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The CSTPR blog, Prometheus (<http://ciresblogs.colorado.edu/prometheus>), was revived in 2016 to feature content from CSTPR core faculty, affiliates, postdocs, and visitors to serve as a resource for science and technology decision makers. This dynamism reflects the new energies and pursuits taking place in and around CSTPR. Below we feature one of the recent blog posts from our core Faculty member Steve Vanderheiden.



Protesters carry signs during the Peoples Climate March at the White House in Washington. Photo: Joshua Roberts/CNS.

Should We Hope for Power to Declare a National Climate Emergency? by Steve Vanderheiden

In the wake of the president's declaration of an emergency along the nation's southern border, bypassing Congressional appropriations authority to fund his promised border wall, observers are of two minds about the powers this declaration invokes and the precedent it sets.

If the declaration stands—and several challenges pending at the time of this post will decide its legal fate—it would significantly expand executive power and further limit the legislative and oversight powers of Congress. While 182 of the 195 GOP members opposed to a February 26 House Resolution may have signaled their support of the declaration by opposing the resolution, several members of the president's party expressed concern. Rep. Jim Sensenbrenner (R-WI), for example, remarked that "it is imperative that no administration, Republican or Democratic, circumvent the will of Congress." Sen Marco Rubio (R-FL), who has characterized opposition to Trump's border wall as "irrational," also expressed reservations, suggesting that "we have to be careful about endorsing broad uses of executive power" that could later be used by future presidents, since "tomorrow the national emergency might be climate change."

Those opposed to both a border wall and a further shift of legislative power to the president may nonetheless find this prospect of granting future presidents emergency powers to address climate change appealing. Rep. Ilhan Omar (D-MN), for example, called upon the next president to invoke emergency powers "to address the existential threat to all life on the planet posed by Climate Change" on "day 1" of their term. Democratic presidential candidates Bernie Sanders and Elizabeth Warren have also both expressed support for declaring a climate emergency.

THIS ISSUE

- | | |
|--|-----------|
| Ogmios Exchange | 1 |
| Should We Hope for Power to Declare a National Climate Emergency?
by Steve Vanderheiden | |
| Faculty Affiliate Forum | 4 |
| Can Genetic Engineering Save Disappearing Forests?
by Jason Delborne | |
| | 7 |
| Unprecedented Sea-ice Conditions in the Bering Sea
by Matthew Druckenmiller | |
| Student Highlight | 9 |
| Reflections from the 2019 AAAS "CASE" Workshop | |
| Local Highlight | 11 |
| Green Suits in Action: Students Photographing Sustainability in Boulder Valley School District by Beth Osnes | |
| Multimedia Highlight | 11 |
| Center News & Events | 12 |
| Center Publications | 14 |

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OGMIUS EXCHANGE

One can certainly understand this sentiment, given the urgency of climate change combined with the federal government's apparent inability to respond to it through normal policy processes. The U.S. Congress has not only failed to pass any meaningful legislation to reduce national carbon emissions in the 27 years since it pledged to do so with the 1992 UN Framework Convention on Climate Change, but it appears unlikely to be able to do so at any point in the foreseeable future. Recent normalization of the filibuster in the Senate for ordinary legislation has created a formidable obstacle. Continued GOP opposition to any kind of policy action on climate change that has prevailed over recent decades means that 60 votes would need to be found among Democratic senators, which is exceedingly unlikely. Neither party has held a filibuster-proof majority since the 95th Congress ended 40 years ago, and increasing partisan polarization suggest bipartisan cooperation will continue to be elusive. With likely defections by Senators from fossil fuel states like Louisiana and West Virginia on any bill involving carbon pricing or other controls, prospects for a legislative path toward federal climate are slim.

Until recently, the most promising path was through EPA regulation of carbon dioxide, which the Supreme Court upheld as within the agency's statutory authority under the Clean Air Act in *Massachusetts vs. EPA* (2006). Acting through this authority the Obama administration EPA promulgated rules controlling carbon emissions from motor vehicles through increases to federal Corporate Average Fuel Economy (CAFE) standards and from power plants in its Clean Power Plan, along with its rule controlling methane releases from oil and gas operations. Using these unilateral executive powers to circumvent certain Congressional obstruction, these proposed actions offered what was regarded as a sufficiently credible U.S. commitment to climate change mitigation for participation in the 2016 Paris Agreement, which was carefully negotiated under the already-ratified 1992 UN Framework Convention on Climate Change so as to avoid certain refusal by the Senate to ratify the climate treaty.

That path no longer looks promising. The Trump administration has withdrawn the U.S. from participation in the Paris Agreement and moved to roll back all three Obama rules controlling greenhouse gas emissions. Over the longer term, GOP control of the presidency and Senate has enabled longstanding conservative plans to pack the federal judiciary with opponents of environmental protection capable of hamstringing future legislative or executive efforts at meaningful mitigation. Ordinary unilateral powers of the presidency like executive orders can be easily undone, and administrative decision making within executive agencies is vulnerable to party turnover in the presidency as well as obstruction by the legislative and judicial branches.

Enter extraordinary executive powers, such as those available through declarations of national emergency. These promise to bypass legislative opposition as well as otherwise-applicable



A banner is hung across a roadway on April 17, 2019 in New York City. Photo: S. Keith/Getty Images.

statutes, as with the waiver of 28 federal environmental laws to allow for construction of Trump's border wall. While the full degree of executive discretion that the judiciary will allow in this border emergency declaration remains to be seen, emergency powers are also a powerful tool for circumventing judicial opposition. For many concerned about the closing policy window for U.S. action on climate change, a precedent that might allow some future president to invoke and mobilize broad unilateral powers on behalf of the climate change mitigation actions that have thus far remained elusive at the federal level is enticing. Tolerating a stunt like Trump's use of this power to build his wall may be a small price to pay for what could be the country's last and best chance to respond to a much more compelling emergency.

