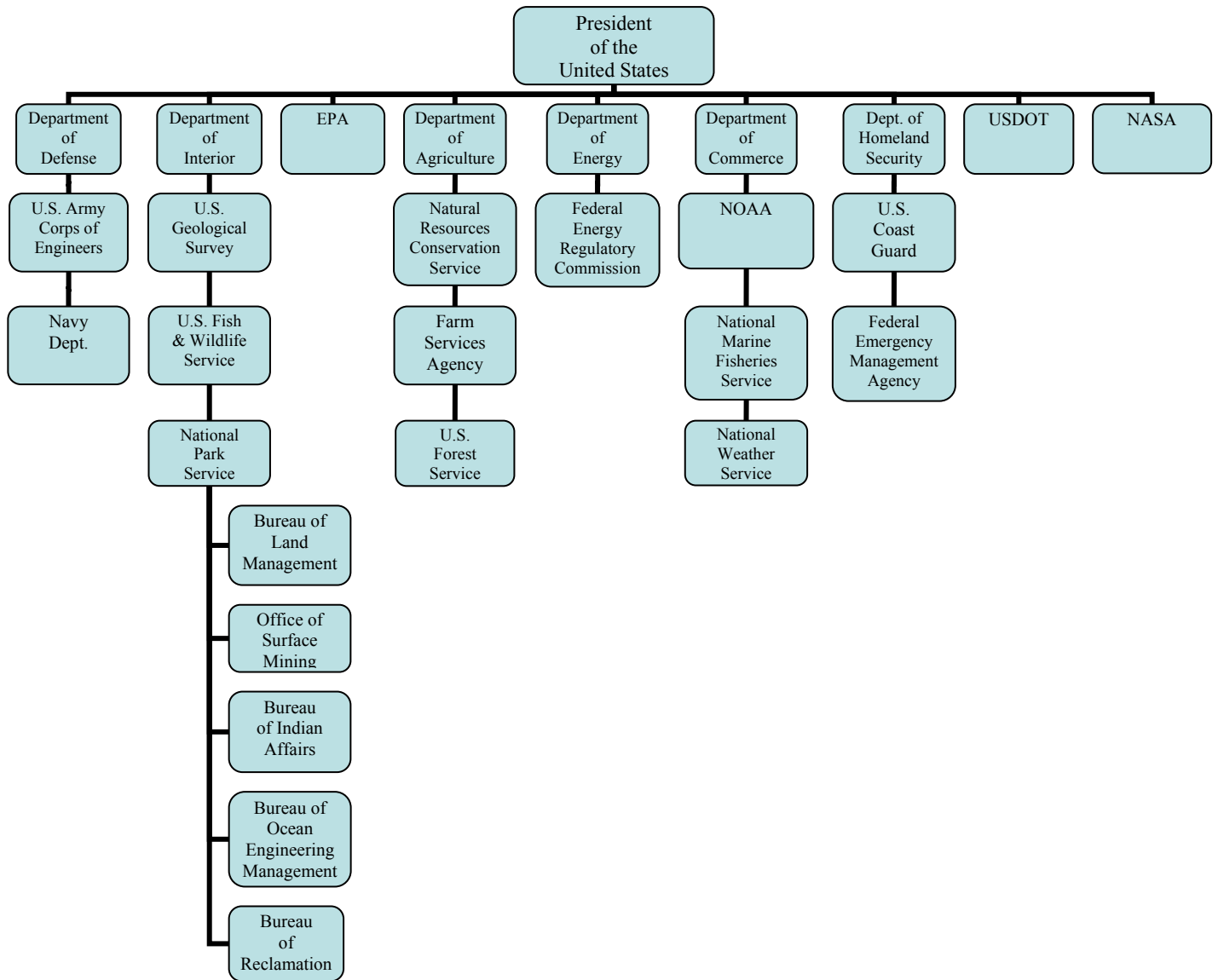
## Federal Water Agencies

Under federalism, U.S. water and climate policy is inherently complex (vertically and horizontally) requiring coordination between the White House and Congress and hundreds of international, Federal, interstate, state, and local and nonprofit agencies (Table 2). At least 20 Federal agencies in 10 cabinet level departments oversee U.S. water and climate policy with a combined \$30 billion budget including the Dept. of Defense (U.S. Army Corps of Engineers and Navy), Dept. of Interior (National Park Service, USGS, Fish and Wildlife Service, Bureau of Land Management, Bureau of Reclamation, Office of Surface Mining, Bureau of Indian Affairs, Bureau of Ocean Energy Management), EPA, USDA (Natural Resource Conservation Service, Farm Services Agency and Forest Service), Dept. of Energy, Dept. of Commerce (NOAA, NMFS, and National Weather Service), Homeland Security (FEMA and U.S. Coast Guard), USDOT, and NASA (Figure 3 and Table 1). Though there is no single Federal water and climate agency as there would be say in France or Britain, water governance in the U.S. is dispersed among many offices with often countermanding missions and while this may be chaotic and inefficient in terms of reaching agreement, this in essence is federalism with a system of checks and balances more preferred in the U.S. instead of unitary authority vested in a single agency. Along with underfunding from a water/climate budget of just \$100 per capita, one of the challenges in U.S. water governance are state-based water regions in EPA and USFWS that ought to conform to Corps of Engineers river basin districts (Figure 4).

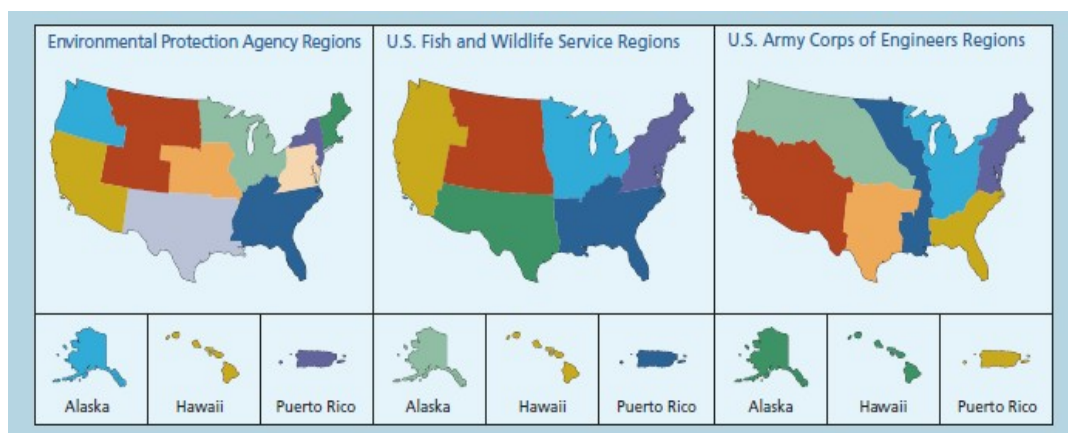
**Table 2.** Water resources governance in the United States

