
Tackling Climate Change:

*Adapting to a changed world, while reversing
global warming to protect communities & ecosystems
and promote climate justice*

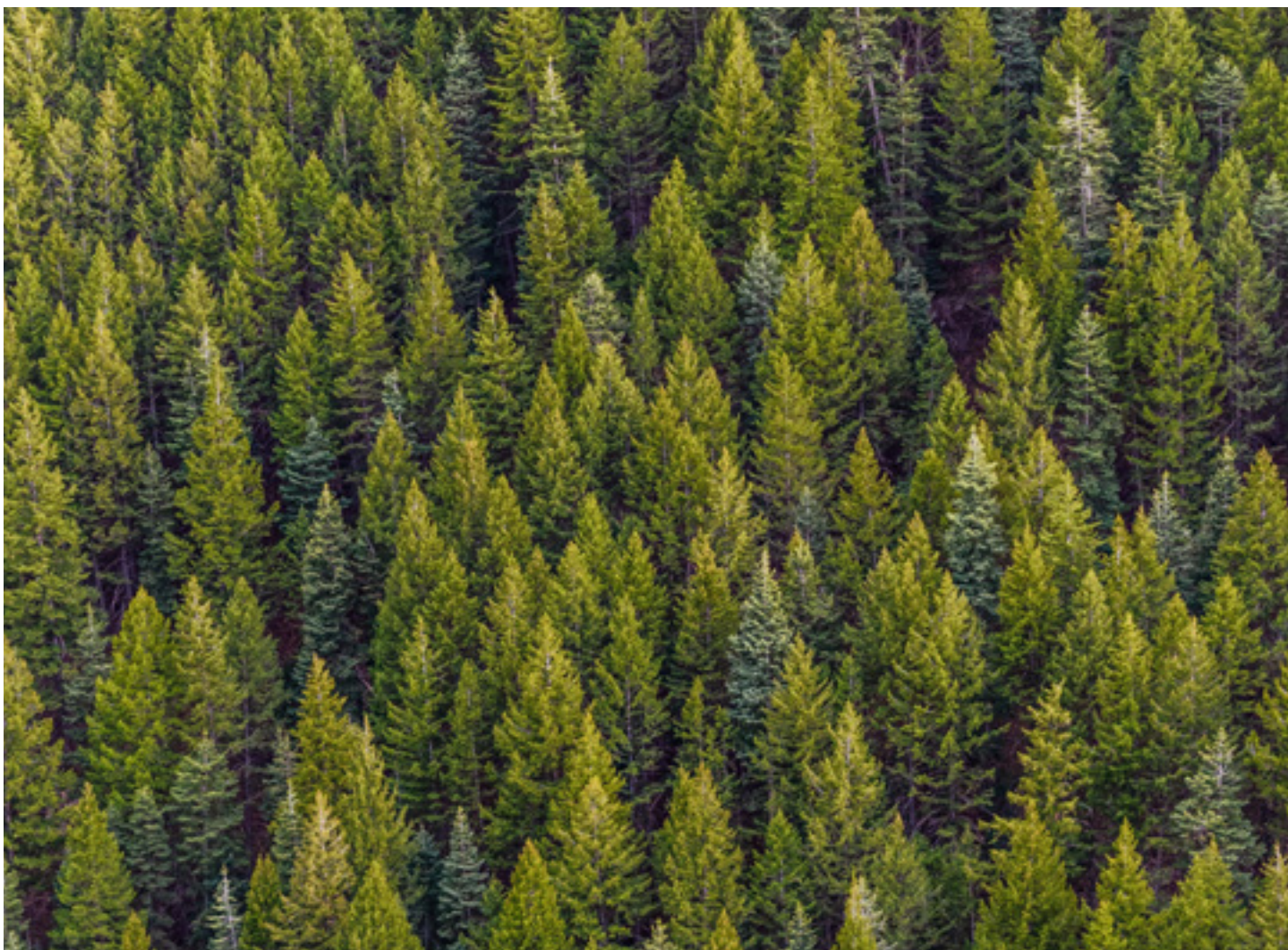
A CLIMATE CHANGE ADAPTATION AND CARBON DIOXIDE REMOVAL
LANDSCAPE ANALYSIS. | FEBRUARY 2019



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Introduction

In April 2018 the Board of Directors authorized the establishment of a Climate Adaptation Task Force to conduct a landscape analysis for the Sierra Club and report recommendations back to the Board. For purposes of this study, “climate adaptation” and the scope of our investigation was defined to include measures needed to adapt to a climate-changed world (hereafter called adaptation); measures to remove carbon dioxide from the atmosphere (hereafter called carbon dioxide removal or CDR); and geoengineering measures such as blocking solar radiation that could potentially reduce global temperatures to reduce global warming (hereafter called geoengineering).

This report does not address reducing new greenhouse gas emissions (what is often called “mitigation”) as the Sierra Club already has a robust program in this area.*

The impetus for this study comes from the growing scientific consensus that emission reductions on their own will be insufficient to prevent a climate change calamity and restore the climate to a state that will support life as we know it. Even if all greenhouse gas emissions were stopped today, the concentrations of accumulated long-lived greenhouse gases exceed the levels regarded to be safe by the scientific community. In 2018 atmospheric

**-These terms and categories are confusing. Under the Paris Accord, some countries consider all CDR activities as mitigation to meet their targets. Some academics regard all CDR as geoengineering; others treat all approaches that do not involve emission reductions as adaptation, including CDR and geoengineering. For clarity we have separated these approaches out and treat them separately as emissions reduction, adaptation, CDR and geoengineering.*

concentrations of CO₂ were at about 425 parts per million (ppm), well above the 350 ppm threshold judged to be necessary to protect life on earth and avoid major climate disruption and even farther above the pre-industrial revolution maximum CO₂ concentration of <300 ppm for the past 800,000 years.

The latest Intergovernmental Panel on Climate Change (IPCC) report on Global Warming of 1.5°C <http://www.ipcc.ch/report/sr15/>, which came out in October 2018, notes the scientific consensus that the 2°C average global temperature increase agreed to in the Paris Climate Accord is more dangerous than the original models projected and that a 1.5°C target is now a necessity. IPCC concludes that to avoid exceeding 1.5°C we must not only stop all greenhouse gas emissions but also urgently deploy programs and technologies to draw down the carbon dioxide already in the atmosphere.

The National Academies of Sciences, Engineering and Medicine report, released in October 2018, also states that technologies that suck CO₂ out of the atmosphere will likely be crucial to meeting global climate goals, and will require more investment to reach scale. [*Negative Emissions Technologies and Reliable Sequestration: A Research Agenda*](#).

Meanwhile, having a plan in place for adapting to climate change is becoming an accepted requirement for responsible government at all levels. In the United States, cities, regions, states, and land management agencies are all starting to pursue climate adaptation planning and implementation. Some are doing it in anticipation of projected climate impacts, and some are doing it in response to climate impacts that are already causing disruption and negative impacts in human communities and natural ecosystems. Climate adaptation planning was a major federal requirement during the Obama administration, but it has largely been ignored and undermined during the Trump administration. Meanwhile, billions of dollars of recovery funds are being expended in the wake of escalating climate-change-induced disasters such as hurricanes, flooding, drought, and wildfires. The result thus far is a system lacking both prevention and cure that is focused instead on application of small, temporary bandages and reconstructive surgery.

Preparedness for natural disasters and resilience in the face of consequences such as displacement are also

major concerns and the subject of much international debate and negotiation. In its 2019 Global Risks Report, the World Economic Forum placed “extreme weather events” and “failure of climate change mitigation and adaptation” on par with “weapons of mass destruction” as the world’s greatest threats. Countries and cultures that are already experiencing the impacts of climate change are pressuring richer countries to assist in adaptation efforts. Many wealthier, better-developed countries are accepting this responsibility; unfortunately, the United States — the largest historic contributor to global warming emissions — has been retreating from Obama-era commitments to meet our obligations. Equity-based programs designed to address loss and damage due to climate change are needed now more than ever to avoid mass starvation, climate migration, water wars, and inundation due to sea level rise of island nations and low-lying coastlines.

The Sierra Club, the national and global NGO community, the private sector, philanthropists, and governments are all in the early stages of seriously addressing adaptation, CO₂ removal, and geoengineering. The Sierra Club needs to urgently explore these complex issues, update its positions and policies in order to adequately address them, and make some decisions about how it can be most effectively engaged at all levels of the organization to make a difference and help lead the effort to restore our climate and protect the human and natural environment from present and projected impacts of climate change.

The Sierra Club is also unifying its existing and evolving work on energy, justice, and equity into a cohesive and inspirational vision (CEFA). This process is designed to fundamentally transform not just how we power this country, but who *holds* power in this country. It is about replacing dirty energy with 100 percent clean energy to prevent runaway climate change while there is still time. It is about ensuring that the frontline communities currently suffering disproportionately from climate change and fossil fuel pollution benefit the most from the transition to a clean energy economy. Our work with communities impacted by climate change should be holistic. It is about being part of a movement that builds power and harnesses our shared values to transform our economic, cultural, and political systems.



The Moral Hazard

Any consideration of taking action requires the Sierra Club and civil society to address the so-called “moral hazard” problem. This is the very valid concern that investments in adaptation, CDR, and geoengineering provide an excuse to avoid cutting greenhouse gas emissions. If we concede that we do not have the national and global will to stop emitting greenhouse gases, and we believe that we can counteract climate change through adaptation, CDR, and geoengineering, then we could ratchet down the urgency of reducing emissions. This could lead countries to slow or even cease efforts to get off dirty fuels and other major greenhouse gas emitters by no later than mid-century.

For that reason, any commitment by the Sierra Club and other parties to promote ramping up adaptation and CDR must be accompanied by a firm commitment to redouble and accelerate all emission reductions programs. These are not mutually exclusive approaches and activities; they are complementary and compulsory. CDR should be used to draw down the existing high level of accumulated emissions, not to allow the continuation of high levels of carbon emissions.

Al Gore once disparaged climate adaptation as “a kind of laziness” for not focusing solely on emission reductions. He now admits that he was “wrong in not immediately grasping the moral imperative of pursuing both policies simultaneously, in spite of the difficulty it poses.”

We cannot wait until we have ceased all new emissions before we start deploying adaptation and CDR approaches to deal with existing accumulated, long-lived emissions that are already disrupting the human and natural environment. It would be morally hazardous to begin concentrating on adaptation and CDR but not simultaneously ease up on emission reduction efforts. There is also a huge danger if we refuse to engage in adaptation and CDR out of

fear that it might reduce emission reduction momentum. Investments in adaptation, including preparedness, response, and recovery, need to happen now. Failure to do so will preclude adaptation and CDR options that might limit harm to human communities and natural systems but are only available *before* climate change progresses much further. Adaptation may be more effective and affordable when taken on proactively, and the right set of acceptable CDR programs requires research, development, and deployment starting immediately to get to scale and to start getting us back below 350 ppm. This task force believes that we must pursue emission reductions with renewed vigor and full commitment while simultaneously ramping up and bringing to scale appropriate climate adaptation and CDR efforts.

“For my own part, I used to argue many years ago that resources and effort put into adaptation would divert attention from the all-out push that is necessary to mitigate global warming and quickly build the political will to sharply reduce emissions of global warming pollution. I was wrong — not wrong that deniers would propose adaptation as an alternative to mitigation, but wrong in not immediately grasping the moral imperative of pursuing both policies simultaneously, in spite of the difficulty that poses.”

-Al Gore



Methodology

Once the Climate Adaptation Task Force was appointed and convened we identified a list of topics that we needed to research in order to make sound recommendations. We also conducted a survey of our chapters, groups, and staff to find out what adaptation and CDR issues they were already involved in and which programs, challenges, and opportunities they felt were most important for the Sierra Club to address. We also identified gaps in Sierra Club policy in this arena.

The topics that we explored include:

- Preparedness and resilience in both urban and rural environments. Community education/outreach and individual actions (behavioral changes related to adaptation).
- Public health
- Restoration and resilience in natural environments
- Extreme weather relief and recovery, relocation/displacement/climate refugees
- Forest carbon management, reforestation, and afforestation
- Agricultural lands, grasslands, soils, and animal management
- Freshwater and wetlands
- Oceans, coasts, and sea level rise
- Bioenergy conversion with carbon capture and sequestration (BECCS)
- Direct carbon capture and carbon sequestration (DACCS).
- Frontier Technologies (enhanced weathering, biochar)
- Geo-engineering
- Demographics, equity, and climate justice
- Mainstreaming climate adaptation into planning activities

Each subgroup was asked to address the following questions:

1. What are the major opportunities for adaptation in this area?
2. What is the potential for significant carbon drawdown, if any?
3. What kind of Sierra Club activity is already happening in this area?
4. What other groups are already working in this area? Are there opportunities for partnership or would Sierra Club efforts be redundant?
5. What governments, foundations and major donors are funding in this area?
6. Which political forums does this play out in? Local, state, regional, national, international?
7. Are there specific geographic locations for focus?
8. What are most important summary documents or experts we should be aware of?
9. Are there key justice and equity concerns we should be aware of? Are there environmental justice groups or individuals we should consult with on this topic?
10. Are there positive or negative environmental or ethical/stewardship concerns or choices we need to be aware of?
11. Is the action consistent with Sierra Club policy? Identify areas where we will need to update, clarify, or revise Sierra Club policy.
12. Any other key questions relevant to your area?
13. Ultimately we want to see what part of this might be particularly ripe for Sierra Club engagement and influence. Since we can't do everything, we will need to make recommendations of the most promising forums and issues to engage in, so deciding what *not* to do is also important. Your advice about the relative priority for Sierra Club engagement, pro and con, will be very valuable.
14. What are the implications for providing well-paid family-sustaining and/or union jobs and a just transition as part of deployment of this type of program?

Each subgroup prepared a lengthy report and assembled key reference documents. An Executive Summary of their findings and answers to these 14 questions can be found in the appendix. The longer reports are available upon request.

Near the end of our study we asked each subgroup that had studied an interest area to put forward up to two

proposed priority campaigns that would make an impact, not be duplicative of other organizations, play to the Sierra Club's strengths, and meet other campaign criteria. Following this process, we then prioritized the suggestions and narrowed our recommendation to six campaigns.



Key Principles to Guide Us

All governments, particularly that of the United States, need to recommit to the Paris Agreement goal of limiting warming to 1.5°C as a matter of survival for all. As the Climate Action Network (CAN) states, “The science is clear: limiting warming to 1.5°C is not only a moral imperative, but technically feasible and economically beneficial. Stabilizing warming to 1.5°C by cutting emissions in the near term will help realise the Sustainable Development Goals (SDGs) and alleviate poverty and inequality.” Limiting warming to 1.5°C should no longer just be an aspirational goal, but a mandatory and binding commitment.

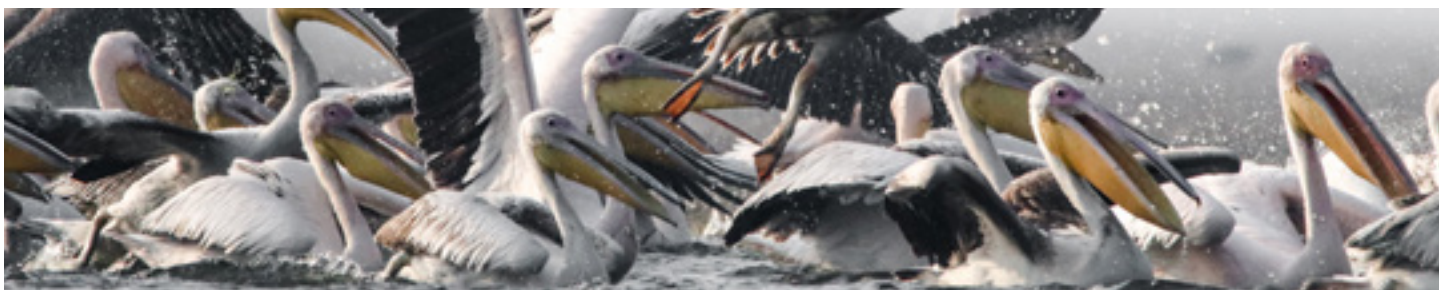
The following set of CAN principles are particularly relevant to our report and are embraced by the Sierra Club as a participant in CAN:

- Full decarbonization of the energy sector by 2050 and replacing fossil fuels with renewable energy sources, supported by energy efficiency in all economic activities, is key to preventing dangerous climate change and avoiding negative externalities of industrial energy-related emissions that cause air, water, and soil pollution.
- Reducing greenhouse gas emissions to net zero, preferably by 2040 and by 2050 at the latest, is the only way to limit global warming to 1.5°C. This move to decarbonization must involve all stakeholders and follow the principles of equity and just transition, taking into account the impact on vulnerable communities and workers in the energy and industrial sectors.
- Delaying stronger and more ambitious action now and relying on future development of more powerful carbon removal technologies to compensate for a potential temperature overshoot between now and then is not

an option. It is more likely to increase the risk of tipping points and runaway climate change.

- In addition to cutting carbon dioxide emissions, slashing potent gases and pollutants such as methane, hydrofluorocarbons, and black carbon must be prioritized and included in revised national climate targets.
- Developed countries must provide financial support to developing countries to help them meet the objectives of the Paris Agreement. This includes enhanced means for adaptation and mitigation as well as fostering equity-based schemes for loss and damage in developing countries already suffering the impacts of climate change.
- The most environmentally, socially, and economically cost-effective option to sequester carbon emissions is through Natural Climate Solutions, based on photosynthesis. Natural Climate Solutions should be focused on the complete halting of deforestation and degradation of lands in favor of ecological restoration and enhancement. Natural Climate Solutions also target sustainable low-carbon farming and forestry.
- Meeting the 1.5°C objective requires significant changes in the lifestyle of the growing middle class around the world. This includes a shift toward a low-carbon lifestyle.

We feel it is important to spell out these principles at the outset of this study in order to dispel any notion that we are advocating for adaptation or CDR as a substitute for the essential steps outlined above. This report is designed to fill in the blanks in some missing parts of a comprehensive Sierra Club approach to climate recovery.



Vital Role for the Sierra Club

As we conducted our study it became clear to us that climate adaptation and CDR were absolutely essential components of the campaign to head off climate catastrophe. It also became very clear that global governments — and specifically the United States government — are failing to adequately address adaptation and CDR. Furthermore, our review determined that the NGO community, both internationally and domestically, is similarly unprepared to adequately address these challenges.

In the appendix you will see a summation of NGO activity in this arena. Other groups have started this work long before us and have helpful programs largely composed of research and education. Some new groups are dedicated exclusively to adaptation and CDR. From our perspective, what's missing is a grassroots presence at the local, state, regional, and national levels in the U.S. to effectively advocate for adaptation and CDR and their full funding and implementation. These are things the Sierra Club is uniquely positioned to provide.

There is no other NGO group out there with a grassroots organizing and lobbying capacity, backed by smart communications, legal action, and digital tools, that can press for climate-smart policies all across the U.S. at the city, county, state, and federal levels.

Local organizations and activists have the opportunity to shape plans that spur the creation of climate-smart policies that include:

- Creating quality careers in renewable energy, energy efficiency, and climate adaptation for people in economically distressed communities;
- Protecting front-line communities from becoming “sacrifice zones” of carbon trading;
- Protecting coal-dependent working families and communities; and
- Substantially reducing carbon pollution.

In the absence of a national institutional framework for state and local coalitions to advocate for emission-reduction policies that create good jobs in the coming decades, intensive community engagement and grassroots leadership will be essential in order to create a clean energy economy rooted in racial and economic justice.

Just climate advocacy must include access to promulgation, implementation, and enforcement of all policies, initiatives, and actions. The people least responsible for the climate crisis bear the greatest burden. As these communities and advocates interact with policymakers, their voices must be incorporated and adhered to if they are to lead the climate movement. The Sierra Club, following the Jemez Principles, can help steer resources to these groups and join with them in a united movement for climate justice and equity. Again, few other NGOs are focused on the justice and equity component of adaptation and CDR campaigning. This is another important role for the Sierra Club to play, and it's something we are already doing in response to extreme weather events.

Climate adaptation and CDR work is not new for the Sierra Club. Much of what needs to be done to address adaptation and CDR has been part of Sierra Club campaigning for decades; we just never called it out as being climate adaptation or CDR work until now. The survey of what chapters, groups, and staff are doing in this area makes it clear that this work would not require adopting a totally new priority campaign, but would rather build on existing work, expertise, and past successes. The Sierra Club has been campaigning for wilderness and forest protection, wildlife habitat preservation, restoring wetlands, and preserving natural coastlines for nature's sake, without seeing these actions as vital to climate adaptation and CDR. Similarly, the Sierra Club has been promoting smart growth in urban areas by promoting infill while protecting and restoring open space, coastal and riparian buffer zones, greenways, and urban watersheds

as ways to promote livable cities, but without explicitly identifying them as climate adaptation and CDR per se. Our historic work on environmental justice is now being harnessed to promote climate justice. (See for example our climate justice work in Puerto Rico, Louisiana, and Texas, led respectively by staff organizers Adriana Gonzalez, Darryl Malek-Wiley, and Bryan Parras and Reggie James. www.sierraclub.org/texas/blog/2018/08/one-year-after-storm-peoples-tribunal-hurricane-harvey-recovery)

The Sierra Club has a well-deserved reputation as an effective campaigner to stop the burning of dirty fuels and move our country to 100 percent clean energy for all while respecting the tenets of justice and equity. Our reputation, movement relationships, campaign capacity, and trust can be built upon as we broaden our climate work to also address adaptation and CDR.



Domestic and International Adaptation and CDR work

If one looks at the problem and the solutions from a global perspective, the areas most vulnerable to climate-related disasters lie outside the U.S. Island nations and heavily populated low-lying areas face total inundation from sea level rise, but they lack the means to address the problem. Major droughts leading to widespread famine and mass migrations are already occurring in other countries, and the situation is only expected to get worse. Again, these countries are generally poor and lack the resources and the power to address the problem.

At the same time, the biggest potential for CDR is outside the U.S. While we must continue to do everything possible to protect and restore our forests, wetlands, and peatlands, the biggest carbon sinks that can easily become carbon sources are found in poorer countries. Consumer demand in wealthy countries for products such as palm oil, soybeans, and beef lead to the destruction of forests, mangroves, wetlands, and peatlands in the developing world and desertification worldwide, thereby destroying huge carbon sinks.

Historic global greenhouse gas emissions in the U.S. and our consumption of resources and energy have been the single largest contributor to climate change. Because of this history we have a responsibility to be a leader and primary funder of global adaptation and CDR programs, and not simply focus on America First.

The NAS calculates the upper limit for safe CO₂ removal — given current technology and a price of carbon under \$100/ton — as 9.13-10.83 gigatons CO₂/year globally. Of that amount, only 1.02 gigatons CO₂/year is achievable from the United States. This means we must have aggressive international *and* domestic CDR programs. If we don't have both, we will fail.

The Sierra Club is primarily a domestic environmental organization, and our strength lies mostly in our domestic chapters and groups. While we have had an effective international program for over 40 years, it is modest in scale, and its role has mainly been to influence global policies and spur U.S. funding of international programs, agreements, and treaties.

The task force met with Fred Heutte and John Coequyt of the Federal & International Climate Campaign to explore options for international engagement on adaptation and CDR. Their conclusion was that it is best for the Sierra Club to concentrate primarily on influencing domestic policy on adaptation and CDR. At the same time, the Sierra Club should seek the resources that will allow us to participate in a meaningful way in lobbying the U.S. government and the international community to make the necessary investments in international adaptation and CDR — and particularly in making sure that rich countries like the U.S. contribute their fair share to fund the most



vulnerable countries and populations through the Green Climate Fund and other programs. This includes enhanced means for adaptation and mitigation, as well as fostering equity-based schemes for loss and damage for populations in developing countries already suffering the impacts of climate change.

We will also continue our successful efforts to compel multilateral development banks to stop funding climate-destroying projects and instead fund adaptation and CDR projects. The Sierra Club can also use its power to make sure that the most vulnerable countries and peoples are represented and empowered to shape future adaptation and CDR plans so that they benefit everyone, not just the wealthy and powerful. Seeking ways to curtail the demand, trade, and import of products that are destroying native cultures and the natural areas that they depend on will also be important approaches for the Sierra Club to consider. We can lend our support and voice to other international climate-justice-oriented NGOs working on adaptation and CDR when we are invited to do so. There are also international initiatives with a clear and important domestic component. For example, the Sierra Club could join and promote [100 Resilient Cities](#), which is devoted to making cities more adaptable and sustainable worldwide. Another example is the [4 per 1000 initiative](#), an international effort to promote soil carbon sequestration.

A prominent sign of the rising profile of global climate change adaptation came with the launch last October of a [Global Commission on Adaptation](#), followed by a December commitment of \$200 billion in climate adaptation financing over five years by the World Bank and partners. The commission was initiated by then-U.N. Secretary General Ban Ki-moon, philanthropist and entrepreneur Bill Gates, and World Bank CEO Kristalina Georgieva. The Global Center on Adaptation, overseen by the World Bank, seeks to “advance bold actions to help societies across the world become more resilient to climate-related threats. We act as a solutions broker, bringing together governments, the private sector, civil society, intergovernmental bodies, and knowledge institutions that can address the obstacles slowing down adaptation action.” The World Bank’s investment will be evenly split between investments cutting emissions and those boosting resilience and adaptation.



The Case for Climate Change Adaptation

As noted earlier, documented human-caused climate change and its negative impacts are not things that pose a threat sometime in the indefinite future — we are already experiencing them, as past emissions commit us to a steady stream of increasingly frequent and severe negative impacts. Around the Earth and across the country, we are experiencing record deadly heat waves, rising seas, increased drought, more frequent, damaging, and deadly storms, ever-more massive wildfires occurring over longer wildfire seasons, polar ice sheet and tundra melting, and rapidly shifting and disappearing habitats for native species, leading to steep population declines, extirpations, or extinctions. Additionally, our increased emissions are acidifying and reducing the available oxygen in our oceans.

If we were to somehow instantly stop all additions to greenhouse gas concentrations, these unacceptable and alarming impacts would continue. Unfortunately, as 2018 illustrates, global and U.S. emissions are continuing to rise and increase the concentration of greenhouse gases in the atmosphere. As a result, global temperatures and the resulting negative impacts are projected to only get worse.

While this sobering situation could lead to hopelessness and inaction, it is also a rallying cry to take action to head off or reduce the negative impacts, thereby saving lives, preventing hardship, building more just and sustainable communities, and protecting the natural world. The dire predictions in scientific reports are not the inevitable future — we can control our destiny if we act now to apply climate-smart solutions to adapt to a climate-changed world.

While almost all countries agree that we need to take immediate action to reduce emissions and draw down carbon dioxide (CO₂) concentrations from the atmosphere, even with a robust global response it will take decades to stabilize the climate by reducing atmospheric CO₂ to safe levels. In the meantime it is essential that we take action to help human communities and ecosystems adapt to the negative impacts of climate change. Adaptation must proceed simultaneously along with emission reductions and carbon dioxide removal (CDR).

The Fourth National Climate Assessment makes a strong case for urgent action on climate adaptation, noting that, “Proactive adaptation initiatives — including changes to policies, business operations, capital investments, and other steps — yield benefits in excess of their costs in the near term, as well as over the long term.”

Climate change adaptation must include a strong commitment to equity and justice. From a moral standpoint, we cannot allow wealthy individuals, neighborhoods, corporations, and countries to insulate and protect themselves from the worst impacts of climate change while ignoring the needs of the most vulnerable who lack the means to protect themselves. Wealthier individuals, corporations, and countries that have access to the technology and financial resources tend also to be the ones who created the lion’s share of emissions.

Similarly, it is not enough to focus protection on the human environment. Human-induced climate change is radically and rapidly threatening native ecosystems from tropical coral reefs to the poles and everywhere in between. The next major biodiversity extinction crisis is inevitable and imminent if we allow climate change to continue unabated. Humans created this latest extinction crisis, and only humans can take action to prevent it from getting worse. We are part of nature, and failure to protect life on earth is certain to imperil our own ability to survive.

There is also a major potential for family-supporting or union job creation in climate adaptation work. Rebuilding communities or restoring ecosystems in a climate-smart way will be labor-intensive undertakings.

Climate change adaptation research and implementation programs are already underway domestically and internationally. With each new superstorm, drought, heat wave, and deadly wildfire the necessity and demand for action on climate change adaptation grows. Non-governmental organizations, scientific bodies, community groups, local governments, regions, land management agencies, tribal and federal governments, international agencies, and others are all starting to recognize the urgency of immediate action on adaptation. What to do, where to do it, how to pay for it, and who will pay for it are subjects of weekly discussions. As noted earlier, in October 2018 the [Global Commission on Adaptation](#) was launched and in December 2018 the World Bank committed \$100 billion earmarked for climate change resilience and adaptation.

Sierra Club groups, chapters, campaigns, and programs have all been engaged in climate adaptation for over a decade, but have been constrained by a lack of campaign resources. Our first major engagement was following Hurricane Katrina’s devastating impacts on the Gulf Coast, and it continues today with national, chapter, and group response and recovery efforts to address recent storms such as Maria and Harvey, and wildfires such as the Tubbs Fire and the Camp Fire. Our state and federal lobby programs routinely address adaptation issues such as the impacts of climate change on the natural world. This work began in earnest with our Resilient Habitats program and it continues today through Our Wild America, as well as chapter and group land and wildlife protection efforts. Our chapter and group survey indicated that most local and state entities are actively engaged in some sort of climate adaptation planning or implementation.

While the scientific community, governments, professional planners, interested private parties, insurance companies, foundations, and a handful of environmental professionals have been deeply engaged in climate adaptation work, there is a major vacuum of grassroots community engagement in the field. The grassroots, particularly in vulnerable communities most affected by climate change, often lack the information and resources to effectively participate in decisions that will impact their lives, their communities, and the natural world. In most cases, there are climate-smart solutions that have been identified by climate planners and ecologists, but the Sierra Club and other environmental groups have not had the resources to share these solutions and campaign for their adoption

and funding. The Sierra Club is particularly well suited to help build a movement to participate in and shape climate change adaptation actions.

If the public is not involved in these decisions, we could very well see climate adaptation responses that continue to cater to the wealthy while giving short shrift to the urgent needs of those who are most vulnerable, as well as the natural world, which has no voice at the table.

One need only contrast the response to recovering wealthy communities in Texas and Florida with the wholly inadequate, tragic response to Hurricane Maria in Puerto Rico to grasp this injustice. Likewise, in the wake of climate catastrophes, environmental regulations are often waived to facilitate recovery efforts, doubling the damage to natural systems and decreasing their ability to regenerate. The Sierra Club can be a driving force to ensure that public engagement is real and powerful, and that we have just, equitable, and climate-smart adaptation solutions that fully protect the human and natural environments.

The task force has put forward draft Sierra Club policy suggestions on Climate Adaptation for consideration by the Conservation Policy Committee and the Board to give our volunteer leaders and staff policy guidance.

The task force set up subgroups to research in detail a number of important topics raised by climate change adaptation. Each subgroup prepared a long detailed report and an executive summary answering key questions. The executive summaries can be found in the appendix of this report. The longer detailed subgroup reports are available upon request. The topics related to Climate Change Adaptation are:

- Preparedness, resilience in urban and rural environments.
- Public health
- Ecosystem resilience
- Extreme weather relief and recovery, relocation/displacement/climate refugees.
- Oceans, coasts and sea level rise
- Demographics, Equity and Climate Justice
- Mainstreaming climate adaptation into planning activities





The Case for Carbon Dioxide Removal, and What Should be in a Portfolio

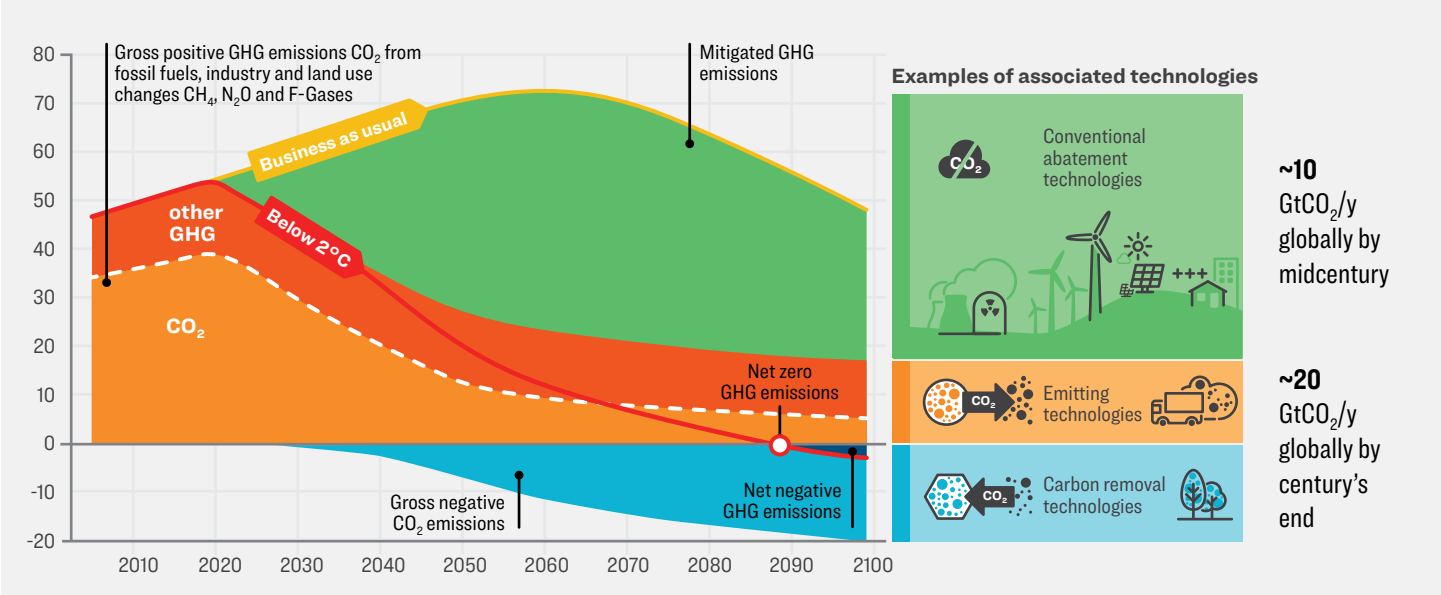
As noted above, the latest Intergovernmental Panel on Climate Change (IPCC) report on Global Warming of 1.5°C concludes that to avoid exceeding 1.5°C we must not only stop all greenhouse gas emissions but also urgently deploy programs and technologies to draw down the carbon dioxide already in the atmosphere.

The IPCC projects that tools to remove CO₂ from the atmosphere, such as technological carbon capture and storage or reforestation, will be needed to suck out up to 1,000 gigatons this century, for a 1.5°C limit. If material consumption in developed countries was reduced and kept in check, it would reduce but not eliminate the need for carbon removal. Carbon removal measures could help return temperatures to 1.5°C above pre-industrial levels

if the world overshoots the threshold, but they may have significant impacts on land, energy, water, and nutrients if used on a large scale. Governments will have to limit the trade-offs and make sure the CO₂ is removed permanently.

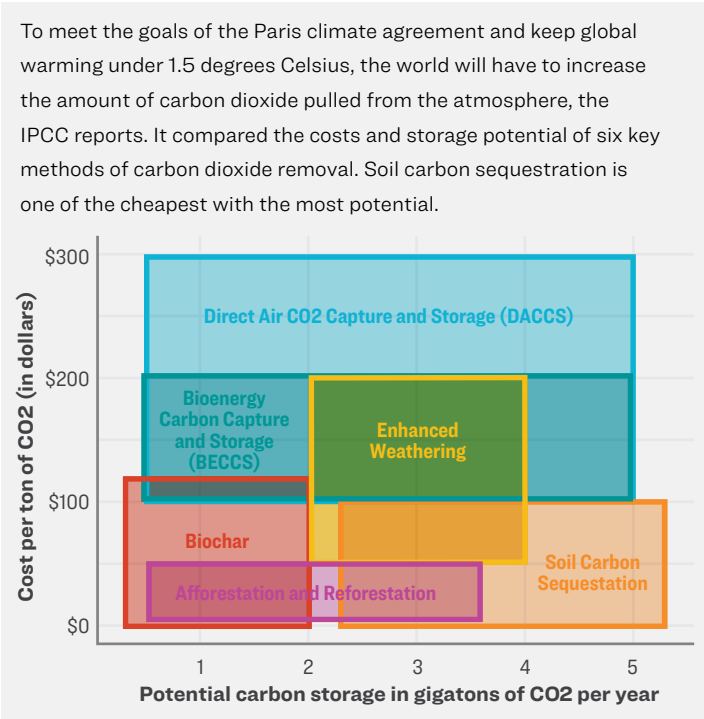
Most models indicate that large amounts of carbon sequestration, or negative emissions, will be required, likely at very large scale, to head off the worst effects of climate change. Out of the 116 model scenarios consistent with keeping warming below 2°C used by the IPCC, 87 percent utilize negative emissions technologies. Note that most of these projections also assume that countries will implement aggressive emissions reduction strategies quickly. With further delayed action, the need for negative emissions will only increase.

How large is potential market for Negative Emissions Technologies (NETs) likely to be? Or equivalently, how much carbon uptake is needed to meet Paris Agreement goals?



The following chart summarizes the IPCC assessment of the potential of various CDR approaches, taking into account the cost of deployment. IPCC did not assume changes in consumption patterns and diets. The IPCC assumption is that all six approaches should be pursued, but that Bioenergy with Carbon Capture and Sequestration (BECCS), enhanced weathering, and direct air capture will only be competitive and available in the future and with a much higher price on carbon.

How do carbon storage techniques stack up?



SOURCE: IPCC

IPCC notes that protecting and restoring forests and wetlands and soil carbon sequestration are available now, require the lowest carbon price to be affordable, have major co-benefits (wildlife habitat, watershed protection, recreation, water and air quality, etc.), but there are significant concerns about the permanence of carbon sequestration, as the carbon stored in forests, wetlands or soils could be lost if land management practices changed. In contrast, BECCS, enhanced weathering or direct air capture are more expensive, have fewer co-benefits, and aren't yet ready for commercial deployment, but the geologic sequestration is much more likely to be permanent. This is best summarized in this chart by Stanford researchers Field and Mach:

Rightsizing Carbon Dioxide Removal Expectations

A sampling of CDR technologies

Comparative features of three widely discussed, potentially large-scale strategies for carbon dioxide removal

	Level of engineering complexity	Environmental cobenefits	Land area required for large-scale deployment	Risk of later carbon dioxide release	Energy status
Forest and Soil Stewardship	Low	High	High	High	-Neutral
BECCS	Medium	Low	High	Low	Production
Direct Air Capture	High	Low	Low	Low	Consumption

The National Academies of Sciences, Engineering and Medicine report that came out in October 2018 states that technologies that suck carbon dioxide out of the air will likely be crucial to meeting global climate goals, and they'll need more investment to reach scale. [Negative Emissions Technologies and Reliable Sequestration: A Research Agenda](#).

The report further states that in order to keep global warming below 2°C above pre-industrial levels, carbon removal techniques worldwide will likely have to remove and permanently store about 10 gigatons of CO₂ per year by the middle of this century. It concludes that natural systems can probably only draw down carbon by 5 gigatons per year worldwide without severely impacting food production or causing significant equity issues.

Scale of Carbon Dioxide Removal Opportunities

Negative Emissions Technology	Estimated Cost (\$/tCO ₂) L = 0–20 M = 20–100 H = >100	Upper-bound* for safe** Potential Rate of CDR Removal Possible Given Current Technology and Understanding and at ≤ \$100/tCO ₂ (GtCO ₂ /y)	
		US	GLOBAL
Coastal blue carbon	L	0.02	0.13
Afforestation/ Reforestation	L	0.15	1
Forest management	L	0.1	1.5
Agricultural soils	L to M	0.25	3
BECCS	M	0.5	3.5–5.2
Direct air capture	H	0	0
Carbon mineralization	M to H	unknown	unknown
Total		1.02	9.13–10.83

SOURCE: NATIONAL ACADEMY OF SCIENCES

*Upper-bound assumes full adoption of agricultural soil conservation practices, forestry management practices, and carbon capture.

**Safe means without large-scale land use change that could adversely affect food availability and biodiversity.

The permanence of natural systems carbon sequestration (or lack thereof) is also a major concern. To reach the 10-gigatons-per-year target, the portfolio of carbon removal options we support will almost certainly need to include some technological approaches. By 2100, the target for CO₂ removal rises upward toward 20 gigatons per year, and in the latter half of the century forests and

soils may have absorbed all the carbon that they can, so other technological approaches will be needed beyond these natural systems.

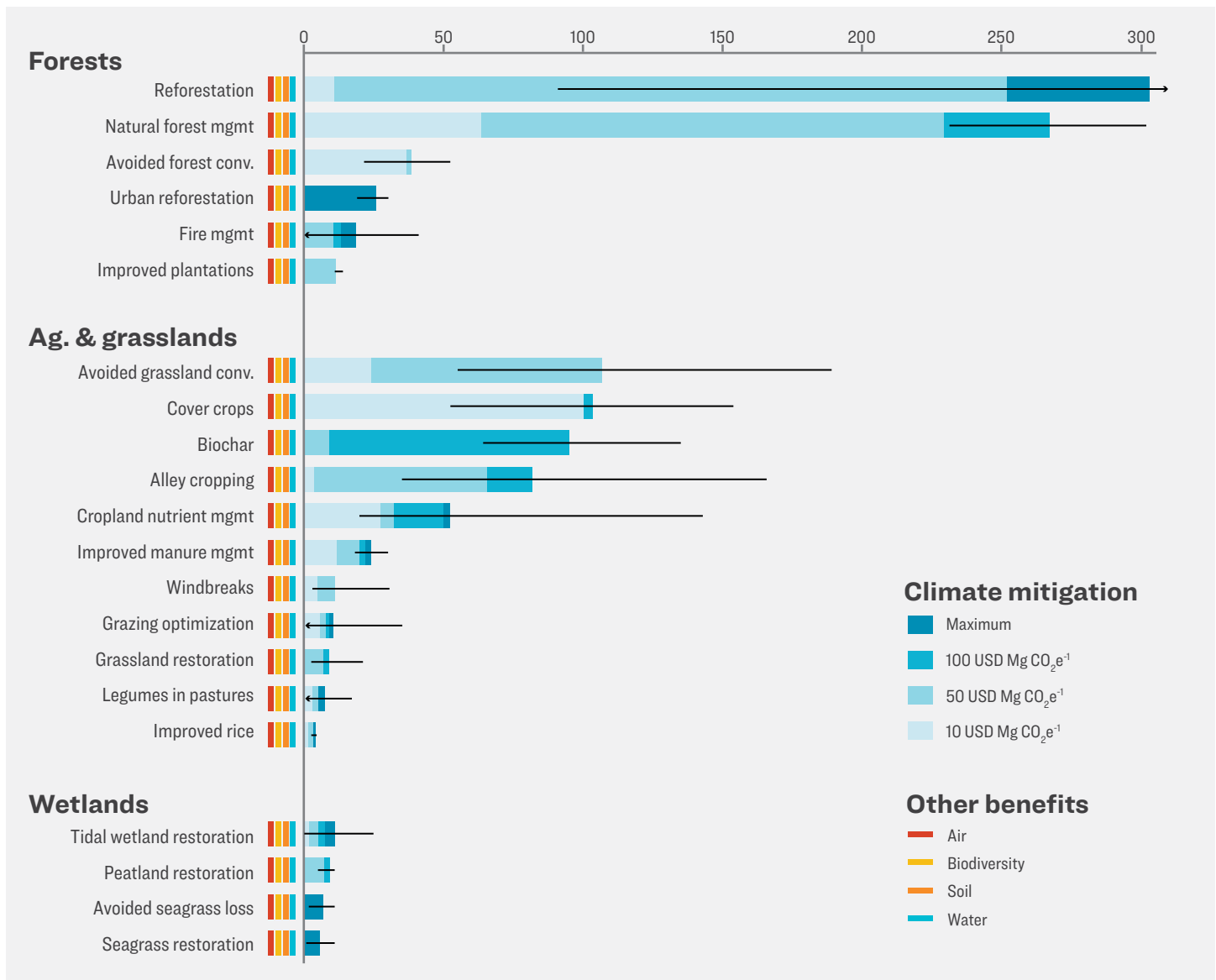
The [US Mid-Century Strategy for Deep Decarbonization](#), released in 2016 by the Obama White House, suggests that U.S. forests and soils could sequester nearly one gigaton of CO₂ annually by 2050, while also supporting nearly 1 billion tons of biomass production for another negative emissions technology: bioenergy plus carbon capture and storage (BECCS). This is a lot, but not enough to do the job.

A study done by The Nature Conservancy et al reports on natural systems' potential just in the U.S. All told, this could offset 21 percent of US total emissions, which is great, but insufficient. These volumes are assuming an acceptable level of deployment that does not compete with food and other vital land uses. Note that volume is dependent on price of carbon. Natural Climate Solutions for the United States, Farigione et al. 2018. Appearing in [Science Advances](#).

There is some disagreement about how much land-based carbon dioxide removal can accomplish. Those opposed to technological CDR approaches project that massive deployment of land-based CDR systems and changes in high carbon consumptive lifestyles can fully meet the emissions reduction targets. The Climate and Land Ambition and Rights Alliance (CLARA) produced an optimistic report that shows how land-based systems and consumption reforms alone could do the job, <https://www.climatelandambition-rightsalliance.org/report>. The assumptions in the report include protecting and restoring half of the earth's original forests, transforming global agricultural practices, reducing food waste, and changing meat-based diets worldwide. These high end estimates are not supported by the IPCC and NAS studies. Note that the CLARA projections calculate both avoided future emissions and CDR. The IPCC and NAS studies do not calculate avoided emissions from natural systems and consumption.

