SAFEGUARDING AMERICA'S FUTURE AND ENVIRONMENT ACT (SAFE)

8/17/2016

Senate Bill 1601; House of Representatives Bill 2804

COLUMBIA SIPA
School of International and Public Affairs

Master of Public Administration in Environmental Science and Policy

Summer 2016

Faculty Advisor: Dr. Robert Cook

This page intentionally left blank.

Disclaimer

Team Members:

Savannah Gentry Miller (Manager)
Nina Gyourgis (Deputy Manager)
M. Umar Ashfaq
Daniel Chi Cook
Lisa Kubotera
Danny Scull
Tiffany Sieler
Averill Q. Wickland
Shira Yashphe

Cover Photo Credit: Dr. Robert Cook

Executive Summary

Global climate change has caused unprecedented stress on many of the United States' fish, wildlife, and plant species. This has put the resilience of species and the vitality of national ecosystem services at risk. Atmospheric carbon dioxide concentrations have increased since the pre-industrial era. The combination of increased CO_2 concentrations and natural forces has contributed to global climatic changes, including, but not limited to, increased global temperature, drought, sea level rise, ocean acidification, and more severe and frequent extreme weather events. Alterations to ecological cycles impact the distribution of fish, wildlife and plant species. Furthermore, climatic changes can disrupt the timing of fish, wildlife, and plants' biological and seasonal cycles, negatively affecting blooming, breeding, and migratory patterns. The Intergovernmental Panel on Climate Change (IPCC) notes that climate change has and will continue to adversely affect all aspects of biodiversity (IPCC 2014).

Losses of fish, wildlife and plant species, as well as the ecosystem services they provide, will greatly impact the national economy. The stability of fish, wildlife, and plant populations represents a critical component of GDP, in addition to inherent aesthetic values. According to a 2012 Outdoor Industry Association report, for example, outdoor recreation – including camping, wildlife viewing, and hunting – was valued at $646 billion (Cartwright 2015). In addition, healthy ecosystems provide invaluable ecosystem services, including crop pollination, and soil and air purification, and increased national resilience to climate change impacts.

The *Safeguarding America's Future and Environment Act* (SAFE ACT) intends to increase government efficiency and effectiveness in responding to climate change. By establishing an integrated national approach for protecting and conserving the country's fish, wildlife, and plant species, the bill seeks to improve the functionality of ecosystem services and prepare for further climate change and variability.

This report provides an overview of scientific components associated with species' vulnerability to climate change as well as how these scientific concerns inform the SAFE Act's objective. It then details the mechanisms by which the SAFE Act will address species' vulnerability and the sustainability of ecosystem services that these species provide for present and future generations.

Table of Contents

1. Introduction

Pressing concern over the impacts of climate change and extreme weather to fish, wildlife and plants highlights the need for governmental efficiency in protecting, managing, and conserving the nation's species and ecosystem services. Currently, a number of Federal, State, local, and tribal agencies have introduced legislation and engaged non-governmental stakeholders in working towards conservation. This includes, but is not limited to, the U.S. Bureau of Land Management, the U.S. Fish and Wildlife Service, the Environmental Protection Agency, the National Park Service, the United States Geological Survey, and the National Oceanic and Atmospheric Administration (NOAA). The SAFE Act aims to foster communication and coordination between these groups, and others, in order to achieve tangible conservation results.

2. The Science of Climate Change and its Effect on Biodiversity

Global climatic changes have and will continue to alter ecological processes, and ultimately the vitality of crucial ecosystem services. Subsequently, many U.S. fish, wildlife, and plant species' resilience to environmental disturbances will weaken.

2.1. Disruption of Atmospheric Processes

An excess of CO_2 has accumulated in the Earth's atmosphere over the last century, primarily as a byproduct of fossil fuel energy consumption (NOAA). The buildup of this greenhouse gas has resulted in a steady and measurable increase in the amount of heat energy trapped in the atmosphere. For example, average surface temperatures in the United States have increased roughly 1.5 degrees Fahrenheit over the last century (The National Aeronautics and Space Administration). Such a rapid shift in temperature has had profound effects on local and regional climates across the country. The frequency and severity of extreme weather events, for example, has increased. These events include floods, hurricanes, seasonal changes, and wildfires, as well as more subtle changes brought on by altered patterns of rainfall, snowfall, and river flow. The rapid accumulation of CO_2 in the atmosphere is also responsible for ocean acidification. Taken together, these phenomena are changing habitat conditions for many species, and introducing new biological, chemical, and physical stresses into their environments.