<b>Executive</b>		<b>117<sup>th</sup> Congress</b>	<b>States</b>	<b>Nonprofit</b>
President Biden	<b>Budget</b>	<b>U.S. Senate</b>	Alabama DEM	The Nature Conservancy
Cabinet	<b>(FY20 \$ mil)</b>		Alaska DEC	Sierra Club
<b>Defense</b>		<b>Senate Appropriations</b>	American Samoa EPA	Nat'l Wildlife Federation
U.S. Army Corps of Engineers (Civil Eng'g)	3,000	Patrick Leahy, (D-VT), Chair	Arizona DEQ	Audubon Society
Navy (Facilities Engineering Command)	1,100	Richard Shelby (R-AL), Ranking Member	Arkansas DEQ	American Rivers
<b>Homeland Security</b>			California DWR	Natural Res. Defense Council
Federal Emergency Mgmt. Agency (FEMA)	1,000	<b>Environment and Public Works Committee</b>	Colorado DPHE	American Littoral Society
Coast Guard (USCG)	2,200	Thomas R. Carper (D-DE), Chairman	Connecticut DEP	Environmental Defense Fund
<b>Interior</b>		John Barrasso (R-WY), Ranking Member	Delaware DNREC	Surfrider Foundation
Bureau of Land Management (BLM)	1,200		DC DOE	League of Conserv. Voters
U.S. Geological Survey (USGS)	990	<b>Energy and Natural Resources Committee</b>	Florida DEP	Earth Island Institute
National Park Service (NPS)	2,400	Joe Manchin (D-WV), Chair	Georgia DNR	William Penn Foundation
U.S. Fish and Wildlife Service (USFWS)	2,800	Lisa Murkowski (R-AK), Ranking Member	Guam EPA	
Office of Surface Mining (OSM)	116		Hawaii DLNR	
Bureau of Reclamation (BurRec)	1,200	<b>Commerce Science and Transportation</b>	Idaho DWR	
Bureau of Indian Affairs (BIA)	1,900	Maria Cantwell, (D-WA), Chair	Illinois EPA	<b>International</b>
Bureau of Ocean Energy Mgmt. (BOEM)	189	Roger Wicker (R-MS), Ranking Member	Indiana DEM	Int'l Joint Commission
<b>Environmental Protection Agency (EPA)</b>	6,068		Iowa DNR	Int'l Boundary Water Comm.
<b>U.S. Department of Agriculture (USDA)</b>		<b>Subcmte. Transportation &amp; Infrastructure</b>	Kansas DHE	U.S. Agency Intl Devel (USAID)
Farm Services Agency (FSA)	2,000	Ben Cardin (D-MD), Chair	Kentucky EEC	World Bank
Natural Res. Conservation Service (NRCS)	2,900	Kevin Cramer (R-ND), Ranking Member	Louisiana DEQ	
Forest Service (USFS)	5,700		Maine DEP	
<b>Energy</b>		<b>Subcmte Interior, Environ Related Agencies</b>	Maryland DOE	
Federal Energy Regulatory Comm. (FERC)	382	Jeff Merkley (D-OR), Chair	Massachusetts DEP	
Energy Information Administration (EIA)	118	Lisa Murkowski (R-AK), Ranking Member	Michigan DEGLE	
<b>Commerce</b>			Minnesota DNR	
NOAA		<b>House of Representatives</b>	Mississippi DEQ	
National Marine Fisheries Service (NMFS)	1,000		Missouri DNR	<b>River Basin Organizations</b>
National Weather Service (NWS)	1,100	<b>House Appropriations</b>	Montana DEQ	Tennessee Valley Authority
<b>Department of Transportation (USDOT)</b>		Rosa DeLauro (D-CT), Chair	Nebraska DEE	DRBC
<b>Nat'l Aeronautic &amp; Space Admin. (NASA)</b>	2,000	Kay Granger (R-TX), Ranking Member	Nevada DCNR	SRBC
<b>State</b>			New Hampshire DES	NEIWPC
International Joint Commission (IJC)	10	<b>Natural Resources Committee</b>	New Jersey DEP	ORSANCO
International Boundary Commission (IBC)	1,100	Raúl M. Grijalva (D-AZ), Chair	New Mexico ED	Colorado River Compact
St. Lawrence Seaway Commission	28	Bruce Westerman (R AZ), Ranking Member	New York State DEC	Great Lakes Commission
			North Carolina DEQ	Chesapeake Bay Program
		<b>Energy and Commerce</b>	North Dakota SWC	
		Frank Pallone (D-NJ), Chair	Mariana Islands CBECQ	
		Cathy McMorris (R-WA), Ranking Member	Ohio EPA	
			Oklahoma DEQ	
		<b>Subcommittee Water, Oceans, &amp; Wildlife</b>	Oregon DEQ	
		Chair, Jared Huffman (D-CA), Chair	Pennsylvania DEP	
		Tom McClintock (R-CA), Ranking Member	Puerto Rico DRNA	
			Rhode Island DEM	
		<b>Subcmte Interior, Envir &amp; Related Agencies</b>	South Carolina DHEC	
		Chellie Pingree (D-ME), Chair	South Dakota DENR	
		Dave Joyce (R-OH), Ranking Member	Tennessee DEC	
			Texas CEQ	
			Utah DEQ	
			Vermont DEC	
			U.S. Virgin Islands DEP	
			Virginia DEQ	
			Washington DOE	
			West Virginia DNR	
			Wisconsin DNR	
			Wyoming DEQ	

**Department of Defense:** Going back to the 1899 River and Harbors Act (the original Clean Water Act) the U.S. Army Corps of Engineers civil engineering command is responsible for navigation, dredging, reservoir O&M and public works along the nation's rivers. The Navy Facilities Engineering Command (NAVFAC) is responsible for civil engineering at government maritime facilities. Working from the Philadelphia Navy Yard, the Naval Construction Battalions (Seabees) returned home from the Atlantic and Pacific theatres after the Second World War and were put right to work by President Truman to clean up the Delaware River.



**Figure 3.** Federal water and climate agencies



**Figure 4.** Contrast of Federal water agency regions

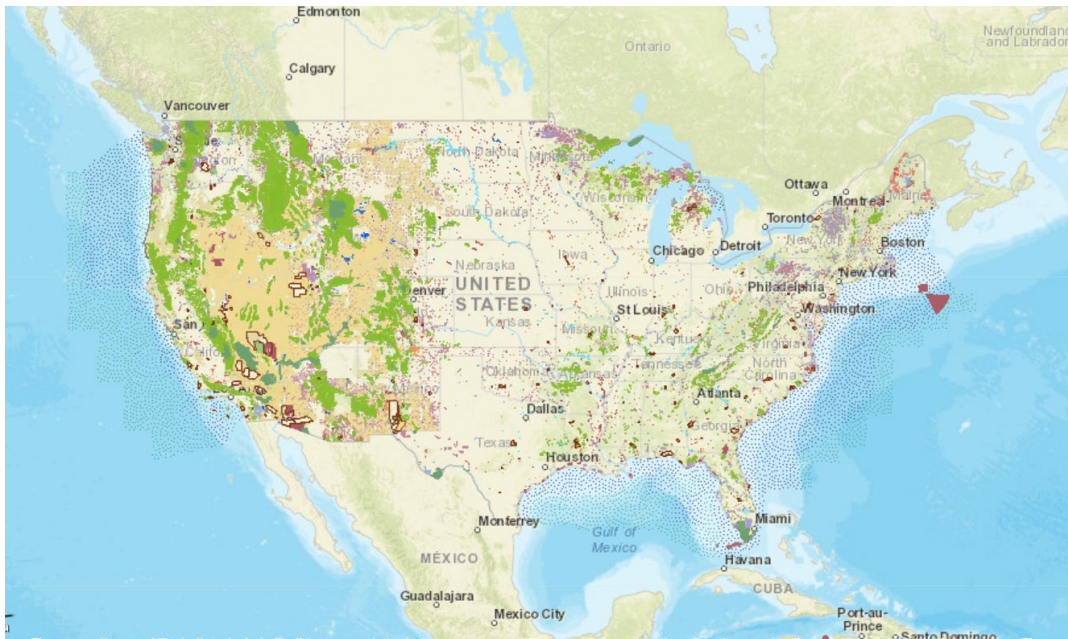
**Department of Interior:** The DOI manages a surprisingly 1/5 of all the land in the United States. The U.S. Geological Survey, with just a billion-dollar budget, is the nation's preeminent water science agency and operates a national stream gage network to monitor droughts and floods during weather related disasters. The U.S. Fish & Wildlife Service was formed after the Great



Depression and administers the 1973 Endangered Species Act that brought the bald eagle back and operates the National Wildlife Refuge System that protects some of the most pristine habitat on the continent. The National Park Service (est. 1916) operates 400 national park units along some of the purest streams protected by the 1968 National Wild & Scenic Rivers Act. Harry Truman established the Bureau of Land Management that oversees 1/8 of the nation's land and the largest expanse of Federal land in the west. The Office of Surface Mining (est. 1977) is in charge of cleaning up abandoned mine drainage (AMD) that pollutes some of the most beautiful rivers in the nation. The Bureau of Indian Affairs, one of the oldest Federal agencies with inception in 1824 oversees often overlooked water rights in the vast lands of the sovereign tribal nations. The Bureau of Ocean Energy Management was established in 2010 to oversee renewable energy leases on the continental shelf in Federal coastal waters including the budding off shore wind portfolio that has the potential to generate more than 2,000 gigawatts (GW) with a \$70 billion business to power 600 million homes or double the nation's current electricity generation by 2030. The U.S. Bureau of Reclamation has a \$1.2 billion budget and is the largest wholesaler of water supply and irrigation in the U.S. and the 2<sup>nd</sup> largest producer of low carbon hydroelectric power in states west of the 100<sup>th</sup> Meridian.

The Interior Department should be directed to protect 30% of the nation's land and water by 2030 (the 30 for 30 program) as introduced by resolution last year by Sen. Tom Udall of New Mexico and Sen. Michael Bennet of Colorado and advocated by 91-year old, two time Pulitzer Prize winning scientist E.O. Wilson (2016) who proposed to save not just one third but half of the globe as the premise of his book "Half Earth." According to USGS, protected lands cover 12% of the U.S. at the Federal, state, local, and nonprofit level (Figure 5). Public open space covers 1950 square miles or 15% of the Delaware River Basin with 65% owned by Delaware, New Jersey, New York, and Pennsylvania, 15% by the counties, 7% by the Federal government and 7% by private lands. Public land covers 31% of the Brandywine and 28% of the White Clay watersheds in Delaware and Pennsylvania.