The Sierra Club should start by embracing maximization of natural ecosystems CDR and avoided emissions approaches. This maximization must take into account justice, equity, and ecological concerns, so we need to avoid competition with food production, indigenous peoples' rights, natural ecosystem protection, and other vital concerns. The more we can squeeze out of

Climate mitigation potential in 2025 (Tg CO₂e year)



SOURCE: NATURAL CLIMATE SOLUTIONS FOR THE UNITED STATES, FARIGIONE ET AL. 2018

deployment of natural ecosystems approaches and avoided emissions, the less we will need to rely on more expensive and impactful technological approaches.

That said, we almost certainly will need to deploy some level of technological CDR by mid-century, if not before. We would be wise to start now with the appropriate level of research, development, and limited deployment to improve the technology, drive down the cost, and develop the approaches with the fewest negative impacts—while ensuring that technological development is informed by consultation with community partners to address equity concerns. It may take several decades to get these technologies to a place where they are affordable, reliable, safe, permanent, and just. Having them fully researched and

available in case reliance on natural ecosystems fails to do the complete job is the prudent course of action.

It should be pointed out that natural systems carbon sequestration poses the fewest risks, is the cheapest to deploy, and has numerous co-benefits, but it is also the least likely to provide new family-sustaining or union jobs, as it mainly involves land and wetland protection, forest stewardship, and changing agricultural land management practices. The technological CDR approaches tend to involve building and running plants and pipelines which have many family-supporting or union jobs associated with them.

Any effort to develop CDR technologies must in no way undermine the urgency of emissions reductions. In some



cases, if such development would impact our ability to dramatically reduce emissions (e.g., CCS at Kemper), the Sierra Club may need to take a position opposing the use of resources to develop CDR technologies. It is also imperative that we keep the moral hazard in mind and not let CDR technology substitute for moving rapidly to 100 percent clean energy.

It should be noted that the Climate Justice Alliance has opposed all global warming interventions like geoengineering and carbon capture and sequestration, as they feel CCS does not address the root causes of global warming—emissions reductions.

In Paris, various justice groups came out strongly against REDD (Reducing Emissions from Deforestation and Degradation) because generally it lacked prior consultation and protections for indigenous communities. The Climate Justice Alliance has opposed market-based approaches to address climate change because they can disproportionately impact low-income communities and communities of color. climatejusticealliance.org/just-transition/ This grassroots network of Climate Justice groups initially expressed reservations about the Green New Deal (GND) because it was not designed with frontline community input. Following these objections, GND leaders and the Climate Justice Alliance met to address their concerns. Following these objections, GND leaders and the Climate

Justice Alliance have been meeting to address their concerns. This is one more important reason to heed the Jemez Principles as we move into the CDR space. What may seem like a good solution needs to fully involve climate justice groups from the start.

The task force has put forward draft Sierra Club policy suggestions in each of these CDR areas for consideration by the Conservation Policy Committee and the Board.

The task force set up subgroups to research in detail a number of important topics raised by carbon dioxide removal. Each subgroup prepared a long detailed report and an executive summary answering key questions. The executive summaries can be found in the appendix of this report. The longer detailed subgroup reports are available upon request. The topics related to carbon dioxide removal are:

- Forests
- Wetlands/peatlands lakes
- Oceans (blue carbon)
- Soils and ag lands
- Biochar
- BECCS
- DAC
- Enhanced weathering
- SRM

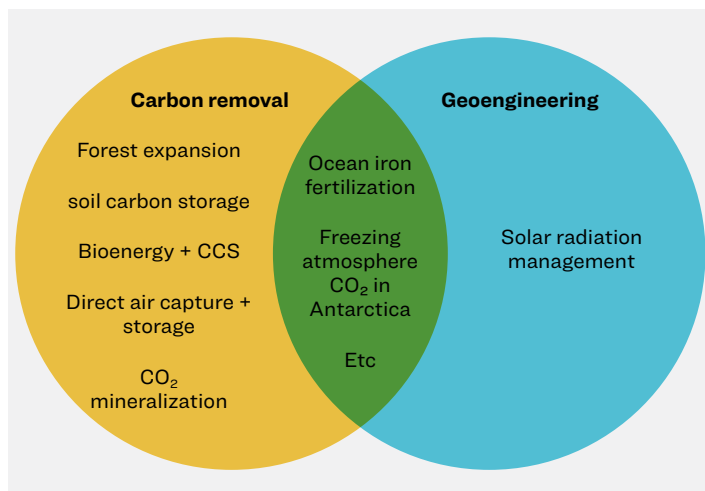


Geoengineering

For purposes of this report we use a very narrow definition of geoengineering. Some people feel that all forms of carbon dioxide removal or solar radiation management is geoengineering, including enhancing natural systems carbon drawdown such as planting trees. For our report, we differentiate between carbon dioxide removal (CDR) at a very localized level, and large-scale cross-boundary climate modification schemes that would impact the global commons. The latter fall into what we define as geoengineering.

A few technologies such as ocean fertilization could be viewed as CDR and geoengineering. Since these pose major risks to the global commons if widely deployed, we chose to put them in the geoengineering category.

Relationship of CDR to Geoengineering



SOURCE: CARBON180

There are many proposed forms of geoengineering, but the most widely discussed are solar radiation modification (SRM) and ocean fertilization. Other geoengineering options include albedo modification (altering large swaths of the earth's surface in order to reflect more sunlight and, marine cloud brightening. We do not propose to study these geoengineering options or take positions on them. We remain highly skeptical of their value and concerned about their global environmental impacts.

Solar radiation modification (SRM) is particularly problematic, and our proposed policy recommends that the Sierra Club oppose it. SRM does not reduce carbon emissions; rather, it attempts to mask them by reflecting solar radiation back into space before it can heat the earth. It does this by continuously spreading sulfide particles and other materials into the stratosphere to reflect the sun's rays, or by deploying huge arrays of mirrors in the upper stratosphere. Given the earth's history of major global volcanic eruptions, solar radiation blockage can temporarily work to reduce global average temperatures. It can also alter regional and global weather patterns in unpredictable ways, leading to dramatic increases or decreases in temperatures and precipitation. For example, it could temporarily slow sea level rise but simultaneously stop South Asia's monsoons. And unless the solar blockage is continuous and carried out forever, it can lead to a huge spike in temperatures and climate shock if and when it is discontinued. Meanwhile, carbon dioxide levels remain unchanged or actually increase.

The IPCC concluded: "SRM technologies raise questions about costs, risks, governance, and ethical implications of development and deployment....Even if SRM would reduce human-made global temperature increase, it would imply spatial and temporal redistributions of risks. SRM thus introduces important questions of intragenerational and intergenerational justice.... The governance implications of SRM are particularly challenging, especially as unilateral action might lead to significant effects and costs for others."

The huge risk here is that some rich countries or private parties could attempt to circumvent the existing ban on SRM and unilaterally seek to deploy it in hopes of advantaging themselves, while ignoring the risks to other countries that would likely suffer the worst unintended

consequences. For this reason it is absolutely vital that international governance be kept in place to ban unilateral deployment and give full voice and veto power to the most vulnerable and least powerful nations.

Our task force does not see a major role for the Sierra Club on SRM issues, except to monitor U.S. actions and research and take action to oppose any U.S. deployment and make sure that international governance matters allow full participation of all parties, particularly the least powerful and most impacted.

While ocean fertilization such as spreading iron filings into the ocean could be pitched as benign augmented natural photosynthesis, it also poses unacceptable risks to the global commons. The blooms of ocean plant life from this fertilization could possibly wreak havoc with the food chain and ocean ecosystems. The waters involved are largely international and so again it poses major governance issues where one country might wish to radically change the ecosystem while other countries might object. Ocean fertilization is presently banned and we believe it should continue to be banned, as there are many other CDR options that do not pose such huge risks to the global commons.

Again, our task force does not see a major role for the Sierra Club on ocean fertilization issues, except to monitor U.S. actions and research, take action opposing any U.S. deployment, and ensure that international governance matters allow full participation of all parties, particularly the least powerful and most impacted.

The updated policy that we will be proposing would also cover geoengineering and reflect the positions stated in this section of this report.



Recommended Priority Campaigns Around Adaptation and Carbon Dioxide Removal

After researching the landscape around climate adaptation and carbon dioxide removal we asked task force members to suggest possible Sierra Club major campaigns in each of the areas. The purpose of this request was to identify potential impactful grassroots campaigns that would be best suited to the Sierra Club. In some instances, it was determined that while the Sierra Club needed to update its policy and take a public position on a CDR technology, there was no grassroots campaign that was needed or made sense to pursue.

We asked those who suggested campaigns to measure them against some campaign criteria that we developed. A campaign did not need to rate high on every criteria to

warrant consideration, but it needed to rate highly in a significant number of the criteria to move forward in the process.

The campaign criteria we selected and applied would:

- Be politically ripe and have a good chance of success
- Follow Jemez Principles, be culturally cross-cutting and respectful, and promote climate justice and equity
- Achieve large amounts of CO₂ removal safely, equitably, and permanently
- Have the ability to make lasting big change and help build the broader climate movement
- Use cities and states as laboratories for change

- Address big climate issues of the day such as flooding or wildfires
- Benefit from added value brought by the Sierra Club
- Have a clear identifiable role for Sierra Club and be a logical priority for our national campaigns, chapters, and groups
- Benefit from the Sierra Club history and brand
- Be of interest to donors and foundations and could attract significant funding
- Fit with the Sierra Club's political goals for making change
- Build ties with rural America and other places where we have been less active
- Rely on multiple Sierra Club capacities and strengths
- Help mobilize the huge Sierra Club lands and wildlife constituency on climate change



Initially, 26 potential priority campaigns were identified. After applying the criteria, the task force settled on recommending six potential national campaigns around Climate adaptation and CDR:

1. Help communities and local, state, and national government agencies adopt, fund, and implement climate-smart, just, and equitable climate adaptation plans.
2. Engage in planning, preparedness, response, recovery, and relocation efforts in response to climate-change-related extreme-weather events.
3. Promote adoption of policies, practices, and programs to protect and restore carbon-rich soils through regenerative organic agricultural practices and improved public and private land management.
4. Protect and restore wetlands and peatlands to secure water resources, mitigate floods, and as natural adaptation/mitigation efforts to address climate change
5. Promote forest protection, restoration, reforestation, eco-forest management, afforestation, and urban forestry as a primary way to address climate change.
6. Protect and restore climate-resilient natural ecosystems by protecting large core natural habitats, establishing connecting corridors, and reducing non-climate stressors both in remote wild public lands and in close proximity to communities.

A short write-up of each of the six proposed priority campaigns can be found in the appendix. These are not campaign plans, but rather brief descriptions of what a campaign might cover and why. If the Board agrees these are directionally right, we would need to convene small groups of volunteers and staff with campaign experience to write up more detailed plans, theories of change, and ultimately grant proposals.



Funding for Climate Adaptation, Carbon Dioxide Removal and Geoengineering

This report is preliminary and will need far more research and follow-up by Advancement staff to verify, identify additional donors, and determine levels of interest in funding NGO advocacy work. In the Appendix you will find a list of potential donors who are funding various ongoing work in these areas. Most are not presently funding the type of grassroots-based work we would propose to conduct. But we do believe there is a vacuum and a high potential to move donor support to groups like the Sierra Club.

This year there was an uptick in donor interest in these areas, with donors funding white papers, conferences, and research. With the IPCC and NAS both calling for urgent action on climate adaptation and carbon dioxide removal (CDR), foundations that have typically restricted climate

funding to emissions reductions campaigns are now exploring what to do in the Adaptation and CDR space.

A seminal report by the Kresge Foundation, “Rising to the Challenge Together” (Dec 2017), kresge.org/content/rising-challenge-together found that climate funders were falling short on the key challenge. It found the field lacked a shared vision, does not have steady and coordinated funding, and is only shallowly focused on equity and justice. It’s summary judgement was that the funding was “utterly inadequate”.

Kresge and Rockefeller are the two most notable foundation players on domestic adaptation. “Rising to the Challenge Together” noted there is growing community action and leadership, but it is very poorly supported and



connected, and support from the federal government has been dramatically scaled back by the Trump administration. There is a growing network of knowledge and tools for adaptation work being developed, but it is not being widely shared and adopted. Attention and resources are being provided to vulnerable large urban areas, with scant attention given to rural areas, vulnerable poor urban communities, and the resilience of natural ecosystems. Root problems such as institutional racism, extractive economies, and wealth inequality are not being addressed.

The Kresge report cites other common failings in philanthropy, such as its tendencies to follow trends and avoid risks. In a field with such profound implications, foundations need to think bigger and for the long term.

A parallel study by the National Committee For Responsive Philanthropy (NCRP) and Grantmakers for Southern Progress, “As the South Grows, Weathering the Storm” (2017), www.ncrp.org/wp-content/uploads/2017/11/As-the-South-Grows-Weathering-the-Storm.pdf found that despite tremendous need and potential, grassroots and community groups are not invited to the table. This report describes the deep divides between larger environmental NGOs and grassroots groups and communities of color. It points out disproportionately low per-person funding in the Southern rural regions over a five-year period (\$31 and \$67, respectively, compared to \$451 nationally) and only a small percentage of that funding going to strategies like community organizing and policy change.

Our own survey and research revealed that there are dozens of foundations that are funding work on Adaptation and CDR. Some focus domestically, some internationally, and some do both. Most up-to-date are funding white papers and conferences, but that is also what the NGO community to date has been pitching to them. Domestic grassroots advocacy groups such as the Sierra Club and our environmental justice partners have not come up with comprehensive and strategic multi-year proposals for advocacy and implementation, so we have yet to gauge donor sentiment.

It appears that the donor community may be ready to make the shift from meetings and further study to action. We do not know if donors and foundations are willing to put large six- and seven-figure gifts into grassroots campaigning around climate change adaptation and CDR.

Developing strategic campaign proposals and then testing them with donors and foundations is a next logical step. In conversations we have had with a few key foundations they are open to talking to the Sierra Club about our vision and plans.



Sierra Club Organizational Landscape

Work on climate adaptation and carbon dioxide removal is nothing new for the Sierra Club, but it has not yet been prioritized, staffed, funded, and developed into a strategic campaign in any way so as to have a major influence on policy or real world outcomes. We have also failed to look at this broad array of issues in a comprehensive way and we have lacked clear cohesive policy and guidance.

The Sierra Club, the NGO community, and the international community have legitimately focused primarily on curtailing greenhouse gas emissions (mitigation) while decrying the past, present, and future impacts of climate change. Only recently has attention shifted to the desperate necessity to simultaneously address climate adaptation and carbon dioxide removal in a significant and coordinated way.

This section of our report is a summary of Sierra Club activities and capacities that are already doing some work on climate adaptation and CDR and could readily be engaged in a stepped-up effort for a major campaign if we had the direction, commitment, and resources to do so.

We start with a major shout-out to our chapters and groups, who have been heavily engaged in on-the-ground, frontline climate adaptation. As the chapter and group survey clearly shows (see more detailed summary of the survey in the appendix), the Sierra Club grassroots is already a very significant player on adaptation and carbon drawdown. They have already prioritized this work, and now they eagerly seek more help and resources from the national organization so they can be even more effective and engaged. Our chapter directors and lobbyists are

already working on climate adaptation policy measures at the state level, so this would not be imposing new work on the chapters and groups; it would be assisting them and building on their existing work.

The Environmental Justice Campaign and Justice Cluster, Federal and International Climate Campaign, Federal Policy Program, Dirty Fuels, and Resist Campaigns have worked with chapters, organizing staff, Advancement, the rapid response team, communications, and others to address extreme weather and wildfire impacts, provide relief, and seek funding and reforms for recovery and preparedness. For example, through partnership with state chapters and the Justice Cluster, our Climate Policy Director, Liz Perera, coordinated lobbying on the three Supplemental Disaster packages that passed Congress in the wake of extreme weather events this past year. Most of the Climate Adaptation and CDR approaches that the Sierra Club will want to support also have significant potential to provide family-supporting or union jobs in their implementation. Some of the most promising approaches that also provide good green jobs are being considered for inclusion in the New Green Deal package.



SOURCE: FEMA

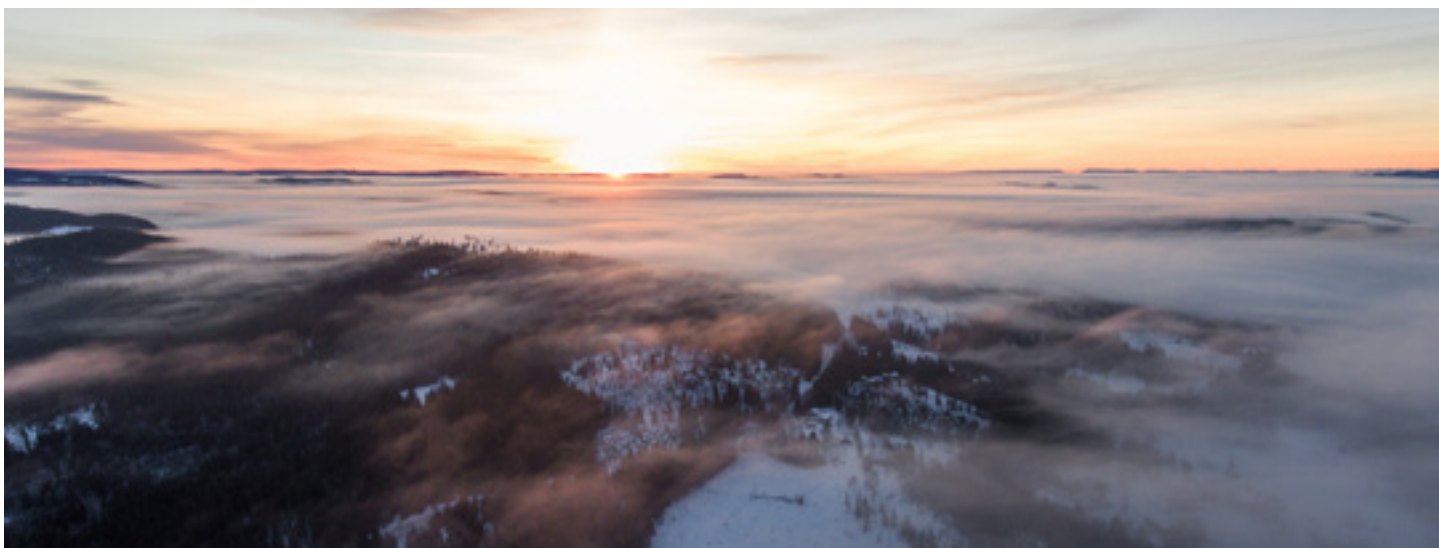
The Dirty Fuels Campaign did hire a full time organizer in Houston, Bryan Parras, whose work has focused primarily on hurricane response — shining a light on the fact that all too often, communities on the frontlines of the climate crisis also bear a disproportionate burden of pollution from the fossil fuel industry. Houston, Port Arthur, New Orleans, and other Gulf Coast cities that are rife with fossil fuel infrastructure bear the brunt of climate-related disasters on a near-annual basis. However, most climate-disaster

response work has been done on a case-by-case basis with no dedicated funding or staff. We have proven we can do this vital work, but we need more dedicated resources to do it even better and be more responsive and effective.

The Federal Policy Program and the Federal and International Climate Program have been represented by Liz Perera in hill advocacy around supplemental disaster assistance packages after this past year's major hurricanes and wildfires. This hill advocacy has allowed chapters working with communities to have a voice in Washington when the money for their recovery is being negotiated, and it was particularly useful in the aftermath of Hurricane Maria in Puerto Rico. There are numerous federal-level coalitions still working in Puerto Rico, where the Sierra Club has been coordinating efforts with Power4Puerto Rico. The Club has also been working with the Disaster Housing coalition, which has responded to all the major hurricanes of the past few years by advocating for robust recovery programs, particularly for people living in public housing. A strong adaptation coalition through the U.S. Climate Action Network (USCAN) called the Sustainable and Just Adaptation and Mitigation (SEJAM) coalition. This USCAN/SEJAM coalition is led by the New Jersey Organizing Project, the Union of Concerned Scientists, and Wisconsin Green Muslims, with participation from Anthropocene Alliance, EFC West, Public Citizen, FloodUSA, and Amnesty International. The membership of this coalition is growing daily and we expect further expansion. (See Sierra Club Resilience and Adaptation Federal Policy work in appendix)

The Environmental Law Program has been a key Sierra Club capacity in all of our conservation campaigns, including our work on emissions reductions; combatting dirty fuels leasing, development and transportation; and protecting forests, wetlands, and wildlife habitats. Our attorneys have already begun legal advocacy on adaptation issues: some examples include challenging the approvals of facilities in floodplains, arguing for the expanded habitat needs of wildlife in a climate-disrupted world, and explaining how conventional pollutants like smog will be greatly exacerbated by climate change.

Communications, Advancement, and Digital Strategies have also been highlighting this work and this issue. During and after each extreme weather episode or wildfire we are carefully messaging the fine line between compassion for



victims and the need to learn lessons so we can both recover and be better prepared for future disasters. The January-February special issue of *Sierra* magazine is dedicated to covering climate adaptation from multiple angles.

Our International and Federal Climate Change Campaign is already engaged in influencing major international governance bodies involved in climate change, including the Conference of the Parties, the United Nations, the Intergovernmental Panel on Climate Change, and federal agency and federal government policy makers. As these various bodies take up climate adaptation, CDR, and geoengineering governance, we are well-positioned to assert Sierra Club influence along with our allies. Given the modest size of our program and our lack of an international grassroots presence, our role and influence may be limited, but they will be vital and valuable.

The Our Wild America Campaign (OWA) has always had a component related to forest protection, but in this specific area of work, the campaign is underfunded and relies primarily on partial time of a handful of national organizers and chapter volunteers, along with some federal policy advocacy by the Lands Team in Washington, D.C. Similarly, the Resilient Habitats Campaign, which was the predecessor of OWA, was folded into OWA objectives, and the specific body of work focusing on connected landscapes remains largely underfunded and understaffed. That work could be resurrected and the federal land management climate adaptation plans developed during the Obama administration could be revived. The work that OWA carries out on protecting wild lands, addressing wildfires, and stopping dirty fuels is all part of a bigger effort to

establish resiliency so that natural areas and wildlife can adapt to climate change and store large quantities of carbon in forests, wetlands, and soils. If we succeed in the OWA 2030 goal of protecting 30 percent of our U.S. land base, that will do wonders to promote climate adaptation and carbon sequestration. But it would be smart to keep adaptation and carbon sequestration goals in mind as we work toward saving that 30 percent so that we make sure to include key carbon sinks and wildlife corridors as we promote and protect our waters — themes that the OWA teams are eager to take up as part of this work.

Our Clean Energy for All Campaign has started to knit together our work on stopping dirty fuels development and energy conversion and adopting 100 percent clean energy at the community, state, and federal levels. But as we have learned, it is not enough to just stop the addition of harmful emissions. We must simultaneously help communities and states adapt to climate change and help adopt plans and policies that will make them safer, more resilient, and help draw down carbon to safe levels. Every community needs to be committed to 100 percent clean energy and have a climate-smart climate adaptation plan.

Our Political Program has made climate change impacts a major campaign theme where it is most salient. Districts that have experienced extreme weather, sea level rise, heat waves, fires, and other impacts are more likely to hold candidates accountable for acting on climate change, including adaptation.



Major Recommendations

Incorporate any changes recommended by the Board of Directors and the Executive Director. Circulate this report to chapters and groups, Grassroots Network teams, national campaign leadership, and other stakeholders for further internal discussion and refinement. Decide if this task force should be extended to conduct that process or if a smaller team can carry it forward.

Adopt a new comprehensive policy on Adaptation, CO2 Removal, and Geoengineering, working with the Conservation Policy Committee and broadly circulating the draft for full grassroots and staff review and comment. Bring a proposed policy back to the Board by no later than September 2019. The Executive Committee to appoint a team to draft the policy and work with the CPC to refine it and produce a final proposal.

Authorize the further exploration on developing and funding the six proposed campaigns. Convene a group of experienced campaigners and strategists around each one that is tentatively approved to develop a more detailed and strategic campaign and assess its viability, potential for success, fundability, and the level of support and integration with group, chapter, and national campaigns and priorities. Bring recommendations on future steps back by no later than September 2019.

The existing Adaptation Task Force and the 40-plus participants in the Adaptation General listserv should be invited to work with the Grassroots Network staff and volunteer leads to set up a Climate Adaptation and Carbon Drawdown Team within the network to carry this work and information sharing forward through the volunteer side.

Conclusion and Acknowledgements

Conclusion

We hope we have made a compelling case that action on climate adaptation and carbon dioxide removal must be undertaken immediately to address already-existing impacts of climate change, and bold action is essential if we hope to protect and restore our human communities and the natural environment in the future. This work cannot wait for five or ten years, and delay will only make necessary changes harder, less effective, and more expensive.

We also hope we have identified the places where the Sierra Club can make the biggest difference, and elucidate how this work will complement and add to our existing efforts rather than compete with them. The alarm has been sounded by the scientific community, and residents of frontline communities worldwide who are bearing the brunt of hardship caused by climate change are calling out

for support and resources to help them survive. Extreme weather and other climate-induced catastrophes remind us weekly of our vulnerability; now more than ever we must prod and rally the philanthropic community and government institutions to step up before it is too late.

A big unknown is whether or not we can raise the necessary funds to carry out the work that we have identified as most important. At the same time, there is tremendous opportunity in this work to undo past damage, restore natural landscapes, help rebuild communities and make them safer and more livable, and build a movement and unite communities in the process. Instead of just heading off climate catastrophe, we can actually help build a better, more just, and more equitable world for present and future generations.

Acknowledgements

We would like to thank the Board of Directors and Executive Director Michael Brune for initiating this project and recognizing the importance and urgency of this study and this work. The two co-chairs, Steve Crowley and Bruce Hamilton, would like to extend our admiration and thanks to the tireless work of the task force members who met weekly for over six months and devoted hundreds of hours to research and writing. Each brought vital background, experience, talents, and compassion to the task. Task Force members are Chance Cutrano, Colleen Kaelin, Warren Lavey, Janice Meier, Robert Murphy, Tom Olivier, Elna Otter, Liz Perera, Dave Raney, Al Tilley, Thomas Wassmer, and James Woodley. (Contact information for this roster is in the appendix.)

In addition, we were assisted by a number of top internal volunteer consultants, notably Chad Hanson and Dominick DellaSala on forest carbon issues, Arthur Feinstein on sea

level rise and wetlands issues, and Fred Heutte on international climate and energy issues. Our report also benefited from advice, tutoring, and technical reviews by the staff of EcoAdapt and Carbon180. Grace McRae was instrumental in helping to prepare and compile the chapter and group survey. We are also indebted to the many professional colleagues inside and outside the Sierra Club who have been working on these issues for years who were so generous with their time to help educate and advise us. Tom Valtin, Peter Walbridge, and Libby Lee-Egan provided vital editing and design skills that helped make this report readable and attractive. Last, and most important, we were inspired by the many Sierra Club chapter and group leaders and staff who have been carrying out vital work on climate change adaptation, extreme weather response and recovery, and carbon dioxide removal; they've been waiting for us to catch up and lend them a hand.

Appendix

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Recommended Campaign: Climate Change Adaptation Planning – Preparedness and Resilience

This Sierra Club campaign concept paper is focused on work Sierra Club could do with communities and local, state, and federal government agencies to adopt, fund and implement climate-smart, just, and equitable climate adaptation plans. There is obviously a lot of overlap with the *Extreme weather relief and recovery, relocation, displacement* campaign ideas document, and while they are discussed separately in this report they should be considered closely related. Another important thing to note is that preparedness, resilience, and extreme weather relief and recovery are all areas where the Sierra Club is going to need to take a close look at how we address human rights and equity in a climate-changed world. The authors propose that we create a separate process to look at the layers of human rights, justice, and equity in all of our proposed work on resilience, adaptation, and extreme weather relief and recovery. These concept papers were limited in their scope and do not fully address the human rights considerations of communities most affected by climate disasters.

Background

According to the Fourth National Climate Assessment (2018) by the U.S. government's Global Change Research Program:

- A wide range of government and private organizations should participate in making communities more prepared for and resilient to climate change. Unfortunately, there is currently little leadership from either, and few states have mandates requiring local action.
- Climate change creates new risks and exacerbates existing vulnerabilities in communities and natural systems across the United States, presenting growing challenges to human health and safety, quality of life, ecosystem services and condition, and the rate of economic growth.
- Incorporating information on current and future climate conditions into design guidelines, standards, policies, and practices would reduce risk and adverse impacts.
- Individuals and organizations of all types assess risks and vulnerabilities from climate change and other drivers such as economic, environmental, and societal factors, and take action to reduce those risks.

Chapter Activity

As climate-related extreme weather events devastate homes and ecosystems across the country and long-term trends such as drought result in local damage, many chapters have been involved in climate adaptation activities. Chapters reported that 59 percent of respondents are working on climate adaptation issues; 55 percent have been dealing with floods, 48 percent with heatwaves, and 45 percent with drought. The forests and other natural habitats that chapters fight so hard to conserve are in danger. Furthermore, chapters are concerned about environmental changes impairing

residents' access to food, water, energy, transportation, healthcare, and other basic services, especially for lower-income, minority, and other marginalized people.

Chapters stated that 44 percent worked on some city or state climate adaptation plans. For example, the Hawai'i Chapter and Oahu Group strongly supported state and local legislation and executive orders requiring agencies to incorporate sea level rise and other climate impacts in their planning processes; they created Climate Change Adaptation Commissions, and they participate in developing and implementing adaptation plans. Additionally, several Grassroots Network teams -- including Agriculture and Food, Beach Nourishment Issues, Clean Air, Climate Adaptation, Marine, and Sustainable Biofuels -- engage in documenting and sharing information related to climate change.

Stronger Through a New National Campaign

The Sierra Club is uniquely positioned to help make adaptation planning reach all communities with the resources they need to be more effective. Chapters should promote widespread climate adaptation through community-level awareness, assessment, planning, implementation, and monitoring/evaluation activities. Compared with national entities, chapters are better able to make adaptation plans reflect the specific needs, conditions, resources, and local community stakeholders. Chapters should support laws that integrate adaptation planning into the policies, plans, and programs of all government agencies, and watchdog local decision-making to ensure those climate-smart policies and plans are implemented in everyday actions (e.g., permitting and capital expenditures). Importantly, work at the chapter level is needed to make the process equitable by addressing the vulnerabilities of disadvantaged/underserved communities and involving them in the planning process. To strengthen the effectiveness of the chapters' local actions, the national organization should encourage chapter involvement in all types of communities, and support their work with a nationally-coordinated toolkit and other resources for training members and applying best-practices in local activities.

Without strong participation by the national Sierra Club, its chapters, and other partners, governments will adopt many "mal-adaptation" actions which would undercut Club goals and achievements. Strategies may favor wealthy property owners at the expense of disadvantaged communities and to the detriment of nature. For example, the Club needs to support advocates for nature-based solutions to reduce flood risks by creating more parks, wetlands, and other areas which can tolerate occasional flooding during major storm events, rather than destructive and costly "hard infrastructure" that will require maintenance costs in perpetuity. Currently, the Lone Star Chapter, Houston Group, Surfrider Foundation, and other public interest groups are challenging U.S. Army Corps of Engineers plans for massive projects involving floodwalls, floodgates, surge barrier gates, and coastal barriers.

All Club efforts need to follow Jemez Principles to make sure we are listening to, integrating and being responsive to impacted communities and promoting justice and equity.

Opportunities and Threats

Climate change provides opportunities as well as threats, and adaptation plans can promote Club policies. Preferred actions in a nationally-coordinated campaign could include:

- Climate-savvy land use planning that includes protection of open space, better transit planning (including non-motorized), watershed protection, increased use of local renewable energy, and much more. (EcoAdapt has tools for this and has offered to partner with us to deploy them.)
- Climate-savvy local decision-making for permits and capital expenditures.
- Reforestation and afforestation projects to restore forest ecosystem function to manage water quantity and quality, improve air quality, ameliorate increasing temperature, and potentially sequester carbon;
- Enhancing food security through locally grown foods raised with a diversity of crops and sustainable soil management;
- Ensuring that water resources are accurately monitored and supply and demand are matched and socially prioritized to avoid the exploitation of surface waters and aquifers.
- Improving the efficiency of agricultural, industrial, and municipal water use and to increasing the use of recycled and reused water systems to reduce the demand of water so that more can remain in the natural environment, providing ecosystem services.
- Making sure that clean water is available to all communities as a basic human right.
- Promoting resilient microgrids using renewable energy sources and creating local jobs;
- Protecting and expanding seagrasses, mangroves, wetlands, and kelp farms to enhance coastal habitats and sequester carbon (e.g “blue carbon” projects);
- Supporting and promoting green infrastructure such as permeable pavement and protected and restored urban watersheds and riparian corridors;
- Providing living-wage green jobs as we invest in building climate-smart adaptation projects. This can be part of Green New Deal.

Climate Adaptation Planning Should Be a High Priority for the Club

The time is ripe, the need is great, and the Sierra Club has the capabilities to elevate climate-change adaptation to a national priority along with climate-change mitigation. Coordinating the two campaigns would strengthen each one. Chapters and groups are already engaged in both, and could benefit greatly from support at the national level.

Recommended Campaign: Extreme weather relief and recovery, relocation, displacement

Opportunities for Sierra Club engagement in extreme weather response, recovery, and relocation issues are all addressed in this priority campaign concept paper. There is obviously a lot of overlap with the Adaptation Preparedness and Resilience Planning campaign ideas document and while they are discussed separately in this report they should be considered very related. Another important thing to note is that both preparedness, resilience and extreme weather relief and recovery are areas where the Sierra Club is going to need to take a significant look at how we address human rights and equity in a extremely climate-impacted world. The authors propose we create a separate process to look at the layers of human-rights, justice and equity in all of our proposed areas of work on resilience, adaptation and extreme weather relief and recovery. These concept papers were limited in their scope and do not fully address the human rights considerations of communities most affected by climate disasters.

Pre-Disaster Preparedness is Key to a Strong, Community-led Relief and Recovery

Communities need to prepare for more frequent and more severe flooding, wildfires, heatwaves, and other events related to climate change. New climate-related conditions require that communities assess the vulnerabilities of residents and services, and strengthen the communities' capacity to inform, protect and respond.

In the survey we conducted 69% of Sierra Club chapters and local groups did not feel that the national Club was helpful in addressing the climate disasters that have affected 56% of the respondents. The national Sierra Club could be most helpful in assisting the chapters and groups to build resilience for disasters by strengthening its support of chapters and groups to work with communities before, during and after climate disasters strike.

Before disasters strike the Sierra Club has an opportunity to mitigate damage by building a community network. Local groups could review available disaster information from governmental sources, as well as from members of Voluntary Organizations Active in Disasters, augmenting it as they see the opportunity and ensuring that their members and their communities are advised. Special emphasis should be placed on informing and engaging the most vulnerable communities with the least access to information and resources.

Following an emergency, community members are often organized to help one another with relief and recovery resources. Local Sierra Club groups could organize networks and procedures for members to check on one another and access official channels of emergency response and recovery following a disaster. Sierra Club members could then volunteer to assist in broader community check in operations, again with a focus on those most vulnerable members of the population from elderly, to disabled to under-

resourced communities. Sierra Club chapters and groups can also identify community allies that are in need of immediate funds to deliver relief and recovery to local communities. This enables the Sierra Club to fundraise for community groups engaged in relief efforts after a climate disaster.. In August and September 2017, Sierra Club for the first time ever, raised restricted donations online for disaster response relief and recovery, with 100% of those funds going to external organizations. In total we raised \$1.6M online for these organizations. In particular we raised significant resources for Sierra Club Puerto Rico and our local community allies. The Sierra Club should continue to refine and expand this digital advancement program, working closely with local chapters and groups in advance to identify and partner with the front line organizations we plan to work with during and after a disaster. This ability to provide immediate funds to these local groups fills a major gap in relief and recovery efforts, usually local NGOs are overlooked and under-resourced in the immediate aftermath of a disaster. FEMA tends to contract with organizations that don't know local communities and in many cases have fraudulently stolen FEMA funds instead of providing immediate relief. These immediate resources can mean life or death in communities most vulnerable to extreme weather impacts. It can also mean life or death for small nonprofits affected by disasters and these resources can be a critical lifeline.

The chapter survey revealed that 47% of responding Sierra Club chapters and groups are already involved in furthering climate adaptation planning. Effective planning must be based on a full assessment of the regional vulnerability to the effects of climate change, and that is rare. Action plans should include pre-disaster plans to reduce risks from extreme weather events and post-disaster plans to guide recovery efforts. The national Sierra Club could provide crucial assistance by providing best practices models describing to chapters and groups what such vulnerability assessments ought to include, and advice on how to influence governmental authorities to produce this often unwelcome information. The local groups might prompt authorities to prepare adequate climate action plans, and monitor their implementation. The Sierra Club is uniquely equipped by its membership base, its freedom from political and financial biases, and its values to undertake promoting and monitoring climate planning.

Communities Must be Supported to Make Decisions Around Relocation

Many regions will become unlivable as a result of climate change. Presently 55% of responding Sierra Club chapters and groups are dealing with flooding, 48% with extreme heat, and 45% with drought. All of these impacts have the potential to cause communities to relocate. Effective adaptation planning will foresee such a necessity and support communities to make decisions around relocation.

When communities choose to enter into a process of relocation/or buyouts, there must be significant resources made available for community participation in all planning processes. There is the potential for new communities to be designed with the community and be made more attractive, more resilient, more equitable, and more sustainable. In the past governmental relocation efforts have typically resulted in FEMA trailer camps, unattractive public housing plots ill equipped to sustain community

life. Or FEMA has forced dispersal of evacuees to areas unequipped for the newcomers with very little planning or resources. Sierra Club has been working with the experts in the Disaster Housing coalition to better address these issues of public needs after a disaster hits and potential relocation processes. Sierra Club recognizes we are not the experts on public housing or disasters so the organization needs to establish strong partnerships with local organizations and lawyers that will lead in this area of work. Public housing lawyers have been engaged in many projects around disaster recovery and have an immense amount to teach local community groups. Sierra Club should follow the lead of these allies when advocating for solutions affecting public housing communities in the aftermath of a climate disaster.

The Sierra Club can educate local groups on the possibility of creating sustainable communities to act as models and seeds for others in the region. It can provide local groups with instructions on how to go about assembling representative task forces of prospective community members and construction professionals to plan the communities and to carry out the plans. This Green New Deal project should make full use of union labor as it provides an equitable and just world that they and the rest of us would wish to call home.

With its broad membership and its values, the Sierra Club is uniquely positioned to initiate planning for those communities as models for a program of social reconstruction. The Club will find enthusiastic general support for such communities, and willing collaboration from such groups as the US Green Building Council and Habitat for Humanity. Local governments should become readily involved in the projects once we have initiated them. Who better than the Sierra Club to lead us to a world we might choose to inhabit?

Recommended Campaign: Healthy Carbon-rich Soils

Sierra Club campaign to promote adoption of policies, practices and programs to protect and restore carbon-rich soils through regenerative organic agricultural practices and improved public and private land management.

Background

Healthy soils provide natural carbon sequestration, essential ecosystem services, and enhanced biodiversity that play key roles in addressing climate change at the community, regional, national, and global levels. The number of goods and ecosystem services provided by agriculture that could be threatened by climate change include:

- Food production (e.g. impacts from drought, extreme rainfall, heat, reduced runoff);
- Global and local climate regulation (e.g. C-sequestration);
- Soil protection and formation (e.g. erosion control);
- Hydrological and nutrients cycling; and
- Biodiversity conservation and restoration

Chapters, Groups, and Grassroots Network Teams Activities

Sierra Club staff and volunteers are overwhelmingly supportive (87%) of a new national agriculture and food campaign, and are poised to leverage strong interest and expertise that currently exists in well over half of the chapters around the country. At least half of all chapters have teams working on food and agriculture; as well as, 35% of chapters and groups responding to a recent survey stated they specifically address agricultural lands promotion of soil carbon sequestration. In the Sierra Club currently there are:

- 13 chapters and 57 groups with formal agriculture leads;
- 10 chapters and 25 groups with leads on grazing
- The Loma Prieta, South Dakota and Iowa chapters have committees specifically dedicated to working on agricultural soil carbon sequestration

Getting it done with Allies and Communities

Sierra Club has advocated for sustainable agriculture for decades. For example, the organization played a leadership role in establishing forums for collaborative policy on sustainable agriculture. Sierra Club served as a founding member of the National Sustainable Agriculture Coalition. the Club should continue to strengthen its ally-ships with other agricultural climate stewards to inspire a broad movement for a sustainable and socially just food production system. Because these issues are culturally cross-cutting, addressing them nationally will give the Club an opportunity to be more active and visible in rural and other communities where it has been less active.

An International Dimension

The Club would play a supporting role, as proponent of international efforts (e.g. 4 x 1000) that advocate for incentives and technical assistance for carbon farming. The Club could continue to leverage its physical and social media communication channels as a vehicle for rural communities to share stories and best practices on issues associated with overall soil health and associated carbon cycling, food productivity, and livelihoods in rural communities.

Why a National Healthy Soils Campaign

Sierra Club holds as a core goal achieving ambitious and just climate solutions. Agriculture is a leading edge of the climate movement; however, there is no national program addressing sustainability of the agricultural food system, soil health restoration, closing the food waste loop, or engagement with rural communities in a meaningful way. The agriculture sector is a significant contributor to emissions, accounting for 9% of all domestic emissions (including being the leading emitter of the potent gases methane and nitrous oxide), but agriculture and forests also have the theoretical potential to draw down 144 to 423 gT C/year in the U.S. alone, equivalent to shutting down 154-451 coal fired power plants. A national campaign addressing soil health and management issues and their impact in climate adaptation and mitigation would be a useful tool for sharing information across the nation and internationally, leveraging resources within the Club, and promoting the importance of regeneration of healthy soils, carbon sequestration, and the appropriate land management practices. The proposed activities position Sierra Club to take advantage of increased interest in agricultural soil carbon sequestration to build a bigger movement for agricultural drawdown (in line with recommended campaigns for healthy forests and wetlands). A national Healthy Soils Campaign should encompass the following priority initiatives:

- Support soil carbon storage and locally appropriate practices (e.g. minimizing soil disturbance; compost application; planting of trees and deep-rooted perennial crops) by promoting adoption of the “4 per 1000” Initiative by appropriate decision-making and implementation entities and governments.
- Bring agricultural solutions (such as California’s [Healthy Soils Initiative](#), Maryland’s [Healthy Soils Program](#), and Hawaii’s [Carbon Farming Task Force](#)) into climate action frameworks at all levels (i.e. national, state and local) by working to expand soil carbon incentives in new and existing programs through education and grassroots lobbying.
- Advocate for equitable federal, state, and local rules that remove structural barriers and create financial incentives for organic regenerative agriculture, while bolstering technical support and research for agroecological farming systems.
- Work with Natural Resource Conservation Service and US Department of Agriculture staff to shift priorities and increase incentives for integrated farming practices that sustain and regenerate soil health both in state and major federal legislation (i.e. the Farm Bill).

- Support urban gardens and landscaping integrating composting and soil building education, particularly in low-income communities, fostering climate resilience and access to nature.
- Promote soil carbon farming as part of Green New Deal and other federal and state climate change reforms.
- Protect public lands from off-road vehicle abuse, steep slope logging, excessive road building, extractive mining, overgrazing and other negative impacts that lead to soil loss and soil carbon depletion.

Recommended Campaign: Protecting and Restoring Wetlands and Peatlands

Sierra Club campaign for wetlands and peatlands protection and restoration to secure water resources, mitigate floods, and as natural adaptation/mitigation efforts to address climate change

Background

Healthy intact wetlands and peatlands -- coastal and terrestrial -- provide natural carbon sequestration, essential ecosystem services, and enhanced biodiversity that play key roles in addressing climate change at the community, regional, national, and global levels. Coastal wetlands face threats from sea level rise and accompanying salt water inundation now and in the foreseeable future. Unless steps are taken, including managed retreat strategies, to allow inland migration as sea level rises; freshwater coastal wetlands can be lost or replaced by salt marshes. This loss or conversion could impact the entire regional ecosystem and the essential services it originally provided. Terrestrial wetlands and peatlands are threatened by dredging and filling, farming, urban development, and climate change. In many states over 90% of historic wetlands have already been decimated by development, and the services they provide to support wildlife, reduce flooding, filter water and recharge aquifers lost.

This campaign is related to the Sierra Club's National [Water Sentinels Grassroots Network Team efforts](#); as well as, the [Our Wild America Campaign](#). However, it has a stronger focus on wetlands protection and restoration as means of climate adaptation and carbon dioxide removal. It is high time to act also on behalf of biodiversity. According to World Wildlife Fund's Living Planet Report 2018, species abundance in freshwater ecosystems, such as rivers, lakes and wetlands, declined by 83% since 1970. Protecting lakes, rivers, wetlands, and peatlands is frequently a justice and equity issue; as some developers seek to exploit these resources for personal gain leaving local communities and indigenous people to suffer the consequences of degraded or destroyed wetlands.

The number of goods and ecosystem services provided by intact wetlands and peatlands that could be threatened by climate change include:

- Wetlands purify and replenish water supplies.
- Wetlands reduce flooding and runoff that leads to toxic algae blooms.
- They are tremendously productive ecosystems that provide fish and allow growing staple crops that feed millions of people.
- Wetlands serve as natural sponges that protect habitats and shorelines from flooding, drought, nutrient loading and erosion.
- Wetlands help fight climate change by sequestering lots of carbon in their soils.
- They are bursting with biodiversity, storing even more carbon.
- They support local economies through tourism and recreation.

Chapters, Groups, and Grassroots Network Teams Activities

In 2018, 59% of Sierra Club Chapters and Groups stated they generally work on climate adaptation issues including flooding (55%), forests (including wetland forests- 43%), and drought (45%). Also the following Grassroots Network Teams (GNTs) along with Sierra Club Chapters and Groups are addressing wetlands health and water security in their states or regions:

- The National Water Sentinels Grassroots Network Team envisions a world where the quality and quantity of water in our rivers, streams, lakes, wetlands and aquifers are protected and are managed to sustain the ecosystems on which all life depends.
- The Forest Certification and Green Building team is incorporating wetlands health into their work plans.
- Florida Chapter: Everglades Restoration Campaign.
- Sierra Club advocates for National Water and Wetlands Policies.

