

**AMERICA'S NATURAL SOLUTIONS:
THE CLIMATE BENEFITS OF INVESTING
IN HEALTHY ECOSYSTEMS**

HEARING
BEFORE THE
**SELECT COMMITTEE ON THE
CLIMATE CRISIS**
HOUSE OF REPRESENTATIVES
ONE HUNDRED SEVENTEENTH CONGRESS

SECOND SESSION

HEARING HELD
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CONTENTS

STATEMENTS OF MEMBERS OF CONGRESS

	Page
Hon. Kathy Castor, a Representative in Congress from the State of Florida, and Chair, Select Committee on the Climate Crisis:	
Opening Statement	1
Prepared Statement	3
Hon. Garret Graves, a Representative in Congress from the State of Louisiana, and Ranking Member, Select Committee on the Climate Crisis:	
Opening Statement	4

WITNESSES

Collin O'Mara, President and Chief Executive Officer, National Wildlife Federation	
Oral Statement	7
Prepared Statement	10
Nick Loris, Vice President, Public Policy, C3 Solutions	
Oral Statement	29
Prepared Statement	31
Dr. Sherry L. Larkin, Director, Florida Sea Grant College Program; and Professor, Food and Resource Economics, University of Florida	
Oral Statement	39
Prepared Statement	40
Dr. Cristina Eisenberg, Courtesy Faculty, College of Forestry, Department of Forest Ecosystems and Society, Oregon State University	
Oral Statement	45
Prepared Statement	47

SUBMISSIONS FOR THE RECORD

Report from <i>Developments in the Built Environment</i> , Vol. 4, "Wood buildings as a climate solution," submitted for the record by Mr. Westerman	75
Report from Center for Climate and Energy Solutions (C2ES), "Decarbonizing U.S. Buildings," submitted for the record by Mr. Westerman	75
Report from the Senate Committee on Environment and Public Works (Minority Staff), <i>The Chain of Environmental Command: How a Club of Billionaires and Their Foundations Control the Environmental Movement and Obama's EPA</i> , submitted for the record by Mr. Crenshaw	75
Article by Glenn Kessler in <i>The Washington Post</i> , "The Bogus 'Allegation' that Putin is Funding a California Environmental Charity," submitted for the record by Ms. Castor	75

APPENDIX

Questions for the Record from Hon. Kathy Castor to Sherry Larkin	76
Questions for the Record from Hon. Kathy Castor to Cristina Eisenberg	78

**AMERICA'S NATURAL SOLUTIONS:
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IN HEALTHY ECOSYSTEMS**

FRIDAY, APRIL 1, 2022

HOUSE OF REPRESENTATIVES,
SELECT COMMITTEE ON THE CLIMATE CRISIS,
Washington, DC.

The committee met, pursuant to call, at 9:33 a.m., via Zoom in Room HVC-210, House Visitor Center, Hon. Kathy Castor [chairwoman of the committee] presiding.

Present: Representatives Castor, Bonamici, Brownley, Huffman, Levin, Casten, Neguse, Escobar, Graves, Palmer, Carter, Miller, and Crenshaw.

Also Present: Representative Westerman.

Ms. CASTOR. This committee will come to order.

Welcome to "America's Natural Solutions: The Climate Benefits of Investing in Healthy Ecosystems."

Without objection, the chair is authorized to declare a recess of the committee at any time.

And as a reminder, members participating in a hearing remotely should be visible on camera throughout the hearing.

For members participating in person, masks are optional, as per the Office of Attending Physician.

And as with in-person meetings, members are responsible for controlling their own microphone. Members can be muted by staff only to avoid inadvertent background noise.

And as a reminder, statements, documents, or motions must be submitted to the electronic repository to sccc.repository@mail.house.gov.

Finally, members or witnesses experiencing technical problems should inform committee staff immediately.

Without objection, Representative Bruce Westerman, the gentleman from Arkansas, shall be permitted to join the committee on the dais and be recognized for questioning the witnesses.

So, thank you all for joining this hybrid hearing today. We will review the climate benefits of the investments made in ecosystem restoration and conservation through the Great American Outdoors Act and the Bipartisan Infrastructure Law.

We will also examine opportunities for further investment to create healthy and resilient habitats and communities.

And I will recognize myself now for 5 minutes for an opening statement.

Again, good morning. This is a very important hearing, something that often goes overlooked.

Nature provides us with critical, low-cost tools to tackle climate change. And that is no April Fool's joke. Whether it is forests, grasslands, or mangroves, healthy ecosystems can help significantly draw down the heat-trapping gases that are fueling the climate crisis. Natural places also serve as vital defense structures, providing communities with a cost-effective buffer against worsening climate impacts.

As Congress works to fast track affordable clean energy and as we strive to address the rising costs of climate disasters, we also must invest in nature based solutions that can help us meet America's climate goals and lower costs for Americans.

Restoring and conserving our natural resources will be necessary to avoid permanent damage to the land that we love. So far this year, the number of fires and acres burned across America are nearly double the 10-year average, according to the National Interagency Fire Center. Sea level along our coastline is projected to rise up to 12 inches in the next 30 years according to NOAA. And nearly 60 percent of the continental U.S. is already experiencing drought conditions.

These climate impacts increasingly will harm important sectors of our economy including agriculture, forestry, energy, and tourism. Unless we take urgent action, these industries will be permanently impacted by the climate-fueled loss of species and habitats, which is already taking place.

Americans' lives and livelihoods are at stake. Investing in healthy habitats today will unlock incredible climate benefits for years to come. Thriving ecosystems remove carbon pollution from the atmosphere by acting as natural carbon sinks. And they can significantly help keep temperatures in check through the end of the decade. The same can be said for our bays, lakes, and ocean—which collectively absorbed enormous amounts of heat-trapping carbon dioxide.

Just in my community of Tampa Bay, healthy coastal habitats have the potential to remove about 74 million tons of carbon dioxide from the atmosphere by the end of the century, according to an analysis by Restore America's Estuaries. That is about the same as taking 15.5 million gas-powered cars off the road.

Beyond these climate benefits, investing in healthy habitats also can bolster local economies. Ecosystem restoration projects often act as economic engines, generating local jobs in planning and engineering, manufacturing, construction, ag, recreation, and forestry.

So we know it is important to source these jobs locally and that we carry out these projects with each community's needs in mind from planning to implementation to listening to disadvantaged communities and Tribes.

And over the past few years, Congress has made good progress on conservation and restoration. With the bipartisan Great American Outdoors Act, we made significant investments to enhance parks, forests, wildlife areas, and other public lands.

In that bill, we permanently funded the Land and Water Conservation Fund, which supports recreation and conservation projects across America, and we established the National Parks and Public Lands Legacy Fund, which will address the mainte-

nance backlog affecting critical infrastructure in our national parks and public lands.

And then, through President Biden’s Bipartisan Infrastructure Law, we devoted nearly \$1.5 billion for coastal resilience and community-based restoration and \$2 billion for forest and rangeland restoration. It also includes permanent funding to restore national forests affected by wildfires and other events, as well as millions of dollars to restore fish passages, establish safe wildlife crossings, and protect our estuaries.

But our work is far from done. We must be proactive and incorporate new projects. We must invest in capacity building to bring these solutions to every community. And we must work towards our goal of conserving at least 30 percent of all U.S. land and ocean areas by 2030.

Preserving America’s unique natural heritage has broad bipartisan support. So I look forward to today’s discussion.

I will yield back the balance of my time, and I am pleased to recognize the Ranking Member for his 5-minute opening statement.

Mr. Graves.

[The statement of Ms. Castor follows:]

Opening Statement of Chair Kathy Castor
Hearing on “America’s Natural Solutions:
The Climate Benefits of Investing in Healthy Ecosystems”

April 1, 2022

As prepared for delivery

Nature provides us with critical, low-cost tools to tackle climate change. And that’s no April Fools’ joke. Whether it’s forests, grasslands, or mangroves, healthy ecosystems can help significantly draw down the heat-trapping gases that are fueling the climate crisis. Natural places also serve as vital defense structures, providing communities with a cost-effective buffer against worsening climate impacts. As Congress works to fast track affordable clean energy, and as we strive to address the rising costs of climate disasters, we also must invest in nature-based solutions that can help us meet America’s climate goals and lower costs for Americans.

Restoring and conserving our natural resources will be necessary to avoid permanent damage to the land that we love. So far this year, the number of fires and acres burned across America are nearly double the 10-year average, according to the National Interagency Fire Center. Sea level along our coastline is projected to rise up to 12 inches in the next 30 years, according to NOAA. And nearly 60% of the continental United States is already experiencing drought conditions. These climate impacts increasingly will harm important sectors of our economy, including agriculture, forestry, fisheries, energy, and tourism. Unless we take urgent action, these industries will be permanently impacted by the climate-fueled loss of species and habitats, which is already taking place. American lives and livelihoods are at stake.

Investing in healthy habitats today will unlock incredible climate benefits for years to come. Thriving ecosystems remove carbon pollution from the atmosphere by acting as natural carbon sinks—and they can significantly help keep temperatures in check through the end of the decade. The same can be said for our bays, lakes, and ocean—which collectively absorb enormous amounts of heat-trapping carbon dioxide. Just in my community of Tampa Bay, healthy coastal habitats have the potential to remove about 74 million tons of carbon dioxide from the atmosphere by the end of the century, according to analysis by Restore America’s Estuaries. That’s about the same as taking 15-and-a-half million gas-powered cars off the road.

Beyond these climate benefits, investing in healthy habitats also can bolster local economies. Ecosystem restoration projects often act as economic engines, generating local jobs in planning, engineering, manufacturing, construction, agriculture, recreation, and forestry. It’s important we source these jobs locally, and that we carry out these projects with each community’s needs in mind: from planning, to implementation, to listening to disadvantaged communities and Tribes.

Over the past few years, Congress has made good progress on conservation and restoration. With the bipartisan Great American Outdoors Act, we made significant

investments to enhance parks, forests, wildlife areas, and other public lands. In that bill, we permanently funded the Land and Water Conservation Fund, which supports recreation and conservation projects across the country. And we established the National Parks and Public Lands Legacy Fund, which will address the maintenance backlog affecting critical infrastructure in our national parks and public lands.

And through President Biden's historic Bipartisan Infrastructure Law, we devoted nearly \$1.5 billion for coastal resilience and community-based restoration, and \$2 billion for forest and rangeland restoration. It also includes permanent funding to restore national forests affected by wildfires and other events, as well as millions of dollars to restore fish passages, establish safe wildlife crossings, and protect our estuaries.

But our work is not done. We must be proactive and incorporate new projects. We must invest in capacity building to bring these solutions to every community. And we must work towards our goal of conserving at least 30% of all U.S. lands and ocean areas by 2030. Preserving America's unique natural heritage has broad bipartisan support, so I look forward to today's discussion.

Mr. GRAVES. Thank you, Madam Chair.

Madam Chair, today I would like to announce that my good friends and I have finally seen the light, that I am 100 percent on board with you-all's efforts to move to renewable energy. I am going to switch parties and—

Ms. CASTOR. You are in sync with most of America now. Thank you.

Mr. GRAVES. So April Fool's.

When I talked about switching—I know. Somebody is going to chop that. Somebody is going to chop that.

And just to finish my statement, when I was talking about switching parties, I am going to switch from the Saturday night Mardi Gras Ball to the Sunday night Mardi Gras Ball.

And when I tell you I have seen the light, I do want to clarify that. So we recently had the President, in fact, over the last 4 months announce that he is going to release a total of 260 million barrels from the Strategic Petroleum Reserve. According to EIA, we have imported up to about 200,000 barrels a day of Russian oil. So you can do the math. The President is saying he is going to release a million barrels. Even if you had a refined product, then you are still significantly below that number. And to me, it verifies what we have expressed concern about previously is that the release of the Strategic Petroleum Reserve, our emergency reserves, are actually to mitigate for bad energy policy.

Madam Chair, you just made reference to the Great American Outdoors Act. And you are right. Congress did pass that, and I know there are a lot of people in this room that supported it. But I also want to remind you that every penny of that money that goes toward funding the national parks and wildlife refuges and our BLM lands and forests and it goes to the maintenance, backlog maintenance, every single penny of that is derived from offshore energy production in the Gulf of Mexico.

And so, over the past year, we have seen, just in one year, we have seen—and I can get the exact numbers but I was looking at some numbers just a minute ago. We have seen a reduction of over \$1 billion, over \$1 billion in revenue to the U.S. Treasury that would go to fund the Great American Outdoors Act, as well as funding things like coastal resiliency and hurricane protection in my home State of Louisiana.

And so there is a relationship here. If we continue, as this administration has done, to say we are not going to produce any energy—we are not going to produce it, the only administration in modern history that has not had a single lease sale for onshore or offshore energy in the United States, and so you are having financial implications. It is causing environmental concerns. It is making the people that we represent in south Louisiana along the Gulf Coast more vulnerable, because we are not making investments into hurricane protection and coastal restoration at the same level as we would. And it is going to be a downward trajectory.

And so some say, well, look, I don't want to use oil and gas. Well, even this administration's Energy Information Agency says we are going to have a 50-percent global increase, 50-percent global increase in demand for energy, this administration's projections show an increase in oil and an increase in gas demand, as well as renewables and everything else we need to be doing. We have got to have a strategy moving forward.

Madam Chair, you just talked about American support and the majority of Americans. You know what the majority of Americans have said? 92 percent of Americans, 92 percent have said that they don't want to import foreign oil, that they don't want to bring in oil from Russia. Yet this administration's policies are actually making us more dependent upon foreign resources.

So what did the President do yesterday? He just says, well, we are going to employ the Defense Production Act and we are going to get these critical minerals. Well, just a few months ago, you actually banned critical minerals from being produced in the United States.

The Defense Production Act really is designed for three things. It is designed for national defense. It is designed to respond to disasters. It is designed to respond to terrorism. It is really unfortunate that we are in a situation where we have to employ the Defense Production Act to address terrorism and disasters committed by our own administration.

Look, we are talking about natural solutions today. And I really appreciate it. And I am looking forward to hearing from witnesses because I think, Madam Chair, this is an area where we agree.

I am excited to have Congressman Bruce Westerman, the Ranking Member of the Natural Resources Committee, come in, in a little while. Bruce has been an incredible leader and very well-versed on natural solutions such as the role that trees can play in sequestering greenhouse gases. And as you may know, he has got this legislation, the Trillion Trees Act, that could sequester up to 205 gigatons of carbon through that initiative.

But we also have other things that we ought to be talking about, and that includes our farms. Some of the largest landholders in conservation in the United States are farms. And, in fact, since 1948, their productivity has increased over 280 times, the productivity of our agriculture. And so that is more efficient farming, providing food to the United States and the world and at much more efficient rates, in fact, some of the most efficient production in the world. In fact, I think it is the most productive in world.

But we have additional opportunities to do better best practices and employ better—I don't know how to say that; let me try that

again—employ best practices on a wider scale, and I think we can resolve to working with our farmers, other natural solutions.

And one other thing, Madam Chair, that I want to make reference to that I think affects both of us is restoring or protecting our coastal areas, because when we have our coastal areas erode and are lost, it results in the emissions of greenhouse gases. And, in fact, when I was working for the State of Louisiana, we did one of the first clean development mechanisms in the world relating greenhouse gas emissions to wetlands restoration and protection. I think we have some opportunities there as well.

So I look forward to hearing from our witnesses. And I yield back.

Ms. CASTOR. Now I want to welcome our witnesses.

Today we will hear from experts on the importance of investing in healthy and resilient habitats and communities. We have a great panel.

Mr. Collin O'Mara is the President and Chief Executive Officer of the National Wildlife Federation. Mr. O'Mara leads the country's largest wildlife conservation organization with 52 state and territorial affiliates and nearly 6 million hunters, anglers, birders, gardeners, hikers, paddlers, and wildlife enthusiasts. Prior to NWF, Mr. O'Mara led the Delaware Department of Natural Resources and Environmental Control as Cabinet Secretary from 2009 through 2014.

Mr. Nick Loris is the Vice President of Public Policy at C3 Solutions. Mr. Loris studies and writes about a wide range of energy and climate policies, including natural resource extraction, energy subsidies, nuclear energy, renewable power, and energy efficiency. He also studies ways in which markets will improve the environment, reduce emission, and better adapt to a changing climate.

Dr. Sherry Larkin is the Director of the Florida Sea Grant College Program and Professor of Food and Resource Economics at the University of Florida. As a natural resource and environmental economist, Dr. Larkin leads work to conserve coastal and marine resources and enhance economic opportunities across Florida. She has served as an elected member of the Executive Committee for the International Institute of Fisheries Economics & Trade, as well as President of the North American Association of Fisheries Economists.

The Chair now recognizes Representative Bonamici to introduce Dr. Cristina Eisenberg.

Ms. BONAMICI. Thank you, Chair Castor.

It is my pleasure to introduce Dr. Cristina Eisenberg, an Oregon State University Courtesy Faculty Member at the College of Forestry and an outstanding alumna and alumni fellow. Dr. Eisenberg is a Native American and Latinx conservation biologist and the principal investigator on two multiyear projects within indigenous communities. She served as a Smithsonian Research Associate and as the Chief Scientist at Earthwatch Institute, where she was responsible for overseeing a global research program focused on ecological restoration, climate resiliency, social justice for indigenous peoples, and sustainability.

Dr. Eisenberg has authored numerous journal articles, books, and book chapters. She serves on several boards and advisory coun-

cils. She works to build government-to-government partnerships with Tribal Nations and Federal agencies in a manner that respects the sovereignty, upholds treaty rights, and advances social and environmental justice.

I look forward to hearing more from Dr. Eisenberg, and I thank her for being here today.

And I yield back.

Ms. CASTOR. Thank you, Rep Bonamici.

And I would also like to welcome a number of students who are in the audience today, graduate students. They are in town for the National Association of Graduate Professional Studies' Spring Legislative Action Days. It is a pleasure to have University of Florida Graduate Student Rock Aboujaoude, who serves as Legislative Director of the association and as Director of the Campus Climate Corps in Gainesville.

Welcome also to Dr. John Capece, who has spent his career supporting graduate students and clean water in the great State of Florida.

With that, Mr. O'Mara, you are going to start us off. You are recognized for 5 minutes for your presentation.

STATEMENTS OF COLLIN O'MARA, PRESIDENT AND CHIEF EXECUTIVE OFFICER, NATIONAL WILDLIFE FEDERATION; NICK LORIS, VICE PRESIDENT, PUBLIC POLICY, C3 SOLUTIONS; SHERRY L. LARKIN, DIRECTOR, FLORIDA SEA GRANT COLLEGE PROGRAM, AND PROFESSOR, FOOD AND RESOURCE ECONOMICS, UNIVERSITY OF FLORIDA; AND CRISTINA EISENBERG, COURTESY FACULTY, COLLEGE OF FORESTRY, DEPARTMENT OF FOREST ECOSYSTEMS AND SOCIETY, OREGON STATE UNIVERSITY

STATEMENT OF COLLIN O'MARA

Mr. O'MARA. Thank you, Chair Castor and Ranking Member Graves, for holding this hearing and for having me, giving me the opportunity to testify before you all.

To achieve net zero emissions, we are going to need to reduce net greenhouse gas emissions in the U.S. by about 6 gigatons and, you know, domestically and about 44 gigatons around the globe. We often think about natural climate solutions and natural solutions as a resilience play. But I want to talk today about how this could actually be—these investments could actually be a quarter of the overall solution.

They are kind of the ultimate win-win-win. They are a win on safety. They make communities more resilient. The healthy forests are less likely to experience megafires, helping wetlands and grasslands help reduce damage from hurricanes and inland flooding. They are a win on carbon. They are a multiple-gigaton solution for sequestering carbon.

There are economic wins. They create a ton of good jobs, about more than 17 to 25 jobs per million dollars invested. They both direct restoration jobs, as well as supporting jobs on working landscapes in the outdoor economy.

Number four, the fourth win is that they are—they make communities healthier. For example, urban trees, you know, filter out

pollution out of the air and the water. They reduce urban heat island effects.

And the fifth one is that there is this huge savings. They save a ton of money. Every dollar we spend on pre-storm disaster preparedness saves us \$6 to \$8 in avoided costs, and that is an incredible ROI that is a great way to reduce our long-term debt.

Yet, despite all of this, climate conversations rarely focus as much on natural solutions as they do on technology. And it is less than 5 percent of overall climate spending. And when you consider that really the only emission reduction strategy that also provides resilience benefits that can cost-effectively save lives, it even becomes more absurd that we don't focus on it more.

You know, last year alone we had twenty climate-fueled disasters that caused at least \$1 billion in damages. These disasters resulted in \$145 billion of total damages and the tragic loss of nearly 700 lives in the U.S. Now, imagine how many of those lives could have been saved. And, you know, when disasters, whether it is Hurricane Katrina or Sandy or Harvey or Maria, or the horrific fires out West, I mean, they disproportionately affect communities of color, low-income communities, frontline communities first and worst.

Now when we think about natural climate solutions, we are talking about a few types of key systems. So we are talking about forests. We are talking about wetlands. We are talking about grasslands and shrublands. We are talking about coasts and the marine environment.

Healthy forests are less likely to burn uncontrollably. Right? They help clean water. They help restore water. They reduce drought conditions. They provide key habitat for wildlife, and they serve as our greatest terrestrial carbon sink. Wetlands and repairing corridors, the average acre of wetlands can hold more than 1 million gallons of water, 1 million gallons. I mean, the absorption capacity is huge. So, when communities face a hurricane or a flash flood, those wetlands reduce both the volume and the velocity of water, protecting all those either inland or downstream.

Grasslands and shrublands, native grasses and shrubs have long, deep roots that sequester a lot of carbon, improve soil health, reduce soil erosion, all of which helps reduce flooding and improve productivity, especially when invasive plants like cheatgrass and buffalo grass aren't allowed to spread and get that tender on the landscape.

Coasts and marines also huge opportunities for resilience in carbon abatement on living shorelines, planted dunes, tidal wetlands, mangroves, kelp, seagrass, and other native vegetation. Each of these systems can mean the difference between life and death, homes in better standing, or communities that are washed away, life that is carrying on or lives that are upended.

Now, fortunately, as Chair Castor said, over the last several Congresses and thanks to many of you, we have made great progress on natural climate solutions, especially resilience. You know, we have gone from these niche products to actually mainstream solutions. We have seen this in WRDA, the Farm Bill, the Great American Outdoors Act, America's Conservation Enhancement Act.

We have seen natural infrastructure prominently focused in disaster supplementals. We have seen it in enhancements to the haz-

ard mitigation programs. The Infrastructure and Jobs Act had historic investments, and the reconciliation package had \$105 billion proposed for restoration resilience. We can and must build on these investments and do so in ways that leave no community behind and ensure that communities of color and frontline communities are never an afterthought ever again.

Now the good news is there is a whole range of bipartisan solutions that are before you right now. I would argue that the biggest single action that Congress could take just for private investment in natural solutions is replicating the success of the 45Q tax credit for carbon capture technology and with a complementary credit that is actually focused on the sequestration of carbon naturally.

Sending a clear market signal that is predictable, accessible, additional, permanent, and ecologically appropriate, we could catalyze innovation and private investment onto public-private Tribal lands, while providing policy parity for natural solutions and their technological counterparts.

If you want more greater public investment in—through the Congress and also reduce long-term debt, we could update the way we budget these projects, the way we score these projects. You know, CBO right now score the dollar we spend on mitigation without the fixed dollars in spending—in savings that we would enjoy. And we are spending a lot on supplementals that, frankly, are kind of that pound of cure where the ounce of prevention would have been a lot cheaper.

We also need to continue to prioritize natural solutions in things like WRDA, things like the next Farm Bill, all the ecological restoration programs, and not just like the estuary programs in the Great Lakes and the Chesapeake and the Delaware but coastal Louisiana, the Everglades, coastal communities up and down the coast, and also the working waterways like the Mississippi, the Ohio, the Missouri, the Colorado, the Rio Grande, some of the resources that don't get the attention.

And, finally, I would be remiss, of course, if I didn't mention the Recovering America's Wildlife Act and other great efforts like the North American Grasslands Conservation Act, Wildlife Corridors Act. And hopefully there is a bipartisan path on the Trillion Trees initiative.

So these present a huge opportunity. And investing in natural infrastructure allows us to center the health and safety of people, as well as advancing our climate, conservation, and economic goals. That is a pretty good win-win-win-win.

Thanks for letting me be with you today.

[The statement of Mr. O'Mara follows:]

Written Testimony of Collin O'Mara
President and CEO, National Wildlife Federation
Before the House Select Committee on the Climate Crisis
Hearing on "America's Natural Solutions:
The Climate Benefits of Investing in Healthy Ecosystems"
April 1, 2022

Introduction

Thank you, Chairwoman Castor, Ranking Member Graves, and members of the select committee for holding this hearing. Natural infrastructure is a proven, life-saving, and fiscally responsible solution to sequester carbon and protect communities from the increasingly severe effects of the climate crisis in every state and territory.

Healthy rivers, forests, grasslands, wetlands, shrublands, and shorelines are each essential for resilient communities, carbon sequestration, thriving populations of fish and wildlife, and a vibrant outdoor economy. These natural systems also reduce the need for costly structural flood and storm damage reduction projects and improve the effectiveness and resilience of other critical infrastructure assets. As we confront climate change and anticipate increasingly more frequent and severe storms and weather events, it is essential that we consider all tools at our disposal, including the use of natural systems to help buffer and protect communities.

As we work to confront the immense threats that the changing climate poses to communities today, natural solutions are essential to protecting communities. Climate-fueled hurricanes, heatwaves, fires, floods, and storms are here and their impacts are very real. *Last year alone*, there were 20 climate-fueled disasters that have each caused at least \$1 billion in damages and collectively resulted in \$145 billion in damage and the tragic loss of 688 lives. Natural systems—ranging from healthy forests to coastal wetlands and dunes to healthy floodplains—can mean the difference between life and death, homes still standing or a community washed away, life carrying on or lives upended.

Natural solutions that sequester carbon should also be central to any plan to achieve net-zero emissions—and, through the right incentives and investments, can account for more than 30 percent of the emission reductions needed.

Fortunately, over the past several Congresses, natural infrastructure has emerged as a bipartisan solution to the challenges millions of Americans are facing. We've seen supportive policies and increased investment through the Water Resources Development Act, the Farm Bill, Storm Recovery Supplemental Appropriations, reform of Hazard Mitigation Programs, the Land and Water Conservation Fund, America's Conservation Enhancement Act, annual appropriations, and most significantly, the bipartisan Infrastructure Investment and Jobs Act. And there are many more bipartisan opportunities to do even more.

By continuing to leverage the protective value of nature, we can implement approaches that break the destructive and devastating cycle of climate-fueled unnatural disasters. Resilient natural systems can withstand changing conditions and readily recover from extreme floods, storms, and droughts. They also provide cost-effective and self-sustaining protections and benefits, including reducing flood risks, sustaining fish and wildlife, improving water quality, regulating sediment loading, stabilizing soil, sequestering carbon, and providing recreational opportunities.

Natural infrastructure and nature-based solutions should be a mainstream choice for our infrastructure investments. We know, based on years of evidence, that this approach saves lives and taxpayer dollars. Conserving, restoring, and investing in natural and nature-based features makes communities safer and more resilient by absorbing floodwaters, buffering storm surges, and giving rivers room to spread out without harming homes and businesses. *Studies show* that restoration can create from around 10 to 40 jobs per \$1 million invested. Natural infrastructure reduces the need for new, often expensive structural projects, and provides an important extra line of defense when levees or other structures are required. Natural infrastructure also avoids unintended adverse impacts such as diverting floodwaters onto other communities and inducing development in high risk areas.

For too long, Congress and conservation-focused organizations looked past people when focusing on wildlife, public lands, clean waterways, forests and headwaters, coastal dunes and wetlands, mountain peaks and pristine coasts. This approach has left behind communities of color and treated environmental justice and frontline communities as afterthoughts. We should center the health and safety of people when we prioritize the conservation and restoration of natural systems, while also

advancing our goals to recover wildlife, provide clean water and air, reduce erosion, and promote outdoor recreation—all while sequestering large amounts of the excess carbon dioxide currently in the atmosphere.

On behalf of the National Wildlife Federation, our 52 state and territorial affiliates, and our nearly 7 million members and supporters, we are grateful for the leadership of this Committee in laying out thoughtful policy recommendations for natural climate solutions, including conserving and restoring forests, grasslands, floodplains, and ocean and wetland ecosystems; boosting federal spending for new and existing conservation programs to help farmers and ranchers adopt practices that help wildlife and stabilize the climate; helping wildlife adapt to climate change by establishing wildlife corridors and implementing landscape-scale conservation plans; and ensuring equitable access and benefits from natural climate solutions.

A Highly Cost-Effective Solution

For every \$1 that we spend on pre-disaster mitigation, we will save \$6 to \$8 in avoided damages and taxpayer costs. Because of our archaic budget rules, it's easier to spend hundreds of billions of dollars after a disaster through a supplemental appropriation than it is to invest in the ounce of prevention that could have mitigated the damage in the first place. While we score the immediate cost of \$1 of mitigation, we fail to account for the long-term cost avoidance on disaster relief and recovery. This just doesn't make sense. As a result, we've spent nearly \$300 billion in disaster supplementals over the past decade and that number will only grow. And we urge the committee to consider working with the Senate to amend both rules and statutes like PAY-GO to account for the net-savings that such investments will achieve, while not undercounting the increased expenditures that will accrue without action.

There is a wide and growing body of literature demonstrating how investing in nature before and after natural disasters reduces costs to taxpayers, landowners, and insurers while also saving lives and protecting property.^[1] For instance, coastal ecosystems represent a critical buffer against hurricanes and other storms. One acre of wetlands can typically store 1–1.5 million gallons of floodwater.^[2] According to a 2008 study, coastal wetlands in the United States provide an estimated \$23.2 billion per year in storm protection services, or as much as \$5 million per square kilometer of wetland.^[3]

Living shorelines, such as marshes enhanced with oyster reef breakwaters, hold up better than bulkheads during major storm events.^[4] This protection also comes at lower cost than traditional protective infrastructure. For example, reviving reefs and mangroves can be an order of magnitude more cost-effective than installing seawalls or breakwaters.^[5] Moreover, residents with bulkheads in coastal North Carolina report paying double the cost to repair their property and four times the cost for annual shoreline maintenance when compared to residents with more natural shorelines.^[6] Living shorelines also protect against coastal erosion on a day-to-day basis, while maintaining connectivity of shoreline habitat.^[7]

In coastal Louisiana, investments in wetland restoration generated 28 times as much flood protection, dollar-for-dollar, than a similar investment in six-meter high dikes.^[8] In Florida, it has been estimated that comprehensive restoration of the Everglades would yield a four-to-one return on investment.^[9] And, wetlands can also help industry meet regulatory requirements at lower cost than by constructing costly water treatment facilities.^[10]

Beach restoration and dune nourishment can provide protection from major storm events, boost the local economy through increased recreation, and provide habitat for migratory birds. When Superstorm Sandy hit the East Coast in 2012, Cape May Point, New Jersey, had recently completed a project to widen two miles of the beach, build an 18-foot tall dune, and restore nearby freshwater wetlands. Cape May Point suffered virtually no damage, while surrounding areas sustained \$640 million in losses. A host of birds have flocked to the restored wetlands and beach, and ecotourism from birders is estimated to add more than \$310 million per year to the county's revenue.^[11]

Floodplain acquisition projects have been effective in reducing flood risk, bringing down flood insurance premiums, and creating green spaces for recreation. Along Mingo Creek in Tulsa, Oklahoma, local property owners and businesses have not suffered property losses due to flooding since a voluntary buyout program was implemented in 1984. Additionally, residents have received up to a 35% discount on their flood insurance premiums, which reflects their reduced flood risk.^[12]

Inland, reforestation, climate-smart forest management, and watershed restoration all have the potential to bolster natural carbon sequestration, benefit wildlife, and provide economic benefits including job creation. In Oregon, each dollar of public investment in forest and watershed restoration is multiplied in economic activity between 1.7 and 2.6 times as it cycles through Oregon's economy.^[13] Similarly, it

was estimated that the first year of the Abandoned Mine Land Reclamation Economic Development Pilot Program, alone, would cost less than \$30 million but generate more than \$140 million in revenue while creating 3,000 jobs and attracting more than 600,000 visitors to the region in Kentucky.^[14]

The need to address greater risks from wildfires in many grasslands and forested areas has also grown considerably in recent years due to climate-related increases in extreme heat and drought, combined with higher fuel loads due to nearly a century of over-reliance on fire suppression. Indeed, the cost of wildfire impacts has grown considerably as more people have moved in to the so-called “wildland urban interface.”^[15] A 2015 study estimated that at least 1.1 million homes are at the highest risk from wildfire in the western United States, with a reconstruction cost of \$268 billion dollars.^[16] In turn, land management agencies such as the U.S. Forest Service have had to spend significantly larger portions of their budgets on fire suppression, eroding their ability to fund restoration and management activities to improve ecosystem health and resilience.^[17]

Ecological forest management has emerged as an important concept for addressing wildfire risks as well as enhancing the health of forest systems. Specifically, ecological forest management may include a combination of strategic thinning, prescribed fire, and managed wildfire to reduce the risk of high-severity wildfire and promote healthier, more-resilient forests. Done thoughtfully, the approach can help balance tradeoffs between short-term costs and impacts of treatment with long-term benefits of reduced risks of large, high-severity fires. For example, a combination of thinning and prescribed fire in eastern and southern California was found to have significantly reduced burn severity in trees during 12 wildfires that occurred between 2005 and 2011.^[18]

Further, improved community planning and collaborative risk management efforts, including both targeted codes and ordinances and voluntary, incentive-based approaches, have significantly reduced risks from wildfires. For example, the Firewise USA ® recognition program, a collaborative effort between state and federal agencies and nongovernmental organizations, has been working with communities across the country to reduce wildfire risks by encouraging homeowners to improve defensible space in their neighborhoods. Recent fires have demonstrated the program’s success. For example, two consecutive fires in the community of Indian Lakes Estates, Florida, spared numerous homes and structures due to risk reduction preparations that homeowners made under the program.^[19] Such programs are likely to be increasingly important as insurance companies continue to assess the risks from worsening wildfires and adjust rates and coverage accordingly.^[20]

By updating our scoring rules to account for the net savings we can both increase investment in these life-saving projects, while reducing the long-term national debt projections.