To put people back to work restoring the environment past is prologue as we need to look no further than FDR's New Deal Civilian Conservation Corps (CCC). The DOI should ramp up and double or even triple the AmeriCorps (often called the domestic Peace Corps) created by Bill Clinton and Congress under the National and Community Service Trust Act of 1993 that included VISTA and National Civilian Community Corps (NCCC). The AmeriCorps employs over 75,000 Americans in public service in education, public safety, health care, and environmental protection. AmeriCorps members are compensated with cost of living and housing allowances, student loan deferment, and public service loan forgiveness. An expanded AmeriCorps should be recruited from a cohort of young people who represent the racial diversity of the U.S. where 40% are Americans of color.



**Figure 5.** Protected land covers 12 percent of the United States (USGS)

**Environmental Protection Agency:** The EPA was formed by Richard Nixon executive order in 1970 a few months after first Earth Day and administers the nation's water, air, and waste laws. In 1987 Congress amended the Clean Water Act (CWA) to replace the Construction Grants program with Title VI that established the Clean Water State Revolving Fund (CWSRF) Program that awarded \$74 billion between 1988-2010 for water infrastructure, nonpoint source, and estuary projects (Arbuckle 2012). The Drinking Water State Revolving Fund (DWSRF) under the 1996 Safe Drinking Water Act Amendments authorizes loans to assist public water systems to protect public health. These revolving fund programs are loans which must be repaid back by the states which is not quite as effective as the preferable and original CWA grants program that poured billions of dollars into wastewater treatment programs during the 1970s and 80s that cleaned up the nation's water and funded millions of public works jobs.

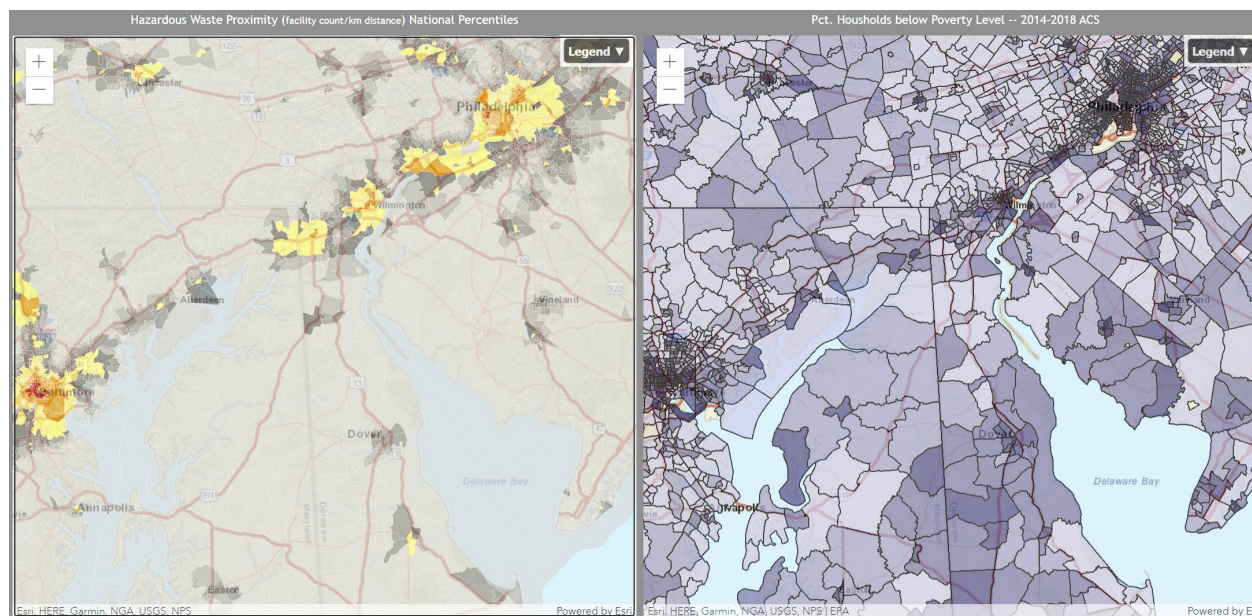
Two of the biggest water quality problems in America are perfluoroalkyls (PFAs) and lead.

PFAs are fluorinated chemicals most prevalent pre 1970s in firefighting foams and consumer products and have been detected in drinking water of 16 million Americans. There is no Federal EPA PFAS drinking water standard MCL) and MA, MI, NH, NJ, NY, and VT are the only states with PFAS drinking water MCLs as low as 10 to 20 parts per trillion (ppt). In 2016 EPA set a non-enforceable health advisory level of 70 ppt for PFAs. In 2017 the Department of Defense identified 401 sites with releases of PFOS/PFOA into groundwater. A federal PFAs drinking water standard of 13 ppt should be set by EPA to provide clear guidance to the public and industries and protect and cleanup drinking water supplies in 33 states.

Lead in drinking water is regulated by EPA under the lead and copper rule. Ill-treated water from the Flint River under the direction of the State of Michigan at the time caused lead poisoning of kids and citizens and could easily have prevented by enforcing pH treatment provisions of the Safe Drinking Water Act. The EPA should be funded and tasked to replace lead pipes and build water treatment systems that adjust pH (to be managed by licensed professional engineers) to eliminate the lead problem.

EPA should restore the Clean Water Act protections of headwater streams and wetlands or Waters of the United States (WOTUS) that were repealed by the prior administration. Restoring WOTUS would again protect 50% of all the small but essential streams and freshwater wetlands that supply clean and plentiful drinking water for 100 million people in the U.S.

Federal water and climate agencies and EPA should recruit scientists who reflect the racial diversity of the U.S. where 40% of the population are people of color (Black, Latino, Asian, Pacific Island, and Indigenous Americans). The EPA should invest proportionate clean water, air, and hazardous waste funding to clean up pollution in poor and disadvantaged communities home to disproportionately high densities of hazardous waste sites mapped by the environmental justice screening tool (Figure 6).



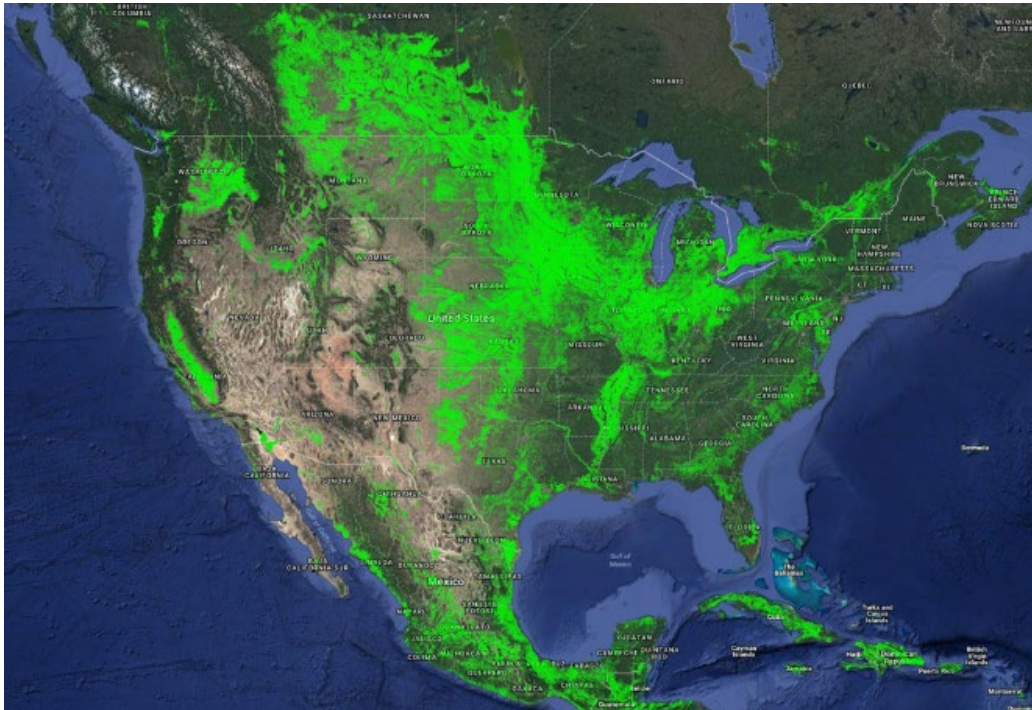
**Figure 6.** Poor communities have more hazardous waste sites (EPA Environmental Justice Screening Tool)

**U.S. Department of Agriculture:** The USDA Natural Resources Conservation Service (NRCS) and Farm Services Agency (FSA) and county soil conservation districts fund agricultural conservation programs through the Farm Bill to reduce nutrient and sediment loads. USDA programs such as the Environmental Quality Incentives Program (EQIP) provide Federal payments to farmers to install conservation BMPs such as no till crops and reforestation that reduce nitrogen loads at a cost of \$5/lb N/yr. The world's largest and longest-running investment in watershed services (IWS) program is the USDA Conservation Reserve Program which pays about \$1.8 billion a year to farmers and landowners. In exchange for payments, farmers agree to plant land cover to improve water quality, control soil erosion and enhance waterfowl habitats. In FY12, the Farm Bill funded \$5.1 billion for USDA NRCS and Farm Services Agency agricultural conservation programs in the U.S.