Getting it done with Allies and Communities

The Sierra Club's history and brand gives it a unique opportunity to be effective in addressing wetlands and peatlands issues, which have become important in addressing climate change globally. Because these issues are culturally cross-cutting, addressing them nationally will give the Sierra Club an opportunity to be more active and visible in rural and vulnerable communities where it has been less active. Also, the Sierra Club could strengthen its ally-ships with other front-line non-governmental organizations in mobilizing community activism addressing many wetland and peatland health issues and take the lead in addressing wetland health policy issues at all governmental levels (which is a Sierra Club strength).

Why a National Wetlands/Peatlands Campaign?

The Sierra Club has been working on clean water and wetlands protection for decades. The Trump administration is writing off Clean Water Act protection for a massive proportion of nation's wetlands through a rewrite of the Waters of the United States (WOTUS) There's an urgent need to mobilize local and state action through a combination of boosting more robust state level regulatory protection where it exists, and through exploring preservation initiatives that could gain public support in areas where agriculture and other interests are typically hostile to wetlands protection. However, there is no funded and staffed national program addressing wetlands protection and restoration in general or water security in a changing climate. A national campaign addressing wetland protection, health, and restoration issues would be a useful tool for sharing information across the nation and internationally; leveraging resources within the Sierra Club; and promoting the importance of intact healthy wetlands. The political climate is ripe for upscaling wetlands management policies

globally and the public is ready to support these efforts financially. A national Wetlands Campaign should encompass the following priority initiatives:

- To secure the full protection and restoration of intact wetlands, peatlands and freshwater bodies for their ecosystem services, biodiversity, and carbon sequestration potential.
- To expose and oppose activities that damage the integrity of our nation's wetlands.
- To inform and educate the public and influence decision makers about the importance of wetlands/peatlands integrity.
- To engage in grassroots activism for sound local and national wetlands/peatlands policies.
- To advocate for equitable and just wetlands protection and restoration policies

Recommended Campaign: Forests and Climate Change

Sierra Club campaign to promote forest protection, restoration - reforestation, eco-forest management, afforestation and urban forestry as a primary way to address climate change.

Background

Primary and intact forests and trees in and around human communities provide natural carbon sequestration, essential ecosystem services, and enhanced biodiversity that play key roles in addressing climate change at the community, regional, national, and global levels. ([See The Great American Stand: US Forests and the Climate Emergency](#)). The number of goods and ecosystem services provided by forests that could be threatened by climate change include:

- Wood and non-wood products;
- Global and local climate regulation (e.g. C-sequestration, moistening and cooling);
- Pollution control, water regulation, and water supply;
- Soil protection and formation (e.g. erosion control);
- Nutrients cycling;
- Biodiversity protection; and
- Tourism and recreation.

Chapters, Groups, and Grassroots Network Teams Activities

In 2018, 59% of Club Chapters and Groups stated they generally work on climate adaptation issues and 43% of them reported that they are working specifically on protecting forests. For example, the following Grassroots Network Team (GNT) and Club Chapters and Groups are addressing forest health in their states or regions:

- Sierra Club Chapters seek “Protected Lands Status,” where appropriate, which prevents logging in those designated areas.
- Chapters from North Carolina to Alaska address the negative impacts of forest clearcutting; as well as, the impacts of logging activities on vulnerable communities.
- Some Chapters and Groups work on urban tree planting initiatives and participate in national and State forest management review processes.
- The Forest Certification and Green Building Team (GNT) works to educate and engage Club members on the role forests play in carbon sequestration thus climate change mitigation.
- The Our Wild America Campaign is establishing a Forest Working Group to better coordinate Chapter, Group and Grassroots Network forest campaigns throughout the country.

Getting it done with Allies and Communities

The Club's history and brand gives it a unique opportunity to be effective in addressing forest issues. Because these issues are culturally cross-cutting, addressing them nationally will give the Club an opportunity to be more active and visible in rural and other communities where it has been less active. Also, the Club could strengthen its ally-ships with other front-line NGOs in mobilizing community activism associated with addressing many intact forest issues (which is a Club strength) and take the lead in addressing forest policy issues at all governmental levels.

The Sierra Club has worked on forest protection and ecological management throughout its history. Our Wild America campaign staff and volunteers and our legal team regularly work with local Sierra Club chapters and groups on national forest planning and protection issues. We have strong alliances with local grassroots groups and national conservation groups; as well as, have a proven record of success in protecting federal, state and private forest lands.

An International Focus

The Sierra Club has had a very limited involvement in international forest protection, mostly working with other NGO leaders at international meetings, and some forest work around illegal logging and trade. While the threat to accelerate climate change from global deforestation and degradation is alarming and of global concern, the Sierra Club's ability to influence the situation is very limited and there are other organizations dedicated to this crisis with far greater capacity and history in the international sphere. It is important for the Sierra Club to support indigenous people as they seek to protect their forest homelands and to make sure that any solutions are just and equitable and have indigenous people in a position of power. The Sierra Club should look for ways to help magnify international forest protection campaigns that are just and equitable.

Why a Forests and Climate Change Campaign?

The Sierra Club has in the past and still is widely active in the protection of primary and intact forests. However; there is no well funded and fully staffed national program addressing these forests. The [Our Wild America Campaign](#) has an expressed desire to expand its work in this area, but is resource constrained. The Council of Club Leaders has petitioned the Board to make forest protection to address climate change a top priority. Recent studies by IPCC, the NAS and others have made clear that forest protection is one of the best, cheapest, and safest ways to reduce carbon dioxide concentrations to address climate change. The political climate is ripe for upscaling forest management policies nationally and globally while the public is ready to support these efforts financially. A national Forest Campaign should encompass the following priority initiatives:

- Protect primary and intact public forests through legislation, litigation and regulation;
- Where there is forest management on public lands, insist that it be conducted where ecosystem protection and carbon sequestration are primary considerations, not commercial timber harvesting;
- Community protection from wildfires should focus on establishing defensible space in the immediate wildland urban interface, not by logging in remote forest lands;
- Prescribed burning should be more broadly applied to restore forest ecosystems and to help prevent larger wildfires with larger carbon releases;
- Restoration of forests of particular value;
- Reforestation and carefully selected afforestation to address climate change;
- Encouraging Chapters and Groups to advocate for urban forestry (tree planting, municipal watershed protection, wooded riparian corridors etc.);
- Encouraging states and the federal government to adopt financial and regulatory incentives for private forest owners to manage their forests to maximize carbon sequestration;
- Ending (global) forest harvesting subsidies while advocating for incentives and policies for reduced primary and intact forest harvesting;
- Advocating for the global reduction of wood consumption and sustainable management of harvestable forests associated with these industries; and
- Advocating for forest management policies proposed in the Green New Deal that would address economic stability and environmental sustainability in a equitable and just manner.

Recommended Campaign: Protect and Restore Climate Resilient Ecosystems

Sierra Club campaign to protect and restore climate resilient natural ecosystems by protecting large core natural habitats, establishing connecting corridors, and reducing non-climate stressors both in remote wild public lands and close to communities.

The Resilient Ecosystems Campaign is a proposed climate adaptation and carbon dioxide removal program that is a proposed expansion of ongoing Sierra Club campaign work with a few new twists. Back in 2009 when the Climate Recovery Partnership was launched a major campaign was Resilient Habitats, which was centered on all of the major components we are proposing in this revitalized campaign. In 2013 Resilient Habitats was expanded and rebranded as Our Wild America, which remains one of our primary national flagship campaigns.

The existing Our Wild America Campaign is an umbrella effort comprised of three priority initiatives:

1. The Protecting Lands, Water and Wildlife Initiative, which seeks to build a powerful grassroots movement to protect our country's public lands, waters and the wildlife that depend on them;
2. The Beyond Dirty Fuels Initiative, which is committed to building a grassroots movement to protect our climate, lands and communities by keeping dirty fuels in the ground;
3. And the Outdoors for All Initiative, which is dedicated to improving people's lives and building the movement of environmental advocates by connecting people with the outdoors.

From this you can see that this campaign would fit well within the bounds of the Lands, Water and Wildlife Initiative of the Our Wild America Campaign. This initiative carries on the legacy work of the Sierra Club, fighting to protect the lands and waters that our members love to explore, and the wildlife that depend on those lands and waters. The initiative is currently embarking on a broader goal of joining many of our partners in taking up the the [global call to protect 30%](#) of natural places by 2030, an overarching goal that would further the likelihood of truly resilient ecosystems.

Ecologists studying climate change say the best way to adapt for climate change to protect large core areas of largely undisturbed wild lands, building on the system of parks, wilderness areas and wildlife refuges that we have already established. But most of these existing protected areas have insufficient protected lands to guarantee the survival of native species under stress from climate change. To fix this we must establish larger climate refugia core areas and then establish and protect connecting corridors between core areas so that species can migrate to more favorable habitats. Lastly, we need to reduce non-climate stressors on native species such as logging, mining, pollution, overfishing and incompatible development. In some cases, to

cope with climate change induced shifts of altitudinal species and community distributions, massive relocation projects will be needed.

This is nothing new for the Sierra Club. The Our Wild America Campaign and all of our chapters and groups are already actively working on protecting more wild lands and heading off incompatible development and pollution threats. But what is different for some of our activists is to put a climate change adaptation and carbon sequestration lens on our efforts. An activist would draw one sort of protected area boundary if the primary goal was to protect scenery, recreational opportunities, or existing critical wildlife habitat. But if the activist was looking to establish a resilient ecosystem for a climate changed world, the boundaries, and the connecting corridors would look very different. Also, the Sierra Club has historically focused primarily on public land protection, and in the climate changed world there is a necessity to also look at state and private open space and how to protect these lands to provide landscape and ecosystem level protection.

And then there is the ongoing work of the Our Wild America Campaign to ensure our lands and waters reduce, rather than contribute to, climate disruption (work that currently focuses primarily on slowing the extraction of fossil fuels on public lands). This can be done through combining the focus on reducing and eliminating fossil fuel extraction while also restoring damaged or degraded forests, coastlines, lands, wetlands/peatlands and waters. (Note we have proposed separate dedicated campaigns on wetlands, forests and soils.) Through this restoration effort we can rebuild the carbon storage potential of ecosystem vegetation and soils.

Great progress was made on adopting climate adaptation plans for federal public lands during the Obama Administration, but those plans prepared by the National Park Service, US Forest Service, US Fish and Wildlife Service and Bureau of Land Management in cooperation with state land management agencies were largely abandoned and dismissed by the Trump Administration in their zeal to deny climate change and promote maximum resource exploitation. But these plans still exist and can be recovered and reinstituted in a new Administration post 2020.

This proposed campaign scores extremely high in all the campaign criteria that we established. The major components of this campaign -- protecting wild places and fighting back development proposals that would destroy wild places -- are already a high priority of the national organization and our chapters and groups, and they have been for over 125 years. This campaign plays to our strengths as we have an active grassroots presence in every location, active Grassroots Network Teams dedicated to this set of activities, and an effective and powerful national campaign in Our Wild America. As noted above, as this campaign succeeds it will contribute greatly to carbon dioxide drawdown and sequestration through preservation and restoration programs. This campaign is ripe politically and particularly post 2020, we will have huge opportunities to make progress if we can shift the leadership and focus of the federal government. If the federal government remains indifferent or hostile post 2020 there is still vital work to be done at the state and local levels, and by challenging the

Administration in the Congress, the courts, and at the federal agency level. Donor interest in land protection in general and resilient ecosystems in particular remains a major challenge, but even a modest campaign of several million dollars per year would be important and a building block for future larger gifts. This campaign is also a way to build up Sierra Club presence and movement building in rural America and “Red States” by boosting hunting, fishing, outdoor recreation and tourism associated with these wild places and habitat protection.

This program is primarily designed to protect nature from climate change for its own sake, but we should not overlook the essential justice and equity components. Our Wild America is grounded in living up to the Jemez Principles and working with Indigenous People and others who share our values and recognize that when we protect nature, reduce pollution, restore lands and watersheds, and provide opportunities to enjoy nature we all benefit. This program is designed to help protect and restore natural areas and provide connecting corridors not just on remote public lands, but also protecting nearby nature close to human communities. The natural world is our common mother and when we protect and restore it, all of life benefits, which then promotes justice and equity for all.

Funding for Climate Adaptation, Carbon Dioxide Removal and Geoengineering

Funders in the Adaptation Space

The Kresge Foundation -- sponsor National Adaptation Forum

The Walton Family Foundation -- sponsor National Adaptation Forum (historical guilt but not continuing funding)

Ford Foundation. Hosted Jan 2019 session on inequitable disaster recovery and philanthropy. (Dan Chu attended)

CORE (Community Organized Relief Effort) Sean Penn, actor and CEO of and founder of the J/P Haitian Relief Organization on building community resiliency and innovative ways to protect and preserve vulnerable communities.

Climate Resilience Fund -- John Nordgren who used to be with Kresge Foundation funded by MacArthur Fdn now.

Wilberforce Foundation -- Liz Bell, sponsor National Adaptation Forum

Switzer Foundation -- sponsor National Adaptation Forum

Rockefeller Foundation -- funds 100 Resilient Cities Program, Bay Area Challenge

Doris Duke Foundation, pledged several million to dedicate to this space

Rand Corporation cosponsored Adaptation Forum

Solutions Project

Surdna Foundation

Coastal Community Foundation

Mary Reynolds Babcock Foundation

MacArthur Foundation (funds Climate Resilience Fund), reportedly withdrew most support for adaptation in the US.

National Collaboration for Equitable Renewal and Ecological Resilience is a national and regional collective grant making, social investment and resource-storing body for just rebuilding efforts. Involved in grant making and social investment challenges and strategies in an age of community destruction by natural disaster and the predatory loss of public assets that often follows.

Pew Charitable Trusts has a project to help make communities and infrastructure flood-prepared.

Robert Wood Johnson Foundation makes grants in Health Leadership Development programs to help build a culture of health in community-based projects; these programs include efforts aimed at “enabling leaders in all fields—such as transportation, urban planning, business, and economic development—to challenge systems, tackle the root causes of health disparities, and build healthier communities.”

Bullitt Foundation: <http://www.bullitt.org/programs/resilient-cities-healthy-communities/>

Business interests that might be source of adaptation funding

Insurance Industry

Reinsurance Industry

Progressive fishing industry

Progressive agriculture industry
Coastal real estate interests
Progressive banks
Rand Corporation cosponsored Adaptation Forum

Federal Agencies Grants:

As a c4 lobbying organization, Sierra Club would be ineligible to receive federal agency grants, but our allies or our communities could receive them and we could help them apply.

- A. NOAA (www.noaa.gov search “climate change adaptation grants”). There are many climate adaptation grants available targeting State, NGOs, Educational Institutions, private businesses, and communities.
- B. EPA (<https://www.epa.gov/arc-x/epa-grants-and-assistance-agreements-awards-supporting-climate-adaptation> examples of recently funded grants). EPA provide climate adaptation grants to various entities supporting many types of climate adaptation activities including those focusing on environmental justice and climate adaptation resiliency within minority communities.
- C. Fish and Wildlife Service (www.fws.gov and search “climate change adaptation grants”). Fish and Wildlife Service within the Department of Interior offer climate change adaptation grants to a variety of types of potential grantees for wildlife conservation and adaptation issues.
- D. Army Corp of Engineers (www.usace.army.mil/corpsclimate/Climate_Preparedness_and_Resilience). Army Corp of Engineers have developed general resources for addressing climate change adaptation and made them available to the public. Most of their work is associated with sea level rise and coastal management. The Corp also address erosion issues for ports and waterways. On their website, they provide climate preparedness and resilience information as well.
- E. US Dept. of Agriculture (USDA) (www.usda.gov/oce/climate_change/ search for climate change adaptation grants). USDA provide grants to States and other entities to address conservation, research, implementation, and education associated with climate change adaptation in forestry, farming, and other agricultural services.
- F. US Dept. of Housing (HUD) (www.hud.gov search for climate change adaptation grants). HUD provides a variety of grants to address housing issues associated with climate change adaptation. They have provided grants associated with Native American housing and community development issues.
- G. US Dept. of Transportation (www.transportation.gov search for climate change adaptation grants). US Dept. of Transportation offer grants to local governments and States to address infrastructure needs due to climate change adaptation. This may be helpful for Chapters and groups to understand funding availability for infrastructure support.
- H. The Centers for Disease Control and Prevention makes grants through its Climate-Ready State & Cities Initiative, applying the Building Resilience Against Climate Effects (BRACE) framework.

Most States have granting programs that support the work of NGOs addressing Climate Change Adaptation. They are usually found in similar departments as those listed for the Federal granting sector. For example, in North Carolina such information can be found at www.deq.nc.gov and search for climate change adaptation grants.

Funders of Natural Systems Carbon Drawdown and Ecosystems Resilience

Member Foundations of Biodiversity Funders Group, now directed by Judy Hatcher Wyss Foundation -- Nature Needs Half \$1

Billion <https://www.wyssfoundation.org/about/>

National Geographic Foundation -- World's Last Great Places Program -- \$1 Billion

Walton Family Foundation funds rivers and wetlands protection and restoration

Hewlett Foundation funds lands and waters protection in the West, also reported to be funding in carbon removal space.

Packard Foundation. Stated interest in funding in carbon removal space, unclear what they are funding. Fund SC to debunk carbon neutrality of wood burning power plants.

Jeremy Grantham reported to fund carbon removal work.

Critical Ecosystem Partnership Fund (CEPF): <https://www.cepf.net>

Finance options and instruments for Ecosystem-based Adaptation (Hunzai et al. 2018)

Gordon and Betty Moore Foundation. Funded first Climate Adaptation Conference and

Publication [*The State of Marine and Coastal Adaptation in North America*](#), an effort to

identify and assess on-the-ground adaptation initiatives through interviews, surveys, and case studies conducted by EcoAdapt.

Johnson Foundation funded a retreat at Wingspread MN to address carbon drawdown. Grant went to RESOLVE.

Leonardo DiCaprio Foundation <https://www.leonardodicaprio.org/projects/wildlife-landscapes/>

<https://www.leonardodicaprio.org/projects/climate-change/>

<https://www.leonardodicaprio.org/programs/california-program/>

<https://www.leonardodicaprio.org/scaling-carbon-farming-and-regenerative-agriculture-in-california/>

Bullitt Foundation: <http://www.bullitt.org/programs/regional-ecosystem-health/>

Kresge Foundation: <https://kresge.org/climate-adaptation> (funded SC original Resilient Habitats Campaign)

Walker Foundation: <http://walker-foundation.org/net/content/projects.aspx> Funds Center for a Sustainable Economy in Oregon which runs US Forest Carbon Pricing Initiative to address climate impacts of industrial forestry through market based solutions.

Laird Norton Family Foundation -- funded Oregon forest carbon work

W Family Foundation: seeks proposals in area of forest ecosystem services

Nutiva Foundation funds Soil Not Oil work (John Roulac)

The following 4 mentioned to me by Carbon180:

VK Rasmussen, Irene Krarup

Incite Labs, Matt Rogers

Foundation for Food and Agricultural Research

ClearPath Foundation

Below is a list of potential funders captured from the “Statement Supporting Forests, Rights, and Lands for Climate”. May be primarily internationally focused. (<http://www.climateandlandusealliance.org/supporting-forests-rights-and-lands-for-climate/>) released from the 2018 Global Climate Action Summit in San Francisco, CA, on Sept. 11, 2018.

“As leaders of philanthropic organizations, we are participating in the Global Climate Action Summit by stepping up our support to protect, restore, and expand forests, make land use more sustainable, and secure the rights of indigenous peoples and local communities, who are the best stewards of their lands, territories, and forests.”

(Note: the website address is embedded within each organization’s title)

- a. *American Jewish World Service*
- b. *Arapyaú Foundation*
- c. *Christensen Fund*
- d. *ClimateWorks Foundation*
- e. *David and Lucile Packard Foundation*
- f. *Doris Duke Charitable Foundation*
- g. *Ford Foundation*
- h. *Good Energies Foundation*
- i. *Gordon and Betty Moore Foundation*
- j. *John D. and Catherine T. MacArthur Foundation*
- k. *Leonardo DiCaprio Foundation*
- l. *Mulago Foundation*
- m. *The Rockefeller Foundation*
- n. *Swift Foundation*
- o. *Tamalpais Trust*
- p. *Tata Trusts*
- q. *Thousand Currents*
- r. *United Nations Foundation*

Federal Agencies Grants:

As a c4 lobbying organization, Sierra Club would be ineligible to receive federal agency grants, but our allies or our communities could receive them and we could help them apply.

- <https://nifa.usda.gov/program/ecosystems-programs>
- <https://nifa.usda.gov/program/forests-programs>
- <https://www.federalgrantswire.com/forest-service-department-of-agriculture-federal-grants.html>

Carbon Dioxide Removal (CDR) Technology Solutions Funders

The William and Flora Hewlett Foundation have funded the Center for Carbon Removal for biochar, BECCS, and other CCS research over the last several years.

ClimateWorks is exploring carbon removal strategies and hosted forum in 2018

Packard Foundation -- Attended Climate Works and WRI carbon drawdown summit 2018, funds Sierra Club work on debunking wood to energy carbon neutrality

Linden Trust for Conservation -- Funded WRI to do climate drawdown analysis (Kate Gordon)

Alexander von Humboldt, Packard, & Bechtel Foundations fund the Stanford Woods Institute on studies on BECCS and land use constraints.

William and Flora Hewlett Foundation, John D. and Catherine T. MacArthur Foundation, Bernard and Anne Spitzer Charitable Trust, and Energy Foundation -- funding National Carbon Capture Leadership Council (group tied with industry that promotes carbon capture and storage technology, with dirty fuels and with renewable fuels or direct air capture)

Climateworks and Linden Trust for Conservation are funding the Moniz group, Energy Futures Initiative on Direct Air Capture.

Gates Foundation -- Gates and other philanthropists-capitalists have funded Harvard's Solar Geoengineering Research Program to the tune of \$7 million. Some of this may be CDR and other parts SRM, which does not remove carbon.

Federal Agencies Grants:

As a c4 lobbying organization, Sierra Club would be ineligible to receive federal agency grants, but our allies or our communities could receive them and we could help them apply.

Small grants (\$5k) are being offered by the Forest Service in the Midwest via the Great Plains Biochar Initiative to expand education and use cases for biochar.

The USDA/NRCS have issued Conservation Innovation Grants (CIG) and Value-Added producer grants for biochar projects and they may be a source for future research funding.

ARPA-E is a venue for more exploratory research on biochar, and their MARINER program has looked at some carbon removal/soil carbon sequestration work.

National Science Foundation have also funded projects on biochar.

Cool Planet Energy received a \$91 million loan guarantee from the U.S. Department of Agriculture to develop carbon negative drop in fuels and CoolTerra biochar soil amendments from biomass pyrolyzation.

Foreign Funders:

Direct Air Capture: The Climeworks commercial plant near Zurich is financially supported by the Swiss Federal Office of Energy and the European Union.

Enhanced weatherization: The Leverhulme Trust funds the primary research being done by the Leverhulme Center for Climate Change Mitigation in the UK. The Leverhulme Trust was established by the will of William Hesketh Lever, the founder of Lever Brothers. Since 1925 they have provided grants and scholarships for research and education; today, we are one of the largest all-subject providers of research funding in the UK, distributing approximately £80m a year.

Geoengineering Governance: Danish government was funding Carnegie Geoengineering Governance Initiative.

Ilkka Herlin, a Finnish billionaire who runs Cargotec, a container logistics company. He recently funded a sequestration programme that studies how farming methods affect carbon content in soils, with much of the research taking place on his own farm.

Richard Branson launched a \$25m global contest for carbon dioxide removal technology in 2007.

2018 Sierra Club Chapters and Groups CATF Survey Summary

By James Woodley

Introduction

The respondents in this survey represent the Chapter and Group leadership throughout the Sierra Club's national infrastructure. There were 87 respondents representing at least 44 coastal areas, 36 inland areas, and 3 islands including Hawaii and Puerto Rico. Of the total 63 Sierra Club Chapters, at least 40 or 63% responded to the survey request.

Item	# of Respondents/Total	% of Total
Coastal States	44/83	53
Inland States	36/83	43
Islands	3/83	4
Chapters	40/63	63

Data Summaries

- ☐ 59% of the respondents currently work on climate adaptation issues
- ☐ 50% of the respondents currently spend some of their resources on climate adaptation activities
- ☐ The top 3 climate impacts that the respondents are currently dealing with in their communities or states include (note: respondents could choose from multiple events):
 - o Flooding-55%
 - o Extreme heat and heat waves-48%
 - o Drought-45%
- ☐ The top 2 adaptation activities that the respondents are presently involved in include (note: respondents could choose from multiple activities):
 - o Working on city or state climate adaptation plans-44%
 - o Protecting forests-43%
- ☐ Additionally, 5 other adaptation activities that the respondents are presently involved in received similar responses (note: respondents could choose from multiple activities):
 - o Agricultural lands promoting soil carbon sequestration-35%
 - o Protecting oceans and coasts-33%
 - o Building resiliency in the human environment-30%
 - o Building resiliency in the natural environment-31%
 - o Promoting climate justice in adaptation-31%
- ☐ 56% of the respondents have been directly affected by climate change related disasters recently.

- 53% of the respondents did not address the issue of how soon should Chapters or Groups “take stock” of how impactful the disaster was on communities and/or organizations.
- 47% of respondents addressed the issue of how soon should Chapters or Groups “take stock” of how impactful the disaster was on communities and/or organizations.
 - 26% of those respondents felt that analysis should occur within first few days.
 - 47% of those respondents felt that analysis should occur after a month or so.
- 49% of respondents addressed how helpful national Sierra Club staff was in addressing the local disaster (41% did not address this issue).
 - Of the respondents that addressed this issue, 31/45 or 69% felt that national Sierra Club staff was not helpful, did not contact national SC, or did not know if they were helpful or not.

Overview

- Based on the survey results, a significant number of Club Chapters and Groups are currently working on and/or spending some of their resources on climate adaptation issues.
- Based on the survey results, there are significant climate adaptation activities already happening in the Club.
- Based on the survey results, the activities that are currently happening in the Club represent a broad area and directly align with the subgroups (for the most part) that are represented in this task force.
- Based on the survey results, a significant number of Club Chapters and Groups are directly impacted by local climate change related disasters.
- Based on the survey results, more than half of the respondents did not address how they should assess the local disaster and of those that did address it, there was a wide range of how soon that initial assessment should occur.
- Based on the survey results, a significant number of Club Chapters and Groups did not address how effective national Club staff was in assisting them with addressing their local disaster. Further, of those that did address that issue, most did not receive assistance.
- Some contact information is provided regarding those current activities, but may require additional QA/QC to ensure that successful contact can be made.

Adaptation Task Force roster

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NGO Landscape on Adaptation and CDR

This is far from comprehensive, but it lays out some of the major players based upon contacts we made throughout 2018. It helps us understand who is playing in which spaces. This list is primarily made up of players in US domestic space, as international players are too many to mention.

Amazon Watch. As name implies, active on international forest protection.

Arctic 21. Protecting Arctic from Climate Change. Supports SRM. Rafe Pomerance.

Arizona State University Center for Negative Carbon Emissions -- Klaus Lackner focuses on Direct Air Capture

Bellona EU -- Jonas Helseth -- focuses on carbon removal technology in Europe

Biodiversity Funders Group. Judy Hatcher Ex Dir. Biodiversity Funders Group is the premier professional association of foundation executives and trustees who make environmental grants. Our 77 member foundations focus on protection of the quality and diversity of life, domestically and internationally. We promote peer-to-peer learning and the sharing of knowledge among our foundation community. Biodiversity Funders Group is not a grantmaking organization and does not offer assistance to grantseekers.

Bipartisan policy center - Erin Smith does DAC leg affairs work

Blue-Green Alliance. Labor and environmental alliance working to enact and expand climate change and clean energy programs that provide family supporting/union jobs.

Breakthrough Strategies and Solutions, Betsy Taylor works on soil carbon

CalCAN - Renata Brillinger soil carbon policy in California

Carbon180 (formerly Center for Carbon Removal) Noah Deich Ex Dir in Oakland. Dedicated to CDR information analysis and exchange.

Carbon Capture Coalition: led by Great Plains Institute + C2ES (Brad Crabtree + Jeff Bobeck)

Carbon Cycle Institute, Torri Estrada, soil carbon policy in CA

Carolina Wetlands Association. Raleigh, NC. Promotes the importance and value of Southeastern, US, wetlands through science-based programs, education, and advocacy. Rich Savage President.

Carnegie Climate Geoengineering Governance Initiative. As name implies getting CDR and SRM governance right. Michael Thompson.

Center for Climate and Energy Solutions (C2ES) Jeffrey Bobeck, energy policy director. Promotes CCS through enhanced oil recovery and coal and gas plants and subsidies in 45Q.

Center on Global Energy Policy, Energy Futures Initiative, Columbia University, Julio Friedmann (formerly with DOE and Lawrence Labs, just published paper on DACs)

Center for American Progress (CAP), about to issue a paper in 2019 urging adoption of "Protect 30% by 2030" goal, touting climate adaptation/protection benefits of land and forests protection. Matt Lee Ashley leading that initiative.

Center for International Environmental Law. Think tank on CDR in Climate and Energy Program. Steven Feit.

Clean Air Task Force. Interested in all things climate and clean air. Deepika Nagabhushan is energy policy associate.

Clean Water Action. Interested in stopping dirty fuels while promoting CDR. John Noel director of O&G Program.

Climate Action Network - International. Stephen Singer, acting executive director, and senior advisor on global energy policies. Sierra Club is a founding member of CAN and active with both CAN-International and USCAN.

Climate Interactive. Developed detailed interactive model for emissions, CDR removal and impacts on CO2 concentrations and temperatures. Ellie Johnston.

Climate Justice Alliance. Coalition of front line impacted environmental justice communities and organizations. Presently opposed to all technological CDR approaches involving CCS.

Climate Nexus. Develops messaging around Adaptation and CDR. Hunter Cutting.

Coalition Agricultural GHG Emissions, Debbie Reed federal soil carbon policy

Conservation International. Research and public education and land protection. Have program on blue carbon.

Dogwood Alliance, Asheville, NC. Address US forests' biodiversity, unmanaged industrial logging, impacts of wood products, EJ issues; as well as, some international work associated with these issues. They also provide guidance to many Sierra Club Chapters, Groups, and Grassroots Network Teams regarding intact forest management,

messaging, and campaign strategies. In 2018 it issued a platform and call to action (to which the Sierra Club signed on) calling for greater investment in sound forest management as a climate adaptation and mitigation tool. Danna Smith Executive Director.

EcoAdapt. Think tank and networking center established by WWF alumni. Publishes CAKE (Climate Adaptation Knowledge Environment) and convenes periodic National Adaptation Forums. The President and Chief Scientist Dr Lara Hansen assisted the Sierra Club during Resilient Habitats Campaign and is now doing project on public health impacts of climate change.

Environmental Defense Fund. Interested in all CDR, especially BECCS. Joe Rudak lead senior scientist, Alex Hanafi, policy and legal.

Four per 1000 (4 per 1000). International soil carbon campaign led by French government..

Friends of the Earth. Founded by David Brower in 1969 after he stepped down as executive director of the Sierra Club. Has grown into an international network with national organization members in 75 countries. On domestic side, FOE-US is particularly active on soil carbon and Soil Not Oil network

Gigaton Strategies. Think tank on CDR with former Obama aide Rick Duke lead researcher.

Great Plains Institute The Minneapolis-based group works on technologies that help energy companies, labor unions, conservation organizations and energy state governors promote carbon capture and storage. A main advocate for 45Q subsidies for enhanced oil recovery, but also CCS attached to coal and gas plants.

Greenpeace. Active on forest protection and dirty fuels.

Gulf Restoration Network. Gulf Restoration Network is committed to uniting and empowering people to protect and restore the natural resources of the Gulf of Mexico Region.

Healthy Climate Alliance. Dedicated to promoting carbon drawdown and even SRM as an interim solution. Felix Cramer of ClimateChangesEverything.org is a primary player.

IEA GHG Program, International CCUS (including some negative emissions) analysis

Indigenous Environmental Network. Tom Goldtooth. Major player in Climate Justice Alliance and international coalition critical of REDD.

Institute for Carbon Removal Law and Policy. Think tank on CDR at American University. Simon Nicholson, Wil Burns, David Morrow. They coordinate loose NGO network on CDR post Wingspread.

Linden Trust for Conservation, Kate Gordon is Senior Advisor on CDR

Marin Carbon Project, Wendy Silver at UC Berkeley

National Audubon Society. Joined Carbon Capture Coalition, a group with industry promoting CCS to clean up dirty fuels.

National Collaboration for Equitable Renewal and Ecological Resilience is a national and regional collective grant making, social investment and resource-storing body for just rebuilding efforts. Works on grant making and social investment challenges and strategies in an age of community destruction by natural disaster and the predatory loss of public assets that often follows.

Natural Resources Defense Council. Active in DC and internationally. Attended CDR events at Climateworks and Wingspread in 2018. Aliya Haq

Oxfam. Active in international arena from justice and equity perspective. Attended Wingspread CDR conference. Sasanka Thilakasiri

Pembina Institute, Canadian NGO focused on carbon removal technologies, Jason Spitzer

Project Drawdown, focuses on natural solutions, Chad Frischmann

Rainforest Action Network. Active on forest protection particularly internationally.

RESOLVE. Consulting firm with contract to bring together NGOs. President Stephen D'Esposito used to work at Earthworks.

Rhodium Group, analysis on DAC, John Larsen

Rodale Institute. Active on soil carbon sequestration.

Soil Health Institute, soil carbon policy and research, Wayne Honeycutt

Southern Environmental Law Center (SELC), Chapel Hill and Asheville, NC. Work to ensure that industry meets State and Federal air and water quality standards; as well as, provide support to vulnerable communities and NGOs addressing intact forests, wetlands integrity, biodiversity, and their role in climate change solutions. Derb S. Carter Director of Chapel Hill Office.

Sunrise Movement. Leaders on promoting Green New Deal. Also promoting action on climate induced disaster relief. Will Lawrence, the group's partnerships director.

The Nature Conservancy -- Issued major report on land based CDR in the US in 2018. Local Chapters. Particularly in CA are active in land based CDR. Internationally they work on protecting biodiversity hot spots which also have CDR value. Work on agricultural land stewardship. Michelle Passero (CA)

Union of Concerned Scientists. Issued reports on CDR and attended CDR meetings in 2018. Active at international meetings on climate. Active on agriculture impacts to climate and tropical and US forest protection. Angela Ledford Anderson and Doug Boucher.

University of Michigan / Global CO2 Initiative, Volker Sick

US Green Building Council. Works for energy efficient buildings. Their LEED certification program includes neighborhoods, communities, and cities. Protecting green space is a priority.

Virgin Earth Challenge, UK innovation contest, David Addison

World Resources Institute. Issued a number of studies on CDR in 2018. Active at international meetings on climate. James Mulligan

World Wildlife Fund. Does research and international advocacy on wildlife, habitats and resilience. Christa Marie Anderson at Stanford University is active on CDR research and land availability for BECCS.

XPRIZE Foundation, US innovation contest, Marcius Extavour

Sierra Club Federal Policy Work on Resilience

Resilience: Major Policy Reforms are Needed at the Federal Level

Sierra Club's Climate Policy Director has been working on climate resilience by advocating for reforms in the supplemental disaster packages in response to hurricanes and wildfires and reforms to the National Flood Insurance Program. Specifically, the Sierra Club has been working for the last two years to ensure that the supplemental Disaster Funding and the Community Development Block Grants (CDBG) are allocated to projects that are designed to respond to the impacts of climate change and are implemented with a democratic process where local communities lead the direction of the projects. Further summaries of Sierra Club's advocacy on the National Flood Insurance Program and the Disaster reform packages can be found below. As was described, Sierra Club's Climate Policy Director works primarily with the Union of Concerned Scientists and a number of organizations working on this policy reform.

National Flood Insurance Program Reform

The National Flood Insurance Program (NFIP), which continually needs to be extended by Congress to prevent a lapse, is the single largest source of flood insurance for homeowners and small businesses with just over 5 million policies currently in force. The program has been on the General Accounting Office's High Risk list since 2006 and is over \$24 billion in debt. As flood risks grow around the nation due to Climate Change, it's time for Congress to reform and update this vital 50-year old program to better protect people and property. Without appropriate action, a warming climate coupled with rapid development in floodplains will raise the human and economic toll of flood disasters while taxpayer dollars are squandered on risky, business-as-usual investments. Last year's devastating hurricane season brought unprecedented flooding to Texas, Florida, and Puerto Rico, while this year, the nation has already seen terrible flooding across the Midwest; in Ellicott City, MD; and in California, demonstrating the importance of ensuring program continuity for flood-prone communities.

Congress has continued to pass extensions for NFIP, but has failed to include provisions to fix the persistent problems plaguing the program. The Sierra Club's Climate Policy Director and the federal policy program have been vocal on the need to not only extend, but also reform the NFIP program. When examining risks to flood-prone communities, it is also critical to consider the fact that many homeowners do not have insurance, for these individuals there is little that can be done after a flood. Communities (especially indigenous and native communities) of people who have been in their homes for generations and do not have mortgages and have not been able to afford additional insurance and are not required to buy flood insurance. The Union of Concerned Scientists has done extensive research in this area and has found in their report entitled *Encroaching Tides: How Sea Level Rise and Tidal Flooding Threaten US East and Gulf Coast Communities over the Next 30 Years (2014)* that in just the next 30 years hundreds of thousands of coastal homes and businesses worth billions of dollars will be at risk from chronic flooding worsened by rising seas.

The National Flood Insurance Program: What Reforms are Needed

The NFIP is also urgently in need of reforms to help put the program on a healthy financial footing and ensure that it encourages climate-smart choices. Sierra Club is working with the Union of Concerned Scientists and others in a coalition through the US Climate Action Network. As part of this process, this coalition recommends the following five ways to improve the program and promote climate resilience:

- Updating flood risk maps nationwide using the latest technology and to reflect the latest science, consistent with the recommendations of the Technical Mapping Advisory Council. Congress will also need to appropriate sufficient funds to make this possible.
- Phasing in risk-based insurance premiums and expanding the number of people carrying insurance to ensure adequate coverage for the growing numbers of homes exposed to flood risk, and to put the program on a more financially and actuarially-sound footing.
- Addressing affordability considerations for low- and moderate-income households through targeted vouchers, rebates, grants and low-interest loans for flood mitigation measures. FEMA's recently-issued affordability framework provides some useful guidance, as do reports from the National Research Council.
- Providing more resources for homeowners and communities to invest in reducing their flood risks ahead of disasters, including expanding funding for voluntary home buyout programs especially in places that flood repeatedly. Budgets for the Federal Emergency Management Agency's (FEMA) pre-disaster mitigation program and flood mitigation assistance programs should also be expanded.
- Ensuring that a well-regulated private sector flood insurance market complements the NFIP without undermining it, including mandating that private insurers contribute to flood mapping fees and provide coverage at least as broad as NFIP policies.

Supplemental Disaster Funding and Community Development Block Grant (CDBG) Implementation Reform

The Sierra Club has been working for the last two years to ensure that the supplemental Disaster Funding and the Community Development Block Grants (CDBG) that deliver most of the recovery dollars to states are allocated to projects that are designed to respond to the impacts of climate change and are implemented with a democratic process where local communities lead the direction of the projects.

Federal role in building disaster resilience

FEMA administers several programs aimed at helping states, territories, and tribal governments build back after disasters as well as invest in preparedness measures to reduce the risks and costs of future disasters. Key FEMA programs include:

- The **Hazard Mitigation Grant Program**, which helps communities implement measures to reduce long-term risks to people and property from hazards after a presidential major disaster declaration. The HMGP provides funding for a range of activities including voluntary home buyouts, home elevation and infrastructure retrofits and is generally 15 percent of the total amount of Federal assistance provided to a State, Territory, or federally-recognized tribe following a major disaster declaration.
- The **Flood Mitigation Assistance Grant Program**, which helps state and local governments fund projects and plans to reduce the long-term risk of flood damages for properties insured by the National Flood Insurance Program.
- The **Pre-disaster Mitigation (PDM) Grant Program**, authorized by the Stafford Act to help states, local governments, and communities implement long-term measures to reduce the risks and losses from disasters. Typically, FEMA pays for 75 percent of project costs and states match the remaining 25 percent. The funding for this program has been increased in the most recent omnibus budget four fold so this is clearly an area of need in the states.
- FEMA's budget for **flood risk mapping** is also vital to ensuring that communities, planners, and policymakers are aware of these risks and can take protective measures to limit them.

The Department of Housing and Urban Development (HUD) runs the **Community Development Block Grant (CDBG) program**, especially the **CDBG-Disaster Recovery** grants, are instrumental in helping low and moderate-income communities—often the hardest hit by disasters—prepare, recover and build resilience. As we know our nation has long underfunded public housing. Despite repeated attempts by the Trump administration to cut agency budgets, including FEMA and HUD's, Congress has recognized the importance of their work for the well-being of the American public, and has maintained or increased funding levels. Unfortunately, funding still remains much below what is needed by communities, especially as the impacts of climate change worsen.

Disaster Recovery Reform Act of 2018

On Oct. 5, 2018, President Trump signed the Disaster Recovery Reform Act of 2018 into law as part of the Federal Aviation Administration Reauthorization Act of 2018. According to the bill sponsors, these reforms acknowledge the shared responsibility of disaster response and recovery, aim to reduce the complexity of FEMA and build the nation's capacity for the next catastrophic event. The law contains more than 50 provisions that require FEMA policy or regulation changes for full implementation, as they amend the Robert T. Stafford Disaster Relief and Emergency Assistance Act. For more details please contact Liz Perera, Climate Policy Director.

Preparedness. Resilience in urban, suburban and rural environments

Community education/outreach and individual actions (behavioral changes related to adaptation).

Members: Colleen Kaelin, Warren Lavey, Janice Meier, Bob Murphy, Liz Perera, Al Tilley, and James Woodley

1. What are the major opportunities for adaptation in this area?

- A. The climate change conversation is changing. Adaptation has joined mitigation as a major concern. In 2017, chapters and groups in the Sierra Club responded to hurricanes Harvey, Irma, and Maria, and to major wildfires in California and other states. Equity issues are receiving increased attention. Recent studies indicate that over 4,600 people died in Puerto Rico because of Hurricane Maria and the island's loss of infrastructure.
- B. Immigration concerns are part of the climate change discussion. Climate change refugees are moving into the United States and other prosperous nations. On June 30, 2018, the Sierra Club mobilized its members in support of immigrants. The Sierra Club's board of directors has called for immigration law reform.
- C. This is what climate change looks like. Forest fires, storms, and floods will become more frequent and more severe, if the climate change problem develops. Millions of people will move towards prosperous and protected areas. Immigrants and other vulnerable groups will often be abused. In the new climate change discussion, the Sierra Club is asked to join with other organizations to help care for the entire planet. As we adapt to this new environment, we will be asked to care for all communities, not just a privileged few.
- D. We ask Sierra Club leaders to "think outside of the box," as they prepare adaptation strategies. The Sierra Club will have to work with funders and agency administrators who have not worked with environmental protection organizations in the past. The list includes health care organizations and advocates for some of the high risk groups that will suffer because of the impact of climate change.
- E. We need to ask, "Who will be abused or marginalized during emergencies? Who can we help?" The list includes the very young and the elderly, people in racial and ethnic minority groups, people with disabilities, immigrants and migrants, and many of the people in the LGBTq community.

Preparedness or resilience encompasses a wide range of activities.

The Subgroup members identified the following as major opportunities:

- A. Advocating for and assisting in developing community climate vulnerability assessments, through engagement with local residents, businesses, governments, and other community groups;
- B. Assisting in developing community climate adaptation action plans, with local stakeholder engagement;

- C. Supporting activities for environmental protection, biodiversity conservation, and animal care in adaptation planning and emergency services;
- D. Working with local governments and other community stakeholders to implement community climate adaptation action plans;
- E. Working with national and community groups in responding to climate-related disasters (hurricanes, wildfires, droughts, heatwaves, floods, and others), including organizing service trips;
- F. Conducting public education programs associated with community-specific threats from climate change and individual actions that decrease risks;
- G. Encouraging State and local policy makers to communicate climate change risks to their respective communities, and setting zoning and building regulations in line with those risks;
- H. Working with groups to assist elderly, people with disabilities, low-income and minority communities, and other vulnerable groups in preparedness and response to disasters;
- I. Working with groups to assist temporary migrants (climate refugees) displaced by disasters;
- J. Strengthening the planning and capabilities of public health departments, hospitals and other healthcare providers to respond to the health impacts of climate change, operate during disasters, and support community actions to decrease health risks;
- K. Improving preparedness for heavy rains and flooding through the federal flood insurance program and floodplain mapping and relocation programs; and
- L. Increasing the capacity of sewer infrastructure, groundwater aquifer replenishment and protection against contamination programs, and other coastal and inland programs.
- M. Sierra Club's public education presentations could include climate change preparedness, especially describing actions to protect vulnerable groups and environmental justice. For example, Sierra Clubs could partner with organizations like the North Carolina Coastal Federation in public education on hurricane preparedness and risks to vulnerable groups.
- N. Sierra Club Chapters and Groups could partner with emergency response organizations (including FEMA) for community recovery from disasters.
- O. Sierra Club volunteers could assist in managing emergency shelters.
- P. Sierra Club Chapters and Groups could assist with the long-term needs of residents and refugees after many relief efforts end.
- Q. Sierra Club volunteers could work with the elderly, people with disabilities, migrants, and other high risk groups to improve access to emergency services.
- R. Sierra Club volunteers could support or assist wildlife rescue, animal care, and habitat protection and restoration.