Increasingly Severe Weather Events Are Wreaking Havoc on Communities

Natural climate solutions are essential to our ability to adapt to unavoidable climate impacts, build resilience, and meet net-zero goals. Adaptation is an essential partner to climate mitigation, and nature-based solutions can play a major role for both and provide significant co-benefits for water, air, recreation, hazard reduction, and many other services to society. However, natural climate solutions must value biodiversity and be ecologically appropriate to ensure no harmful unintended consequences.

The Intergovernmental Panel on Climate Change (IPCC) released a report in February that warned climate change is already severely impacting people and the ecosystems we depend on in every region of the world, with the poorest and most vulnerable at greatest risk, and one million animal and plant species facing the threat of extinction—more than any other time in human history. The IPCC also reported that despite an increase in adaptation activities by governments, businesses, and civil society, far more is needed to help people and wildlife prepare for a changing world.

America is facing increasingly severe storms and floods, extreme droughts, massive wildfires and record high temperatures, fueled by a rapidly changing climate.^[21] We have suffered more billion-dollar inland flood disasters in the last decade than in the prior three decades combined. We have endured more billion-dollar hurricane disasters in the last five years than in the decade before.^[22] The human suffering caused by these and many smaller disasters is incalculable, with low-income and frontline communities bearing a disproportionate share of the harm.

The ever-mounting toll of human suffering and economic loss from natural disasters shows no sign of abating and every sign that it will continue to grow. Research shows that both the intensity and number of extreme storms will continue to increase appreciably as our climate warms. In some locations, future extreme events

could be twice as intense as historical averages.^[23] By 2100, previously rare extreme rainstorms could happen every two years.^[24] By 2050, high tides could cause “sunny day” flooding in coastal communities 25 to 75 days a year.^[25] By the end of the century, homes and commercial properties currently worth more than \$1 trillion could be at risk of chronic flood inundation.^[26]

Storms and floods in the United States disproportionately harm Black, Latinx, Indigenous, low-income, and frontline communities. For example, the neighborhood that suffered the worst flood damage during Hurricane Harvey was in an area of southwest Houston where 49 percent of the residents are people of color. Similarly, damage from Hurricane Katrina was most extensive in the region’s Black neighborhoods. In fact, in four of the seven ZIP codes that suffered the costliest flood damages from Hurricane Katrina, at least 75 percent of residents were Black.^[27] Over the next 30 years, the “risk of coastal floods damaging or destroying low-income homes will triple” resulting in the flooding of more than 25,000 affordable housing units each year.^[28]

In addition, “while severe storms fall on the rich and poor alike, the capacity to respond to and recover from flooding is much lower in socially vulnerable populations that even in the best of times are struggling to function.”^[29] Even low levels of flooding can wreak havoc on buildings and the residents who live in them, damaging belongings, disrupting electrical equipment, contaminating water sources and septic systems, and generating mold. These impacts can “cause profound disruptions to families already struggling to make ends meet” and can be particularly challenging to remedy in affordable housing units, which are often in poor repair to begin with.^[30]

Nature-based Solutions to Address Community Climate Risks

As the impacts of climate change accelerate, exposing the limitations of relying only on conventional gray infrastructure, the value of nature-based solutions to address community climate risks is becoming increasingly evident. Known by a variety of terms—including natural infrastructure, natural defenses, natural climate solutions, ecosystem-based adaptation, and natural and nature-based features—nature-based solutions can effectively deliver both climate mitigation and climate adaptation outcomes. In 2016, the International Union for the Conservation of Nature (IUCN) published a global standard for the use of these approaches, defining nature-based solutions (NbS) as “actions to protect, sustainably manage and restore natural and modified ecosystems in ways that address societal challenges effectively and adaptively, to provide both human well-being and biodiversity benefits.”

The use of natural and nature-based systems to address climate risks can encompass a wide range of options, from the protection and conservation of still-intact natural systems, to the restoration of degraded ecosystems, to the use of engineered systems designed to emulate natural system functions. Importantly, nature-based approaches can also be used in concert with structural options to form hybrid or “green-gray” systems for risk reduction. In practice, these approaches can be as simple as planting trees in urban neighborhoods to provide shade and stormwater management benefits or as complex as reengineering riverine systems to restore natural floodplains and lessen flood risks and restore natural ecosystem functioning and biodiversity integrity.

The National Wildlife Federation recently conducted a review and synthesis of nature-based solutions as a contribution to the U.S. Climate Resilience Toolkit’s Steps to Resilience planning framework. This review highlighted the following seven key considerations for incorporating nature-based approaches into community-based climate adaptation planning:

- Recognize natural systems and processes as critical infrastructure
- Consider climate impacts on priority natural assets
- Consider equity implications in the design and application of nature-based solutions
- Ensure that nature-based solutions yield net positive biodiversity benefits
- Seek to protect or restore critical natural infrastructure
- Give natural features and processes space to function
- Integrate nature-based solutions into existing planning processes

The Changing Climate and Massive Habitat Losses Have Pushed Wildlife to the Brink

The changing climate, combined with historic and ongoing destruction, fragmentation, and degradation of vast swaths of habitat, have pushed America’s wildlife into crisis, helping to drive the planet’s ongoing sixth mass extinction of species.^[31] As many as one-third of America’s plant and wildlife species are vulnerable, with one in five imperiled and at high risk of extinction.^[32]

America's freshwater species have been particularly hard hit. Approximately 40 percent of the nation's freshwater fish species are now rare or imperiled.^[33] Nearly 60 percent of the nation's globally significant freshwater mussel species are imperiled or vulnerable, and an additional 10 percent are already extinct.^[34]

Our wildlife crisis extends well beyond rare and endangered species, and now affects many widespread and previously abundant creatures, such as the little brown bat, monarch butterfly, and many of our most beloved songbirds. State fish and wildlife agencies have identified more than 12,000 species nationwide in need of conservation action, and fully one-third of North America's bird species require urgent conservation attention.^[35] The best way to spur collaborative, proactive recovery efforts to save these thousands of species of greatest conservation need is for Congress to pass the bipartisan Recovering America's Wildlife Act (H.R. 2773).

The historic loss and degradation of aquatic wildlife habitat across the country makes each additional acre of wetland lost or natural stream segment channelized even more consequential for the long-term viability of our nation's fish and wildlife. At least ten states have lost more than 70 percent of their wetlands, which provide essential fish and wildlife habitat, while 22 states have lost 50 percent or more of their original wetland acreage.^[36] The construction of levees to reduce the frequency and duration of flooding in the lower Mississippi River Valley is the single largest contributor to wetland losses in the country, according to the Department of the Interior.^[37] Fish and wildlife have also been severely harmed through the pervasive alteration of natural stream flows, including from reservoirs and locks and dams, which have occurred in 86 percent of the almost 3,000 streams assessed by the U.S. Geological Survey.^[38] It is past time that we turn to the most ingenious engineer on the planet, Mother Nature, to help protect people and wildlife alike with natural infrastructure.

Ecosystem Restoration Provides Multiple Environmental, Health, and Economic Benefits

From the Coastal Louisiana to the Everglades and the Great Lakes to the Puget Sound, many iconic ecosystems across the country have associated restoration plans that, with enough support, could enhance the many co-benefits ecosystem restoration provides for communities and wildlife alike. These watershed-wide ecosystem restoration programs and plans were carefully crafted based upon the best available science and with extensive public input. They enjoy broad, bipartisan support, and their success hinges on the construction and maintenance of shovel-worthy infrastructure projects, including natural infrastructure projects. Implementing these plans creates thousands of good-paying jobs through the on-the-ground work needed to restore our nationally significant lakes, rivers, and estuaries. Many federal and state agencies—including the Army Corps of Engineers, Environmental Protection Agency, Department of Interior, Department of Agriculture, and National Oceanic and Atmospheric Administration—have a critical role to play in supporting a robust restoration economy by developing and implementing these watershed-wide restoration plans and programs.

There are also critical watersheds—such as the Ohio River, the Mississippi River, the Delaware River, and coastal Louisiana—where restoration plans exist or are currently under development at the state or regional level. These working watersheds are also home to many low-income and vulnerable communities, who suffer firsthand as a result from the degradation and pollution of these rivers and surrounding floodplains.

The recently passed bipartisan infrastructure law recognizes the multitude of benefits of investing in watershed-wide approaches that utilize natural infrastructure to restore and protect our aquatic ecosystems across the country. For example, it invested more than \$1.7 billion in the Environmental Protection Agency's ecosystem restoration programs, including \$1 billion to clean up toxic pollution, restore fish and wildlife habitat, reduce farm and city runoff pollution, and confront invasive species through the federal Great Lakes Restoration Initiative and \$238 million for the Chesapeake Bay Program, which coordinates Chesapeake Bay watershed restoration and protection efforts. The law also provided nearly \$1 billion for coastal restoration and resilience investments through NOAA and through the National Coastal Resilience Fund, as well as \$1.9 billion for Army Corps of Engineers' aquatic ecosystem restoration efforts across the country, including a historic \$1 billion for efforts to restore the Everglades. It contains a historic amount of funding for water infrastructure, including over \$11.7 billion for the Clean Water State Revolving Fund (CWSRF), of which at least 10 percent of each state's capitalization grants will go toward Green Project Reserve eligible projects, including natural infrastructure projects like wetland restoration and reforestation efforts.

These investments, coupled with annual federal appropriations, will help achieve comprehensive, watershed-wide restoration, enhancing drinking water quality, safeguarding nearby communities from floods and sea level rise, sustaining local and regional economies, protecting wildlife habitat, and creating jobs.

Restored watersheds improve our quality of life, increase property values, provide clean water, support fish and wildlife and enhance outdoor recreation for our families. The on-the-ground work to restore our coasts, lakes, rivers, and estuaries produces jobs and utilizes skills and machinery available in the local workforce, benefiting local economies. These cost-saving, job-creating, and resilience-building investments will also help advance the administration's goals to conserve and restore 30 percent of America's lands and waters.

Continuing to direct federal resources toward these widely-supported and thoughtfully-crafted regional restoration programs are among the smartest and most strategic investments we can make as a nation to create jobs, support regional economies, protect natural resources, enhance fish and wildlife habitat, and make our roads, bridges, water systems, and communities more resilient. These ecologically and culturally-important natural places are nationally-significant hubs of tourism, and many support and protect other critical industries including fisheries, shipping, and energy production. Restoration implementation also supports a \$25 billion "restoration economy" that directly employs 126,000 people and supports 95,000 other jobs, mostly in small businesses. Restoring these great watersheds helps sustain our nation's \$887 billion outdoor recreation economy. Through federal and state restoration we have an opportunity to stimulate growth and produce jobs in regional economies, and to support the national outdoor economy for years to come. Some specific examples of the benefits of investing in ecosystem restoration, and opportunities to expand ecosystem restoration efforts, include:

- **Coastal Louisiana and the Mississippi River Delta:** Large-scale restoration of coastal Louisiana presents a significant opportunity to protect existing infrastructure and industries of national importance, while growing a restoration economy that can be a model for other coastal communities around the world. Resources should be directed to implement critical large-scale restoration projects in coastal Louisiana, drawn from the state's Coastal Master Plan. These investments would protect vulnerable communities, sustain critical wildlife habitat, and create jobs. Additionally, lifting the existing cap on shared Gulf of Mexico Energy Security Act (GOMESA) revenues would increase resources available to sustain a restoration economy.
- **Mississippi River Restoration and Resilience Initiative:** Congress should pass H.R. 4202, the Mississippi River Restoration and Resilience Initiative (MRRRI) Act, to establish a non-regulatory EPA geographic program for the Mississippi River mainstem states. The MRRRI Act centers natural infrastructure solutions that have co-benefits for flood risk reduction, water quality improvements, wildlife habitat, recreation, and other services to communities. It would enhance federal coordination with the Army Corps and other agencies around a shared agenda to improve the overall health and resilience of the Mississippi River, through collaboration with states, Tribes, local governments, and other river stakeholders.
- **Chesapeake Bay Restoration:** The Chesapeake Bay watershed is home to more than 18 million people and spans 64,000 square miles across parts of Delaware, Maryland, New York, Pennsylvania, Virginia, and West Virginia and the entire District of Columbia. Over the past decade, the states and the federal government have jointly committed to a massive restoration program in the Bay watershed to restore the Bay and its tributaries by 2025. The COVID-19 pandemic has set back progress—from delayed implementation of conservation practices on farms to the implementation of stormwater practices in urban areas. None of the watershed's restoration goals can be met without the leadership, guidance and accelerated funding support provided by various federal agencies, especially the Environmental Protection Agency.
- **Delaware River Basin Restoration Program:** More than 13 million people rely on clean drinking water from the Delaware River watershed, including residents of New York City, Philadelphia, Trenton, Camden, and Wilmington. The Delaware River Basin Restoration Program, administered by the U.S. Fish and Wildlife Service, develops a coordinated approach to identify and implement restoration and conservation activities across the Delaware River watershed, including natural infrastructure projects that help restore water quality, enhance water management efforts, improve wildlife habitat, and create public access through the entire Delaware River watershed.

- **Everglades:** The bipartisan plan to restore America's Everglades involves constructing a suite of resilience-building water infrastructure projects designed to remove barriers to water flow and to clean, store, and send water south. Completing the restoration milestones outlined in the Army Corps' Integrated Delivery Schedule for Everglades restoration will create over 65,000 jobs, protect drinking water supplies of more than 9 million Floridians, and enhance wildlife habitat. It will also make Florida more resilient in the face of climate change by defending against saltwater intrusion, strengthening shorelines, protecting coastal and inland communities from flooding, and sequestering carbon through restoring seagrass, mangrove, and wetland habitat. Congress should appropriate \$725 million to the Army Corps of Engineers in FY 23 to maintain critical recent momentum to accomplish keystone projects within the Comprehensive Everglades Restoration Plan.
- **Great Lakes Restoration Initiative:** Investing in the Great Lakes Restoration Initiative, which helps protect, restore, and maintain the Great Lakes ecosystem, will protect the drinking water for over 30 million Americans, create jobs, and safeguard public health. Advancing the implementation of such projects in this region creates a 3-to-1 return on investment in local communities, from new real estate and commercial development, to boosting outdoor recreation and tourism, and more housing options and higher home values.
- **National Estuary Programs:** The EPA's National Estuary Programs help protect and restore water quality and habitat in 28 estuaries of national significance in the United States. These estuaries provide important ecosystem services, create wildlife habitat, support economically significant fisheries, and generate billions of dollars in tourism revenues for the country. This program leverages \$22 on average in local, state and private sector investment for every \$1 of federal funds appropriated to the program.
- **Ohio River Basin:** The Ohio River supplies drinking water to more than 5 million people, and millions more depend on the river for their health, jobs, and quality of life. Unfortunately, the Ohio River basin faces the worst water pollution in the nation that threatens drinking water quality, wildlife habitat, and human health. Resources should be invested in developing and implementing a plan to restore and protect the Ohio River basin ecosystem.
- **Texas Coastal Resiliency Master Plan:** Resources should support ecosystem restoration projects described in the Texas Coastal Resiliency Master Plan, an inclusive stakeholder and community-driven plan that identifies nature-based solutions spanning the entire nearly 400 miles of coastline to help the state shore up its coast and withstand accelerating erosion rates, sea level rise, and increasingly intense Gulf storms.

However, ecosystem restoration and the deployment of natural infrastructure doesn't have to be at the watershed scale to make a meaningful impact. Local and regional restoration efforts around the nation are creating important benefits for people and wildlife. For example, long-term partnerships between the National Wildlife Federation and local communities have led to innovative resilience projects around the country, including in the Great Marsh of Massachusetts, and along the Eastern Shore of Maryland, *in the town of Oxford*, where a project will incorporate living breakwaters into a design that works with nature to protect coastal communities threatened by increased sunny day flooding and coastal storms.

Additionally, as part of the *Resilient Schools Consortium (RiSC) program* for middle and high schools in New York City, public school students aged 12 to 20 are planting and caring for native trees on their school grounds to help mitigate urban heat island and absorb stormwater. They're planting thousands of American beach grass plants to stabilize dunes in the frontline community of Coney Island, Brooklyn. Once mature, these vegetated dunes will help to mitigate flooding and property damage from coastal storms, and help to prevent the migration of sand into shoreline roads. These education efforts are foundational to addressing the multi-generational threat of climate change and the need for adaptation.

An Ounce of Prevention is Worth a Pound of Cure

The value of natural systems for protecting communities has long been recognized. In a 1972 study evaluating options to reduce flooding along the Charles River in Massachusetts, the Army Corps of Engineers concluded:

"Nature has already provided the least-cost solution to future flooding in the form of extensive [riverine] wetlands which moderate extreme highs

and lows in streamflow. Rather than attempt to improve on this natural protection mechanism, it is both prudent and economical to leave the hydrologic regime established over millennia undisturbed.”^[39]

Wetlands prevented an estimated \$625 million in flood damages in the 12 coastal states affected by Hurricane Sandy, and reduced damages by 20 to 30 percent in the four states with the greatest wetland coverage.^[40] Coastal wetlands reduced storm surge in some New Orleans neighborhoods by two to three feet during Hurricane Katrina, and levees with wetland buffers had a much greater chance of surviving Katrina’s fury than levees without wetland buffers.^[41] The forest and other conservation lands that make up the 28,000 acre Meramec Greenway along the Meramec River in southern Missouri contribute about \$6,000 per acre in avoided flood damages annually. Wetlands in the Eagle Creek watershed of central Indiana reduce peak flows from rainfall by up to 42 percent, flood area by 55 percent, and maximum stream velocities by 15 percent.

Evidence of the effectiveness of natural climate solutions in reducing flood and storm damages continues to mount, as highlighted in the National Wildlife Federation’s report, *The Protective Value of Nature*^[42] and in the examples provided as an appendix to this testimony. As aptly noted by the Reinsurance Association of America: “One cannot overstate the value of preserving our natural systems for the protection of people and property from catastrophic events.”^[43]

Natural infrastructure is also often more cost-effective than structural measures. A *recent study* documents that using natural infrastructure solutions to reduce coastal flood risks in Texas, Louisiana, Mississippi, and Florida would have a benefit-cost ratio of 3.5 compared to just 0.26 for levees and dikes. Restoring wetlands in this region could prevent \$18.2 billion in losses while costing just \$2 billion to carry out. Natural infrastructure also has the significant added benefits of being self-sustaining and avoiding the risk of catastrophic structural failures. Importantly, natural infrastructure can work both alone and in combination with more traditional gray infrastructure to reduce flood and storm risks. And while gray infrastructure deteriorates over time, particularly when exposed to climatic conditions that exceed their design parameters, natural infrastructure often has significant adaptive capacity and an ability for self-repair.

A new approach that prioritizes nature-based pre-disaster mitigation and resilience will save taxpayers money and make our communities safer. Far too often, we approach resilience planning through the lens of disaster response and recovery rather than through proactive efforts to increase the resilience of vulnerable communities and water resources before disaster strikes.

One clear example of this is evidenced by the Army Corps’ history of supplemental appropriations. From 2005 to 2016, the Corps received \$31.4 billion in supplemental funding, which amounts to almost half of the agency’s annual discretionary appropriations over that same period. Of those supplemental funds, 87 percent (\$27.2 billion) was respond to flooding and other disasters. With ever increasing effects from storms, these emergency supplemental appropriations have also dramatically increased over time, with the Corps receiving “\$1.1 billion in the 1990s, \$19.2 billion in the 2000s, and \$29.0 billion in the 2010s.” Many of these expenditures could have been avoided, if we had invested in the necessary resilience projects. Even though we know that *for every \$1 invested in pre-disaster mitigation, we save \$6 in avoided costs*, Congressional budgetary rules continue to make it much easier to fund an emergency supplemental appropriation after a disaster than to invest in the ounce of prevention that could have saved money and reduced damage in the first place.

Nature Can Help Mitigate Climate Change

Natural ecosystems also have the ability to sequester and store large amounts of atmospheric carbon, the primary driver of accelerating climate change. Indeed, natural climate solutions have the potential to remove and store more than an additional gigaton of carbon dioxide annually. Such nature-based solutions should be a central component of the nation’s climate mitigation strategy.

Forests and other wooded areas represent one of the best opportunities to remove carbon from the atmosphere quickly, reliably, and relatively cheaply. In 2017, the combination of forest land, harvested wood products, and urban trees in the United States accounted for an estimated net uptake of 730.9 million metric tons of carbon dioxide equivalent (MMT CO₂ eq.)^[44]—the equivalent of 15 percent of our economy-wide CO₂ emissions (Domke et al., 2020). Forested ecosystems also provide an abundance of ecosystem services and societal benefits: they create habitat for wildlife, produce clean water, provide space for recreation, regulate temperatures, and much more. Between 1990 and 2017, “forest land remaining forest land” was the nation’s

largest net carbon sink, and conversions of forest land were the largest source of land-based emissions.^[45] However, these benefits depend on careful policy and program design and implementation. The combined pressures on forests from development, introduced pests and diseases, aberrant patterns of precipitation, fragmentation, and extreme fire can hamper forest growth and even prevent successful regeneration after disturbance.

It is important, however, to optimize rather than maximize carbon in implementing natural solutions. Strategies that focus strictly on maximizing carbon sequestration—such as converting natural habitat to plantations of rapidly growing tree species—may run counter to important ecological and social values. Avoiding conversion of existing forests, especially carbon-rich old growth, increasing reforestation of historically forested areas, and focusing afforestation on severely degraded lands can all balance ecological and climate needs. Management of the nation's forests should also take account of the changing climate, while also restoring natural patterns of fire and other ecological processes. Urban forestry also deserves significantly more attention for its multiple benefits to air quality, reduction in energy use and the urban heat island effect, absorbing stormwater, and providing wildlife habitat.

Forest and watershed restoration not only increase the climate benefits of forests by increasing their ability to store carbon, but also reduce emissions from fire and decay. A rapidly changing climate, including more severe drought and changing weather patterns, coupled with more than a century of fire exclusion and excessive fuels, has increased the size and intensity of wildfire.

Mitigating the size, severity, and effects of forest fires, and reconnecting forest systems, is essential to ensure watershed health and function, and to optimize the climate benefits forests provide. We can and must better manage our forests, as ecologically appropriate, to increase the capacity for our forests to store carbon and produce clean water. The National Wildlife Federation is grateful that the proposed reconciliation package included \$27.5 billion for forest restoration, and we urge the committee to help ensure it remains in any final version that is signed into law.

At the same time, fire is an essential component of many of our forest ecosystems. Prescribed burns can mimic natural processes and reduce fuel loads, unlock nutrients, and reduce the intensity of future wildfires. Furthermore, embracing traditional ecological knowledge and practices and forming authentic partnerships with Indigenous peoples in forest management can be another tool to help to restore the fundamental role fire played in many forested ecosystems, while simultaneously supporting traditional cultural practices and livelihoods (Marks-Block et al., 2021).

Good forest and watershed management is about more than just fire. For example, we need to restore forests at the landscape level and consider their management over longer lengths of time, but also be nimble to account for uncertainty. The U.S. Forest Service estimates that 75–82 million acres of our nation's forests need restoration, including nearly 2 million acres where changes in climate have thwarted nature's ability to reseed and grow forests.

With more than 50 percent of the nation's forestlands under private ownership, it's clear that partnering with landowners will be an essential part of any strategy to increase the climate, wildlife, and community benefits these ecosystems provide. Tax credits for carbon capture accomplished through natural climate solutions could play a key role in halting deforestation, increasing restoration and thereby accelerating greenhouse gas reductions, while providing a host of valuable co-benefits, including increased soil productivity and resilience, water quality and quantity, wildlife habitat and landowner economics. Such a provision could promote additional carbon storage in the soils and vegetation of our nation's private grasslands, wetlands, forests and agricultural lands. Modeling such a tax credit on the 45Q provision for direct air capture could provide parity among natural and technological carbon storage in terms of incentives. In addition, there is a need for incentives to promote responsible, long-term stewardship of forestlands and ensure that the public goods they provide will be enjoyed for years to come. Programs such as those of the Healthy Forests Reserve Program and the collaborative Regional Conservation Partnership Program, which has been used to restore critical longleaf pine (*Pinus palustris*) habitat in the Southeastern United States are critically underfunded.

Since the time of European colonization, we have lost millions of acres of biodiverse bottomland hardwood forests, primarily to conversion for agricultural uses—and when these forests are lost, so are the invaluable services they provide to adjacent communities, including flood water retention and water quality protection (Allen et al., 2004). Investing in restoration of these ecosystems can reduce burdens on gray infrastructure while simultaneously providing habitat where waterfowl and other wildlife can thrive, especially in regions with imperiled wetland forests, such as the *coastal plains* of the Southeast.

We also have abundant opportunities to improve the productivity and resilience of agricultural land through targeted forest restoration. In formerly forested areas, restoring tree cover can block wind to reduce erosion, create habitat for pollinators and other beneficial biodiversity, or even help to diversify farmer’s income with timber products (*USDA, Agroforestry*). We should not, however, encourage afforestation and tree planting in native grasslands and other historically non-forested ecosystems, as this can have dire negative consequences on biodiversity and carbon reservoirs (e.g., Tölgyesi et al., 2022).

As extreme climate events increase in frequency, some agricultural lands may begin to flood so frequently that they transform from asset to liability. Restoring riparian forest buffers (30 meters, or about 100 feet) and reforesting floodplains with bottomland hardwoods represents another enormous opportunity to increase climate mitigation while providing a suite of ecosystem benefits, including flood attenuation, erosion prevention, and habitat conservation for aquatic species (Cook-Patton et al., 2020).

Open urban areas have been identified as another high priority area for reforestation and forest restoration (Cook-Patton et al., 2020). And with around 80 percent of the nation’s residents inhabiting cities, increasing access to nature and ecosystem service provisioning for urban residents may be one of the most impactful actions at our fingertips.

Urban trees in the United States store an estimated 643 million metric tons of carbon, and sequester an estimated 25.6 million tons annually.¹⁴⁶ Urban forests offer an incredible array of other benefits: they moderate the urban heat island effect, lowering energy bills and providing shade and relief from extreme heat; they intercept rainfall, reducing the intensity of storm impacts on urban gray infrastructure; they can be strategically used to enhance air quality—in other words, they can help us to adapt to many of the challenges of climate change (Pataki et al., 2021). Urban forest patches can provide spaces for recreation, reflection, and wildlife observation not available elsewhere in the urban landscape. Their presence can even provide benefits to physical and mental health (Wolf et al., 2020). The Forest Service estimates these services are valued at more than \$18 billion annually (Nowak et al., 2018).

Yet at the present, we know that urban forest canopy cover is often inequitably distributed among racial groups and income levels (Gerrish and Watkins, 2018; Watkins and Gerrish, 2018; *Tree Equity, American Forests*). This exacerbates disparities in exposure, for example, to the urban heat island effect and in related health risks or financial burdens related to cooling. Historical discriminatory policies such as redlining have shaped these patterns of inequity, with formerly redlined communities often containing less than half the tree canopy (Locke et al., 2021) and experiencing elevated temperatures in compared to their counterparts, by an average 2.6°C and up to 7°C (Hoffman et al., 2020).

We can and should take advantage of the benefits urban forests can provide. But interventions must be community-led. Attempts to “green” communities or increase tree plantings without authentic community engagement, consultation, and involvement at all stages can result in unintended and harmful consequences, including displacement resulting from changes in property values, maintenance costs shouldered by residents, and even negative effects on health (Wolch et al., 2015; Jelks et al., 2021). On the other hand, investment in workforce development to support climate-informed urban forest restoration and reforestation presents yet another opportunity to stimulate local economies and create jobs.

Restoring America’s Grasslands for Resilience and Carbon Sequestration

As important as our nation’s forests are, its grasslands and sagebrush steppe ecosystems cannot be forgotten. They are as critical to climate success, wildlife habitat, and clean water, as they are iconic. They are working lands, relied upon by ranchers, farmers, energy developers, hikers, campers and hunters. They are also home to hundreds of species of wildlife, from mule deer to snowshoe hare to meadowlark. Yet, investments in their restoration and management are needed to ensure their role as an important tool in combating climate change.

A 2018 University of California at Davis study surmised that grasslands could be a greater and more reliable carbon sink than forests, because they are less “climate-vulnerable.” Forests store most of their carbon in the soil, but less than grasslands, so when forests, which are more susceptible to climate conditions, burn they release more carbon into the atmosphere relative to grasslands. Jim Blackburn, professor at Rice University and co-director of its Severe Storm Prediction, Education and Evacuation from Disasters Center estimates that grasslands could potentially capture 1 billion metric tons of carbon each year—more than 14 percent of U.S. annual emissions.

Unfortunately, grasslands are the fastest declining ecosystem in the United States, disappearing at rates exceeding those of the Amazon rainforest.^[47] As a result, grassland birds have suffered the steepest losses of all bird species, with populations declining 53 percent since 1970.^[48] At least 60 percent of historical grasslands have been converted to cropland and other land uses, with some areas having lost upward of 90 percent over the last two centuries (Brennan and Kuvlesky 2005). The loss and degradation of these habitats have had, and will continue to have, dire consequences for biodiversity and provisioning of ecosystem services, including their ability to store carbon and contribute to climate change resilience.

These losses are also especially troubling for the thousands of species of pollinators who rely on grasslands as habitat. One out of every three bites of food we eat is supported by pollinators, including wild bees and other species—*adding more than \$15 billion to the nation's crop values.*

Grasslands and sagebrush steppe are threatened by invasive grasses that outcompete native grasses and carry fire, and development and cropland conversion. Invasive cheatgrass covers as much as 100 million acres of land in the United States, a serious problem for wildlife and an accelerant for catastrophic fire on both public and private land. On private land, we lose a football field's worth of grasslands every four seconds to development and cropland conversion. We've lost 40 percent of grassland birds in our lifetimes, and some indicator species, like the Greater Sage-grouse, are teetering on the edge of listing under the Endangered Species Act. We must invest in restoration on our public lands, and find new tools for collaboration to conserve and restore private land.