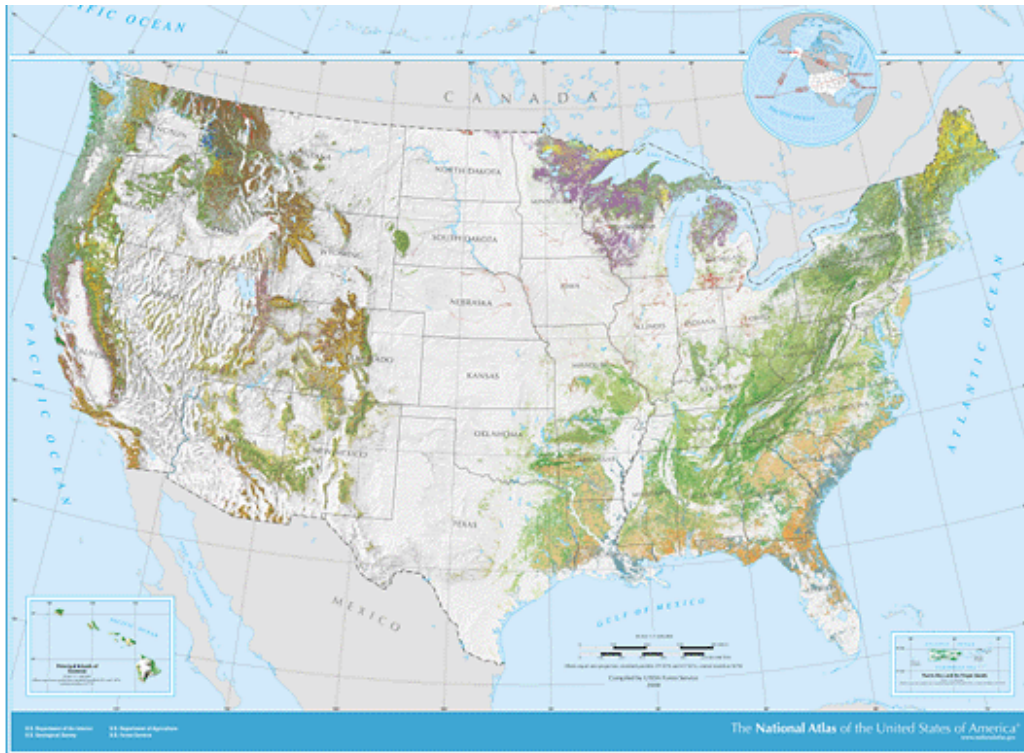
The USDA should be in charge of regenerative agriculture with long-established and low-tech techniques such as organic farming, no till cropping, and winter cover crops to reduce soil erosion to better sequester massive amounts of carbon in soil. If 1,000 farms are converted to regenerative organic farming, the emissions drop would be similar to removing 100,000 autos from driving. If all 640,000 square miles of croplands or 20% of the U.S. landmass (Figure 7) adopted regenerative agriculture, soil cover would capture an immense 370 million tons of carbon and cut nitrogen oxide (NOX) emissions significantly (Rodale Institute).



To combat climate change and put thousands of young people to work, the U.S. Forest Service should be tasked with a massive reforestation program as forests cover 1.3 million square miles or 36% of the continental U.S. (Figure 8) that right now provide annual economic benefits from carbon storage of \$690 billion at \$827/acre (Nowak et al. 2008).



**Figure 7.** Cropland covers 20 percent of the United States (USGS)



**Figure 8.** Forests cover 36 percent of the continental U.S. (USGS)

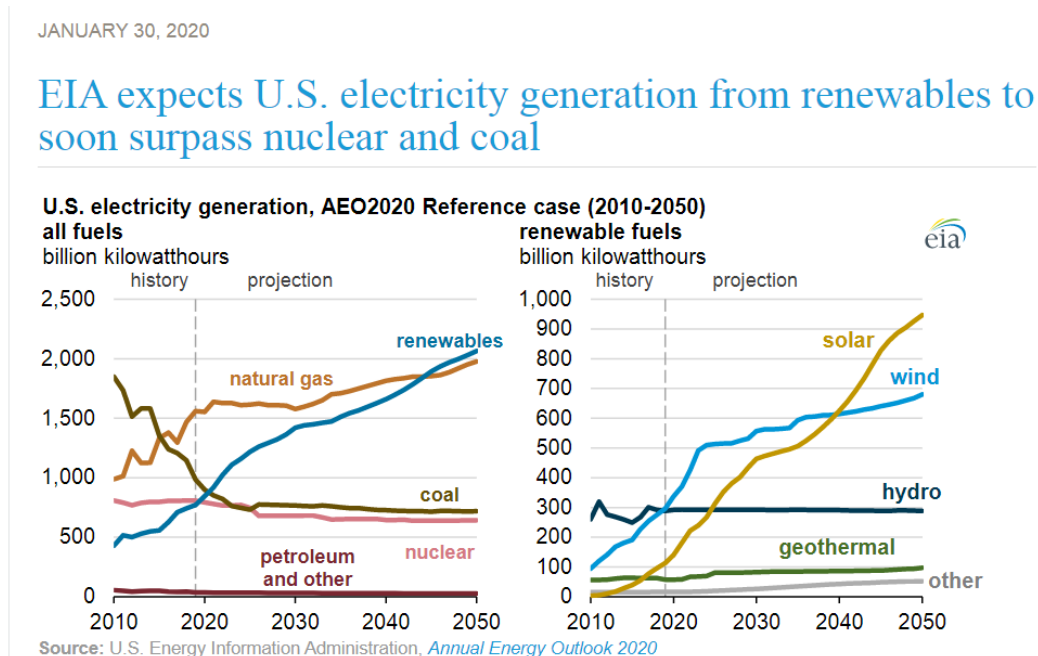
**Department of Commerce:** NOAA and the National Marine Fisheries Service (NMFS) and National Weather Service (NWS) within are the preeminent centers of Federal climate science positioned one and two degrees of separation below the Secretary of Commerce. NOAA and the NWS perhaps ought to be elevated to cabinet level prominence (comparable to EPA) to illuminate their key water and climate mission.

**Department of Homeland Security:** Assigned to DHS after 9/11, FEMA oversees the Federal flood insurance program, maps the national floodplains, and leads flood disaster response. Reporting to the Secretary of DHS, FEMA's response can be uneven (see Katrina) and it was once most effective as a cabinet level office one call from the President and perhaps ought to be so again. With borders on three oceans the U.S. is a maritime nation and the U.S. Coast Guard has time and time again proved to be the nation's most effective and efficient agency (see Katrina) of any in Federal government and is responsible for protection of the nation's coastal waters and should be funded as such.

**Department of Energy:** The DOE hosts the Federal Energy Regulatory Commission (FERC) that regulates the energy industry including renewable wind, solar, and hydroelectric power. The Energy Information Administration (EIA) collects monthly energy data for sound policy making. The EIA (2020) energy outlook (Figure 9) projects that U.S. electricity generation from renewables will exceed nuclear and coal by 2025 and approach natural gas by 2030 meaning the U.S. may move toward a low carbon and zero emissions future sooner than 2050 perhaps even by 2030 or 2040.

**Department of Transportation:** The USDOT and Federal Highway Administration (FHWA) has a key role in rebuilding transportation infrastructure to bring the nation back to work from the pandemic while fighting climate change by adopting more stringent fuel standards, expanding mass transit, and increasing the electric vehicle fleet.

**National Aeronautic and Space Administration (NASA):** Although known for the space mission, NASA oversees a \$2 billion earth science program essential for addressing climate change. The agency operates a satellite fleet that monitors the atmosphere, forests, snow and ice caps, sea level rise, weather systems and other terrestrial and atmospheric conditions central to unlocking the secrets of climate change.



**Figure 9.** U.S. electricity generation from renewables will exceed nuclear and coal and approach natural gas by 2030 (EIA 2020)

**Congress:** Congressional committees such as the Senate Environment and Public Works (EPW), Interior, Environment, and Related Agencies and House of Representatives Natural Resources committee and Water, Oceans, and Wildlife subcommittees possess significant authority in passing water and climate appropriations and laws under leadership of chairs and ranking members depending on the majority in each chamber (Figure 10). A good example of working together in a nonpartisan Congress that reminds one of the golden era of environmentalism in the 1970s and 80s and can be again is the \$900 million Land and Water Conservation Fund Act of 2020 passed by 3 to 1 majority or 73 to 25 in the Senate.