2.2. Disruption of Ecological Processes

Fish, wildlife, and plants experience a natural adaptability and resiliency threshold to environmental disturbances. For example, if a food source becomes depleted, animal populations will attempt to identify a new one and tailor their diet accordingly in order to survive. If a habitat becomes unsuitable for nesting, a bird species may adjust its migratory pattern in order to ensure the survival of its brood. These types of common behavior modifications are generally referred to as adaptations and are essential to the viability of a given species or population. In many cases, however, climatic conditions are changing faster than the species' ability to adapt, resulting in population decline and system-wide biodiversity loss. When population numbers decline due to environmental factors, the degree and speed with which they can eventually recover, referred to as a population's resilience, will also decline.

Large system-wide impacts have the potential to occur if climate change results in the decline of a keystone species. A keystone species is one that serves a role within its ecosystem that is disproportionately large compared to other species in the same ecosystem. Their decrease in population can lead to a cascading decline of other species. These losses will lead to reductions in ecological biodiversity, defined as the species variety of fish, wildlife, and plants in an environment as well as the diversity of genes within a population or species.

2.3. Disruption to Biological Processes

When climate change reduces greater numbers of a population, the remaining organisms are left with fewer gene variants to protect them and their offspring from disease and environmental stress. Survivor populations become more susceptible to predation, habitat loss, food scarcity and other factors, creating a feedback mechanism for the population's decline. Other disrupted biological processes include shifts in the timing of fish, wildlife, and plant's natural

cycles. For plants, warming temperatures can trigger blooms too early in the calendar year, when pollinators are not yet ready to assist in seed dispersal. Similarly, wildlife often base their mating and breeding behaviors on the regular patterns of the seasons. If these conditions occur at the wrong time of year, due to changing climates, offspring can be born when food sources are unavailable or without enough time to be properly reared (Memmot et. al 2007).

2.4. The Implications of Climate-Induced Biodiversity Loss

The last century has seen changing patterns of extreme weather and climate events. From the acceleration in global sea level rise, to a measured increase in surface and ocean temperatures, these changes have increased in frequency over the last 50 years and they will continue to increase in frequency for the foreseeable future (Church 2006, Levitus 2007, USCEI 2016). US Federal agencies such as the National Aeronautics and Space Administration and the United States Geological Survey have demonstrated that wildlife, fish and plant populations are affected by such extreme weather occurrences. Loss of biodiversity and changes to species' seasonal cycles are just two examples of how climate change negatively impacts an ecosystem. Simply put, climate change is occurring at a pace faster than species' adaptation rates, reducing the resilience of fish, wildlife, and plants to population disturbance on a nationwide scale.

The United States' economy relies on the resources and services its wildlife, fish, and plants provide. Just as labor and technology contribute value and functionality to the economy in the form of human capital, ecosystems yield a supply of natural capital. Clean air, storm protection, health benefits and jobs that support human communities are only a handful of the ecosystem services produced. Thus, when ecosystems are put at risk, so are the communities and industries that depend on them.

Figure 1. Salmon populations are major economic, cultural, and ecological components of US natural resources and their populations are dwindling due to the impacts of climate change. Impacts include loss of snowpack, warmer water temperatures, and increased extreme weather events and flooding. Source: *The Washington Post*

3. The SAFE Act's Legislative Solution

The *Safeguarding America's Future and Environment Act* (SAFE Act) intends to establish an integrated national approach to respond to the deleterious effects of climate change and extreme weather conditions on fish, wildlife and plant populations through the implementation of the National Fish, Wildlife, and Plants Climate Adaptation Strategy. The SAFE Act was presented in both the Senate (S.1601) and the House of Representatives (HR. 2804) and has been endorsed by twenty organizations, including Defenders of Wildlife, the Sierra Club, and The Nature Conservancy. Twenty-three U.S. congressional representatives have signed on to the proposed legislation as co-sponsors.