What powers could be invoked through a future presidential declaration of a climate emergency? According to UC-Berkeley Law Professor Dan Farber, these powers could include the immediate and indefinite suspension of federal oil leases, significant restrictions on automobile and truck use to decrease greenhouse emissions, mobilization of federal financial support for renewable industry, and the sanctioning of "companies or countries trafficking in fossil fuels." As Farber suggests, the judicial response to challenges against Trump's declaration matters, as federal courts upholding his use of this power with the border emergency declaration would "be a sign that they're not willing to apply any meaningful oversight to presidential actions." Significant new powers to combat climate change could be granted to a future president if the declaration is allowed to stand, and none of these powers stand any chance of being granted by Congress.

But should those concerned about an unfolding climate emergency thereby hope that emergency powers be allowed to stand in the current context, for the purpose of using them in a future one? This is not altogether clear, and indeed the use of emergency power and of the proper balance of power between the legislative branch and president have long been the subject of debate.

OGMIUS EXCHANGE

At the U.S. Constitutional Convention in 1787, James Madison and Alexander Hamilton grappled over this question, with Madison urging that the legislative branch be granted more powers and Hamilton urging a stronger executive. In his *Federalist* #70, Hamilton claimed that “decision, activity, secrecy, and despatch will generally characterize the proceedings of one man in a much more eminent degree than the proceedings of any greater number,” allowing a unitary executive like the president to more effectively respond to national emergencies, like those presented by military threats. Madison, whose designs are reflected in the larger share of power vested in Congress through the Constitution’s Article I, argued that limits upon power were of greater importance, pointing to the role of electoral accountability of House members in his *Federalist* #57, who will by the requirement of biannual elections “be compelled to anticipate the moment when their power is to cease, when their exercise of it is to be reviewed, and when they must descend to the level from which they were raised; there forever to remain unless a faithful discharge of their trust shall have established their title to a renewal of it.” It has only been through several intervening national emergencies—the Civil War, the Great Depression and two world wars, and the Vietnam war in particular—that power has shifted from the legislative branch to the president, giving rise to what some lament as an “imperial presidency” in which Congress is often unable to provide the constitutional check that Madison insisted upon.

With the increasing popularity of a national security discourse following the 2001 attacks upon the Pentagon and World Trade Centers, some advocates for taking state action on climate change urged an “environmental security” or “climate security” discursive frame for such actions. As explained by the influential Copenhagen School of security studies, invoking an existential threat could invoke broad emergency powers to address that threat, temporarily setting aside the normal constraints upon executive actions like Congressional or judicial oversight, statutory limits upon state power, and even individual rights. Through this process of securitization, which “claims a need for and right to treat [the threat] by extraordinary means” powers previously unavailable to effectively combat a climate emergency might become so if the issue could be credibly linked with a threat to national security.

As with current interest in new presidential powers to declare a climate emergency, some advocated for securitizing new threats like climate change in the post-9/11 period of high salience for national security, but the authors cautioned against an uncritical invocation of emergency power, noting that “one has to weigh the always problematic side effects of applying a mind-set of security against the possible advantages of focus, attention, and mobilization.”

As environmental security scholar Dan Deudney points out, the treatment of climate change as “the moral equivalent of war” may motivate strong defensive actions and mobilize

important powers to address a problem like climate change, but carries significant downside risks. Given that the traditional security focus is upon armed conflict and often involves an “us versus them” mindset, whereas effective climate action requires sustained international cooperation, it would be more accurate to say that “environmentalism is a threat to ‘national security’ mindsets and institutions” than it would be to claim that environmental change threatens national security.[1]

A similar cautionary note might be sounded in regard to the more recent call for emergency powers to address climate change. As noted by J. Goffman, executive director of Harvard Law School’s Environmental and Energy Law Program, “climate change is going to require a significant reinvestment and reinventing of basic infrastructure that involves lots of players buying into the solution and sustaining that kind of effort over a long period of time,” requiring public buy-in and political coalition-building rather than the sort of powers that declarations of emergency make available.[Consolidating new powers in the presidency to act on emergencies like climate change risks abuse of such power without the legislative and judicial checks that framers of the Constitution insisted upon and which have prevented past abuses, and provides only a temporary and limited set of powers in return. While climate change offers a much more compelling threat than does the claimed “emergency” at our southern border, it is not the kind of emergency for which these powers are designed, requiring sustained domestic and international cooperation over time along with a transformation of public attitudes and beliefs along with a transformation of our energy and transportation infrastructure.

Such is not to dismiss the potential value of such emergency powers altogether, nor is it to identify any near-future basis for securing political support for the kind of social investment that Goffman identifies as needed. Rather, it is to temper some of the recent enthusiasm through which such powers have been suggested as unproblematically attractive or potentially sufficient as a top-down solution on their own. While it might be taken as evidence of the inadequacy of any set of governance institutions that they cannot generate meaningful policy responses to a problem like climate change, working within those flawed institutions while working to reduce their flaws offers more likely prospects for future climate actions than do hopes that they might be preempted or circumvented through emergency powers.

[1] D.H. Deudney, 1999. *Environmental Security: A Critique*, from *Contested Grounds: Security and Conflict in the New Environmental Politics*, Albany: SUNY Press, 187-219.

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FACULTY AFFILIATE FORUM

Can Genetic Engineering Save Disappearing Forests?

by Jason Delborne



Ash tree killed by the invasive emerald ash borer. Photo: K Steve Cope

This article was originally published in *The Conversation*:
<https://theconversation.com/can-genetic-engineering-save-disappearing-forests-109793>

Compared to gene-edited babies in China and ambitious projects to rescue woolly mammoths from extinction, biotech trees might sound pretty tame.

But releasing genetically engineered trees into forests to counter threats to forest health represents a new frontier in biotechnology. Even as the techniques of molecular biology have advanced, humans have not yet released a genetically engineered plant that is intended to spread and persist in an unmanaged environment. Biotech trees – genetically engineered or gene-edited – offer just that possibility.

One thing is clear: The threats facing our forests are many, and the health of these ecosystems is getting worse. A 2012 assessment by the U.S. Forest Service estimated that nearly 7 percent of forests nationwide are in danger of losing at least a quarter of their tree vegetation by 2027. This estimate may not sound too worrisome, but it is 40 percent higher than the previous estimate made just six years earlier.