**Figure 10.** Congressional water and climate committees (Van Scoyoc 2021)

### Office of Science and Technology Policy

In the White House Office of Science and Technology Policy (OSTP), a new position should be appointed to champion water and climate change policy response across the myriad of the 20 Federal water offices, agencies, and bureaus. In 1976 during the Carter Administration, Congress established the Office of Science and Technology Policy (OSTP) in the White House to advise the President on the effects of science and technology on domestic and international affairs. The OSTP mission is to provide the President with timely scientific and technical advice, ensure the policies of the Executive Branch are informed by sound science; and ensure that the scientific and technical work of the Executive Branch is properly coordinated with the Federal government. The organization of the OSTP should be reworked to include an Assistant Director of Water Policy and Climate Change who would report directly to the Director of OSTP (Table 3)

**Table 3.** Reorganization of OSTP to include Assistant Director of Water Policy and Climate Change

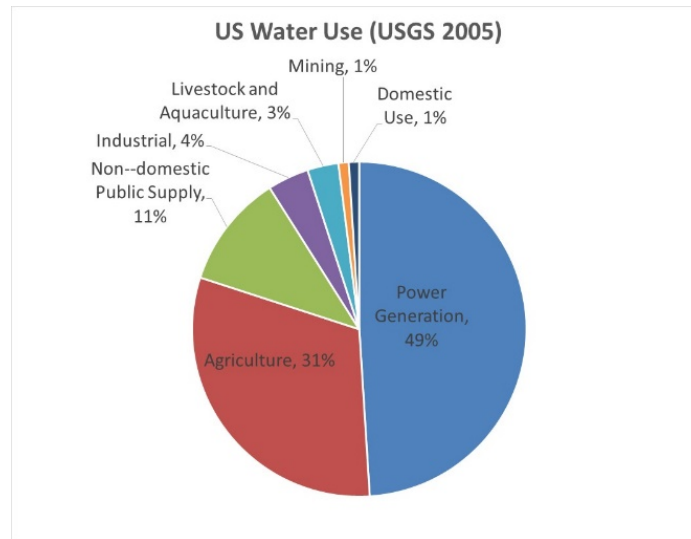
Director Office of Science and Technology Policy (OSTP)
Chief of Staff
Deputy Chief of Staff and Assistant Director
Senior Advisor to the Director
<b>Assistant Director of Water Policy and Climate Change</b>
General Counsel
Deputy General Counsel and Senior Policy Advisor for Oceans and Environment
Assistant Director, Federal Research and Development
Assistant Director, Legislative Affairs
Communications Director and Senior Policy Analyst
Senior Communications Advisor
Senior Policy Advisor, Public Engagement
Policy Advisor to the Chief of Staff

### Economic Benefits of Water

Why clean up waterways? Because water resources are flora and fauna factories that support an annual \$100 billion U.S. economy:

- Rivers supply irrigation, industry, power, drinking water (Figure 11) that support a \$21 billion economy (Kauffman 2010).
- Ecosystem services and wetland habitat in U.S. National Wildlife Refuge is worth \$27 billion (Ingraham and Foster 2008).
- Wildlife recreation supports \$122 billion in expenditures from fishing, hunting, and bird/wildlife watching (USFWS 2008).
- The national outdoor recreation economy is \$140 billion for water sports such as boating, paddling, and sailing (OIA 2017).
- The Delaware River Basin sustains over \$22 billion in annual economic activity and 600,000 jobs (Kauffman 2016).
- The largest estuary in the U.S. (Chesapeake Bay) supports a trillion-dollar economy (Chesapeake Bay 2003).
- The Colorado River supports a \$1.4 trillion economy, 16 million jobs, and 12% of U.S. GDP in CA, AZ, NV, UT, CO, NM and WY (James et al. 2014).
- American Rivers (2020) estimates the U.S. could gain \$220 billion in annual economic activity annually and generate 1.3 million jobs by investing \$82 billion in water and wastewater infrastructure (Figure 12):





**Figure 11.** U.S. water use (USGS 2005)



**Figure 12.** Economic benefits of rivers (American Rivers 2020)

### National Institutes for Waters Resources (NIWR)

Brainpower at the nation's colleges and universities are positioned to restore our waters and the climate. The Water Resources Research Act of 1964 and 1984 established Congressionally designated National Institutes of Water and Technology at the nation's land grant universities to (1) plan, facilitate, and conduct research to aid in the resolution of state and regional water problems, (2) promote technology transfer and dissemination and application of research results, and (3) train scientists and engineers for jobs through their research. The 54 National Institutes for Water Resources (NIWR) at our nation's universities and colleges are located at land grant universities in the 50 states, District of Columbia, Puerto Rico, U.S. Virgin Islands, and Guam (Figure 13). The WRRP Program at universities with over 10 million alumni have trained over 11,000 students and funded thousands of research projects addressing water resources. The water institutes connect university expertise on water-related issues to water users and managers. The 54 National Institutes for Water Resources (NIWR) at U.S. land grant universities focus on water research and training that increases: (1) water available to users, (2) water quality and safety, (3) water supply reliability, (4) skilled U.S. Workforce and decrease (1) water-borne threats to public health, (2) socio-economic water inequities, (3) impacts of flooding events, and (4) water use conflicts (USGS draft 2019).





**Figure 13.** 54 National Institutes for Water Resources (NIWR) at land grant universities across the United States

## AWRA Water Policy

In a call for national water policy published a decade ago General Gerald E. Galloway (2011) with the American Water Resources Association (AWRA) declared that the United States lacks national policies to “face a long list of water challenges” such as:

- More frequent and more severe droughts and increased water demand.
- Degraded water quality with 1970s goal of providing fishable, swimmable, and drinkable water
- Increasing flood damage with Hurricane Katrina and floods in 2008 and 2011 losses higher than average of \$6 billion.
- Aging maritime infrastructure with ports, harbors, and inland waterways critical to national and international commerce.
- Lack of understanding of the water-energy nexus with water critical to extraction of energy resources.
- Crumbling water infrastructure, American Society of Civil Engineers (ASCE) grades water infrastructure at C- up from D+.

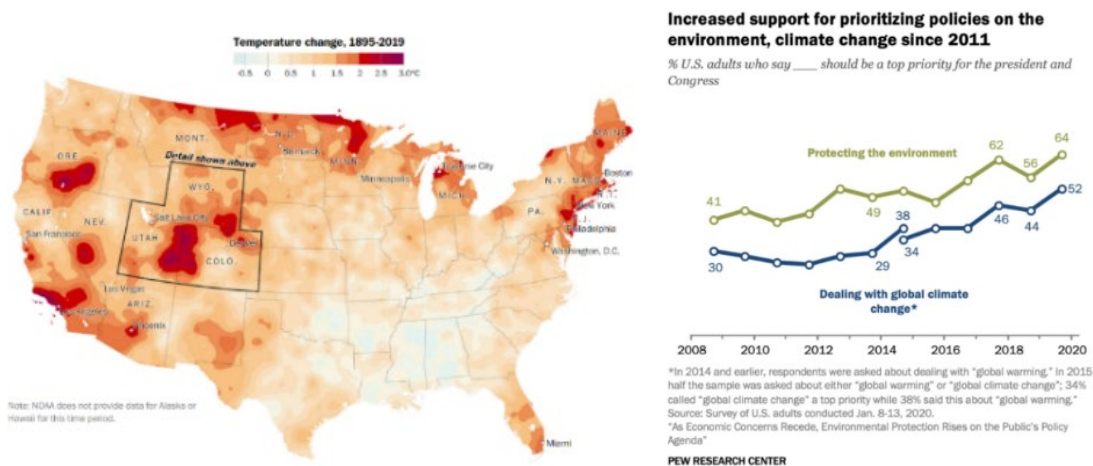
## American Rivers

American Rivers (2020) released a comprehensive position paper this year that recommends Congress invest in rivers with:

- \$50 billion/yr for EPA Clean Water and Drinking Water State Revolving Funds and Water Infrastructure Finance and Innovation Act (WIFIA)
- \$20 billion/yr for FEMA to acquire flood-prone properties through Flood Mitigation Assistance and Building Resilient Infrastructure and Communities Program (BRIC).
- \$10 billion/yr for farm bill programs in the Environmental Quality Incentives Program (EQIP), Regional Conservation Partnership Program (RCCP) and the Agricultural Conservation Easement Program.
- \$15 billion for the DOI National Park Service, National Wildlife Refuge System, Bureau of Land Management, U.S. Forest Service and Bureau of Indian Education.
- \$900 million in permanent annual funding for the Land and Water Conservation Fund (LWCF).
- \$9 billion to create a CCC work program (AmeriCorps) to restore the nation’s public lands with the National Park Service, Bureau of Land Management, Fish and Wildlife Service and U.S. Forest Service.

## Climate Change

Temperatures are increasing in the U.S. and with every passing weather-related disaster there is increasing support from the public to deal with climate change (Figure 14). But how do we know climate change is real? Perhaps because groups as diverse as Wall Street, the banks, corporations, UN, and the military all take it seriously. In December 2020, 40 Fortune 500 companies such as Amazon, Citigroup, Ford and others lined up with the environmental community and urged Congress to rejoin the Paris Climate Accord and work on bipartisan climate solutions. In the tax code the IRS is looking at simplifying and streamlining over 40 green energy tax incentives currently on the books to just three provisions to spur investment in wind, solar, and electric vehicles at the corporate and consumer level.