The highly successful North American Wetlands Conservation Act (NAWCA) provides a model for this type of collaborative work on private lands. It was signed into law in the 1980s when waterfowl numbers were in sharp decline. Because of collaborative action sparked by the act, waterfowl have since increased by 56 percent. Not only do we need to invest in protecting and restoring our federal grasslands, we need to authorize a program for private lands modeled after NAWCA, the North American Grasslands Conservation Act.

To slow continued losses of grasslands to crop production, Congress should make national, the Farm Bill's Sodsaver provision—a common-sense crop insurance reform currently effective in six states (Minnesota, Iowa, North Dakota, South Dakota, Nebraska, and Montana) that reduces crop insurance rates on newly converted agricultural acres for the first three years of production. This reform corrects a policy incentive to convert marginal land to crop production.

Significant investments in grasslands and sagebrush steppe restoration and passage of the North American Grasslands Conservation Act would increase these ecosystems' ability to store and retain carbon, reduce grassland and rangeland wildfire, increase water resources, and improve technology to control cheatgrass and other invasive species.

Making Agricultural Lands More Profitable and Resilient

U.S. farmers and ranchers are uniquely productive compared to the rest of the world. Popular and oversubscribed USDA conservation programs can further enhance and make producers, and their agro-ecosystems, more resilient to extreme weather events exacerbated by climate change. Programs like the Conservation Stewardship Program, Environmental Quality Incentives Program, Conservation Reserve Program, and Regional Conservation Partnerships Program, among others, are examples of public-private partnerships that are in high demand from producers and conservationists but lack the funding to meet that demand. In the past decade nearly 1 million applicants have been rejected by the Environmental Quality Incentives Program, alone (Happ, Michael. 2021. "Closed out: How U.S. Farmers Are Denied Access to Conservation Programs." Institute for Agriculture & Trade Policy. <https://www.iatp.org/documents/closed-out-how-us-farmers-are-denied-access-conservation-programs> (March 28, 2022)).

Agricultural conservation has many co-benefits for farmers, communities, and the climate (Henneron, L., et al. 2015. "Fourteen Years of Evidence for Positive Effects of Conservation Agriculture and Organic Farming on Soil Life." *Agronomy for Sustainable Development* 35: 169–81.). Cover crops enhance soil health by reducing erosion and providing natural weed suppression, reducing unintended consequences of overusing increasingly expensive pesticides and herbicides. Diverse crop rotations can also improve a farm's mitigation and adaptation to climate change by naturally cycling nutrients, reducing pests and disease, and while providing a diversified income stream to producers. Reduced or no-till farming rapidly sequesters carbon in the soil and reduces agricultural runoff and erosion of precious topsoil. Further, producers with livestock and cropping systems can increase soil carbon while reducing costs on feed and fertilizer (Khalil, Mohammad Ibrahim et al. 2019. "Strategic Man-

agement of Grazing Grassland Systems to Maintain and Increase Organic Carbon in Soils.” CO₂ Sequestration. <https://www.intechopen.com/online-first/strategic-management-of-grazing-grassland-systems-to-maintain-and-increase-organic-carbon-in-soils> (June 10, 2020). Fully implementing these practices could remove as much as 100–200 million metric tons of carbon dioxide annually by 2050.^[49]

Technical assistance, research, and extension provided by USDA conservation programs are essential for increased adoption of cover crops, diversified crop rotations, decreased tillage, and livestock grazing integration with row crops, among others. The United States’ topsoil is disappearing at twice the rate as it was during the Dust Bowl (DeLonge, Marcia, and Karen Perry Stillerman. 2020. *Eroding the Future: How Soil Loss Threatens Farming and Our Food Supply*. Union of Concerned Scientists. <https://www.jstor.org/stable/resrep28410> (August 9, 2021)). Unfortunately, USDA conservation programs are greatly oversubscribed and unable to meet the demand from producers and need for conservation practices on the land that can address climate and ensure healthy soil, water and wildlife resources into the future. A doubling of conservation funding would begin to address this demand and need.

Reclamation of Degraded Lands

Investments in reclamation of degraded lands such as abandoned mine lands, orphaned oil and gas wells, brownfield sites, and Superfund sites are also an integral part of the climate solution. With proper management, these lands can be turned into forests, grasslands, prairie lands and soils that have the potential to sequester millions of tons of carbon dioxide annually while mitigating other harmful emissions like methane, protecting biodiversity, improving air and water quality, and revitalizing local economies through job creation and increased property value and tax revenues.

Blue Carbon

Oceans and coastal ecosystems also play a valuable role in mitigating climate change, particularly through the ability of wetlands, mangroves, and seagrasses to capture and store carbon, as well as buffer the effects of sea-level rise and increasingly severe storms. These repositories of “blue carbon” sequester more carbon per unit area than forests, and store carbon for a longer period of time.^[50] Therefore, maintenance and enhancement of these ecosystems are a critical part of a successful climate strategy—for mitigation, climate adaptation, and community resilience objectives.

Key Bipartisan Opportunities for Congress

LEVEL THE PLAYING FIELD FOR NATURAL CLIMATE SOLUTIONS

- **Replicating the Success of 45Q for Natural Climate Solutions:** The broadly supported and bipartisan 45Q federal tax credit for carbon capture, utilization, and sequestration currently provides a much-needed financial incentive for reducing carbon dioxide emissions from industrial sources, power plants, and through direct air capture technologies. An opportunity exists to replicate this successful model to also spur innovation and deployment of capital into natural climate solutions that sequester additional carbon through restoration of our grasslands, forests, wetlands, waters, and agricultural lands.

Creating a 45X tax credit for natural climate solutions would catalyze private investment onto private, public, and Tribal lands, while providing greater policy parity for natural solutions with their technological counterparts. It would be a game changer. In addition to accelerating GHG sequestration, such investments would improve the economics of investing in natural carbon sinks, while also increasing soil productivity, boosting resilience (reducing erosion, etc.), improving water quality/quantity, and providing wildlife habitat.

A 45X tax credit provision could be modeled upon 45Q, providing a per ton credit for additional carbon storage in natural systems at a cost point that’s a fraction of the 45Q incentive levels (\$20–\$30/ton on average natural solutions compared to ~\$50–\$130/ton for CCUS). While the IRS would implement the tax credit, as it does for 45Q, USDA could manage the measurement/practices side for private lands (this could build upon the carbon accounting protocols envisions by the Growing Climate Solutions Act), DOI could manage protocols for investments in public lands (in conjunction with USDA for National Forests), and NOAA could manage protocols for blue carbon. Tax credits could either be refundable (as proposed by the enhanced 45Q) or transferable for when the value of the tax credit is greater than the taxpayer’s tax liability. We believe such an approach would enjoy bipartisan support across the political spectrum.

Key principals for program integrity:

- **Predictability/simplicity:** The credit must be easily understandable and accessible for all communities, especially Indigenous communities, people of color, small landowners, veterans, etc. to ensure equitable distribution of the benefits of the program;
- **Additionality:** Investments must produce new reductions above and beyond the baseline and do not “double pay” for tons already accounted for through carbon offset programs/purchases;
- **Permanence:** Investments must sequester carbon over the long-term; and,
- **Ecologically appropriate:** Restoration/reforestation investments must be ecologically consistent for the project’s location (e.g. native plants) and should provide co-benefits of resilience, habitat, clean water, etc., as documented through a credible, but simple, management plan.

A 45X tax credit could include multiple options for participation:

- **Practice-based option for small landowners:** Tax credit would be determined by approved practices on the land implements (selected from an approved USDA list of practices with well-documented and predictable results that meet standards of additionality, permanence, and ecologically-appropriateness). This approach would allow smaller landowners to participate and could be easily implemented by USDA.
- **Performance-based option for large landowners:** Tax credit is determined by carbon sequestration performance above a baseline as documented by a carbon registry, approved by USDA. This approach would work better for larger landowners, offers opportunities at scale, and encourages innovation.
- **Natural sequestration on public lands and waters:** Tax credit opportunities should also exist for private investment on public lands (BLM, USFS) and waters (NOAA, etc.) to sequester carbon in ecologically-appropriate ways and provide addition public co-benefits. This would drive significant investment into states with significant public lands, while expanding opportunities for job creation and revenues.

Encourage Conservation of Lands with High Carbon Sequestration, Resilience, and Habitat Values: Just as the Congress came together to create Opportunity Zones to encourage private investment in economically distressed communities, similar opportunities exist to improve the economic incentives for conserving lands that have high carbon sequestration, resilience, or wildlife habitat values. Such an approach would recognize the higher public value of these lands and compensate landowners accordingly with a higher incentive level than the one-size-fits all traditional approach that does not consider ecological value.

Pass the Growing Climate Solutions Act: The bipartisan Growing Climate Solutions Act would direct USDA to standardize protocols for measuring carbon sequestration on agricultural lands. This would create new revenue opportunities for America’s farmers through voluntary actions and participation in private and public carbon markets.

ENSURE RESILIENCE INVESTMENTS ACCOUNT FOR NET-SAVINGS IN CBO SCORING

- **Modernize CBO scoring rules:** Through the House Rules package and other vehicles, ensure that investments in resilience that would achieve clear and demonstrable net-savings score as debt-reducing. This would free up resources for proactive investments, end the cycle of ever-growing disaster supplemental appropriations, and reduce long-term debt.

PASS BIPARTISAN CONSERVATION INVESTMENTS

- **Bipartisan Recovering America’s Wildlife Act:** This landmark piece of bipartisan legislation will restore essential wildlife habitat in all 50 states and territories to recover the more than 12,000 species of greatest conservation need through proactive, collaborative and voluntary actions. This will restore natural systems across the country that will also provide critical resilience services for communities and additional carbon sequestration capacity.
- **North American Grasslands Conservation Act:** Grasslands are the fastest declining ecosystem in the United States, but they are also underappreciated powerhouses of carbon sequestration and storage. Authorizing a program modeled after NAWCA should be a top priority.

- **Wildlife corridors:** Helping wildlife adjust to changing and shifting habitat conditions by facilitating wildlife movements is a critical climate adaptation strategy. Congress took a major step forward by passing a comprehensive wildlife crossings program, including the first funding committed to wildlife crossings, as part of the Infrastructure Investment and Jobs Act. Wildlife corridors must also be maintained away from roads and highways. We appreciate that the House of Representatives passed the full Wildlife Corridors Conservation Act as part of the INVEST in America Act and encourage continued work on wildlife corridors legislation and the Tribal Wildlife Corridors Act.
- **Trillion Trees:** The idea of accelerating the pace of forest restoration is a critical climate solution. We're encouraged by the bipartisan, bicameral negotiations that could result in a consensus bill to achieve essential ecologically-appropriate reforestation, resilience, and carbon sequestration goals.

WATER RESOURCES DEVELOPMENT ACT

There are key opportunities that Congress can pursue to enhance the ability of natural ecosystems to provide climate mitigation, resilience, and other benefits to communities in the context of the Water Resources Development Act of 2022, which is currently under development. More specifically, in the 2022 bill Congress should:

- **Increase Organizational Capacity Through a Resilience Directorate.** Congress should establish a Resilience Directorate within the Office of the Chief of Engineers at the Corps of Engineers to improve the Corps' ability to reduce flood risks, promote coordinated planning across districts and Corps business lines and among Federal agencies, and better leverage the benefits of natural infrastructure. The Directorate should be tasked with ensuring that existing programs, authorities, and operations take full advantage of natural infrastructure and adopt modern, comprehensive planning approaches. Critically, the Directorate should have the resources and budgetary authority needed to work and coordinate across Corps business lines to infuse resilience into every aspect of the Corps' work. Congress should also establish "community and natural systems resilience" as a co-equal project purpose for each water resources project to eliminate a perceived barrier to comprehensive resilience planning. These reforms will help the Army Corps—one of our nation's most influential resilience agencies—take full advantage of its programs and authorities to improve community and water resources resilience and avoid piecemeal planning that can increase flood risks and recovery costs.
- **Utilize Federal and State Expertise.** Congress should ensure that the Corps utilizes the expertise of federal and state fish and wildlife experts when planning projects. Congress should direct the Corps to utilize recommendations made pursuant to mandatory Fish and Wildlife Coordination Act reviews that derive from the special expertise of federal and state fish and wildlife experts (e.g., methods and metrics for assessing fish and wildlife impacts and mitigation opportunities). The Corps often ignores these critically important recommendations, leading to projects that cause unnecessary harm and to mitigation plans that do not work. Utilizing these carefully developed state and federal expert recommendations is a common sense, cost-effective way to make projects better and improve planning efficiency.
- **Employ Voluntary Easements to Improve Resilience.** Congress should ensure the Corps has the tools it needs to develop and implement resilient solutions. Congress should: (a) direct the Corps to map all flood easements, conservation easements, and permanently protected lands and waters in the project area when assessing the impacts and benefits of a water resources project; (b) direct the Corps to map the many flood easements already purchased by the Corps across the country to facilitate consideration of those easements when planning projects and updating operating plans; and (c) direct consideration of Corps purchased permanent flood easements as an appropriate natural infrastructure solution. Increasing reliance on voluntary flood and other conservation easements will facilitate development of resilient solutions.

FARM BILL

- **Bolster Working Lands Conservation Programs.** Congress should double the funding levels for these popular and successful programs to ensure they can continue to provide benefits to producers, wildlife, and adjacent communities. The historic funding increases proposed in the House-passed reconciliation bill would accomplish this goal.

- **Develop Workforce and Capacity to Meet Reforestation and Restoration Goals.** With additional stocking of our nation’s lands, forest ecosystems could uptake nearly 20 percent more CO₂ than they already do (Domke et al., 2020). Whether on public and private forestlands, successful reforestation and active forest restoration depends upon the capacity of nurseries to collect seeds and produce healthy growing stock, as well as the availability of a workforce for nursery production, site preparation, planting, and maintenance (Fargione et al., 2021). And with a rapidly changing climate, we need to ensure that nurseries cultivate and supply robust seedlings, suited for local site conditions and—as much as possible—the conditions of the future. According to a survey of nurseries, labor shortages create the largest bottleneck in the “reforestation pipeline” (Fargione et al., 2021). Investing in a 21st-century Civilian Conservation Corps that puts millions of young Americans to work, in a manner that benefits all communities and provides high-quality workforce development to prepare participants for jobs in the private sector, remains one of our best options to address this bottleneck. Investments in infrastructure, innovation, and research in this space are also badly needed. Expanding both public and private nursery capacity via Farm Bill programs and other targeted funding will provide jobs and stimulate rural economies.

Other Key Opportunities:

- **Increase Green Project Reserve Funding Through the Clean Water State Revolving Fund (CWSRF):** Since its inception in 1987, the CWSRF has provided over \$153 billion in low-cost financing to water quality projects across the nation. In 2009, Congress passed the American Recovery and Reinvestment Act, which required that states allocate at least 20 percent of their annual CWSRF capitalization grant for green infrastructure, water efficiency, energy efficiency, and other environmentally innovative projects. It successfully helped shift federal and state wastewater investment toward projects that utilize green and natural infrastructure and promote holistic approaches to wastewater treatment systems. The Green Project Reserve requirement has been extended via appropriations bills every year, but was reduced in Fiscal Year 2012 to 10 percent annually. In order to create additional certainty and incentive for projects that utilize green and natural infrastructure, Congress should permanently require states to use at least 20 percent of their annual CWSRF capitalization grants for the Green Project Reserve. This will help communities finance green infrastructure projects that address climate change, enhance access to green space, protect wildlife habitat, and improve water quality.
- **Ensure Hazard Mitigation Programs Support Natural Solutions:** Hazard mitigation programs at FEMA, HUD, and through the National Flood Insurance Program are significant potential sources of resources for nature-based hazard risk reduction. Although natural infrastructure projects are eligible for many of these programs, challenges exist that impede successful applications for nature-based projects, including in the context of Benefit Cost Analyses and feasibility demonstration requirements. FEMA should continue work to ensure that the Benefit Cost Analysis toolkit is supportive of different nature-based project types, and allows communities to capture the full array of their benefits. The agency should also work to provide communities with additional detailed guidance on designing and successfully applying for funding for nature-based projects. These improvements should be accompanied by additional technical assistance and capacity building support to ensure that all communities benefit from this solution set to improve health and safety. Congress should support expanded consideration of natural solutions for hazard mitigation by requiring at least 15% of funding through the Building Resilient Infrastructure and Communities (BRIC) program to be designated for nature-based projects, and/or by authorizing and directing FEMA to partner with the National Fish and Wildlife Foundation (NFWF) to establish a demonstration grant program designed to fund nature-based projects through FEMA hazard mitigation dollars. By encouraging FEMA to partner with NFWF, Congress can bring NFWF’s unique expertise to efforts to promote nature-based mitigation projects, build capacity at all levels of government, and help to further demonstrate the efficacy and multiple benefits delivered by these types of projects. Additionally, NFWF has flexibility to build public private partnerships to support natural infrastructure projects and to leverage private sector funding to support added investment. Finally, Congress can support natural solutions by fully reauthorizing and reforming the National Flood Insurance Program (NFIP) to ensure NFIP premiums communicate accurate levels of risk, with means-tested assistance for those who cannot

afford actuarial rates; expanding pre-disaster mitigation efforts, including through nature-based solutions; and increasing funding available for updated and climate-informed floodplain maps.

- **Increase Funding Available for Gulf Coast Restoration and Resilience:** Congress should increase offshore energy revenues shared with Louisiana and other states under the Gulf of Mexico Energy Security Act (GOMESA), including by lifting the current cap on revenues shared. The State of Louisiana, through a constitutional amendment, has committed these revenues to restoration and resilience efforts, including implementation of the state’s Coastal Master Plan. With no time to lose in the battle against sea level rise and coastal land loss, additional GOMESA revenues are vital to continue the essential and urgent work that this funding stream has enabled.
- **Mississippi River Restoration and Resilience Initiative:** Congress should pass H.R. 4202, the Mississippi River Restoration and Resilience (MRRRI) Act, to establish a non-regulatory EPA geographic program for the Mississippi River mainstem states, following the successful model in the Great Lakes. The MRRRI Act centers natural infrastructure solutions that have co-benefits for flood risk reduction, water quality improvements, wildlife habitat, recreation, and other services to communities. It would enhance federal coordination around a shared agenda to improve the overall health and resilience of the Mississippi River, through collaboration with States, Tribes, local governments, and other river stakeholders.
- **Enhance the Capacity of Federal Agencies to Access Needed Climate Adaptation Science:** Over the past decade federal agencies have made important advances in developing their capacity to provide support and climate science to natural resource managers and others charged with the conservation and restoration of the nation’s lands, waters, and wildlife. Congress should provide robust budget support to such programs as the U.S. Geological Survey Climate Adaptation Science Center Network, the NOAA Regional Integrated Sciences and Assessments (RISA) Program, and the USDA Climate Hubs. In order to assure the availability of such climate science for natural resource managers, Congress should pass H.R. 6654, the “Climate Adaptation Science Centers Act,” which would permanently authorize the U.S. Geological Survey’s National and Regional Climate Adaptation Science Centers.
- **Support Ocean-Based Climate Solutions:** Congress should advance solutions that leverage and support the immense climate mitigation and adaptation potential of ocean and coastal ecosystems, which can make coastal communities more resilient and can provide for the conservation and restoration of ocean and coastal habitats, biodiversity, and marine mammal and fish populations. This includes efforts to advance the protection and restoration of blue carbon ecosystems including wetlands, mangroves, kelp, and seagrass, to address challenges with ocean acidification impacts, and to protect and restore coral reef ecosystems that buffer communities.
- **Appropriations and other Spending Packages:** As Congress considers how to fund priorities in Fiscal Year 2023 and beyond, the National Wildlife Federation strongly urges you to ensure that America’s lands, waters, and wildlife are not left out of any future investment package. With hurricane and wildfire seasons fast approaching, communities around the country are bracing for another record-breaking year of extreme weather and natural disasters that devastate local economies, ecosystems, and families. Congress has an opportunity to prevent lost lives and livelihoods with proactive, robust investment in natural infrastructure and natural climate solutions.

During the COVID pandemic, Americans sought refuge outdoors—from neighborhood parks to hiking trails to the most remote wilderness spots in our nation. Families and friends were able to connect safely outside, and millions rediscovered or newly adopted lifelong hobbies like hunting, fishing, and bird watching. However, this increased use—coupled with decades of neglect and underfunding—has strained our forests, wetlands, grasslands, and rivers, as well as the wildlife inhabiting them. It is critical that Congress invest in the restoration and resilience of these shared spaces so that future generations may be able to enjoy them.

Our outdoor heritage is part of the fabric of our society, and it supports an \$887 billion outdoor recreation economy. In addition to the economic and societal benefits, these natural landscapes provide a significant opportunity to address the climate crisis, both in adaptation and mitigation. Healthy forests sequester carbon and filter regional water supplies. Resilient shorelines protect communities from storm and

flood damage. Removal of invasive species like cheatgrass helps prevent catastrophic fires. Restoration and resilience projects can be tailored to every community in America, improving safety and putting people to work. That's why we're encouraged that the bipartisan IJA included more than \$50 billion for resilience and restoration projects and that the proposed reconciliation package recommends investing an additional \$100 billion in on-the-ground work like forest restoration and conservation programs at USDA; public lands, national parks, wildlife habitat, and species recovery through the Department of the Interior; funding for Tribal nations; and coastal resilience initiatives at the Department of Commerce. These resources can flow to communities quickly and make an immediate impact, so long as there is sufficient consultation and permitting staff to efficiently process the project proposals.

Conclusion

Thank you again for the opportunity to testify at this important hearing. Natural infrastructure has the potential to mitigate the threats facing millions of Americans while also conserving and restoring the landscapes and waterways essential to our wildlife heritage and way of life.

The good news is that bipartisan investments in natural infrastructure have already started under your leadership. The bipartisan Infrastructure Investment and Jobs Act made historic investment in natural landscapes essential to our water, wildlife, and way of life—as well as natural infrastructure. The law includes \$492 million for the National Coastal Resiliency Fund, a program established in 2018 that invests in restoration and resilience projects that expand natural infrastructure like wetlands and barrier islands. The bill also included \$350 million to support the development and construction of wildlife crossings that will improve habitat connectivity and reduce wildlife-vehicle collisions. These investments, from our coasts to our highway system, will save lives.

These investments show Congress has already started to transition toward natural solutions. On behalf of the National Wildlife Federation, our members, supporters, and affiliates, I would urge you to continue down this path. Natural infrastructure is a proven strategy to save lives, protect homes and businesses, conserve and restore our public lands and waters, and practice fiscal responsibility. Thank you and I look forward to your questions.

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- ^[44]Domke, G.M., B.F. Walters, D.J. Nowak, J. Smith, S.M. Ogle, and J.W. Coulston. 2019. Greenhouse gas emissions and removals from forest land, woodlands, and urban trees in the United States, 1990–2017. *Resource Update FS-178*. Newtown Square, PA: US Department of Agriculture, Forest Service, Northern Research Station.
- ^[45]U.S. Environmental Protection Agency (EPA). 2019. *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2017*. EPA 430-R-19-001. U.S. Environmental Protection Agency: Washington, D.C.
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- ^[47]Wright, Christopher K., and Michael C. Wimberly. 2013. “Recent Land Use Change in the Western Corn Belt Threatens Grasslands and Wetlands.” *Proceedings of the National Academy of Sciences of the United States of America* 110(10): 4134–39.
- ^[48]Cornell Laboratory of Ornithology, *State of the Birds 2019*, <https://www.stateofthebirds.org/2019/download-pdf-report/>

^{149]}National Academies of Sciences, Engineering, and Medicine. 2017. Coastal Blue Carbon Approaches for Carbon Dioxide Removal and Reliable Sequestration: Proceedings of a Workshop—in Brief. Washington, DC: The National Academies Press. doi.org/10.17226/24965.

^{150]}Mulligan, J., et al. 2020. CarbonShot: Federal Policy Options for Carbon Removal in the United States. Working Paper. Washington, DC: World Resources Institute.

Ms. CASTOR. And good job on getting—summarizing your 30-page—

Mr. O'MARA. Voluminous.

Ms. CASTOR [continuing]. Testimony in 5 minutes. Thank you very much.

Mr. Loris, you are now recognized to give a 5-minute presentation of your testimony.

STATEMENT OF NICK LORIS

Mr. LORIS. Thank you. I think Collin said double what I can say in the same amount of time, but I echo a lot of his sentiments. So I appreciate that.

Chair Castor, Ranking Member Graves, and distinguished members of the Select Committee, thanks for this opportunity to testify this morning. My name is Nick Loris, and I am the Vice President of Public Policy at the Conservative Coalition for Climate Solutions.

C3 Solutions is a think tank that focuses on policy reforms to empower entrepreneurs and innovators to solve our greatest energy and environmental challenges. And with my time, I would like to make two brief observations.

The first is to underscore the economic, environmental, and climate benefits of investing in America's natural ecosystems. Active management of America's forests, grasslands, and wetlands will improve air and water quality, restore wildlife habitat, and capture and sequester more carbon dioxide. Forest restoration and eradicating invasive species will also reduce the risk of wildfires, floods, and droughts.

Furthermore, innovative agricultural technologies and practices enable farmers and ranchers to produce more with less. The result is higher yields, cost savings, and healthier soils that prevent erosion and sequester more CO₂. Without active care and investment, however, the mismanagement of America's ecosystems can increase greenhouse gas emissions and pollution, exacerbate the risks of extreme weather, and be an economic drain on communities.

For instance, the 2020 wildfires in California emitted more carbon dioxide than the entire State's fossil fuel emissions that year. Addressing the fuel load through controlled burns and timber harvesting will reduce the size and intensity of wildfires and improve the health of America's forests.

Another major challenge is invasive species, which devalue properties, damage infrastructure, devastate ecological systems, and threaten economic livelihoods. Whether it is cheatgrass increasing wildfire risks, or zebra mussels compromising water infrastructure, invasive species impose significant economic and environmental harm. Allocating resources toward prevention, early detection, and rapid response are the most cost-effective solutions, as they prevent the invasive species from becoming too invasive.

Harnessing the power of incentives is also an effective mechanism to reduce invasive species. For instance, the nutria is a semiaquatic rodent that adversely affects wetlands and vegetation in Louisiana and several other states. Through a federal-state program, participants can hunt and trap nutria and receive \$6 per nutria delivered to a collection center.

Another example is a resource incentive where Florida's Fish and Wildlife Service provides a permit to harvest one additional spiny lobster for every 25 lionfish captured. The State also held a contest to see who could capture the most lionfish, and last year participants collected more than 3,400 in total. These collaborative relationships that utilize incentives are an effective tool to reduce and ideally eradicate invasive species.

The second point I would like to underscore is the importance of reducing or removing barriers that obstruct or delay investments in healthy ecosystems. These projects frequently run into burdensome, time-consuming permitting challenges. In addition, conservation projects can be held up for years in litigation. The significant loss of time to actively thin forests or eradicate invasive species often causes much worse environmental and climate outcomes. Rather than have pragmatic evaluation of risks and tradeoffs, environmental reviews have too often devolved into a tool to stunt the development of cleaner infrastructure and delay projects that will restore America's ecosystems.

To be clear, environmental reviews are a critical part of any project, as is the participation of the public and the communities affected by that project. Modernizing permitting is not about removing environmental safeguards but increasing accountability and improving efficiency.

Permitting reforms will allow preventative and restorative ecosystem investments to occur more resourcefully. Streamlined permitting will stretch taxpayer dollars further and inject more private capital into natural climate solutions. Federal agencies, States, the private sector, and nonprofits will be able to tackle our backlog of environmental priorities with more urgency and efficiency.

With respect to agriculture, pro-growth tax policies will incentivize investment in new farming technologies and equipment. And leveraging Department of Agriculture programs to provide technical assistance for farmers and ranchers who want to pursue regenerative and precision agriculture will improve soil health and better optimize seed planting and treatment application, which will reduce the use of fertilizers, pesticides, fuel, and water.

In conclusion, investment in healthy ecosystems is smart economic and climate policy. Rehabilitating forests, preventing and eradicating invasive species, promoting sustainable agriculture, and encouraging responsible land and water use practices will result in better ecological health, will reduce emissions, and will build up natural resiliencies to a changing climate.

Natural climate solutions and healthy ecosystems will not come from treating America's lands and waters as if they should be stored behind glass in a museum. Instead they require active attention, investment, and management. Policies and regulations should reflect those needs.

Thank you, and I look forward to your questions.
[The statement of Mr. Loris follows:]

**America's Natural Solutions:
The Climate Benefits of Investing in Healthy Ecosystems**

**House Select Committee on the Climate Crisis
United States House of Representatives**

April 1, 2022

Nick Loris

Vice President of Public Policy

Conservative Coalition for Climate Solutions (C3 Solutions)

My name is Nick Loris, and I am the Vice President of Public Policy at the Conservative Coalition for Climate Solutions (C3 Solutions). Thank you for this opportunity to appear before the select committee to discuss the climate benefits of investing in healthy ecosystems.

My written testimony consists of the following two sections:

- **The economic, environmental, and climate benefits of investing healthy ecosystems.** Natural solutions are integral to reducing the risks of climate change. Conservation, restoration, and better land practices create more opportunities for forests, grasslands, and wetlands to capture and store carbon dioxide. Active land management that promotes healthy forests and eradicates invasive species will also reduce the risk of wildfires, floods and droughts. Various farming and ranching practices such as regenerative agriculture and precision agriculture will result in healthier soils and higher yields while sequestering more emissions and reducing the risk of flooding. In addition, integrating natural climate solutions for remediating abandoned mine sites would minimize environmental liabilities make these sites more economically attractive.
- **Expanding opportunities for investments for healthier ecosystems.** Policymakers should reduce barriers to healthy ecosystem investment, improve incentives for productive federal-state and private partnerships to prevent and eradicate invasive species. Furthermore, Congress and the administration should provide pathways to expand the use of regenerative and precision agriculture and implement reforms that generate alternative funding sources for natural climate solutions.

Section I. The economic, environmental, and climate benefits of investing healthy ecosystems

Investing in America's natural ecosystems will expand economic opportunities and reduce environmental liabilities. Moreover, healthier ecosystems will produce climate benefits by reducing greenhouse gas emissions and reducing the risks of extreme weather events. Creating positive incentive structures among private property owners, the federal government, tribes, and state and local governments will improve the environmental health of America's land and water systems. Whether it is healthy forests or regenerative farms, empowering landowners to deploy local and specialized knowledge will best deliver economic, environmental, and climate benefits. Landowners have the most to gain from responsible stewardship and the most to lose from mismanagement. Natural climate solutions and healthy ecosystems will not come from treating America's forests, farmland, grasslands, and watersheds as if they should be stored in a museum. Instead, they require active attention, investment, and management.

Active forest management

Healthy forests are vital for America's environmental health and are an essential natural climate solution. Forests in the United States sequester about 16 percent of annual carbon dioxide emissions.¹ Reducing deforestation and increasing tree cover will protect and enhance a sound natural climate solution to sequester carbon dioxide. Fully restoring understocked, productive forestland in the U.S. could in-

¹ Penn State Extension, "How Forests Store Carbon," September 24, 2020, <https://extension.psu.edu/how-forests-store-carbon#:~:text=According%20to%20the%20US%20Forest,mainly%20in%20trees%20and%20soil.>

crease carbon sequestration by 20 percent.² That is not to suggest a complete stop to logging, mining, building roads or other economic reasons why private property owners may cut down trees. Rather, policymakers should eliminate illegal deforestation, establish defined and legally protected property rights, and increase the availability of compensation for conservation.³

If improperly managed, however, America's forests are an economic, environmental, and public safety liability. Wildfires threaten communities, endanger lives and reduce productivity. They spew exorbitant amounts of pollutants and carbon dioxide emissions into the atmosphere. In 2020, California's wildfires emitted more carbon dioxide than the entire state's fossil fuel emissions.⁴ Wildfires can also cancel out carbon offset projects, where companies purchase carbon dioxide credits to offset their own emissions. Decomposing trees also release carbon dioxide and methane into the atmosphere. While global decarbonization will help minimize human-induced warming's impact on wildfires and wildfire seasons, a more immediate and effective solution to reduce the size of wildfires is to address the fuel load. The fuel load exacerbates the size and intensity of wildfires. Fuel includes grass, shrubs and small trees as well as dead leaves and materials on the forest floor.⁵ Prescribed or controlled burns and timber harvesting will significantly reduce the fuel load, while regulatory morass, litigation, and funding challenges prohibit or impede these activities.