In 2018, at the request of several U.S. federal agencies and the U.S. Endowment for Forestry and Communities, the National Academies of Sciences, Engineering, and Medicine formed a committee to “examine the potential use of biotechnology

to mitigate threats to forest tree health.” Experts, including me, a social scientist focused on emerging biotechnologies, were asked to “identify the ecological, ethical, and social implications of deploying biotechnology in forests, and develop a research agenda to address knowledge gaps.”

Our committee members came from universities, federal agencies and NGOs and represented a range of disciplines: molecular biology, economics, forest ecology, law, tree breeding, ethics, population genetics and sociology. All of these perspectives were important for considering the many aspects and challenges of using biotechnology to improve forest health.

A Crisis in US forests

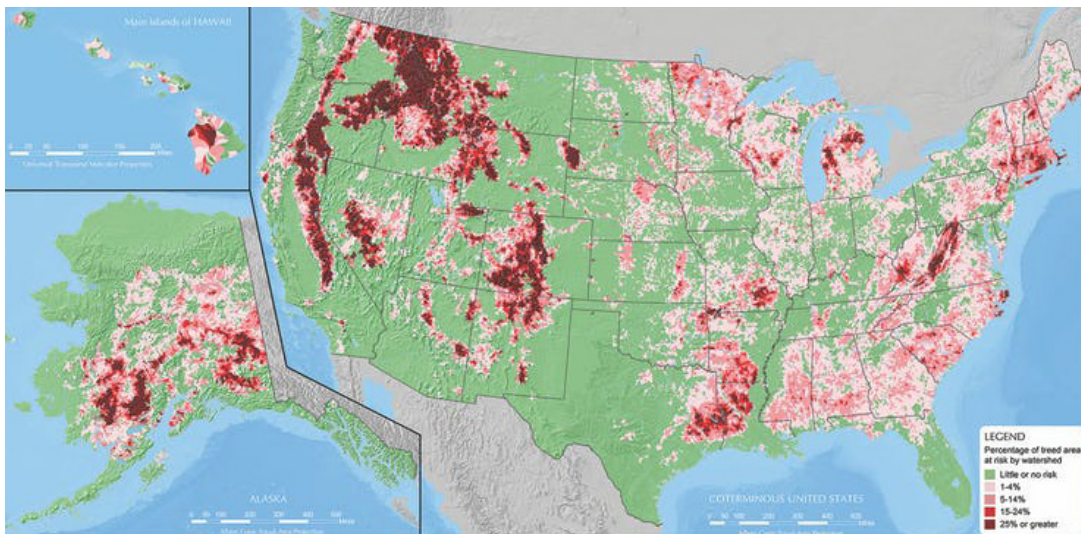
Climate change is just the tip of the iceberg. Forests face higher temperatures and droughts and more pests. As goods and people move around the globe, even more insects and pathogens hitchhike into our forests.

We focused on four case studies to illustrate the breadth of forest threats. The emerald ash borer arrived from Asia and causes severe mortality in five species of ash trees. First detected on U.S. soil in 2002, it had spread to 31 states as of May 2018. Whitebark pine, a keystone and foundational species in high elevations of the U.S. and Canada, is under attack by the native mountain pine beetle and an introduced fungus. Over half of whitebark pine in the northern U.S. and Canada have died.

FACULTY AFFILIATE FORUM CONTINUED

Can Genetic Engineering Save Disappearing Forests?

Poplar trees are important to riparian ecosystems as well as for the forest products industry. A native fungal pathogen, *Septoria musiva*, has begun moving west, attacking natural populations of black cottonwood in Pacific Northwest forests and intensively cultivated hybrid poplar in Ontario. And the infamous chestnut blight, a fungus accidentally introduced from Asia to North America in the late 1800s, wiped out billions of American chestnut trees.



More than 80 million acres are at risk of losing at least 25 percent of tree vegetation between 2013 and 2027 due to insects and diseases. Credit: Krist et al. (2014), CC BY-SA.

Can biotech come to the rescue? Should it?

It's Complicated

Although there are many potential applications of biotechnology in forests, such as genetically engineering insect pests to suppress their populations, we focused specifically on biotech trees that could resist pests and pathogens. Through genetic engineering, for example, researchers could insert genes, from a similar or unrelated species, that help a tree tolerate or fight an insect or fungus.

It's tempting to assume that the buzz and enthusiasm for gene editing will guarantee quick, easy and cheap solutions to these problems. But making a biotech tree will not be easy. Trees are large and long-lived, which means that research to test the durability and stability of an introduced trait will be expensive and take decades or longer. We also don't know nearly as much about the complex and enormous genomes of trees, compared to lab favorites such as fruit flies and the mustard plant, *Arabidopsis*.

In addition, because trees need to survive over time and adapt to changing environments, it is essential to preserve and incorporate their existing genetic diversity into any "new" tree. Through evolutionary processes, tree populations already have many important adaptations to varied threats, and losing those could be disastrous. So even the fanciest biotech tree will ultimately depend on a thoughtful and deliberate breeding program to ensure long-term survival. For these reasons, the National Academies of Sciences, Engineering, and Medicine committee recommends increasing investment not just in biotechnology research, but also in tree breeding, forest ecology and population genetics.

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Oversight Challenges

The committee found that the U.S. Coordinated Framework for the Regulation of Biotechnology, which distributes federal oversight of biotechnology products among agencies such as EPA, USDA and FDA, is not fully prepared to consider the introduction of a biotech tree to improve forest health.

Most obviously, regulators have always required containment of pollen and seeds during biotech field trials to avoid the escape of genetic material. For example, the biotech chestnut was not allowed to flower to ensure that transgenic pollen wouldn't blow across the landscape during field trials. But if biotech trees are intended to spread their new traits, via seeds and pollen, to introduce pest resistance across landscapes, then studies of wild reproduction will be necessary. These are not currently allowed until a biotech tree is fully deregulated.

Another shortcoming of the current framework is that some biotech trees may not require any special review at all. The USDA, for example, was asked to consider a loblolly pine that was genetically engineered for greater wood density. But

FACULTY AFFILIATE FORUM CONTINUED

Can Genetic Engineering Save Disappearing Forests?

because USDA's regulatory authority stems from its oversight of plant pest risks, it decided that it did not have any regulatory authority over that biotech tree. Similar questions remain regarding organisms whose genes are edited using new tools such as CRISPR.