**Figure 14.** Temperature change (NOAA) and increased support for the environment in the United States (PEW)

**CERES:** This international group of environmentally minded investors calls for U.S. Federal regulators to confront climate change through the the Federal Reserve System, Office of the Comptroller of the Currency, Federal Deposit Insurance Corporation (FDIC), Securities and Exchange Commission (SEC), Fannie Mae and Freddie Mac, and Financial Stability Oversight Council (Ramani 2020).

**United Nations:** UN Secretary General Antonio Guterres warned "Our planet is broken ... and wants to put tackling climate change at the heart of the UN's global mission with net zero refers greenhouse gas emissions as far as possible" and recommends:

- Put a price on carbon.
- Phase out fossil fuel finance and end fossil fuel subsidies.
- Shift the tax burden from income to carbon and from tax payers to polluters.
- Integrate the goal of carbon neutrality (a similar concept to net zero) into all economic and fiscal policies and decisions.
- Help those around the world who are already facing the dire impacts of climate change.

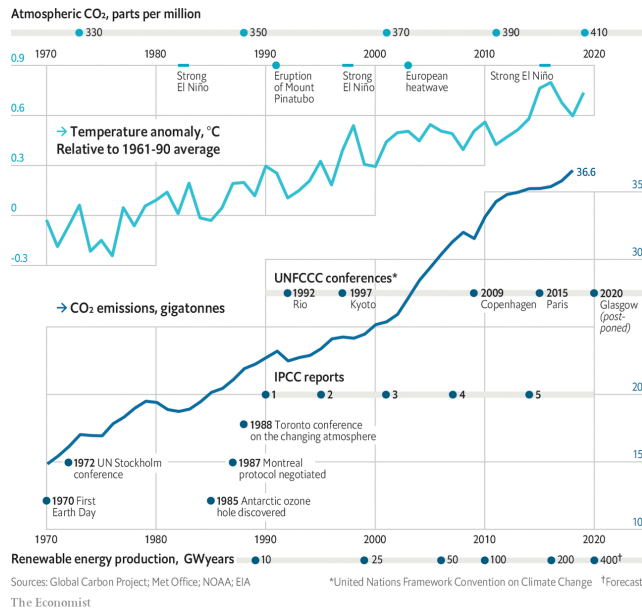
**U.S. Commodity Futures Trading Commission:** The Market Risk Advisory Committee (Behnam et al. 2020) warns that "U.S. financial regulators must recognize that climate change poses serious emerging risks to the U.S. financial system..." recommending:

- The U.S. should establish a price on carbon to be fair and effective in reducing emissions consistent with the Paris Agreement.
- The Commodity Futures Trading Commission (CFTC) should include climate-related financial risks in its reporting to Congress.
- U.S. regulators should join the Sustainable Insurance Forum (SIF) and agenda of G7 and G20 meetings and FSB committees.
- State insurance regulators should require insurers to assess underwriting investment portfolios that are impacted by climate-risks."

**International Treaties:** Since the first Earth Day in 1970 (Figure 15), the U.S. has engaged in a half-century of international climate conventions including the 1972 Stockholm conference, 1987 Montreal protocol, and UN climate conferences in Rio, Kyoto, Copenhagen, and Paris while global temperatures have climbed 3 degrees F and CO<sub>2</sub> emissions have risen by 20 gigatonnes during that span (The Economist 2020). Given that air and water does not respect political boundaries, the U.S. (as still the globe's largest economy) should re-engage, lead, and comply with the world's multilateral environmental treaties including:

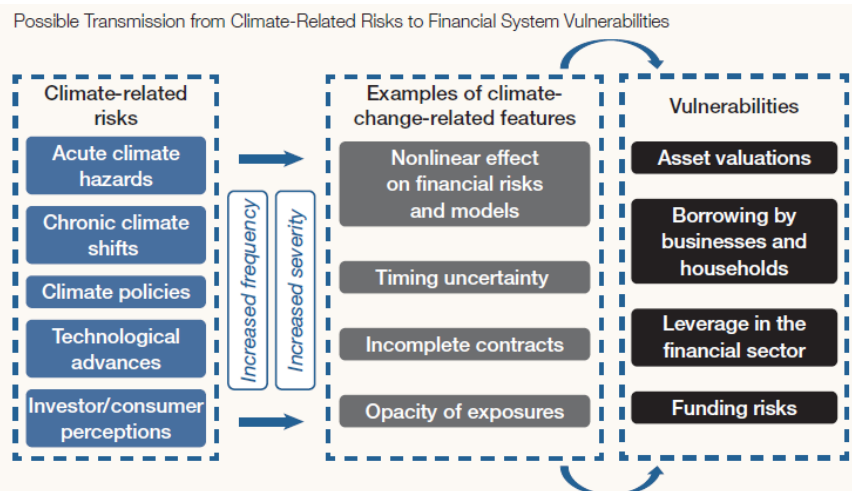
- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (1992)
- Convention of Biological Diversity and Conference of the Parties (COP) from the Rio Earth Summit of 1972
- Framework Convention on Climate Change (1994)
- International Convention for the Prevention of Pollution from Ships, MARPOL (1973 and 1978)
- Kyoto Protocol to the United Nations Framework Convention on Climate Change (2005)
- UN Law of the Sea, UNCLOS (1942)
- North American Agreement on Environmental Cooperation, (1993)
- Ozone Treaties, Montreal Protocol (1989) and the Kigali Amendment on Hydrofluorocarbons (HFCs)
- North American Free Trade Agreement, NAFTA (1994)
- International Boundary Waters Treaty, U.S. and Mexico (1944)

### → Changes, fast and slow, in the climate and its politics



**Figure 15.** Climate change and politics (The Economist 2020)

**Federal Reserve Bank:** In December 2020, the Federal Reserve Board by a unanimous vote of 5-0 joined the Network for Greening the Financial System (NGFS) an association of 75 central banks that agree to reverse climate change by better understanding economic risk (Figure 16). In November 2020, the Fed (2020) warned of the risks of climate change in its Financial Stability Report noting “how climate change ... is likely to increase financial shocks from ... acute hazards, such as storms, floods, droughts, or wildfires and ... chronic hazards (like sea level rise) that have potential to produce similar abrupt repricing events”.



**Figure 16.** Possible transmission from climate-related risks to financial system vulnerabilities (Fed 2020)

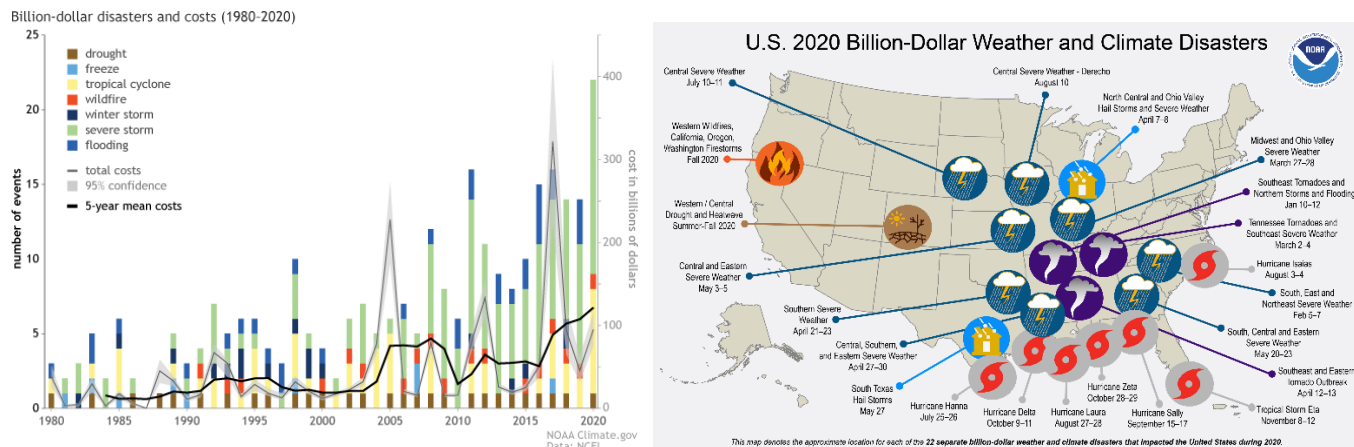
**Bank of Japan:** Furukawa et al. (2020) published a survey on the link between climate change and financial systems finding:

- Real estate properties and stocks do not adequately price in physical risks...
- Natural disasters restrict the credit supply of banks which has adverse effects on the real economy...
- Insurance plays a critical role in mitigating adverse effects of climate change but the need remains to increase coverage.”