Internationally, establishing defined and legally protected property rights is critical to encourage landowners, including indigenous populations, to reduce global deforestation.⁶ Governments, businesses, and private organizations are dedicating more resources (a combined \$19 billion pledged at the Glasgow climate summit)⁷ to combatting international deforestation. Through domestic rehabilitation efforts and international cooperation, the United States should continue to be an international leader in curbing illegal deforestation and in increasing afforestation efforts.

Address invasive species

Invasive species are an economic and environmental menace for private property owners, communities, and for public lands and waters. The U.S. Department of Agriculture (USDA) explains that the widespread "economic and social impacts of invasive species include both direct effects of a species on property values, agricultural productivity, public utility operations, native fisheries, tourism, and outdoor recreation, as well as costs associated with invasive species control efforts. A 2021 study estimated that invasive species have cost North America \$2 billion per year in the early 1960s to over \$26 billion per year since 2010."⁸ Rising global temperatures make invasive species worse, and invasive species can also increase the threat of extreme weather. A problematic example of an invasive species worsening the size and intensity of wildfires is the pervasion of cheatgrass and buffelgrass.⁹ Invasive species also deteriorate the health of forestland and grassland, which increases erosion and reduces opportunities to sequester more carbon dioxide.

Private property owners have a direct incentive to eradicate invasive species, but those incentives are weaker if eradication requires active planning, coordination and action from multiple landowners. Federal, state, and local government policies and

²Grant M. Domke, et al., "Tree planting has the potential to increase carbon sequestration capacity of forests in the United States," *PNAS*, Vol 117. No 40, October 6, 2020, <https://www.pnas.org/doi/epdf/10.1073/pnas.2010840117>

³Brad Plumer, "A Cheap Fix for Climate Change? Pay People Not to Chop Down Trees," *The New York Times*, June 20, 2017, <https://www.nytimes.com/2017/07/20/climate/a-cheap-fix-for-climate-change-pay-people-not-to-chop-down-trees-uganda.html>

⁴Elizabeth Claire Alberts, "'Off the chart': CO₂ from California fires dwarf state's fossil fuel emissions," *Mongabay*, September 18, 2020, <https://news.mongabay.com/2020/09/off-the-chart-co2-from-california-fires-dwarf-states-fossil-fuel-emissions/>

⁵U.S. Department of Interior, "Fuels Management," <https://www.doi.gov/wildlandfire/fuels>

⁶Kathryn Baragwanath and Ella Bayi, "Collective property rights reduce deforestation in the Brazilian Amazon," *PNAS*, Vol 117., No 34., August 11, 2020, <https://www.pnas.org/content/117/34/20495>

⁷Catrin Einhorn and Chris Buckley, "Global Leaders Pledge to End Deforestation by 2030," *The New York Times*, November 10, 2021, <https://www.nytimes.com/2021/11/02/climate/cop26-deforestation.html>

⁸Ed Arnett, "This Invasive Species Is Fueling Western Wildfires," Theodore Roosevelt Conservation Partnership, August 28, 2020, <https://www.trcp.org/2020/08/28/invasive-species-fueling-western-wildfires/>

⁹Colorado State University, "Cheatgrass and Wildfire" <https://extension.colostate.edu/docs/pubs/natres/06310.pdf>

regulations can further complicate coordination.¹⁰ The Infrastructure Investment and Jobs Act allocates \$100 million each to the Department of Interior and Department of Agriculture to address invasive species.¹¹ Prevention and early detection are the most cost-effective ways to deal with invasive species.

Furthermore, federal and state governments should consider expanding incentive programs to reduce invasive species. For instance, the nutria is a semi-aquatic rodent that adversely affects wetlands and vegetation in Louisiana. Through a federal-state program, participants can trap and hunt nutria and will receive \$6 per nutria delivered to a collection center.¹² Another example is a resource incentive, where Florida's Fish and Wildlife Service provides a permit to harvest one additional spiny lobster for every 25 lionfish (the invasive species) captured. The state also had a contest to see which diver can capture the most lionfish and awards prizes for participants that capture the most. In 2021, the participants collected more than 3,400 lionfish.¹³ Different types of incentive programs (bounty, contractor, community, recreation) are effective and can vary depending on the region and species.¹⁴

Additionally, non-profits are stepping up in a big way. Friends of Tonto National Forest in Arizona, for example, is removing invasive grasses from the national forest after a heavy monsoon season resulted in aggressive growth.¹⁵ Through collaborative relationships with landowners, non-profits and state and local governments, the federal government should continue to prioritize invasive species prevention, early detection systems, and eradication.

Expand regenerative and precision agriculture and invest in innovative agricultural technologies

Regenerative agriculture can diversify farmers' and ranchers' income and produce many environmental benefits. Those benefits include improved soil health and carbon sequestration, cleaner air and water, and diversified, healthier wildlife habitats. Improved soil health also reduces soil erosion and creates land that is more flood and drought resistant.¹⁶ With access to more data, better information, and newer equipment, producers can improve yields while reducing emissions and unwanted environmental byproducts. Automated technologies, GPS, and enhanced imagery better optimizes seed planting and treatment application, which reduces the use of fertilizers, pesticides, fuel, and water.¹⁷

One study has shown that precision agriculture adoption increased corn and soybean yields on existing lands and avoided cultivating another 10.2 million acres of new cropland, the size of 4.5 Yellowstone National parks.¹⁸ Another case study examined the adoption of precision agriculture on a family farm in Illinois and found the family reduced its per acre costs by \$67 and reduced greenhouse gas emissions more than 15 percent.¹⁹

Although not a natural solution, continued innovation and investment in new technologies will drive efficiency, increase output, reduce emissions. Other innovative companies are turning waste into valuable products. For instance, Sedron Technologies processes liquid and solid wastes to useable products for soil nutrition, fer-

¹⁰ Hannah Downey, "What are Invasive Species? A Q&A with Chris Costello," The Property and Environment Research Center, September 12, 2016, <https://www.perc.org/2016/09/12/what-are-invasive-species-a-qa-with-chris-costello/>

¹¹ Laura Bies, "Senate infrastructure bill includes wildlife funding," The Wildlife Society, August 18, 2021, <https://wildlife.org/senate-infrastructure-bill-includes-wildlife-funding/>

¹² Nutria.com, "Coastwide Nutria Control Program," <https://nutria.com/nutria-control-program/coastwide-nutria-control-program/>

¹³ Florida Fish and Wildlife Conservation Commission, "Lionfish Challenge 2021 Update—June 29," June 29, 2021, <https://myfwc.com/news/all-news/lionfish-update-621/>

¹⁴ U.S. Department of Interior Invasive Species Advisory Committee, "Harvest Incentives: A Tool for Managing Aquatic Invasive Species," May 15, 2014, https://www.doi.gov/sites/doi.gov/files/uploads/isac_harvest_incentives_white_paper.pdf

¹⁵ Jen Wahl, "Preventing Arizona wildfires: Non-profit removes invasive plants from desert landscape," *12 News*, February 21, 2022, <https://www.12news.com/article/news/local/wildfire/preventing-wildfires-arizona-non-profit-removes-invasive-plants-from-desert-landscape/75-a3789cb1-2f9c-45e8-94e1-1f489759120d>

¹⁶ The Noble Research Institute, "Regenerative Agriculture Is About Direction Over Perfection," March 2020, <https://www.noble.org/news/publications/ag-news-and-views/2020/march/regenerative-agriculture-is-about-direction-over-perfection/>

¹⁷ Association of Equipment Manufacturers, American Soybean Association, CropLife America, and National Corn Growers Association, "The Environmental Benefits of Precision Agriculture in the United States," <https://app.box.com/s/3s8x8xq1olm2ygmguo8iu56mgaowl41>

¹⁸ *Ibid.*

¹⁹ *Ibid.*

tilizer, and drinking water.²⁰ Pro-growth economic policies that open pathways for more agricultural innovation and investment will maintain American leadership in farming and ranching and deliver natural climate benefits.

Voluntary carbon offset and removal markets

Voluntary carbon markets can be a cost-effective way for companies and individuals to reduce their climate footprint. In effect, landowners would receive compensation for preventing and reducing greenhouse gas emissions or for sequestering carbon. This could include activities such as planting trees or farming and ranching practices that increase carbon sequestration. For companies that have set their own net-zero targets, especially in hard-to-decarbonize sectors, offsets provide a market-based mechanism to reduce or avoid emissions at lower costs. For others, voluntary partnerships provide opportunities for carbon removal. For instance, Shopify's Sustainability Fund has committed \$32 million to carbon removal climate entrepreneurs, many of which are delivering natural climate solutions (for forests, soils, and mineralization).²¹

These markets are not without their challenges. In some instances, offset projects did not materialize in the ways expected. For example, satellite imagery has shown that forest preservation or reforestation projects covered only a fraction of the land they were intended to cover.²² Another challenge is accurately measuring the emissions avoided or reduced. Soil samples taken to measure carbon stored can vary depending on which methods samplers use. Renewable power output can change from day-to-day. A reforestation project could be wiped out by a wildfire. The greatest challenge in verifying offsets is proving additionality. In other words, how can we be sure that farmers or businesses aren't getting paid for something they were going to do anyway? For example, if a company makes an investment in a new energy savings technology for financial reasons, but that technology also reduces emissions, those emissions reductions are not additional. For many reasons, proving or disproving that counterfactual is difficult to do.

These markets, however, have made dramatic improvements in collecting accurate data, improving carbon accounting methodologies, and having transparent, proper oversight. Third-party verifiers are improving methods to demonstrate the veracity of emissions reductions. For instance, one verifier tests soil at the beginning of an offset project, collects samples over the years and then inputs the data "into an agricultural carbon model that estimates the sequestration that's taken place."²³ Other companies, including Nori, are using blockchain technology to create a voluntary, verifiable carbon removal market for buyers and sellers.²⁴ The Environmental Defense Fund, World Wildlife Fund and Oeko-Institut (Germany) are setting up a carbon credit quality initiative.²⁵

Like other methods to rehabilitate ecosystems that produce climate benefits, incentives matter. Jonathan Wood, research fellow at the Property and Environment Research Center (PERC), writes that carbon markets will work best when they "incentivize compliance, rather than relying on enforcement."²⁶ Wood writes, "If offsets are only purchased to comply with the regulation, neither the purchaser nor the seller necessarily has the incentive to ensure that the offsets provide results. Instead, those incentives depend on how closely the regulator scrutinizes transactions and monitors long-term compliance."²⁷ With the right incentive structure and through weeding out fraudulent credits, voluntary carbon markets can make meaningful gains in reducing emissions and reducing risks of climate change.²⁸ The

²⁰ Sedron Technologies, <https://www.sedron.com/varcor/>

²¹ Shopify, "Going All In To Get Carbon Out: Shopify's Commitment to Climate Entrepreneurs Reaches \$32M," March 28, 2022, <https://news.shopify.com/going-all-in-to-get-carbon-out-shopifys-commitment-to-climate-entrepreneurs-reaches-32m>

²² Lisa Song, "An Even More Inconvenient Truth: Why Carbon Credits for Forest Preservation may be Worse Than Nothing," *ProPublica*, May 22, 2019, <https://features.propublica.org/brazil-carbon-offsets/inconvenient-truth-carbon-credits-dont-work-deforestation-redd-acre-cambodia/>

²³ Jim Giles, "Digging into the complex, confusing and contentious world of soil carbon offsets," *GreenBiz*, February 26, 2021, <https://www.greenbiz.com/article/digging-complex-confusing-and-contentious-world-soil-carbon-offsets>

²⁴ Nori, "The Nori Carbon Removal Marketplace," <https://nori.com/>

²⁵ Environmental Defense Fund, "Carbon Credit Quality Initiative: Assessing the quality of carbon credits," August 3, 2021, <https://www.edf.org/climate/carbon-credit-quality-initiative>

²⁶ Jonathan Wood, "A Role for Carbon Markets?" *The Property and Environment Research Center*, May 29, 2019, <https://www.perc.org/2019/05/29/a-role-for-carbon-markets/>

²⁷ *Ibid.*

²⁸ Steve Schwartzman, et al., "What ProPublica's forest carbon credits story still gets wrong—and right (with update)," *Environmental Defense Fund*, May 23, 2019, <http://blogs.edf.org/climate/2019/05/23/what-propublicas-forest-carbon-credits-story-gets-wrong-and-right/>

federal government could be a hub of information, offer technical assistance,²⁹ and provide any necessary verification for the inclusion of carbon markets in international agreements.³⁰

Embrace sound science on genetically modified crops and genetically engineered animals

Genetically modified (GMs) crops have been paramount to feeding American households and enabling farmers to produce higher yields with fewer resources. Genetically modified crops such as golden rice have been instrumental in combatting global hunger and malnutrition.³¹ These crops are safe, tested and approved by regulatory agencies in the U.S. (Food and Drug Administration) and around the world. By improving output on existing cropland and reducing the use of herbicides and insecticides, GMs have significant environmental and climate benefits (both for emissions reductions and climate resiliency).

A June 2020 study found that, in 2018, GM crops raised farm income nearly \$19 billion and raised farm income \$225 billion from 1996–2018. The same study found that in 2018 the “combined GM crop-related carbon dioxide emission savings from reduced fuel use and additional soil carbon sequestration were equal to the removal from the roads of 15.3 million cars.”³² Similarly, genetically engineering animals has proven to make them healthier, more productive, and more environmentally friendly. For example, genetically engineered cows have more disease-resistant milk, which reduces the emissions per gallon of milk produced.³³ Moreover, researchers have inserted a gene into cows to produce more male offspring, which weigh more but eat less.³⁴ Again, the result is greater output with a small environmental footprint.

Section II. Expanding opportunities for healthy ecosystem investment

There is no shortage of opportunities to invest in America’s natural ecosystems and reap the economic, environmental and climate benefits that come with it. To capitalize on those opportunities, policymakers should reduce the regulatory barriers that obstruct or delay ecosystem investment. Congress and the administration should also explore ways to improve incentives for constructive partnerships and generate alternative funding sources for natural climate solutions.

Such reforms offer several noteworthy advantages. Permitting reforms will allow preventative and restorative ecosystem investments to occur more resourcefully. Efficient permitting and collaboration will stretch taxpayer dollars further, inject more private capital into natural ecosystem rehabilitation, and incentivize investments in stewardship. The outcome will be a cleaner environment, more protection from extreme weather and greater reductions in greenhouse gas emissions. To that end, policymakers should:

- **Streamline forest and invasive restoration projects, expedite judicial review, and expand opportunities for timber development.** An April 2021 PERC report highlights the environmental and climate benefits of forest restoration. The report details many pragmatic recommendations to expedite forest restoration processes and encourage collaborative partnerships.³⁵ Notable policy solutions include making categorical exclusions easier to apply for, excluding prescribed burns from state emissions calculations, requiring lawsuits to be filed quickly and resolved quickly, narrowing the scope of the Endangered Spe-

²⁹ See, for instance, Senator Mike Lee’s amendment to the Growing Climate Solutions Act, <https://www.lee.senate.gov/2021/6/growing-climate-solutions-act>

³⁰ Frank Watson, “COP26: Nations strike deal on international carbon markets at Glasgow summit,” *S&P Global*, November 14, 2021, <https://www.spglobal.com/commodity-insights/en/market-insights/latest-news/energy-transition/111421-cop26-nations-strike-deal-on-international-carbon-markets-at-glasgow-summit>

³¹ Daniel Norero, “Unfairly demonized GMO crops can help fight malnutrition,” *Alliance for Science*, June 20, 2018, <https://allianceforscience.cornell.edu/blog/2018/06/unfairly-demonized-gmo-crops-can-help-fight-malnutrition/>

³² Graham Brookes & Peter Barfoot, “GM crops: global socio-economic and environmental impacts 1996–2018,” *PG Economics, Ltd, United Kingdom*, June 2020, <https://pgeconomics.co.uk/pdf/globalimpactfinalreportJuly2020.pdf>

³³ Robert Wall et al., “Genetically enhanced cows resist intramammary *Staphylococcus aureus* infection,” *Nat Biotechnol.* April 2005, <https://pubmed.ncbi.nlm.nih.gov/15806099/>

³⁴ Kristin Houser, “This genetically modified cow could transform beef production,” *Freethink*, July 26, 2020, <https://www.freethink.com/science/gmo-food>

³⁵ Holly Fretwell and Jonathan Wood, “Fix America’s Forests: Reforms to Restore National Forests and Tackle the Wildfire Crisis,” *The Property and Environment Research Center*, April 12, 2021, <https://www.perc.org/2021/04/12/fix-americas-forests-reforms-to-restore-national-forests-and-tackle-the-wildfire-crisis/>

cies Act to on-the-ground impacts of endangered species, opening timber markets for export, and allowing the Forest Service to be a “Good Neighbor” with states, tribes, and counties.³⁶

- **Maximize funding and flexibility for wildfire prevention, reforestation, and afforestation efforts.** Bipartisan legislative proposals including the Emergency Wildfire and Public Safety Act³⁷ and the Trillion Trees and Natural Carbon Storage Act³⁸ have many sensible provisions to improve wildfire prevention and enhance natural climate solutions. The bills would provide funding and accelerate the use of fire detection equipment (including the use of satellites), matching grant programs for tree planting, seed and sapling funding, and small tweaks to federal agency technical assistance for carbon sequestration and forest management activities. Congress should also explore mechanisms to solve budgeting challenges of long-term forest restoration projects. As the PERC report underscores, “Under the Antideficiency Act and appropriations rules, the Forest Service cannot obligate funds in advance of appropriations or after funding has expired. This constrains its ability to participate as an equal financial partner when states, tribes, or private groups are willing to contribute funds to forest restoration.”³⁹ PERC recommends the creation of a restoration fund that would provide the funding certainty and commitment toward long-term projects.
- **Reform the National Environmental Policy Act.** Investments in healthy ecosystems and natural climate solutions often run into burdensome, time-consuming permitting challenges. In addition, conservation practices can be held up for years in litigation. The consequence has been missed opportunities to thin forests or eradicate invasive species, resulting in much worse environmental and climate outcomes. A common obstacle that can block or delay investments in projects that enhance ecosystems, reduce emissions, and provide natural resilience for communities is the National Environmental Policy Act (NEPA). President Nixon signed NEPA into law more than 50 years ago. Since then, many federal, state, and local environmental laws have been enacted, creating a confusing web of unclear, overlapping, and complex requirements. As columnist Ezra Klein recently wrote in the *New York Times*, NEPA is “part of a broader set of checks on development that have done a lot of good over the years but are doing a lot of harm now. When they were designed, these bills were radical reforms to an intolerable status quo. Now they are, too often, powerful allies of an intolerable status quo, rendering government plodding and ineffectual and making it almost impossible to build green infrastructure at the speed we need.”⁴⁰ Green infrastructure also encompasses investments in natural climate solutions. Rather than have pragmatic evaluations of risk and trade-offs, NEPA has too often devolved into a tool to stunt the development of cleaner infrastructure and to delay projects that will restore America’s ecosystems.

While the Infrastructure Investment and Jobs Act included and codified some important reforms, a more systemic overhaul is necessary. Two legislative proposals that would properly narrow the scope of NEPA are the Undoing NEPA’s Substantial Harm by Advancing Concepts that Kickstart the Liberation of the Economy Act (UNSHACKLE Act)⁴¹ and the Building United States Infrastructure through Limited Delays and Efficient Reviews Act of 2021 (BUILDER

³⁶ Ibid.

³⁷ S.4431—Emergency Wildfire and Public Safety Act of 2020, <https://www.congress.gov/bill/116th-congress/senate-bill/4431#:~:text=This%20bill%20addresses%20wildfire%20preparedness,wildfire%20due%20to%20climate%20change>

³⁸ S.4985—Trillion Trees and Natural Carbon Storage Act, <https://www.congress.gov/bill/116th-congress/senate-bill/4985/text>

³⁹ Holly Fretwell and Jonathan Wood, “Fix America’s Forests: Reforms to Restore National Forests and Tackle the Wildfire Crisis,” The Property and Environment Research Center, April 12, 2021, <https://www.perc.org/2021/04/12/fix-americas-forests-reforms-to-restore-national-forests-and-tackle-the-wildfire-crisis/>

⁴⁰ Ezra Klein, “Government Is Flailing, in Part Because Liberals Hobbled It,” *The New York Times*, March 13, 2022, <https://www.nytimes.com/2022/03/13/opinion/berkeley-enrollment-climate-crisis.html>

⁴¹ H.R.3814—UNSHACKLE Act, <https://www.congress.gov/bill/117th-congress/house-bill/3814?q=%7B%22search%22%3A%5B%22UNSHACKLE+Act%22%2C%22UNSHACKLE%22%2C%22Act%22%5D%7D&s=2&r=1>

Act).⁴² Environmental reviews are a critical part of any project, as is the participation of the public and communities affected by the project. NEPA reform is not about removing environmental safeguards but increasing accountability, improving efficiency, and curbing excessive litigation.

- **Provide efficient and flexible pathways for invasive species prevention, detection, and eradication.** Congress should expedite permitting for any invasive species eradication plans (see NEPA reform bullet), and the Department of Interior and Department of Agriculture should have the flexibility to use federal funds to experiment with different prevention and detection methods (within the confines of statutory requirements). The federal government should also explore opportunities to collaborate with the private sector and state and local governments to expand the use of incentive programs (bounty, contractor, community, recreation). Many of these programs, which vary by region and species, have proven to be effective.⁴³ The Interior Department Invasive Species Advisory Committee should continue and expand its outreach and provide recommendations and technical assistance on program implementation and how to avoid unintended consequences.⁴⁴
- **Integrate natural climate solutions into abandoned mine site cleanups.** There are hundreds of thousands of abandoned mine sites on federal lands, and policymakers should turn these environmental liabilities into opportunities. Establishing better incentives for abandoned mine clean up can turn health, safety, and environmental dangers into productive, cleaner lands and waters.⁴⁵ The Good Samaritan Remediation of Abandoned Hardrock Mines Act⁴⁶ would be an important step forward that helps reduce the liability risk of remediating abandoned mine sites.
- **Explore alternative funding pathways. Increase user fees and charge international visitors higher fees.** To address invasive species at federal and state parks or waters including the Great Lakes (where 25 invasive species of fish and numerous invasive plants have entered the lakes since 1880),⁴⁷ parks should charge market rates for entrances.⁴⁸ That revenue could be used to address deferred maintenance at parks but also to address environmental concerns such as invasive species. Charging international visitors to federal parks by increasing visa fees or for out-of-state visitors to state parks (as many do) will generate additional revenue for conservation efforts. Vouchers could be offered to low-income communities to ensure all Americans have access to U.S. parks.
- **Expand opportunities for investment in more efficient agricultural equipment, and for investment in precision and regenerative agriculture.** Innovative agricultural technologies and more efficient practices enable farmers and ranchers to produce more with less. Congress should reform laws to encourage investment in new equipment by making immediate expensing a permanent fixture of the tax code. Immediate expensing will allow farmers and ranchers to deduct the cost of automated, more efficient equipment in the year the cost is incurred rather than over years using cumbersome depreciation schedules. Congress could also consider leveraging existing USDA programs to incentivize precision agriculture and regenerative agriculture practices. For instance, the Producing Responsible Energy and Conservation Incentives and Solutions for the Environment Act (PRECISE Act) would expand USDA conservation loans and programs to include precision agriculture invest-

⁴² H.R.2515—Building United States Infrastructure through Limited Delays and Efficient Reviews Act of 2021, <https://www.congress.gov/bill/117th-congress/house-bill/2515?q=%7B%22search%22%3A%5B%22BUILDER+ACT%22%2C%22BUILDER%22%2C%22ACT%22%5D%7D&rs=1&r=1>

⁴³ U.S. Department of Interior Invasive Species Advisory Committee, “Harvest Incentives: A Tool for Managing Aquatic Invasive Species,” May 15, 2014, https://www.doi.gov/sites/doi.gov/files/uploads/isac_harvest_incentives_white_paper.pdf

⁴⁴ Ibid.

⁴⁵ Jonathan Wood, “Prospecting for Pollution: The Need for Better Incentives to Clean Up Abandoned Mines,” The Property and Environment Research Center, February 2020, <https://www.perc.org/wp-content/uploads/2020/02/prospecting-for-pollution-abandoned-mines.pdf>

⁴⁶ S.3571—Good Samaritan Remediation of Abandoned Hardrock Mines Act of 2022, <https://www.congress.gov/bill/117th-congress/senate-bill/3571/text>

⁴⁷ U.S. Environmental Protection Agency, “Invasive Species in the Great Lakes,” February 3, 2022, <https://www.epa.gov/greatlakes/invasive-species-great-lakes>

⁴⁸ Nicolas Loris, “Tackling the Enormous Deferred Maintenance Backlog for America’s National Parks,” The Heritage Foundation, June 9, 2020, <https://www.heritage.org/environment/report/tackling-the-enormous-deferred-maintenance-backlog-americas-national-parks>

ments and provide technical assistance for farmers and ranchers who want to pursue soil health planning.⁴⁹ Furthermore, the Naturally Offsetting Emissions by Managing and Implementing Tillage Strategies (NO EMITs Act)⁵⁰ would compensate farmers for lost revenue for a period that farmers and ranchers switch to a healthier soil cropping system. Funds could also be available for technical assistance for farmers and ranchers that transition to regenerative practices in which they could consult with USDA's conservation service experts, non-profits, or other farmers.⁵¹

- **Provide accurate accounting of the environmental and climate effectiveness of conservation programs.** Voluntary USDA conservation programs provide important assistance to farmers and ranchers, protect the environment, and increase carbon sequestration in soil and trees. Conservation programs help protect drinking water, preserve wildlife habitat, prevent soil erosion, and protect and restore forests and wetlands.⁵² Data collection, transparency, and evaluation will maximize the efficiency of these initiatives and safeguard the taxpayers from waste, fraud, and abuse. The bipartisan, bicameral Farmer-Driven Conservation Outcomes Act of 2020 would authorize the USDA to identify goals, metrics, and assessment processes to measure the effectiveness of conservation programs.⁵³ Developing goals, metrics, and monitoring programs and modifying the programs as necessary will provide sound scientific data to maximize conservation efforts. Data collection, monitoring, and evaluation will also better inform efforts to capture and sequester carbon.
- **Keep GM labeling voluntary and promote the economic and environmental benefits of GM crops and animals.** Mandatory labeling could create a negative stigma about genetic engineering, which would undermine the evidence that GM crops and animals are scientifically safe and beneficial for farmers, consumers, and the environment. Evidence also suggests that non-GMO labels may reveal enough information to consumers to deem mandatory labels unnecessary.⁵⁴ Additionally, USDA should consider reinstating its GM checkoff program to convey the minimal risks and economic and environmental benefits of GM crops and animals. While the USDA should not be in the business of picking winners and losers, public perception, acceptance, and communication of sound science and data is key to legitimizing GMs where widespread skepticism still exists.⁵⁵

Conclusion

Investment in healthy ecosystems is smart economic and climate policy. Eradicating invasive species, rehabilitating forests, promoting sustainable agriculture, and encouraging responsible land and water use practices are pragmatic natural climate solutions. Stronger ecological health and biodiversity in the United States and around the world will reduce emissions and build up natural resiliencies to a changing climate. To expand natural climate solutions, policymakers should remove barriers to ecosystem investments and encourage collaborative partnerships that harness the power of positive incentives.

Ms. CASTOR. Thank you very much.

⁴⁹ Producing Responsible Energy and Conservation Incentives and Solutions for the Environment, https://republicans-agriculture.house.gov/uploadedfiles/04.14.2021_preciseacthinsonsummary.pdf?utm_campaign=2760-396

⁵⁰ H.R.2508—Naturally Offsetting Emissions by Managing and Implementing Tillage Strategies Act of 2021, <https://www.congress.gov/bill/117th-congress/house-bill/2508/text?r=95&s=1>

⁵¹ U.S. Department of Agriculture, Natural Resources Conservation Service Technical Service Providers, <https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/technical/tsp/>

⁵² U.S. Department of Agriculture, Conservation Programs, <https://www.fsa.usda.gov/programs-and-services/conservation-programs/>

⁵³ H.R.6182—Farmer-Driven Conservation Outcomes Act of 2020, <https://www.congress.gov/bill/116th-congress/house-bill/6182/text>

⁵⁴ Aaron Adalja et al., “Direct and Indirect Effects of Mandatory GMO Disclosure with Existing Voluntary Non-GMO Labeling,” March 2022, <https://deliverypdf.ssrn.com/delivery.php?ID=674066092020080070126007004087016101038046007020059034127065092110126100099074031028056033058006042055014031029109121124084098053082054001060121119079000100104073006061053066087025064088072020125013070024065027124087029031088097081069022122103072028104&EXT=pdf&INDEX=TRUE>

⁵⁵ Brian Kennedy and Cary Lynne Thigpen, “Many publics around world doubt safety of genetically modified foods,” Pew Research Center, <https://www.pewresearch.org/fact-tank/2020/11/11/many-publics-around-world-doubt-safety-of-genetically-modified-foods/>

Next, Dr. Sherry Larkin, you are recognized for 5 minutes to summarize your testimony.

Welcome.

STATEMENT OF DR. SHERRY L. LARKIN

Dr. LARKIN. Thank you.

Good morning, Chair Castor, Ranking Member Graves, and members of the Select Committee.

Thank you for your willingness to hear of new solutions to address the impacts of climate change, solutions that improve our coastal habitats, strengthen our communities' ability to withstand sea level rise, and increase America's blue economy that NOAA estimates affects 127 million people that live in coastal counties, municipalities, and parishes, or 40 percent of the U.S. population.

In 2018, America's blue economy supported 2.3 million jobs and contributed \$373 billion to the nation's gross national product. In Florida, the share of the economy that is driven by our coastline is well above 40 percent. It is over 75 percent, making climate resilience intertwined with our state's future.

My name is Sherry Larkin, and I am a professor in the Food and Resource Economics Department at the University of Florida and am the Director of the Florida Sea Grant College Program. Florida is one of 34 university-based programs in states that border the Atlantic and Pacific Oceans, the Great Lakes, Gulf of Mexico, Puerto Rico, and Guam.

Science helps us understand how much our environment reduces the economic impact of climate change. It is now time for us to partner fully with that environment to improve the resilience of our coastal areas. In fact, in the recent bipartisan Infrastructure and Jobs Act, NOAA was awarded \$1.5 billion for coastal resilience-related work. And FEMA was awarded \$3.5 billion for flood mitigation assistance. This is just 1.3 percent of the annual contribution of our coastline to our economy.

Sea grant programs are charged with not just funding science relevant to local stakeholders but ensuring that those findings are communicated to the public and used by resource managers in coastal communities. Every dollar of Federal investment in sea grant must be matched with non-Federal funds which is a model that fosters collaboration.

The Blue Carbon Initiative indicates that 83 percent of global carbon cycle is circulated through the ocean, and coastal habitats account for half of the carbon that is stored sediments. That means there is an opportunity to invest in coastal habitats, which account for less than 2 percent of the total ocean area. Just think of how big our blue economy can grow.

In Florida, some of our activities in this space include restoring coastal sea grasses, mangroves, sponges, corals, and sea oats habitats; improving coastal water quality by helping divert boats in which to clean marinas, and removing plastics from oyster restoration projects; building the capacity of local agencies, institutions, and associates to apply for Federal funding; and improving FEMA's community ratings system force to reduce flood insurance premiums. We train shellfish aquaculture farmers and offer certifications for marine contractors to build living shorelines. We create

public education programs like Climate Smart Floridians, Seagrass Safe Boating, and Mangrove Trimming Best Management Practices that help residents live more sustainably.