- S. Sierra Club Chapters and Groups could work with city councils, utilities, hospitals, and other major stakeholders on assessing climate change risks, identifying vulnerable groups, and planning for disasters.
- T. Sierra Club Chapters and Groups could work on policies for climate change preparedness.
- U. Sierra Club Chapters and Groups could work with governments on laws and programs to promote forests, infrastructure improvements, and permaculture.
- V. The Sierra Club could endorse the United Nations' Sustainable Development Goals.
- W. Sierra Clubs could partner with forest advocacy groups, such as the Dogwood Alliance and the Audubon Society.
 - a. Such partnerships could promote public understanding of the benefits of trees for climate change mitigation and adaptation; as well as promote actions to reduce deforestation and forest degradation; along with efforts to enhance urban forestry.
 - b. Such partnerships could also increase awareness of the importance of biodiversity.
- X. Sierra Club members could join municipal and county environmental, community health, and resilience advisory committees.
 - a. On these committees, Sierra Club members could promote actions for climate change preparedness and environmental justice.
 - b. Many such committees do not have participation by environmental groups.

2. What is the potential for significant carbon drawdown?

Some preparedness activities would sequester carbon from the air or decrease carbon emissions.

- A. For example, community climate adaptation plans may include planting trees and protecting wetlands to reduce urban heat islands or flooding, which would also sequester carbon.
- B. Another illustration may include public education programs which could promote actions for households to improve the insulation and other energy efficiency of homes, which would reduce carbon emissions.
- C. Many important preparedness activities do not target significant carbon drawdown. Some examples may include planning evacuations in response to hurricanes, flooding or wildfires, or increasing public education on actions for health and safety during heatwaves.

3. What kind of Sierra Club activity is already happening in this area?

- A. The project that was especially impressive in the past involved the Sierra Club response to Hurricane Katrina in New Orleans. Darryl Malek-Wiley coordinated much of the Sierra Club work in New Orleans. The New Orleans Group was active, but this was a national Sierra Club project that continued with national

participation for at least ten years. It may be the best example of national Sierra Club involvement in local adaptation work.

- B. From the survey of Chapters, about half of the Chapters participated in work on city or state climate adaptation plans. Many chapters worked on climate adaptation in diverse sectors – forests, agriculture, coasts, grasslands, and human environment. To add to the insights from the survey of Chapters, the Preparedness Subgroup collected descriptions of experiences of our members on this issue.
- C. Some of the highlights of the personal stories described in the Appendix are: Sierra Club volunteers could advance local preparedness by partnering with groups like the American Red Cross as first aid trainers.

4. What other groups are already working in this area?

- A. Voluntary Organizations Active in Disaster (VOAD) is the major coalition of organizations involved in emergency services work. VOAD has 110 member organizations, including organizations like the American Red Cross; Islamic Relief; the Jewish Federations; etc., etc. VOAD has a memo of understanding with FEMA. The VOAD agencies focus most of their attention on human suffering. Some agencies are involved with animal rescue (mostly domestic animals.) I haven't identified any VOAD members that recognize environmental protection work as being a major concern.
- B. The Livable Communities program emphasizes the need to develop communities that are friendly to older people and people with disabilities. Access to community services is a major concern. Some Sierra Club groups have been involved with Livable Cities projects, because of the attention given to public transportation, pedestrian and bicycle needs, energy efficient homes, etc.
- C. The Centers for Disease Control and Prevention (CDC) funded the Healthy Communities Program for several years. The program is no longer functioning. However, some of the reports developed as part of the program are helpful.

5. What funders if any, are funding in this area?

Sierra Club should be eligible for numerous substantial climate adaptation educational grants. There may also be opportunities for re-granting to eligible SC Chapters and Groups; as well as, partnerships with other NGOs and educational institutions. Even though the Sierra Club, by policy, does not go after Federal grants or grants from Federal Agencies, the grant opportunities listed under each Federal agency may be appropriate to provide to eligible allies in a tool kit.

There are Federal granting registers that provide information, forms, and support for competing for substantial Federal grants. These registers have a process for eligibility determination, particular grant access, webinars and training materials for grant writing, and forms.

Some registers include:

- A. Grants.gov (www.grants.gov)
- B. Catalog of Federal Domestic Assistance (CFDA) (www.cfda.gov)
- C. USA Grant Connect (www.usagrantconnect.com)

Federal Agencies Grants:

[likely not applicable to SC's work, but may be a valuable resource to allies]

- A. NOAA (www.noaa.gov search "climate change adaptation grants"). There are many climate adaptation grants available targeting State, NGOs, Educational Institutions, private businesses, and communities.
- B. EPA (<https://www.epa.gov/arc-x/epa-grants-and-assistance-agreements-awards-supporting-climate-adaptation> examples of recently funded grants). EPA provide climate adaptation grants to various entities supporting many types of climate adaptation activities including those focusing on environmental justice and climate adaptation resiliency within minority communities.
- C. Fish and Wildlife Service (www.fws.gov and search "climate change adaptation grants"). Fish and Wildlife Service within the Department of Interior offer climate change adaptation grants to a variety of types of potential grantees for wildlife conservation and adaptation issues.
- D. Army Corp of Engineers ([www.usace.army.mil/corpsclimate/Climate Preparedness and Resilience](http://www.usace.army.mil/corpsclimate/Climate_Preparedness_and_Resilience)). Army Corp of Engineers have developed general resources for addressing climate change adaptation and made them available to the public. Most of their work is associated with sea level rise and coastal management. The Corp also address erosion issues for ports and waterways. On their website, they provide climate preparedness and resilience information as well.
- E. US Dept. of Agriculture (USDA) ([www.usda.gov/oce/climate change/](http://www.usda.gov/oce/climate_change/) search for climate change adaptation grants). USDA provide grants to States and other entities to address conservation, research, implementation, and education associated with climate change adaptation in forestry, farming, and other agricultural services.
- F. US Dept. of Housing (HUD) (www.hud.gov search for climate change adaptation grants). HUD provides a variety of grants to address housing issues associated with climate change adaptation. They have provided grants associated with Native American housing and community development issues.
- G. US Dept. of Transportation (www.transportation.gov search for climate change adaptation grants). US Dept. of Transportation offer grants to local governments and States to address infrastructure needs due to climate change adaptation. This may be helpful for Chapters and groups to understand funding availability for infrastructure support.

State Granting Registers:

- A. There are probably State-specific granting registers or filters to support SC Chapter and Groups granting opportunities.
- B. For example in NC they include: NC Grant Watch (www.northcarolina.grantwatch.com)

State Granting Programs:

- A. Most States have granting programs that support the work of NGOs addressing Climate Change Adaptation. They are usually found in similar departments as those listed for the Federal granting sector. For example, in North Carolina such information can be found at www.deq.nc.gov and search for climate change adaptation grants.
- B. Also, such information may be useful in providing SC Chapters and Groups resource options for helping particular areas of their state address climate change adaptation issues.

Potential Grants from Other NGOs, Foundations, and Networks:

- A. United States Climate Action Network (USCAN) (www.usclimatenetwork.org). Member to the network requires submittal of an application, review by member organizations (160+), attend annual meetings, participate in network activities, pay a fee based on 990 info, and attain eligibility to receive in-house and other grants. Sierra Club is already a member.
- B. Foundation Center (www.foundationcenter.org). The Foundation Center provide public access to essential information about over 100,000 foundations and over 250,000 IRS forms 990 PF.

6. Which political forums does this play out in? Local, state, regional, national, international?

Although Adaptation needs to be locally tailored to the specific community, the answer is **all of the above**.

- A. Internationally: To begin, there is an equity dimension to adaptation that is born in the prioritization of action between mitigation and adaptation. That question demands to be dealt with in the International sphere of the UNFCCC Adaptation climate negotiations. The forum is in place as part of the Paris agreement, and, in general the UNFCCC has chosen to provide support to adaptation and mitigation on an equal basis. However while that seemingly good outcome is pretty much in place, the reality is that projects get support based on many factors, the most important of which is access to finance.
- B. Nationally: Leadership from the White House is unlikely, but the US national climate survey can help to inform the regions covered by the report to understand which regions may have similar concerns.
- C. Regionally: There is, in general, good synergy of needs among the regions of the developing world, which gives incentive to countries in the various regions of the world to work cooperatively. In the NW US, there has been sharing, for example, grid initiatives to protect users from power outages. (Fred Heutte can speak to that.)

- D. Locally: The local community is the final frontier in which goals must be set in alignment with all segments of the community. This requires a generally lengthy process that must include everyone's view as well as addressing any trade-offs among goals. It may well require advice from paid experts as to what those trade-offs might be. And that may well lengthen the timeline.

7. Are there specific geographic locations for focus?

Each season is becoming increasingly warmer. Also the US can be divided into the following geographical areas with additional clarifications possible. The importance of the geographical classifications could be in requesting that Federal, State, and/or local climate adaptation plans accurately characterize potential measures needed for protection of populations in their jurisdictional area. For example some areas could be classified as coastal, urban, and southeastern, such as Miami, FL.

Areas of focus, how data should be presented, questions:

- A. The areas of focus would be those geographical areas that have a Sierra Club presence or should have such a presence. This strategy may allow for potentially more effective actions addressing a particular issue in a specific geographical area.
- B. The majority of the listed geographical areas will have similar climate change impacts requiring the same type of adaptive measures. However, most of these geographical areas, depending on the season, can have climate change impacts that will require unique adaptive measures. Should we focus on the unique measures? Should we prepare a table?

Northeast

- A. Climate events include: heat waves, extreme weather, and sea level rise.
- B. Climate impacts: infrastructure, including water supply, drainage, power, and transportation systems (true for all regions) agriculture, fisheries, ecosystems; relocation of at-risk populations (true for all regions); loss of state revenues (true for all regions); destabilization of local, regional, and state government (true for all regions) and erosion.
- C. Future Facts (from Underwater: Rising Seas, Chronic Floods, and the Implications for US Coastal Real Estate, 2018).
 - a. Within 30 years, approximately 62,000 homes off the coast of New Jersey will be at risk of chronic flooding.
 - b. Ocean City may have at least 7,200 homes damaged due to constant flooding during that 30 year period.

Southeast

- A. Climate events include: heat waves, extreme weather, sea level rise, storm surges, flash flooding and chronic inundation.
- B. Climate impacts: infrastructure, agriculture, fisheries, ecosystems, potable water availability, health, energy use, and erosion.

- C. Future Facts (from Underwater: Rising Seas, Chronic Floods, and the Implications for US Coastal Real Estate, 2018).
 - a. Within 30 years, approximately 64,000 homes off the coast of Florida will be at risk of chronic flooding.
 - b. Of those homes and in that period, Miami Beach is projected to have more than 12,000.

Midwest

- A. Climate events include: heat waves, extreme weather, lake-effect events, and flooding.
- B. Climate impacts: infrastructure, agriculture, forestry, fisheries, ecosystems, potable water availability, health, transportation, air and water quality, and erosion.
- C. Future Facts:
 - a. Climate change impacts affect the Great Lakes' fisheries, tourism, and recreation.

Southwest

- A. Climate events include: heat waves, extreme weather, constant high temperature (spring-fall), wildfires, drought, insect outbreaks, flooding and in coastal areas.
- B. Climate impacts: infrastructure, potable water supply, agriculture, erosion associated with flooding, and fisheries and ecosystems in coastal areas.
- C. Future Facts (from Underwater: Rising Seas, Chronic Floods, and the Implications for US Coastal Real Estate, 2018).
 - a. In nine counties surrounding the San Francisco Bay, 13,000 homes worth about \$8.6 billion are at risk of chronic inundation within the next 30 years.
 - b. This represents approximately 33,000 people that may need to relocate if adaptive actions are not in place and effective.

Northwest

- A. Climate events include: heat waves, extreme weather, stream flow variations due to ice and glacier melting, inundation, ocean acidity, sea level rise, wildfires, and flooding.
- B. Climate impacts: infrastructure, agriculture, fisheries, marine ecosystems, potable water supply, forestry and tree-diseases resulting in tree die offs, insect outbreaks, and erosion.
- C. Future Facts (from Underwater: Rising Seas, Chronic Floods, and the Implications for US Coastal Real Estate, 2018).
 - a. Oregon and Washington are states that within the next 30 years, 60% of the homes at risk of chronic inundation are projected to be below the state median home value.

Alaska

- A. Climate events include: sea ice and glacier melting, sea level rise, thawing permafrost, inundation, ocean acidity, and wildfires.
- B. Climate impacts: infrastructure, agriculture, fisheries, marine ecosystems, erosion, wildlife habitats, and recreation and tourism.
- C. Future Facts (from Climate Change and Alaska Fisheries, 2016, www.alaskaseagrant.org/wp-content/uploads/2018/02/Climate-Change-and-Fisheries_Johnson_WEB.pdf).
 - a. Alaska is home to nation's largest commercial fisheries (\$1.5 billion annually) which drives about \$5.8 billion in annual economic activity.
 - b. Alaska's oceans (Pacific and Arctic) provide more than \$1 billion in recreation and tourism annually.

Hawaii

- A. Climate events include: higher ocean temperature, increased ocean acidity, heavy downpours, and sea level rise.
- B. Climate impacts: infrastructure, agriculture, fisheries, erosion, marine and wildlife ecosystems, coral bleaching and diseases, food and water security, health and safety, saltwater intrusion into freshwater aquifers, and human migration to States.
- C. Future Facts (from Impacts of Sea Level Rise, 2016, www.climateadaptation.hawaii.gov/impacts-of-sea-level-rise/)
 - a. Waves from four dominant sources impact Hawaii coasts year round resulting in storm surges.
 - i. North Pacific swell in winter months,
 - ii. South Pacific swell in summer months,
 - iii. Easterly trade wind waves year round, and
 - iv. Southerly "Kona" storm waves.

Other Geographical Classifications

Below are additional classifications that will need to be considered how they should be part of the discussion. (for example: a Southeastern, coastal, urban area such as Miami Fla.)

Coastal

- A. Climate events include: heat waves, extreme weather, sea level rise, storm surges, inundation, and flooding.
- B. Climate impacts: infrastructure including ports, agriculture, fisheries, wildlife and marine ecosystems, potable water supply, water quality, energy, tourism, human migration to inland areas, health, and erosion.
- C. Future Facts (from Underwater: Rising Seas, Chronic Floods, and the Implications for US Coastal Real Estate, 2018).

- a. There are 23 coastal states representing nearly 13,000 miles of coasts are associated with oceans.
- b. There are 7 additional states surrounding the Great Lakes.
- c. There are 10 additional states surrounding Mississippi River corridor within the US.
- d. There are 4 US Territories completely surrounded by oceans.
 - i. Puerto Rico, The Virgin Islands, and Caribbean Islands have recently experienced climate change and disaster situations, how should we address those in this piece?
- e. Within 15 years, approximately 147,000 existing homes and 7,000 commercial properties located near coastal areas of the US and currently worth over \$63 billion will be at risk of chronic flooding.
- f. About 280,000 people who live in those areas today will have to adapt or relocate.

D. Urban

- A. Climate events include: heat waves, extreme weather, sea level rise, storm surges, inundation, flooding, and drinking water availability.
- B. Climate impacts include:
 - a. Infrastructure issues are profound since they potentially affect significant quantities of people including the elderly, people with disabilities, children, and impoverished families.
 - b. Building standards upgrade is required.
 - c. Public transportation issues can be significant.
 - d. Relocating mass number of people during significant climate event or chronic inundation.
- C. Future Facts (from Houston Looks to Nature to Rebuild After Harvey, Houston Chronicle, June 2018).
 - a. After Hurricane Harvey pummeled Houston in 2017, adaptation efforts include the requirement of FEMA funded rebuilt homes to be elevated 2 feet above the 500 year flood plain.
 - b. Additional adaptation efforts include converting a golf course into a wetlands and incorporating retention ponds in the area.
- D. Over 200 cities within US has adopted a Cool Cities initiative which includes 4 actions agreed to by Mayor.
 - a. Take Cool City Pledge with the US Mayors signing a Climate Protection Agreement.
 - b. Conduct a Global Warming Emissions Inventory.
 - c. Create a Solutions Plan to reduce emissions.
 - d. Implement and Monitor progress.

Rural

- A. Climate events include: heat waves, extreme weather, sea level rise, storm surges, inundation, flooding, and drinking water availability due to groundwater contamination.
- B. Climate impacts include:
 - a. Infrastructure issues are significant.
 - b. Building standards upgrade is required.
 - c. Eroding tax base based on property value decline.
 - d. Declined residential services.
 - e. Accepting mass influx of coastal and storm disaster refugees referred to as climate refugees.
- C. Future Facts (Hurricane Matthew, October 2016)
 - a. Many NC counties impacted and families relocated because of flooding in rural areas.
 - b. A significant number of those families are still climate refugees.

Mountain Range Areas

- A. Climate events include: heat waves, heavy downpours, and flash flooding.
- B. Climate impacts: infrastructure, agriculture, fisheries, ecosystems, and erosion.
- C. Future Facts (from Climate Change in Mountain Ecosystems, www.usgs.gov/centers/norock/science/climate-change-mountain-ecosystems-ccme?qt-science_center_objects=0#qt-science_center_objects).
 - a. Glaciers and ice melting because of higher temperatures cause variable stream water volume, change in water temperature, and runoff timing.
 - b. These changes may have significant impacts on ecosystems especially the aquatic animal nurseries.

Great Plains

- A. Climate events include: heat waves, extreme weather, constant high temperature (spring-fall), and drought.
- B. Climate impacts: potable water availability, agriculture, health, and wind erosion.
- C. Future Facts (from Global Climate Change Impacts in the US, 2009, www.nca2009.globalchange.gov/great-plains/index.html).
 - a. Highly variable temperature change within the seasons from North Dakota to Texas.
 - b. Current water use in the Great Plains is unsustainable, as the High Plains aquifer continues to be tapped faster than the rate of recharge.

Southern Piedmont

- A. Climate events include: heat waves, extreme weather, and flash flooding.
- B. Climate impacts: potable water availability, agriculture, health, forestry, erosion, public services reduced and infrastructure issues.
- C. Future Facts (from Hurricane Matthew, October 2016, www.fema.gov/disaster/4285).
 - a. In North Carolina 44 of the 100 counties suffered significant damages.

- b. FEMA estimates that there were 29,000 approved assistance applications for about \$99 million and a total of nearly \$285 million in public assistance grants.

8. What are most important summary documents or experts we should be aware of?

Non-Governmental Organizations

- A. NAACP specifically addresses equity and resiliency within minority communities associated with climate change adaptation policies.
(www.naacp.org/search/?q=climate+change+adaptation)
- B. Underwater: Rising Seas, Chronic Floods, and the Implications for US Coastal Real Estate provides a comprehensive analysis of the potential impacts of sea level rise and flooding associated with US coastal states and their communities. It focuses on commercial and private sector real estate, alluding to a decline in tax base for local governments, a shortage of affordable housing for minorities, possible climate refugees, and a decline in livable space in particular coastal areas. (www.ucusa.org/underwater)

Federal Government Climate Adaptation Plans

In 2014, the Federal Government Climate Adaptation Plans were developed, by an Executive Order mandate, to ensure that their specific missions to serve the US public and provide support to the International communities include issues associated with climate change. Since most of the plans are developed for a 5 year span and most of the listed plans are at the 4 year stage, if there are particular parts of the plan that is not being implemented; articulating those issues to the agencies before the new plan is finalized is critical. Also, those agencies will be held accountable and will work to ensure that they are doing what they have laid out to do. On the other hand, if an area of the plan is very effective, the agency should also be told that.

- A. EPA's Climate Adaptation plan describes how the agency plans to integrate climate adaptation into its programs, policies, rules, and operations (US Environmental Protection Agency Climate Change Adaptation Plan, 2014, EPA 100-K-14-001).
- B. Global Climate Change Impacts in the United States addresses climate change adaptation comprehensively. It was sponsored by the Executive Office of the President of the United States along with NOAA.
(www.globalchange.gov/usimpacts) (Global Climate Change Impacts in the United States, US Global Change Research Program, 2009).
- C. The National Fish, Wildlife, and Plants Climate Adaptation Strategies overarching goal is "to inspire, enable, and increase meaningful action that helps safeguard the nation's natural resources in a changing climate
(www.wildlifeadaptationstrategy.gov)
- D. NOAA's Adaptation to Climate Change: A Planning Guide for State Coastal Managers developed by NOAA in 2010. This document address climate change

associated with coastal areas. It lays out the potential impacts, the planning process, vulnerability assessments, the plan, and implementation guidance. (www.coastalmanagement.noaa.gov/climate/adaptation.html)

- E. The U.S. Department of Transportation Climate Adaptation Plan 2014 Ensuring Transportation Infrastructure and System Resilience lists many potential impacts to climate change including damage to infrastructure such as roads, railways, and bridges due to increased temperature, inundation, and storm surges (www.transportation.gov search for climate change adaptation plans).
- F. The US Dept. of Agriculture Climate Change Adaptation Plan (June 2014) incorporates into its mission of service to the American public goals for addressing farming, forestry, water quality and wildfires during periods of drought, inundation, extreme weather, erosion, and sea level rise www.usda.gov/oce/climate_change/adaptation/USDA_Climate_Change_Adaptation_Plan_Only.pdf).
- G. [USDA_Climate_Change_Adaptation_Plan_Only.pdf](http://www.usda.gov/oce/climate_change/adaptation/USDA_Climate_Change_Adaptation_Plan_Only.pdf)).
- H. The US Dept. of Housing and Urban Development Climate Change Adaptation Plan (2014) builds into its mission of service to their grantees and American public by addressing the vulnerabilities of communities to climate change. It ensures that “the lives of the vulnerable and disadvantaged are not only considered but improved” (www.hud.gov/program_offices/economic_development/resilience/plan).
- I. The US Dept. of Health and Human Services is supporting a climate resilient healthcare infrastructure. The 2014 Environmental Justice Implementation Progress Report has a section addressing climate change adaptation. It states that the CDC is supporting a public health professional training effort based on the CDC’s “Building Resilience Against Climate Effects (BRACE) through its Climate Ready States and Cities Initiative” (www.hhs.gov).

State and Local Governments Climate Adaptation Plans

- A. Most States have climate change adaptation plans and other information specific to its geographical location, seasonal variations, and other pertinent state-specific nuances. For example, in North Carolina such information can be found at www.deq.nc.gov search for climate change adaptation.
- B. County, City and local governments within the US have Climate Change Adaptation Plans. For example in North Carolina’s Pitt County and the City of Greenville has adopted the “Cool Cities” initiative and is addressing its carbon footprint through energy and water conservation policies, no idling policies for public transportation and school buses, and converting its fleet of public transportation vehicles into hybrids that utilize less fossil fuels.

9. Are there key justice and equity concerns we should be aware of? Are there environmental justice groups or individuals we should consult with on this topic?

- A. Even though most recently adopted climate change adaptation plans articulate the need to ensure that the most vulnerable communities receive proper support, recent history does not support that will happen. Traditionally, minorities

including people of color, Native Americans, the disabled, and the elderly have not been treated justly regarding FEMA distribution of pay outs after disasters nor the availability or affordability of flood insurance in low income neighborhoods. The Sierra Club could use its considerable reach to hold these financial entities accountable. The NAACP (found at www.naacp.org/search/?q=climate+change+adaptation) can provide additional information regarding recent issues regarding FEMA distributions and flood insurance availability for low income and vulnerable US neighborhoods.

- B. According to “Underwater: Rising Seas, Chronic Floods, and the Implications for US Coastal Real Estate (2018)” found at (www.ucusa.org/underwater):
- a. Nearly 175 communities with at least 10 percent of their homes at risk nationwide can expect significant chronic flooding by 2045 with about 40% of them having poverty levels above the national average. The largest share of these communities are located in the Terrebonne Parish communities in Louisiana where about one-third of its residents are living in poverty and half or more are African American.
 - b. North Carolina, New Jersey, and Maryland also have significant numbers of communities at risk for chronic flooding by 2045 which are above the national average rate of poverty.
 - c. There are 400 US communities with at least 50 homes at risk of chronic flooding by 2030 and about 60% currently have large populations of elderly people.

10. Are there positive or negative environmental concerns or choices we need to be aware of?

- A. Diesel generators, which are often used after disasters when the electricity grid is not operational, emit air toxins. Distributed electricity generation, including rooftop solar power systems, can decrease power outages and the use of diesel generators.
- B. Nature-based systems, which can be used to decrease flood and heat risks, can have environmental benefits such as habitat for pollinators and other wildlife. They can also provide parks for human exercise and recreation.
- C. Higher-density housing can be a part of preparedness planning, such as in locating people outside of floodplains and with access to air conditioning. This feature can also allow for more open spaces.

11. Is the action consistent with Sierra Club policy?

The Sierra Club's Board of Directors adopted several policies relevant to climate change adaptation (including preparedness.)

What follows is a list of some of the important policy statements that need attention in the adaptation discussion.

- A. EARTH CHARTER: The Board of Directors endorsed the Earth Charter on May 20, 2000. The Board affirmed the Club's desire "to bring forth a sustainable global society founded on respect for nature, universal human rights, economic justice, and a culture of peace."
- B. ENVIRONMENTAL SECURITY: Policy statement about Environmental Security adopted by the Board in November, 1981. "A secure and sustainable global environment is an intrinsic part of universal human rights and is indispensable to a sustainable society."
- C. ENVIRONMENTAL JUSTICE: Policy statement about environmental justice adopted by the Board in September, 1993. "The Board of Directors of the Sierra Club recognizes that to achieve our mission of environmental protection and a sustainable future for the planet, we must attain social justice and human rights at home and around the globe."
- D. POPULATION POLICY: Policy statement adopted on May 21, 2017. "The Sierra Club seeks a sustainable planet where all living beings have a clean, healthy environment." The need for gender justice and improved health care and social services is recognized.
- E. AGRICULTURE AND FOOD: Policy statement adopted on February 28, 2015. "The Sierra Club supports agricultural policies and practices designed to provide abundant healthy food, fiber, and other services to all communities while maintaining the fertility of the soil and protecting the Earth's climate and the natural diversity of plants and animals."
- F. TRANSPORTATION: Policy statement adopted in February, 1994, and amended in May. Statement recognizes the need "to provide everybody, including pedestrians, bicyclists, and others, with adequate access to jobs, shopping, services, and recreation." Guidelines for Sierra Club involvement in transportation planning are presented.

12. Any other key questions relevant to your area?

- A. How can we integrate the work of the Preparedness Subgroup, the Adaptation Task Force, Sierra Club national initiatives, and local Sierra Club chapter activities?
- B. How can we align our recommendations as a national Task Force to make adaptation planning geographically specific, locally driven, and reflective of the work of Sierra Club chapters?
- C. How can the Sierra Club integrate with local stakeholders for adaptation planning and activities, and not be viewed as an outsider?
- D. Although we have the mission of addressing climate adaptation activities, we recognize that we need to take an integrated view for climate adaptation and mitigation activities. In addition to supporting some carbon drawdown actions, climate adaptation actions can raise community awareness of the need for climate mitigation actions. How should our mission and recommendations reflect the integration of climate adaptation and mitigation?

- E. Some preparedness actions (such as building sea walls) are contrary to sustainability principles and ultimately doomed as large-scale strategies. Can the Sierra Club help planners integrate sustainability analysis into the evaluation of adaptation options?

13. Ultimately we want to see what part of this might be particularly ripe for Sierra Club engagement and influence. Since we can't do everything, we will need to make recommendations of most promising forums and issues to engage in, so deciding what not to do is also important. Your advice about the relative priority for Sierra Club engagement, pro and con, will be very valuable.

- A. Climate change preparedness has become central to Sierra Club's mission and activities. The Sierra Club needs to focus on its role in preparing for these threats and trying to manage these impacts.
- B. We are on the brink of enormous dislocations of people and businesses because of climate change. All communities are feeling the impacts of climate change, and these effects will worsen. For some communities, including those experiencing more frequent flooding, wildfires and hurricanes, the Sierra Club can't do any of its work without addressing climate change impacts.
- C. The Sierra Club has responded to several individual climate-related disasters. Along with responding on a case-by-case basis, the Sierra Club needs to prioritize getting all communities involved in adaptation planning and remedial actions.
- D. Adaptation planning and implementation must be locally driven. The Sierra Club chapters are critical for leading local adaptation efforts, developing community-appropriate plans, and working with local stakeholders. The national organization can provide guidance on priorities and processes, tools for assessments and plans, and expertise in evaluating opportunities.
- E. The challenges of climate change to low-income, minority, disabled, and other vulnerable people provide an opportunity for the Sierra Club to broaden the reach of its membership to become more inclusive. The Sierra Club must ensure that the process and implementation of its work on climate change adaptation reflects equity, inclusion and justice for all communities.
- F. The Sierra Club's membership base is its strength. In some communities, key stakeholders for adaptation planning are current members of Sierra Club chapters.

14. What are the implications for providing good paying family-sustaining and/or union jobs and a just transition as part of deployment of this type of program?

Preparedness for climate adaptation will create many good paying union and other jobs, such as in rebuilding infrastructure, restoring wetlands, developing state and city adaptation plans, training service workers, and communicating best practices to residents and businesses.

Appendix

Personal Experiences: Opportunities for Sierra Club in Climate Change Preparedness Activities

Bob Murphy

My first Sierra Club experience with preparedness was in 1979 with the New England Chapter. The chapter and the Greater Boston Group were active in creating what is now the Boston Harbor Islands National and State Park. I was one of the volunteers who helped to establish the educational programs for the islands. Volunteers needed first aid training. I trained with the American Red Cross to become a first aid trainer. I taught the basics to Sierra Club leaders and other volunteers. It was a successful preparedness program. Sierra Club people who were working with the public received first aid training.

I moved to the Outer Banks of North Carolina during the 1990s. I volunteered to assist the Red Cross, received training and certification, and managed emergency shelters during hurricanes Bertha, Fran, Dennis, and Floyd. The Sierra Club was not involved in preparedness or hurricane response activities in North Carolina. However, after Hurricane Floyd, chapter and group leaders began to mention hurricanes in presentations about climate change. The destruction of hog waste lagoons was mentioned in Sierra Club publications. The North Carolina Coastal Federation began to mention the importance of environmental justice.

In 2000, I moved to Cape Cod, Massachusetts. I was active in the Cape Cod and Islands Group for fifteen years. I was also active in preparedness and emergency services activities, and was involved in environmental justice work in Massachusetts. I served as a shelter manager during a series of tropical storms and blizzards. Winter Storm Nemo (2013) was especially difficult. We had extensive coastal flooding during freezing weather. Highways were blocked by snow and ice. The emergency shelters depended on generators and all of the generators failed. We had to evacuate shelters in the midst of a major snow storm.

In the midst of Winter Storm Nemo, I received a telephone call from one of the well-known environmental protection groups. The caller asked for money "to help prevent climate change and future storms." It was not a happy situation. I had similar experiences during Hurricanes Floyd and Sandy. The organizations involved were NOT part of the Sierra Club, although I mentioned the problem to Sierra Club leaders. In the midst of a crisis situation, it's pointless to talk to victims about climate change. At best, such behavior looks naive. At the worst, it's dishonest, insensitive, and manipulative. Suggestion: When something like Hurricane Sandy or Hurricane Maria arrives, the Sierra Club should place its emphasis on helping the victims. No promises or suggestions that "this could have been prevented if people had supported our climate change program." We don't know if climate change caused last year's wildfires and hurricanes. We don't know if twenty years of cigarette smoking caused our neighbor's lung cancer problem. We only know that "this is the kind of response that becomes more likely, if certain kinds of behavior continue."

I was in New Orleans in 2003 for an environmental justice conference. We received two reports that anticipated the damage that would be caused if a major hurricane hit the city. However, there weren't any suggestions for preparedness. When Hurricane Katrina hit New Orleans, I went back to the city to work with several emergency response groups. I made several trips to New Orleans to work with different organizations. The national Sierra Club provided major support for a gathering of Christian organizations at Loyola University. The national Sierra Club was involved with community recovery programs for at least ten years.

I worked with climate change refugees because of Hurricane Katrina. The term "refugee" wasn't popular with some people. About two hundred people were moved from New Orleans to Massachusetts because of Hurricane Katrina. The Red Cross and other agencies provided care at the Otis military base.

I moved to Florida's Gulf Coast in 2015. I've been active in preparedness activities in Florida and I've had some involvement with emergency services in Cuba and Puerto Rico. I led an environmental justice tour of Cuba in the year 2015. I've been involved in the response to hurricanes Matthew, Harvey, Irma, and Maria.

Allen Tilley

Members of the NE Florida Sierra Club group have delivered many talks to regional groups on the risks we are running with climate change. In fact, we have about exhausted the opportunities.

Members of the club met quarterly from about 2000 to about 2016 with representatives of the Jacksonville Electric Authority, our local utility. At first the topic was criteria pollutants but beginning in about 2008 the primary topic shifted to climate mitigation and preparedness. We were at least effective in bringing up climate issues as they related to the utility's actions, but I cannot say that we were directly responsible for any improvements. A new CEO ended the meetings when (in my perception) the executives with whom we were meeting began to join with us in asking for climate action. (Some were retired.) Tom Larson was the leader of our delegation and will have further information.

About 2014 the group steering committee was moving to organize lobbying by club members of their Jacksonville City Council representatives to undertake a climate vulnerability study but when opposition arose within the club the initiative faltered. So far as I can tell the opposition was led by a member convinced that the real problem we face is peak oil, but I cannot be sure of that. I do believe that the opposition arose from one strong member assisted by the general feeling that the project might be premature. Members of the group leadership have participated in various attempts to organize pressure on the Jacksonville city government to undertake climate action, but nothing was accomplished, and no such lobbying groups are now operating.

We partnered with the local Audubon Society in conducting lobbying visits with congressional representatives from the region on the topic of climate action. Again, I cannot say that we can point to any specific accomplishment other than raising the issue with them.

James C. Woodley

I first became involved with the NC Sierra Club in 2013 through my work with the City of Greenville's Environmental Advisory Commission (EAC). While conducting my duties as Chair of the EAC, I was invited to attend an NC Sierra Club Cypress Group meeting. At that meeting, I heard the story, presented by Dogwood Alliance, of my hometown being the center of a deforestation and environmental justice scenario that brought me to tears. I instantly became a member of that Group and became the NC Chapter advocate for promoting healthy forests because of their role as a climate change mitigating tool. Within the EAC, I supported urban forests, greenways, parks, and wrote a strategic plan that highlighted the Cool Cities initiative, the City had adopted, as a climate change adaptation tool.

In 2014, I became a member of Dogwood Alliance's Board of Directors. They captured my story on short video clips, I was interviewed by national and international media, and sat in on political discussions regarding deforestation. I wrote letters to the NC media and some were published.

As I continued to speak across the state at local group meetings about deforestation, the Chapter was not taking the issue on in a manner that I felt it should. I was now a member of the NC Chapter Conservation Committee and an Ex Com member of the Cypress Group. I went before the Chapter Ex Com to encourage them to take on the deforestation issue. I got a rejection that hit me like a ton of bricks. I was told the issue is important but so are coal ash impacts, fighting fossil fuels industry, and metropolitan transit development in NC's largest city, Charlotte. That I was doing a great job and I should continue. I left the meeting abruptly after the vote and drove 4 hours home. I felt that a lot of what we do in NC is driven by the passion and fight of those on the front line. I was willing to use my considerable experience to lead the fight I just wanted some support. In 2015, I took a leave of absence from all of my volunteer work and developed my own non-profit that has an environmental component that would allow me to work on what I felt was important. That gave me an out if I was rejected again (especially if I was willing to take the lead on the issue).

I was invited back to the Cypress Group in the fall of 2017. I resumed my role as a healthy forest advocate, a member of the Chapter's Environmental Justice Committee, and I resumed my role as a member of the Dogwood Alliance's Board of Directors. To my disbelief, the North Carolina Chapter was now taking on deforestation issues robustly; as well as, Environmental Justice issues. It was amazing. I came back ready to accept that I would be okay with the non-action. Yet, there was action. Many groups were engaged and saw what I saw. So here I am.

Warren Lavey

In 2017, I served on an advisory group for the Champaign County Public Health District in Illinois for developing the triennial Community Health Improvement Plan. We were successful in spurring an environmental sustainability component for the first time in such county planning, with reference to the adverse health impacts of climate change.^[1] While the advisory group included many representatives of healthcare and other community organizations, neither the Sierra Club nor any other environmental organization participated. Having participation from the Sierra Club would have added support to including environmental factors and additional stakeholders in preparedness planning.

I also serve on the Champaign County Climate Resilience Task Force, initiated by the University of Illinois. We developed a resilience proclamation, baseline assessment, and indicators for monitoring and evaluation. In addition to university faculty and staff, the group includes county and city sustainability planning and emergency management agencies as well as hospital representatives. Again, neither the Sierra Club nor any other environmental organization participates. Having such participation would improve representation of the community and the group's consideration of environmental issues.

Janice Meier

My experience with preparedness is primarily on the policy side, that is, I troll the data from recently completed and in-progress projects looking for better ways to get more bang for the buck within the vision of the country's take on the Sustainable Development Goals (SDGs). I do this within the framework of the UNFCCC in which the Least Developed Countries are our top priority. Unfortunately, the vast majority of projects fail to acquire funding, predominately as the result of lack of equitable funding for the Green Climate Fund (GCF). Unfortunately the US seems to have decided to continue to negotiate within the UNFCCC and is, within the GCF negotiations pushing the idea of payors' right to choose projects.

My concerns include the thought that the climate/world is changing more quickly than we can keep up with adaptation. Even two months ago I would have thought that taking care of our forests would be a top goal. After having seen the fires in the West, I can't help but conclude that that ship may have sailed, at least in the West. What's more concerning to me is the range of the fires, not only in the West, but in Florida and even here in my home state of Vermont (where we have now broken many records this summer). My takeaway is to support permaculture in which we take a much longer range view.

[1] "All community partners are in consensus and recognize the many connections between health in our county and environmental factors. In seeking an environmentally sustainable community, we want safe air and water, natural spaces for exercise and mental relaxation, conservation of flora and fauna that support local food production, control of insects that spread diseases, and other health benefits. We also recognize the dangers to health from extreme weather events like heavy rains, heat waves and drought. Promoting environmental health requires monitoring conditions, preparing for emergencies, and reducing activities that impair the sustainability of our community's environment. The Community Health Improvement Plan will promote a culture of environmental sustainability across all sectors." Champaign County Community Health Improvement Plan 2018-2020 at 5.

Public Health

Subgroup Charge:

Members: Colleen Kaelin, Warren Lavey, Liz Perera, Robert Murphy

1. What are the major opportunities for adaptation in this area?

Public Health intersects with several other subgroups in the Climate Adaptation Workgroup. Specifically, Preparedness and Health Equity have many goals and activities which overlap and impact public health. Some of the major opportunities in the public health area are:

- Define, identify and locate vulnerable populations including, but not limited to:
 1. People living in coastal areas, flood zones, urban heat islands and drought prone areas, as well as areas where the impact of extreme weather events are particularly severe
 2. The very young and the elderly, who are more likely to suffer from exposure to extreme temperatures or a severe weather event
 3. People with any chronic health condition or disability that is likely to be negatively impacted by an extreme weather event (dialysis or oxygen dependant, diabetic, cardiovascular or respiratory disease, vision or hearing impaired etc.)
 4. People who's access to transportation and/or communication resources
 5. as well as medical care and help from first responders is negatively impacted by their socioeconomic status
 6. People with limited communication skills due to lack of proficiency in English or other
 7. Plan adaptation activities specifically for local climate impacts and vulnerable populations in the local area
 8. Refer to the American Public Health Association's Climate Change, Health and Equity: A Guide for Local Health Departments (2018).
 9. Develop contacts between local Sierra Club groups and chapter and government leaders, community planners, and volunteer organizations such as the Red Cross
 10. Review and implement the Center for Disease Control and Prevention's Building Resilience Against Climate Effects (BRACE) Framework
 11. Use the information gathered by the BRACE Framework to develop and evaluate a Climate Response Plan for the jurisdiction
 12. Continue to evaluate and revise the plan as further information becomes available
- Collect and publish data on local health status, with a focus on areas that can be impacted by climate change, such as respiratory health, heat related illness, injuries from extreme weather events, and mental health/ social stability. Data on climate measures such as temperature and precipitation along with related health impacts can easily be accessed through the Center for Disease Control's Environmental Public Health Tracking Network, at <https://ephtracking.cdc.gov/> . The tracking network is a public access, query able

web portal with data on 6 climate change indicators, 11 health effect indicators, and 5 broad categories of population/demographic data. The data on the network can easily be applied to planning and mitigation activities that can increase climate resilience at the local, state, or regional level.

- Public health agencies have the capacity to be especially effective in educating the general population and community leaders as to the impacts of climate on the local area and what should be done to mitigate and adapt to those impacts. In addition to health care providers, local, regional and state health departments work regularly with first response agencies, emergency planners, and volunteer organizations such as the Red Cross. The development of sustainable and resilient communities also depends on collaboration with the agencies responsible for maintaining local infrastructure such as transportation, energy, and civic planning.

Public health adaptation must include long term planning, preparedness for and immediate response to extreme weather events. Utilizing the BRACE framework, the planning and adaptation process becomes a continuous cycle of anticipating the impacts and vulnerabilities of a specific area to climate change, planning activities to mitigate and adapt to the expected impacts, evaluating the effectiveness of the adaptation, and improving the mitigation and adaptation activities to increase the resilience of the jurisdiction. Public health adaptation can address several types of threats, including preparedness for extreme weather events, immediate responses to extreme weather events, long-term responses to extreme weather events, and preparedness for other health threats (such as longer allergy seasons and increased respiratory illnesses). Most hospitals engage in community health needs assessments which are designed to have broad community input

2. What is the potential for significant carbon drawdown?

The public health community intersects with infrastructure agencies such as transportation and community design. Collaboration with regulatory agencies can result in outcomes that reduce carbon output and benefit public health, such as public service campaigns to promote ridesharing and more walkable communities with better access to public transportation.

The healthcare sector can reduce its environmental footprint and serve as a model for communities.

3. What kind of Sierra Club activity is already happening in this area?

A key part of the Sierra Club's mission is to promote physical activity and contact with the outdoors, which is a cornerstone of public health agencies' initiatives at the local, state and national levels. Also, the Sierra Club is promoting public health in all its

activities to preserve and promote clean air, clean water, sustainable agriculture, and a renewable energy infrastructure.

Sierra Club has supported numerous pieces of climate and health legislation such as:

Case Study on Sierra Club's work adaptation work in Detroit - <https://www.cakex.org/case-studies/using-green-infrastructure-prevent-sewage-overflows-detroit>

4. What other groups are already working in this area?

Public health is a key element of government infrastructure. Public health departments at the local, state and federal level are already developing resources to mitigate and adapt to the effects of climate change. Public health departments are also collaborating with several crucial stakeholders within government, including environmental and energy regulatory agencies, transportation and community design and other key stakeholders. Several nonprofit agencies, such as the Climate Parents initiative, and the US Climate Action Network, are also working to promote action to mitigate the impacts of climate on public health

Most hospitals engage in community health needs assessments which are designed to have broad community input. While a few community health needs assessments already identify the health threats from climate change, there is a huge opportunity for environmental groups to highlight local health effects of climate change and the need for actions to improve community health resilience.

Major professional healthcare groups are actively advocating for climate change mitigation and adaptation. See the Medical Societies Consortium on Climate and Health. Other groups include the Respiratory Health Association and Moms Clean Air Force.

5. What funders, if any, are available in this area?

The Centers for Disease Control and Prevention is the primary source of funding for climate programs in most state and local public health agencies. The CDC's Climate Ready City and State's Initiative is the most common source of funding for climate adaptation activities. The EPA and other government agencies also provide some funding for activities related to climate mitigation for the benefit of public health.

6. Which political forums does this play out in? Local, state, regional, national or international?

As a key part of government infrastructure, public health plays out in every level of the political forum. However, activities directed at protecting public health from the impacts

of climate change are most effective when tailored to the needs and specific circumstances of the local community.

Add Health in All Policies comments:

<https://www.cdc.gov/policy/hiap/index.html>

Health in All Policies (HiAP) is a collaborative approach that integrates and articulates health considerations into policymaking across sectors to improve the health of all communities and people. HiAP recognizes that health is created by a multitude of factors beyond healthcare and, in many cases, beyond the scope of traditional public health activities. The HiAP approach provides one way to achieve the National Prevention Strategy and Healthy People 2020 goals and enhance the potential for state, territorial, and local health departments to improve health outcomes. The HiAP approach may also be effective in identifying gaps in evidence and achieving health equity.

7. Are there specific geographic locations for focus?

A key element of public health is determining locations and types of vulnerable populations in a community. Some population subsets can be vulnerable by living in a geographic location that is especially prone to a specific type of climate hazard, such as coastal areas that are more likely to flood due to more frequent and severe extreme precipitation events. Geographic areas are only one factor in determining which segments of the population are more vulnerable to the health impacts of climate change.

8. What are the most important summary documents or experts we should be aware of?

The document that best summarizes the main areas of impact that climate change has on public health is the U.S. Global Change Research Program's Climate and Health Assessment at:

<https://health2016.globalchange.gov/>

The American Public Health Association called climate change the greatest public health threat of the 21st century, and developed resources including Climate Change, Health and Equity: A Guide for Local Health Departments (2018).

<https://www.apha.org/news-and-media/news-releases/apha-news-releases/2018/climate-change-health-and-equity>

The CDC's main resource in mitigating climate public health impacts is the Building Resilience Against Climate Effects (BRACE) framework, which can be accessed at:

<https://www.cdc.gov/climateandhealth/BRACE.htm>

The BRACE framework is a five-step series that helps health departments to identify how climate has and will affect human health. It enables health departments to undertake a systematic, evidence-based process to customize their planning and response to local circumstances.

The framework has been applied by grantees of the CDC's Climate Ready City and States Initiative (CRCSI). Information on how state and local public health agencies have applied the BRACE framework can be found at:

https://www.cdc.gov/climateandhealth/crsci_grantees.htm

9. Are there key justice and equity concerns we should be aware of? Are there environmental justice groups or individuals we should consult with on this topic?