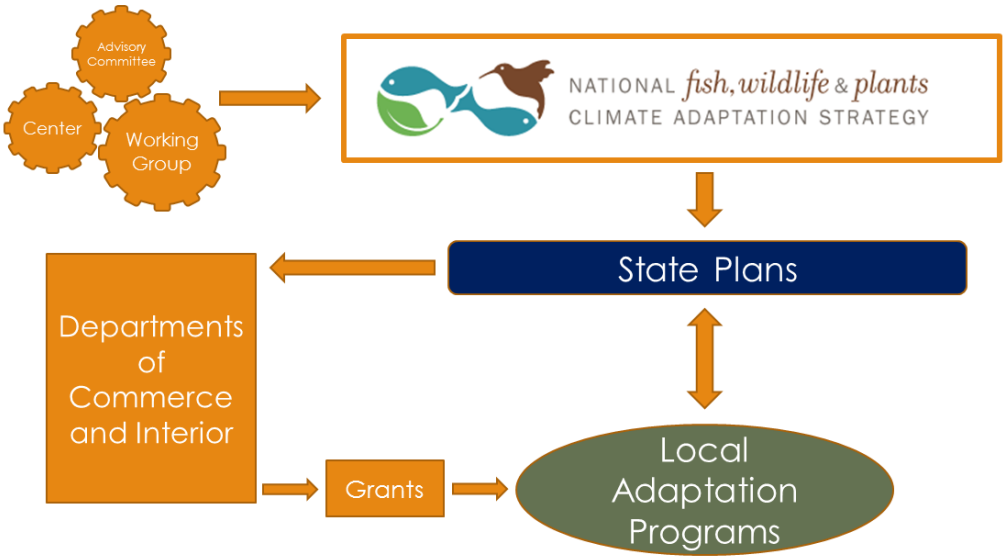

Figure 2. The SAFE Act Legislative Framework

3.1. Multilateral, Multi-Stakeholder Collaboration

Within ninety days of the bill being passed, the President will establish a Working Group. This Working Group will consist of the heads of Federal and State agencies or departments that have authority over the fish, wildlife, and plant resources of the US and tribal representatives. The Working Group will make use of the *National Fish, Wildlife and Plants Climate Adaptation Strategy* (National Strategy), which was released in 2013. This strategy protects, manages and conserves fish, wildlife, and plants by maintaining or improving their ability to withstand, adjust to, or recover from the effects of current or future extreme weather conditions.

The Secretary of the Interior, State officials, tribal leaders, and other partner organizations, will establish a National Climate Change and Wildlife Center in accordance with the bill. The Center will assess and develop scientific information, tools, strategies and techniques to support the Working Group, and other interested organizations, in addressing the effects of extreme weather and climate change on fish, wildlife, and plants. In addition, the Advisory Committee on Climate Change and Natural Resource Sciences will aid the Working Group, by offering a multi-stakeholder perspective in the fields of ecology, biology, and climate change. It will be representative of the private sector, public sector, non-governmental organizations, etc.

3.2. The Formulation of Local Adaptation Plans

Within one year of the bill's passing, and no later than one year after each revision of the National Strategy, the Working Group will develop a plan of action, provide options for public review and comment, and submit the plan to the President to be approved. Each State has the right to be considered for funds within one year of this bill being passed and each revision of the National Strategy. The Secretary of the Interior and the Secretary of Commerce will review and approve States' plans in order for plans to receive funding.

3.3. Review and Revision

Each process of the SAFE Act, from the National Strategy to States' local adaptation plans, will undergo periodic review and revision. Each plan is considered a "living document," and adapts with evolving scientific understanding, fieldwork, and innovative policy tools. In order to address ecological and climatic variance, the SAFE Act legislation must remain dynamic and innovative.