Investigating regulatory revisions that would allow shellfish growers to supply seafood and be used for coastal restoration is particularly needed in Florida. We are building climate alliances in the Gulf of Mexico region and to improve justice, equity, diversity, and inclusion with respect to health outcomes in the Southeastern U.S. and Caribbean.

The reality is, to generate societal benefits, a lot of pieces need to be in place other than just habitat restoration, namely, number one, site-specific research that quantifies the net carbon benefits, estimates the feasibility and value of alternative solutions, and evaluates proposed policies; number two, education to encourage careers in natural coastal solutions and for homeowners, policy-makers, and relevant industry sectors; and, number three, training and workforce development to grow a new blue economy that benefits all Americans.

As Sea Grant supports students and connects to the public through boots-on-the-ground outreach, we believe we can create a grassroots movement, which is why I was delighted to learn that several graduate student leaders with the Campus Climate Corps were planning to be in front of you today. And if we don't embrace the opportunity now, the blue economy could leave America behind and especially the underserved even perhaps further behind.

Finally, I wish to thank the network of Sea Grant programs nationwide and all of our unrecognized government and NGO partners, since we really do none of this alone. I appreciate the opportunity to share our collective vision regarding nature-based solutions and look forward to our discussions.

Thank you.

[The statement of Dr. Larkin follows:]

**Testimony for the House Select Committee on the Climate Crisis
on**

***America's Natural Solutions:
The Climate Benefits of Investing in Healthy Ecosystems***

April 1, 2022 (updated)

Sherry L. Larkin, Ph.D.

**Professor, Food and Resource Economics, UF/IFAS
Director, Florida Sea Grant College Program**

Chair Castor, Ranking Member Graves, and members of the Select Committee:

Thank you for inviting me to testify today and your willingness to listen and learn of new solutions to address the impacts of climate change—solutions that improve our coastal habitats, strengthen our communities' ability to withstand adverse environmental conditions, and increase America's Blue Economy. My name is Sherry Larkin, and I am a professor in the Food and Resource Economics Department at the University of Florida and serve as the Director of the Florida Sea Grant College Program. In my testimony I will describe several ongoing projects and conclude with an identification of the suite of tools and skills that can help ensure natural solutions are effective at helping mitigate the negative environmental and economic effects of climate change.

I would like to begin by providing some context. As an economist specializing in ways to measure the value of natural resources, I am thrilled to see the growing scientific literature that estimates the economic value of our nation's natural capital—and a genuine interest from resource managers and policy makers com-

mitted to ensure those values are sustained, and perhaps even grow with targeted investments. Our nation benefits greatly from our natural environment—from our watersheds that start high in the mountains, across the plains, and out to the end of our Exclusive Economic Zone 200 miles offshore. These environments have consistently worked to protect our shorelines, diffuse and dilute our wastes, remove excess nutrients from our land-based activities, and excess carbon from our atmosphere, but we are outgrowing the capacity of these environments to protect us and clean up after us. As our growing scientific literature is helping us understand just how much our natural environment has helped us to adjust to climate change, it is now time for us to partner fully with that environment to improve the resilience of our coastal areas moving forward.

As the Director of the Florida Sea Grant College Program, which is one of 34 university-based programs nationwide, our network generates solutions for the issues affecting our Nation's coastal communities throughout the Atlantic and Pacific (including the Great Lakes and Gulf of Mexico), yielding quantifiable economic, social, and environmental benefits. The National Sea Grant College Program Act of 1966 authorizes our funding for research, education, and advisory services in any field related to the conservation and development of marine resources. Sea Grant is a unique program within the National Oceanic and Atmospheric Administration (NOAA) under the Department of Commerce. We are charged with not just funding research but ensuring that those findings are communicated to the public and used by resource managers and coastal communities and businesses. We operate across line offices in NOAA and across state and federal agencies in support of our broad mission. A joint federal, state, and county investment, Sea Grant competitively awards over 90% of appropriated funds to coastal states through issues identified locally with boots-on-the-ground extension specialists and science communicators who live in the communities they serve. You can find more information on Sea Grant in the Sea Grant Association's Programmatic Request for FY2023 (<https://bit.ly/sgaprogrammaticask>), including planned efforts to extend and upscale efforts to improve coastal resilience that we are discussing today. Every dollar of federal investment in Sea Grant must be matched with \$0.50 of non-federal investment, which is a model that fosters cost-effective and collaborate efforts. As a network, we have documented investments of more than six times the required match.

In 2020, the Sea Grant program helped generate an estimated \$520 million in economic benefits, created or supported 11,044 jobs, created or sustained 1,332 businesses, assisted 285 communities improve their resilience, helped restore or protect an estimated 4.2 million acres of habitat, and supported the education and training of 2,027 undergraduate and graduate students (NSGO, Fall 2021). Aside from metrics of accomplishment, Sea Grant programs are trusted sources of scientific information and occupy a neutral, partner-building space at the community level; we are neither regulatory nor fundraising-focused and have a 50-year track record. That consistent presence and support, often in conjunction with our Land Grant partner institutions, provides an invaluable link between the terrestrial and aquatic ecosystems that help us be particularly effective.

Today, I appreciate the opportunity to speak about the climate benefits of investing in healthy ecosystems, with a focus on coastal and marine ecosystems. While discussing the ecosystem services associated with forest or agricultural lands is understood by many, the physical processes of the ocean are not as observable—and yet, our oceans are undeniably our biggest asset in the fight against climate change. Coastal marine ecosystems—mangroves, tidal marshes, and seagrasses¹—sequester and store large quantities of carbon in both the plants and the sediment below. In fact, all carbon in seagrass meadows is stored in the soils, which is why the mounting concern over loss of seagrasses in Florida is more than just for manatees.

According to The Blue Carbon Initiative (<http://thebluecarboninitiative.org>) 83% of global carbon cycle is circulated through the ocean, and coastal habitats account for approximately half of the total carbon that is deposited and stored (i.e., sequestered) in ocean sediments. This means there is opportunity to invest in coastal habitats, which currently only account for less than 2% of the total ocean area. That is the ideal scenario, that we only need to invest in more habitat and rely on photosynthesis and the potential that all plants have to regenerate and support sustainable industries, including plants from the ocean. Which is why Sea Grant has “Healthy

¹ Seagrasses are not grasses, they are flowering plants more akin to land-growing lilies or ginger. Their leaves are thin but strong and flexible, which allows the plant to withstand constant movement from waves and currents; the same movement also disperses their seeds and pollen (like land-based plants use bees and wind for pollination). Seagrasses have evolved to grow on the soft, sandy seafloor through a vast network of roots and specialized branching stems that act as anchors and stabilize the sediment.

Coastal Ecosystems” as one of four National Focus Areas and has invested in habitat restoration as mentioned with the metric previously. Florida is no exception; we have grown and replanted new seagrasses, mangroves, and shoreline sea oats, and we have even invested in genetic studies to create more effective plant varieties. Plant breeding is not just for food and fiber crops, and could become a more important tool as we learn that not all marine vegetation is a net carbon sink because the reality is that respiration releases carbon dioxide. Moreover, if these areas natural areas are disturbed—such as scarring by boat motors or excessive trimming by oceanfront homeowners—these coastal ecosystems will release the carbon they have stored (which could have been for centuries for native habitat), and that carbon returns to the atmosphere and contributes to greenhouse gasses that are responsible for global warming, rising seas and ocean acidification.

As this example shows, we also need research on plant biology and breeding to maximize the carbon uptake and growth potential. We also need public education programs, like our “Seagrass Safe Boating” that has recreational boaters take a pledge (<http://besegrasssafe.com/>) and “Mangrove Trimming Best Management Practice” videos that show the how and why (<https://edis.ifas.ufl.edu/publication/FR448>). In these programs, we are not only seeking that the public gain knowledge, we are also providing the education to make them act and change their behaviors. And that education extends to other efforts that will help maintain the integrity of natural systems, such as removing invasive species (e.g., beach vitex is a wonderful ornamental, but kills native sea oats and is without the root structure needed to stabilize shoreline dunes; <https://blogs.ifas.ufl.edu/escambiaco/2018/06/24/an-unwanted-invasive-plant-beach-vitex/>). For some communities, the urgency has led to local ordinances where violations result in fines. Thus, sound policy and regulation could be another mechanism to help maximize atmospheric carbon removal.

But there is more good news. In addition to the carbon sequestration generated from photosynthesis, our oceans help us remove carbon dioxide from the atmosphere through calcification; that is, as carbon is absorbed from the ocean, the shellfish secretes calcium carbonate to form its shell (<http://oceanacidification.wordpress.com/2008/04/24/can-seashells-save-the-world/>), which means a percentage of shells contain carbon. The calcification process thus provides a permanent conversion of carbon dioxide into an insoluble mineral. In other words, the calcium carbonate from shellfish and in particular bivalves like oysters, clams, scallops, and mussels can persist indefinitely as limestone. This is promising: molluscan shellfish aquaculture has two products—food for humans and long-term storage of greenhouse gases. In contrast, the carbon contained in most plant and animal tissues return to carbon dioxide in a few years. Moreover, shellfish aquaculture practices do not produce merely the shell-bearing animals (such as oysters and clams with commercial value), but there are additional hard materials associated with external growth (often known as “biofouling”) that is costly for farmers to remove but beneficial for society due to its carbon capture properties. The post-consumption shells are an industry byproduct with value in construction, restoration, and potentially even for making decorative tiles like a partner institution in South America. However, just because there are carbon sink properties, and other societal benefits, does not mean that research is no longer needed. The lead author of a recent study concluded that, “If you want to create jobs and income, grow oysters to feed people and provide habitat for other species, and that can be done anywhere that’s suitable to oyster reef development. But if you want to sequester carbon, near shore is the best bet.” (Fodrie et al. 2017). In short, location matters.

Sea Grant, especially in Florida, has long provided outreach support to individuals that want to become shellfish growers, but from the perspective of supporting a financially sustainable and profitable industry. This support includes the provision of habitats, in part through assisting in the permitting and licensing process, and potentially the need to protect the juvenile shellfish from predation. We are now seeing the opportunity to manage growing operations with environmental benefits in mind. Farming in the sea doesn’t require irrigation, food, or fertilizer, but does require planning, permitting, and education that is not readily available or passed down between generations. And for new crops and shellfish products (<https://shellfish.ifas.ufl.edu/sunray-venus-clams/project-venus/>), Sea Grant has also helped introduce consumers and chefs to these new supplies so marketing can also be a tool to promote growth in carbon sequestering shellfish production.

So far, I have focused on the potential carbon sequestration benefits of shellfish aquaculture, but I would be remiss to not share that these systems also provide equal promise in removing excess nutrients, like nitrogen, and there is tremendous potential to foster a nutrient credit training program. To that end, Florida Sea Grant recently used COVID-19 relief funding to purchase market sized clams that have sized out of retail markets for their nutrient management functions and mon-

itor those functions under a research experiment (<https://www.flseagrant.org/clams/> and <https://blogs.ifas.ufl.edu/news/2019/12/09/uf-researchers-team-up-with-florida-aquarium-for-noaa-project-part-of-coral-reef-restoration-initiative/>). While this practice—of having multiple and complementary markets for hard clams—would seem the ideal solution, current regulations prohibit this practice, which is a long way of saying that permitting and regulatory revisions could be a prudent investment as efforts like the new “All Clams on Deck” (<https://www.allclamsondeck.org/>) develop. The development of such programs would mimic efforts proposed by USDA for land-based agriculture, such as the Partnerships for Climate-Smart Commodities (<https://www.usda.gov/climate-solutions/climate-smart-commodities>) or those of Solutions for the Land (<https://www.solutionsfromtheland.org/flcsa/>), dubbed a “renaissance” in production with a focus on innovation, entrepreneurship, and advanced environmental sustainability objectives.

Now you might be thinking, what about other invertebrates such as corals, sponges, and sea urchins? In fact, Florida Sea Grant is investing in all three with a focus on restoration (e.g., https://www.flseagrant.org/wp-content/uploads/SGEF_215_SpongeRestoration_web.pdf and <https://blogs.ifas.ufl.edu/news/2019/12/09/uf-researchers-team-up-with-florida-aquarium-for-noaa-project-part-of-coral-reef-restoration-initiative/>). At first glance, it would seem obvious that other invertebrates also might serve as carbon “sinks” (i.e., net consumers of carbon). In fact, like shellfish and seagrasses, the benefits are driven by a multitude of factors that justify the need for both theoretical and applied (site-specific) research to identify, measure, and ultimately document the net carbon effects of habitat restoration efforts (especially in regards to current water quality conditions).²

Augmenting and extending habitats through targeted species-specific restoration, incentivizing, and promoting the growth of shellfish that absorb atmospheric carbon can only take us so far, which is why we’ve moved toward the development, training, and practice of “Living Shorelines” or LSLs. A “Living shoreline” (<https://floralivingshorelines.com/>) is a broad term used to describe a range of nature-based approaches to stabilize a shoreline. In suitable environments, living shorelines can be used instead of seawalls or bulkheads to reduce erosion and protect property. Living shoreline projects are made up of mostly natural materials, such as native wetland vegetation, natural fiber logs, or oyster reef breakwaters, thus maintaining natural shoreline features—and utilizing the carbon sequestration properties of the plants and shellfish. In Florida, these configurations predominantly utilize salt marshes, mangroves, and oysters (<http://floralivingshorelines.com/types-of-living-shorelines/>). According to NOAA, a living shoreline is:

“A shoreline management practice that provides erosion control benefits; protects, restores, or enhances natural shoreline habitat; and maintains coastal processes through the strategic placement of plants, stone, sand fill, and other structural organic materials (e.g. biologists, oyster reefs, etc.)” (<https://shoreline.noaa.gov/glossary.html#partj>)

As you have likely surmised, every LSL should be the result of thoughtful, careful consideration of each project site and strategic placement of natural components along the shoreline profile. As a result, coastal property owners have a menu of potential solutions available for solving erosion problems—it’s not just seawalls anymore! And, in fact, every site needs a “green-to-grey” assessment to determine the range of vegetation, edging, sills, breakwater structures, revetment and bulkheads that are most suitable. Sea Grant has attempted to foster the adoption of this technique (and seawall replacement) by both educating homeowners³ and by developing a workforce training module—dubbed the Marine Contractors training (<https://blogs.ifas.ufl.edu/ncbs/2021/01/07/living-shorelines-for-marine-contractors-virtual-course-this-month/>) to foster development of a new industry and upscale efforts to combat atmospheric carbon.

This homeowner education program was recently recognized at the national level by the Association of Natural Resource Extension Professionals (ANREP) and re-

²The scientific evidence is clear on the value of preserving and restoring coral reefs aside from carbon sequestration (<https://www.nature.com/articles/ncomms4794>, and <https://www.nature.com/articles/s41893-021-00706-6>). Benefits include reducing coastal flooding and associated damage to infrastructure and loss of human life, and there are several promising innovations that could translate to other invertebrates.

³The FMNP includes two courses, each with 24 contact hours, developed by Florida Sea Grant Extension agents that increase education of restoration (<https://masternaturalist.ifas.ufl.edu/become-a-master-naturalist/master-naturalist-courses/>): (1) Coastal Shoreline Restoration, and (2) Marine Habitat Restoration.

ceived the Gold Award in the Outstanding Educational Materials category for a Book or Comprehensive Program Curriculum for the *FMNP Marine Habitat Restoration Special Topics Course*. The program provides detailed information on the ecology, benefits, restoration methods, and monitoring of marine habitats in Florida. A team of six faculty created the course curriculum, focused on restoration of seagrasses, coral reefs, sponges, and marine enhancement through artificial reefs. The companion video series consisting of four videos, each between 10 and 26 minutes long also garnered the Silver Award for the TV and Video category.

With the goal of shoreline restoration, it might be easy to overlook that the methods and materials matter. Sea Grant is committed to also helping clean nearshore and offshore aquatic systems, including from plastics. We have a long-standing micro plastics awareness program (<https://flseagrant.ifas.ufl.edu/microplastics/>) and strive to reduce the use of plastics in our own programs. One example is PROS—a Partnership for Plastic-free Restoration of Oyster Shorelines (<https://blogs.ifas.ufl.edu/ncbs/2021/09/03/a-partnership-for-pros-plastic-free-restoration-of-oyster-shorelines/#:~:text=This%20project%20is%20called%20the,free%20material%20called%20reef%20prisms.>). This partnership resulted from faculty research project that sought to improve upon the most common LSL configuration, that is, creating reefs by stacking up rows of “shell bags” (oyster shell contained in plastic nylon mesh sacks). Given that the bags can release microplastics into the marine environment, researchers sought a new design and Reef Prisms were born. This new design uses jute fiber instead of plastic and an adhesive that is free of additives and readily available from local big box stores; an outcome that reduces costs, increases availability of materials and helps local economies—in addition to providing an alternative career path. You see, the development of a Blue Economy is also an unprecedented opportunity for workforce development and mechanism to help address diversity, equity and inclusion objectives at the community level; if we don’t consider the opportunity now, the Blue economy could leave the underserved even further behind.

I hope you are beginning to see the value of LSLs for both the environment, coastal property owners, and coastal economies. Investments in habitat restoration improve the health of coastal ecosystems and reduce coastal waves and erosion that mitigate the economic impacts of sea level rise—and they do it at a much lower cost. But to make those projects come to fruition, we need local programs, communities, and planners to learn about their potential. Sea Grant has worked hard, through its boots-on-the-ground outreach, to engage with the public and local planners. For example, we have a Climate Smart Floridians program (<https://sites.google.com/ufl.edu/climatesmartflorida/climate-smart-floridians-program>) to provide citizens research-based information about climate change and engage them as volunteers to help reduce household expenses and personal greenhouse gas emissions; topics include landscaping, water resources, transportation, home energy, food and waste and highlights the impacts of individual choices on climate change. And one of our agents works closely with the Tampa Bay Regional Planning Council and is a member of their Technical Advisory Committee; those efforts have resulted in the development of a shoreline suitability model for the siting of LSLs. Working directly with communities has also been the objective of projects designed to develop flood resilient upgrades to natural buffers around transportation corridors near the Space Coast. Such projects change the aesthetics of an area and, as such, need local resident support and policy makers willing to invest in new designs. Finally, the Gulf Sea Grant programs have partnered with local organizations and agencies for more than a decade in hosting an annual climate “community of practice” meeting where we bring together scientists, outreach professionals, and local leaders and decision makers to identify solutions to climate related challenges facing communities today and anticipated to impact them tomorrow.

So, this is a great story of a win, win, win scenario for the environment (and all its natural dependents), the public that lives on or near coastal areas, and the entire nation’s economy as costs (and lives) are saved. The reality is that to generate societal benefits, a lot of pieces need to be in place—other than just funding the growth and replanting or stocking of plants and animals—namely:

- Site specific research on the physical and biological sciences behind carbon capture, storage, and release—for living shorelines and its component species such as seagrasses and shellfish to inform the development of interventions that includes:
 - quantifying the net carbon effects,
 - estimating the feasibility and economic values of alternative solutions, and
 - advises on the needed policies and or regulations.

- Education to students to encourage careers in natural coastal solutions to climate change and homeowners, policy makers, and relevant industry sectors with the goal of behavioral change.
- Training and workforce development to upscale our capacity to grow and support a new Blue economy that benefits all Americans, and especially the underserved.

Thank you for allowing me the opportunity to share the accomplishments, priorities, and ongoing activities of our Sea Grant program. You can find more information on many of the projects I described through links in the written testimony, but if you should have more questions or desire more information, please feel free to contact me directly. As a final caveat, as a program that is charged with (and embraces) developing partnerships to leverage resources, I speak on behalf of not just Florida Sea Grant, or the network of Sea Grant programs nationwide, but for all of our partners in these efforts since we do none of this alone. And I thank all of our unrecognized partners at this time.

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Ms. CASTOR. Thank you, Dr. Larkin.

Next, Dr. Cristina Eisenberg, you are recognized for 5 minutes to present your testimony. Welcome.

STATEMENT OF DR. CRISTINA EISENBERG

Dr. EISENBERG. I want to thank Chair Castor, Ranking Member Graves, and the others members of the Select Committee on Climate Crisis for this opportunity to speak.

To create ecosystems more resilient to climate change including drought and other stressors, it is essential to partner with Tribal Nations and braid traditional ecological knowledge with Western science. Our Fort Belknap Indian Community Grassland Restoration Project in Montana exemplifies such work. Taking place on BLM land and Aaniiihnen and Nakoda Tribal lands, funded by the conservation and restoration program lead Peggy Olwell, using Seeds of Success protocols, this project is sponsored by Oregon State University and the Society for Ecological Restoration.

I am the lead Principal Investigator and Thomas H. DeLuca, Dean of the Oregon State University College of Forestry, is the co-PI. The Fort Belknap Tribal Council, Tribal Historical Preservation Office, BLM Montana/Dakotas botanist Wendy Velman oversees our project.

TEK is knowledge and practices generate and passed down by indigenous people across generations. We are applying TEK on the Northern Great Plains to improve ecological resiliency and restore degraded lands with native plants to increase wildlife habitat, productivity, and carbon sequestration potential.

Incorporating TEK in ecocultural restoration empowers Tribal Nations. This matters because Tribal Nations in America are underserved communities with unemployment, poverty, and suicide rates far higher than U.S. rates. Ours is also a high-priority project because this prairie is a critical carbon sink and endangered by anthropogenic climate change.

We deploy a Tribal conservation corps of at-risk youth to collect the seeds of ecologically and culturally significant plants strictly protected by Tribal data-sovereignty. We are implementing the National Seed Strategy and Plant Conservation and Restoration Program by following SOS protocols to ensure a stable economical supply of native plant materials for public land restoration. We are collecting data for BLM Assessment, Inventory and Monitoring protocols to assess public lands. Maintaining healthy, sustainable ecosystems supports diverse land uses and benefits the national public lands trust.

Over the first 2 years of the project, fiscal year 2020 and 2021, outcomes include 45 jobs created, 94 percent of them for Native Americans, 39 of which were for Tribal youth, totaling 15,000 hours of employment. We raised \$200,000 in external and in-kind funding and collected 25 pounds of seeds for ecocultural restoration. Youth on our projects have stayed alive and in school and some have begun college.

Beyond these tangible outcomes, during a Category 4 drought in 2021, I received a major lesson. On BLM land, I found ankle-height grasses. In few places where plants had bloomed, their seedpods were hollow because the plants had suppressed growth because of the drought to survive.

On Tribal land, in the same ecological conditions, the grasses grew 4 feet tall with an abundance of seed. The stark difference was unattributable to cattle. Both Tribal and BLM lands were multiple-use lands subject to cattle raising documented by our trail cameras.

Co-PI Tom DeLuca, a soil scientist, and I will be looking at fire and other land management practices and their impacts on soils. Charcoal in the soil, created by low-severity fires set by indigenous people, sustains soil carbon capital and increases nutrient availability and drought resiliency. When Tribal lands were stolen and settled throughout the U.S., fires were suppressed. Indigenous burning is a key TEK practice and used globally to improve soil health.

The next step is to create an ecocultural restoration plan with Fort Belknap that includes native seed collection, ethnobotany, and pollinator and soil health studies. The plan will contribute to the Fort Belknap climate change program. We have applied for U.S. Fish and Wildlife Service Grassland Conservation Program funding for this work.

Ecocultural restoration partnerships can advance our national climate resiliency agenda. This requires building capacity with edu-

cation and jobs in botany, soil science, entomology, forestry, and ecological restoration for Native Americans.

OSU can deliver the necessary education and in partnership with Federal agencies, Tribal Nations, and non-Tribal landowner. Together we can empower Tribal Nations and help America meet the climate challenge.

Thank you.

[The statement of Dr. Eisenberg follows:]

Select Committee on the Climate Crisis

Dr. Cristina Eisenberg Testimony

April 1, 2022 Hearing

**America's Natural Solutions:
The Climate Benefit of Investing in Healthy Ecosystems**

My name is Cristina Eisenberg. I am Native American and Courtesy Faculty at Oregon State University (OSU) in the College of Forestry (CoF). The views expressed in this testimony are my own and should not be construed as representing any official position of the CoF or any of my research partners. I want to thank Chair Castor, Ranking Member Graves, and the other members of the Select Committee on the Climate Crisis for this opportunity to speak.

To create ecosystems more resilient to climate change, including drought and other stressors, it is essential to partner with Tribal Nations and braid Traditional Ecological Knowledge (TEK) with Western Science. Our *Fort Belknap Indian Community (FBIC) Grassland Restoration Project* in Montana exemplifies such work. Taking place on Bureau of Land Management (BLM) and *Aaniiih* and *Nakoda* Tribal lands, funded by the BLM Seeds of Success (SOS) Program led by Peggy Olwell, this project is sponsored by OSU and the Society for Ecological Restoration. I am the Lead Principal Investigator (PI), and Thomas H. DeLuca, Dean of the OSU CoF, is the co-PI. The FBIC Tribal Council, Tribal Historical Preservation Office, and BLM Montana/Dakotas botanist Wendy Velman oversee our project.

TEK is knowledge and practices generated and passed down by Indigenous people across generations. We are applying TEK on the Northern Great Plains to improve ecological resiliency and restore degraded lands with native plants to increase wildlife habitat, productivity, and carbon sequestration potential. Incorporating TEK in ecocultural restoration empowers Tribal Nations. This matters, because Tribal Nations in America are underserved communities with unemployment, poverty, and suicide rates far higher than U.S. rates. Ours is also a high priority project because this prairie is a critical carbon sink endangered by anthropogenic climate change.

We deploy a Tribal conservation corps of at-risk youth, who collect the seeds of ecologically and culturally significant plants, strictly protected by Tribal data-sovereignty. We are implementing the National Seed Strategy and Plant Conservation and Restoration Program by following SOS protocols, to ensure a stable, economical supply of native plant materials for public land restoration. We are collecting data per BLM Assessment, Inventory, and Monitoring (AIM) protocols, to assess public lands. Maintaining healthy, sustainable ecosystems supports diverse land uses and benefits the national public lands trust.

Over the first two years of the project (FY20–FY21), outcomes include: 45 jobs created, 94% of which were for Native Americans, 39 of which were for Tribal youth, totaling 15,000 hours of employment. We raised \$200,000 in external and in-kind funding and collected 25 pounds of seeds for ecocultural restoration. Youth on our project have stayed alive and in school, and some have begun college (<https://www.hcn.org/issues/53.10/north-prairies-collecting-seeds-to-restore-prairie-grasslands>).

Beyond these tangible outcomes, during a Category 4 drought in 2021, I received a major lesson. On BLM land I found ankle-height grasses. In the few places where plants bloomed, their seed pods were hollow, because the plant had suppressed growth to survive. On Tribal land, in the same ecological conditions, the grasses grew four feet tall, with an abundance of seeds. This stark difference was unattributable to cattle; both Tribal and BLM lands are multiple-use lands, subject to cattle grazing, documented by trail cameras. Co-PI Tom DeLuca, a soil scientist, and I will be looking at fire and other land-management practices and their impacts on soil health. Charcoal in the soil, created by the low-severity fires set by Indige-

nous people, sustains soil carbon capital and increases nutrient availability and drought resiliency. When Tribal lands were stolen and settled throughout the U.S., fires were suppressed. Indigenous burning is a key TEK practice used globally to improve soil health.

The next step is to co-create an ecocultural restoration plan with FBIC that includes native seed collection, ethnobotany, and pollinator and soil health studies. The plan will contribute to the FBIC Climate Change Program. We have applied for U.S. Fish and Wildlife Service Grassland Conservation Program funding for this work.

Ecocultural restoration partnerships can advance our national climate resiliency agenda. This requires building capacity with education and jobs in botany, soil science, entomology, forestry, and ecological restoration for Native Americans. OSU can deliver the necessary education, in partnership with Federal agencies, Tribal Nations, and non-Tribal landowners. Together we can empower Tribal Nations and help America meet the climate challenge.

Ms. CASTOR. Thank you, Dr. Eisenberg.

And thanks to all of our witnesses for your insightful testimony.

And, without objection, all of the witness testimony will be incorporated into the record.

Now we will turn to member questions, and I will recognize myself for the first 5 minutes.

Well, we know that wetland and forest and ecosystem restoration and conservation is critical to adaptation and mitigation over time. But it is also, as many of you highlighted, it is also vitally important to capturing carbon and sequestering carbon. Just a few weeks ago, the world's top scientists said we must act urgently to reduce carbon pollution. There is a rapidly closing window for us to avoid catastrophic impacts and the rising costs of the climate crisis.

So I want to know: How do we do that? What is working right now? The Federal level, helping states and local communities, all in partnership, how do we make sure that we are getting the best bang for the buck, the Federal dollar that we are investing in natural solutions to sequester carbon? And how do we prioritize?

Mr. O'Mara.

Mr. O'MARA. I mean, over the last several—especially in the wake of several hurricane seasons in the last several years, I mean, at this point, we have such great evidence in kind of the projects that have been successful and the projects that haven't.

There is a lot of—back in the Sandy package, you know, a decade ago, there is a whole bunch of mountain monitoring that was done to kind of look at the health of these systems, to kind of make the case that they are truly achieving the resilience goals and some of the, you know, carbon goals that we have.

And I think it is just a matter of, you know, doing that deep research in the early investments that are made. There is huge opportunities in the bipartisan infrastructure package to look at the forest restoration projects, look at some of the grasslands projects, look at some of the flood abatement programs, and make sure that they are actually achieving the goals.

And what we are finding is that they are cheaper, they are more durable, and achieve more co-benefits than a lot of the traditional manmade solutions. And there are some solutions where the natural makes sense. There is some places where the structural makes sense. There is some places where a blend does.

But there is a lot of good data now to kind of show us the types of public infrastructure investments that really should prioritize natural investments maybe over some of the last century solutions.

Ms. CASTOR. And, Dr. Larkin, you are well-versed in those partnerships. There are so many funding streams that come from Federal initiatives, down to State and localities.

How are we being the most efficient and making sure at this urgent moment in time that those dollars really are going to the best projects to sequester carbon and to make our communities more resilient?

Dr. LARKIN. Thank you, Congresswoman Castor. That is a great question.

And I think we have, like the previous speaker said, we have a lot of mechanisms to follow up and track. I think we do a much better job now of tracking and quantifying outcomes. The science has helped us progress to the point where we can actually get to the economic value of those outcomes.

I do see a trend in terms of making more impact in these integrated calls for proposals where you are tasked to go out and have local groups on the ground, and you are tasked to bring different parts of the Federal Government together. So we often work not just within NOAA—but within projects with the Department of Defense and the EPA, and I think those funding mechanisms and those language that really charge us to go out and develop a network of partnerships are where you see a lot of the impact happening.

Ms. CASTOR. So we see it in partnership, for example, with farmers through agricultural extension. We see it in some of the land conservation programs.

But, Dr. Larkin, there are so many communities that just do not have the capacity to go and fight for the Federal grants. What do we need to be doing to make sure that lower income communities, rural areas understand that they are—they have a partnership and can access the investments and tools they need?

Dr. LARKIN. That is really good.

First, I would say, you know, I think we are lucky that we sit with our Land Grant partners, Land and Sea Grant. We have those boots on the ground.

I think in developing partnerships, well, so one thing, we go where the problems are. And we are not big enough to go out and reach out to every company. No agency is—or every organization. So we have to rely on “training the trainer” program almost, like, where if we help one community, we help that community develop another community.

I think when you look at the force multiplier effect, for instance, or organic—the notion of organic growth is we set some models in motion. That success breeds more success, and I think that is one area that we are most excited in because applying for Federal money is not easy. So helping that capacity is definitely right. But when we help that capacity, help them with one grant, they will then have the capacity to go after the next one. So we really hope that that grassroots will pay off in the long run.

Ms. CASTOR. Thank you very much.

Next we will go to Mrs. Miller.

You are recognized for 5 minutes.

Mrs. MILLER. Thank you, Chair Castor and Ranking Member Graves. And thank you to our witnesses for being here today.

West Virginia is a—it is just so well-known to be one of the most beautiful locations in the country, if not the world.

In southern West Virginia, we highly prize our environment. And we know that the beauty of our State lies both in our geography and in our abundant natural resources. I was proud to be a sponsor of the bill to designate the New River Gorge as our nation's newest national park.