The committee noted that U.S. regulations fail to promote a comprehensive consideration of forest health. Although the National Environmental Policy Act sometimes helps, some risks and many potential benefits are unlikely to be evaluated. This is the case for biotech trees as well as other tools to counter pests and pathogens, such as tree breeding, pesticides and site management practices.

How Do You Measure the Value of a Forest?

The National Academies of Sciences, Engineering, and Medicine report suggests an "ecosystem services" framework for considering the various ways that trees and forests provide value to humans. These range from extraction of forest products to the use of forests for recreation to the ecological services a forest provides – water purification, species protection and carbon storage.

The committee also acknowledged that some ways of valuing the forest do not fit into the ecosystem services framework. For example, if forests are seen by some to have "intrinsic value," then they have value in and of themselves, apart from the way humans value them and perhaps implying a kind of moral obligation to protect and respect them. Issues of "wildness" and "naturalness" also surface.

Wild Nature?

Paradoxically, a biotech tree could increase and decrease wildness. If wildness depends upon a lack of human intervention, then a biotech tree will reduce the wildness of a forest. But perhaps so would a conventionally bred, hybrid tree that was deliberately introduced into an ecosystem.

Which would reduce wildness more – the introduction of a biotech tree or the eradication of an important tree species? There are no right or wrong answers to these questions, but they remind us of the complexity of decisions to use technology to enhance "nature."

This complexity points to a key recommendation of the National Academies of Sciences, Engineering, and Medicine report: dialogue among experts, stakeholders and communities about how to value forests, assess the risks and potential benefits of biotech, and understand complex public responses to any potential interventions, including those involving biotechnology. These processes need to be respectful, deliberative, transparent and inclusive.



The emerald ash borer is destroying ash trees in 31 states. Photo: Herman Wong HM/Shutterstock.



The emerald ash borer feeds on ash trees, damaging and eventually killing them. Photo: K Steve Cope/Shutterstock.

Such processes, such as a 2018 stakeholder workshop on the biotech chestnut, will not erase conflict or even guarantee consensus, but they have the potential to create insight and understanding that can feed into democratic decisions that are informed by expert knowledge and public values.

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FACULTY AFFILIATE FORUM

Unprecedented Sea-ice Conditions in the Bering Sea

by Matthew Druckenmiller



The village of Wales in the Bering Strait region of Alaska. Photo: Matthew Druckenmiller.

A cause for re-examining how science partners with Indigenous Arctic communities

During the winter of 2017-18, the Bering Sea experienced the lowest sea ice coverage observed in at least 160 years. The combination of extremely reduced sea ice extent, little or absent protective ice along community coastlines, and winter storm activity caused substantial damage in several Bering Sea communities. The state and national media picked up on just how extraordinary conditions were. Scientists scrambled to put together short reports to raise awareness (e.g., this report from the University of Alaska Fairbanks: <https://uaf-iarc.org/2018/04/09/new-summary-available-on-bering-strait-winter-2018-sea-ice-conditions>), and the Alaska Regional NOAA branch quickly assembled a collection of briefing reports from over two dozen federal programs on what they were observing, intended to directly inform Alaska Native communities. A special session was held at the 2018 Fall Meeting of the American Geophysical Union (“Unprecedented Bering Sea Ice Extent and Impacts to Marine Ecosystems and Western Alaskan Communities”) and many related scientific papers are undoubtedly in the publication pipeline.

The lack of sea ice cover was remarkable, but urgency is more evident when considering the connections to the daily lives of local communities and to their Bering Sea foodshed. The connections are many: less sea ice exposes communities to greater storm surge, increased coastal erosion, reduced hunting access to marine mammals, unstable conditions for on-ice travel by community members, etc. Such issues are critical motivations for the research community to gain a deeper understanding of how the “system” is changing, and many of the previously mentioned efforts are important contributions especially where local communities have established entry points into the research process.

Yet, there is need for more local voices and new forms of collaboration, especially when unbounded to share outside the confines of a particular science program or project. More importantly, communities increasingly need to “use” the science and to insert it directly into their adaptation planning, emergency response protocols, and efforts to draw multi-level government and political attention to the challenges they face. The Bering Strait region is home to thousands of Inupiat and Yupik, who have lived in the region for millennia. For them, understanding their changing environment is critical to exercising tribal sovereignty.

FACULTY AFFILIATE FORUM

Unprecedented Sea-ice Conditions in the Bering Sea

As a case in point: In spring of 2018, local community observations combined with satellite-observed conditions of weather and sea ice collectively documented poor walrus hunting conditions around several Bering Sea communities. Because the lack of hunting access was a substantial threat to local food security, the Eskimo Walrus Commission used this information to declare a food-scarcity disaster with the State of Alaska. Similar declarations in the past have resulted in large donations of fish to communities unable to harvest the number of walrus they require to feed themselves.

Following last winter, the science community largely came to the consensus that the unprecedented conditions were the result of both the footprint of climate change and the rare convergence of particular environmental conditions, most notably sustained periods of south wind that pushed the fragmented ice northward throughout winter. The winter of 2017/18 was unique, but also in-line with what we might expect with Arctic amplification on a warming earth.

Most scientists did not necessarily expect last year's conditions to return this year. Yet, here we are in mid-February 2019 where Alaska is facing "strange days" of way-above normal temperatures and sea ice coverage in the Bering Sea that is now once again within the range of being historic (see figure below), if you ignore last year of course. A lot can change

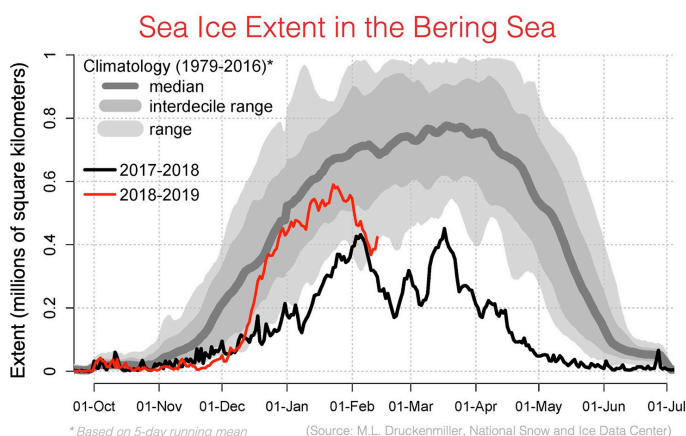


Bering strait, image taken by MISR satellite. Photo: Wikipedia/NASA.

however during the last few months of winter; the increasing sub-seasonal variability is just another challenge faced by the region.