Public health equity is closely linked with environmental quality and equity within communities. The primary resource for public health equity is the Social Vulnerability Index (SVI) developed by the Association of State and Territorial Health Officials. The Index combines indicators on several social determinants of public health and combines them into four broad categories: socioeconomic status, household composition, race/ethnicity/language, and housing/transportation. A fact sheet describing the composition and application of the Social Vulnerability Index is available at:

<https://svi.cdc.gov/Documents/FactSheet/SVIFactSheet.pdf>

10. Are there any positive or negative environmental concerns or choices we need to be aware of?

Issues of public health as relating to environmental issues nearly always touch on issues of social justice, with equal access to clean and healthy places to live, work, and learn for all segments of society.

11. Is this action consistent with Sierra Club Policy?

The Sierra Club's commitment to stopping and reversing the effects of pollution, preserving the natural environment, and encouraging access to outdoor activity and clean food and water for all people is in complete concordance with the policies and activities promoted by public health agencies and related organizations at the local, state, national and international level.

Current Sierra Club policies address (1) cooperation by the public and private sectors in communities to identify and remediate public health threats; (2) education of health professionals and other community leaders on environmental health threats; (3) safeguarding human health through environmental regulations; and (4) access to health care for all, especially vulnerable populations.

- Hazardous Waste Management

- “Public and private sectors should cooperate with the communities where hazardous waste facilities are located so that acute and chronic health problems can be identified and addressed quickly.”
- Indoor Air Pollution
 - “Education of the general public as well as such key individuals as teachers, office workers, members of the building industry, health professionals, government officials, labor union leaders, and the media is an important element of a program to reduce indoor air pollution because personal behavior as well as public regulation is involved.”
- Urban Environment, adopted February 1, 1986:
 - “Management of toxic and hazardous materials to decrease their use and to assure that public health and the environment are fully protected from any releases to air, water or land (during manufacture, use, storage, transport or disposal).”
- Toxic Chemicals Policy, adopted February 2018:
 - “Use, concentration and dispersal of compounds and elements must be strictly controlled to prevent adverse effects on human health and the environment.”
- Toxic Air Pollutants, adopted December 1-2, 1984:
 - “The EPA shall review, for potential health impacts, toxic air pollutants that may be reasonably anticipated to result in an increase in mortality, or an increase in serious irreversible or incapacitating reversible illness.”
- Environmental Justice policy, adopted February 17, 2001:
 - “We support the right to a clean and healthful environment for all people.”
 - “When an activity potentially threatens human health or the environment, the proponent of the activity, rather than the public, should bear the burden of proof as to the harmlessness of the activity.”
- The Earth Charter, May 20, 2000:
 - “Affirm gender equality and equity as prerequisites to sustainable development and ensure universal access to education, health care, and economic opportunity.”
 - “Uphold the right of all, without discrimination, to a natural and social environment supportive of human dignity, bodily health, and spiritual well-being, with special attention to the rights of indigenous peoples and minorities.”
- Stratospheric Ozone Protection, September 1, 1975:
 - “[N]on-essential uses [of CFCs], such as in aerosol spray cans, should be phased out expeditiously within a two-year minimum period unless the preponderance of scientific evidence shows that these substances pose no significant present or future risk to public health and safety or to the environment.”

12. Any other key questions relevant to your area?

- What can we do to increase local Sierra Club coordination with health departments and volunteer organizations such as the Red Cross in community emergency planning and disaster response?
- How can Sierra Club initiatives such as land conservation, renewable energy infrastructure, and clean air and water be made to intersect with preparedness planning to help increase community resilience during disasters and extreme weather events?
- How can the Sierra Club contribute to public health agencies' efforts to communicate the health impacts of climate change?

13. Ultimately we want to see what part of this might be particularly ripe for Sierra Club engagement and influence. Since we can't do everything, we will need to make recommendations of most promising forums and issues to engage in, so deciding what not to do is also important. Your advice about the relative priority for Sierra Club engagement, pro and con, will be very valuable.

The Sierra Club, several non profits and Public Health agencies are both focused on communicating the impacts of Climate Change on Public Health, and promoting activities to increase community resilience to extreme weather events. The club can support communication efforts and promote a consistent message on the health impacts of climate and the importance of adaptation to key decision makers and the general public. This will help ensure that local community planning and emergency preparedness will include actions to mitigate the impacts of climate on public health.

The Sierra Club can do more to emphasize and promote the public health impacts of the policies that have been our foundation from the beginning. Our emphasis of physical activity and exposure to the outdoors has a major potential impact on America's epidemic of obesity and related chronic diseases, and our policies to ensure clean air and water are obviously a positive influence on public health. Other areas such as: reducing exposure to toxic waste; promoting a clean, renewable energy infrastructure; sustainable agriculture with a focus on a plant-based diet; are all initiatives and policies that promote individual and community health. An emphasis on health in our public communication and legislative interactions will increase the possibility of success for these initiatives. By making health the cornerstone of our efforts to mitigate climate change, we have a much better chance that our message will be received favorable by the general public and others.

14. What are the implications for providing good paying family-sustaining and/or union jobs and a just transition as part of deployment of this type of program?

Many careers in public health incorporate environmental health, emergency preparedness, health equity and justice, and climate related health impacts. Public

health incorporates all levels of government, from local to state to territorial to federal and international. Specific job titles that would be focused on climate related issues include: epidemiologist; preparedness coordinator; and community planner; among others. Non profit agencies and universities are also areas that provide stable, good paying jobs in these fields.

Bob Murphy's Comments:

The only other points that I can add.... These points can be inserted where they will be helpful. (No special order. What follows are random thoughts.)

"Improve access to community services, including emergency services, for people with disabilities and other vulnerable groups." (This is a goal.)

"The climate change discussion is changing. In the past, climate change has often been addressed as an environmental protection concern. As the climate change problem develops, public health agencies are becoming more involved. Human rights advocates are beginning to address the climate address problem. Because of the impact of climate change, environmentalists will become more engaged with human services providers. New partnerships will develop but there will be different priorities and different agendas, for the various agencies that respond to sea level rise, extreme weather, vector borne diseases, and other difficulties in the environment.

"Religious organizations and other non-profit agencies have long been involved with human services programs, including programs for medical services, community health improvement, and community education. Private sector organizations are involved with climate change refugees, human rights advocacy, and the protection of vulnerable groups. Some of these private organizations may be interested in working with the Sierra Club. New sources of funding may develop."

"Public health advocates understand the human need for food, water, housing, medical care, and protection from hazardous conditions. The United Nations has addressed human rights needs, through the work of the World Health Organization and in documents like the Universal Declaration of Human Rights. The United Nations has developed the Global Sustainable Development Goals, to address human rights needs during an era of climate change."

"Energy use is a human right. All people need to consume energy, in order to survive with some measure of dignity. The disparities in the energy economy are impressive. Some people waste enormous amounts of energy, and food and water, while others beg for adequate shelter and hot meals."

"The world's human population is increasing during a time of climate change. The demand for air conditioning (refrigeration) and for transportation is increasing. Energy conservation is needed, but there is something else that needs to be said and it's a point that's especially important for environmental justice advocates.

In an era of climate change, there's a need to secure energy justice. All people, in all places, need an adequate supply of energy that is safe, affordable, and sustainable. Without energy justice, low-income people may be concerned about climate change, but, as one authority notes, "the poor will burn whatever they can get."

Warren Lavey's thoughts:

- Other groups include the Respiratory Health Association and Moms Clean Air Force
- Major professional healthcare groups are actively advocating for climate change mitigation and adaptation. See the Medical Societies Consortium on Climate and Health
- See the recent resource <https://www.apha.org/news-and-media/news-releases/apha-news-releases/2018/climate-change-health-and-equity>

Liz Perera's thoughts:

EcoAdapt Notes

They are working to highlight case studies of Pub Health Depts and/or community groups working on pub health preparedness/adaptation with NRDC. NRDC is funding this project with \$ from the Robert Wood Johnson Foundation. They are funded to do case studies and produce a report by March 2019. They also mentioned that RWFJ has funded George Mason's new center and they are working with Paul Schram with the CDC Brace Framework. NRDC is also a part of this SPARC coalition that stands for Strong, Prosperous, And Resilient Communities Challenge - <https://www.sparcchub.org/> (I have pasted the description of that below) Richie - were you aware of this work?

NRDC has funded them to research case studies following states: FL, OR, PA, VA, WA, NV, NJ, NC, CO, IL, Iowa, MI, MO, OH, WI and NY. They would like to be funded in the other states of course and they'd love to feature our chapter's work.

Here are suggested next steps:

- 1) They would love to see the results of our survey and follow-up with some of the chapter leaders to feature their work (even beyond health) in this report or in their Cake newsletter. (note: they have already written up the work we've done in Detroit)
- 2) They don't have funding to do the rest of the states but they'd be happy to partner to get more funding.
- 3) Juanita Constible is the person overseeing this work at NRDC (she's a friend and I can call her to see if they'd be open to partnering...but that might be a long shot).

Thoughts on that?

Building Climate Resilience of Natural Environments

Introduction of topics

In their brand-new 2018 edition of The Living Planet Report (World Wildlife Fund 2018e), the WWF paints a devastating picture of human destruction of natural environments and extermination of species. In the relatively short time between 1970 and 2014, human-caused losses in vertebrate species - mammals, fish, birds, amphibians and reptiles - averaged 60% with South and Central America suffering an even more dramatic decline in vertebrate populations - an 89% loss compared with 1970. The organization aligns the problem of human-made habitat destruction and species extinction with the also human-made climate change and expects losses of wildlife in the next future to be intensified by climate change. The organization calls for "a new global deal for nature and people" similar to the 2015 Paris agreement to tackle climate change and assumes a likewise narrow time window for action of about one decade if we want to have any chance to preserve biodiversity on our planet.

Resilience and Restoration

Under climate change, species' adaptedness to places where they currently live is and will be increasingly reduced. Possible adaptive mechanisms include reducing or shifting local ranges to places with still suitable climates (such as higher elevations or latitudes), moving long distances to new locations while tracking habitat shifts under climate change or adapting genetically in place to new climates. The speed of climate change will most probably overwhelm the rate at which many species can genetically adapt. Existing habitat fragmentation will limit abilities of many species to shift their ranges. Invasive species may be favored in altered climates. Undoubtedly, many species will become extinct in the 21st century. Hannah (2011) provides an overview of many of these issues.

Given ongoing anthropogenic climate change, promoting biosphere resilience under climate change through ecosystem restorations has emerged as a new strategic need or opportunity.

To the extent possible within changed climates, preserving ecosystems in their native or near-native states and restoring native biological systems on formerly disturbed lands can add to biosphere resilience under climate change.

Even if somewhat simplified, restored ecosystems have additional value under climate change due to their ability to provide carbon capture and other mitigating ecosystem services. Indeed, man made ecosystems, such as those promoted by permaculture (refer to the permaculture subreport of the "Agricultural lands, soils and animal management" subgroup), can add to biosphere resilience.

Although one can judge the value of living systems simply in terms of their utility for humans, many people, probably most, recognize inherent value to living systems. Recognizing such a value, we have an obligation to seek coexistence with other living things.

Human population growth and activities have driven environmental destruction to date, including atmospheric pollution with greenhouse gases. Uncontrolled population growth will undermine efforts to contain and adapt to climate change.

Types of Natural Environments

The protection and restoration of natural environments is a gigantic task as our planet harbors an amazing number and diversity of ecosystems and habitats. The WWF distinguishes 867 terrestrial ecosystem regions (Olson et al. 2001; World Wildlife Fund 2018b), 232 marine ecoregions of the coastal and continental shelf areas (Spalding et al. 2007; World Wildlife Fund and The Nature Conservancy 2018), and 426 freshwater ecoregions (Abell et al. 2008; World Wildlife Fund 2018c). In a desperate attempt to prioritize ecosystem regions that are all valuable and unique, the WWF prioritized 238 of these 1525 ecoregions as specifically important for conservation (Olson and Dinerstein 1998; Olson and Dinerstein 2002; World Wildlife Fund 2018d).

Report Topics

Sequestration of carbon in living systems is widely discussed in other climate adaptation task force subgroups (e.g. “Forest carbon management”, reforestation and afforestation, “Oceans, coasts, and sea level rise” and “Freshwater and wetlands”) and will not be discussed here. We will focus on:

1. Biodiversity conservation challenges in an age of climate change.
2. Promotion of resilience-fostering ecosystem services through restoration/other strategies.
3. Human responsibilities to other life forms.
4. Population

Response to the Questions

1. What are the major opportunities for adaptation in this area?

- Ecosystem Services and Climate Adaptation
 - Ecosystem-based adaptation to climate changeEcosystem-based adaptation (EbA) promotes conservation while alleviating poverty and removing GHGs (Scarano 2017; Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH 2018; Gentry et al. 2017):
 - Blue Carbon - Sea GrassesSeagrass ecosystems: abundant marine life, fisheries, protection from coastal erosion, carbon sink (Hejnowicz et al. 2015).

- Buffering nature against climate change
- Climate refugia; migration corridors; maintain viable populations (Taylor and Figgis 2007).
- Ecological restoration
 - Increased biodiversity and ecosystem services, intact better than restored (Benayas et al. 2009).
 - (Re)afforestation and rehabilitation: mediating weather patterns, mean temperatures, patterns of precipitation, incidence of extreme climatic events, and increasing sea levels (Harris et al. 2006).
- Biodiversity, Hotspots, and Conservation Priorities
 - Wildlife Management and Biodiversity Conservation
 - Land and water conservation, ecological restoration, agri-environment schemes, species translocation, captive propagation, monitoring, natural resource planning, and legislation/regulation (Mawdsley et al. 2009; World Wildlife Fund 2018)
 - Potential adaptive measures:
 - Identify, protect local refuges from temperature increases (e.g. deep ravines, higher altitude areas).
 - Identify, protect climate tracking movement corridors, including terrestrial, aerial, aquatic.
 - Consider translocations by humans of some species that are unable to migrate current disturbed conditions.
 - Consider invasive species management options:
 - Monitoring and mapping distributions.
 - Triage program for identifying invasive species management targets.
 - Control methods (e.g. manual, chemical, biological).
 - Climate adaptation in priority areas (hotspots)
 - The North American Coastal Plain (NACP) only US global biodiversity hotspot (Noss et al. 2014; Critical Ecosystem Partnership Fund 2016).
 - World Heritage sites: 'Universal' value and is to be conserved for all humankind, in perpetuity (International Union for Conservation of Nature 2018; Perry 2015)
 - Climate change-induced losses to biodiversity will exceed those of habitat destruction, invasive species, pollution, habitat loss and fragmentation (Perry 2015; World Wildlife Fund 2018).
 - Hotspots may experience an average loss of 31%. Greatest losses in low-latitude hotspots (Atlantic forest, Cape floristic region and Polynesia–Micronesia (Bellard et al. 2014).
 - Food security vs. biodiversity conservation (Molotoks et al. 2017)
 - Highest threat where high biodiversity and high food insecurity: tropical areas, especially Madagascar.
 - Less land use, alternative production methods, food choice and diet.

- Increased biodiversity vulnerability due to climate impacts on human populations
 - Conservation areas with high population growth and wetting or drying (e.g. the Horn of Africa, Himalaya, Western Ghats, and Sri Lanka, Aukema et al. 2017).
 - Riparian ecosystems as adaptation hotspots (Capon et al. 2013)
 - Hotspots vs. Coldspots (Marchese 2015)
 - Focusing on hotspots alone: biodiversity in other biomes neglected
 - Coldspots might provide important ecosystem services.
- Natural Environment as Intrinsic Value and Stewardship Duty
 - Instrumental, intrinsic and relational values of nature
 - The moral obligation of humankind toward the environment is similar to any situation where a party, such as a child, does not have the ability to protect itself or defend its rights (Ghotbi 2014).
 - The natural instinct of the love of the environment, biophilia (Ghotbi 2014).
 - Things possess inherent worth or satisfy one's preferences: intrinsic or instrumental values. Also appropriateness: actions and habits conducive to a good life, both meaningful and satisfying (Chan et al. 2016).
 - Ecocentrism and "Nature Needs Half" and bio-proportionality (Piccolo 2017; Kopnina et al. 2018; Piccolo et al. 2018)
 - Good life for one species should not compromise good lives of other species.
 - Vital aspect of conservation of the biosphere: obligation to do good.
 - Nature Needs Half (The WILD Foundation 2018).
 - Bio-proportionality: Not merely viable but optimal populations of all species (Mathews 2016).
- Population

The global human population has grown from about 2.5 billion in 1950 to over 7 billion today. The United Nations (2017) projects a global human population size of nearly 10 billion by 2050 and over 11 billion by 2100. A World Wildlife Fund report (2010) suggested that the human population became unsustainably large sometime in the 1980's, a period when the global population was about 5 billion people and poverty more prevalent. Efforts to contain and adapt to climate change are undermined by the combination of a still growing population already in ecological overshoot and elevated per capita consumption. O'Neill et al. (2010) found that "that slowing population growth could provide 16–29% of the emissions reductions suggested to be necessary by 2050 to avoid dangerous climate change." The Club could play an important role by educating the public on the contributions of population growth to climate change and by encouraging environmentally responsible reproduction.

2. What is the potential for significant carbon drawdown?

The protection and restoration of natural environments, especially forests and wetlands can significantly reduce GHGs. Project Drawdown (Hawken 2017) identifies the following strategies and the corresponding CO₂ reduction related to ecosystem restoration:

Rank	Ecosystem	Category	Drawdown
5	Tropical Forests	Land Use	61.23
12	Temperate Forests	Land Use	22.61
13	Peatlands	Land Use	21.57
15	Afforestation	Land Use	18.06
35	Bamboo	Land Use	7.22
38	Forest Protection	Land Use	6.2
39	Indigenous Peoples' Land Management	Land Use	6.19
51	Perennial Biomass	Land Use	3.33
52	Coastal Wetlands	Land Use	3.19

Also refer to the “Forest carbon management, reforestation and afforestation” and the “Fresh water and wetlands” reports.

3. What kind of Sierra Club activity is already happening in this area?

The “Our Wild America” program includes efforts at restoration of Puget Sound and the Everglades. The Grassroots Network “Marine Action”, “Wildlands” and “Wildlife and Endangered Species” teams do or likely do related work.

4. What other groups are already working in this area?

- International Union for Conservation of Nature (IUCN): <https://www.iucn.org/resources/issues-briefs/ecosystem-based-adaptation>
- WWF: <http://wwfadapt.org>
- PANORAMA – Solutions for a Healthy Planet: <https://panorama.solutions/en>
- Convention on Biological Diversity (CBD), Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA): <https://www.cbd.int/recommendations/sbstta/?m=sbstta-22>
- Foundation for Deep Ecology (FDE): <http://www.deepecology.org>
- Ecosystems Knowledge Network: <https://ecosystemsknowledge.net>
- International Climate Initiative of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety: <https://www.international-climate-initiative.com/en/>
- Environmental Change Institute at the University of Oxford: <https://www.eci.ox.ac.uk/research/ecosystems/index.html>
- UNESCO: Climate Change Impacts in Major Mountainous Regions of the World: <https://en.unesco.org/news/climate-change-impacts-major-mountainous-regions-world-0>

- UNESCO, International Hydrological Programme (IHP): <https://en.unesco.org/themes/water-security/hydrology>
- UNESCO, Man and the Biosphere Programme: <http://www.unesco.org/new/en/natural-sciences/environment/ecological-sciences/>
- Society for Ecological Restoration: <https://www.ser.org/>
- EcoAdapt: <http://ecoadapt.org/>
- Society of Conservation Biology (SCB) <https://conbio.org>
- The Nature Conservancy: <https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/edc/reportsdata/terrestrial/resilience/Pages/Downloads.aspx>

5. What funders if any, are funding in this area?

- Finance options and instruments for Ecosystem-based Adaptation (Hunzai et al. 2018)
- Critical Ecosystem Partnership Fund (CEPF): <https://www.cepf.net>
- The Wyss Foundation: <https://www.wyssfoundation.org/about/>

6. Which political forums does this play out in? Local, state, regional, national, international?

On all levels.

7. Are there specific geographic locations for focus?

In North America, there is only one recognized global biodiversity hotspot, the North American coastal plain (Noss et al. 2014). In a state based ranking of the biodiversity of the USA, (Stein 2002) explicitly mention California, Hawaii, Texas, and Alabama for having exceptional levels of biodiversity. A more recent biodiversity mapping project (Jenkins et al. 2015; Jenkins 2018) places biodiversity priorities within the US at Blue Ridge Mountains, Sierra Nevada Mountains, California Coast Ranges, Tennessee, Alabama, northern Georgia watersheds, Florida panhandle, Florida Keys, Klamath Mountains, South-Central Texas around Austin and San Antonio and Channel Islands of California. Globally, there are 36 recognized biodiversity hotspots (Myers et al. 2000; Critical Ecosystem Partnership Fund 2018).

8. What are most important summary documents or experts we should be aware of?

Refer to long version of the report and Literature.docx

9. Are there key justice and equity concerns we should be aware of? Are there environmental justice groups or individuals we should consult with on this topic?

Creation of conservation areas can require displacement of current residents. Need for displacements must be demonstrated and adequate compensation those displaced must be provided. Local organizations representing affected residents should be contacted.

10. Are there positive or negative environmental concerns or choices we need to be aware of?

The actions proposed here appear broadly and simply positive regarding environmental effects.

11. Is the action consistent with Sierra Club policy?

The Forest Protection and Restoration Policy calls for “establishment of biological corridors to link isolated stands” of forest. Creation of movement corridors are key to proposals of this subgroup. However, the section also opposes conversions to non-native species. In some cases, non-native species will be useful in ecosystem restoration (planting non-native evergreens to suppress weeds during forest re-establishment). Creation of refugia, movement corridors and other biodiversity conservation areas will sometimes conflict with a section of the Club “Agriculture and Food” policy that discourages conversion of established agricultural lands to other uses.

12. Any other key questions relevant to your area?

Human population and consumption.

13. Ultimately we want to see what part of this might be particularly ripe for Sierra Club engagement and influence. Since we can't do everything, we will need to make recommendations of most promising forums and issues to engage in, so deciding what not to do is also important. Your advice about the relative priority for Sierra Club engagement, pro and con, will be very valuable.

1. Prioritize US biodiversity hotspots (provided literature) and currently most untouched and natural environments.
2. Support creation of climate change local refugia and restoration of landscape connectivity that will allow species to shift ranges as habitat locations move under climate change.
3. Work stronger and more explicit on the human obligation for stewardship .
4. Promote movement to a global human population of ecologically sustainable size.

14. What are the implications for providing good paying union jobs and a just transition as part of deployment of this type of program?

The restoration and stewardship of natural environments will allow for the creation of many naturalist, rangers, technicians and scientists as well as law enforcement personnel to monitor and reinforce the resources.

Extreme weather relief and recovery, relocation, displacement/climate refugees

Subgroup members: Robert Murphy, Elna Otter, and Allen Tilley

1. What are the major opportunities for adaptation in this area?

Anticipating and reacting to extreme weather emergencies. Before disasters strike the Sierra Club has an opportunity to moderate damage by building a sense of community among its members. Local groups could review available disaster information from governmental and news sources, augmenting it as they see the opportunity and ensuring that their members are advised. Hurricane evacuation plans are one example; another is information about the availability of temporary housing for victims of forest fires or of shelter from heat waves.

Following an emergency community members are often organized to help one another, with great effect. The Cajun Navies which formed in Houston and North Carolina in the recent hurricanes are one example, and so are the neighbors who checked on one another in the Chicago heat wave. Local Sierra Club groups could organize calling trees and procedures for members to check on one another following a disaster.

For example: Consider the recent Hurricane Florence. Prior to landfall, we could have sent out useful information to North or South Carolina affected members via texts or e-mail. Members would opt-in to the program, and provide their smartphone (preferred) or email contact information. The information would be more than the generic online advice, but pull together resources available by county and state. The research and materials would have been prepared months in advance, focusing on areas that are prone to hurricanes. We should be careful to refer to official sources of emergency information where appropriate, and avoid duplicating other informational programs.

We would suggest that the appropriate chapters (or coastal groups) start out with a notice to their members trying to attract a team that would deal with any future coastal problems. That team could then work on what information would be most useful to threatened residents. (This might consist of things to do beforehand to prepare, useful phone numbers, etc.) The call for participation would also serve as a notice to the general membership that such a group would exist. It would be very possible for other volunteers from around the nation to also participate, especially since they would be in a position to make calls and follow-up with affected residents.

When the forecasts are quite sure that there will be a hurricane landing in a specific location, then all affected members should be sent the county/state-specific information that had been prepared, via text message or e-mail. The information, complete with the Sierra Club logo, could be easily shared with friends and neighbors. Again, local groups should avoid duplicating or competing with local emergency information sources. We should refer members to official sources and not attempt to recreate what already exists there.

After the extreme weather event, the team might set up an information line with geographically specific information. Members could be sent a follow up message that could mainly consist of a repeat of the first message, also contain the phone number for an information line, and possibly contain more location and event-specific information. It might also ask if help is needed. "Would you like to request a team of Sierra Club members or student members to assist you with clean-up?" (assuming that there are people who have volunteered to help.) Any Sierra Club efforts should be designed to augment other efforts, with care taken not to interfere in any way with those activities.

Finally, a week or so after the event, there might be a follow-up call to affected members to make sure that they have survived the ordeal and are OK.

Suppose that the threatening event is a forest fire. As in the above case, local chapters or groups would have educated a team of people. The local fire departments frequently have information to share, and at the very least the team could help disseminate that information. However, additionally, we note that there are private companies available for a price that make lodging accommodations for subscribers as a forest fire approaches, and then send a team to their endangered house to fortify it against fire. As far as we know these are the same techniques used by local fire departments. The club could certainly help out by disseminating this type of information and going through the same kind of process as outlined above for hurricanes.

In disasters ecosystems are sometimes disrupted. Wise adaptation policies can strengthen those systems in the process of recovery. We suggest that Chapters be asked to identify damages and risks to ecosystems following extreme weather and other disasters. The reports should initiate action plans at the appropriate levels, perhaps in cooperation with other organizations and authorities.

Some communities will be relocated as the result of climate change. By providing for the planning of sustainable communities in advance of the relocation, the process can be made less stressful and the resulting new communities more attractive, more resilient, more equitable, and more ecologically benign.

Miami is losing its water supply as saltwater infiltrates the Biscayne Aquifer. The region will lose progressively more of its drainage as the ocean rises. Communities in the area will be forced to relocate. Other coastal communities face a similar necessity. If we wait until the last moment when we have no option but to relocate under emergency conditions we can expect poor results.

Phoenix, Arizona, is already losing people to the rising heat. It too must face relocation, along with other cities. How relocation proceeds will determine the quality of life we face, and whether we are building a world we can look forward to with pleasure.

Relocation, if poorly imagined and managed, can intensify social inequities. We will slide into a world of gated and guarded preserves for the wealthy and plots of FEMA trailers for the rest of us unless we take active steps to promote environmentally sound, socially just, and attractive places to live and work. Sustainable communities for all ages and classes should be our goal, but it is one which will take determined effort. Market

mechanisms shepherd developers toward the current housing projects. The Sierra Club, in cooperation with other groups such as the US Green Building Council and the Urban Land Institute, is positioned to lead a movement toward sustainable communities. Only the Sierra Club has the broad membership base with the interests and values to be the leaders of such a movement toward broad social change.

A sustainable community should practice sustainable development so that it handles its own stormwater. It should gather most of the water it uses and should use landscape practices which do not lead to ecologically damaging runoff. It should return water to the environment which is at least as clean as the water it receives.

A sustainable community should supply most of its own energy if renewable energy is not available locally; it might grow at least some of its own food. It should provide for many of its needs through the small businesses it includes. It should be diverse in every way, representing the range of ages, races, cultures, occupations, and economic levels in the community at large.

A sustainable community should provide a diversity of housing types, all designed to be energy efficient, attractive, and healthy. It should provide plenty of green space, recreational opportunities, and amenities. It should connect to and be open to the larger community. It should be a pleasure to its inhabitants, a model to and source of pride for the region.

Where possible the sustainable community should not urbanize existing green space. Disused shopping malls, airports, and other such urban spaces can provide good opportunities to found sustainable communities.

The Sierra Club can educate local groups on the possibility of founding sustainable communities. It can provide those groups with instructions on how to go about assembling representative task forces to plan the communities and carry out the plans. It could provide models of self-funding through blockchain technology, which allows easy and transparent management of collective funding. The Sierra Club might identify sources of funding for the local groups as it is able.

In partnership with the US Green Building Council and the Urban Land Institute, the Sierra Club can help build a future we might look forward to inhabiting, and a way of being more at home on the earth. Market forces will not take us there. Perhaps no other organization has such a good chance of bringing off such a social transformation.

2. What is the potential for significant carbon drawdown?

There may be some opportunities for carbon drawdown as damaged areas are repaired, for example, by reforestation.

3. What kind of Sierra Club activity is already happening in this area?

Several groups in our survey reported post-disaster activities.

The national Sierra Club has partnered with local chapters to identify local community - based relief and recovery organizations and helped by linking Sierra Club national members and donors to these organizations. In the wake of Superstorm sandy the local chapter gathered camping and other temporary housing equipment to distribute to those in need. Local chapters then worked on storm recovery, seeking federal recovery funds, and developing plans to avoid future impacts by rebuilding smarter.

4. What other groups are already working in this area? Opportunities for partnership or redundancy

Emergency relief is a standard function of all levels of government. Not only the Red Cross but many religious and social organizations undertake emergency relief activities. Chapters and groups should consider whether their proposed activities are unnecessary, and, if necessary, where they might look for common efforts.

The National Center for Disaster Preparedness of the Earth Institute at Columbia University could be of use in laying plans for local groups to prepare for and react to weather emergencies: <https://ncdp.columbia.edu>

Concerning developing sustainable communities for relocation, the US Green Building Council has a LEED neighborhood certification program and expertise relevant to the development of sustainable communities. The Urban Land Institute fosters and celebrates the establishment of sustainable communities. The National Low Income Housing Coalition and Habitat for Humanity work to supply affordable housing, which should be part of any effort we would assist. However, we do not believe any organization has an active program of establishing sustainable communities, and have not seen any sign of serious planning for general coastal relocation. We could well join with other organizations in promoting the development of a way to relocate in communities we could look forward to living in, working in, and enjoying.

The Sierra Club has identified community based groups that help get aid and recovery assistance to those most in need and has helped raise funds for these groups.

5. What funders if any, are funding in this area?

Emergency relief has obvious private and public funding sources, but the Club has little chance of receiving support from these, in our opinion, even where our guidelines might permit it. Relocation funds may be available from the source community or from federal agencies, but no such funding efforts have been announced at this time. The Club would do well to assume that at least the first communities would need to be privately financed.

Rockefeller Foundation's 100 Resilient Cities program has recently become a conduit for funds to support community resilience: <https://www.100resilientcities.org> It is possible that this or other sources might support the development of a model sustainable community.

6. Which political forums does this play out in? Local, state, regional, national, international?

Successful sustainable communities should serve as models for imitation. Model communities might be publicized to broaden their occurrence. Community establishment will require interplay with local, regional, and state governments.

Federal, state and local relief and recovery plays out in the Congress, state legislatures, city councils and agency programs for FEMA and other government agencies.

7. Are there specific geographic locations for focus?

No region is expected to be exempt from climate change threats. Coastal communities, those located in floodplains and those in the wildland interface where fires are more likely are particularly vulnerable.

8. What are most important summary documents or experts we should be aware of?

Design Charrettes for Sustainable Communities (Island Press, 2012) is a basic guide for planning sustainable communities.

The literature on emergency management is vast. The information supplied to the public about prospective disasters, such as flooding, comes from both government and private sources, such as newspapers and tv stations; it varies by region. The same may be said of information following a disaster. Local Sierra Club groups will best be able to determine whether further information should be supplied in their region.

9. Are there key justice and equity concerns we should be aware of? Are there environmental justice groups or individuals we should consult with on this topic?

The goal of energy justice is to provide all people with an adequate supply of energy that is safe, affordable, and sustainable. The Club might consider a rhetorical stance on energy which emphasizes the basic role of equity and environmental justice in the transition to sustainable energy.

There was some concern about EJ issues recently in the Carolinas, and certainly in Puerto Rico. We could preferentially allocate assistance to poor and minority communities that ask for help since they are more apt to be uninsured or underinsured.

10. Are there positive or negative environmental or ethical/stewardship concerns or choices we need to be aware of?

Sustainable communities should be coordinated with greenway and rewilding efforts.

11. Is the action consistent with Sierra Club policy? Please flag areas where we would need to update, clarify or revise policy.

Sustainable communities should support the Sierra Club's policy on the urban environment. <https://www.sierraclub.org/policy/urban-environment> If no suitable space is available within existing urban boundaries, we should take care not to sponsor leap-frog sprawl. We should preserve open spaces as we can. <https://www.sierraclub.org/policy/open-space-and-taxation>

The Club has taken historic positions on community and infrastructure relocation to avoid hazardous areas or those damaged by extreme weather, but we have no policy in this area. We have supported various state and federal bills dealing with floodplain and coastal insurance and other subsidies and support for disaster relief going to all impacted communities.

12. Any other key questions relevant to your area?

Sustainable communities could become a source and supporter of responsible environmental practices. Few other programs are as central to the Club's concerns or provide a more apt opportunity for its efforts.

13. Ultimately we want to see what part of this might be particularly ripe for Sierra Club engagement and influence. Since we can't do everything, we will need to make recommendations of most promising forums and issues to engage in, so deciding what not to do is also important. Your advice about the relative priority for Sierra Club engagement, pro and con, will be very valuable.

Our society is due for some great stresses. The Club is positioned to play a central role in how well we cope. As we work to build a resilient community we provide those seeds for the community at large. Because we are relatively insulated from political and commercial pressures we are free to undertake measures up to the challenge of reforming our society on a sustainable, just, and ecologically responsible base.

The Sierra Club should consider the following initiatives:

1. Ask chapters and local groups to consider whether further information should be supplied in their region concerning both preparation for and recovery from emergencies. If so, they should be encouraged to pursue either asking appropriate sources to supply the information or undertaking to supply it themselves.
2. Recommend that local groups form readiness teams to contact members following disasters concerning their need for assistance, and to organize general community support where they perceive it to be needed.
3. Prepare a planning kit for those local groups interested in organizing a sustainable community for the purpose of relocation from a threatened area. The kit might contain advice in organizing a design charrette, selecting a site,

securing financing, and proceeding with construction. The kit should advise the group on the general characteristics of a sustainable community as preparation for the group's specific plans.

4. Undertake a general educational and promotional campaign to support the establishment of sustainable communities as part of a program of climate adaptation.

14. What are the implications for providing good paying family-sustaining and/or union jobs and a just transition as part of deployment of this type of program?

The Sierra Club board has identified equity as being a major concern for the Sierra Club. In developing a clean energy economy, the Sierra Club should affirm that all workers have the right to receive fair compensation for their work. All workers should be adequately protected from occupational hazards, including the hazards that are associated with extreme weather. The Sierra Club should affirm that all workers have the right to establish and join labor unions that help to defend worker rights.

Establishing a sustainable community will provide ample opportunities for union labor. If the program is successful in prompting imitations, workers experienced in this type of green building should find a continuing market for their skills. The communities themselves should provide places for workers to live and businesses to employ them.

Oceans, Coasts, and Sea Level Rise

1. What are the major opportunities for adaptation in this area?

- Even with aggressive mitigation measures, sea levels, ocean temperatures and acidification will continue to rise in the future. Coral reefs, tidal marshes, mangrove swamps, seagrass beds, and other inter- and subtidal- aquatic features play crucial roles as habitats, food sources (these shallow coastal habitats are essential to 70-90% of commercial fisheries species), and protection of coastal areas from storms, tsunamis, and other high energy events causing loss of lives and properties. Increased sea temperatures cause coral bleaching and mortality, and ocean acidification erodes existing reefs and hinders creation of new reefs. Increased sea temperature can result in mangrove swamps replacing tidal marshes along coastlines that no longer experience deep freezes. Sea level rise will drown tidal marshes that will disappear if there are no adjacent uplands for them to migrate to or if they are not able to increase their elevation quickly enough.
- Adaptation opportunities for coral reefs include selective breeding of corals, and the microalgae which provide food for corals through photosynthesis, to create coral reef colonies able to withstand higher temperatures and increased acidification. Large scale projects are underway to restore coral reefs in the Florida Keys by transplanting colonies of such corals. Other opportunities include projects for reducing conventional coral reef stressors, including actions to reduce overfishing and amounts of nutrients and sediments entering coastal waters.
- Adaptation opportunities for tidal marshes include preserving adjacent uplands to allow wetlands to migrate inland. Other techniques include the use of dredge material to increase the sediment load of the marshes so that they can keep up with sea level rise elevations. The Army Corps of Engineers will experiment this year with this technique in 10 areas around the nation. “Thin broadcasting” is also being experimented with by the US Fish and Wildlife Service. This consists of spraying thin layers of mud onto tidal marshes in order to help raise the marsh substrate elevation.
- As sea levels rise and climate change increases the frequency and intensity of storm events and accelerates coastal erosion, property owners will seek to protect coastlines with seawalls, revetments, and other form of coastal hardening, which result in loss of beaches, public access, loss of biological diversity and other negative effects. Ultimately many communities behind seawalls will suffer flooding because streams and/or heavy rains, will flood the areas behind the levees since those waters will have nowhere to go due to the levees.
- Adaptation opportunities include promotion of environmentally sound alternatives to coastal hardening which can result in new or expanded wetlands and other natural areas, public parks, and other public benefits. Many studies show that coastal vegetation such as mangroves, seagrass beds, and salt marshes may be more effective storm surge barriers than hard structures. As sea levels rise,

however, natural migration of coastal vegetation inland is blocked in many cases by man-made barriers such as seawalls, revetments, residences, and coastal highways. In such cases, adaptation options include “managed retreat” strategies for removing or relocating man-made barriers.. “Living shoreline”, nature-based approaches also offer “softer” alternatives to coastal hardening. In many states adaptation policies are being discussed or adopted at local, regional and state levels addressing issues such as managed retreat, living shorelines, wetland restoration, etc. There are many opportunities for Sierra Club Chapters and Groups to assist state and local governments in developing and implementing climate adaptation strategies that avoid or reduce loss of lives and property, while also addressing environmental justice issues. Where vulnerability studies have not been conducted (and few have), Sierra Club groups could be educated and organized to pressure local governments to undertake them as the necessary first step toward an action plan. Once the plan is established Groups could monitor its implementation.

- Adaptation planning must be based on authoritative information. Political pressure has placed significant information sources into doubt. The Sierra Club could act to endorse or even to disseminate trustworthy sources of information about such topics as expected sea level rise, ocean temperatures, and rates of acidification. The NOAA Sea level Rise Viewer, for example, (<https://coast.noaa.gov/digitalcoast/tools/slr.html>) is a great tool that could be disseminated digitally. The Club can also develop and disseminate toolkits to aid Groups and Chapters engage in climate adaptation issues at state and local levels.

2. What is the potential for significant carbon drawdown?

- According to [the Blue Carbon Initiative](#), “The coastal ecosystems of mangroves, seagrass meadows and tidal marshes mitigate climate change by sequestering carbon dioxide (CO₂) from the atmosphere and oceans at significantly higher rates, per unit area, than terrestrial forests.” The recent Global Climate Action Summit states, “Coastal wetlands—tidal marshes, mangroves, and seagrasses—are powerful “blue carbon” sinks that sequester up to 5 times more carbon by area than terrestrial forests, resulting in globally significant carbon stores.¹⁰ If destroyed, these ecosystems can release their carbon stores back to the atmosphere, turning what were significant carbon sinks into sources of carbon emissions. These “blue carbon” ecosystems are some of the most threatened on Earth.”
- Climate adaptation strategies which protect, expand or restore such coastal ecosystems could increase carbon drawdown. Conversely, actions which reduce such ecosystems will release carbon into the atmosphere. We need to support strict protection of all remaining coastal vegetation and replanting of seagrasses, mangroves and eventually also salt marshes.
- According to some experts, kelp and other seaweeds have the potential to sequester more carbon than all other aquatic plants combined. Support for kelp and other seaweed farming projects should be considered, subject to

consideration of the nature and scale of specific projects. Industrial scale aquaculture projects may pose unacceptable risks..

3. What kind of Sierra Club activity is already happening in this area?

- The Hawai'i Chapter has made climate change adaptation its highest priority conservation issue, with a major focus on adaptation measures incorporating projections of sea level rise. It has engaged in lobbying in support of climate adaptation (and mitigation) measures at the State legislature, has participated in various workshops conducted by the State of Hawai'i Climate Commission, helped build coalitions supporting climate adaptation initiatives, and features climate adaptation issues in its quarterly newsletter. The O'ahu Group has been especially active, and effective, in supporting climate adaptation and mitigation efforts for the island of O'ahu, the major population center of the islands. They were instrumental in providing support for formation, and funding of, the City and County of Honolulu's Office of Climate Change, Sustainability and Resiliency and the Climate Change Commission established by that Office. The Chapter is working with its Neighbor Island Groups to support similar initiatives in the other counties (Kauai, Maui, and the island of Hawai'i).
- Some San Francisco Bay Area chapters have taken part in "resilience by design" exercises funded by the Rockefeller Foundation as well as taking part in planning efforts undertaken by State agencies such as the SF Bay Conservation and Development Commission.
- The Sierra Club California's California Conservation Committee (formerly CNRCC) is developing sea level rise policies to address issues such as social equity (particularly displacement of disadvantaged communities), habitat impacts, etc.
- The "South Bay Salt Pond Restoration Project" in San Francisco Bay has just been awarded over \$100 million from the US Army Corps of Engineers to work on developing a combination of levees and salt marsh restoration over 20,000 acres of salt ponds previously owned by Cargill Salt and now by the SF Bay National Wildlife Refuge - a project that both restores habitat and will protect Silicon Valley.

4. What other groups are already working in this area?

- International: Intergovernmental Panel on Climate Change, International Union for Conservation of Nature
- Conservation International, The Ocean Conservancy, Oceana, Kresge Foundation, National Fish and Wildlife Foundation (NFWF), The Nature Conservancy, Pew Charitable Trusts, Union of Concerned Scientists
- Global Climate Action Summit: **Priority Goals for Ocean-Related Climate Mitigation:**
 - **Goal 1: By 2030, the global area of coastal wetlands that are critical to global carbon sequestration and storage—mangroves, tidal marshes, and seagrasses—is increased by 20 percent over 2018 levels.**

- **Goal 7: By 2025, the world's coastal and island populations, especially the most vulnerable, have sufficient financing and capacity to develop and implement ocean-related climate mitigation and adaptation measures**

5. What funders if any, are funding in this area?

- Rockefeller Foundation, including 100RC-100 Resilient Cities fund
- The National Fish and Wildlife Foundation (NFWF)
- NOAA Coastal Resilience Grants

6. Which political forums does this play out in? Local, state, regional, national, international?

- Given the posture of climate denial and rolling back of regulations under the Trump administration and the current Congress, and Sierra Club's limited capacities for engaging in international issues, most of the opportunities will be at regional, state and local levels. In most cases, the important climate adaptation decisions affecting coastal areas are made at the local level. This level of government often lacks technical and financial resources, and political decision makers tend to focus on short term issues. Sierra Club can provide a long-term perspective on climate adaptation and can help Chapters and Groups engage in regional, state, and local decision making--especially the political processes.

7. Are there specific geographic locations for focus?

- Oceans and coastal areas, including islands, within the United States and its territories.

8. What are most important summary documents or experts we should be aware of?

- IPCC, 2018: Summary for Policymakers. In: Global warming of 1.5°C
- IPCC Fifth Assessment 2014 Chapters 14-17.
- <https://www.ipcc.ch/sr15/chapter/summary-for-policy-makers/>
- NOAA Tech Report 83, Global and Regional SLR Scenarios for the U.S., January 2017,
- Georgetown Climate Center
- State of California Ocean Protection Council "Sea Level Rise Guidance, Update 2018"
- State of California Coastal Commission's Policy Guidance for Sea Level Rise

9. Are there key justice and equity concerns we should be aware of? Are there environmental and climate justice groups or individuals we should consult with on this topic?

Yes. Minority groups often suffer disproportionately from hurricanes, flooding, coastal erosion, and other impacts exacerbated by sea level rise and climate change, as occurred with Hurricanes Katrina and Sandy.

Subsistence fishing plays an important role in some coastal disadvantaged communities. This food source will be impacted (and already is) with climate change and sea level rise as inshore fisheries habitats are altered and decline.

We should be consulting with the NAACP Environmental and Climate Justice Program, which has worked closely with Sierra Club on climate adaptation and justice issues.

As wealthier shoreline communities face flooding they may move inland displacing adjacent upland disadvantaged communities.

10. Are there positive or negative environmental concerns or choices we need to be aware of?

- Positive environmental choices include opportunities to create new or expanded wetlands and other natural areas, public parks, and other public benefits consistent with Sierra Club policy.
- Negative environmental choices, which we would oppose, include loss of beaches, tidal marshes and other shallow inshore water habitats and public access to shorelines.

11. Is the action consistent with Sierra Club policy?

Climate adaptation is consistent with current Sierra Club policies related to protection and restoration of ecosystems as well as environmental justice, but those policies need updating in this new era of climate change. As global temperatures, sea levels, and ocean acidification continue to rise ecosystems evolve accordingly. Our policies have to incorporate adaptation, to preserve the health of ecosystems as they evolve, recognizing it may not be possible, or even desirable, to preserve or restore the pre-climate change states of ecosystems. Adaptation strategies may also require more direct interventions than the Club is accustomed to, such as transplanting sea turtle populations from low-lying nesting areas in the Northwestern Hawaiian Islands threatened with sea level rise to new nesting sites in protected areas of the main Hawaiian islands.