My community has seen a huge increase in the attention and in the tourism from so many Americans, as well as visitors from around the world, who have had the opportunity to encounter West Virginia for the very first time. In fact, 600,000 more people visited the New River Gorge National Park this year than the year before. That is over 1.7 million people.

I am so proud of the abundant resources, the natural resources that my state has to offer. From the clean coal to the high-quality oil and natural gas, we power the nation and the world. And we have provided a livelihood for so many people in our state.

And I am really proud of my neighbors who, they are kind, loving, hardworking Americans who have been doing their best to get by no matter what our government tries to throw at them.

Unfortunately, West Virginians know all too well that the government doesn't always offer the best solution. That is why I think it is so important to empower the private sector to get to work. Streamlining permitting processes across a variety of sectors is something Congress could do right now to expand energy deliverability, expand opportunities of the timber development, and produce more right here at home while we are providing jobs and opportunities for many of my constituents.

Mr. LORIS, can you explain how the National Environmental Policy Act, known as the NEPA process, has become so burdensome over the last 50 years? And what can Congress do to help streamline the process?

Mr. LORIS. Yeah, thank you for the question.

You know, the National Environmental Policy Act, you know, is more than 50 years old. And, you know, it is certainly well-intentioned and served its purpose. I think, since then, we have seen a number of Federal environmental laws passed and amended, a number of State environmental laws passed and amended.

And I think what the problem with NEPA is that it has become a tool to obstruct and delay or to challenge projects in court. And there has been a number of documented cases, particularly with forest restoration. For instance, a Property and Environment Research Center report in April of 2021 documented some really troubling ones where projects took years and years and are still held up in courts.

And so the more we can have, again, an efficient permitting process that, again, still engages stakeholders, still engages communities, still allows, you know, litigation to happen but be challenged and resolved more quickly will allow for more of these projects to happen efficiently.

I think there is several legislative ideas out there. Representative Graves with the BUILDER Act, Senator Mike Lee with the UNSHACKLE Act, that would still have this environmental accountability and safeguards but allow projects, again, not just for

forest restoration and timber development, but also it will help with clean energy projects, more transmission lines, more liquefied natural gas exports, which are cleaner than Russian piped gas.

This is one issue in which I have heard from, you know, people who are working on forest restoration, energy developers, manufacturers all run into these challenges. And the quicker we can resolve this issue, I think the more we can work with urgency to provide economic and environmental benefits.

Mrs. MILLER. I agree.

In your testimony, you mention the possibilities that carbon offsets can provide to companies who are looking to reduce their carbon footprint.

Can you explain in more detail some of the opportunities and challenges that are presented by the carbon offsets, along with their effectiveness?

Mr. LORIS. Yeah, I think these voluntary carbon offset markets, you can provide flexibility to engage with companies and nonprofits and entrepreneurs, a lot of climate entrepreneurs, who are motivated by reducing emissions to ultimately reduce their environmental footprint and reduce emissions. And the people who are doing that will then get paid for it. So it is certainly a win-win.

And I think there have been concerns about carbon offsets, primarily the validity of them, as well as, you know, if a restoration project for forests or a forestation project happens and it burns down, what does that mean for the offsets or—and there has been some challenges with validity.

But those concerns, I think a lot them have been alleviated by the work of the private sector by nonprofits in terms of we have better technology now. We can use drones and satellite imagery and better data to verify that these offset projects are happening.

I think another concern is the concept of additionality which, you know, are people getting paid for something they were going to do otherwise? And it is very difficult to prove a counterfactual there.

But that said, I think the fact that carbon offsets provide this flexibility and market-based mechanism for some companies who have a very challenging task ahead to reduce emissions is something that results in more productive relationships.

The more we can have the private sector taking the lead on that, which I think is what has happened, I think the better off we are going to be. I think the role for the Federal Government should be limited in ensuring that these are verifiable carbon credits and to prevent things like the Chinese flooding the markets with fake credits. There is a role there, but I think it should be pretty limited.

Mrs. MILLER. Thank you.

I yield back.

Ms. CASTOR. Rep Bonamici, you are recognized for 5 minutes.

Ms. BONAMICI. Thank you so much, Chair Castor and Ranking Member Graves, for holding this important hearing. And thank you to the witnesses for your expertise.

In November, this committee held a hearing, examining Tribal perspective on the climate crisis. I asked a question about the announcement from the White House Council on Environmental Quality and the Office of Science and Technology Policy about the

administration's commitment to elevating indigenous traditional ecological knowledge the Federal policymaking process.

Early last month, the White House announced that the administration will be developing guidance to lift up traditional ecological knowledge in Federal decisionmaking.

So, Dr. Eisenberg, you have substantial experience with traditional ecological knowledge. What are the lessons learned and the best practices that should inform the development of this guidance?

Dr. EISENBERG. Thank you for that question, Representative Bonamici.

I was actually present at some of the meetings that you just mentioned. And I am very actively involved with the process of providing guidance on how to use indigenous traditional ecological knowledge, or TEK as it is referred to by the scientific community.

We need to have government-to-government relationships. That means Tribal Nations are not stakeholders. A stakeholder is a member of the public. Tribal Nations are nations, and so that means honoring sovereignty rights in all aspects of our partnerships with them.

Tribal Nations very much, all the Tribal Nations I have worked with around the world, want to partner with federal governments and nonprofits. But it needs to be decolonized, this process. So we need to all sit at the table as equals.

TEK is—it is our native science, but it is also a world view, and it includes ethics and so that everyone is equal and the living world needs to be respected equally. And this is within the context of multiple uses.

So one of the things that can help advance this is to integrate our cultures, our elders in all the conversations. And the White House is really leading with this. The White House Council on Environmental Quality, some of those meetings have been held by Secretary Haaland. And she really embodies these principles in how—in her leadership style.

Ultimately what we want is a conservation corps of indigenous people out on the landscape. Our TEK, our ecological knowledge, is the way our Nation's lands, what is today the United States of America, have been managed for millennia. So all of our grasslands, all of our forests, all of our coastal ecosystems co-involved with a large population of Indigenous people very actively managing those lands.

And the grasslands—

Ms. BONAMICI. I am sorry. I don't mean to cut you off, but I really want to get another question in. We will continue conversation at another time, and I may ask to you submit more for the record because we have a lot to learn.

Dr. Larkin, I am the co-chair of the House Oceans and Estuary Caucus. I have long advocated for elevating the role of marine and estuarial ecosystems in adapting and mitigating the effects of climate change, because we know of the potential which you, of course, have recognized to reduce flooding, reduce the intensity of storms, sequester carbon, and generate good-paying jobs.

I do want to invite all of my colleagues on the committee and beyond to sign onto my bipartisan Blue Carbon for Our Plant Act.

So, Dr. Larkin, in your testimony, you cite training and workforce development as necessary components of an effective natural climate solutions toolkit. So what are the current workforce challenges you and your colleagues have experienced, and how can Congress help you close the gap?

Dr. LARKIN. Well, thank you. Thank you.

So you are absolutely right. The training and workforce development is the key to our future as we try to draw new students in and develop new programs.

I think one of our challenges is finding our partners. But the good news is, because these solutions can be implemented at the local level all the way up to the State level, the fact that we do have partnerships at every one of those levels and with our state organizations. For us, it is the Florida Department of Environmental Protection and the Fish and Wildlife Service.

And, even as we try to develop programs that can be incorporated into our curricula, start training students to think about these as careers moving up, how do we do that? Well, in high schools in Florida there is a curriculum process, and it is not necessarily easy to break into.

So right now we are working on trying to help support the development of an aquaculture curriculum, because aquaculture—several different types of aquaculture, and how do we develop a curriculum around that so that the STEM courses in high school and those AP courses can use these examples as part of their learning tool, and maybe plant a seed that, after high school, this is something I can do, or maybe I will want to be a researcher and go on in my education.

So I think it is interesting, because that does take our State partners, it takes our local partners, and it takes the folks that are working in the area to really see what is that type of that project?

You know, these projects are so site specific, so we need theoretical and applied research at the site level. Because what happens in one bay is so different than what happens in another in terms of the outcomes that we are going to receive.

And that should really resonate with our workforce. So, as we share our communications around the State, we really need to tailor them around the State to get the folks and the table to figure out which one of these workforce programs might work best for you. We can't—

Ms. BONAMICI. Thank you, Dr. Larkin. I see my time has expired, and I really appreciate your response as a member of the Education Committee as well.

Ms. CASTOR. Your time has expired.

Ms. BONAMICI. I yield back. Thank you, Madam Chair.

Ms. CASTOR. Next up, Mr. Carter.

You are recognized for 5 minutes.

Mr. CARTER. Thank you, Madam Chair.

And thank all of the witnesses for being here.

I know it is going to be a surprise to my colleagues on this committee, but I want to talk about forestry. And the reason I want to talk about forestry is because Georgia is the number one forestry state in the nation.

Georgia has over 22 million acres of commercially available private timberland, more than any other state. And each of those acres serves as a carbon sink. You see here? Trees are the answer. Trees are the answers. Because forests serve as carbon sinks. They serve as a water filter, as an air filter, as well as a habitat for wildlife.

In fact, Mr. Loris, in your testimony, you said that fully restoring understocked productive forestland in the U.S. could increase carbon sequestration by 20 percent—by 20 percent.

Bruce Westerman, Representative Westerman, the Ranking Member on Natural Resources, has a bill called the Trillion Trees Act. We are trying to make sure that we plant a trillion trees. It is a great, great bill, a great effort.

And one of the problems that we are facing is ensuring that forests remain forests, because landowners can use their land for just about anything to make a living, and they do. But, unfortunately, due to natural disasters, hurricanes, fires, a lot of times after they have this natural disaster, they don't put it back into forestland. And that is what we need to encourage them to do.

So I have got legislation that is cosponsored by Representative Sewell from Alabama. It is called the Disaster Reforestation Act. And this will help fix a portion of the Tax Code that makes it difficult for forest landowners to continue using their land for forest.

I want to ask you, Mr. Loris, what are some other barriers to expanding and maintaining our forests, both public and private forestland?

Mr. LORIS. Yeah. Yeah. I think that the two challenges are we need to protect the ones we have got. And there are a number of policy fixes that I think could help with timber harvesting—removing export bans on timber harvesting that occurs on Federal lands; expanding acreage limits for categorical exclusions for controlled or prescribed burns; excluding State-level air quality emission standards for prescribed burns as well, which would just be a temporary fix.

But to allow a prescribed burn to happen on a good day where it is not windy is a temporary fix to ensuring that we don't have worse environmental and climate outcomes as a result of a more intense natural disaster in a wildfire.

And then I think to your other point is planting more. There is a number of provisions within the Trillion Trees Act—matching grant programs to provide seeds and saplings for States, for non-profits, for Tribes to continue to plant more trees.

And I think the more we could also expand afforestation efforts as part of remediation of abandoned mine sites. There are thousands of mine sites that need environmental remediation. And the more we could inject natural climate solutions into that remediation—and there is some good legislation that will remove some of the environmental liability risk associated with environmental mine land cleanup, the better off we are going to be.

Mr. CARTER. Good. Well, thank you.

Well, one thing I know that we can do is to expand the use of wood and the wood products as a renewable resource. And that would both ensure that there is always a market for working for-

ests, keeping them economically viable, and that we continue to grow trees that pull CO₂ out of the atmosphere.

Mr. Loris, can you speak very quickly to the environmental benefits of using wood and forest products and how we could further incentivize this, specifically about the lifecycle of emissions?

This is one thing that I think we miss that point. When people talk about biomass, they think, “Oh, you are burning something, therefore it is putting carbon in the atmosphere. No way it can be environmentally friendly.” But, if you look at the whole lifecycle, it indeed is.

Mr. Loris.

Mr. LORIS. Yeah, that is right. I think we can expand the use of wood projects to continue to utilize wood as a safe, environmentally sustainable product.

And, again, that is where I think some of the legislative opportunities to enhance the availability of wood projects, whether that is through ARC legislation that would enhance opportunities for these kind of new, more efficient types of wood, and even harvesting younger trees is still going to be better off from an environmental standpoint.

And, if you would look at what the alternative might be in terms of using cement or other products that are more emissions intense, you are still going to be better off from an environmental and climate standpoint.

So not only does it provide economic opportunities, but it provides environmental benefits.

Mr. CARTER. Okay. Well, good.

Again, trees are the answer. Remember what they say back home, Madam Chair. When you breathe fresh air, get down on your knees and thank the farmer who planted the trees.

God bless America. And I yield back.

Ms. CASTOR. Mr. Carter, you are giving me visions of The Lorax and Thneeds and Truffula trees and the Once-ler. And I know—what did they say? Unless someone cares a whole awful lot, nothing is going to get better, it is not. So let’s all take that to heart today.

And now we will go to Rep. Levin for 5 minutes.

Mr. LEVIN. I am not sure if I can follow my friend, Buddy Carter. But thank you, Chair Castor.

As a Representative for California, I want to highlight how natural solutions can and must play a key role in addressing some of the pressing environmental challenges, particularly those facing California.

First, let me start off with natural solutions to address wildfire risk. Over the last 4 years, California communities have suffered from seven of the largest fires in State history. Again, that is just over the last 4 years.

These fires have collectively burned over 2.5 million acres and destroyed or damaged over 30,000 structures. With climate change, we know that we can’t just prepare for a fire season, but must now deal with this threat year round.

And we know that wildfire risk will likely only continue to increase with the U.N. Environment Programme recently finding that the likelihood of extreme wildfires is expected to increase by

up to 14 percent by 2030 and up to 50 percent by 2100 as a result of climate change and changes in land use.

Mr. O'Mara, thanks for your testimony. You highlighted how natural solutions can minimize the impacts and severity of wildfires, and you noted how, due to ever-increasing wildfire risk, Federal land management agencies, such as the U.S. Forest Service, have had to spend significantly larger portions of their budgets on fire suppression, limiting their ability to fund restoration and management activities to improve ecosystem health and resilience.

This hearing, I hope, is making it abundantly clear that an ounce of prevention is worth a pound of cure.

Mr. O'Mara, can you share why the significant investments in the Bipartisan Infrastructure Law, specifically for wildfire risk reduction, are so important in reducing long-term wildfire risk?

Mr. O'MARA. Yeah. Thank you for that question, and thanks for your incredible leadership on this difficult issue.

As you said, I mean, healthy forests, making sure that you have ecologically appropriate reforestation practices, making sure you are removing invasives, making sure you are trying to get at things like disease, or trying to make sure that you have—moving, in some cases, small-diameter trees and some of the tinder that leads to these massive fires, is all part of having systems that are much more resilient to the kind of fire spread that we have seen.

I think a lot of folks talk about the acreage of the fires. It is the intensity, too. It is the level of heat. There is not enough soil moisture in some of these cases. So all of a sudden fires that may have had a couple—tens of thousands of acres all of a sudden are in the hundreds of thousands of acres or millions of acres because these systems are not sufficiently resourced.

And, like, for most of the last decade, the Forest Service is spending more than 60 percent of the budget fighting fires, not actually restoring forests. The bipartisan infrastructure package is going to help reverse that. The 27 billion that is proposed in the reconciliation package would very much fix that, so hopefully that can be part of the ongoing negotiations.

Mr. LEVIN. Exactly. Well, you pointed out that 27.5 billion for forest restoration that was included in the House-passed reconciliation bill, that would be transformational for the West. And I think we will all continue to fight for a strong reconciliation package, and specifically for that funding.

Shifting gears, I wanted to speak about another challenge we are facing in southern California. That is water scarcity. We know that droughts, wildfires, rising temperatures, and the degradation of natural ecosystems are exacerbating this water crisis that we are facing.

Can you expand on how protecting natural ecosystems on a watershed-wide scale can protect access to reliable clean water, and also how restoration projects in upper watersheds benefit users downstream?

Mr. O'MARA. Yeah. I mean, having healthy ecosystems, whether that is healthy forests or healthy grasslands, do provide an absorption value to keep kind of water where you need it and not having the high rates of evaporation that we are seeing in southern California, for example, some of the challenges we are facing in the

Sacramento Delta up north, and really kind of making sure you are kind of holding the water where you need it so you have the access to it as the demand in the right places.

And so, again, I mean, folks don't always think about forests as not just a carbon sink, but kind of a water sink, as a way to have these healthy watersheds, but it is a critical part of the solution. And I would much rather see that than some of the manmade conveyances that aren't nearly as effective as what Mother Nature created.

Mr. LEVIN. Thank you for that.

Dr. Eisenberg, I would like to turn to you, staying on the topic of water, I was excited to hear about your work with Tribal communities in Montana restoring degraded lands with native plants, and was glad to hear about the positive ecosystem health benefits you have seen through these restoration partnerships with Tribal communities.

Can you discuss how these restoration practices can improve water resilience on an ecosystem-wide scale? And, also, how can restoring grasslands be a key natural solution to the West's water scarcity challenges?

Dr. EISENBERG. Well, this has to do with fire and soil. So fire is part of traditional practices done by Native people in forests and grasslands throughout the United States for millennia. And what this does is it puts more carbon into the soil and in the prairie rangelands. And what that does is it greatly increases, has the potential to greatly increase the capacity of the soils to store water.

Prairie soils, there are roots that go down up to three meters from these prairie grasses. And so the combination—Native people used fire to create the sort of resiliency that you have been expressing concern about and to help retain moisture in both forest and grassland ecosystems. So fire is a critical piece of it.

And so the restoration programs that we are working on, right now we have a proposal to the BLM for a large program in Oregon, in the forests of Oregon, in the dry forests, to look at these things. So it is not just about grasslands.

Thank you.

Mr. LEVIN. Thank you, Dr. Eisenberg.

I am out of time, but I look forward to working with you and all of our witnesses and hopefully across the aisle on this very important issue.

And I will yield back.

Ms. CASTOR. Thank you, Rep. Levin.

Next up is Rep. Crenshaw.

You are recognized for 5 minutes.

Mr. CRENSHAW. Thank you, Madam Chair, thank you to the Ranking Member for holding this hearing, and thank you to the witnesses for being here.

I absolutely think the work of conservation efforts and forest management and protection of our natural resources is extremely important, and I am sure the work done by many of our witnesses has contributed positively to that effort.

I do have some concerns, as you might imagine. I have concerns that many environmental groups do not understand that critical balance between energy development and environmentalism. I fear

that many do not understand that you can indeed do both. After all, it was natural gas fracking in America that led to historic reductions in CO₂ emissions.

And I don't think this is a goal of many environmental groups. Unintentionally, intentionally, whatever it may be, there has been a serious undermining of American energy development in United States, which has geopolitical implications, as we are seeing now with Russia and Ukraine and Europe's dependence on Russian oil and gas.

So my questions are going to be for Mr. O'Mara.

You stated in your 990 that you are currently supporting litigation against Enbridge Line 5, which, if successful, would remove half a million barrels per day, causing yet another serious supply shortage of petroleum products in an environment where there is already extreme shortages, increasing gas prices in an environment where gas prices are already very high.

Are you using Federal grant money to do this for your efforts, recognizing, given the context, that that money is indeed fungible?

Mr. O'MARA. No. No. We receive very little Federal money.

Mr. CRENSHAW. Okay. But money is fungible.

So you are taking grant money, and just a quick count of Federal grant money from the last few 990s is over \$4 million.

Mr. O'MARA. For projects on the ground.

Mr. CRENSHAW. But it is fungible.

Mr. O'MARA. It is not.

Mr. CRENSHAW. Outside of grant money from the United States Government, what other sources fund your organization?

Mr. O'MARA. So we receive—we have 6 million members, so folks that are sending \$15. We have Ranger Rick Magazine, which folks subscribe to. We have some foundations that support us.

Mr. CRENSHAW. What about Sea Change Foundation, how much have you received from Sea Change?

Mr. O'MARA. Nothing in years.

Mr. CRENSHAW. The number is in front of me. In the past, your organization has received \$3.4 million in funding from Sea Change.

Mr. O'MARA. Nothing in the last 6 years, though. I have only been CEO for the last 5 or 6 years. I think that was before.

Mr. CRENSHAW. Okay. So it was before. So it has happened in the past. It is good to know.

The reason I am concerned about this is because it is well documented that Sea Change is, in part, funded by a Russian shell company based in Bermuda called Klein Ltd. Vladimir Putin funnels money through Klein to organizations for obvious reasons: to undermine American oil and gas and keep the world dependent on Russian oil and gas.

And I will submit these reports for the record.

But you were never aware of this or aware of this organization?

Mr. O'MARA. No. And, Congressman, I mean, I think, if you talk to some of your colleagues, we are considered like one of the most moderate, pragmatic organizations, actually trying to find solutions for domestic production and conservation at the same time. So I am a little surprised by this line of questioning, frankly.

Mr. CRENSHAW. Well, it is because of these talking points that Russia puts out and that some of our environmental groups put out

that are anti-American energy, they tend to coincide, they tend to be the same. And it is concerning when you start to follow the money.

I appreciate the fact that it hasn't happened in 6 years. That is good news. But the talking points haven't changed and the efforts haven't changed.

And here is another question. So if you get rid of this pipeline, you get rid of more American production, do you think that affects worldwide demand or worldwide emissions?

Mr. O'MARA. Well, I think—I mean, if you want to talk about Line 5 specifically, it is coming from Canada. It is going across the Great Lakes. It is a 63-year-old pipe that is under both Lake Huron and Lake Michigan. If it ruptures, it will be a catastrophic impact that is greater—it is going to make the BP oil spill look like child's play.

I do think that is different. I mean, there are other pipeline projects we have not opposed. I mean, we are not in kind of the pipeline business generally.

If the Great Lakes become contaminated, especially when there are other alternatives—there is the Sarna (ph) Line, there is the 17th Line, there is a bunch of other options in that region. Having the Great Lakes be contaminated on our watch would be one of the greatest environmental disasters in our history.

We are not in the middle of all these other pipeline fights that you hear from other different groups, but that is one where it is the most important freshwater source of water in the world. And having that happen—and, frankly, Enbridge, given their history of the Kalamazoo spill and others, I mean, it is just one of those cases where we need a better solution, because you have a pipe that was supposed to last for 50 years, and we are at 60-something and counting.

Mr. CRENSHAW. Okay. Look, the reason I am concerned about this—I am not the only one who has ever brought this up, that Russian propaganda has made its way into a lot of environmentalist talking points. You have done a good job defending your organization today, and I appreciate that.

But I am not the only one who has said this. Hillary Clinton has stated this is true. NATO's Secretary General has stated this is true. Our ODNI has stated this is true. Our National Security Council members have come out and testified for this.

So it is an important piece of the puzzle when we talk about American production and how to balance that with environmentalism. Believe it or not, we are all on the same page on a lot of these efforts to increase our conservation efforts and protect the environment.

But we also have to protect people's ability to make a life for themselves and bring themselves out of poverty. You can only do that through energy security and in an environment where inflation isn't skyrocketing. And so some of these efforts directly contribute to that and benefit Russia. And I think that is the broader point that I am making.

Mr. O'MARA. Well, I mean, Congressman, to that plan, I mean, look, I would much rather have clean American energy displacing Russian oil and gas. I would much rather have clean supplies. Let's

make sure it is as clean as possible. Let's make sure the rhetoric is real.

Mr. CRENSHAW. Glad to hear that.

Mr. O'MARA. Let's use American energy and clean energy, [inaudible] pumps, renewable energy. But let's export all of our technologies to fight—

Mr. CRENSHAW. Fully agree. Forty-one percent higher emissions if you use Russian gas over American gas. So thank you. I yield back.

Ms. CASTOR. Gentleman from Texas yields back.

Next, we will go to Rep. Brownley.

You are recognized for 5 minutes.

Ms. BROWNLEY. Thank you, Madam Chair. Thank you for holding this hearing. And I thank the witnesses today.

I can't help but to take the opportunity to brag about a project in the district that I will soon represent, after the 2022 election. It is a project in a little town called Agoura Hills between the Simi Hills and the Santa Monica Mountains. And, on Earth Day of this month, April 22nd, there will be a groundbreaking in terms of building a bridge over the 101 Freeway.

It is a bridge that is billed as the world's largest wildlife crossing. It is a bridge that will be the first of its kind near a major metropolitan area. And, as I mentioned, the largest in the world, stretching over ten highway lanes on a very, very, very, very, very busy freeway.

And so, Mr. O'Mara, I know that the National Wildlife Federation has been involved in this project. It is a very, very exciting thing that is happening in my area of the Conejo Valley, the Santa Monica Mountains, the Simi Hills.

The partnership on this project is really inspiring. I think it is extraordinary. It is a partnership with the Santa Monica Mountains Conservancy, the California Department of Transportation—as we call it, Caltrans, in California—the Mountains Recreation and Conservation Authority, the National Park Service, and the National Wildlife Federation.

So, Mr. O'Mara, I just wanted you to comment on this project. I wanted you to talk a little bit about the benefits of this project. And, if you could, talk a little bit about how this whole public-private partnership came to be.

Mr. O'MARA. Thank you so much for the questioning. And we are looking forward to seeing you on Earth Day. It is going to be a great event out there in just a few weeks.

So this is a great project. It will be the largest wildlife crossing in the world. The mountain lion population of southern California across the Agoura Hills and into San Gabriel, kind of thinking like the 101 and 5, has been completely bisected by massive highways.

And so this is the project to try to reconnect some of that habitat in a very smart ecological way. It was started by some amazing research by the National Park Service that was looking at fatalities of these amazing mountain lions that were dying as they were trying to get across the 101 as a way to find mates and find food.

And so Beth Pratt, who I am sure you know, Congresswoman, has been a dynamo on this project, pulling together all the partners. Amazing leaders, like philanthropists like Wallis Annenberg,

and the Governor, as well as so many other partners that you mentioned.

But this is a project, and I think, if we can show that we can go across a ten-lane highway in California, we should be able to have wildlife crossings and connectivity all across the country.

And we were grateful for your leadership and others on this committee for making that crossings program part of the infrastructure package. There is about \$50 million a year to do these kind of projects.

And the interesting thing, too, is that the insurance companies love it because one of the biggest sources of payouts are wildlife collisions. And so it is a way to actually reduce vehicle accidents and make streets—make roads a little safer and help wildlife at the same time.

Ms. BROWNLEY. Thank you so much for that.

And, just with another minute or so left, in your testimony, you talked about nature solutions only being about 5 percent of climate spending altogether. So that sort of makes me—I think this might go back to somewhat of what the chair of the committee was asking originally in her questions.

But if it is only 5 percent of the climate spending, are we really—and I think this hearing is really about an ounce of prevention is worth a pound of a cure. The benefits are so great. Are we really prioritizing correctly, I guess is the question, in terms how we are spending dollars to mitigate climate?

Mr. O'MARA. Yeah. No, I appreciate the question. And, I mean, of course I want to see more investment on the natural climate solutions. I think it is bipartisan. I think it is incredibly smart, both for resilience and for carbon abatement. And, at the same time, we also need the technological solutions.

So I don't want to position it as an either/or. I think we have been a little light on that side. But as we are electrifying the grid and thinking about transportation and all the other investments on the climate side, I just want to make sure that something that could be a quarter of the solution isn't left so far behind, especially when it can be so bipartisan in this current environment.

Ms. BROWNLEY. Thank you so much.

Thank you, Madam Chair. I yield back.

Ms. CASTOR. Thank you.

Next up, Rep. Palmer, you are recognized for 5 minutes.

Mr. PALMER. Thank you, Madam Chairman.

I want to go back to a question that my colleague, Mr. Crenshaw, asked about your funding. You did receive \$2.1 million from the MacArthur Foundation between 1991 and 2021 that would fall under the time frame for climate solutions and environmental work. Is that correct?

Mr. O'MARA. The MacArthur Foundation?

Mr. PALMER. Yes.

Mr. O'MARA. Yes. I think we received maybe half a million dollars last year.

Mr. PALMER. How about the Hewlett?

Mr. O'MARA. Yeah.

Mr. PALMER. Okay. Thank you.

Mr. Loris, there was a report from the Little Hoover Commission entitled “Fire on the Mountain: Rethinking Forest Management in the Sierra Nevada” that was the topic of a San Francisco Chronicle article. And the lede of the article said, “A century of mismanaging Sierra Nevada forests has brought an unprecedented environmental catastrophe that impacts all Californians.”

The Commission goes on to say, “Plans for prescribed burning to rid the forests of dense ground cover often clash with regional air quality regulations, even as emissions from catastrophic wildfires nullify hard-fought carbon reduction accomplishments.”

I just want to know your opinion in regard to the misguided ideas about prescribed burns which have led to unhealthy forests, more carbon emissions, and unnecessary wildfire damage and deaths, and particularly the intense heat that is created by wildfires because of the failure to properly manage the forests.

Would you comment on that?

Mr. LORIS. Yeah. And Collin was exactly right when he said it is not just about the size of these wildfires, it is also about the intensity and the heat.

And prescribed burns and controlled burns is something that the U.S. has been doing for a long time. And, unfortunately, in places where there has been more bureaucratic hurdles, it has been happening less frequently than it otherwise should.

I mean, you could look at a place like Florida juxtaposed to California, and the rate of controlled burns in a place like Florida is so much more efficient than what happens in California.

And so I think this is something that has been time and proven again where forest managers at the Federal level, at State level, nonprofits, private organizations, private landowners, all understand the environmental importance of controlled burns. And when an overly bureaucratic environmental review process happens, when these projects are held up in years of litigation, we see what happens.

Mr. PALMER. Okay. I also have an article from Mother Jones News. It is a favorite publication of leftists. And it is about the pine beetles that are ravaging western forests. It has been an issue in southern forests for decades, for years, as long as I can remember.

And in the article—I will read what it says. They are often described as pesky invaders, bark beetles have been a key part of conifer ecosystems for ages, ensuring that the groves don’t get overcrowded.

Is this a leftist—I don’t even know how to describe this. Is this some idea of how to log forests through beetles, to manage forests? I mean, to allow pine beetles to continue to decimate these forests and actually create even more fuel for forest fires?

Mr. LORIS. Not to my knowledge. And, again, preventing and eradicating invasive species should be a bipartisan issue, and I think there are a lot of pragmatic groups who believe that to be so. And the infrastructure bill provides \$100 billion each to the Department of Agriculture and Department of Interior.

Again, I think the more we can get people on the ground doing the work to eradicate the invasive species, and the more we can provide and harness collaborative relationships between private

landowners, Federal and state agencies, and the Federal agency, the better off we are going to be.

Mr. PALMER. Okay. Let me move on to that.

One of the ways to prevent this destruction of the forests is to log these forests. And that is a way of sequestering carbon. When you cut the timber and you turn it into wood products, you sequester carbon. But that is also a way to mitigate the infestation of the pine beetles. You can cut the infested trees, peel off the bark, and burn them, which that creates some emissions issues, or cut the trees and then spray with toxic sprays.

Doesn't it make more sense to engage in sensible logging practices and forest management than to allow the pine beetles to continue to destroy the forests and, again, create this massive amount of deadwood fuel that create these intensely hot fires?

Mr. LORIS. Yeah. And part of that speaks to permitting and, again, environmental review challenges. I don't mean to sound like a broken record. You could lift the export ban on unprocessed timber on Federal lands.

You know, I mentioned the ARC legislation, the America's Re-vegetation and Carbon Sequestration Act, that would allow for some of this development to occur and, again, for more mass timber development. And, again, I think we need to look at the tradeoffs.

When you use more timber, when you promote healthier forests, rather than using concrete and rather than losing these forests to extremely intense and large wildfires, the better off we are going to be from an economic standpoint, but also from a pollution and a greenhouse gas emissions standpoint.

Mr. PALMER. My time has expired. I yield back.

Ms. CASTOR. Next up, Rep. Casten.

You are recognized for 5 minutes.

Mr. CASTEN. Thank you, Madam Chair.

I want to talk about natural solutions as the theme of this, but I do just want to start, I feel compelled to respond to some of the comments that have been made.

Tomorrow will be the 2-year anniversary of President Trump calling the Saudi Arabian Government and saying that we are going to withhold, we are going to take our troops out, unless you cut OPEC production, and in his words, because of a strong desire to protect the U.S. oil industry.