The Indigenous Peoples of the Bering Sea region face a new normal: an environment that is unrecognizable in many ways. Yet, this is their backyard. We may be quick to think that "science is needed now more than ever". Rather, this perspective needs to be flipped – "science needs to listen to communities now more than ever". Research-community partnerships, informal learning networks, and channels for sharing knowledge need investment that puts community leaders more in the driver's seat for steering research agendas increasingly toward the local realities of food security, emergency planning, human health and, ultimately, survival. Some of this requires the long-view—a generational investment in the institutions and infrastructure necessary for "knowledge co-production", but for those on the frontlines of global change, they are starving now for new approaches to actionable science.

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STUDENT HIGHLIGHT

Reflections from the 2019 AAAS “CASE” Workshop

Each year, with support from the Graduate School and the Center for STEM Learning at CU Boulder, CSTPR hosts a competition to send CU Boulder students to Washington, DC to attend the AAAS “Catalyzing Advocacy in Science and Engineering” (CASE) workshop. During the workshop portion, the winners learned about the structure and organization of Congress, the federal budget and appropriations processes, and tools for effective science communication and civic engagement. In addition, the winners participated in interactive seminars about policy-making and communication. Below are comments by the winners about this year’s workshop.

Katie Chambers

My first trip to Washington, D.C. to participate in the 2019 AAAS Catalyzing Advocacy in Science and Engineering (CASE) was a whirlwind tour of science policy in the nation’s capital. From former members of Congress, to current Hill staffers, to federal science agency employees, each of the workshop’s sessions revealed a different role that science plays in policy. Among many topics, we learned about United States science and technology policy history, the federal budget process, Congress’s structure, and how scientists can better engage in policy. Each session left me wanting more and often with more questions than before the session began.



2019 AAAS Competition Winners in Washington, DC. Photo: Heather Bené.

One important topic that was pressed upon us during the workshop was the importance of understanding the mechanics of the federal government, specifically the federal budget process. Admittedly, before attending the workshop, the thought of two full sessions dedicated to the federal budget process sounded dry. However, science can’t happen without funding, and learning about the intricacies of such an important process for science was fascinating. For example, shortly before we arrived in D.C., the President released his budget and proposed massive cuts to science funding. The budget made its rounds through media outlets and caused quite a stir. However, through the workshop, we learned about how Congress controls the budget and how members of Congress from both political parties considered the President’s budget “dead-on-arrival” and a “non-starter” (for most President’s budgets too, not just our current President). We also learned about how politicians with diverse interests in both the House of Representatives and Senate come together to create the budget, which is an even messier process than it sounds like. A memorable quote from the first night of the workshop was “law and sausage are two things you do not want to see being made,” and it certainly proved to be true. **Read more of Katie’s comments about the workshop:** <https://sciencepolicy.colorado.edu/stcert/aaas/chambers.html>

Claire Lamman

This workshop was far more informative and impactful than I anticipated when applying, and I had high expectations after reading the reflections from last year’s students. Although I’ve always known that I love talking about astronomy, I never considered communicating science outside of an educational space or even thought about what exactly science policy is. That all changed in the space of a few days, when I had the opportunity to listen to consistently engaging and informative speakers and experience real Hill meetings. Although here I will focus on what I took away from the scheduled activities, one of my favorite parts about the workshop was interacting with other young scientists interested in advocacy. I had no idea there were so many others with a similar interest in communicating science, and all from wildly different disciplines. The fascinating people I met and great conversations had really helped me digest and consider everything we were learning.



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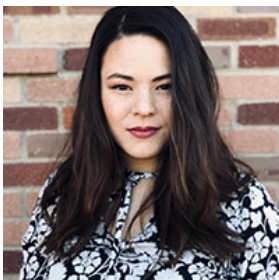
This experience has affirmed that I never want to become a politician, but I saw how vital it is for scientists to be able to understand how that very different world works. I reflected on the stark cultural divide between scientists and politicians, and the importance in being able to bridge that gap. One of the sessions presented a thorough introduction to the budget process. Although I won't remember many of the specifics, it gave me an appreciation for the complexity behind supporting most major projects in my field. After learning about this, it's astounding to me that many scientists aren't more well informed about this essential process. ***Read more of Claire's comments about the workshop:*** <https://sciencepolicy.colorado.edu/stcert/aaas/lamman.html>



2019 AAAS Competition Winners in Washington, DC. Photo: Heather Bené.

Danielle Lemmon

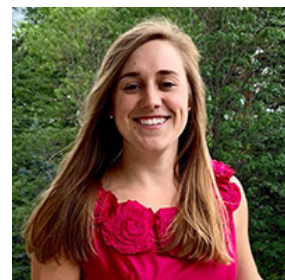
The AAAS Catalyzing Advocacy in Science and Engineering student workshop synthesized science policy issues, legislative processes, politics, and science advocacy into 3 intensive, exciting days. The opportunities to speak with our local policy makers, to practice mock appropriations processes, to discuss policy issues candidly, and to put sticky notes on Alexandria Ocasio-Cortez's wall made the event an experience I will never forget. The take home message I took away from this year's workshop was that in order to pass legislation and make a real difference, you need to align your politics, policy, and procedure.