**Armed Services:** The Army, Navy, and Air Force take climate change seriously. DOD (2019) in the Pentagon warned Congress in a “Report on Effects of a Changing Climate to the Department of Defense” that “more than two-thirds of the military’s operationally critical installations are threatened by climate change.” In an assessment of 79 installations, which included Army, Air Force and Navy bases, the armed services reported that 53 of the 79 faced current threats from flooding; 43 of the 79 face current threats from drought and 36 of the 79 faced current threats from wildfires.

## Flooding

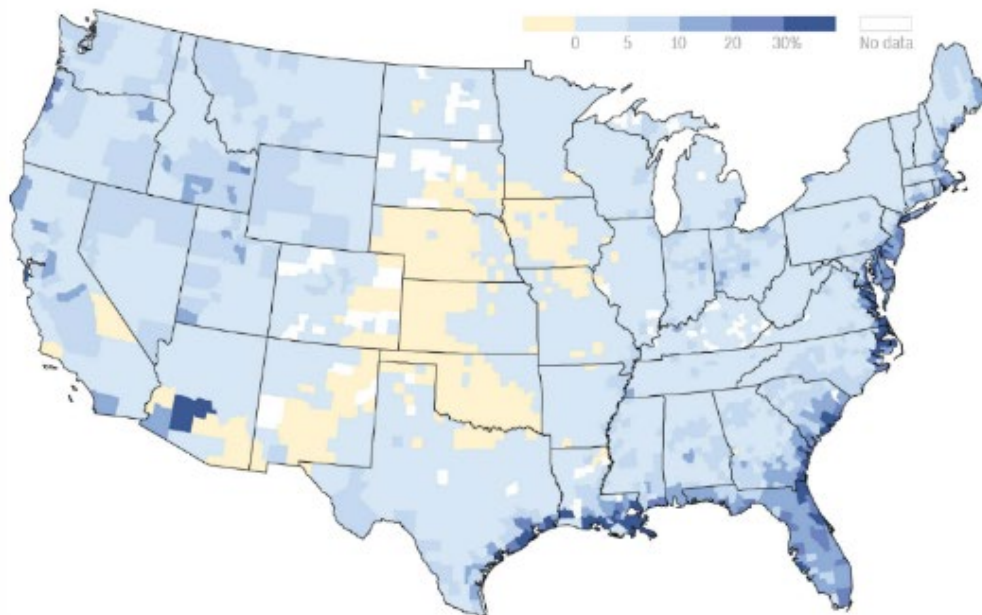
Flooding is the most common and costly disaster causing \$155 billion in damages over the last decade or \$15 billion annually according to FEMA. In 2020, twenty-two billion-dollar weather disasters hit the United States a record dating to 1980 according to Smith (2020) at NOAA (Figure 17).



**Figure 17.** Billion-dollar disaster events (1980-2020) as reported by NOAA (Smith 2020)

The Government Accountability Office (GAO) reported the FEMA National Flood Insurance Program (NFIP) funded 1 million NFIP policies and borrowed \$37 billion from federal taxpayers since 2006 to cover claims from Hurricane Katrina in 2005 and hurricanes Harvey, Irma and Maria in 2017. The 1<sup>st</sup> Street Foundation (2020) found that 8.7 million properties are in FEMA floodplains but up to 15 million properties may be in flood risk areas and need flood insurance. With sea level rise and more extreme storms due to climate change, over 16 million properties may be in the floodplain by 2050 (Figure 18). A homeowner could be expected to be hit with at least one 100-year flood over a typical 30-year mortgage.

Flood risk is projected to grow in many parts of the country. Here is the percentage change from 2020 to 2050 in the number of properties with substantial risk:



**Figure 18.** The number of properties at risk of flooding could climb to 16.2 million by 2050 (1<sup>st</sup> Street Foundation)

In November 2020 Politico published an analysis indicating taxpayers hold more than a trillion dollars in home mortgages with Fannie Mae (est. 1938) and Freddie Mac (est. 1970) holding the majority. The mortgages are packaged so a borrower in Nebraska say may be subsidizing flood prone homes in New Jersey and if properties are destroyed then Fannie Mae and Freddie Mac would pay off the mortgages. Much of a person's worth is locked up in real estate and if homes become uninsurable and unmarketable, property values will plummet perhaps to zero. Catastrophic flooding has real potential to bankrupt Federal flood insurance and mortgage markets.



## Conclusions and Recommendations

We recommend adopting these water and climate change policies to restore the economy and environment of the United States:

1. **Climate Change is Water Change:** The Clausius-Clapeyron relationship establishes for every 2 degrees F increase in temperature, the atmosphere can hold 7% more water vapor. Global warming changes the water cycle increasing humidity and water saturation in the atmosphere and causes more floods, intense drought, snow storms, and sea level rise.
2. **4<sup>th</sup> Era of Environmentalism:** With a new White House and 117<sup>th</sup> Congress, we are entering a new era where water and climate change is again a top priority of the Federal government that began with the \$900 million Land and Water Conservation Fund Act of 2020 passed by 73 to 25 in the Senate.
3. **Clean Water (and Air) is Neither Red or Blue, it is Clear:** Therefore, deliberations on climate change ought to be apolitical and nonpartisan.
4. **Four grand challenges of the day:** Are intertwined and sound Federal water and climate change policy can address: (1) fighting the pandemic, (2) revive the economy, (3) combat climate change, (4) and achieve racial justice.
5. **Bretton Woods of water and climate policy:** It's been five years since we were invited to the March 22, 2016 White House Water Summit and we're looking forward to the next assembly of the nations to define a new world order of water and climate.
6. **The Delaware Way:** Constitutionally, Delaware is the First State and so it is in water. The First State enacted collaborative water and climate programs a generation ago and this cooperative model of working together to clean up the environment is available to the greater United States.
7. **Watershed Approach:** Is one of the fundamental tools in addressing water and climate change challenges since rivers and the atmosphere in the U.S. cross over political boundaries resulting in contentious use of the water resource (**hydro-politics**).
8. **Symphonic Watershed Approach** The problems of complying with the Clean Water Act are not those of science but rather of governance to balance the interests of governments and stakeholders. A model symphonic approach is the Philadelphia's William Penn Foundation's \$100 million program to protect the Delaware River Watershed that supplies drinking water to \$15 million people in Delaware, New Jersey, New York, and Pennsylvania and the first and sixth largest cities in the U.S.
9. **Complex Vertically and Horizontally:** U.S. water and climate management requires coordination between Congress and the White House and hundreds of international, Federal, interstate, state, local and nonprofit agencies. At least 20 Federal agencies in 10 cabinet level departments oversee U.S. water management with a \$30 billion budget or just \$100 per person.
10. **Navy Civil Engineering Command:** Once commanded by President Truman to clean up the Delaware River after the Second World War, the Navy should be charged once again to lead national water and climate change infrastructure efforts.
11. **30 for 30 Program:** The Interior Department should be directed to protect 30% of the nation's land and water by 2030 as introduced by resolution last year by Sen. Tom Udall (NM) and Sen. Michael Bennet (CO) and advocated by E.O. Wilson in the 2016 book Half Earth. Protected lands cover 12% of the U.S. at the Federal, state, local, and nonprofit level.
12. **AmeriCorps (Civilian Climate Corps):** To put people back to work restoring the environment see FDR's Civilian Conservation Corps (CCC), the DOI should ramp up and double the AmeriCorps (the domestic Peace Corps) created by Bill Clinton and Congress under the National and Community Service Trust Act of 1993.
13. **Bureau of Ocean Energy Management: BOEM** should be directed to speed up renewable energy leases in Federal coastal waters to spur the budding off shore wind portfolio that has the potential to generate more than 2,000 gigawatts (GW) with a \$70 billion business to power 600 million homes or double the nation's current electricity generation by 2030.
14. **EPA Clean Water and Safe Drinking Water Revolving Loans:** EPA should convert the Clean Water Act Drinking Water State Revolving Loan Fund (DWSRF) and 1996 Safe Drinking Water Act Clean Water State Revolving Loan Fund (CWSRF) from loans back to the successful Title VI Construction Grants program that awarded \$74 billion between 1988-2010 and cleaned up the nation's waters while supporting millions of public works jobs.
15. **PFAs:** A perfluoroalkyls drinking water standard of 13 parts per trillion (ppt) should be set by EPA to protect/cleanup drinking water of 16 million Americans in 33 states since MA, MI, NH, NJ, NY, VT are the only states with a PFAs standard.