12. Any other key questions relevant to your area?

13. Ultimately we want to see what part of this might be particularly ripe for Sierra Club engagement and influence. Since we can't do everything, we will need to make recommendations of most promising forums and issues to engage in, so deciding what not to do is also important. Your advice about the relative priority for Sierra Club engagement, pro and con, will be very valuable.

Climate change is the most important environmental and social issue of our time, and warrants the Club's highest priority. The Club has done outstanding work on mitigation, but equal priority must now be granted to adaptation. The amount of carbon dioxide already in the atmosphere, and continuing to grow daily, is already causing the long-predicted impacts of climate change. These include global warming, sea level rise, ocean acidification, increased frequencies and intensities of storms, flood events, droughts, and forest fires. These impacts are widespread and pervasive, affecting many areas of historic concern to the Club, including wilderness areas, national parks and forests, and more recently, marine reserves and protected areas. These areas are not immune to climate change impacts, which transcend protective boundaries which we

have fought hard to establish, including remote areas in the Northwestern Hawaiian islands otherwise fully protected from human activities.

The nation's coastal regions support the great majority of people in the nation. As they face increased flooding as well as permanent inundation there will be a corresponding impacts to these communities including complete loss of homes and infrastructure as well as the loss of coastal habitats. These are compelling impacts that will provide the Club with an increasing number of people seeking direction and an organization within which to work. A well-defined Club policy and implementation plans towards addressing these issues will attract these people as well as, one hopes, funding to carry out the work

Coastal areas are especially vulnerable to sea level rise, which amplifies the impacts of coastal erosion, storm surges, and heavy rainfall events. Much of the U.S. population is centered in coastal areas, and many of our Chapters and Groups are directly affected. Important as global mitigation efforts are, the amount of carbon dioxide already present in the atmosphere and oceans will continue to cause increasing levels of climate change impacts for the foreseeable future. It is imperative that we recognize the need to develop and implement ecosystem-friendly adaptation strategies which promote justice and equity. The Club should make such climate adaptation efforts a high priority and provide adequate resources for their successful implementation.

For example, no Florida Group will be immune from sea level rise and the dislocations which will result in coastal communities. As state revenues depend on property taxes, they will diminish as property values dwindle, and the Club members will be forced to confront a potentially chaotic social and political environment. The Club may find itself one of the few steady voices.

As discussed above, inshore shallow coastal waters provide some of the world's most productive and important habitats (tidal marshes, mangrove marshes, mudflats, seagrass beds, seaweed beds, coral reefs, and shallow subtidal waters). Over 70% of commercial fisheries depend on these habitats for survival as do shorebirds, waders and other waterbirds. These habitats play an especially important role in sequestering carbon. This carbon may be released as these habitats drown. Replacing or sustaining these habitats in the face of sea level rise is an important step in preventing increases in GHGs. Increasing these habitats provides an important tool towards reducing atmospheric C.

Disadvantaged communities are often the most impacted by these events. Subsistence fishing plays a significant role in some of these coastal communities and future reduced fisheries will bring substantial impacts. Often these communities will not be able to afford sea level rise adaptation efforts and will face displacement.

Since most efforts to restore or sustain these habitats is occurring on a state or local level the Club has an opportunity to play a substantial role in seeing that these efforts take place. Local communities will have to decide between erecting seawalls or using more sustainable tools such as managed retreat and creating or restoring tidal marshes, developing living shorelines and other approaches. The Club can play leadership role in educating decision-makers, building alliances with disadvantaged communities, and helping to shape the future of our coastal environments.

14. What are the implications for providing good paying union jobs and a just transition as part of deployment of this type of program?

An ambitious program of wetland preservation, restoration, and development will provide significant continuing employment just in those regions most impacted by a contracting seafood industry. Wetland restoration, for example, usually requires the use of landforming machinery (graders, backhoes, earthmovers, etc.). These are usually well paying jobs. A program of kelp permaculture on a scale to provide significant carbon drawdown will employ a large workforce and emphasize the skills acquired in commercial fishing experience. The Sierra Club is positioned to support both those programs politically, and because neither is likely to make a lot of money for anyone, the Club is positioned to provide particularly valuable political support. It should be able to keep an eye on the use of union labor and on social justice generally as the programs are deployed.

Demographics, Equity and Climate Justice

Members: Colleen Kaelin, Janice Meier, Bob Murphy, James Woodley

The Sierra Club began its journey of becoming a more equitable, inclusive, and just organization in 2014. Today, the Club has developed a Department of Equity, Inclusion, and Justice (EIJ). That department, led by its Director-Nellis Kennedy-Howard, works to transform the Sierra Club so that equity, inclusion, and justice are a part of every aspect of its' operations.

1. What are the major opportunities for adaptation in this area?

Preparedness or resilience encompasses a wide range of activities. The Subgroup members identified the following as major opportunities:

- Define, identify and locate vulnerable populations to make adaptation equitable.
- Major groups include various educational levels, minorities and communities of color, children and the elderly, disabled, geographically vulnerable (coastal areas, etc.), native and indigenous people, migrants/refugees, limited English proficiency, and LGQBT
- Since the Club has recently reinvigorated its EIJ presence, today there is an opportunity for the Club and Chapter Committees to learn from each other. There no strategic pathways to follow to be successful. Thus, each organizational step forward will offer a fresh perspective to share.
- Get feedback from subpopulations at greater risk of health impacts from climate
- Include under-represented groups in Sierra Club activities
- Inclusion of minority, low socioeconomic, and other vulnerable population subgroups in community outreach and adaptation planning
- Ask these groups for their input on how we can be helpful

2. What is the potential for significant carbon drawdown?

We can promote the My Carbon Footprint website and encourage people to calculate their impact. Promote sustainable/affordable energy infrastructure as a human right and focus on building those resources among vulnerable populations. Work with the Preparedness subgroup to develop mitigation, evacuation and recovery efforts for vulnerable populations

3. What kind of Sierra Club activity is already happening in this area?

In 2015, the Club's Multi-Year Diversity, Equity, & Inclusion Organizational Plan was developed, and it provided a history of how the Club has progressed to that point. The Club now report annually on its EIJ progress. The 2017 report can be found at

www.sierraclub.org/sites/www.sierraclub.org/files/1759_Equity_Annual_Report_04_low.pdf

National Sierra Club is already working with the indigenous populations to protect their lands and natural resources. National Sierra Club Environmental Justice Subgroup, whose purpose is to discuss and explore the link between environmental quality and social justice and to promote dialogue, increased understanding and appropriate action

1. Regional Sierra Club EJ programs

2. Chapters are encouraged to develop an EIJ committee comprised of group members.
3. Studies such as the air particulate matter study
4. National Sierra Club Environmental Conferences
5. Immigration Justice policy documents from the Board of Directors

The Club has produced the following tools to assist members and staff in addressing EIJ members or issues.

Sierra Club's Equity Language Guide (2018)

The Club uses Jemez Principles for Democratic Organizing

It has profiles and stories on its website that cover a wide range of EIJ issues affecting staff or members. Information can be found at www.sierraclub.org/equity

Chapters are encouraged to form EIJ committees. North Carolina has a EIJ committee and information regarding its activities can be found at www.sierraclub.org/north-carolina/about

The Sierra Club's Gender, Equity, and Environment Program has expressed concern about population topics and climate change.

The national Sierra Club has been involved with labor unions that are concerned about climate change and energy policy topics.

The Climate Parents initiative has partnered with several Sierra Club programs to promote awareness of climate impacts.

4. What other groups are already working in this area?

The NAACP and the EPA both have Environmental Justice programs and resources. The AARP can also be a resource for elderly in communities of color. The US Climate Action Network (USCAN) addresses climate justice issues through its selection of members and disseminating grant funding. The Department of Energy also has EJ resources. Many federal, state and local public health agencies have environmental justice resources

5. What funders if any, are funding in this area?

Several agencies in the federal government, such as the CDC and the EPA, offer grant application opportunities for projects in environmental equity. It is possible the Sierra Club may not wish to seek out funding from federal sources. We should also look at non-profit, non-governmental organizations for funding sources. We should develop a tool kit for communities to research funding resources in preparedness and equity

6. Which political forums does this play out in? Local, state, regional, national, international?

More than any other forum, demographics and equity plays out at the local level. Each community has a different set of vulnerable populations, and different types of vulnerabilities.

7. Are there specific geographic locations for focus?

Vulnerable populations tend to congregate in areas that are geographically vulnerable, such as Gulf Coast States and other coastal areas. Issues of displacement, relocation, and mental health are especially relevant to vulnerable populations.

Also, there are geographical variations associated with the location of the race and ethnicity of vulnerable communities. In some states, minorities may be located more in urban centers because of transportation and other issues associated with their socio-economic status.

8. What are most important summary documents or experts we should be aware of?

The Department of Energy Environmental Justice Plans and Strategy

National Environmental Justice Advisory Council 20-year retrospective report and Recommendations

USDA Cooperative Extension Programs, and the National Flood Insurance Program

The US Dept. of Housing and Urban Development Climate Change Adaptation Plan (2014) builds into its mission of service to their grantees and American public by addressing the vulnerabilities of communities to climate change. It ensures that “the lives of the vulnerable and disadvantaged are not only considered but improved

(www.hud.gov/program_offices/economic_development/resilience/plan).

The US Dept. of Health and Human Services is supporting a climate resilient healthcare infrastructure. The 2014 Environmental Justice Implementation Progress Report has a section addressing climate change adaptation. It states that the CDC is supporting a public health professional training effort based on the CDC’s “Building Resilience Against Climate Effects (BRACE) through its Climate Ready States and Cities Initiative” (www.hhs.gov).

9. Are there key justice and equity concerns we should be aware of? Are there environmental justice groups or individuals we should consult with on this topic?

Many vulnerable populations have not been included in the conversation, such as the LGBTQT community. Senior citizens and advocates for the disabled should also be included in the conversation. We should also be careful not to exclude faith-based community groups.

10. Are there positive or negative environmental concerns or choices we need to be aware of?

We need to continue to promote outreach with vulnerable communities. Adhere to the Jemez Principles of Democratic Organizing when working with minority communities. A summary of the Jemez Principles includes:

We need to effectively communicate our message after we have gathered information about the needs of the people of the target areas (including minorities).

We need to focus on the issues where the solutions may be within the control of the host and/or the audience.

Most people are comfortable working with representatives and/or organizations they are familiar with, such as their religious organizations and local community leaders. For that reason, it is important that the Club recruit members from all groups, cultures, faith (spiritualties) ethnicities, sexual orientations, ages, genders, able-bodiedness or disabled, and veterans.

11. Is the action consistent with Sierra Club policy?

The Sierra Club has a long history of outreach and promoting equity and the preservation of natural resources among the most vulnerable and disenfranchised segments of American society. Promoting equity and social justice among those who are most vulnerable to the impacts of climate change is a natural extension and continuation of our history and tradition as members of the Sierra Club. This action is in line with the Sierra Club re-invigorated EIJ policies and initiatives as mentioned above.

12. Any other key questions relevant to your area?

None

13. Ultimately, we want to see what part of this might be particularly ripe for Sierra Club engagement and influence. Since we can't do everything, we will need to make recommendations of most promising forums and issues to engage in, so deciding what not to do is also important. Your advice about the relative priority for Sierra Club engagement, pro and con, will be very valuable.

Justice and equity is best integrated into all of our work rather than being viewed as a separate effort.

Mainstreaming Climate Adaptation

1. What are the major opportunities for adaptation in this area?

Mainstreaming has many layers, ranging from federal, state and local governments, to assure that climate adaptation and mitigation concerns and projections are “mainstreamed” into the statutes, regulations, and programs governing environmental assessments, planning and permitting processes. It also involves relevant actions affecting the natural and man-made environments and promoting awareness and conversations with the general public on the need for climate adaptation as well as climate mitigation through public media and other forums.

From the Sierra Club’s perspective, the opportunities for mainstreaming climate adaptation, while continuing to pursue and expand climate mitigation efforts, are many and occur at all levels of the Club in both its staff and volunteer arms.

Government decisions. Mainstreaming climate adaptation systematically integrates climate change threats, analyses and adaptation goals into a wide range of government decisions, programs and plans – at the national, state and local levels, and in areas such as zoning, transportation, housing, agriculture, forestry, water infrastructure, healthcare services, emergency preparedness, energy, education, social services, and natural resources. Mainstreaming recognizes opportunities and needs for adaptation throughout sectors of the economy and society.

Sierra Club support for mainstreaming would increase preparedness for the effects of climate change, including by spurring more green infrastructure, open spaces, conserved natural areas, and ecosystem services. Moreover, mainstreaming would reduce losses of mal-adaptation, such as locating or rebuilding low-income housing in floodplains or erecting sea walls.

To promote mainstreaming for climate adaptation, Sierra Club Chapters and Groups would advocate for federal, state and municipal legislation, regulations, and executive orders on planning, decision-making and reporting by agencies. Sierra Club Chapters and Groups would also work with federal, state and local government agencies and public-private partnerships to integrate climate adaptation concerns and analyses into decisions, programs and plans.

Public communications. The increasing occurrence of major hurricanes, tropical storms, and associated flooding as well as the extensive forest fires in the West have raised the national awareness of the need for better adaptation strategies. There is an opportunity for greater public discussion of and support for relocating vulnerable populations from floodplain areas, to avoid or reduce the loss of life and property, even while there may be disagreements over linking these events directly to climate change.

An integrated mainstreaming plan is required to match Club media resources with the various opportunities. Some initiatives include use of social media tools such as the Grassroots Network, Sierra Rise, and Addup, to build and inspire activist constituencies to carry out specific campaigns at international, national, state and local levels. Chapter and Group websites and newsletters offer additional channels for reaching activists and

sharing best practices and lessons learned from Chapters and Groups on the leading edge of climate adaptation at state and local levels. Other initiatives would mobilize Club resources to participate in and support efforts furthering the United Nations Framework Convention on Climate Change, including the upcoming twenty-fourth Conference of the Parties (COP 24).

2. What is the potential for significant carbon drawdown?

Direct effects of mainstreaming include increased carbon sequestration in agriculture, forestry and natural areas, as well as reduced emissions from energy used in buildings, transportation, and other sectors. Mainstreaming would make consideration of potential positive and negative impacts on greenhouse gas emissions an integral part of decision-making.

Also, highlighting the impacts of climate change and the costs and benefits of adaptation throughout sectors of the economy and society would increase support of initiatives for clean energy, energy efficiency, and carbon sequestration. For example, infrastructure planning based on climate change vulnerability analyses and mapping will help justify climate adaptation strategies such as relocating housing, roads and utility lines to reduce the risks of major losses of lives and property in the future as flood-prone areas expand under the impacts of climate change. While such strategies may require very large investments, they can be phased in over time and justified by identification of the even larger costs of failing to take such climate adaptation actions.

3. What kind of Sierra Club activity is already happening in this area?

Sierra Club adopted policies in many areas which provide the basis for mainstreaming climate adaptation, such as in energy resources; land-use planning and urban environment; transportation systems; wetlands; and forest protection and restoration. Also, some Sierra Club Chapters and Groups are helping to integrate climate adaptation by engaging in local zoning boards, community health needs assessments, emergency preparedness committees, and other organizations and activities. From the survey of Chapters, about half of the Chapters participated in work on city or state climate adaptation plans. Many chapters worked on climate adaptation in diverse sectors – forests, agriculture, coasts, grasslands, and human environment.

Sierra Club is one of the few major NGOs which lobbies at the federal level and litigates to protect and enforce environmental laws and regulations, including those related to climate change. Reforms to national programs such as the National Flood Insurance Program (including removing provisions that encourage or require rebuilding in floodplains) or Army Corps of Engineers programs (that rely on higher and higher levees, rather than setting aside parks and natural areas which could be allowed to flood on occasion to reduce river levels) would benefit climate adaptation efforts at state and local levels.

4. What other groups are already working in this area? Opportunities for partnership or redundancy?

Leading groups of professionals, state governments, federal agencies, and international organizations support mainstreaming climate adaptation.

According to the American Planning Association (2011):

Planners must play a key role in promoting energy efficiency in the existing built environment and changing development patterns, transportation systems, and regulations in ways that reduce GHG emissions, while simultaneously enhancing the resilience of communities to unavoidable climate impacts through adaptive responses such as stormwater management, improved hazards planning, and efficient use of climate-sensitive resources like water.

Similarly, the American Public Health Association (2018) promotes a “health in all policies” approach and urges local health departments to recognize that “addressing climate change and health inequities requires transformational change in our systems and communities”.

The mission of the Yale Program on Climate Change Communication (<http://climatecommunication.yale.edu/>) is to advance the science of climate change communication, help leaders communicate more effectively, and increase the public's understanding of climate risks and opportunities. This Program appears quite relevant to our subgroup's goal of mainstreaming climate adaptation.

Hawaii is a leader on mainstreaming climate change adaptation, including through Act 286 (2012) (requiring all state and state actions to consider climate change adaptation policy in land use, capital improvement and program decisions), Act 83 (2014) (establishing an interagency climate adaptation committee), and Act 32 (2017) (assigning tasks to the Hawaii Climate Change Mitigation and Adaptation Commission to identify vulnerable people, provide policy direction, recommend actions to improve resiliency, and track progress). The state's Coastal Zone Management program delegates much of its implementation to the counties. The City and County of Honolulu is taking the lead among the counties in implementing climate adaptation measures. Sierra Club's Hawai'i Chapter helped pass the county bill and associated appropriations to create a county Climate Change Commission; this commission recently provided the mayor with a set of recommendations for promoting climate adaptation especially as relates to sea level rise. The mayor issued an executive order to all county agencies to adopt the recommendations. Mainstreaming efforts have now begun in the form of Climate Action Plan public meetings held in City and County of Honolulu City Council Districts. The initial meetings ask residents what their visions are for a resilient, fossil fuel free future for our island, and invite them to learn about Oahu's first climate action plan, engage in a "game" that helps kick-start a discussion about how best to cut emissions, and chart the next steps for the island.

Federal executive orders requiring mainstreaming sustainability in planning and decisions by federal agencies span Presidents Bush, Obama and Trump, including Executive Orders 13423 (2007), 13514 (2009), 13693 (2015), and 13834 (2018) (agencies shall prioritize actions which “enhance the resilience of Federal infrastructure and operations”, eliminate unnecessary use of resources, and protect the environment).

The Center for Climate and Energy Solutions (C2ES) has a partnership with the U.S. Conference of Mayors to strengthen climate cooperation between cities and businesses

nationwide; the Alliance for a Sustainable Future helps cities and businesses respond to the growing impacts of climate change.

Also, the European Commission, World Bank and several nations (with Wales as a model recognized by the United Nations) adopted mainstreaming policies.

5. What funders if any, are funding in this area?

Processes for planning, stakeholder engagement, and reporting to mainstream climate adaptation in government decisions are typically funded through the budgets of government agencies. Governments are also developing financing for adaptation measures through green bonds and infrastructure banks.

The Centers for Disease Control and Prevention makes grants through its Climate-Ready State & Cities Initiative, applying the Building Resilience Against Climate Effects (BRACE) framework.

Many foundations provide funding to help prepare communities to deal with certain challenges related to climate change. As examples:

- the Pew Charitable Trusts has a project to help make communities and infrastructure flood-prepared.
- the Robert Wood Johnson Foundation makes grants in Health Leadership Development programs to help build a culture of health in community-based projects; these programs include efforts aimed at “enabling leaders in all fields—such as transportation, urban planning, business, and economic development—to challenge systems, tackle the root causes of health disparities, and build healthier communities.”

6. Which political forums does this play out in? Local, state, regional, national, international?

In the absence of effective mainstreaming of climate adaptation considerations, government actions at all levels will fail to promote, or will even be detrimental to, several United Nations Sustainable Development Goals, including ending poverty and hunger, ensuring healthy lives, ensuring clean drinking water and sanitation, building resilient infrastructure, making cities resilient and sustainable, and protecting marine and terrestrial resources.

Each level of governance has a role to play. Local decision-making is most important, such as in land use, infrastructure, and emergency preparedness planning.

7. Are there specific geographic locations for focus?

All areas face climate threats and must mainstream climate change adaptation, including for heatwaves, intense storms and flooding, droughts, wildfires, worsening air quality, and infectious diseases. Coastal areas have particular urgency because of sea level rise and hurricanes.

8. What are most important summary documents or experts we should be aware of?

Intergovernmental Panel on Climate Change (IPCC) Report, GLOBAL WARMING OF 1.5 °C, October 6, 2018. <http://www.ipcc.ch/report/sr15/>. This report is a clarion call for global action to prevent the dire consequences of exceeding a 1.5 degree C increase in global temperatures. Adaptation strategies should be consistent with the mitigation strategies of this report.

World Resources Institute, *From Planning to Action: Mainstreaming Climate Change Adaptation Into Development* (2018) <https://www.wri.org/publication/climate-planning-to-action>

Hawai'i Climate Change Mitigation and Adaptation Commission, *Hawai'i Sea Level Rise Vulnerability and Adaptation Report* (2017) https://climateadaptation.hawaii.gov/wp-content/uploads/2018/01/SLR-Report_January-2018.pdf

Bedsworth, Louise, et al., *California's Fourth Climate Change Assessment: Statewide Summary Report* (2018) <http://www.climateassessment.ca.gov/state/docs/20180827-StatewideSummary.pdf>. See also California's Adaptation Capability Advancement Toolkit for local governments to identify key actions and resources for increasing their capability to undertake climate change adaptation <http://arccacalifornia.org/adapt-ca/>

The White House Council on Environmental Quality, *Implementing Instructions for Executive Order 13693 – Planning for Federal Sustainability in the Next Decade* (2015) https://www.fedcenter.gov/_kd/Items/actions.cfm?action=Show&item_id=30816&destination=ShowItem

American Planning Association, *Policy Guide on Planning & Climate Change* (2011) https://planning-org-uploaded-media.s3.amazonaws.com/legacy_resources/policy/guides/pdf/climatechange.pdf

American Public Health Association, *Climate Change, Health, and Equity: A Guide for Local Health Departments* (2018) https://www.apha.org/-/media/files/pdf/topics/climate/climate_health_equity.ashx?la=en&hash=14D2F64530F1505EAE7AB16A9F9827250EAD6C79

9. Are there key justice and equity concerns we should be aware of? Are there environmental justice groups or individuals we should consult with on this topic?

Climate justice issues should be part of mainstreaming throughout areas of government decisions. The impacts of climate changes are disproportionately borne by low income, minority, elderly, young, and other disadvantaged people. The impacts of climate change on disadvantaged people include losses of community, property, financial resources, and jobs as well as increased mortality and morbidity.

Planning for these impacts spans healthcare services, water management, transportation, housing, emergency preparedness, social services, and other areas. As an equity issue, resources must be given to the neediest households first and foremost.

10. Are there positive or negative environmental or ethical/stewardship concerns or choices we need to be aware of?

Mainstreaming should take a comprehensive approach to environmental and ethical aspects of decisions. The model approach integrates life-cycle analysis of the multiple dimensions of climate impacts and preparedness into government decisions.

The efficacy of climate adaptation strategies will depend upon when, where, and how they are employed. As a matter of Club policy, it should be understood that although we might endorse broad categories of adaptation strategies, specific instances of implementation must be subject to environmental reviews by mainstreaming these strategies into case-by-case decision-making.

Positive environmental choices include opportunities to create new or expanded wetlands and other natural areas, public parks, and other public benefits, consistent with Sierra Club policy. Negative environmental choices, which we would oppose, include loss of forests, beaches, tidal marshes and other shallow inshore water habitats and public access to shorelines.

11. Is the action consistent with Sierra Club policy? Please flag areas where we would need to update, clarify or revise policy.

Yes, see the answer to Question 3. Policies should be revised to specifically include climate change adaptation in legislation, regulations, planning, programs and decisions.

Mainstreaming climate adaptation into a wide range of government decisions is consistent with current Sierra Club policies related to protection and restoration of ecosystems as well as environmental justice. But, those policies need updating in the new era of climate change. As global temperatures, sea levels, and ocean acidification continue to rise, ecosystems evolve accordingly. Our policies for government actions must incorporate adaptation, to preserve the health of ecosystems as they evolve, recognizing it may not be possible, or even desirable, to preserve or restore the pre-climate change states of ecosystems.

Adaptation strategies may also require more direct interventions than the Club is accustomed to. An example is transplanting sea turtle populations from low-lying nesting areas in the Northwestern Hawaiian Islands threatened with sea level rise to new nesting sites in protected areas of the main Hawaiian Islands.

12. Any other key questions relevant to your area?

None.

13. Ultimately we want to see what part of this might be particularly ripe for Sierra Club engagement and influence. Since we can't do everything, we will need to make recommendations of most promising forums and issues to engage

in, so deciding what not to do is also important. Your advice about the relative priority for Sierra Club engagement, pro and con, will be very valuable.

Mainstreaming climate change adaptation is essential for the effective implementation of Sierra Club's climate adaptation policies and strategies, as well as other sectors affected by climate change. Our mission is to find a niche where the Club can either work on its own or cooperate with other environmental NGOs on resilience.

14. What are the implications for providing good paying family-sustaining and/or union jobs and a just transition as part of deployment of this type of program?

Climate adaptation will create many good paying union and other jobs, such as in rebuilding infrastructure and restoring wetlands. Mainstreaming climate adaptation in government decisions makes it more likely that legislatures and agencies will recognize and promote such job-creating opportunities.

Forest Carbon Management Subgroup

Introduction

General Forest Issues

Current scientific analyses indicate that moving beyond fossil fuel consumption is necessary to mitigate the worst effects of climate change, but it is not sufficient. We must also substantially increase “natural climate solutions” measures--mainly forest protection from logging, and recovery of forests (re-establishing native forests where they were long ago eliminated for agriculture) (Griscom, B.W., et al. 2017. Proceedings of the National Academy of Sciences of the USA, Vol. 114, pp. 11645- 11650).

Ecosystem Services

The number of goods and ecosystem services provided by forest include:

- Wood and non-wood products (e.g. biomass-based energy)
- Global and local climate regulation: e.g. C-sequestration, moistening and cooling
- Pollution control
- Soil protection and formation: e.g. erosion control
- Nutrients cycling
- Biodiversity protection
- Water regulation and supply
- Recreation

The full report with 37 references to current research papers and summaries and a short commentary on each can be found at:

https://drive.google.com/open?id=12Yoz3jm3eKqoyl_44EmEXdXpft7JFQ2s

Forest Management

Climate change is threatening the essential interactions between microbes, plants, and animals on a global scale by reducing their diversity. Climate change can be linked to forest degradation and deforestation. In particular, forests provide 80% of world's terrestrial biodiversity (WWF, Forest Habitat Overview, 2018). Yet, forests are disappearing at a rate of 18.7 million acres annually (WWF, Forest Habitat Overview, 2018). A significant portion of that decline is associated with deforestation. Approximately 15% of global greenhouse gas emission are due to deforestation (WWF, Forest Habitat Overview, 2018). In some cases, once healthy intact forests are degraded, they no longer function efficiently in carbon sequestration, provide vital ecosystem services, nor support biodiversity in a manner that old growth forests currently do across the southern US (Davis S. L., A History of Forests in the South: The Great American Stand Series, 2018).

1. What are the major opportunities for adaptation in this area?

General Forest Issues

- Forests absorb large amounts of CO₂ from the atmosphere and sequester and store it.
- Measures to allow forests to continue this climate change mitigation activity would include steps such as:
 - Protecting public lands and particular forests of high value from logging;

- Eliminating current financial incentives and tax breaks that drive intensive logging and deforestation on private lands in the U.S. and redirecting such funds into incentives to encourage forest landowners to retain their forests unlogged or to substantially reduce logging levels in order to store more carbon; and
- Providing incentives to encourage farmers to facilitate native forest recovery on lands that were previously forest but had been deforested and converted to agriculture long ago.

Ecosystem Services

- Cooling and moistening of urban heat islands. Heat and drought are especially dangerous in cities and other urban areas due to the lack or scarcity of vegetation and especially trees, and the prevalence of heat absorbing and storing construction materials. This trend will become even more severe in the future due to climate change.
- Reducing heat and drought in tropical to semi-arid climate regions. Tropical and subtropical regions are receiving much higher solar radiation and are therefore prone to be most affected by heatwaves and droughts.
- Reducing heat and drought in other parts of the world.
- Forests also prevent and/or mitigate flood risk, landslides and protect river banks, lake shores and sea coasts
- Biodiversity and physical diversity allow forests to be more resilient against climate change.

Forest Management

- Using Sierra Club considerable reach; education regarding the importance of intact, healthy, and old growth forests in addressing climate change by carbon sequestration within the forest ecosystem including associated soils would be effective.
- Using Sierra Club's profound infrastructure; revitalizing the front line work being done at the grassroots level by having a vocal and visible national backing would be enormous.
- Using Sierra Club significant voice, influencing Federal, State, and local forest friendly policies and best management practices would be possible. At the State and local level, such policies are rare.
- Using Sierra Club's global influence, putting forest health and sustainable management on the global stage would be a reasonable expectation.
- The Sierra Club (Club) should continue to work with States, other environmental non-profits (such as Dogwood Alliance, Southern Environmental Law Center (SELC), and United States Climate Action Network (USCAN)) to educate the public about the importance of forests and to work with the Federal government to address the forest biodiversity and necessary ecosystem services issues. Currently, these allyships are at the Group level and should be elevated to the National level. Dogwood Alliance, SELC, and USCAN each have strong domestic and international reach that the Club can become more engaged in.

- Below are some of the proposed national and international actions that are needed and the Club can participate in addressing by leading and/or effective allyships:
 - In the US, States should identify unmanaged industrial logging as an emerging threat to maintaining healthy, intact, old growth forests; as well as, the environmental justice and social justice issues associated with the current, for the most part, unmanaged practice.
 - In the US, Federal and State governments should amend policies that don't work and/or are detrimental to protecting forests in general, i.e. Healthy Forests Initiative of 2003 (Wikipedia, Healthy Forests Initiative, 2018)
 - There should be clear standards developed and enforced, in the US and internationally, that protect- as much as possible-healthy intact old growth, native, and wetlands forests; implement strategies similar to REDD (Wikipedia, Reducing Emissions from Deforestation and Forest Degradation (REDD), 2018) in developing countries.
 - The US and other countries should restrict use of whole trees for energy producing biomass and (SELC, Biomass Energy in the South, 2015) (NRDC, 2018) (Porter, 2015) (Nunez, 2014).
 - The US and other countries should protect important forest habitats and ecosystems including national parks and sanctuaries (SELC, Biomass Energy in the South, 2015).
 - The Temperate Deciduous Forests of the Eastern US (Carey, 2014) and old growth forests (Talk, 2018) generally sequester more carbon than forests in other regions of the country; thus, the US should be encouraged to provide significant protection of these forests to help manage atmospheric carbon concentrations.
 - Reforestation and afforestation efforts should take into consideration biome specifications and climate change variations that would support continued biodiversity and enhanced ecosystem services provided by healthy intact forest ecosystems. (See Tables 2-4 in https://drive.google.com/open?id=1UIAt1tB4nB85hlz5M8m8Ma_hjDOw1ogvpxbt02WVK3E)

2. What is the potential for significant carbon drawdown?

General Forest Issues

The relatively easier, and most “cost effective”, natural climate solutions measures (again, these are overwhelmingly dominated by forest protection and forest recovery) would reduce CO₂ levels by 11.3 petagrams per year, representing 37% of the climate change mitigation needed to keep global temperature rise below an additional 2 degrees Celsius, while bolder steps would equate to 20 petagrams of CO₂ equivalent per year, or slightly more, representing 50% or more of the climate change mitigation needed to have a near certainty of keeping global temperature rise to less than an additional 1.5 degrees Celsius (Griscom et al. 2017).

Ecosystem Services

The ecosystem services of forests are not as much related to climate mitigation than to climate adaptation, however climate adaptation by trees and forests constitutes reforestation and afforestation methods see the below categories from (Hawken 2017) – numbers in gigaton CO₂ reduction.

Table 1.

Tropical Forests	61.23
Temperate Forests	22.61
Afforestation	18.06
Bamboo	7.22
Forest Protection	6.2
Indigenous Peoples' Land Management	6.19
Perennial Biomass	3.33
Total	124.84

Forest Management

(See Tables 2- 4 of question 7 in this document for geographical and biome-specific factors)

- Forest ecosystems play a vital role in carbon drawdown by carbon sequestration and long-term storage. Since effective carbon sequestration usually require mature trees, it is important to maintain old growth and mature deciduous forests such as those in the eastern region of the US and tropical rainforests globally.
- Identification of forests with the highest carbon sequestration potential for afforestation/reforestation program would be important. Those trees should be suitable for the geographical biomes including emerging temperature rise, precipitation fluctuations, and changing hydrology.
- Maintaining intact old growth forests will keep stored carbon from re-entering atmosphere and increasing the heat trapping potential of greenhouse gases. Unfortunately because of intense logging in the Southeastern portion of the US, most of those types of forests are now located in the Northwestern portion of the US.

3. What kind of Sierra Club activity is already happening in this area?

General Forest Issues

Though forest protection and recovery is sometimes mentioned by Club staff and volunteer leaders in the context of climate change mitigation, it is not currently a component of the Club's climate change campaign work.

Ecosystem Services

- The search term “ecosystem services” is only indirectly found on Sierra Club pages, e.g. here: <https://www.sierraclub.org/sierra/garden-reconsidered>
- “Forest” appears mainly on pages concerned with logging.

- Searching for “Sierra club forest climate adaptation” yielded only slightly more, exclusively within the CLIMATE CHANGE ADAPTATION TEAM:
 - <https://content.sierraclub.org/grassrootsnetwork/team-news/2016/08/building-climate-resilience-us-landscapes>
 - <https://content.sierraclub.org/grassrootsnetwork/team-news/2017/07/major-scale-forest-restoration-needed-protect-climate>
 - https://content.sierraclub.org/creative-archive/sites/content.sierraclub.org.creative-archive/files/pdfs/100_173_ForestReport_Whitepaper_08_low.pdf
- Some Sierra Club groups work on urban tree planting (one notable area is Oakland CA)
- Sierra Club participates in national forest and BLM planning processes to influence forest management practices on public lands. We favor an end to commercial logging on all federal public lands. Our chapters are active in promoting sound state regulation of forest management on state and private lands.
- The Sierra Club seeks protected lands status with no logging by promoting new wilderness areas, national parks and monuments, wild and scenic rivers and interim protection of all national forest roadless areas.
- Sierra Club has promoted protecting all ancient/primary forests domestically and internationally. Sierra Club has been active internationally on REDD+ and protection of primary forests worldwide, but not a major player.
- Sierra Club opposes large scale logging, thinning, and salvage logging under the guise of fire prevention.
- Sierra Club supports natural forest ecosystem restoration through prescribed burns and allowing natural fires to burn in remote areas where human life and property are not at risk. This may lead to a temporary reduction in stored carbon but the natural forest ecosystem restoration brought on by the fires will lead to long term carbon sequestration by encouraging the growth of larger older trees.
- Sierra Club has supported using a price on carbon or public funds to help pay woodlot owners or indigenous people to protect or restore their forests and manage them permanently for carbon sequestration and biodiversity both domestically and internationally.

Forest Management

- Forest Certification and Green Building Team (a current Sierra Club's Grassroots Network Team) has recently reached out to educate and engage Club members on the subject of the role forests can contribute to carbon sequestration thus climate change mitigation. The team is also working to have the wood products industry meet specific healthy forests management and harvesting goals.
- North Carolina Chapter along with Cypress and other Groups: Address maintenance of healthy forests by seeking to maintain the integrity of all forests in NC including but not limited to National, wetland, and coastal plain forests.
- The Climate Change Adaptation 2018 survey should identify what other Club activity is happening across the US regions.

- Sierra Club efforts to protect USFS roadless areas and to designate more forested public lands as parks and wilderness areas helps by establishing new permanent protection and carbon storage.
- Sierra Club efforts in various states seek to curtail or eliminate clearcut logging on state and private lands and restrict logging for biomass energy.
- Sierra Club efforts to head off legislation that would provide funds and a mandate to step up salvage logging and other logging beyond the WUI fuel reduction zone.
- Sierra Club litigation to challenge logging on public and private lands.

4. What other groups are already working in this area?

General Forest Issues

- Dogwood Alliance,
- John Muir Project,
- Geos Institute.

Ecosystem Services

- Conservation International:
https://www.conservation.org/publications/Pages/climate_change_and_the_role_of_forests.aspx
- United Nations Collaborative Program on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries: <http://www.un-redd.org>
- Forest Carbon Partnership Facility of the World Bank Group:
<https://www.forestcarbonpartnership.org>
- United Nations Framework Convention on Climate Change, REDD+:
<https://redd.unfccc.int>
- FAO, CBD: <https://www.cbd.int/forest/CC.shtml>
- USAID CONSERVING BIODIVERSITY AND FORESTS:
<https://www.usaid.gov/biodiversity>
- WWF: <https://www.wwfclimatecrowd.org/projects>
- <https://www.naturebank.com/about-us/>
- <http://projects.worldbank.org/search?lang=en&searchTerm=forest%20adaptation>
- <http://www.wri.org/blog/2016/06/cities%E2%80%99-war-against-climate-change-heating-and-cooling-transport-are-key-battlegrounds>
- <http://www.wri.org/our-work/project/transformational-adaptation>
- <https://www.iucn.org/theme/forests/projects>
- <https://www.cifor.org/projects/>
- <https://www.nature.org/science-in-action/ecosystem-services.xml>
- <https://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/pennsylvania/workingwoodlands/index.htm?redirect=https-301>
- <https://www.nature.org/ourinitiatives/urgentissues/global-warming-climate-change/nature-is-a-powerful-solution/index.htm?intc3=nature.climate.lp.r1c2>
- <https://www.thenatureofcities.com>

Forest Management

(Domestic)

- Dogwood Alliance, Asheville, NC (www.dogwoodalliance.org) is addressing the impact of extractive industries on forests in Southeastern US. They have numerous educational campaigns and best management policy advocacy programs across this region. These policies address biodiversity, deforestation, forest degradation, forest conservation and EJ issues. They are advocating for forest best management practices globally.
- Southern Environmental Law Center (SELC), Chapel Hill, NC, (www.southernenvironment.org) work to ensure that the wood pellet industry meets State and Federal air quality standard; as well as, provide support to Dogwood Alliance's national and international educational initiatives addressing forest health, biodiversity, and their role in climate change solutions.
- The Nature Conservancy – on all levels, e.g. <https://www.nature.org/en-us/what-we-do/our-priorities/protect-water-and-land/>
- Many other local and state based groups working to protect forest areas, particularly old growth and wilderness.

(International)

- World Wildlife Fund (WWF) (www.worldwildlife.org/initiatives/forests) has been working for over 60 years protecting nature (including forests) globally. WWF works in over 100 countries with over 5 million members globally.
- The Organization for Economic Co-operation and Development (OCED) (www.OECD.org) works to promote global policies that improves the economic and social well-being of all people.
 - OCED through the Reducing Emissions from Deforestation and Degradation (REDD) Program in developing countries seek to mitigate global climate change through policies advocating sustainable forest management and enhancement of forests carbon stocks.
 - OCED also addresses the drivers of deforestation and provide incentives for Nations to protect their forests while maintaining the integrity of local communities and indigenous peoples.

5. What funders if any, are funding in this area?

General Forest Issues

- Numerous funders are of course funding climate change mitigation work, but mainly in the form of actions and campaigns to move us beyond fossil fuel consumption and to truly clean, green energy.
- This is essential work, which must continue, but such funders generally do not yet realize that forest protection and recovery must be incorporated in order to effectively mitigate climate change.

Ecosystem Services

- <https://www.leonardodicaprio.org/projects/wildlife-landscapes/>
- <https://www.leonardodicaprio.org/projects/climate-change/>
- <https://www.leonardodicaprio.org/programs/california-program/>
- <https://nifa.usda.gov/program/ecosystems-programs>
- <https://nifa.usda.gov/program/forests-programs>
- <https://globalforestatlas.yale.edu/conservation/finance-forest-conservation-payment-ecosystem-services>
- <https://www.conservationfund.org/our-work/conservation-finance/ecosystem-services/345-focus-areas/finance>
- <https://www.federalgrantswire.com/forest-service-department-of-agriculture-federal-grants.html>
- https://www.wfamilyfoundation.org/documents/WFF_SFCI_Guidelines_2018.pdf
- <http://www.bullitt.org/programs/resilient-cities-healthy-communities/>
- <http://www.bullitt.org/programs/regional-ecosystem-health/>
- <http://www.bullitt.org/programs/energy-climate-and-materials/>
- https://www.thegef.org/sites/default/files/project_documents/10-19-16_Project_Document_PAD_revised_CLEAN.pdf
- <http://walker-foundation.org/net/content/projects.aspx>
- <https://www.google.com/search?q=grants+forest+ecosystem+services>
- <https://kresge.org/climate-adaptation>
- <https://www.google.com/search?&q=heat+adaptation+cities>
- **The Wyss Foundation:** <https://www.wyssfoundation.org>

Forest Management

- Should be many. Sierra Club's overall budget may compromise its eligibility since it is one of the more robust environmental non-profits globally. However, its infrastructure and global reach would make it attractive to foundations and big funders.
- Below is a list of potential funders captured from the "Statement Supporting Forests, Rights, and Lands for Climate" (<http://www.climateandlandusealliance.org/supporting-forests-rights-and-lands-for-climate/>) released from the 2018 Global Climate Action Summit in San Francisco, CA, on Sept. 11, 2018.
 - [American Jewish World Service](#)
 - [Arapyaú Foundation](#)
 - [Christensen Fund](#)
 - [ClimateWorks Foundation](#)
 - [David and Lucile Packard Foundation](#)
 - [Doris Duke Charitable Foundation](#)
 - [Ford Foundation](#)
 - [Good Energies Foundation](#)
 - [Gordon and Betty Moore Foundation](#)
 - [John D. and Catherine T. MacArthur Foundation](#)
 - [Leonardo DiCaprio Foundation](#)
 - [Mulago Foundation](#)
 - [The Rockefeller Foundation](#)

- Swift Foundation
- Tamalpais Trust
- Tata Trusts
- Thousand Currents
- United Nations Foundation

6. Which political forums does this play out in? (Local, state, regional, national, international?)

General Forest Issues

All Levels

Ecosystem Services

All Levels

Forest Management

Forest health plays out in all political forums because of its climate change implications, biodiversity and ecosystem services impacts globally. The US should be the leader in addressing this issue globally; however currently the US allows millions of acres of southern forests- which are a national treasure- to be clear-cut, for export as wood products. This could be addressed in the following:

- National Forest plans
- USFS Appropriations
- State climate action plans
- UN sponsored climate meetings and accords

7. Are there specific geographic locations for focus?

General Forest Issues

Federal and state public lands, and southeastern private forestlands, would be high priorities.

Ecosystem Services

Global solution although most important in cities and in tropical and subtropical regions. Areas with diverse old growth should be completely protected anywhere on the planet

Forest Management

The areas of focus would be those geographical areas that have a Sierra Club presence and the geographical variations in biodiversity and emerging threats, biome delineations, and carbon drawdown potential. The geographical variations are depicted in the Tables 2-4 in the supplementary document available here:

https://drive.google.com/open?id=1UIAt1tB4nB85hlz5M8m8Ma_hjDOw1ogvpxbt02WVK3E. Based on the summary information, regional variations should be a significant factor in how the Club should address the issues outlined. Thus, there should be different strategies for proposed actions in the various regions. The Club's

infrastructure is robust and flexible enough to easily accommodate those strategic variations.

8. What are most important summary documents or experts we should be aware of?

General Forest Issues

Scientists at organizations such as Woods Hole Institute, Geos Institute, and John Muir Project can be resources on this issue, and can provide many scientific citations and sources.

Ecosystem Services

The full report with 37 references to current research papers and summaries and a short commentary on each can be found at:

https://drive.google.com/open?id=12Yoz3jm3eKqoyl_44EmEXdXpft7JFQ2s

Forest Management

Note: See References for this section in Forest Biodiversity, Deforestation, Forest Degradation, and Associated EJ Issues Report of the Forest Carbon Management, Reforestation, and Afforestation-subgroup and links here. Some include:

- Dogwood Alliance, Asheville, NC, address US forests' health, biodiversity, unmanaged industrial logging, impacts of wood products, EJ issues; as well as, some international work associated with these issues.
(www.dogwoodalliance.org)
 - Treasures of the South Report (2018). Calculate the value of ecosystem services provided by intact healthy forests in Southeastern US.
 - The Great American Stand: US Forests and the Climate Emergency (2017). Characterizes the importance of healthy forests in mitigating climate change.
 - A History of Forests in the US South (2018): A review of how forests have been degraded or destroyed by industrialization in the US.
- World Wildlife Fund (www.worldwildlife.org/habitats/forest-habitat)
 - Forests provide 80% of world's terrestrial biodiversity
- Southern Environmental Law Center (SELC), Chapel Hill, NC, address US forests' health, biodiversity, unmanaged industrial logging, EJ issues; as well as, some international work associated with these issues. (www.southernenvironment.org)
 - Analysis projecting required acreage of forests needed to meet EU wood pellets demands (2016-2030)
 - Map depicting location of wood pellet plants in Southeastern US.
 - The Carbon Impacts of Woody Biomass for Energy
 - The North American Coastal Plain-A Biodiversity Hotspot Threatened by the Woody Biomass Industry.

- Memo from SELC to EU explaining that the burning of woody biomass would generate more CO₂ than burning coal.
- Wood Pellet Industry Destroys Forests and Harms Birds of Conservation Concern
- Wood Pellet Exporters Rely on Standing Hardwood Forests in Southeastern U.S.

9. Are there key justice and equity concerns we should be aware of? Are there environmental justice groups or individuals we should consult with on this topic?