I am delighted that in the 2 years since my colleagues across the aisle are now opposed to Vladimir Putin. I am delighted that my colleagues across the aisle now support providing defensive weapons to Ukraine. That is a genuine transition. It is welcome, overdue, and I think it is genuine.

I am also extremely disappointed that they continue to oppose every policy that would reduce fossil fuel demand while simultaneously opposing anything that would increase fossil fuel supply, as the ranking member did today in his opening statement. You cannot oppose demand reduction and oppose supply reduction and claim to be in support of lowering fossil fuel costs.

I get that that provides a lot of money to the fossil fuel industry. I get the fossil fuel would like to charge more for their product. Please do not represent that ever again as being in the interest of consumers.

I am sure you will have some responses.

Let me now move to—I want to thank Mr. Carter for his comments on trees, and I think that the benefits of trees sequestering carbon are welcome.

Urban trees are a really interesting thing. And the Morton Arboretum does some fascinating work in Chicago showing that urban areas with trees, because of evapotranspiration, because of shade, are five to ten degrees cooler, less load on the air conditioning.

It was my pleasure to provide them with \$750,000 to help further their research, because these trees are actually increasingly unable to survive in urban environments because of warming and pollution.

And, Mr. O'Mara, I am wondering if you have any thoughts on what we can do federally to enhance our urban tree canopy and help the viability of those forests?

Mr. O'MARA. Thanks so much, and thanks for your leadership on this.

I think it is a huge opportunity. And it is not just the urban heat island effect. It is also the health benefits. I mean, folks that have healthy tree canopies have lower rates of asthma. You see less upper respiratory illnesses. I mean, the public health benefits are massive.

Some of the best work in the country is actually being done in Louisville, Kentucky, where they are actually doing a lot of work—it has been fairly segregated, the wealthier areas had a lot of trees, other areas didn't—and looking at, like, the benefits.

On the policy side, I think making sure that, like, urban tree canopies are just an eligible use for a lot of these programs. A lot of times they are an afterthought, because you think of private lands or State lands or Federal lands.

I think there is an issue with, like, technical assistance, making sure there is enough capacity to actually do the care and feeding, and making sure the trees survive, because, as you said, warmer temperatures are leading to higher death rates of trees in different communities.

But I think there are big opportunities to do some existing pots as well as some things we could kind of tuck into other authorizations.

Mr. CASTEN. I would love to work on that.

Moving from the urban to the much broader, I have seen estimates that getting back to the agricultural—the soil carbon contents that we had a hundred years ago—I have seen as much as 30 to 80 parts per million that we could pull out of the atmosphere if we could bring that back. Now, some of that is easier said than done.

But there is a really interesting program that Illinois has rolled out to enhance the use of cover crops and couple that to reductions in crop insurance for farmers, to sort of use currency that the farmer understands, but add cover crops that not only increase soil carbon retention, but increase topsoil retention, a whole host of other—I see you are nodding your heads.

We are working on trying to find ways to sort of federalize that really good state policy. And I am wondering if you have any comments on what we might factor in as we think about maximizing

the use of cover crops, not just in terms of the climate benefits, but also doing it in ways that will resonate with the farmers who are going to deploy this and address any concerns that they might have.

Mr. O'MARA. Yeah. I mean, it is interesting. We are seeing the uptick of cover crops going up in many parts of the country right now, and Illinois is a great example, some good work in Wisconsin as well.

It is not for climate reasons. I mean, it is because it reduces soil erosion. It improves productivity, because the soils are richer and they are more fertile. It also is a way to reduce kind of flooding impacts and just make sure that topsoil isn't kind of blowing off.

And I also think that we should be compensating farmers for some of the carbon benefits as well if they are willing to do it.

And so, I mean, I would love to be in a world where farmers are paid for the commodity, but also for some of the other benefits they are providing. And the incentive of crop insurance is a perfect one, where all of a sudden we know we are going to have to pay out less. If the soils are healthier and there is less erosion, you are going to have less damage from the next catastrophic storm.

So I think getting those incentives right but not making it a climate program, there is a climate co-benefit, which is great, but let's do it because it improves the economics, improves the soil health.

Mr. CASTEN. Okay. And I know we are about out of time, but if you have further comments for the record, one of the things that we have been struggling with is different regions of the country, depending on the planting season and when the cover crop goes in, farmers think about it in different ways.

And trying to find a way to do this not with a one size fits all, but something that works for the different kinds of agricultural environments in the country.

Mr. O'MARA. Yeah. And there is some great thinking going on right now actually at the University of Illinois, Champaign around making sure that some of the cover crops have markets and not thinking of them just as like a byproduct, but actually as another economic driver. So I would love to work with you on that.

Mr. CASTEN. Thanks so much. Yield back.

Ms. CASTOR. Next up, Ranking Member Graves.

You are recognized for 5 minutes.

Mr. GRAVES. Thank you, Madam Chair.

It is not often that I have a chance to speak after Mr. Casten, so I am going to go ahead and enjoy this for just a minute.

Look, we can sit here all day long, and I would be happy to stay here as long as you want and go through all the facts. The facts are that under the Biden administration we saw a 161 percent increase in dependence upon Russian crude oil, number one, period. That is a fact.

Number two, you and your colleagues not only have opposed domestic energy production, just as this administration is doing—and I am going to quote this President when he said, “We are going to ban all oil and gas.” I am going to quote his Interior Secretary when I say that she said, “We are going to ban drilling on public lands and fracking everywhere.”

I am going to talk about the SEC ESG initiatives. I am going to talk about the executive order that said we are not going to do any new production on Federal lands.

And then talk about how we are going to go out there and we are going to use renewables, but then stop the Twin Metals mine and other efforts to actually produce critical minerals in the United States that are required for renewable energy. Your energy policy is none of the above, not all of the above.

Every single thing that we are experiencing right now is a result of the failed or just say the lack of an energy strategy by this administration. And I hate to say this, Mr. Casten, but you and your colleagues have been complicit in this.

We have offered amendments. I have offered amendments over and over again to ban Russian oil, to prohibit it, and you know who has voted against it? That side of the aisle.

You all want to have this discussion? I will have this discussion all day long. Let me say it again. The President yesterday said a million barrels of oil, a million barrels of oil a day. You know how much he was importing from Russia? Two hundred thousand barrels. That is five times the amount, five times the amount every single day. You know why? Because it is mitigating for stupid energy strategies.

I am all for all of the above. I will sit down with any of you all and talk through it. No policy and objecting to everything is not a strategy, and the American people that we all represent are paying for it right now, and it is ridiculous.

I want to thank you all for being here.

I want to say, Mr. O'Mara—I have got to tell you, I have worked with him for a while when he was in Delaware, and I have found him to be an honest man, and I have found him to be a good partner to work with, although I do want to say, to protect your reputation, we don't always agree.

Mr. O'Mara, I want to make sure I understand something that you said, and just give me a yes or no. You said in your extensive testimony a lot of things, but one of them is that you believe that sequestration is a part of a—should be part of a net zero strategy. Is that right?

Mr. O'MARA. Absolutely.

Mr. GRAVES. Okay. Thank you. And you advocate for natural solutions, such as trees and other natural uptake. Something I think you and I have worked on in the past is engineered oyster reefs, living shorelines, and things like that as a way to kind of get your win-win-win-win-win scenarios. That is accurate?

Mr. O'MARA. Absolutely.

Mr. GRAVES. Okay.

So 45Q, which is enacted, is that an okay policy?

Mr. O'MARA. Absolutely.

Mr. GRAVES. But we need to make improvements?

Mr. O'MARA. But let's—and I think let's make it inclusive. Let's include—

Mr. GRAVES. Right. So you believe that 45Q is good, but that we should expand its scope to include natural or biogenic sources?

Mr. O'MARA. Exactly.

Mr. GRAVES. Okay.

Mr. O'MARA. And it is cheaper. It is a lot cheaper.

Mr. GRAVES. Which I totally agree with you. Totally on board. And I think that that does make sense.

And then, lastly, in regard to efforts to restore coastal ecosystems or wetlands or help to prevent the loss of those, you agree that that—both of those are strategies to either sequester or to prevent the release of greenhouse gas?

Mr. O'MARA. Absolutely.

Mr. GRAVES. Okay. Thank you very much. I appreciate it.

Mr. Loris, Ezra Klein did an op-ed in The New York Times a while back, and he was talking about how NEPA, National Environmental Policy Act, while well-intentioned perhaps, over the years and much case law that has, in my opinion, very much deviated from the actual focus or purpose of NEPA, that it has actually contributed to the impediments, I guess, in terms of our efforts to try to carry out projects such as renewable energy projects.

Do you care to respond or comment on that?

Mr. LORIS. Yeah. I think you are seeing a movement from a lot of folks kind of on the center-left aisle who are recognizing that some of the biggest impediments to clean energy infrastructure, to natural climate solutions is onerous and bureaucratic environmental reviews and litigious organizations who prevent these projects from happening in a timely manner.

Ezra Klein did it. Matt Yglesias, another center-left economist, talked about the importance of cost reduction, but also of deployment. And you can't deploy technologies, you can't deploy transmission lines, you can't deploy new nuclear power plants, you can't deploy natural climate solutions without efficient environmental reviews and permitting.

And so I think if you are talking about a silver bullet, this is certainly not it. There is a lot of things we need to do for American leadership and for global decarbonization.

But in terms of helping with all of these solutions to decarbonize the energy sector, the manufacturing sector, and the agriculture and environmental sector for more carbon uptake, this is something that can really accomplish all of those things.

Mr. GRAVES. Thank you, Mr. Loris.

I am out of time. But, Madam Chair, just one line. There is a quote from a 2016 private speech that Hillary Clinton gave that says, quote, "We were even up against phony environmental groups, and I am a big environmentalist, but these were funded by the Russians."

Yield back.

Ms. CASTOR. Okay.

Next up, we will go to Representative Huffman.

You are recognized for 5 minutes.

Mr. HUFFMAN. Thank you, Madam Chair.

You know, I thought we started off on a fairly hopeful note in terms of finding one of those rare issues in the climate conversation where we could have common ground and try to solve problems. And, unfortunately, some of the recent comments have taken us pretty deep down the rabbit hole.

A few moments ago, I actually thought we were going to hear that Bill Gates was implanting microchips into pine beetles. And

then, more recently, we hear this preposterous narrative that major national environmental groups are somehow under the influence of Vladimir Putin, as if he wants clean energy, the one thing that would render him powerless and irrelevant on the world stage.

Look, the truth is there is a glass house problem when our colleagues across the aisle start suggesting that environmental groups are parroting Putin talking points. It is the fossil fuel industry that for decades has had a very lucrative bromance with Vladimir Putin. It was the Trump administration for 4 years that had the greatest collection of Putin fanboys outside of the Kremlin anyone has ever seen, and our colleagues thought that was just wonderful. It was making America great again.

Look, we should not be looking to the fossil fuel industry that has been writing their talking points on these subjects for solutions to this mess. We should be sending them the bill for the war in Ukraine, because the fossil fuel industry has always been interested and today is still interested in only one thing, and that is keeping as many people as possible hooked on their fossil fuel so that they can keep making lots and lots of money. It is not very complicated.

And maybe I should put it in terms that my colleagues could understand in light of last week's revelations. If you have got a colleague that is doing key bumps of cocaine, whatever that is, and you tell them, "Gee, that is really bad for you, that is hurting you, let me hook you up with this other dealer who has got better stuff," that is not a very good answer to the problem.

And replacing dirty Putin natural gas with more dirty natural gas is not an answer to the energy crisis, the climate crisis, or the fact that we continue to experience fossil fuel-driven wars.

So let's just get real about all of this stuff, and let's try to bring the conversation back to things that were actually agendized where we might be able to find some solutions together.

Mr. O'Mara, restoring and better managing our U.S. lands and waters can mitigate a fifth of our carbon emissions. We can create hundreds of thousands of jobs. That is something we ought to be interested in talking about.

Can you talk a little more about how natural solutions not only protect communities—and I represent a coastal community like Mr. Graves—but also increase the resiliency of ecosystems in the face of our climate crisis?

Mr. O'MARA. Thank you for all the work that you have done.

I think we are seeing both obviously huge sequestration benefits, but the ecological resilience of these systems, it is just increasingly important. We are seeing, whether it is from a wildlife perspective, given the stressors that we are seeing on a whole range of species for communities that are adjacent, whether that is coastal communities that are suffering from some kind of coastal storm or a fire, and these healthy systems, that basically every dollar we have spent, whether it is in your district or out east, in restoring these systems returns about \$6 to \$8 of avoided damage.

And the places where we have invested have been able to come through these kind of horrific events much more whole than other communities that haven't had those same benefits. And so I think

it really is just that win-win-win where it is safer, healthier, and better for the economy.

Mr. HUFFMAN. Terrific. And then we haven't heard from Mr. Westerman yet, but he does have a bill with a wonderful title, Trillion Trees Act. If good titles made a great bill, we would be off to the races with that legislation.

And he and I have had lots of conversations about this, but the science is pretty clear that not all forests are alike, not all treatments are the same in terms of their carbon sequestration capacity.

Could you talk about the importance of protecting old growth trees? I don't know about Georgia and Mr. Carter's trees, but I know that, on the West Coast and in lots of places in California, we have trees that can keep growing up to 800 years.

And I think the science is fairly clear that it is that old growth phenomenon that most powerfully sequesters carbon. So we have got to protect those things while we talk about other types of forest management strategies.

Please.

Mr. O'MARA. Yeah. No, absolutely. And I think some of the amazing sequoias and redwoods are spectacular from a carbon point of view.

I think one of the cases we tried to make is that if we were actually compensating, whether it is landowners or others, for the carbon value, all of a sudden you change the incentives around cutting earlier or, like, having these different economic drivers. Because I really don't want forest owners growing houses either, right? I want them to stay in forests.

But I do think some of the economic incentives, especially given some of the trade policy issues the last several years, have been pushing folks to cut earlier, and so we are not getting the carbon benefits. We are also not getting the long-term benefits that you are talking about.

And so the question is, how do you realign those incentives? That is why I think that that 45Q idea is kind of interesting, because all of a sudden, if I know I am going to make more by allowing it to grow longer, because all of a sudden those incentives start aligning, and you can have robust markets at the same time.

Mr. HUFFMAN. Thanks, Madam Chair. I yield back.

Ms. CASTOR. Thank you.

Next up, Rep. Escobar.

You are recognized for 5 minutes.

Ms. ESCOBAR. Thank you, Madam Chair.

And many thanks to our panelists as well. Really appreciate the opportunity to talk about these issues.

Frequently when we talk about protecting ecological treasures, we talk about the oceans, we talk about forests. We rarely talk about the desert.

I represent El Paso, Texas, a vibrant and safe, wonderful community on the U.S.-Mexico border that is in the Chihuahuan Desert. And in my community, in the middle of it is the Franklin Mountains. And, at the base of the Franklin Mountains is this incredible treasure known as Castner Range.

Castner Range is about 7,000 acres that belongs to the Federal Government. And, for generations, for at least 50 years, El Pasoans

have been trying to preserve Castner Range and try to convince the Federal Government to preserve it for open space purposes.

I have filed legislation to designate Castner Range a national monument in the hopes that it can at some point be utilized for trails and for educational opportunities for young people, because there were many ancestors who came before us who lived on that land, lots of archeological treasure, and also lots of endangered species.

The challenge for us is that it was an artillery range, and so there is unexploded ordnance on the property. And so we have been trying to collaborate with the Federal Government about how to approach it.

But, in the meantime, the area around Castner, or at the foot of it on the other side of our freeway, there has been lots of development. We know that there is always, especially in urban areas, a desire to have the best view and to build as much as possible on the side of the mountain, and El Paso is no different. Unfortunately, we have seen a lot of that happen.

But one of the things I would actually like to ask you, Mr. O'Mara and Dr. Eisenberg, about we were talking about damage done to our ecological treasures. Castner Range is also home to lots of arroyos. And, for folks who don't know what an arroyo is, it is a water channel basically. And, even though El Paso is in the Chihuahuan Desert and we, unfortunately, have dealt with long-term drought, we also have monsoon seasons.

And we have now seen hundred-year flooding. We have seen unprecedented damage done to property and people, literally hundreds of millions of damage. And with the ongoing drought, the soil just is not ready or equipped for rapid and large amounts of rainfall.

So if both of you could speak to helping me get the Federal Government to understand preserving open space in a desert where there is drought and flooding, that it protects people and property.

Can you speak to the importance of that?

Mr. O'MARA. Yeah. No, thank you, Congresswoman. And thanks for your work on that, and it was great to see the Secretary there the other day.

I think there is a huge opportunity, and there is this assumption that, because it is a desert environment, that it is not a living environment. And there are challenges with invasive species, there are challenges with restoring native vegetation. There are issues in some cases in part of that range with, like, salt cedar and turmeric and some of the other invasive species that suck up so much water there isn't enough for kind of the native vegetation.

And I think the conservation of the area is kind of the starting point. But, like, what we would like to work on with yourself and others in the valley, kind of more broadly, is the restoration of these assets.

I mean, I think when you look at the water levels in the Rio Grande, in particular, a little further south, the challenges that we have with not having enough water, with the river running dry, is because it is actually absorbing billions of dollars, 25 billion gallons of water between the salt cedar.

And there is a huge restoration opportunity there. It doesn't get the same kind of attention because folks don't think of it the same way. But I would love to work on it with you.

Ms. ESCOBAR. Thank you so much.

Dr. Eisenberg, in the final 40 seconds of my time, would you like to add anything?

Dr. EISENBERG. Yes. Ecocultural restoration is critically important here, and restoration practices that take into consideration the processes of—the practices of the ancestors. And, actually, that is the part of North America that my ancestors are from, northern Mexico.

And so tapping into Tribal wisdom about this is essential, and restoring those practices which addresses invasive species, reintroducing fire if it was used regionally, which it probably was, and that then enables the soil to retain more moisture.

Fire was used throughout the Southwest by Native people.

Ms. CASTOR. Thank you, Dr. Eisenberg. I am sorry. We have a vote, and we have another member.

Thank you, Rep. Escobar.

And next we will go to Mr. Westerman.

Thank you for your interest in the Climate Crisis Committee. Welcome. You are recognized for 5 minutes.

Mr. WESTERMAN. Thank you, Madam Chair, and thank you for allowing me to join today. A lot to cover here, so I am going to just jump right into it.

I was pleased when I read the majority's memo on the hearing, and especially the part where they reference climate and ecological data. And just to be brief, I want to make sure that our witnesses are on the same page.

As I read these bullet points, if you disagree with it, please raise your hand. If not, we will just go to the next one.

The first point says: A 2020 report published in the journal *Nature* found that if 15 percent of identified priority areas are restored 60 percent of expected extinctions could be avoided and around 465 billion tons of CO₂ could be sequestered, equal to 30 percent of the total amount of CO₂ emitted in the atmosphere since the industrial revolution.

Anybody disagree?

A 2019 report published in the journal *Environmental Science and Technology* found that restoring tree canopy cover can lead to a 27 percent further reduction in air pollution.

Anybody disagree?

A 2021 study in *Environmental Research Letters* found that forests provide the highest quality water supplies among all land uses and that more than 150 million Americans depend on forested lands for their drinking water.

Anybody disagree?

A 2021 study published in the journals *Frontier and Plant Science* found that the restoration of degraded grasslands from severe to moderate degradation stage improved grassland vegetation by more than 38 percent and soil water storage by almost 42 percent.

Anybody disagree?

A 2021 study published in the journal *Science* found that 20 years after replanting tropical forests, numerous measures, including soil fertility, carbon storage, and tree diversity, returned to nearly 80 percent of the levels of old growth forest.

Finally: A 2019 study published in the journal *Science* found that adding 2.2 billion acres of tree cover would capture 205 billion metric tons of carbon from the atmosphere, which is equivalent to nearly two-thirds of the carbon emitted since the industrial revolution.

Anybody disagree?

I have read most of the reports that are behind these statements, and I agree. And that last one is actually the basis for the Trillion Trees Initiative, the global Trillion Trees Initiative.

Madam Chair, for the record, I would also like to submit this paper called “Decarbonizing U.S. Buildings” by the Center for Climate and Energy Solutions.

And it has a statement: Residential and commercial buildings account for roughly 29 percent of U.S. greenhouse gas emissions.

Anybody disagree?

Here is another one. It is a published journal article on mass timber, global warming, carbon, and CLT. It is talking about using buildings to reduce greenhouse gas emissions.

And it says: “The building sector is a major source of global greenhouse gas emissions. Construction related CO₂ emissions equal 5.7 billion tons, accounting for 23 percent of the emissions resulting from global economic activities.”

It goes on to say: “The building sector takes on even greater significance when considering the approaching wave of 2.3 billion new urban residents.”

And it says energy-related CO₂ emissions from buildings is 39 percent globally.

Anybody disagree?

Next, do you support planting trees at home and abroad and using natural regeneration methods to increase forest cover so that we can grow more wood to store more carbon?

Anybody disagree?

Do you support management activities to make our existing forests more resilient and healthy to grow more wood and store more carbon?

Nobody disagrees.

Do you support sustainable building practices to reduce carbon emissions during manufacturing and transporting building materials, reducing carbon emissions from building operations, and increasing the amount of carbon stored in the built structure?

Everybody support that?

Do you support using low-grade woody biomass material from our forests to make renewable biofuel and biochar that could be used as a soil additive for grasslands and agriculture that increases soil water efficiency and would be a long-term carbon storage solution?

Everybody supports that.

Madam Chair, it appears that there is unanimous, overwhelming support from this panel for the Trillion Trees Act, and this com-

mittee should fully embrace it, because that is exactly what the Trillion Trees Act does.

Next, I want to talk about giant sequoias. Mr. Huffman, I think, mentioned that.

This chart shows fires in the giant sequoias. From 1898 to 2014, we averaged three fires per century. Previous to that, going back centuries and centuries, we averaged 31 fires per century, one every 3 years.

Starting in 2015 to 2021, the number of fires and the intensity of the fires has greatly increased. We lost 20 percent of our giant sequoias to wildfires because of mismanagement leading up to this time.

Does the panel think we should save our giant sequoias?

I agree, and there is a way to do it, and too bad we are out of time or I would tell you.

Ms. CASTOR. Thank you, Mr. Westerman.

And next we will go to Rep. Neguse, who, unfortunately, is all too familiar with wildfire destruction.

Rep. Neguse, you are recognized for 5 minutes.

Mr. NEGUSE. Well, thank you, Madam Chair, for your leadership and for hosting this important hearing today.

The timing of this hearing couldn't be better. Just yesterday, my staff and I had the opportunity to visit with the Colorado Forest Restoration Institute, which is located at Colorado State University in my district, to learn more about the great work that they and the Southwest Ecological Restoration Institutes are doing to restore our lands and our forests, particularly after wildfires.

For communities in my district, as you mentioned, Madam Chair, the threat of wildfires, of drought, and deteriorating air quality is only worsening. Wildfire seasons are turning into wildfire years, with fires burning in August, in December, and in March.

In the last 18 months alone, the largest, second largest, and most destructive fires in Colorado history all occurred in my district, with the devastating Marshall Fire in December destroying over a thousand homes. And just last weekend we had another wildfire, the NCAR Fire, in South Boulder.

The cost of climate change for my community could not be more clear. We need bold, decisive action to address these impacts and to tackle these existential threats.

Earlier this month, I was proud to join with my colleague, Representative Matsui from California, to launch the Nature and Oceans Task Force of the House Sustainable Energy and Environmental Coalition. Thank you to my select committee colleagues, Representative Huffman and Representative Bonamici, for joining us in this effort as members of the task force, and I certainly look forward to the important work on those matters.

It is time for Congress to take action to mitigate the impacts of these climate-fueled disasters, and I am so glad that we are holding this hearing today to explore some of the ways that we can use natural climate solutions to do just that.

Mr. O'Mara, you used one of my favorite phrases in your written testimony, that an ounce of prevention is worth more than a pound of cure. I have certainly found this to be true in wildfire and forest

restoration efforts and in preparing for natural disasters more broadly.

I wonder if you might be able to share or perhaps expound more on some of the examples of the cost savings resulting from forest restoration and ecosystem protection efforts and how those efforts strengthen our lands, our forests, and our oceans against future natural disasters.

Mr. O'MARA. Thank you, Congressman.

And in the forest space, we see at least like a 3:1 cost savings. For every dollar we spend on forest restoration we can avoid \$3 to \$4 of damage. Some estimates are even much higher than that.

And so we are incredibly bullish and grateful for your leadership on the bipartisan infrastructure package, as well as the forestry package and reconciliation, to drive a lot of these investments.

I think it is not a one size fits all. It has got to be ecologically appropriate. It has got to be done in ways that kind of work on the local landscape and work with the local communities.

But it is a huge cost savings. And it is much cheaper—as, unfortunately, folks in Boulder have experienced repeatedly—to have healthier systems earlier as opposed to trying to pick up the pieces afterwards.

So I just think, again, one of the things I would like to work with all of you on is actually scoring this appropriately, because right now you have to figure out how to pay for that \$1 of prevention, where what we don't count for the supplemental appropriation, you have to pay after the fact, when we could avoid a lot of that damage.

So there has got to be a way to fix that with CBO because these are savings that are attributing—we are spending, I don't know, a hundred, two hundred billion dollars a year on supplemental appropriations. None of that is in the forward-looking debt projection. But it is definitely there, it is definitely real. And we should be investing now because we know we can save those costs tomorrow.

Mr. NEGUSE. I couldn't agree with you more. And I think the point that you raise is a salient one with respect to being cognizant of finding ways to incorporate the costs on the back end as we are making these considerations here in the Congress.

The fact that it is a 1:3 cost savings is just—it is a fact that I think we lose sight of here in Congress and that we shouldn't. And certainly my community has not lost sight of that fact in light of the natural disasters that we have experienced in just the last 18 months.

So I thank you for the testimony.

I thank all of the witnesses for their testimony today.

Cognizant perhaps of the votes that have been called, I will yield the balance of my time, but, again, will thank the witnesses and the chair for her leadership.

And I yield back.

Ms. CASTOR. Thank you, Rep. Neguse.

And thank you to all of our witnesses for your very insightful testimony today.

All members have 10 business days within which to submit additional written questions for the witnesses, without objection. And I will ask the witnesses to respond promptly.

Mr. Westerman has asked for unanimous consent to submit into the record two reports, one entitled, “Developments in the Built Environment,” November 2020, and, “Decarbonizing U.S. Buildings,” from Climate Innovation from July 2018.

I believe Rep. Crenshaw also asked for a 2014 staff report from the Senate Republicans, Environment and Public Works.

So, without objection, we will enter that into the record.

[The information follows:]

Submissions for the Record

**Representative Bruce Westerman
Select Committee on the Climate Crisis**

April 1, 2022

ATTACHMENT: Himes, A. and Busby, G., 2020, “Wood buildings as a climate solution,” *Developments in the Built Environment*, Volume 4.

The report is retained in committee files and available at:
<https://doi.org/10.1016/j.dibe.2020.100030>.

ATTACHMENT: Leung, J., July 2018, Center for Climate and Energy Solutions, “Decarbonizing U.S. Buildings.”

The report is retained in committee files and available at:
<https://www.c2es.org/wp-content/uploads/2018/06/innovation-buildings-background-brief-07-18.pdf>

Submission for the Record

**Representative Dan Crenshaw
Select Committee on the Climate Crisis**

April 1, 2022

ATTACHMENT: Senate Committee on Environment and Public Works (Minority Staff), 30 July 2014, *The Chain of Environmental Command: How a Club of Billionaires and Their Foundations Control the Environmental Movement and Obama’s EPA*.

The report is retained in committee files and available at:
<https://www.influencewatch.org/app/uploads/2020/10/chain-of-environmental-command-2014-report.pdf>

Ms. CASTOR. And I will also ask unanimous consent for a March 2022 article from The Washington Post titled “The bogus ‘allegation’ that Putin is funding a California environmental charity.”

[The information follows:]

Submission for the Record

**Representative Kathy Castor
Select Committee on the Climate Crisis**

April 1, 2022

ATTACHMENT: Kessler, G., 17 March 2022, “The Bogus ‘Allegation’ that Putin is Funding a California Environmental Charity,” *The Washington Post*.

The article is retained in committee files and available at:
<https://www.washingtonpost.com/politics/2022/03/17/bogus-allegation-that-putin-is-funding-california-environmental-charity/>

Ms. CASTOR. It concludes, “For years it has been clear that Sea Change Foundation has no connection to secret Russian money.”

With that, I want to thank everyone. We will remain committed to natural climate solutions to benefit the planet and make sure that we can give our kids and future generations a livable planet to live in.

So thank you all. The hearing is adjourned.

[Whereupon, at 11:30 a.m., the committee was adjourned.]

**United States House of Representatives
Select Committee on the Climate Crisis**

Hearing on April 1, 2022

**“America’s Natural Solutions:
The Climate Benefits of Investing in Healthy Ecosystems”**

Questions for the Record

Dr. Sherry Larkin

Director, Florida Sea Grant College Program

Professor, Food and Resource Economics

University of Florida

THE HONORABLE KATHY CASTOR

1. Ecosystem restoration and conservation are key tools in adapting to and mitigating the risks from climate change, but we must ensure these types of projects are designed and implemented in a way that secures the needed results for climate, biodiversity, and communities. What are the main challenges and lessons learned from engaging with communities, especially underserved communities, when developing projects to respond to climate change?

There are several challenges and lessons that have been learned from engaging with communities, especially underserved communities, in adapting to and mitigating the risks from climate change. As a result, and to be effective, projects need to consider the following:

1. Working with communities is labor intensive due to the need to develop relationships and ascertain capacity, needs, and constraints. This creates a **need for capacity building for engagement** to get local projects approved and secure funding. Taking time to understand a community’s issues and learning how to dialogue and discuss contentious issues (both with disadvantages and advantaged sectors). Having dedicated personnel to meaningfully engage over the long-term and translate the science and advancements would catalyze mitigation actions. This is especially important for climate initiatives to gain stronger support.

2. Time horizons of projects needs to be long enough to develop meaningful partnerships. Community-based interventions/projects can often be too small (2–5 years long) and sporadic (i.e., one-off projects) in an uncoordinated manner. Movement towards “phased” projects is a prudent strategy.

3. Interventions often do not take into consideration the cultural, political, and economic conditions of local communities. Holistic approaches are needed for identification and valuation of benefits in terms of community health and well-being, carbon mitigation, green infrastructure, etc.

4. Critical examination of existing finance and funding mechanisms is needed to understand who benefits (and who does not), how and why.

5. Racial zoning and redlining have creating pockets of disadvantage for some and prosperity for others. Planning and development processes/policies/practices need to be linked to environmental justice and social vulnerability to dismantle systemic inequities and redistribute power and privilege.

6. There are often mismatches in locations where marine system restoration is permitted versus locations that actually need the ecosystem service. While more relevant for nutrient storage and removal as opposed to carbon, it is

still important when thinking about value to an individual community as opposed to worldwide value.

7. Climate resilience is about more than physical safety. Projects should ensure that they are looking at all adaptation measures within a holistic vision of what is needed, wanted and how to get there. Then they can determine how NNBF's (Natural & Nature-Based Features) fit into adaptation plans.

Publications

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- <https://www.liebertpub.com/doi/10.1089/env.2020.0054>

Websites

- <https://www.aas.org/events/community-and-organization-panel-discussion-green-infrastructure>
- <https://n-ewn.org>

Related Sea Grant Projects

- ***Southeast and Caribbean Climate Alliance***, funded by NOAA's Climate Program, Regional Integrated Science and Assessments (RISA): <https://gacoast.uga.edu/outreach/programs/coastal-hazards/southeast-caribbean-climate-alliance/>
- ***PLACE:SLR (Program for Local Adaptation to Climate Effects: Sea-Level Rise)***, a partnership between Sea Grant programs in the northern Gulf of Mexico has:
 - Provided several tools for climate mitigation at the local level: www.GulfTREE.org, www.localslr.org, www.bit.ly/Future-Flooding
 - Assembled best practices on stakeholder engagement and testing the findings: <https://coast.noaa.gov/digitalcoast/training/underserved-communities.html>
 - Described their experience in putting tools into practice (video): <https://youtu.be/V2-wJWSD9Rc>
- ***Climate Smart Floridians*** helps an individual identify what they can do to reduce their own greenhouse gas emissions. Demonstrating that there are small, actionable, steps, one can do to address climate change makes it seem more approachable, and could help overcome the general distrust of science (especially when it comes to climate change research).