Salmon in the Upper Quinault River: Local Adaptation Plan

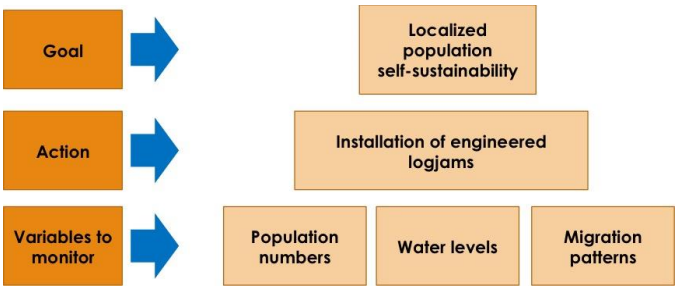

Figure 3. This figure represents the overarching objective, interim actions, and measurable indicators for the local adaptation plan for salmon in the Upper Quinault River, in Washington State.

Case Study – Salmon of the Upper Quinault River

The National Wildlife Federation has coined salmon the "canary in the coal mine" for indicating climate change impacts. The unique migratory patterns of salmon expose them to environmental conditions ranging from freshwater streams to open ocean, and therefore diverse climate-related changes. Their climate risks include, but are not limited to:

- Loss of snowpack, which can result in reduced and more variable stream flows
- Warmer water temperatures, which add stress to salmon populations and increase vulnerability to predators, parasites, and disease
- Increasingly severe storms and floods, which disrupt nesting sites.

As salmon populations decline, so too do the predators that depend on them as a food source. These predators in turn help deposit nutrients originating from the salmon to other locations within an ecosystem. Salmon are integral components of their ecosystem, and thus their absence would result in widespread ecological harm.

These factors have informed the efforts of the Quinault Indian Nation, in collaboration with State, Federal, local, and nonprofit partners, to design interim conservation strategies to protect the salmon along the Upper Quinault River. The project's overarching goal is to restore habitat-forming processes on the river and protect the genetic diversity and resilience of salmon populations. Since 2007, local conservation managers have installed 27 engineered logjams, a common restoration solution for conserving salmon populations and their ecosystem. Engineered logjams break up stream flows and ease erosion, returning the system to an approximation of its natural state. Furthermore, they play a vital role in providing safe refuge for salmon amid stream flow variability and when hiding from predators. Conservation managers will continue to measure birth and death rates, water levels, and migration patterns, in order to monitor the success of the local adaptation plan's restoration strategy. This project serves as an example of the kind of feasible and monitored local adaptation plan for which the National Fish, Wildlife, and Plants Climate Adaptation Strategy provides a framework.

4. Measuring the Success of the SAFE Act

Given the multi-faceted nature of the SAFE Act, and the inter-governmental cooperation required to achieve its objectives, a performance measurement framework at all working levels is imperative for its success. Monitoring and evaluation is an integral component in the design phase of any project or task, and specific, quantifiable, and measurable indicators of success are a tangible benchmark to measure progress. Any species conservation and adaptation measures proposed and undertaken via the SAFE Act require clearly defined goals and outcomes to be established at the outset.

4.1. Indicators of Success

Specific conservation targets that the SAFE Act aims to create and execute are, in many cases, yet to be laid out. As such, baseline studies to assess existing rates of population decline are also included as part of the general plan, as envisioned in the bill. Given that the proposed Working Group outlined in the SAFE Act will include State representatives as well as the Director of the US Fish and Wildlife Service, technical expertise to develop performance measurement systems for adaptation measures will be available.

Performance measurement for the SAFE Act would require a two-pronged approach, measuring progress at the micro-level for each proposed conservation plan, as well as the processes that lead to the formulation of each plan. Methods for monitoring, specific targets, and the types of data collected are likely to differ among adaptation strategies, and must be driven by the specific information needs of species specialists, key decision makers, and public interest (Heinz 2008).

4.2. Process Evaluations

Process evaluations assess the effectiveness of inter-governmental meetings. They are conducted to further the National Strategy and require quantitative indicators for performance benchmarking. These macro-level targets would define the deliverables and outcomes of meetings, as well as the budgetary quantum of expenditures required at specific time periods (UNEP 2006).

4.3. Outcome Evaluations

Recovery plans for various species, developed by the US Fish and Wildlife Service under the Endangered Species Act of 1973, serve as good examples of outcome-based performance measurement systems (USFWS 2004). The steps required to develop performance management systems for adaptation plans would first include the identification of conservation targets for a vulnerable species of plant, fish or wildlife, as well as a study of threats the species faces. Next, a conceptual model would be developed that identifies potential indicators of target status and conservation effectiveness. These targets would guide the implementation of the proposed conservation activities, and outline markers for success (Heinz 2008).