Even though I already study science and technology policy with Center for Science Technology Policy Research (CSTPR) graduate certificate program, there was an invaluable benefit to hearing from speakers whose boots were on the ground in Washington DC. As Judy Schneider, a Congressional specialist, pointed out: all of the concepts in the national discourse are large, complicated subjects like healthcare, climate change, affordable housing, drug pricing, immigration, etc. However, all of these issues differentially impact states which is why it is important to align local policies, local politics, and local procedures as you advocate for more science funding to your representatives. This idea of grounding policy, politics, and procedure locally certainly helped the Colorado delegation advocate effectively! ***Read more of Danielle's comments about the workshop:*** <https://sciencepolicy.colorado.edu/stcert/aaas/lemmon.html>

Madeline Polmear

The AAAS “Catalyzing Advocacy for Science and Engineering” Workshop in Washington DC was an insightful and inspiring experience. The seminars, presentations, and interactive activities provided exposure to a wide range of science and technology policy issues from an impressive suite of experts. The workshop offered an engaging crash course in Congress, the legislative process, and the federal budget and covered topics including STEM education, the role of federal agencies, and civic engagement.



One of the greatest strengths of the workshops was the expertise of the speakers, presenters, and panelists. It was interesting to hear about the professional trajectories of people at all stages of their careers from recent graduates to lifelong public servants. Learning about their experiences and perspectives humanized policy. It was also insightful to hear about how the federal government works from people within it. They provided a more nuanced understanding of Congress and how its ultimate function is not to pass laws but to stop bad laws from passing. It was such a unique opportunity to learn about the structures and processes of Congress from the specialist who trains freshman lawmakers on procedural rules. ***Read more of Madeline's comments about the workshop:*** <https://sciencepolicy.colorado.edu/stcert/aaas/polmear.html>

LOCAL HIGHLIGHT

Green Suits in Action: Students Photographing Sustainability in Boulder Valley School District by Beth Osnes

Green Suits BVSD is a participatory photography project in which Boulder Valley School District students donned green suits to be photographed enacting sustainable practices associated with food, energy, waste, transportation, or nature. This was inspired by an Inside the Greenhouse project I began in 2016 while touring a show in Europe in conjunction with the Rockefeller Foundation 100 Resilient Cities Initiative. In London I first had the idea to wear a green suit outside near the Thames to make literal the greening of the city and to document that through photography. Next, I tucked my green suit in my backpack and donned it for a photograph in Paris near the Eiffel Tower and in Barcelona at the Gaudi museum. Not only was it fun, but it prompted unlikely conversations about environmental issues. I continued to gather photos by myself and others and have curated them into a Green Cities collection hosted on the Inside the Greenhouse website: <http://www.insidethegreenhouse.org/student-projects/greencities>.

During the fall semester of 2018, six BVSD secondary schools participated in this Green Suits BVSD project created through a partnership between BVSD Office of Sustainability, EcoArts Connections, the University Corporation for Atmospheric Research (UCAR) Center for Science Education, and Inside



the Greenhouse-CU. Participating students photographed scenes of sustainability in action including one or more students dressed in a green suit. Each school selected up to 20 of its students' best photographs. A jury of local arts, science, and sustainability professionals chose the top photos to be exhibited. The winning photo was chosen by local celebrated photographer, James Balog. On April 6, there was a reception and awards ceremony honoring youth and teacher participants in an exhibit of photographs from Boulder, Centaurus, Fairview, and Monarch High Schools and Casey and Manhattan Middle Schools. The photos will be exhibited for six months at the National Center for Atmospheric Research (NCAR): 1850 Table Mesa Drive, Boulder, CO.

MULTIMEDIA HIGHLIGHT

Creative (Climate) Communications

Mètode TV Interview with Max Boykoff

Max Boykoff opened the series "The great challenges of science" at the University of Valencia, Spain with his lecture on Creative (Climate) Communications. On the occasion of his visit to Valencia, he also addresses this issue in his interview for Mètode TV.

Video [3:48]: <https://youtu.be/p1W8GplmCRc>

To view more videos from CSTPR see: <https://sciencepolicy.colorado.edu/news/multimedia/index.html>



CENTER NEWS

Winners Announced for the ITG Comedy & Climate Change Video Competition

Humor is a tool underutilized, and comedy has the power to effectively connect with people about climate change issues. Inside the Greenhouse held a competition to harness the powers of climate comedy through compelling, resonant and meaningful videos.

The videos from the 2019 winners were announced and shown to a live audience at the Stand Up For Climate Change event on April 25 (<http://www.insidethegreenhouse.org/news/stand-climate-change-april-25>). Here are the 2019 winners:

First Place Winner

Al Gore – Man On The Street



by Rollie Williams & An Inconvenient Talk Show

<https://www.youtube.com/watch?v=IQWiEVHtg9A>

Second Place Winner

How (not) to talk about Climate Change



by Adam Levy, Geoff Marsh & Adam Corner

<https://www.youtube.com/watch?v=v4y9SzK8-oQ>

Third Place Winner

The Climate Rock (Climate Elvis)

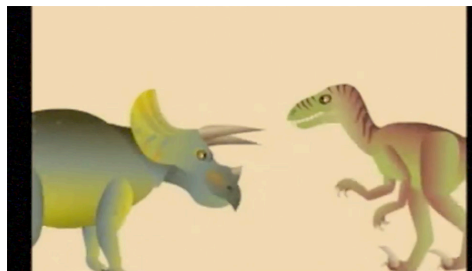


by Josh Willis & Lizze Gordon

<https://www.youtube.com/watch?v=WGfKRfyhvd0>

Honorable Mentions

An Inconvenient Joke by David Krantz



<https://youtu.be/HSBPL5O-8MM>

Giving Climate Denial the FLICC by John Cook



<https://youtu.be/AqcUP0sDglg>

Patrick Chandler Receives 2019 Radford Byerly, Jr. Award In Science And Technology Policy

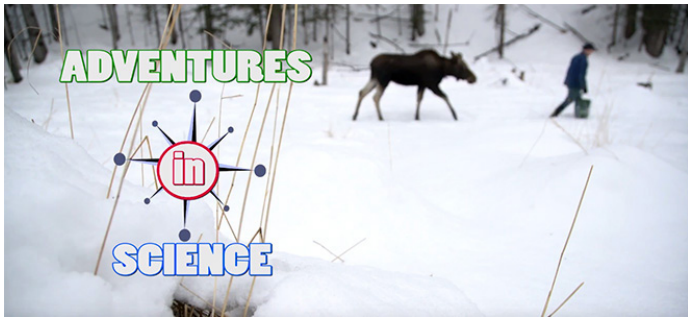
Rad Byerly, Jr., passed away in 2016 after an impressive career that included more than twenty years as staff on and ultimately Director of the Science Committee of the U.S. House of Representatives. He also was Director of the Center for Space and Geosciences Policy at CU Boulder. Rad spent the last years of his career with CSTPR, where he was known as a mentor, adviser and friend. In 2017, CSTPR launched the *Radford Byerly, Jr. Award in Science and Technology Policy* in recognition of his contributions to and impact on the CSTPR community. Thanks to several generous donations CSTPR was able to offer a \$1500 award to a graduate student for the past three years. (We are soliciting donations for future awards here: <https://giving.cu.edu/fund/radford-byerly-jr-award-science-and-technology-policy>).