2. Certain habitats, including forests, grasslands, and wetlands, can provide needed carbon sequestration. However, different habitats provide different benefits. What are the similarities and differences between terrestrial and marine carbon sequestration? What additional research on blue carbon is needed and why?

The quest for carbon storage strategies should be addressed through both terrestrial and marine projects because we are going to have to find and use every mechanism to have to sequester and store excess carbon. That said, finding the most efficient and least expensive ways to sequester carbon over the long run is important. There are at least three contexts in which marine and terrestrial carbon storage differ:

The first primary difference between marine and terrestrial carbon storage is that in marine systems, carbon is typically buried in the soil instead of in plant biomass (like forests), which makes marine carbon storage less susceptible to many hazards (e.g., forest fires). While that is true, marine carbon storage remains susceptible to things like resuspension due to plant loss and hurricanes, and to the disruption of the sediment that might increase rates of decomposition. There is some debate on what happens if plants die; the living plants with a healthy root system keep the sediments in place so if they die, the long-term storage may be lost. Direct measurements of this loss though are rare and vary probably depend on the scale of the loss and on site-specific wave energy (see Aoki 2021 and references there in). The

Fourqurean paper estimated carbon stocks for seagrasses and discusses some of those differences. The classic paper is McLeod 2011.

The second primary difference in marine and terrestrial carbon storage is that we have the ocean, which can absorb carbon. A consequence of this is acidification. Recent work suggests that coastal blue carbon habitats might not be as efficient at carbon storage as originally thought because of dissolved inorganic carbon export (Santos et al. 2021).

The third primary difference in marine and terrestrial carbon storage is with respect to shellfish where carbon is sequestered from photosynthesis, storage as biomass, and through calcification (shell growth). Fodrie et al. 2017 found that reefs next to marshes were carbon sinks while reefs isolated on mudflats were carbon sources. It is also important to remember that calcification produces CO₂. Grabowski et al. discusses the ecosystem services of oysters. But, the location of these habitats really matters, not only for carbon storage (Fodrie et al) but also nutrient removal (Smyth et al.).

Research needs should seek to determine:

1. the sources and magnitude of variability in estimates of carbon sequestration;
2. a common system of assessment and measurement in support of the development of payment systems and trading programs;
3. the importance of size and scope of restoration projects on the trajectory or timeline of carbon sequestration; better understanding the role of alkalinity, organic and inorganic carbon and the carbon cycle in general in coastal systems;
4. interactions between multiple stressors like acidification and eutrophication;
5. drivers of greenhouse gas emissions and burial rates from coastal habitats to move beyond sequestration and look at the balance between services and disservices;
6. the contribution of outwelling of dissolved carbon as well as carbon sequestration;
7. how blue carbon habitats in tropical and subtropical ecosystems differ from other climates and land-based systems;
8. the extent of permanent carbon storage (net carbon balance) from shell growth;
9. the role and importance of macroalgae as a carbon sink; and
10. what management approaches promote carbon sequestration.

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 Fourqurean: <https://www.nature.com/articles/ngeo1477>
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Questions for the Record

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THE HONORABLE KATHY CASTOR

1. In your testimony you referred to “ecocultural” restoration. Can you define what this means and say a little more about the impact you are seeing on how your ecological restoration work is also generating cultural and climate resilience for the Fort Belknap community? How can Congress ensure ecocultural restoration is integrated in Federal decision-making?

Definition of Ecocultural Restoration:

Ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed.¹ *Ecocultural restoration* acknowledges and honors Indigenous peoples' contributions and traditional wisdom. Defined as the process of restoring key historic pre-contact, pre-industrial ecosystem structures, processes, and functions, and the Indigenous cultural practices that helped shape ecosystems, ecocultural restoration (also referred to as biocultural restoration) increases resiliency to climate change and other stressors, while supporting Indigenous ecosystems and their cultures.²

Ecocultural restoration is based on Traditional Ecological Knowledge (TEK; also known as Indigenous Traditional Knowledge—ITEK), defined as knowledge and practices passed from generation to generation informed by cultural memories, sensitivity to change, and values that include reciprocity. TEK land-care practices include using prescribed fire and seasonal flooding to modify vegetation, conserving culturally significant species such as beaver (*Castor canadensis*) and bison (*Bison bison bison*), or adjusting timber use to create more sustainable communities of traditional plants that provide wildlife habitat, and in turn, food for humans. These processes increase biodiversity and ecological resilience by creating fine-grained, landscape mosaics that function within an ecosystem's range of natural variability. Further, TEK acknowledges that change is constant in an ecosystem. Because Indigenous people see the world as always changing, their TEK is designed to observe and acknowledge these changes, and act on them rapidly by adjusting Indigenous land stewardship and subsistence practices. In this manner, TEK can optimize climate resiliency, as a form of adaptive management that has been used for millennia globally.³

Ecocultural Restoration and Cultural and Climate Resilience:

Established in 1888, the Fort Belknap Indian Reservation (FBIR) is homeland of the *Nakoda* (Assiniboine) and *Aaniiihnen* (Gros Ventre) Tribes. It lies in north-central Montana, north of the Missouri River, on the Northern Great Plains, comprising 263,000 ha. FBIR lands are primarily used for grazing, agriculture, ceremonies, hunting, gathering traditional plants for food and medicine, recreation, natural resource extraction, and conservation. Adjacent Bureau of Land Management (BLM) lands are used for grazing, natural resource extraction, hunting, recreation, and conservation.

On the FBIR, the ecocultural restoration work we are doing will help generate cultural and climate resilience for Fort Belknap Indian Community (FBIC) and BLM. Specifically, in partnership with BLM, Oregon State University (OSU), and Society for Ecological Restoration (SER), we are developing an ecocultural restoration plan based on FBIC TEK, with the guidance and participation of the Tribal Council, the Tribal Historical Preservation Office, Tribal elders, youth, natural resources staff, and educators, applicable to multiple-use FBIR and BLM lands in this region. Because the plan will be built on Indigenous stewardship practices in this grassland used for millennia (e.g., prescribed burning, conserving culturally significant plants that also function as soil-stabilizing plants and carbon sinks) that have always included adaptation to changes in the climate, it will build climate resilience and increase what today we refer to as the *ecosystem services* on which humans rely for survival, such as fertile soil, plants, pollination, and clean water.⁴

Additionally, because we are engaging the FBIC with jobs and training for youth, including creating a Tribal youth conservation corps that provides income and natural resource training, and because the youth involved in this program will be the lead authors of the ecocultural restoration plan we are developing, this work is also very directly building capacity within FBIC. By engaging Tribal youth, we are creating a STEM pathway for them in higher education at institutions such as OSU, helping them develop into future leaders in natural resource management and conservation. Collectively this is generating cultural resiliency—by empowering youth to use their culturally traditional relationships with the natural world to find nature-based climate solutions that are also firmly grounded in Western science. This strategy is called Two-Eyed Seeing. By combining the empirical strengths and logic of Western science and the insights and wisdom of TEK, one gains binocular vision that enables people to find solutions to challenging natural resource problems, such as global warming. The ecocultural restoration plan we are co-creating will be based

¹Gann, et al. 2019.

²Kimmerer 2011; Zedler, and Stevens 2018; Martinez 2019; Dickson-Hoyle, et al. 2021.

³Kimmerer 2000; Roos, et al. 2018; Eisenberg, et al. 2019; Reyes-Garcia et al. 2019.

⁴Food and Agriculture Organization (FAO) of the United Nations. 2021.

on cultural competency (e.g., understanding the FBIC culture), and will go beyond that to cultural humility (e.g., self-assessment and accountability, openness, and equitable relationships with all involved).⁵

How Congress Can Ensure Integration of Ecocultural Restoration into Federal Decision-Making:

According to the White House Office of Science and Technology Policy, TEK could and should improve understanding of climate change and environmental sustainability. TEK also could help in the development of comprehensive climate adaptation and natural resources management strategies, aimed at achieving mutually beneficial outcomes for Tribal Nations and U.S. Federal agencies.⁶ However, the U.S. Federal government tends to implement top-down strategies using one-size-fits-all approaches. Such approaches will not be effective in incorporating ecocultural restoration into Federal decision-making. This is because ecocultural restoration, which is informed by TEK, is strongly place-based, and comes from Indigenous cultures, with each Tribal Nation having a unique culture.⁷

Co-management is a partnership whereby the government shares power with resource users, with clearly specified rights and responsibilities for each actor relating to management and decision-making. In the U.S., Federal co-management efforts that incorporate ecocultural restoration via TEK and uphold treaty rights are one of the foundational principles in addressing initiatives such as Presidential Executive Order 14008 on Climate Change.

With Tribal Nations, co-management typically includes a Memorandum of Understanding (MOU). Such partnerships convey economic benefits to Tribes and government agencies, with mutual respect and reciprocity, and can function as stepping-stones to self-determination. However, in practice, co-management can be an imperfect alliance, because its roots lie in settler colonialism. Successful co-management acknowledges and supports self-determination and natural resources treaty rights, with clear understanding of what TEK means to the specific Tribal Nation involved in the partnership.

Ecocultural restoration has huge potential for co-management of public lands. In order for it to succeed in its application, it must be place-based and part of a partnership based on inclusive, equitable, and respectful interactions. It must include relationship building that leads to government-to-government policy actions that honor Tribal sovereignty and self-determination rights, via formal agreements (e.g., MOUs).⁸

Congress can ensure that ecocultural restoration is incorporated into Federal decision-making by implementing policies and providing secure, dedicated funding to enable development of the trust-based relationships described above. In doing so, it is important to consider that it takes time to build relationships between Tribal Nations and Federal agencies that lead to collaboration to partner in natural resource ecocultural restoration. Building this trust means beginning to overcome 175 years of genocide, breaches of treaties, and exploitation of Tribal Nations. Note that the Indian Self-Determination and Education Assistance Act of 1975, 25 U.S.C. §§ 450 et seq. and the 1994 Tribal Self-Governance Act, 25 U.S.C. § 458aa et seq. passed fairly recently. These acts acknowledged and reinstated Indigenous peoples' sovereignty rights and empowered them to manage their lands. Nevertheless, securing such rights in practice continues to challenge many Tribal Nations, particularly regarding natural resource and subsistence treaty rights.⁹

2. In your testimony, you noted the differences you saw in the condition of the grasslands on Tribal lands as compared to the BLM lands. Please describe what these differences indicate, and why healthy grasslands are so important.

Differences between FBIC Tribal lands and BLM lands:

Global warming is leading to increasingly frequent severe and extensive drought and wildfires. Warmer temperatures, below-average winter precipitation, earlier

⁵ Bartlett, et al. 2012.

⁶ White House Council on Environmental Quality (CEQ); 2021a. White House Council on Environmental Quality (CEQ). 2021b.

⁷ Reyes-Garcia 2019.

⁸ Usher 200; Houde 2007; Nadasdy 2007; Nie 2008; Kenney 2012; Casson 2015; Reid et al. 2018; Grey and Kuokkanen 2019.

⁹ U.S. Congress. 1975. Indian Education and Self-Determination Act of 1975; Deloria, and Lytle 1983; U.S. Congress. 1994. Tribal Self Governance Act of 1994; Wilkins, and Lomawaima 2001; Treuer 2012; Treuer 2019.

snowmelt, and drier summers are creating longer wildfire seasons. Ecosystems managed for agriculture often lack the resiliency to recover from these disturbances and other environmental stressors (e.g., insect outbreaks), because such management involves plowing the soil, planting non-native agronomic species for harvest, and eliminating or disrupting processes with which these ecosystems co-evolved, such as intermittent intensive grazing by herds of bison, low-severity fires set by Indigenous people, and mixed-severity wildfires.¹⁰

We are working to address the above issues in our grassland restoration project, which began in 2019 in the Northern Great Plains Biome of Montana, on BLM and FBIR lands. I am the Lead Principal Investigator (PI) of this project, and Dr. Thomas H. DeLuca is the co-PI. In addition to the FBIC and BLM, project partners consist of OSU and SER. Our grassland restoration project goals are to:

- a) Help the BLM Plant Conservation and Restoration Program (PCRP) ensure a stable commercial supply of native plant materials for restoration and rehabilitation efforts on public lands.
- b) Help BLM inventory and quantitatively assess the condition and trend of natural resources on the nation's public lands.

We are meeting these goals by surveying U.S. Federal and adjacent Tribal lands using Assessment, Inventorying and Monitoring (AIM) protocols, and then applying BLM Seeds of Success (SOS) protocols to collect the seeds of target species for conservation. Target species include those known to stabilize soils after a severe fire or other disturbance, such as Junegrass (*Koeleria macrantha*), which can rapidly resprout and help prevent erosion. Seeds go to the National Seed Repository to eventually be used for ecological restoration of public lands that have been degraded by catastrophic fire, drought, or intensive conventional agriculture.¹¹ An additional goal is to co-create an ecocultural restoration plan with the FBIC, based on TEK (described in the response to Q1), to increase resiliency to drought and other environmental stressors.

During the summer of 2021, much of the Western U.S. experienced an extreme drought. Per National Oceanic and Atmospheric Administration (NOAA) and State of Montana data, our study site on the FBIR and surrounding BLM lands was in D3 (Extreme) and D4 (Exceptional) drought. In D3 conditions, crops are not harvestable, winter pasture is opened for grazing, the soil has large cracks in it, and the fields are bare. Cattle have very little water and producers must import water and supplemental feed. Fire restrictions increase. In D4 conditions, pasture loss is widespread, crops are destroyed, fire risk is extremely high, and fires are widespread.¹² Given that most of our study site (both FBIC and BLM land) is used primarily for some form of agriculture, and that for residents of north-central Montana, agriculture is a leading occupation and income source, D3 and D4 drought can have devastating economic impacts on human communities in this region.

In June-August, 2021, when we surveyed FBIR and BLM lands, which consist of mixed-grass prairie communities, I received one of the most powerful lessons of my career as an ecologist. In keeping with expected D3–D4 drought conditions, our field crew and I found that in late spring on BLM lands, which were dominated by exotic (e.g., non-native/invasive) grass species (primarily crested wheatgrass, *Agropyron cristatum*), with some native grasses (Sandberg bluegrass, *Poa secunda*, and Western wheatgrass, *Pascopyrum smithii*), these grasses grew approximately six inches tall. On adjacent FBIC land that had the same drought conditions, climate, elevation, geomorphology, and other ecological characteristics, but contained mostly native plant species (primarily Western wheatgrass, Sandberg bluegrass, and green needlegrass, *Nassella viridula*), the same grasses grew up to four feet tall. On BLM land, in the few places where native plants, such as bluegrass, had bloomed, their seed pods were hollow, lacking a cotyledon, because the plant had suppressed growth to survive. This stark difference in plant drought resiliency was unattributable to cattle; both Tribal and BLM lands are multiple-use lands, subject to cattle grazing, which we documented with trail cameras. Further, because of the drought response described above, on FBIR land we were able to collect 23 pounds of seeds of target species for conservation. On neighboring BLM land we were only able to collect 3 ounces (0.19 pounds or 0.8%) of seeds of target species, despite scoping those Federal lands really thoroughly for several weeks, working in Blaine and Phillips Counties.

¹⁰ Bond, et al. 2004; Fuhlendorf, et al. 2008; Allred, et al. 2011; Grimm, et al. 2013; Polley, et al. 2013; Lark, et al. 2020; Hessburg, et al. 2021.

¹¹ BLM 2021a; BLM 2021b.

¹² NOAA, NRCS, State of Montana 2022.

Dr. DeLuca, an eminent soil scientist, and I hypothesize that this difference between FBIR and BLM land is at least partly related to differences in soil ecology between the two systems. Charcoal (also known as pyrogenic carbon, PyC) legacies in the soil created by the low-severity fires historically set by Indigenous people were deposited in mineral soils on a frequent and in some cases annual basis. The recalcitrant nature of PyC results in its accumulation over time, thereby increasing the scale and function of the soil carbon pool, resulting in increased nutrient availability and drought resiliency.¹³

Indigenous burning is a key TEK land stewardship practice used globally to improve soil health.¹⁴ In what is today the U.S., Indigenous use of fire to improve habitat for wildlife and productivity of culturally significant species of plants harvested as part of the hunter-gatherer lifeway has been widely documented. On the Northern Great Plains, Indigenous people used fire to manage plant communities to improve availability of culturally significant plants used for medicine and subsistence, such as Indian turnip (*Pediometum esculentum*), and improve bison habitat. These prescribed fires were typically of low severity.¹⁵

In the 1800s, when Tribal lands were stolen and settled by Euro-Americans throughout the U.S., fires were suppressed. As part of colonization, the Indian Appropriations Act of 1871 placed Native Americans on Indian Reservations and ended Tribal sovereignty rights.¹⁶ Yet, despite strong encouragement to assimilate into Euro-American culture, Native American people did not completely cease their cultural traditions regarding grassland, forest, and wildlife stewardship. On reservation lands, in keeping with TEK, Native Americans continued to set some prescribed fires, even though they were discouraged from doing so by the U.S. Federal government. On non-Tribal lands, fire exclusion post-Euro-American colonization changed soil biogeochemical properties significantly, in ways that created plant communities far less resilient to drought and other environmental stressors.

Pyrogenic carbon (PyC) is a fire legacy formed through the thermal decomposition of organic matter during fires. PyC can increase nutrient cycling in soils and the carbon budget in an ecosystem. PyC is highly stable and can be preserved in mineral soils for decades to centuries. Recent studies have shown that the presence and content of soil PyC explains a significant amount of variation in soil function (e.g., water infiltration, carbon microbial cycling, nutrient availability and dynamics).¹⁷

The quantity and quality of PyC in soils is related to fire severity and frequency. Low- and mid-severity fire improves soil properties and processes, by stimulating nutrient release and depositing PyC in the topsoil (O and A soil layers, called “horizons”). Low- to mid-severity fire will retain much of the soil seedbank and nutrient capital, simply losing some of the topsoil to volatilization. After such events, microbial activity rebounds quickly and nutrient availability actually increases. In contrast, the sort of high-severity wildfires we have been experiencing globally, linked to climate change, result in complete combustion of the topsoil, loss of key species from the seedbank, mortality of shallow plant roots, reduced resprouting of herbs, and loss of carbon and nitrogen from surface mineral soil.¹⁸

Soils on the FBIR and adjacent BLM lands are predominantly moderately fertile, high-clay soils derived from glacial till.¹⁹ Surface soils are susceptible to wind erosion and loss of soil organic matter under conditions of limited vegetative cover. Frequent fire and deposition of degradation-resistant PyC created a more fertile and higher tilth soil condition, which is more resilient to drought. On BLM lands, exclusion of fire and decades of heavy grazing pressure by cattle likely led to slow, consistent loss of soil carbon due to mineralization and erosion losses, with only modest returns of fresh organic matter from the resident plant community. Differences in plant community composition also influence ecosystem carbon stocks, with exotic plant species often resulting in a net decline in soil carbon.²⁰

Understanding how different management practices and fire history influence soil PyC stock, dynamics, and soil biogeochemical properties at various spatial scales will be of great importance in designing nature-based solutions and strategies to improve the resilience of all grasslands. To be effective, such solutions must incor-

¹³ DeLuca et al., 2020.

¹⁴ Bond, et al. 2005; Kimmerer, and Lake 2001.

¹⁵ Boyd 2022; Lake, et al. 2017; Roos, et al. 2018.

¹⁶ Indian Appropriations Act of Mar. 3, 1871.

¹⁷ Bird 2015; Bowring, et al. 2022.

¹⁸ DeLuca, et al. 2020; Gao, and DeLuca 2018; Gao, and DeLuca 2020; Michelotti, and Miesel 2015; Adkins, and Miesel 2021; Landry, and Matthews 2017; Hart, et al. 1994; Merino, et al. 2019.

¹⁹ Hilts 1986.

²⁰ Lesica, and DeLuca 1996; Zouhar 2021.

porate TEK, including ethnobotany.²¹ While soil characterization (e.g., measuring the depth of the various soil horizons) is part of AIM protocols, in 2022 and beyond, we will be taking a more detailed look at soils. It is possible that the difference we observed between BLM and FBIR lands may be related to the legacy of PyC on FBIR lands, a legacy that as part of TEK cultural burning practices on this grassland created the landscapes and plant communities more resilient to climate change we observed in summer of 2021. Nevertheless, relationships in the natural world are far from simple, which Indigenous people have acknowledged since time immemorial as part of their TEK. We also expect that a variety of site-specific environmental factors will have bearing on the drought resilience of FBIR and BLM lands.²²

Many factors have degraded grasslands and continue to threaten them, including increasing agricultural development and drought. Restoring grasslands for the ecosystem services they provide is a global priority. Maintaining ecologically resilient, productive grassland and forest ecosystems that can reliably and sustainably supply the ecosystem services on which humans rely for survival will help us address the climate crisis and create a more sustainable future for humanity.²³

Why Healthy Grasslands Are so Important:

Grasslands are critically important to humanity as we respond to the climate crisis because they are one of the most stable and reliable terrestrial carbon sinks, providing 12% of terrestrial carbon stocks globally. During photosynthesis, plants draw carbon dioxide from the atmosphere and store it in their leaves, stems, and roots. Unlike forests, grasslands store the majority of their carbon (~81%) belowground, in their roots and soil. In fact, the roots of prairie grasses such as Western wheatgrass often extend belowground as far as twelve feet. Because most of a grassland's carbon is stored in the soil, when a grassland burns, it does not release much carbon into the atmosphere, the way a forest does when it burns. Additionally, prairie grasses typically grow as "bunchgrasses," sprouting from near-surface root crowns or rhizome mats. These grasses are highly adapted to fire, because they co-evolved with regular Indigenous cultural burning. When burned lightly, they can resprout within 48 hours, and grow back with increased vigor.

Overgrazing combined with introduction of exotic species reduces soil organic matter storage. Our data suggest that BLM lands have a far higher proportion of exotic species such as crested wheatgrass and cheatgrass (*Bromus tectorum*) than Tribal lands. Part of this is an artifact of the Homestead Era, during which semi-arid lands in the Northern Great Plains were settled and developed for agriculture. Attempts to stabilize soils in the 1920s involved planting exotic grass species. Many of these lands have not recovered from the ecological degradation caused by over a decade of drought that culminated in the 1930s Dust Bowl. Even with reintroduction of prescribed low-severity fire that replicates Indigenous traditional burning, on BLM lands these exotic species will influence fire behavior and post-fire responses. In grassland ecosystems comprised primarily of native grass species, with a small proportion of exotic species, prescribed burning and mixed-severity wildfire do not cause a sharp increase (known as an *irruption*) in exotics. However, as the proportion of exotics increases in a prairie, some, such as cheatgrass, will irrupt in response to fire, out-competing native grass species.²⁴

All of this means that as the climate continues to warm and wildfires continue to increase in frequency, size, and severity, grasslands provide a highly stable and important carbon sink that is more resilient than forests as a source of carbon. In general, native grass species, which are perennial, long-lived plants, are the most effective at sequestering carbon. This is because many of the exotic agronomic species, which come from Europe or the Middle East, do not grow roots as deeply into the soil as North America's native grasses. Since Montana's Northern Great Plains provide a unique combination of grasses and forbs of high conservation value, establishing and maintaining a native seed conservation program here that incorporates TEK and ecocultural restoration is crucial to meeting U.S. Federal plant conservation and climate resiliency objectives.²⁵

3. Can you describe the importance of a stable, economical supply of native plants and seeds? What programs are needed to ensure this supply is available to local communities and local landscapes?

²¹ Lake 2021; Gann, et al. 2019; Turner 2015.

²² Roos, et al. 2018.

²³ Havstad, et al. 2007; Bedunah, et al. 2012; Augustine, et al. 2021.

²⁴ Briggs, et al. 1995; Strassburg, et al. 2000; Libecap, and Hansen. 2002; Ontl, and Janowiak 2017; Dass, et al. 2018; Eisenberg, et al. 2019; Lark, et al. 2020; Nagy, et al. 2021.

²⁵ Lavin, and Seibert 2011. Oldfield, et al. 2019.

Importance of Supply of Native Plants and Seeds:

As wildfires and other climate-driven disasters continue to devastate the U.S., ecological restoration has become a national and global priority. Having a stable, economical supply of native plants and seeds is critical to restore ecosystems in the aftermath of these crises. Currently the availability of native seed of a sufficient range of species and of appropriate genetic provenance for ecological restoration does not match the need locally, regionally, or nationally. Federal agencies, such as the BLM, U.S. Forest Service (USFS), U.S. Fish and Wildlife Service (USFWS), National Park Service (NPS), Tribal nations, and the U.S. Department of Defense (DoD) are the largest purchasers of native plant seeds in the U.S.²⁶ The use of genetically-appropriate native plants (rather than non-native species or native species from a different locality) in restoration is required or encouraged in policy documents by some agencies, like the NPS and USFS. BLM policy strongly encourages the use of native plants used for restoration on federal land, and BLM alone buys hundreds of thousands of pounds of seed annually in response to wildfires.

Although BLM and other agencies have large stores of native seeds, and are actively working to increase their supply, large disasters create a reactive demand on what is already a limited supply, driving up the cost of native seeds, and in some cases, leading to the use of non-native species in plantings and seed mixes. State and local authorities are also users of native seeds, frequently sourcing them for roadside revegetation, invasive species control, landscape beautification, soil and water conservation, and pollinator and wildlife habitat restoration. However, these proactive state and local restoration efforts contend with the same supply chain limitations as the Federal agencies that dominate the market. This lack of appropriate native plant material generally strongly constrains ecological restoration. To that end, there exist several programs which, with additional support, are well positioned to address this increasing need, as well as opportunities to create new programs.

Existing Programs and Needs:

The **BLM Plant Conservation and Restoration Program (PCRP)** is working to ensure that land managers across our nation can buy the native seed that will work to restore native plant communities that provide wildlife habitat, ecosystem services, and recreational opportunities for all Americans to enjoy. Seed collection is the first step in native plant materials development.²⁷ Seeds of Success (SOS; <https://www.blm.gov/programs/natural-resources/native-plant-communities/native-plant-and-seed-material-development/collection>) is the national native seed collection program housed under the BLM's PCRP. The mission of SOS is to collect wildland native seed for research, development, germplasm conservation, and ecosystem restoration. Established in 2002, SOS has made over 26,000 seed collections of over 5,800 unique taxa, from 43 states. Additional SOS accomplishments include:

- Over 2,500 seed collectors trained in over 140 collecting teams
- In 2015, the DOI awarded BLM a \$3.5 million grant through the Hurricane Sandy Supplemental Mitigation Fund for seed collection in coastal habitats from Virginia to Maine. As of 2018, over 125 SOS East collections have been used for Hurricane Sandy restoration projects.

To continue the success of the PCRP, we need more:

- **Botanical Expertise**—As of 2021, there were 32 botanists in the BLM. The BLM manages 245 million acres. This means, there is only one botanist for every 7.656 million acres of public lands.
- **Restoration Ecologists**—As the availability of locally adapted native seed increases, we need restoration practitioners who know how to best leverage this national investment back onto the landscape.
- **Seed cleaning and testing facilities**—In the 20 years that the PCRP has existed, the infrastructure available to clean, test, and store 20 years' worth of seed collections has remained stagnant. More seed cleaning facilities like the USFS Bend Seed Extractory are needed for the PCRP and SOS to continue to grow and provide a stable supply of native seeds for increase and use on public lands.

To address the urgent need for native plant materials for restoration, the **Plant Conservation Alliance** Federal Committee (<https://www.blm.gov/programs/natural-resources/native-plant-communities/national-seed-strategy/pca>), which includes representatives from twelve Federal agencies, developed the **National Seed**

²⁶ National Academies of Sciences, Engineering, and Medicine 2020.

²⁷ Oldfield 2019.

Strategy (NSS; <https://www.blm.gov/programs/natural-resources/native-plant-communities/national-seed-strategy>). The vision of NSS is to provide the right seed in the right place at the right time. Successful establishment and survival of seedlings depends on where and how seeds are collected. Research suggests that it is important to use locally adapted seeds. Local populations often show a home-site advantage and non-local genotypes may be maladapted to local environmental conditions. Furthermore, intraspecific hybridization of local and non-local genotypes may have a negative impact on the genetic structure of local populations through mechanisms such as outbreeding depression. Additionally, many species show a strong, small-scale genetic differentiation between different habitats so that matching habitats of the restoration and donor site can be more significant than minimizing geographical separation. In sum, locally adapted seeds have a far higher germination and survival rate, leading to more effective ecological restoration efforts, than do seeds obtained from other geographical areas.²⁸

The mission of NSS is to ensure the availability of appropriate seed to provide healthy and productive plant communities in a changing climate. 2015–2020 NSS accomplishments (<https://www.blm.gov/sites/blm.gov/files/docs/2021-02/NSS%20Progress%202020%20Fact%20Sheet.pdf>) include:

- 17 Federal Agencies, 20+ Tribal Nations, 52 States & Territories, 380 total partners, \$167 million invested
- Almost 9,000 seed collections
- 170+ scientific reports & articles on native seed research and development
- National Academies of Science national seed needs study underway
- 1000s of native seed crops developed by local and regional efforts in over 32 ecoregions
- 65+ nurseries, farms, growers, and botanic gardens engaged, 21+ regional seed partnerships
- 2 facilities increased seed storage capacity to 2.1 million pounds
- 250+ types of seed available for large-scale restoration
- 10+ million acres impacted

Largely because of global warming, wildfires and storms are becoming increasingly frequent and severe. Warmer temperatures, below-average winter precipitation, earlier snowmelt, and drier summers are creating longer wildfire seasons.²⁹ Hurricanes are also becoming increasingly frequent and severe, also linked to global warming. These natural disasters increase our need for native plant materials for restoration. Accordingly, next steps for the NSS are:

- Expand economic opportunities for farmers to grow locally adapted native seed
- Actively engage with Native American Tribes and Alaska Native villages to honor their Indigenous knowledges and ensure culturally important plants are conserved
- Increase botanical expertise in federal agencies to inform all restoration, rehabilitation and reclamation projects
- Develop regional “Seed Hubs” with partners who develop, store, and deliver locally adapted native seeds
- Increase research to enhance decisions based on science for every step, from seed collection to restoration
- Increase public education and awareness on the importance of locally adapted native seed in ecological restoration

Continuing to support the above programs in a manner that can meet our nation’s needs for native plant material for restoration requires stable, dedicated Federal funding. Such support would fund:

- SOS seed collecting efforts, and analysis of such efforts under the Justice40 Initiative, of which SOS is a pilot program
- Genomic studies on seeds to be used for restoration
- Education of specialists (e.g., botanists) and employment opportunities, particularly from underserved communities such as Tribal Nations
- Seed-growing enterprises and training and opportunities
- Community and public outreach

Future Programs:

A stable, enduring native seed supply must include a diversity of voices and autonomy of community groups that builds equitable participation in social, economic,

²⁸ Vander, et al. 2010; Baughman, et al. 2019.

²⁹ Grimm, et al. 2013; Polley, et al. 2013; Hessburg, et al. 2021.

and environmental benefits. In the U.S., supporting Tribal Nations in developing seed-growing enterprises will create a participatory, community-based seed supply approach that will:

- Address social and environmental justice
- Honor TEK, because seeds are sacred in most Indigenous cultures
- Help achieve the goals of the U.S. Federal government in creating ecosystems more resilient to fire, drought, and other ecological disasters
- Address the goals of the UN Decade for Ecosystem Restoration

Meeting large-scale restoration goals requires connection between local seed production and collaborative platforms to negotiate roles, rights, and responsibilities between all partners. When partnering with Tribal Nations, this will require government-to-government negotiations that fulfill sovereignty and self-determination rights.³⁰

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³⁰Reyes-Garcia 2019; Fernandez, et al. 2021; Urzedo, et al. 2022.

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