16. **Lead:** The EPA should be funded and tasked to replace lead pipes and build water treatment systems (to be managed by licensed professional engineers) that adjust pH to eliminate the lead problem that poisoned children in Flint, Michigan.
17. **WOTUS:** EPA should restore Clean Water Act protections of Waters of the United States rolled back by the prior administration to again protect 50% of headwater streams and wetlands that supply drinking water for 100 million Americans.
18. **Environmental Justice:** Federal water and climate agencies should recruit scientists who reflect the racial diversity of the U.S. where 40% of the population are people of color (Black, Latino, Asian, Pacific Island, and Indigenous Americans). The EPA should invest clean water, air, and hazardous waste funds to clean up pollution in poor and disadvantaged communities that hold a disproportionate share of hazardous waste sites based on the environmental justice screening tool.
19. **Regenerative Agriculture and Carbon Storage:** To combat climate change, the USDA should fund well-known techniques such as organic farming, no till cropping, and winter cover crops on 20% of the land mass in the U.S. to reduce soil erosion and better store and sequester massive amounts of carbon (370 million tons) in soil. Congress should look into the Commodity Credit Corporation established by FDR during the New Deal to pay farmers to practice soil carbon capture.
20. **Reforestation:** To combat climate change and put thousands of young people to work through AmeriCorps, the USDA Forest Service should be tasked with a massive reforestation program as forests cover 36% of the continental U.S. to provide carbon storage with economic benefits of \$690 billion/yr (\$827/acre).
21. **NOAA and National Weather Service:** Are the centers of Federal climate science positioned one and two degrees of separation below the Secretary of Commerce and ought to be considered for cabinet level positions (comparable to EPA).
22. **FEMA:** Reporting to the Department of Homeland Security, FEMA's response can be uneven (see Katrina) and it used to be a cabinet level office one call from the President and perhaps ought to be so again.
23. **US Coast Guard:** The USCG is perhaps the nation's most effective and efficient Federal agency. It is responsible for protection of the nation's coastal waters (see Katrina) and ought to be budgeted as so to assist more with water and climate change since the U.S. is a maritime nation.
24. **DOE:** The Energy Information Administration projects U.S. electricity from renewables such as wind and solar will exceed nuclear and coal by 2025 and approach natural gas by 2030 meaning the U.S. could meet low carbon or zero emissions goals sooner than 2050 perhaps even by 2030 or 2040.
25. **Department of Transportation:** The USDOT has a key but often underappreciated role in rebuilding transportation infrastructure to bring the nation back from the pandemic and fighting climate change by adopting more stringent fuel standards, expanding mass transit, and increasing the electric vehicle fleet.
26. **NASA:** Although known for the space mission, NASA oversees a \$2 billion earth science program that should be further utilized to combat climate change. NASA operates a satellite fleet that monitors the atmosphere, forests, snow and ice caps, sea level rise, weather systems, terrestrial and atmospheric conditions central to unlocking the secrets of climate change.
27. **Congressional Committees:** The Senate Environment and Public Works (EPW) and House of Representatives Natural Resources committees and subcommittees possess significant authority in passing water and climate appropriations and laws. A good example of Congress working together is the \$900 million LWCF Act of 2020 passed by 3 to 1 majority in the Senate.
28. **Office of Science and Technology Policy:** In the White House OSTP, a new position should be appointed to coordinate water policy and climate change response across the myriad of 20 Federal water agencies and bureaus in 10 cabinet offices. An Assistant Director of Water Policy and Climate Change should be appointed to report directly to the Director of OSTP.
29. **Economic Value of Water:** Water resources support an annual \$100 billion economy in the U.S.: (a) surface waters for irrigation, industry, thermoelectric power, and drinking water worth \$21 billion, (b) \$122 billion in for fishing, hunting, and bird/wildlife watching, (3) national outdoor recreation of \$140 billion for boating, paddling, and sailing, (4) a trillion dollar economy in Chesapeake Bay, and (5) \$22 billion in activity and 600,000 jobs in the Delaware River Basin in DE, NJ, NY, and PA, and (6) the Colorado River supports a \$1.4 trillion economy and 16 million jobs in CA, AZ, NV, UT, CO, NM and WY.
30. **Water and Climate Jobs:** The U.S. could gain \$220 billion in annual economic activity and generate 1.3 million jobs by investing \$82 billion/yr in water and wastewater infrastructure. Per CBO after the 2008 recession, the American Recovery and Reinvestment Act (ARRA) created 4.6 million conservation jobs, reduced unemployment by 1.8%, and generated 33 jobs per

\$1 million invested. Headwater Economics reports the outdoor recreation water economy is \$427 billion with 5.2 million jobs.

31. **National Institutes for Water Resources (NIWR):** The brainpower at our nation's colleges and universities are positioned to restore our waters and the climate. The Water Resources Research Act of 1964 and 1984 established Congressionally designated National Institutes of Water and Technology at 54 land grant universities to focus on water research & training that increases: (a) water available to users, (b) water quality, (c) water supply reliability, (d) skilled U.S. workforce and decreases (a) water-borne threats to public health, (2) socio-economic water inequities, (3) flooding events, and (4) water use conflicts
32. **AWRA Water Policy:** In 2011 General Gerald E. Galloway with the American Water Resources Association declared that the United States lacks national policies to "face a long list of water challenges" such as: (a) more severe drought, (b) degraded water quality, (c) increasing flood damage, (d) aging maritime infrastructure such as ports, harbors, and inland waterways, and (d) crumbling water infrastructure with a grade of D by ASCE.
33. **American Rivers:** Recommends Congress invest in rivers with: (a) \$50 billion/yr for EPA Clean Water and Drinking Water State Revolving Funds, (b) \$20 billion/yr for FEMA to acquire flood-prone properties, (c) \$10 billion/yr for farm bill programs like EQIP and RCCP, (3) \$15 billion for the DOI National Park Service, National Wildlife Refuge System, Bureau of Land Management, U.S. Forest Service and Bureau of Indian Affairs, (d) \$900 million in funding for the Land and Water Conservation Fund (LWCF), and (e) \$9 billion to create a CCC work program (AmeriCorps) to restore nation's public lands.
34. **Climate Change is Real.** Temperatures are increasing in the U.S. as there is increasing support from the public to address policies on climate change. Groups as diverse as Wall Street, the banks, corporations, UN and the military take it seriously. Ceres calls for the Federal Reserve System, Office of the Comptroller of the Currency, Federal Deposit Insurance Corporation, Securities and Exchange Commission, and Fannie Mae and Freddie Mac to address climate change.
35. **Tax Code:** The IRS should simplify and streamline over 40 green energy tax incentives current on the books to just three clean energy credits to spur investment in wind, solar, and electric vehicles at the corporate and consumer level.
36. **United Nations:** Secretary General Antonio Guterres warned "Our planet is broken" and called for "tackling climate change at the heart of the UN's global mission with net zero refers to cutting greenhouse gas emissions."
37. **U.S. Commodity Futures Trading Commission:** The Market Risk Advisory Committee warns that "U.S. financial regulators must recognize that climate change poses serious emerging risks to the U.S. financial system..."
38. **Federal Reserve Bank:** In December 2020 by a unanimous vote of 5-0 the Fed joined the Network for Greening the Financial System (NGFS) an association of 75 central banks that agree to reverse climate change by better understanding economic risk.
39. **Bank of Japan:** Warned of the interaction between climate change and the financial system: (a) real estate properties and stocks do not adequately price in physical risks, (b) natural disasters restrict the credit supply of banks which has adverse effects on the real economy, and (c) insurance plays a critical role in mitigating adverse effect increased coverage is needed.
40. **Bilateral Environmental Treaties:** Given air and water do not respect political boundaries, the U.S. as the globe's largest economy should re-engage, lead, and comply with the world's multilateral environmental treaties negotiated since the first Earth Day in 1970 including the 1972 Stockholm conference, 1987 Montreal protocol on Ozone Treaties and Kigali Amendment on Hydrofluorocarbons (HFCs), and UN climate conferences in Rio, Kyoto, Copenhagen, and Paris while global temperatures has climbed 3 degree F and CO2 emissions have risen by 20 gigatonnes during that span.
41. **Armed Services:** The Army, Navy, and Air Force take climate change seriously. In 2019 the Pentagon warned Congress in a "Report on Effects of a Changing Climate to the Department of Defense" that "more than two-thirds of the military's operationally critical installations are threatened by climate change." with 53 of the 79 faced current threats from flooding, 43 face threats from drought and 36 of the 79 faced current threats from wildfires.
42. **Flooding:** Is the most-costly disaster with \$155 billion in damages over the last decade per FEMA. In 2020, 22 billion-dollar weather disasters hit the U.S. a record from 1980. The GAO reported the FEMA National Flood Insurance Program funded 1 million policies and borrowed \$37 billion from federal taxpayers for Hurricane Katrina claims in 2005 and Harvey, Irma and Maria in 2017. The First Street Foundation found 8.7 million properties are in FEMA floodplains and homeowners could be hit with at least one 100-year flood over a 30-year mortgage. Taxpayers hold a trillion dollars in mortgages with Fannie Mae (est. 1938) and Freddie Mac (est. 1970). Catastrophic flooding could bankrupt Federal flood insurance and mortgage markets.

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