Following a selection process, Patrick Chandler was chosen to receive the 2019 Byerly award. Patrick is a graduate student in the Environmental Studies Program at CU Boulder. His research is focused on the methodologies and impacts of combining art and science to communicate about environmental issues, and he hopes to publish a guide for communities and organizations on that subject. Patrick also works as an Education Consultant for the Washed Ashore Project and has ten years' experience developing environmental education, stewardship, and science programs including curricula.



CENTER NEWS

Ryan Vachon and Dan Zietlow Nominated for Emmy Award



Ryan Vachon and Dan Zietlow are CSTPR Research Affiliates and creators of Provare Media. Their episode of Adventures in Science has been nominated for a 2019 Emmy Award. Award winners will be announced in June. Adventures in Science is an emerging science-education show aimed at exciting middle school kids around the wonders of the world, the value of natural resources, and the breadth of human culture.

Adventures in Science – How Caribou Survive Arctic Winters is the exciting pilot to this network series. The film is hosted by youths questioning how our world works, and the storyline transports audiences to the Northern Slope of Alaska. There, scientists show how cutting-edge research examines the nutrition locked in vegetation and how these nutrients provide caribou with just enough to survive the Arctic's cold and dark winters. Watch the trailer: <https://www.youtube.com/watch?v=P8dBiOhAw2k>.

CSTPR's 2nd Annual Volunteer Work Together



Our CSTPR community came together in January to volunteer at the Community Food Share, a local charity in Louisville, Colorado that works with multiple nonprofits to collect food for those in need. CSTPR joined together for an evening of reflection and celebration, along with considerations of a bright 2019 to come!

Peter Newton Selected as Honoree for Denver Business Journal's Who's Who in Agriculture

Pete Newton, CSTPR Faculty Affiliate and Assistant Professor in Environmental Studies, has been selected as an honoree among Denver Business Journal's Who's Who in Agriculture in 2019!

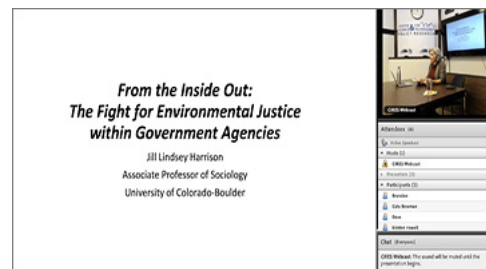


The Denver Business Journal partnered with the Colorado Farm Bureau to put together a profile of the movers and shakers within the Colorado Agricultural industry. Pete was selected not only for his "dedication to making an impact on the Colorado agricultural industry" but also for his "unfailing willingness to give back to the communities" where he works and lives.

Spring 2019 Noontime Seminar Series

CSTPR hosted a series of talks this Spring. Webcast recordings are available on the website for the following talks:

January 23, 2019



From The Inside Out: The Fight For Environmental Justice Within Government Agencies
by Jill Harrison, Department of Sociology, CU Boulder

February 6, 2019



The Geopolitics of the Energy Transition
by Morgan Bazilian, Public Policy, Colorado School of Mines

March 6, 2019



Solutions for Nature and People: Bridging the Ecological and Social Dimensions of Conservation
by Charlotte Chang, University of Tennessee

Our Fall lineup will be announced by August. Please visit our website for updates to the schedule: https://sciencepolicy.colorado.edu/news/center_talks.html

CENTER PUBLICATIONS

Stories of Transformation: A Cross-Country Focus Group Study on Sustainable Development and Societal Change

Wibeck, V., B-O. Linner, M. Alves, T. Asplund, A. Bohman, M.T. Boykoff, P.M. Feetham, Y. Huang, J. Nascimento, J. Rich, C.Y. Rocha, F. Vaccarino, and S. Xian, 2019. *Sustainability* 11 (8), doi: 10.3390/su11082427.

Abstract: Societal transformation is one of the most topical concepts in sustainability research and policy-making. Used in many ways, it indicates that nonlinear systematic changes are needed in order to fully address global environmental and human development challenges. This paper explores what sustainability transformations mean for lay focus group participants in Cabo Verde, China, Fiji, Sweden, and the USA. Key findings include: (a) Tightly linked to interpersonal relationships, sustainability was seen as going beyond the Sustainable Development Goals to include a sense of belonging; (b) transformations were framed as fundamental changes from today's society, but most participants stated that transformation pathways need to splice new structures into the old; (c) new technologies are key engines of change. Yet, the most common drivers were awareness, education, and knowledge sharing; and (d) regardless of whether state-centric or decentralized governance was preferred, personal action was seen as essential. The focus groups displayed a shared understanding across the geographical settings; a common realization of profound sustainability predicaments facing societies across the world; and a desire for fundamental change towards a more sustainable way of life. Read more: http://sciencepolicy.colorado.edu/admin/publication_files/2019.05.pdf



Rural-urban water transfers in the past have been linked to the collapse of rural economies if pursued to the extreme extent of “buy-and-dry,” where water rights were purchased outright and permanently removed from agricultural land (e.g. Crowley County). This article focuses on the emerging innovations of ATMs, which seek to accomplish the same purpose of providing additional water to growing cities but through more flexible mechanisms, such as rotational fallowing, interruptible supplies, and water banks, that aim to preserve rural economies as well. We review the history and context for water allocation in Colorado, the history of rural-urban transfers, and focus on ATMs and their pros and cons. We conclude with implications of ATMs for water governance and providing flexibility and sustainability in a changing climate. Read more: http://sciencepolicy.colorado.edu/admin/publication_files/2019.03.pdf

Broadly Inflicted Stressors Can Cause Ecosystem Thinning

Burgess, M.G., A. Fredston-Hermann, D. Tilman, M. Loreau, and S.D. Gaines, 2019. *Theoretical Ecology*, doi: 10.1007/s12080-019-0417-4.