General Forest Issues

- Yes, adding forest protection and recovery will make our work on climate change mitigation more effective, and will help curb the worst effects of sea-level rise, which will threaten tens of millions of people in lower-income coastal communities in the U.S. if we do not succeed in minimizing temperature rise (e.g., Strauss, B.H., et al. 2015, Proceedings of the National Academy of Sciences of the USA, Vol. 112, pp. 13508-13513).
- Moreover, this approach would address some significant environmental justice issues that have arisen in recent years with regard to impacts to communities from increased localized heating from deforestation in the area (thus exacerbating climate change impacts from rising temperatures), and air pollution in lower-income communities, that already have health risks from air pollution, due to the increase in “biomass” logging—i.e., logging forests and incinerating the trees for kilowatts.

Ecosystem Services

- Right for everybody to a healthy environment, preservation of a livable climate, pollution reduction etc. refer to list of forest ecosystem services. Nationally and internationally there are injustices based on income, race, nationality, etc. Literature: (Ernstson 2013; Chaudhary et al. 2018). Groups involved: consult with James Woodley (woodley50@yahoo.com)
- The [Tropical Forest Alliance 2020](#) is a partnership that brings together governments, businesses and civil society organizations to remove deforestation from the production of beef, soy, palm oil and paper. It's currently convening its [first General Assembly in Jakarta, Indonesia](#).
- The state of California is keen to include REDD credits in its cap-and-trade programme. California's governor Jerry Brown [worked closely with the oil industry](#) on California's climate policy, and is pushing for REDD to be allowed to “offset” ongoing pollution in California.
- In November 2010, the governments of California, Acre, and Chiapas signed a [Memorandum of Understanding](#) aimed at creating a REDD carbon credit system between the three states. Money would go to Acre and Chiapas in exchange for continued greenhouse gas emissions in California.

- But California's cap-and-trade programme still does not allow polluting industry in California to buy REDD credits from Acre and Chiapas.
- Friends of the Earth International recently [launched](#) a report that looks into the lessons to be learned from the cooperation between California, Acre, and Chiapas. The report, "[REDD+ The carbon market and the California-Acre-Chiapas cooperation: Legalizing mechanisms of dispossession](#)", was written by Fabrina Furtado.
- There are significant concerns among indigenous communities about the ways that REDD is being carried out. <https://www.treehugger.com/corporate-responsibility/redd-forest-protection-program-could-threaten-rights-of-350-million-people.html>

Forest Management

- The path from forest clearcutting to produce wood pellets to electricity service in EU has many points intercepting EJ issues and carbon drawdown potential.
- Wood Pellet Industry community impacts include:
 - 36 Wood Pellet Facilities in Southeastern US produces 13,872,000 lbs (13.8 mmt) of wood pellets in 2017.
 - Facilities located in vulnerable communities
 - 700 -1000 vulnerable communities impacted in Southeastern US.
 - The Industry is growing rapidly across the Eastern US.
- Deforestation and forest degradation issues are particularly profound in EJ communities globally.
- There are significant concerns among indigenous communities about the ways that REDD is being carried out. <https://www.treehugger.com/corporate-responsibility/redd-forest-protection-program-could-threaten-rights-of-350-million-people.html>
- Large scale afforestation could lead to major ecosystem conversions and impact existing communities reliant on the land. It could also compete with food production from the same lands.

10. Are there positive or negative environmental concerns or choices we need to be aware of?

General Forest Issues

Yes. Protecting forests as part of the climate change adaptation campaign would also dovetail with the Club's mission regarding protection of wild places and native biodiversity.

Ecosystem Services

- Restoring biodiverse forests and creating biodiverse urban parks for cooling has a lot of positive effects on other environmental issues (pollution, water balance) and social issues (coming together, same list as in permaculture report).
- Afforestation can compete with productive lands for food production. There is a choice between afforestation and devoting land to bioenergy crops. Forest carbon sequestration suffers from a possible lack of permanence either due to fire or logging.
- Increasing forest cover decreases the albedo effect in the subarctic and other regions with snow cover that provides reflectivity.
- When planting trees need to consider species and can they survive in changing climate?
- The Sierra Club should not promote monocultures and GMO trees and should prioritize native trees whenever possible.
- Paying landowners or tribes to protect forests requires a multi-generational commitment to continue the funds, even after the carbon drawdown has plateaued.

Forest Management

- Globally; maintaining and restoring intact, old growth, and healthy native forests coupled with the use of truly sustainable clean energy, as opposed to fossil fuels, will help reduce the concentration of atmospheric greenhouse gases and ultimately help cool the planet.
- Domestically and internationally, there are points of contention regarding what biological products should be included on the list of sustainable energy biomass. Environmental NGO's and scientists strongly recommend removing some biological entities off the list of biomass suitable for fuel. Whole trees are one such biological entity.
- Carbon counting is another controversial issue. Burning wood pellets as a fuel alternative to coal has been deemed sustainable and carbon neutral because the current carbon counting does not include carbon being re-emitted into the atmosphere during burning, does not account for the carbon released to the atmosphere from storage due to soil disruption during tree harvesting, and does not account for the lag time required for effective sequestering to occur within newly planted trees.
- The industry will say they are replanting trees and harvesting a certain type of tree and no true accountability of what they are harvesting is occurring.
- As noted above under EJ concerns, large scale afforestation could lead to major ecosystem conversions and impact existing communities reliant on the land. It could also compete with food production from the same lands.

11. Is the action consistent with Sierra Club policy?

General Forest Issues

Yes

Ecosystem Services

We need to see what the proposed action is? If it is protecting ancient forests and reducing/eliminating commercial logging on federal lands it is within policy. We have no policy on afforestation. We might need better policy direction on protecting international forests while respecting indigenous rights as there are emerging conflicts.

Forest Management

The proposed actions are within Sierra Club policy and many State chapters and groups are already addressing these issues without a national backing from the Club. Being a global advocate for addressing climate change issues and supporting those organizations already on the front line, is what has been expected from the Club. Now is the time to meet those expectations and be a team player addressing the deforestation and forest degradation issues which would ultimately enhance biodiversity and decrease EJ incidents. The Club's voice in educating its members about what is happening in SE US regarding industrial logging in vulnerable communities would shame this industry into adopting more community-friendly logging practices.

12. Any other key questions relevant to your area?

General Forest Issues

See answer to #10 above.

Ecosystem Services

Not at this moment but the topic is very connected to other issues.

Forest Management

No additional questions at this time.

13. Ultimately, we want to see what part of this might be particularly ripe for Sierra Club engagement and influence. Since we can't do everything, we will need to make recommendations of most promising forums and issues to engage in, so deciding what not to do is also important. Your advice about the relative priority for Sierra Club engagement, pro and con, will be very valuable.

General Forest Issues

Because this advances climate change mitigation, protection of wild places and biodiversity, and environmental justice; it should be a high priority for the Club.

Ecosystem Services

- Even though forest ecosystem services are more connected to climate adaptation than mitigation, it is nevertheless a key issue to survive the inevitable degree of climate change stressors.

- Bruce Hamilton would love to see here your thoughts on the most important things you think the Club could promote given all the opportunities and the challenges we face.
- Do we want to be involved in afforestation at all? Maybe it is fine, but we have little to add. The SC should not prioritize afforestation.
- Do we at least need some policy update on when afforestation is good and when it might be a problem? For example, if one were just to rely on afforestation to get 10 Gtons of carbon we would need to double the present forest cover on the globe, with a major impact on food production, existing human uses of unforested lands, and albedo. I presume that is a bad idea. Should we only promote afforestation in sites that have historically (last 200 years) been forested? That would make sense.
- Is there an important role for Sierra Club in reforestation domestically? Where?
- What, if anything, should Sierra Club focus on internationally given what other parties are already doing. Would it be OK for us to just sign on through existing coalitions or are we needed to lead in any area? I think clear statements about the failures of REDD and the CA cap and trade system are needed and endorsing the work of TNC and others.
- What federal or state forest policies or reforms should we champion? Is there any model state legislation we want to adopt in other states? I am uncertain if any US state or other country are doing this so good to be a shining model - Chad??
- Is there a suite or portfolio of forest carbon drawdown practices we want to promote as opposed to settling on just one or two? Hawken, Chad, Dominick?
- All the above are not gearing towards Ecosystem services but rather Forest Management???

Forest Management

- Deforestation and forest degradation that have biodiversity and environmental justice intersecting points are already being addressed by other NGOs and Chapters and groups within the Club. This will not be a start-from-scratch endeavor. The Club can easily become an ally to these other front-line organizations while leading in addressing policy issues at the governmental level. Also, the Club would be a leader in global education about this issue. The smaller NGOs just don't have the necessary global reach to be truly effective.
- This should be a priority for the Club. Time zero is now. Once mature forests are clear-cut, they may never return and the ecosystem services they once provided may be lost to future generations.
- Once the soil is disrupted and climate change variations in temperature, hydrology, precipitation, are added into the equation; forest degradation and diminished biodiversity in the target areas are certain. These areas would become prime candidates for future deforestation events.

14. What are the implications for providing good paying family-sustaining and/or union jobs and a just transition as part of deployment of this type of program? What are the implications for providing good paying union jobs and a just transition as part of deployment of this type of program?

General Forest Issues

See answers below.

Ecosystem Services

- There are no high paying jobs in this area of employment, but they are family sustaining.
- Restoring forests and afforestation can provide jobs, but generally not high paying.
- The study, monitoring, and management of ecosystem services invites many well paying jobs.

Forest Management

- Protecting forests can protect those who are dependent on intact forests for their livelihood such as indigenous communities.
- The restoration and stewardship of forests will allow for the creation of many naturalist and ranger positions.
- There will also need to have more trained State forest field officers associated with managing forests, wildlife, biodiversity, ecosystem services, healthy soil technicians, and those technicians that can provide support to private forest/land owners.
- All of the issues identified in this report, as well as the efforts of the entire task force, may create the need for more scientists, the development of more climate tailored curricula, and an entire new field of technical positions as the US and other countries move toward a more responsible climate change attitude.

Literature:

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Freshwater and Wetlands

Subgroup Team Members Contributing to this report include: James Woodley, Tom Wassmer, and Elna Otter

Report Topics:

- a. Freshwater and Wetlands Habitats as Resources and Climate Resilience Tools
- b. Impacts of Climate Change on Freshwater Supply

This report will identify and recommend appropriate adaptations that the Sierra Club (SC) or “Club” should advocate for to address these freshwater and wetland habitats issues, as well as maintain their function as climate change resiliency tools. Also, this report will provide information regarding different situations of freshwater availability and recommend adaptations the SC could promote to help address them.

Literature to and abstracts about our topics can be found in two external documents:

<https://drive.google.com/open?id=1oGZ2UDhCImI0ISXC7jZarOI1WkyyyAL1> and https://drive.google.com/open?id=15oidtfA_ZK2IOB06v52_isNwvWZThalh . Below citations refer to literature identified in one of these documents.

1. What are the major opportunities for adaptation in this area?

- Wetlands are one of the most important global carbon sinks; therefore, the Club could include the preservation, restoration, and conservation of freshwater and particular wetland habitats in a national campaign addressing climate change adaptations (see The Global Wetland Outlook, 2018).
- The Club should advocate for actions to halt the lost of wetland biodiversity identified in “What the World Needs Now to Fight Climate Change: More Swamps” (Moomaw, 2018) and codified in the recent opinion piece “Addressing the Decline in Wetland Biodiversity by Finlayson (2018).
- The Club should be aware that the management and restoration of floodplains, mangroves, seagrasses, saltmarshes, arctic wetlands, peatlands, freshwater wetlands, and wetland forests will require unique approaches for each type since each have different environmental stressors (Erwin, 2008). The SC educational programs and advocacy for wetlands should be regionally diverse.
- To preserve drinking water, the Club should advocate for a state-wide and interboundary registry of groundwater withdrawal and limits to withdrawal for industry, mining and large-scale agriculture as well as a statewide comprehensive supply-and-demand management strategy.
- The Club should advocate for agricultural efficiency-making better use of recycled and reused water systems- and the improvement of urban water efficiencies. Such policies could help close the gap even more and further reduce the reliance on non-renewable groundwater resources. Here consult especially Massoud et al. (2018) and Famiglietti (2014).

- The Club should take a strong stand for the transition away from large-scale, intensive monoculture to permaculture practices which will reduce the stress on groundwater almost entirely.
- Using the Sierra Club's national reach, the Club could support organizations such as the Wetlands Forest Initiative in elevating the conservation of wetland forests as a national conservation priority by becoming a working group member (Forest, 2018) (Davis, 2017).
- Also, using the Club's national reach, the Club could work with organizations to ensure that marine coastal wetland areas (such as salt marshes and mangrove forests), are conserved for their role in protecting those specific coastal areas from flooding during violent storm events such as hurricanes (William Moomaw, 2018).
- Using the Club's robust infrastructure and substantial political voice, it could work with organizations such as Dogwood Alliance and Wetlands Forest Initiative to have policies developed and administered to expand (where appropriate) riparian buffers nationally to 150 feet (Davis, 2017).
- The Club could work with appropriate organizations to address the impact of contaminated runoff from violent storm events on potable water (such as ground water wells), surface freshwater, and freshwater and wetland habitats.
- The Club could work with states such as Oregon and North Carolina that are aggressively addressing the destruction of wetlands and freshwater habitats (Chandra LeGue, 2018) (Wetland Forest Initiative, 2018).
- The Club should work with States such as California whose recent budget appropriations include \$500 million for addressing wetlands, watersheds, and forests health (see ww2.arb.ca.gov/our-work/programs/california-climate-investments/cci-funded-programs)
- The Club should work with states to address appropriate valuation of wetland forests (see Dogwood Alliance's "Treasures of the South: The True Value of Wetland Forests" at www.dogwoodalliance.org/our-work/wetland-forests-initiative/treasures-of-the-south/). In so doing we would further educate private landowners as to the true value of their wetland habitats.

2. What is the potential for significant carbon drawdown?

Conserving intact wetlands can have a significant impact on atmospheric CO₂ concentration.

- Wetlands and all forests account for the reduction of CO₂ in the atmosphere from anthropogenic activities by 28% each year (William Moomaw, 2018).
- Better management of US forests, grasslands, and soils could offset greenhouse gas emissions by 21% (www.nytimes.com/2018/11/14/climate/climate-change-natural-solutions.html).
- Undisturbed soils associated with wetlands actively store CO₂. When that soil is disturbed by clear-cutting or other anthropogenic activities, CO₂ is released into the atmosphere. Wetland soils and sediments are considered among the world's largest carbon sinks.

- Wetlands seem to be able to store approximately twice the organic carbon load compared to cropland that is not tilled. Natural wetlands emit approximately 25% of the total emissions from all anthropogenic and natural sources. Wetland methane flux rates represent the net effects of microbial production and consumption. If constructed wetlands are not designed and managed properly, they could become sources of greenhouse gases such as carbon dioxide and methane (Kayranli et al. 2010).
- Large quantities of organic carbon are stored in frozen soils (permafrost) within Arctic and sub-Arctic regions. A warming climate can induce environmental changes that accelerate the microbial breakdown of organic carbon and the release of the greenhouse gases carbon dioxide and methane. This feedback can accelerate climate change (Schuur et al. 2015). Thawing of arctic permafrost (which is considered a wetland soil) currently releases massive quantities of once-stored carbon into the atmosphere (William Moomaw, 2018).
- The recent discovery of an extensive forest peatland in the central Congo Basin of roughly 145,500 km² with an estimated 33 billion tons of carbon stored in these peatlands, lead to questions about whether these carbon stocks are under threat and, if so, what can be done to protect them (Dargie et al. 2018).

3. What kind of Sierra Club activity is already happening in this area?

- Freshwater
 - i. Numerous SC Chapters and Groups are working on water quality issues.
 - ii. There are Grassroots Network Teams addressing water issues.
- Wetlands
 - iii. Numerous SC Chapters and Groups are working on wetlands issues.
 - iv. There are Grassroots Network Teams addressing wetland issues.

4. What other groups are already working in this area?

- International Hydrological Programme (IHP): en.unesco.org/themes/water-security/hydrology
- United Nations Development Programme: www.stories.undp.org/return-of-colombias-wetlands
- The Convention on Wetlands, called the Ramsar Convention: www.ramsar.org/
- Dogwood Alliance addressing wetland forests www.dogwood.org

5. What funders if any, are funding in this area?

Many of the funders for the wetlands, in general, and forest wetlands specifically will be the same as for the Forest Carbon Management subgroup's reports. Some will be included here (*Below is a list of potential funders captured from the "Statement Supporting Forests, Rights, and Lands for Climate"* (<http://www.climateandlandusealliance.org/supporting-forests-rights-and-lands-for-climate/>) released from the 2018 Global Climate Action Summit in San Francisco, CA, on Sept. 11, 2018. (Note: the website address is embedded within each organization's title)

- [American Jewish World Service](#)
- [Arapyaú Foundation](#)

- Christensen Fund
- ClimateWorks Foundation
- David and Lucile Packard Foundation
- Doris Duke Charitable Foundation
- Ford Foundation
- Good Energies Foundation
- Gordon and Betty Moore Foundation
- John D. and Catherine T. MacArthur Foundation
- Leonardo DiCaprio Foundation
- Mulago Foundation
- The Rockefeller Foundation
- Swift Foundation
- Tamalpais Trust
- Tata Trusts
- Thousand Currents
- United Nations Foundation
- Freshwater Funders
- The Wyss Foundation: <https://www.wyssfoundation.org>

6. Which political forums does this play out in? Local, state, regional, national, international?

On all levels

7. Are there specific geographic locations for focus?

- For carbon drawdown yes: coastal wetlands, tundra wetlands, peatlands.
- For ecosystem services all wetlands are important.
- For groundwater depletion mostly arid and semi arid areas in central and western part of country but also coastal aquifers such as the Florida peninsula
- For permafrost/ice/glacier melting: North Western portions of the US
- For flooding: Eastern portions of US

8. What are most important summary documents or experts we should be aware of?

- See the annotated compilation of current research papers: Literature.docx in this report folder
https://drive.google.com/open?id=15oidtfA_ZK2IOB06v52_isNwvWZThalh
- See CATF subgroup “Forest Carbon Management Biodiversity” . . . report
- See CATF subgroup “Oceans and Coast” report
- See CATF subgroup “Restoration and resilience in natural environments” report
- “Treasures of the South Report (2018)”. This report calculates the value of ecosystem services provided by intact healthy forests in Southeastern US.
- “The Great American Stand: US Forests and the Climate Emergency (2017)”. This report characterizes the importance of healthy intact forests in mitigating climate change.

- The Global Wetland Outlook (2018). This report promotes healthy wetlands as essential to positive qualities of human, animal, and plant life.

9. Are there key justice and equity concerns we should be aware of? Are there environmental justice groups or individuals we should consult with on this topic?

- The EJ concerns may be associated with wetland forest clear cutting issues but also access to safe and sufficient freshwater, case studies such as the CA central valley: <https://www.nytimes.com/2017/03/02/movies/water-power-a-california-heist-review.html>
- See also “Forest Carbon Management Biodiversity”. . . report

10. Are there positive or negative environmental concerns or choices we need to be aware of?

- There are many synergies between water security and wetlands and other issues. Water security and wetlands as water/moisture buffers are related to agriculture and can be improved by transitioning to an environmentally more sound practice such as permaculture (see subreport permaculture in the Agriculture report).
- Wetlands are also related to the restoration of natural environments. Refer also to that report.

11. Is the action consistent with Sierra Club policy?

All of the action put forth in this report are consistent with Club policy.

12. Any other key questions relevant to your area?

No other questions.

13. Ultimately we want to see what part of this might be particularly ripe for Sierra Club engagement and influence. Since we can't do everything, we will need to make recommendations of most promising forums and issues to engage in, so deciding what not to do is also important. Your advice about the relative priority for Sierra Club engagement, pro and con, will be very valuable.

- Based on the results from the 2018 Sierra Club Chapters and Groups Survey administered as part of the information collection activities associated with this action, many of the Chapters and Groups are addressing some of the issues this report is putting forth:
 - 55% of respondents are already addressing flooding issues thus they are aware of more of the frontline issues.
 - 44% of the respondents are already working with local and state governments addressing climate adaptation plans.
 - 43% of respondents are already working to protect forests.
- The Club's Grassroots Network Teams are addressing some of the issues put forth by this report. The efforts of those teams can only be enhanced by the support of a national climate adaptation program addressing freshwater and wetland habitats; as well as, drinking water supply issues.

- The Club should take a strong stand for wetland protection and restoration. The Club should also work to significantly reduce non-climate stressors of wetlands such as water delineation, pollution, and invasive species.
- To preserve drinking water; the Club should advocate for a intrastate and interstate registry of groundwater withdrawal and limits to withdrawal.
- In addition, The Club should take a strong stand for the transition away from large-scale, intensive monoculture to permaculture practices.
- The Club should advocate for the US and other Countries to adopt the Ramsar Convention Steps for healthy wetlands (see The Global Wetland Outlook, 2018).

14. What are the implications for providing good paying family-sustaining and/or union jobs and a just transition as part of deployment of this type of program?What are the implications for providing good paying union jobs and a just transition as part of deployment of this type of program?

- The restoration and stewardship of wetlands will allow for the creation of many naturalist and ranger positions.
- Accessing the availability of new aquifers will allow for the creation of more skilled technicians and scientists to gather this data.
- Taking better control over our water resources will also create the need for skilled technicians and scientists as well as law enforcement personnel to monitor and reinforce water budgets.
- All of the issues identified in this report, as well as the efforts of the entire task force, may create the need for more scientists, the development of more climate tailored curricula, and an entire new field of technical positions as the US and other countries move toward a more responsible climate change attitude.

Ocean fertilization and related projects

1. What are the major opportunities for adaptation in this area?

Ocean fertilization for carbon drawdown and sequestration.

Phytoplankton, present in large numbers in the upper waters of the world's oceans, use ambient carbon to construct their bodies, especially the shells of some species such as diatoms. Phytoplankton are at the base of the oceanic food chain, so their carbon may become part of another organism when they are eaten. When they are not eaten, their carbon settles to the bottom and part is sequestered, at least for a while. Ocean fertilization supplies nutrients to encourage phytoplankton blooms which will lead to carbon sequestration on the ocean floor.

One nutrient necessary to the photosynthesis by which phytoplankton produce energy is iron, common enough from blown dust near shore but sparse offshore. Strewing iron filings in the ocean produces a phytoplankton bloom, but because the bloom attracts hungry sea life (especially jellyfish), little carbon may reach the ocean floor. LOHAFEX, a joint Indian-German project in 2009, was conducted in water low in silicic acid so that a low count of the shelled phytoplankton was generated. The shells of phytoplankton are primary carriers of carbon to the sea floor.

https://en.wikipedia.org/wiki/Iron_fertilization Thus, not all locations will produce successful carbon sequestration.

Adding iron may deplete other nutrients and lead to low phytoplankton growth elsewhere. Most of the carbon from phytoplankton blooms is dissolved and returned to the environment in a matter of days to centuries, so that iron fertilization does not provide long term sequestration. Some phytoplankton, such as those which produce the red tide, are toxic to sea life.

“Researchers worldwide have conducted 13 major iron-fertilization experiments in the open ocean since 1990. All have sought to test whether stimulating phytoplankton growth can increase the amount of carbon dioxide that the organisms pull out of the atmosphere and deposit in the deep ocean when they die. Determining how much carbon is sequestered during such experiments has proved difficult, however, and scientists have raised concerns about potential adverse effects, such as toxic algal blooms. In 2008, the United Nations Convention on Biological Diversity put in place a moratorium on all ocean-fertilization projects apart from small ones in coastal waters. Five years later, the London Convention on ocean pollution adopted rules for evaluating such studies.” <https://www.nature.com/news/iron-dumping-ocean-experiment-sparks-controversy-1.22031>

Artificial upwelling for carbon sequestration induces a flow of nutrients from deep water to the surface to promote a phytoplankton bloom. “Artificial upwelling suffers from many of the same problems as Ocean Fertilization, including unknown, unpredictable, and potentially highly damaging impacts on marine ecosystems, with little evidence to suggest that carbon is actually sequestered. It is based on a false equivalence between the complexities of natural upwelling events and artificial ones, and ironically, this

method may also “upwell” already sequestered CO₂ in the form dead or living sea creatures.” <http://www.geoengineeringmonitor.org/2018/06/artificial-upwelling/>

China recently completed experiments with artificial upwelling. The results have not been announced. A Chinese modelling found that the energy efficiency of the process decreases with water depth, and that the efficiency of the carbon sequestration varies greatly with region. file:///C:/Users/atill/Downloads/sustainability-10-00664.pdf

2. What is the potential for significant carbon drawdown?

The potential for carbon drawdown by ocean fertilization with iron is high, since a small amount of iron added in the open ocean can produce a great mass of phytoplankton. In the right area their shells can carry a significant amount of carbon to deep waters. The time scale of sequestration may be short, however. Both the promise and the limitations of iron fertilization apply also to artificial upwelling. IPCC 1.5 report page 4-50 says that potential might be 4.4GtCO₂/yr “following a modeling approach” but then states that Fuss et al consider the potential to be extremely limited given the evidence and existing barriers.” It also says that there is “low agreement” on permanence with estimates of 1,600 years to millennia if injected or buried in or below the seabed, but storage at the surface could be rapidly released.

3. What kind of Sierra Club activity is already happening in this area?

None.

4. What other groups are already working in this area?

Ocean fertilization by iron is now under a moratorium in international waters.

5. What funders if any, are funding in this area?

None.

6. Which political forums does this play out in? Local, state, regional, national, international?

Iron is already available to phytoplankton in coastal waters. Any effective iron fertilization would have to be carried out in international waters. In 2008, the United Nations Convention on Biological Diversity put in place a moratorium on all ocean-fertilization projects apart from small ones in coastal waters. Five years later, the London Convention on ocean pollution adopted rules for evaluating such studies.

7. Are there specific geographic locations for focus?

The open ocean.

8. What are most important summary documents or experts we should be aware of?

<https://www.nature.com/news/iron-dumping-ocean-experiment-sparks-controversy-1.22031>

9. Are there key justice and equity concerns we should be aware of? Are there environmental justice groups or individuals we should consult with on this topic?

No. Fertilization could disrupt the biosphere and impact cultures and countries dependent on ocean fisheries. The mining, crushing, and transporting of iron filings or other fertilization minerals could have significant justice concerns.

10. Are there positive or negative environmental or ethical/stewardship concerns or choices we need to be aware of?

Iron fertilization is under an international moratorium partly because of concerns about environmental impact. Potential significant impacts both in the oceans and the land based impacts of mining, crushing and transporting the iron or other minerals.

11. Is the action consistent with Sierra Club policy? Please flag areas where we would need to update, clarify or revise policy.

None exist. The Club has expressed concern about this technology in past statements but lacks policy, which would be good to develop.

12. Any other key questions relevant to your area?

No.

13. Ultimately we want to see what part of this might be particularly ripe for Sierra Club engagement and influence. Since we can't do everything, we will need to make recommendations of most promising forums and issues to engage in, so deciding what not to do is also important. Your advice about the relative priority for Sierra Club engagement, pro and con, will be very valuable.

The Sierra Club should monitor the issue of ocean fertilization by iron. It is possible that the technology could yet be a viable way to sequester carbon.

The Sierra Club should monitor artificial upwelling in case it should prove effective, against expectations. If there are attempts to end the moratorium on ocean fertilization the Sierra Club may decide to weigh in to keep it in place.

The Sierra Club should enthusiastically support such relatively benign biological means of carbon sequestration as regenerative agriculture, forestation, biochar, and kelp permaculture. Kelp growth, for example, lessens acidity in surrounding waters, promotes phytoplankton health, and provides refuge for sea life. It is scalable for significant carbon sequestration.

14. What are the implications for providing good paying family-sustaining and/or union jobs and a just transition as part of deployment of this type of program?

Even if deployed, the ocean fertilization technologies are not likely to provide significant employment opportunities. There could be high paying jobs associated with the on shore mining, but these would not be green jobs.

Agricultural lands, soils and animal management

Permaculture, as growing side of restorative agriculture

This report focuses on innovative farming practices and their impact on climate mitigation and adaptation. Unfortunately, there are currently no good examples for incentives and policies to facilitate **large scale** shifts to innovative farming practices in any country of the world.

1. What are the major opportunities for adaptation in this area?

Our food systems including the way we produce, transport, preserve and consume food – contribute between 19% to 29% of greenhouse gas (GHG) emissions. Climate change is detrimental on yields in most producing regions and GHGs might lead to widespread nutrient deficiencies. Agricultural soils contain 25–75% less soil organic carbon than their counterparts in undisturbed or natural ecosystems. Thus, re-carbonization of soil (and the terrestrial biosphere) is an important strategy for climate change adaptation and mitigation.

- The impact of agriculture on climate change can be reduced by lifestyle changes, especially dietary choices. The decision to consume less meat and dairy would lead to a massive reduction of livestock resulting a significantly less emissions, reduced deforestation, and soil erosion.
- In farming/growing, production must shift from large monocultures with high fossil fuel impact to small polycultures with a small carbon footprint. This can be done without shortages in the global food production as small and medium farms (≤ 50 ha) produce 51–77% of nearly all commodities and nutrients on the planet.
- Permaculture consciously designs landscapes which mimic the patterns and relationships found in nature, while yielding an abundance of food, fiber and energy for provision of local needs. Permaculture techniques mitigate climate change and allow us to cope with climatic changes without food shortages:
 - a. Water Regulation and Management
 - b. Soil protection and restoration
 - c. Revegetation
 - d. Agrodiversity (or agrobiodiversity)
 - e. Agroecology
 - f. Creation and Use of Microclimates

2. What is the potential for significant carbon drawdown?

Agriculture has one of the largest potentials to draw down carbon. Following Hawken, numbers in Gigatons of reduces CO₂:

- a. Direct effects: Regenerative Agriculture (increase of soil carbon storage): 23.15, Tropical Staple Trees: 20.19, Conservation Agriculture: 17.35, Tree Intercropping: 17.2, Farmland Restoration: 14.08, Improved Rice Cultivation 11.34, Multistrata Agroforestry: 9.28, Composting: 2.28, Nutrient Management:

- 1.81, Farmland irrigation: 1.33, Biochar: 0.81; total: 118.82; Adding innovative grazing: Silvopasture: 31.19, managed grazing: 16.34; grand total: 166.39
- b. Indirect, associated effects: Plant-Rich Diet (lifestyle changes) 66.11, restoration of ecosystems by integrating conservation and permaculture: tropical forests: 61.23, temperate forests 22.61, peatlands: 21.57, forest protection 6.2, indigenous peoples land management: 6.19, total: 183.91.
- c. Grand total 350.26 that is 33% or 1/3 of all measures discussed in Drawdown!
- 3. What kind of Sierra Club activity is already happening in this area?**
- <https://www.sierraclub.org/michigan/regenerative-agriculture-project>
 - <https://oregon2.sierraclub.org/sites/or.sierraclub.org/files/juniper-group/pdf/Regenerative%20Agriculture.pdf>
 - <https://content.sierraclub.org/grassrootsnetwork/tags/permaculture-solutions-climate-change>
 - <https://www.sierraclub.org/sierra/garden-reconsidered>
- 4. What other groups are already working in this area?**
- <http://www.permacultureclimatechange.org>
 - <https://www.climatecolab.org/contests/2017/exploring-synergistic-solutions-for-sustainable-development/c/proposal/1334301>
 - <http://www.zerocarbonbritain.org/en/>
 - <https://www.4p1000.org>
 - Permaculture International Research Network: <https://pirn.permaculture.org.uk>
 - [Marin Carbon Project](#)
- 5. What funders if any, are funding in this area?**
- <https://www.leonardodicaprio.org/scaling-carbon-farming-and-regenerative-agriculture-in-california/>
 - <https://nifa.usda.gov/program/ecosystems-programs>
 - 2017 Healthy Soils Program of the State of California. However, given the scope of just \$7.5 million from the states cap and trade proceeds, the extend of funded demonstration projects and incentives is very limited for what needs to happen.
- 6. Which political forums does this play out in? Local, state, regional, national, international ?**
- On all levels.
- 7. Are there specific geographic locations for focus?**
- Global solution although most important for global food production in most fertile and productive climate zones: cold-temperate to warm-temperate. Important and doable everywhere for self-sustenance and for export cash crops such as chocolate, coffee, and spices.
- 8. What are most important summary documents or experts we should be aware of?**
- See bibliography and links in full report.

9. Are there key justice and equity concerns we should be aware of? Are there environmental justice groups or individuals we should consult with on this topic?

Right for everybody to healthy food and water, preservation of livable climate, pollution reduction. Nationally and internationally there are injustices based on income, race, nationality. For groups refer to full report.

10. Are there positive or negative environmental concerns or choices we need to be aware of?

Permaculture techniques have a lot of positive and synergistic effects on other environmental issues (water shortages, pollution) and social issues (grounding people to the basis of life, uniting and mobilizing people. More in full report.

11. Is the action consistent with Sierra Club policy?

Promoting permaculture, carbon farming and reduced meat in diets is fully consistent with the Sierra Club Food and Agriculture

Policy <https://www.sierraclub.org/policy/agriculture/food>

12. Any other key questions relevant to your area?

I branched out into several – see full report.

13. Ultimately we want to see what part of this might be particularly ripe for Sierra Club engagement and influence. Since we can't do everything, we will need to make recommendations of most promising forums and issues to engage in, so deciding what not to do is also important. Your advice about the relative priority for Sierra Club engagement, pro and con, will be very valuable.

Permaculture/agroecology includes many ranks on Hawken's list with a combined carbon reduction of 166.39 GT CO₂, which is more than the impact of a greatly intensified to exclusive use of wind parks and solar farms for energy production. Adding indirect benefits of regenerative agriculture makes it one of 3 key areas for climate mitigation while providing also powerful tools to adapt and survive the inevitably changing climate.

14. What is the potential for family supporting and/or union job creation?

Promoting carbon farming can increase farm income and helps family farms but generally farming jobs are not high paying or union jobs. Permaculture-based agriculture is more rewarding and yield higher prices with the potential to improve the livelihood of farmers.

Biochar

Chance Cutrano

1. What are the major opportunities for adaptation in this area?

Biochar, char made from the partial combustion of plant mass, is a co-product of the pyrolysis-bioenergy-biochar-platform (PBBP), where locally harvested biomass undergoes pyrolysis or gasification processing to produce bioenergy and biochar co-products. When applied as a soil amendment, biochar can stimulate microbial benefits (Lehmann et al. 2011), increase the soil's water-holding capacity (Masiello et al. 2015), improve nutrient availability (Liang et al. 2006; Laird et al. 2010), decrease susceptibility to plant disease (Elad et al. 2010), and remediate contaminated soils (Beesley et al. 2011). By enhancing soil quality, biochar application can increase crop yields (Spokas et al. 2012; Jeffery et al. 2017) and carbon return to soil, thereby further increasing soil carbon storage (Whitman et al. 2011). Biochar carbon remains in soils for hundreds to thousands of years and will allow farmers to sustainably harvest a greater fraction of above-ground crop residues for use as feedstock in pyrolysis or gasification conversion systems.

In the near term, biochar can be used for a variety of non-agricultural purposes such as mine-land remediation, urban brownfield remediation, remediation of soils contaminated with heavy metals, anaerobic digester gas clean up, phosphate removal from water in anaerobic bioreactors, potable and effluent water treatment, gasifier feedstocks, and fertilizer formulations and stabilizers.

2. What is the potential for significant carbon drawdown?

Recent estimates of biochar's climate change mitigation potential range from 1.1 to 3.3 petagrams CO₂-eq per year by 2030 (Paustian et al. 2016; Griscom et al. 2017). This is equivalent to 1,100,000,000 MTCO₂e- 3,300,000,000 MTCO₂e. It can encompass drawdown related to forest and food biochar via fertilizations and mineralization (*Project Drawdown ranking #72*), and clean cookstoves via (*Project Drawdown ranking #21*).

3. What kind of Sierra Club activity is already happening in this area?

So far, we largely are opposing bad biomass projects, and we are not promoting biomass projects; therefore, we have not supported the projects that would provide for byproducts such as biochar. As we have noted in the BECCS subgroup report, the ideal projects that meet our requirements and have CCS have not presented themselves and may not be economic until a 2040 timeframe.

Sierra Club is opposing wood to energy projects -- both wood pellet production/exports and wood to energy power plants. We are arguing against including wood to energy

plants in any RPS plan as they are not carbon neutral, as EPA falsely claims. We have a small Packard grant to do organizing on this issue in several states.

In June of 2017, Sierra Magazine covered the topic of biochar.

4. What other groups are already working in this area? Opportunities for partnership or redundancy?

The International Biochar Initiative

The Breakthrough Institute

The New Carbon Economy Consortium is well positioned to target the bioenergy equation holistically, including looking at biochar feedstock and the entire supply chain (e.g., biofuel production from woody and herbaceous biomass harvested sustainably). The New Carbon Economy consortium is made up of the following researchers:

Center for Carbon Removal (now known as Carbon 180)

Arizona State University

ASU LightWorks

Purdue University

Iowa State

Lawrence Livermore National Laboratory

the Center for Negative Carbon Solutions

Energy Futures Initiatives

Columbia University

Cornell University

Colorado School of Mines

University of Wyoming

Colorado State University

Howard University

National Renewable Energy Laboratory

The Great Plains Biochar Initiative, a partnership of the Nebraska Forest Service, the Kansas Forest Service, and private industry.

5. What funders if any, are funding in this area?

- The William and Flora Hewlett Foundation have funded the Center for Carbon Removal for biochar, BECCS, and other CCS research over the last several years.

- ClimateWorks is exploring carbon removal strategies.

- The Berkeley Energy & Climate Institute

- Small grants (\$5k) are being offered by the Forest Service in the Midwest via the Great Plains Biochar Initiative to expand education and use cases for biochar.
- The USDA/NRCS have issued Conservation Innovation Grants (CIG) and Value-Added producer grants for biochar projects and they may be a source for future research funding.
- ARPA-E is a venue for more exploratory research, and their MARINER program has looked at some carbon removal/soil carbon sequestration work.
- The Department of the Interior and the National Science Foundation have also funded projects.
- Cool Planet Energy received a \$91 million loan guarantee from the U.S. Department of Agriculture to develop carbon negative drop in fuels and CoolTerra biochar soil amendments from biomass pyrolyzation.

6. Which political forums does this play out in? Local, state, regional, national, international?

Internationally, organizations can continue to provide working papers on the state of biochar research implementation, strengthen coalitions, and identify knowledge gaps.

Overcoming the cost barriers of large-scale biochar processing, application, and long-term life cycle assessments from field trials will require national support in the form of research and implementation grants. Policies favorable to carbon sequestration efforts should be balanced along with policies supporting small and midsize food producing landholders. The following federal, state, and local levers are taken from the task force's BECCS report:

Federal:

- Tax credits, feed-in tariffs, contract for differences, trading schemes, etc.
- Dramatic increase in RD&D at the federal and state levels from both public and private sector actors. (AEIC& PCAST recommend x4 increase.)
- Carbon tax (e.g., Norway)
- Regulatory caps (e.g., CPP, California's SB 1368) • Border adjustable carbon tariffs
- Export of pellets for wood burning.
- Congressional handles: Subsidizing logging and wood burning; subsidizing and mandating corn ethanol (e.g., Water Efficiency via Carbon Harvesting and Restoration a.k.a. *WECHAR* Act of 2009, S 1717/HR 3748, 111th Cong., 1st sess.)
- EPA handles: CO₂ regulations, methane regulations, rulings on carbon neutrality of wood to energy plants.

State:

- Carbon tax (e.g., Norway)
- Regulatory caps (e.g., CPP, California's SB 1368)
- Border adjustable carbon tariffs
- State-sponsored "strategic" projects (China's 5-year plan)
- Broader clean financing mechanisms (CEPS vs. RPS; LCFS vs. RFS)

- Procurement authorities
- State RPS standards and climate/adaptation plans.
- State and federal pollution laws, and subsidizing logging and wood burning.

Local:

- Local decisions on plant siting and energy mix requirements.
- Local zoning and land use planning.
- Primary producer/landowner education and technical assistance via RCDs

7. Are there specific geographic locations for focus?

The literature does not identify specific geographic locations for focus. Appropriate implementation will vary depending on particular ecological conditions, social and political climates, and the access to sustainably harvested materials for biochar processing.

Degraded ecosystems (due to timber extraction, conventional agriculture, mining, or fossil fuel extraction) may be the primary focus in the short term (next 3-5 years). This seems like a possible option for any carbon depleted agricultural land and not just degraded ecosystems, if one had the source of biomass to make the biochar.

8. What are most important summary documents or experts we should be aware of?

Carbon180. (2018). "Building a New Carbon Economy: *An Innovation Plan*." Online available at:
<https://static1.squarespace.com/static/5b9362d89d5abb8c51d474f8/t/5b98383aaa4a998909c4b606/1536702527136>

Center for Carbon Removal. (2016). "Philanthropy Beyond Carbon Neutrality: How Near-Term Grants to Carbon Removal Can Make Long-Term Climate Goals a Reality," Retrieved from: <https://www.centerforcarbonremoval.org/philanthropy-beyond-carbon-neutrality>.

Fuss et al. (2018). "Negative Emissions—Part 2: Costs, Potentials, and Side Effects," Environmental Research Letters 2018. <https://doi.org/10.1088/1748-9326/aabf9f>.

Gurwick NP, Moore LA, Kelly C, Elias P (2013) A Systematic Review of Biochar Research, with a Focus on Its Stability in situ and Its Promise as a Climate Mitigation Strategy. PLoS ONE 8(9): e75932. doi:10.1371/journal.pone.0075932

Morrow, David R., Holly J. Buck, Wil C. G. Burns, Simon Nicholson, and Carolyn Turkaly. (2018). *Why Talk about Carbon Removal?* Washington, DC: Institute for Carbon Removal Law and Policy, American University.
<https://doi.org/10.17606/M6H66H>

Mulligan, J., G. Ellison, K. Levin, and C. McCormick. (2018). “Technological Carbon Removal in the United States.” Working Paper. Washington, DC: World Resources Institute. Available online at <https://www.wri.org/publication/tech-carbon-removal-usa>.

9. Are there key justice and equity concerns we should be aware of? Are there environmental justice groups or individuals we should consult with on this topic?

The use of biochar as a soil amendment to agricultural soils can be an important win-win for carbon management and agricultural productivity. Biochar additions to farmland may aid small, medium, and large-scale agricultural producers improve a variety of previously mentioned on-farm soil health measures, ultimately resulting into improved soil productivity and agricultural yields. However, building a biochar industry large enough to remove a significant amount of carbon from the atmosphere requires substantial interdisciplinary research in agronomy, engineering, macroeconomics (markets and policies), and techno-economic analyses (supply chain and site-specific plant design). This presents an opportunity for cross-cutting social science research.

Although it is an established soil-additive technology, biochar is not widely applied, and its climate benefits are debated. A lack of data and well-designed long-term studies limit current understanding of biochar’s effectiveness and scalability (Gurwick et al., 2013). The world might be able to remove up to a few billion tons of CO₂ per year through biochar initiatives that relies entirely on agricultural waste, forest residues, and similar inputs, which could have minimal impact on land use if accompanied by careful policy.

Removing, say, 10 billion tons per year, however, would require devoting roughly 380–700 million hectares of arable land—an area up to twice the size of India—to growing bioenergy crops,¹⁵ which would negatively affect food security, land security, water conservation, and biodiversity (Morrow et al., 2018). The social impacts of diverting land from food crops to fuel crops will depend on global food demand, which in turn depends on population growth and demand for meat.

10. Are there positive or negative environmental or ethical/stewardship concerns or choices we need to be aware of?

A number of fundamental research questions, scaling considerations, and sustainability challenges are associated with bioenergy (National Research Council, 2015). For bioenergy conversion technologies and biochar production processes that rely on dry cellulosic biomass as a feedstock, the sustainable production of such feedstocks is a key prerequisite to achieving net climate change mitigation in any carbon-negative bioenergy with carbon capture and storage scheme (U.S. Department of Energy).

It is important to note that the removal of agricultural residues can in some instances reduce soil carbon sequestration potential or even lead to soil carbon losses, depending on whether complementary conservation practices are adopted (Kim et al. 2017). For

example, crop and woody biomass residues are not simply classified as “waste”; rather, they have vital ecological roles in agricultural and forest ecosystems, such as residue decomposition recycling nutrients back to the soil and the build-up of soil organic matter. The unconstrained harvesting of crop residues causes soil degradation and ultimately reduces productivity.

Trustworthy monitoring and verification is a serious concern for all terrestrial offsets. Biochar could potentially be produced on a wide scale (from very small to industrial-scale systems), from a diverse variety of feedstocks, and applied to a vast range of soil types in diverse climates. Each of these variables presents M&V challenges

Economies of scale may require complimentary BECCS/Biomass Gasification/other bioprocessing capacities such a syngas or liquid fuels ([Enders et al., 2012](#); [Schimmelpfennig and Glaser, 2012](#); [Tripathi et al., 2016](#)). Furthermore, heterogeneity of biochar quality, type, source can add further variation when added as a soil amendment across different geographies, climates, and soil types.

Community-scale gasification bioenergy project pollutants include nitrous oxides (NO_x), particulate matter (PM), carbon monoxide (CO), and volatile organic compounds (VOC) along with greenhouse gas emissions including methane (CH₄) and carbon dioxide (CO₂) that are prevalent throughout most community-scale projects.

Potential emissions points through the process include but are not limited to:

- Collection and processing of feedstock;
- Transportation to a bioenergy facility;
- Onsite storage of feedstock;
- Pre-Processing (e.g. drying);
- Internal combustion engine emissions;
- Flare emissions;
- Employee commute; and
- Onsite equipment use.

In gasification technology, the gasifier itself is not an air emissions source. Gasification units typically convey feedstock into the vessel via an air locked chamber and the output is biochar and syngas. The primary recipient of syngas is the internal combustion engine and the flare, the two primary sources of air pollutant emissions in the system.

The scale of bioenergy project air emissions depends on the size of the system producing biochar. A very helpful [NRDC biochar white paper](#) groups them into three categories: Small, mobile systems for char production; Larger-scale pyrolysis and gasification units; Hydrothermal carbonization.

11. Is the action consistent with Sierra Club policy? Please flag areas where we would need to update, clarify or revise policy.