5. The Science and Mechanisms Behind the SAFE Solution

There are numerous scientific points of discussion pertaining to the general SAFE Act's process of adaptation, prioritization, and diverse implementation strategies. The scientific community has not reached a consensus on all issues, with an overarching lack of understanding concerning the value of biodiversity, and the way ecosystems interact with and benefit society. This controversy informs the specific disagreements regarding species' ability or inability to adapt to climate change, the prioritization of vulnerable species, and most effective adaptation solution.

5.1. Identification of Vulnerable Species' Adaptation Rates

The SAFE Act is predicated on the presumption that fish, wildlife and plant species are identifiably unable to adapt quickly enough to the effects of climate change. However, some controversies surround the degree to which changing climates negatively impact the survival of target species. Furthermore, defining species' adaptation rates to environmental disturbances can present a challenge. These debates rest upon the uncertainty of available methodology.

5.2. Biases in Vulnerable Species Prioritization

The SAFE Act determines that species must be ranked according to their vulnerability and their impact on other organisms within their ecosystem. However, there is a lack of consensus on how to identify and prioritize species based on these parameters. No standard prioritization process currently exists, and, due to limitations in current research, bias is often developed during species identification. For example, a larger number and much higher proportion of species of vertebrates have been studied and ranked for vulnerability when compared to insects (Pacifici 2008). There is also a lack of consensus on valuing cultural prioritization, as a local society's values may influence the perceived importance of a given species. Species with relatively low ecological value may be misconstrued as more integral to an ecosystem, possibly distracting attention and diverting resources away from species with ecologically larger impacts within that ecosystem (Fletcher 2005).

5.3. Unknowns in the Effective Formulation of Local Adaptation Plans

Each State will propose species-specific adaptation plans for addressing the protection, management, and conservation of identified vulnerable populations. However, defining success presents a critical controversy, with regard to setting population targets. Furthermore, if an adaptation plan requires the creation of a static ecosystem, it can create an unnatural ecological situation. Other controversies relate to timescales of ecosystem recovery, since they are often much longer than fiscal and political cycles (Hilderbrand, 2005).

In addition to the challenges of creating an appropriate adaptation plan, there is also the possibility of failure in a well-designed plan, and unintended harm. Translocation, or physically transporting a species into a new ecosystem, is often unsuccessful, and can even result in a species becoming invasive in its new home (Griffith 1989; James 2015). Avoiding unintentional damage to other ecosystems is a crucial aspect of any successful adaptation plan.

6. Conclusion

The Intergovernmental Panel on Climate Change is in consensus that climate change negatively impacts biodiversity, and threatens ecosystem services (IPCC 2014). Studies undertaken by United States research institutions and federal agencies have observed the same phenomenon. Local and regional communities are already experiencing the effects of fish, wildlife, and plant populations that have been compromised and degraded by climate change. The SAFE Act intends to unify and maximize the efficiency of activities that have begun to take form, but is still disparate. The primary method by which the SAFE Act will achieve this will be through the coordination of government agencies and the implementation of the National Strategy. Though uncertainty and controversies do remain, and are important to consider in reviewing local adaptation plans, they do not undermine the SAFE Act's intention to safeguard America's future and environment through the efficient protection, conservation, and management of fish, wildlife and plant species.

Glossary

Adaptation- A change by which an organism or species becomes better suited to its environment.

Biodiversity - The existence of many kinds of plants and animals in an environment

Center - National Climate Change and Wildlife Center - assesses and develops scientific tools, strategies, and techniques to support the Working Group, federal and state agencies, and other parties trying to address the effects of climate change and extreme weather conditions on fish, wildlife and plants.

Ecological Processes - The biological, chemical, or physical interaction between the biotic and abiotic components of an ecosystem. These include, but are not limited to: decomposition, disease, gene flow, hydrological cycling, nutrient cycling, pollination, predator-prey relationships, and soil formation.

Ecosystem Services- Benefits gained by humans such as crop pollination, seed dispersal, water purification, as well as aesthetic and recreational value.