Abstract: Many anthropogenic stressors broadly inflict mortality or reduce fecundity, including habitat destruction, pollution, climate change, invasive species, and multispecies harvesting. Here, we show—in four analytical models of interspecies competition—that broadly inflicted stressors disproportionately cause competitive exclusions within groups of ecologically similar species. As a result, we predict that ecosystems become progressively thinner—that is, they have progressively less functional redundancy—as broadly inflicted stressors become progressively more intense. This may negatively affect the temporal stability of ecosystem functions, but it also buffers ecosystem productivity against stress by favoring species less sensitive to the stressors. Our main result follows from the weak limiting similarity principle: species with more similar ecological niches compete more strongly, and their coexistence can be upset by smaller perturbations. We show that stressors can cause indirect competitive exclusions at much lower stressor intensity than needed to directly cause species extinction, consistent with the finding of empirical studies that species interactions are often the proximal drivers of local extinctions. The excluded species are more sensitive to the stressor relative to their ecologically similar competitors. Moreover, broadly inflicted stressors may cause hydra effects—where higher stressor intensity results in higher abundance for a species with lower sensitivity to the stressor than its competitors. Correlations between stressor impacts and ecological niches reduce the potential



Savior of Rural Landscapes or Solomon's choice? Colorado's Experiment with Alternative Transfer Methods for Water (ATMs)

Dilling, L., J. Berggren, J. Henderson, and D. Kenney, 2019. *Water Security* 6, doi: 10.1016/j.wasec.2019.100027.

Abstract: This article focuses on the emerging landscape for Alternative Transfer Methods (ATMs) in Colorado, USA. ATMs are developing within a legal landscape of water rights governed by prior appropriation law, growing demand for water in urban centers driven by population growth, and an aging rural farm population whose most valuable asset may include senior water rights.



CENTER PUBLICATIONS

for indirect competitive exclusions, but they consequently also reduce the buffering effect of ecosystem thinning on ecosystem productivity. Our findings suggest that ecosystems experiencing stress may continue to provision ecosystem services but lose functional redundancy and stability. Read more: http://sciencepolicy.colorado.edu/admin/publication_files/2019.02.pdf

Expanding the Contribution of the Social Sciences to Social-Ecological Resilience Research

Stone-Jovicich, S., B. Goldstein, K. Brown, R. Plummer, and P. Olsson, 2018. *Ecology and Society* 23 (1), doi: 10.5751/ES-10008-230141.

Introduction: As we are confronted with mounting evidence of the profound and potentially irreversible impacts of human activities on the planet—encapsulated in the notion of the Anthropocene—the need to engage across a range of ways of knowing and doing becomes increasingly urgent. The intersection and interdependence of human–environment systems is seen by scholars, policy makers, and other stakeholders as providing a promising vehicle for bridging understandings and guiding actions toward a more sustainable future (Berkes and Folke 1998, Berkes et al. 2008). Growing attention is thus being focused on social-ecological resilience. Indeed, it is increasingly being adopted as a centerpiece of policy making, planning processes, and management strategies (e.g., Field et al. 2014; <http://www.100resilientcities.org>). It also is being embraced in other fora—such as civil society and social movements (e.g., the Transition Movement) and in arts and creative practice—as a means to invoke and provoke critical reflection and debates about society directions and alternative visions (e.g., Rathwell and Armitage 2016, Brown et al. 2017; <https://transitionnetwork.org>). Read more: https://sciencepolicy.colorado.edu/admin/publication_files/2018.17.pdf

Testing the Potential of Multiobjective Evolutionary Algorithms (MOEAs) with Colorado Water Managers

Smith, R., J. Kasprzyk, and L. Dilling, 2019. *Environmental Modelling & Software* 117, doi: 10.1016/j.envsoft.2019.03.011.

Abstract: Multiobjective Evolutionary Algorithms (MOEAs) generate quantitative information about performance relationships between a system's potentially conflicting objectives (termed tradeoffs). Research applications have suggested that evaluating tradeoffs can enhance long term water utility planning, but no studies have formally engaged with practitioners to assess their perceptions of tradeoffs generated by MOEAs. This article examines how practitioners

interact with MOEA tradeoffs and reports their ideas for how their agencies could use MOEA results. We hosted a group of Colorado water managers at a charrette, or structured investigatory workshop, where they directly interacted with tradeoffs, discussed how they used the information, and linked their workshop experiences to opportunities for MOEAs to enhance their agencies' planning processes. Among other interesting results, we found that managers' portfolio preferences diverged as tradeoff information increased and that structured information about the relationships between decision levers and performance would be beneficial for interpreting tradeoffs. Read more: http://sciencepolicy.colorado.edu/admin/publication_files/2019.04.pdf

Personal Carbon Trading and Individual Mitigation Accountability

Vanderheiden, S., 2019. Chapter in *Transformative Climates and Accountable Governance*, Ed. B. Edmondson and S. Levy, 273–299, Palgrave Macmillan.

Excerpt: National carbon budgeting forms an essential component of international climate change mitigation efforts. Through it states track the carbon emissions for which they are responsible with a view toward meeting specified decarbonization targets. Under the 2015 Paris Agreement, state parties pledged to follow non-binding national carbon budgets through their Nationally Determined Contributions to international litigation efforts (NDCs). Through these, in principle, their contributions toward the goal of avoiding 'dangerous anthropogenic interference' (United Nations, 1992) could be assessed. In the absence of legally binding targets or guidelines for what constitutes an equitable contribution, reputational accountability would presumably serve as both motive and enforcement mechanisms for states to adopt ambitious

12
Personal Carbon Trading and Individual Mitigation Accountability
Steve Vanderheiden

1 Introduction
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B. Edmondson and S. Levy (eds.), *Transformative Climates and Accountable Governance*, Springer Nature in Environmental Transformation, Transition and Accountability, https://doi.org/10.1007/978-1-4939-9400-2_12

273

ABOUT US

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