There is a narrow biomass to energy with CCS scenario that could be consistent with Sierra Club policy, but most existing technologies do not meet this test and none have CCS.

<https://www.sierraclub.org/policy/energy/biomass-guidance>

<https://www.sierraclub.org/sites/www.sierraclub.org/files/SC-Forest-Biomass-Guidelines.pdf>

<https://www.sierraclub.org/sites/www.sierraclub.org/files/energy.pdf>

<https://www.sierraclub.org/sites/www.sierraclub.org/files/uploads-wysiwig/ZeroWasteExtendedProducerResponsibilityPolicy.pdf>

There is no specific policy addressing biochar and we should probably develop one.

12. Any other key questions relevant to your area?

Who else is funding in this space? Carbon180 doesn't report on philanthropic and private funders for their work.

13. Ultimately we want to see what part of this might be particularly ripe for Sierra Club engagement and influence. Since we can't do everything, we will need to make recommendations of most promising forums and issues to engage in, so deciding what not to do is also important. Your advice about the relative priority for Sierra Club engagement, pro and con, will be very valuable.

Opposing bad carbon-polluting biomass projects is part of climate adaptation work, and often dovetails with protection of wildlands and biodiversity, and environmental justice and equity goals and values. We need to lobby to make sure that biomass projects that are environmentally destructive and carbon polluters do not get a free pass and are not allowed to be counted as renewable and clean, as that will undermine climate change mitigation goals, as well as hold back the development of potentially good biomass projects that are carbon negative.

Increased forest protection has been identified as a key component, in conjunction with moving beyond fossil fuel consumption, with regard to meeting climate change mitigation goals, as discussed above. Opposing projects and policies that promote biomass logging would be consistent with this climate change mitigation goal. As noted elsewhere, we may need to be involved in discussions on CDR governance for BECCS and other technologies as it gets to larger scales and involves impacts on other countries and cultures. These efforts must be addressed while concurrently monitoring the regional scalability of biochar production.

To build a biochar industry large enough to have a significant impact on the global carbon cycle will require substantial research: agronomic, engineering, macroeconomic (markets and policies), technoeconomic (costs and revenue for a specific plant design in a specific location), and that focused specifically on supply chains. Lifecycle assessments, which consider both direct effects (such as emissions due to harvest, storage, and transport of biomass; biochar carbon sequestered; and fossil fuel displaced) and indirect effects (such as positive or negative priming of soil organic matter mineralization and the impact on food security and land use) are needed to quantify the net impact of biochar systems on greenhouse gas emissions.

14. What are the implications for providing good paying family-sustaining and/or union jobs and a just transition as part of deployment of this type of program?

Internationally, family sustaining jobs may be achieved by employing land managers to selectively harvest or aggregate biomass residuals. The actual process of pyrolysis is highly specialized and requires more technical and scientific skill sets to effectively deploy biochar technology.

Bioenergy and Carbon Capture and Storage (BECCS)

What are the major opportunities for adaptation in this area?

The desired outcome is a sustainable source of non-forest biomass that could be grown and harvested with minimum environmental impact and then converted to fuel or energy in a way that captured and stored the released carbon dioxide. Such a system would be renewable and either carbon neutral or ideally carbon negative, while supplying energy. One issue is that the amount of land that it would take to make a dent in the CO₂ would push a land-grab in which the poor and others would lose their land/food source. That would pose unacceptable justice and equity issues. The other major problem is that the source of biofuel could adversely impact native ecosystems (for example palm oil plantations) or have negative impacts if it is grown in an unsustainable way (monocultures with heavy fertilization and pesticides such as corn for ethanol). Depending on the feedstock, BECCS could end up being a carbon source, even with CCS. At present there are several barriers to adoption of perennial grains on significant areas of land currently allocated to conventional annual crops. Chief among these barriers are low yields and hence questionable economic viability if brought to scale.

An effective means for increasing soil carbon content is through changing land cover: converting annual cropland to forest or perennial grasses. However, if widely applied, such land use conversions would have negative consequences for food and fiber production from the crops that are displaced. Moreover, displaced crops could in turn lead to increased conversion of native ecosystems to agriculture.

A perennial crop such as switchgrass or miscanthus could be an attractive biofuel in some locations and not require constant cultivation and fertilization. It is invasive and unsuitable in natural ecosystems (an issue that would need to be addressed is the potential for this invasive grass to spread to nearby native ecosystems). Switchgrass and miscanthus can be harvested annually for 15 years before replanting. (Drawdown) The Drawdown calculations presume that perennial crops for fuel expand from .5 million acres to 143 million acres globally. CCS would increase the cost.

Most biomass conversion and biofuels do not meet this desirable set of outcomes. Choices range from biomass residues, waste, landfill gas, to energy crops.

Wood biomass burning is damaging to forest ecosystems and is carbon polluting (by most calculations worse than coal) as well as having other human health pollution problems (Haberl et al. 2012, Energy Policy Vol. 45, pp. 18-23; Sterman et al. 2018, Environmental Research Letters, Vol. 13, Article 015007). Despite the potential GHG mitigation and carbon sequestration of biochar--a byproduct of biomass pyrolysis processes, the production and transport of the biochar (and bioenergy coproducts) entail a number of different GHG emission sources. The actual mitigation attained (vis a vis the atmosphere) depends on the full biochar life cycle and emissions of the biomass feedstock production and harvesting, biochar production process and field application (Paustian et al., 2017). Logging not only removes the carbon stored in trees from forest

ecosystems, but it also compacts and damages soils, removes vital nutrients that are stored in trees, and disturbs the carbon contained in soils ((a) Elliot, W.J., et al. 1996. The effects of forest management on erosion and soil productivity. Symposium on Soil Quality and Erosion Interaction. July 7, 1996, Keystone, CO. (b) Helmisaari, H.S., et al. 2011. *Forest Ecology and Management*, Vol. 261, pp. 1919-27. (c) Achat, D.L., et al. 2015. *Scientific Reports*, Vol. 5, Article 15991). All of these impacts from logging combine to significantly reduce forest productivity (the rate at which trees and plants will grow), and therefore reduces the capacity of our forests to absorb and sequester CO₂ over time.

The current Administration has argued that logging, conducted ostensibly to “thin the forest”, “reduce fuels”, or for so called “restoration”, is needed ostensibly to prevent carbon emissions from wildland fires in forests, but current science indicates that such logging causes a net loss of carbon from forest ecosystems (Campbell et al. 2011). Can fuel reduction treatments really increase forest carbon storage in the western US by reducing future fire emissions? *Frontiers in Ecology and Environment* 10: 83-90). Even in the largest, most intense, crown fires, only a very small percentage of carbon stored in trees is actually consumed by the fire. Forests burn in a mosaic pattern of low, moderate and high severity, and in the areas of a forest which burn at low and moderate severity (which amounts to most of the area of any given fire), this percentage is even lower. After fires, including in high intensity fire areas, forests rapidly and dramatically sequester carbon from the atmosphere, incorporating CO₂ into the abundant plant and tree regeneration that begins to occur almost immediately after the fire burns out ((a) Meigs et al. 2009. Forest fire impacts on carbon uptake, storage, and emission: the role of burn severity in the eastern Cascades, Oregon. *Ecosystems* 12: 1246-67; (b) Hanson. 2018. Landscape heterogeneity following high-severity fire in California’s forests. *Wildlife Society Bulletin* (in press)). Scientists conclude that our best chance of keeping temperatures from rising about an additional 1.5 degrees C due to climate change, we must not only transition beyond fossil fuel consumption but must also substantially increase forest protection, and promote recovery of forests where they were previously converted to agriculture, as part of a “natural climate solutions” approach that will also aid with conservation of native biodiversity (Griscom, B.W., et al. 2017. *Proceedings of the National Academy of Sciences*, Vol. 114, pp. 11645-50). This will not be possible if we turn to our forests as a source of energy. Further, in this context, to the extent that existing croplands might be used for non-forest bioenergy and carbon capture, such as switchgrass or miscanthus, such activities should not occur on croplands that were once forest ecosystems, in order to maintain the potential for such areas to be devoted to native forest recovery for the benefit of biodiversity and climate change mitigation.

In areas that have already previously been converted to agriculture, negative emissions can also be achieved via enhanced storage of carbon in managed agricultural soils through increased plant productivity, cultivation of deeper-rooted or more decomposition-resistant crops, decreased soil disturbance, and with organic amendments such as biochar addition (Paustian K, Lehmann J, Ogle S, Reay D, Robertson GP, Smith P. (2016a) Climate-smart soils, *Nature*, 532:49–57.)

Corn based ethanol is displacing food production, relying on polluting fertilizers and pesticides, and is energy intensive and heavily subsidized. The carbon emissions are not captured and stored. Ethanol produced using sugarcane, alternatively, has an energy balance that is 7 times greater than that of corn-based ethanol. Energy balance is the difference between the energy expended to convert the crop into ethanol and the amount of energy released from its consumption. There are several reasons why this occurs: unlike sugar, only 50% of the dry mass of corn kernels (the starch) can be converted into ethanol. Once this is done, that starch must be converted into sugar before it can be distilled into ethanol. There is no need for these first steps when using sugarcane-based ethanol, for obvious reasons. This significantly reduces the operation costs of sugar-based ethanol compared to corn-based ethanol; In addition to Brazil's lower operating costs, sugarcane-based ethanol is also more productive. On average, an acre of sugarcane-based ethanol produces about twice as much ethanol as its corn-based counterpart. The chart below compares corn to sugarcane-based ethanol:

Characteristic	US	Brazil
Feedstock	corn	Sugarcane
total ethanol fuel production (2009) (million gallons)	10,750	4,200
total area used for ethanol crop (million acres)	24.71	8.90
productivity (gallons per acre)	330-424	727-870
energy balance (energy obtained / energy expended)	1.3-1.6	8.3-10.2
greenhouse gas emission reduction	10-30%	86-90%
cost of production (USD/gallon)	1.14	.83 (no import tax)

Source: <http://large.stanford.edu/courses/2010/ph240/luk1/>

In terms of impacts, the U.K. Department of Environment, Food, and Rural Affairs [published a document](#) indicating that the land use dynamics have not been negatively altered due to sugar cane production. For instance: The growth of sugarcane areas did not induce the displacement of cattle heads to other regions of Brazil, as cattle's density raised in all where sugarcane expansion took place. There is no evidence that

deforested areas have been used for the enlargement of sugarcane cultivation, as in all states where the growth of production was significant (São Paulo, Minas, Paraná and Goiás, with 1.2 million hectares in the period) there was a simultaneous growth of forested areas (3.6 million hectares).

Furthermore, environmental impacts on resources such as water consumption, contamination of soils and water shields due to the use of fertilizers and chemicals, and loss of biodiversity have been found to be less impactful than other crops (i.e. corn, soybean); however, research and sustainability metrics are still being developed, and it should again be stressed that previously forested areas should be allowed to return to native forest cover, rather than being used as bioenergy croplands.

There is also an increasing threat to tropical forests from clearcutting and subsequent creation of palm oil plantations, including the use of palm oil for bioenergy (NRDC 2006, “The Use of Palm Oil for Biofuel and as Biomass for Energy”). This not only has serious costs for biodiversity but also increases greenhouse gas emissions.

Growing algae to make fuel is another possibility with minimal impact but has limited potential given its intensive nature. Advanced biotechnology is applied to develop high-production varieties, which has its own sets of pros and cons. Again, [any energy conversion would require CCS and electricity](#), which would increase the cost. The system’s economic viability depends on the price of carbon and the market value of the protein-based nutritional products being produced.

It is better to capture and use landfill gas than to let it leak. But the Sierra Club favors zero waste and full composting rather than landfilling organic matter and then trying to capture and use the gas. Even with partial capture, significant percentages of that gas will continue to leak. We also oppose incinerating waste because of the toxics and pollution that are released when burning mixed waste. (*[link to Club policies.](#)*)

2. What is the potential for significant carbon drawdown?

[Project Drawdown](#) estimates that non-forest [biomass](#) could potentially produce 7.5 gigatons reduced CO₂ by 2050 at a net cost of \$402.3 billion. (Does not assume CCS added to the process.)

Drawdown separately calculates an additional 10.3 gigatons of CO₂e reduction by 2050 from [Methane Digesters](#) at a net cost of \$217 billion.

Drawdown separately calculates the carbon savings from [Perennial Biomass](#) (switchgrass etc.) at 3.3 gigatons reduced CO₂ by 2050 at a net cost of \$77.9 billion. Collectively this equates to a 21.1 gigaton reduction of CO₂e by 2050 with a net cost of \$697.2 billion.

Global climate models indicate that carbon removal of roughly 700 GtCO₂ —and up to 1,000 GtCO₂ —may be necessary in the 2011–2100 period to stabilize temperatures at

either 1.5°C or 2°C above preindustrial levels (Minx et al. 2018). Others suggest 10-12 Gt/CO₂/yr removal to get to 1.5 degrees. (American University)

BECCS won't succeed or be competitive until there is a price on carbon to fund the CCS part of it. BECCS was developed by modelers, not proven technology through deployment.

CCS also risks leakage if done improperly, and we have very little experience except in abandoned oil fields. It's not only leak potential. We know from fracking liquids forced underground in Oklahoma and Kansas that liquids forced underground at high pressure can cause earth movement where there had never been any seen before.

3. What kind of Sierra Club activity is already happening in this area?

So far, we largely are opposing bad biomass projects, and we are not promoting biomass projects. The ideal projects that meet our requirements and have CCS have not presented themselves and may not be economic until a 2040 timeframe.

Sierra Club is opposing wood to energy projects -- both wood pellet production/exports and wood to energy power plants. We are arguing against including wood to energy plants in any RPS plan as they are not carbon neutral, as EPA falsely claims. We have a small Packard grant to do organizing on this issue in several states.

Sierra Club has a policy against corn based ethanol but has no campaign around it other than to try to reduce subsidies and requirements for use.

Sierra Club promotes recycling, composting and other zero waste measures to reduce landfill requirements.

4. What other groups are already working in this area?

World Resources Institute, Natural Resources Defense Council, Dogwood Alliance, World Wildlife Fund, IUCN, Roundtable for Sustainable Biofuels, Climate Action Network, Partnership for Public Integrity. Also Center for Carbon Removal, Union of Concerned Scientists, Environmental Defense Fund.

There are industry "renewable fuels" groups promoting existing polluting technologies.

Carbon Capture Coalition promotes CCS, primary for enhanced oil production. This includes coal companies, oil companies, and The Nature Conservancy. It is not clear they are involved with BECCS. <http://carboncapturecoalition.org/about-carbon-capture/>

5. What funders if any, are funding in this area?

Packard
Climate Works

Linden Trust for Conservation

Alexander von Humboldt, Packard, & Bechtel Foundations fund the Stanford Woods Institute on studies on BECCS and land use constraints.

6. Which political forums does this play out in? Local, state, regional, national, international?

All of the above. There is an equity issue that needs to be handled internationally, an opportunity to reap benefits in regional collaborations, and the most important need for goals to be agreed at local level.

- National and international logging for wood to energy conversion is a significant and growing environmental threat.
- Roundtable for Sustainable Biofuels.

Federal:

- Tax credits, feed-in tariffs, contract for differences, trading schemes, etc.
- Dramatic increase in RD&D at the federal and state levels from both public and private sector actors. (AEIC& PCAST recommend x4 increase.)
- Carbon tax (e.g., Norway)
- Regulatory caps (e.g., CPP, California's SB 1368) • Border adjustable carbon tariffs
- Export of pellets for wood burning.
- Congressional handles: Subsidizing logging and wood burning; subsidizing and mandating corn ethanol
- EPA handles: CO₂ regulations, methane regulations, rulings on carbon neutrality of wood to energy plants.

State:

- Carbon tax (e.g., Norway)
- Regulatory caps (e.g., CPP, California's SB 1368) • Border adjustable carbon tariffs
- State-sponsored "strategic" projects (China's 5-year plan)
- Broader clean financing mechanisms (CEPS vs. RPS; LCFS vs. RFS)
- Procurement authorities
- State RPS standards and climate/adaptation plans.
- State and federal pollution laws, and subsidizing logging and wood burning.

Local:

- Local decisions on plant siting and energy mix requirements.
- Local zoning and land use planning.
- Primary producer/landowner education and technical assistance via RCDs

7. Are there specific geographic locations for focus?

[Paustian et al. \(2017\)](#) estimates that the highest carbon sequestration potentials via management interventions on cropland are in the Midwest, northern Great Plains and Mississippi River Valley. The potential on irrigated croplands of the arid and semi-arid west are also significant. Potentials for U.S. grasslands (western rangelands and

eastern pastures) are lower than those we estimated for croplands, but spatial patterns are more distinct due to differences in climate and in management practices: eastern pastures sequester more carbon per unit area, but the expanse of western rangelands leads to a higher total carbon sequestration on grasslands in the west than in the east.

Corn belt; states with extensive beetle kill in forests (such areas are in particular need of protection, given increasing political and economic pressures to log trees killed by cycles of drought and native beetles or fire for bioenergy, despite a deep body of science indicating that such “[snag forest](#)” habitat is extremely biodiverse and many rare and imperiled native wildlife species depend on this habitat; forests in general are under increasing threat from biomass logging, both in the western US and the eastern US; major cities with major waste disposal problems and landfills. New England states have seen numerous large-scale Biomass-energy proposals, and such proposals are increasing in the West, while Southern US forests are seeing increasing impacts from biomass logging for wood pellets for export to European markets.

Biomass resource needs to be within 50-100 miles of the plant to be affordable from transportation standpoint. Animal waste or crop residue can be used, but would reduce soil carbon if not returned to the soil through composting.

International forums, too

8. What are most important summary documents or experts we should be aware of?

- TECHNOLOGICAL CARBON REMOVAL IN THE UNITED STATES, JAMES MULLIGAN, GRETCHEN ELLISON, KELLY LEVIN, AND COLIN MCCORMICK, WORLD RESOURCES INSTITUTE

- DOE did a study called “a billion tons” looking at biomass potential. UCS did a critique of it.

- <http://whrc.org/burning-wood-for-energy-is-not-carbon-neutral/>

- Burning wood may seem like a reasonable climate strategy, but it isn't. Starting with George Woodwell, WHRC scientists have not only documented the contribution of forest loss and degradation to climate change, but also shown that protecting and recovering forests and other natural systems is essential to its solution.

- The Natural Resources Defense Council released an [analysis](#) on wood-fueled power recently concluding that the net impact on the climate is worse than fossil fuel emissions for decades, as it takes significant time for forests to grow back and offset emissions.

- Principles for Sustainable Biomass

•Joint Statement on the Recognition of the Roundtable for Sustainable Biofuels Certification System by the European Commission

<http://cms.iucn.org/about/work/programmes/business/?7898/RSBECrecognition>

• Paustian, K., Larson, E., Swan, A., Marx, E., Kent, J, and Zenes, N. (2017). Carbon Farming – A Working Paper Assessing the Potential for soil C Sequestration. Accessed from:
http://assets.climatecentral.org/pdfs/July2017_CarbonFraming_WorkingReport_Larson.pdf

9. Are there key justice and equity concerns we should be aware of? Are there environmental justice groups or individuals we should consult with on this topic?

Waste to energy plants, wood to energy plants, and landfills are routinely located in low income communities and communities primarily comprised of people of color. Air pollution concerns are often significant in these communities, and biomass plants exacerbate this pollution, adding to already existing human health impacts (e.g., this is a substantial and growing problem in Central Valley communities in California).

International logging, palm oil plantations etc. have major impacts on Indigenous People as well as the primary forests and ecosystems they depend upon. Converting agricultural land to energy crops poses conflicts with needed food/fiber production and could displace farmers.

10. Are there positive or negative environmental concerns or choices we need to be aware of?

As noted above, logging associated with wood to energy conversion poses major forest ecosystem and native culture negative impacts, and impacts to low income communities and communities comprised primarily of people of color. Growing corn for energy competes with food and is heavily reliant on polluting pesticides, herbicides and fertilizers. Landfill gas and waste to energy is dependent on continuing to have a throw away society rather than a zero waste society. If BECSS goes to multi-gigaton scale to maximize carbon removal and energy production it would take over more and more land mass, either displacing food crops and rural residents or natural ecosystems.

There needs to be full energy accounting, as there are lots of losses in transportation, compression, conversion (25%loss), leakage. When all is considered, do you get net energy produced?

To get to negative (net carbon drawdown), you need to start with a carbon neutral feedstock (if the feedstock takes more carbon to produce then it will store it will not be negative). This excludes harvesting and burning forests or cultivated corn.

11. Is the action consistent with Sierra Club policy?

There is a narrow biomass to energy with CCS scenario that could be consistent with Sierra Club policy, but most existing technologies do not meet this test and none have CCS.

<http://www.sierraclub.org/policy/energy-policies/biomass-guidance>

<https://www.sierraclub.org/sites/www.sierraclub.org/files/energy.pdf>

<https://www.sierraclub.org/sites/www.sierraclub.org/files/uploads-wysiwig/ZeroWasteExtendedProducerResponsibilityPolicy.pdf>

12. Any other key questions relevant to your area?

Defining sustainable harvest of biomass is difficult. Who defines it and how can it affect the sustainability of a given biomass project?

13. Ultimately we want to see what part of this might be particularly ripe for Sierra Club engagement and influence. Since we can't do everything, we will need to make recommendations of most promising forums and issues to engage in, so deciding what not to do is also important. Your advice about the relative priority for Sierra Club engagement, pro and con, will be very valuable.

Opposing bad carbon-polluting biomass projects is part of climate adaptation work, and often dovetails with protection of wildlands and biodiversity, and environmental justice and equity goals and values. We need to lobby to make sure that biomass projects that are environmentally destructive and carbon polluters do not get a free pass and are not allowed to be counted as renewable and clean, as that will undermine climate change mitigation goals, as well as hold back the development of potentially good biomass projects that are carbon negative. It may well be that BECCS may comprise some part of the 2050 mix to meet climate goals, but we need to look for promising BECCS projects that are truly green and meet our high standards and then lobby to have them taken to scale. This may very well be a mid-term goal, but not a top priority in next 5 years or more. Increased forest protection has been identified as a key component, in conjunction with moving beyond fossil fuel consumption, with regard to meeting climate change mitigation goals, as discussed above. Opposing projects and policies that promote biomass logging would be consistent with this climate change mitigation goal. As noted elsewhere we may need to be involved in discussions on CDR governance for BECCS and other technologies as it gets to larger scales and involves impacts on other countries and cultures.

Club support for recovery of native perennial grasses and forest on land abandoned from agricultural use (as well as agricultural land that could be encouraged to transition back to native ecosystems) due to soil degradation or lands that are poorly suited for agricultural production (Zumkehr & Campbell 2013, Campbell *et al.* 2008) can result in

significant carbon build-up over time (Tilman *et al.* 2006). In the U.S., the Conservation Reserve Program (CRP) pays farmers to retire marginal and highly erodible croplands, with peak cumulative enrollments of just over 35 million acres (USDA FSA 2012). Existing federal and state subsidies that drive damaging biomass logging in the U.S. could be redirected to enhance this program, such that even more cropland is returned to native ecosystems, thus sequestering and storing more carbon and aiding biodiversity. The EPA National Greenhouse Gas Inventory report credits CRP land as a key contributor to agricultural soil carbon sinks in the U.S. (USEPA 2017). A new synthesis by Conant *et al.* (2016) estimated C stock increases of 39% after conversion of annual cropland to permanent vegetation.

14. What are the implications for providing good paying family-sustaining and/or union jobs and a just transition as part of deployment of this type of program?

Growing and harvesting biomass crops provides jobs, but may not be high pay. Building, running and maintaining BECCS plants and associated carbon sequestration pipelines and injection facilities would likely be high paying jobs that could be unionized.

Direct Air Capture

1. What are the major opportunities for adaptation in this area?

Direct Air Capture (DAC) is a technology that uses chemicals to capture and separate carbon dioxide (CO₂) directly from the ambient air. DAC systems separate CO₂ from the air by using chemicals that bind directly to carbon dioxide molecules in the air. The chemicals are then heated to separate the chemicals from the CO₂. The CO₂ is captured, and the chemicals are reused to capture more CO₂. The CO₂ that is produced is 98% pure, and can either be sequestered geologically, or used to produce fuel or put to other industrial purposes.

Once the cheaper and more environmentally benign land and water based solutions which rely on photosynthesis are fully deployed in the next few decades, the environment reaches a point of carbon saturation where plants, soils and waters can't take up any more carbon. At that point, presuming we still need to drawdown additional CO₂ from the atmosphere to get below 350 ppm and stabilize the climate, we will need to pursue other solutions that do not involve photosynthesis. The chemical based approach employed by DAC is one option, but it does have significant hurdles. It appears to be far less risky and hazardous than geoengineering options such as solar radiation management.

There is very little experience with pilot plants to date, so much more needs to be studied and determined. And DAC clearly should not be viewed as a substitute for the rapid transition to 100% clean energy. Zero net emissions should not be achieved by staying on dirty fuels and deploying DACs.

2. What is the potential for significant carbon drawdown?

When the extracted CO₂ is injected into geological reservoirs or used to make long-lasting products, DAC can become a negative emissions technology (NET). Existing pilot projects use the captured CO₂ for other purposes, such as producing fuels. When captured CO₂ is used to produce fuels or put to other industrial ends, the process is not actually reducing the overall concentration of CO₂ in the atmosphere, though it may be allowing for less carbon intensive products. So depending upon the use of the CO₂ that is extracted the process can either drawdown atmospheric CO₂ or not.

The potential for significant carbon drawdown is limited by the scale of deployment, the economics (DAC is very expensive as presently designed), and the steep energy penalty (it takes a great deal of energy to run a DAC plant.) Also carbon drawdown depends upon the permanence of the sequestration. To capture and store gigatons/year, the cost and energy penalty would be staggering and unacceptable using present technology.

Cost estimates vary widely, with two recent expert assessments projecting long-run costs of US\$100–300 and US\$400–1,000 per ton of CO₂, respectively. A recent expert

assessment estimates potential sequestration of 0.5–5 billion metric tons of CO₂ per year in 2050, with a theoretical longer-term potential in the tens of billions of tons per year, limited mainly by cost, availability of low-carbon energy, and the rate of upscaling.

3. What kind of Sierra Club activity is already happening in this area?

To our knowledge the Sierra Club is not working on DACs in any forum. It is a future speculative technology and we have no position on whether or not to promote or oppose it or to encourage research.

4. What other groups are already working in this area? Opportunities for partnership or redundancy.

Various non-profits studying carbon drawdown are joining in the debate about DACs. Most notable are the Center for Carbon Removal, and World Resources Institute.

Institute for Carbon Removal Law and Policy, American University, is active in studying DAC.

Dr Jen Wilcox, Colorado School of Mines.

The Center on Global Energy Policy at Columbia University's School of International and Public Affairs will house a DAC initiative and work with the university's Earth Institute. Dr Julio Friedmann is chief investigator.

A think tank led by former Energy Secretary Ernest Moniz announced today it is developing a federal plan to promote technologies for removing carbon dioxide from the atmosphere. The Energy Futures Initiative's air-capture project aims to bring new focus and dollars to an idea that proponents say is necessary to hit long-term climate targets.

DAC technologies on a small-scale have been available and deployed for decades, with one commercial plant, Climeworks AG, in operation since 2016 in Zurich, Switzerland, and a demonstration plant running in Canada. Neither is currently sequestering the captured CO₂: the Swiss plant pumps it into a greenhouse to fertilize plants, and the Canadian plant uses it to produce synthetic fuels. However, proposals for large-scale deployments that can actually reduce global atmospheric CO₂ concentrations have only emerged recently.

A detailed economic analysis published on 7 June suggests that the geoengineering technology is inching closer to commercial viability. The study, in *Joule*, was written by researchers at Carbon Engineering in Calgary, Canada, which has been operating a pilot CO₂-extraction plant in British Columbia since 2015. That plant — [based on a concept called direct air capture](#) — provided the basis for the economic analysis, which includes cost estimates from commercial vendors of all of the major components. Depending on a variety of design options and economic assumptions, the cost of pulling a tonne of CO₂ from the atmosphere ranges between US\$94 and \$232. The last

comprehensive analysis of the technology, conducted by the American Physical Society in 2011, estimated that it would cost \$600 per tonne. Founded in 2009, Carbon Engineering is one of a few companies pursuing direct air capture technologies. One competitor, Climeworks in Zurich, Switzerland, opened a commercial facility last year that can capture 900 tonnes of CO₂ from the atmosphere each year for use in greenhouses. Climeworks has also opened a second facility in Iceland that can capture 50 tonnes of CO₂ a year and bury it in underground basalt formations.

Climeworks says that capturing a ton of CO₂ at its Swiss plant costs about \$600. Company officials expect the figure to dip below \$100 per tonne in 5-10 years as operations ramp up. In the meantime, Carbon Engineering's paper provides the most detailed look yet at the cost of such technology.

Carbon Engineering's design blows air through towers that contain a solution of potassium hydroxide, which reacts with CO₂ to form potassium carbonate. The result, after further processing, is a calcium carbonate pellet that can be heated to release the CO₂. That CO₂ could then be pressurized, put into a pipeline and disposed of underground, but the company is planning instead to use the gas to make synthetic, low-carbon fuels. Keith says that the company can produce these at a cost of about \$1 per litre. When Carbon Engineering configured the air-capture plant for this purpose, they were able to bring costs down to as low as \$94 per tonne of CO₂.

The availability of cheap renewable energy provides an opportunity to implement negative emissions that were previously considered uneconomic. DAC, for example, can provide some of the flexibility that is needed for system integration of renewables. This could make DAC more cost effective by using excess wind or solar power during periods of high supply, low demand and low prices. Put simply, you can switch on DAC whenever renewable generation is high and leave it off at other times. On top of that, DAC could be deployed in a decentralised fashion, which can help alleviate local grid congestion.

5. What funders if any, are funding in this area?

Climeworks and Linden Trust for Conservation are funding the Moniz group, Energy Futures Initiative.

The Climeworks commercial plant near Zurich is financially supported by the Swiss Federal Office of Energy and the European Union.

6. Which political forums does this play out in? Local, state, regional, national, international?

Research is happening in a variety of developed countries. US Department of Energy, which is not focused on climate now, will eventually need to be involved so research funding might flow through their R&D budget in future years.

7. Are there specific geographic locations for focus?

Siting is flexible, but to reduce costs you would want to site it near geology that would be suitable for permanent sequestration (salt domes, abandoned oil fields, basalt, deep oceans). Since it requires a major amount of energy input you also need to site near available clean power source to avoid transmission losses. If sited remotely from sequestration sites, then would need to also invest in expensive and disruptive CO2 pipeline system.

8. What are most important summary documents or experts we should be aware of?

See documents in Direct Air Capture subgroup folder. Also see Drawdown page 192.

Ernest Moniz, Julio Friedmann, Noah Deich (Center for Carbon Removal)

9. Are there key justice and equity concerns we should be aware of? Are there environmental justice groups or individuals we should consult with on this topic?

To be economic you would need a steep price on carbon. Some estimate it could require \$800-\$1,000 a ton. Any high price of carbon has obvious equity and justice issues for low income people.

The land area required to supply the energy for wide scale use of DAC could compete with food production or other human land uses and pose justice concerns.

10. Are there positive or negative environmental concerns or choices we need to be aware of?

The high energy penalty is a concern. Energy required to run DACs is competing with clean energy to displace dirty fuels. Alternatively if dirty fuels power DAC plants, the purpose is largely defeated.

If DAC product of CO2 is used produce fuels or are used to manufacture that could displace a higher carbon industrial process, such as cement manufacturing.

The main risks from DAC come from injecting CO2 into geological reservoirs. Poorly chosen sites or mistakes in implementation could lead to leakage, seismic activity, or pollution of groundwater. Like other forms of carbon removal, the promise of DAC may also reduce motivation to reduce greenhouse gas emissions or adapt to projected climate impacts.

11. Is the action consistent with Sierra Club policy?

We have no Sierra Club policy in this area and we need it.

12. Any other key questions relevant to your area?

Not at this time, it appears this is a post 2040 technology so question is how much we should prioritize research now. Also do we want to adopt list of parameters, such as source of energy to power the plant or limiting use of the CO2.

The IPCC notes in its latest report that deploying the technology at a scale where it could

contribute to keeping warming well below 2.7 degrees Fahrenheit is “still a considerable challenge.”

“The thing about direct-air capture is that it’s one of the less technologically developed solutions out there,” says Matt Lucas, associate director of the Oakland, California-based nonprofit [Carbon180](#) (formerly the Center for Carbon Removal). “It has quite high technology risk.”

13. Ultimately we want to see what part of this might be particularly ripe for Sierra Club engagement and influence. Since we can’t do everything, we will need to make recommendations of most promising forums and issues to engage in, so deciding what not to do is also important. Your advice about the relative priority for Sierra Club engagement, pro and con, will be very valuable.

The primary role the Sierra Club could play, if we chose to, would be to help lobby for research and development funds, if we think this is a promising technology that may be required by mid century. It will probably take decades to work out the bugs and bring down the costs and make sure the sequestration is permanent, so initiating appropriately scaled R&D might make sense. At the same time, if we do get involved we should also advocate for appropriate parameters on the R&D so it is not used to promote continued reliance on dirty fuels. Our role should also be to make sure that equity and justice concerns are addressed and that any impacted communities are represented in the decisions. They may be governance issues to address, too. The rich countries should not seize the right to deploy massive DAC projects in the developing world unless the projects are welcomed by those countries because they would benefit and the projects fully address justice concerns.

14. What are the implications for providing good paying family support union jobs and a just transition as part of deployment of this type of program?

These industrial plants and the pipeline infrastructure needed to move the CO2 to sequestration sites requires a good deal of skilled workers, which should be provided by highly paid union labor. The amount of high wage labor depends on the scale of deployment and the extent of the pipeline structure. The clean power sources needed to run the DAC plants also requires high paid skilled labor which should be unionized. Many of these can be jobs that offer alternative employment to those households that used to be employed in the old dirty fuel economy, providing a just transition. But large scale deployment is probably in mid century, if ever, so it is not an immediate just transition opportunity for displacement in the near future.

Enhanced Mineralization or Enhanced Weatherization

1. What are the major opportunities for adaptation in this area?

Enhanced mineralization (or enhanced weatherization) involves accelerating the natural processes by which various minerals absorb CO₂ from the atmosphere. It involves mining, crushing, and spreading on land or in the oceans specific kinds of rock.

In the land application you would use silicate rocks such as olivine or basalt. The crushed rock on the land application reacts with the air to form carbonate minerals. The carbonates find their way into streams, rivers and oceans, eventually becoming calcium carbonate. Minerals released in the process could also enhance soil fertility.

The National Academy of Sciences report of October 2018 on Negative Emissions promotes extracting CO₂ directly from the air because, once developed, it appeared to have no inherent limitations. Carbon mineralization takes advantage of the fact that CO₂ reacts spontaneously with carbon-containing rocks, and it eventually becomes part of the rocks. Minerals such as calcium and magnesium bind with carbon in the air to form such rocks as calcite, magnesite, and dolomite.

Ocean alkalization involves spreading alkaline substances, such as lime from limestone, over the ocean, where it would absorb CO₂. This offers the added benefit of directly counteracting ocean acidification by increasing the pH of seawater.

Enhanced mineralization remains at the very early stages of research and development, but the long-term potential may be quite significant. The carbon removal would be exceedingly slow.

2. What is the potential for significant carbon drawdown?

The carbon dioxide removal potential is large, but at a very significant environmental and energy cost. Drawdown notes that “sequestering 11 gigatons of CO₂, which is about 30 percent of fossil fuel emissions, would require 16 billion tons of rock being mined, powered and shipped per year, a bit more than twice the output of the coal industry.”

IPCC 1.5 reports (page 4-48) from a literature search that potential of land based weathering is .72-95 GtCO₂/yr. Marine application would be 1-6 GtCO₂/yr. Numbers are very uncertain and scaling would take decades.

So, this is another option that one might deploy in a portfolio, but it is no panacea.

3. What kind of Sierra Club activity is already happening in this area?

None, and we have no policy or position on it.

4. What other groups are already working in this area? Opportunities for partnership or redundancy.

Work is being done primarily by a handful of universities and there is limited NGO engagement.

5. What funders if any, are funding in this area?

The Leverhulme Trust funds the primary research being done by the Leverhulme Center for Climate Change Mitigation in the UK. The Leverhulme Trust was established by the will of William Hesketh Lever, the founder of Lever Brothers. Since 1925 they have provided grants and scholarships for research and education; today, we are one of the largest all-subject providers of research funding in the UK, distributing approximately £80m a year.

6. Which political forums does this play out in? Local, state, regional, national, international?

Research is logical next step, so this could take place in DOE, EPA, USDA, NOAA or private universities and research centers.

7. Are there specific geographic locations for focus?

Deployment is most likely with nearby very specific type of rock source to avoid large transportation costs. To spread rock dust on land and gain the soil enhancement value it is best to consider doing it on existing developed agricultural lands where road infrastructure and heavy farm equipment already operate. It would not be appropriate for undeveloped public lands.

Drawdown points out that a high impact area for application on land might be the tropics where soils are warmer and wetter and have fewer minerals that would inhibit dissolution.

8. What are most important summary documents or experts we should be aware of?

Dr James Hansen (primarily promoting the idea and citing UK researchers) Rock Dust in Farming: A Potential Strategy to Help Close the Climate Gap 19 February 2018

Professor David Beerling, Director of the Leverhulme Centre for Climate Change Mitigation at the University of Sheffield, UK

Steve Long, University of Illinois

Jonathan Leake, University of Sheffield

Paul Nelson, James Cook University

Roger Aines at Lawrence Livermore Lab argues it is not cost effective for individual farmers so any deployment would likely be by government.

Dr Olaf Schuiling, University of Utrecht, Netherlands
Project Drawdown pages 176-177.
IPCC 1.5 report Chapter 4 page 48
NAS Oct 2018 report on carbon mineralization

9. Are there key justice and equity concerns we should be aware of? Are there environmental justice groups or individuals we should consult with on this topic?

The mining and crushing and transport of the rock could adversely impact local communities and indigenous cultures. Similarly there is a potential for air and water pollution from toxic elements in the rock that are released.

10. Are there positive or negative environmental or ethical/stewardship concerns or choices we need to be aware of?

To produce and reduce the rock to a size to dissolve carbon may require so much energy that it largely negates the positive CDR benefits. The mining, crushing, and transport poses significant adverse impacts. The potential air and water pollution risks are largely unknown and would depend on the composition of the source rocks. Scientists are still investigating potential side effects of adding the powder to farmland or allowing it to wash into water sources.

On the positive side, it is projected that spreading powdered rocks on agricultural lands would reduce the demand for polluting fertilizers and increase productivity. It could also help neutralize acidic soils and provide protection against pests and diseases. Unlike other carbon removal strategies enhanced rock weathering doesn't compete for land used to grow food or increase the demand for freshwater. Other potential but unproven benefits include reducing the use of agricultural fertilizers and pesticides, lowering the cost of food production and increasing farm profitability.

Ocean applications could help address ocean acidification and coral reef loss. Ocean liming could change the biochemical cycles and release toxic minerals. There are also associated risks of mining, crushing and transporting the limestone.

The cost is unknown, and Drawdown says the range is anywhere from \$88 to \$2,120 per ton of removed CO₂.

11. Is the action consistent with Sierra Club policy? Please flag areas where we would need to update, clarify or revise policy.

We have no policy or position in this area. If we feel it has some promise, we could advocate for limited research and development to test it out. We should also flag problems and concerns to put sideboards on any R&D.

12. Any other key questions relevant to your area?

Where you deploy it is important, whether on land or in the oceans.

13. Ultimately we want to see what part of this might be particularly ripe for Sierra Club engagement and influence. Since we can't do everything, we will need to make recommendations of most promising forums and issues to engage in, so deciding what not to do is also important. Your advice about the relative priority for Sierra Club engagement, pro and con, will be very valuable.

This technology is still in early research stage. Limited applications could be beneficial if it becomes economic, but there are significant trade offs. This should probably not be a major Club priority for work as we have no involvement to date, no experience, and no great public policy handles. We might go on record supporting limited R&D.

14. What are the implications for providing good paying family-sustaining and/or union jobs and a just transition as part of deployment of this type of program?

The mining, crushing and transport could provide jobs, but mining is highly disruptive of the natural environment so these are not the type of green jobs we want to promote even if they might be good paying jobs.

Solar Radiation Modification (SRM)

1. Major opportunities in this area:

The IPCC, arguably the most climate savvy organization in the world, considered the option of allowing the climate models to use SRM, but it decided against allowing it in the models for a number of reasons:

“So-called solar radiation modification—pumping particles into the air to reflect sunlight—could be “theoretically effective” in reaching the 1.5°C goal. But it is excluded from the model scenarios due to:

- “large uncertainties”: The fact that this technology cannot be tested without potentially exposing the world to unknown potential issues after more than ten years+ of research suggests that the technology may have unknown or unknowable risks.
- “knowledge gaps”: The technology faces knowledge gaps because it cannot be fully tested except by open air experiment with our only earth. As a result the Technology has gaps on deployment issues that arise as how to calibrate or choose the right agent to throw into the air, and more importantly which agent to use.
- substantial risks: substantial unknown risk is associated with any open air experiment.
- “institutional and social constraints”: By far, the most important issue is the institutional and social constraints. This technology represents a cross-boundary technology which is constrained by the UNFCCC Convention. Among other issues it is likely that there will “be winners and losers” among the countries of the Earth, making any deployment of the technology subject to UN governance. And it distracts from the real solution to Climate Change which is to take strong mitigation efforts.

And, in our view solar radiation modification is a distraction that might temporarily mask rising temperatures but fails to address the real climate issue: too much CO₂ in the atmosphere. If we were to temporarily adopt solar radiation modification, when the time was up, all of the CO₂ that had been building in the air over the years might cause a nearly immediate rise of temperature that might shock earth system might not be able to cope with. Adding to that, the technology would not have equal effects over the world the generating equity issues.

By intentionally changing the Earth’s albedo, or reflectivity, scientists propose that we could reflect more heat back out into space. We could also intercept sunlight before it reaches the Earth through a literal shade built in space. The effects are uncertain but it has been suggested that 2% albedo increase would roughly halve the effect of CO₂ doubling.

The National Academy of Sciences describes several of the potential benefits and risks of solar radiation management: Modeling studies have shown that large amounts of cooling, equivalent in scale to the predicted warming due to doubling the CO₂ concentration in the atmosphere can be produced by the introduction of tens of millions of tons of aerosols into the stratosphere.

Preliminary modeling results suggest that albedo modification may be able to counter many of the damaging effects of high greenhouse gas concentrations on temperature and the hydrological cycle and reduce some impacts to sea ice. It will do nothing for ocean acidification or the increase in anoxic zones, however. Models also strongly suggest that the benefits and risks will not be uniformly distributed around the globe. The applicability of many techniques listed here has not been comprehensively tested. Even if the effects in computer simulation models or of small-scale interventions are known, there may be cumulative problems such as ozone depletion, which become apparent only from large-scale experiments.

Helpful references:

Mark, Jason (2009). Hacking the Sky: Geo-Engineering Could Save the Planet... And in the Process Sacrifice the World. Earth Island Journal. San Francisco, CA: Earth Island Institute. 24 (3): 40–46. ISSN 1041-0406. 472240324.

The Effects of Volcanic Sulfur Dioxide on the Ozone Layer www.meteor.iastate.edu. Retrieved 2017-06-03. Wikipedia

2. What is the potential for significant drawdowns?

SRM does not drawdown carbon dioxide, it just reflects and leaves carbon dioxide in place. If and when SRM is discontinued or disrupted, there can be a climate shock as the sun is no longer reflected.

3. What kind of Sierra Club Activity is already working in this area?

None that we know of.

The Sierra Club has expressed concern about SRM and its dangers and drawbacks, but has done no work in this area.

4. What other groups are already working in this area?

Rafe Pomerance of Arctic 21 is promoting R&D&D in this area.

The Carnegie Climate Geoengineering Governance Initiative is funded to work on international governance to regulate or restrict SRM.

5. What Funders, if any, are funding in this area?

Danish government was funding Carnegie Geoengineering Governance Initiative.

6. Which political forums does this play out in?

The UNFCCC Technology Mechanism has a role in suggesting policies and funding. Some form of the UN or other international body would be where it is discussed as far as governance. A UN body is needed, but the UN has few experts and any work that the UN might take up would be based on research of scientific research of country-based bodies, such as the US National Academies of Sciences which is already proposing to take up Geoengineering governance.

Research for SRM might play out in DOE or NOAA budgets?

7. Are there specific geographic areas for focus?

There is no geographic focus, as it is global.

8. Need to do more research?

The Club needs to decide if there is any level of research with NO deployment that we would want just to flesh out the dangers to discourage deployment.

9. Are there any key justice issues and equity concerns?

Solar Radiation Modification bears the spectre of a technology that is unlikely to have consistent impacts across the globe. The claim that this technology will help developing countries most comes from their high vulnerability.

The equity concerns would be that rich developed countries might deploy it seeking benefits and the poorer countries that are not even consulted could bear the brunt of the impacts such as drought, flooding, loss of monsoon season etc.

10. Are there positive or negative environmental or ethical issues?

Yes, SRM raises huge negative environmental and ethical issues, where one country or private party could adversely impact another country or entire part of the world. While there might be positive impacts on part of the globe, there could well be negative impacts even greater on another part.

11. Is the action consistent with Sierra Club policy?

The Club has no formal policy on SRM and we should develop one. We have informally been letting lab research go forward, but we oppose any open air experimentation and deployment.

12. Any key other questions in our area

Governance is one area to explore if we need to engage to make sure it is not deployed and that all parties are at the table if governance is set up.

13. Ultimately we want to see what part of this might be particularly ripe for Sierra Club engagement

Red flag on SRM, but is there a role for the Club other than speaking out or weighing in on research and governance?

14. What are the implications for good-paying, just family-supporting jobs?

From SRM little or none.

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