Greenhouse Gases - A gas that contributes to the greenhouse effect by absorbing infrared radiation. This includes, but is not limited to, carbon dioxide, latent heat, methane, and nitrous oxide.

Habitat - The physical, chemical, and biological properties that fish, wildlife, and plants use for growth, reproduction, survival, food, water, and/or cover.

Keystone Species- A species that has a large impact its ecosystem, disproportionate to the population of that species.

National Strategy - National Fish, Wildlife, Plants Climate Adaptation Strategy - a plan created by federal, state, and tribal government representatives outlining seven goals to help the fish, wildlife, and plant species withstand the effects of climate change.

Resiliency- The ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions.

State - Includes a) the states of the United States, b) the District of Columbia, c) American Samoa, d) Guam, e) the Commonwealth of the Northern Marina Islands, f) the Commonwealth of Puerto Rico, and g) the United States Virgin Islands

Tribal - Includes any Native American tribe, band, nation, or other organized group, or community.

Working Group - The National Fish, Wildlife, and Plant Adaptation Joint Implementation Working Group - comprised of the heads of Federal and State agencies and local and tribal representatives.

Works Cited

Church, John A., and Neil J. White. “A 20th Century Acceleration in Global Sea-Level Rise.” Geophysical Research Letters 33 (01.062006): 1–4. Print.

The John Heinz III Centre for Science, Economics and Environment. 2008. *Measuring Results of the State Wildlife Action Plans*. Washington, DC, xx pp.Web. 20 July 2016

Intergovernmental Panel On Climate Change. "Summary for Policymakers." *Working Group III Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change Climate Change 2014 Mitigation of Climate Change* (n.d.): 1-30. Web.

Levitus, S., J. Antonov, and T. Boyer. “Global Ocean Heat Content 1955-2006 in Light of Recently Revealed Instrumentation Problems.” AGU Fall Meeting Abstracts. Vol. 1. N.p., 2007. 6. Google Scholar. Web. 14 June 2016.

Melillo, Jerry M., Terese TC Richmond, and G. W. Yohe. “Climate Change Impacts in the United States.” *Third National Climate Assessment* (2014): n. pag. *Google Scholar*. Web. 14 June 2016.

Memmott, Jane, Paul G. Craze, Nickolas M. Waser, and Mary V. Price. "Global Warming and the Disruption of Plant Pollinator Interactions." *Ecology Letters Ecol Letters* 10.8 (2007): 710-17. Web.

Merriam-Webster Dictionary. “Definition of PHENOLOGY.” N.p., 14 June 2016. Web. 14 June 2016.

National Fish, Wildlife*, and Plants Climate Adaptation Strategy*. Association of Fish and Wildlife Agencies, Council on Environmental Quality, Great Lakes Indian Fish and Wildlife Commission, National Oceanic and Atmospheric Administration, U.S. Fish and Wildlife Service. National Fish, Wildlife, and Plants Climate Adaptation Partnership. (2012)

Pacifici, Michela, Wendy B. Foden, Piero Visconti, James E. M. Watson, Stuart H.m. Butchart, Kit M. Kovacs, Brett R. Scheffers, David G. Hole, Tara G. Martin, H. Resit Akçakaya, Richard T. Corlett, Brian Huntley, David Bickford, Jamie A. Carr, Ary A. Hoffmann, Guy F. Midgley, Paul Pearce-Kelly, Richard G. Pearson, Stephen E. Williams, Stephen

G. Willis, Bruce Young, and Carlo Rondinini. "Assessing Species Vulnerability to Climate Change." *Nature Climate Change Nature Climate Change* 5.3 (2015): 215-24. Web. Safeguarding America's Future and Environment Act (SAFE Act), H.R. 2804, 114th Cong. (2015). Print.

"Salmon and Global Warming - National Wildlife Federation." *Salmon and Global Warming - National Wildlife Federation*. N.p., n.d. Web. 13 Aug. 2016.

United Nations Environmental Program (UNEP) (2006). *Ecosystem-based management: Markers for assessing progress*. UNEP/GPA, The Hague. ISBN 92-807-2707-9. Web. 20 July 2016

"U.S. Climate Extremes Index (CEI): Introduction | Extremes | National Centers for Environmental Information (NCEI)." N.p., n.d. Web. 14 June 2016.