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To: Executive Office of the President - Office of Science Technology and Policy

From: Ecological Society of America

Subject: Request for Information Response, Framing the National Nature Assessment

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The Ecological Society of America (ESA) appreciates the opportunity to provide a response to the Office of Science and Technology Policy (OSTP) Request for Information, "Framing the National Nature Assessment." ESA, founded in 1915, is the world's largest community of professional ecologists and a trusted source of ecological knowledge, committed to advancing the understanding of life on Earth. The 8,000-member society publishes five journals and a membership bulletin and broadly shares ecological information through policy, media outreach and education initiatives.

Defining nature and its value to the nation is critical as it strikes at the core of national security, prosperity and health. ESA wholeheartedly supports the development and use of a National Nature Assessment (NNA) that contributes to civil society.

ESA views this initial response as the beginning of a multi-year process of engagement between the ecological community, OSTP and potential users of the NNA. The questions posed cover sweeping areas of cultural, societal and ecological knowledge, and are all essential to establishing a durable foundation for the NNA. ESA widely sought input to inform our response from its members and the larger community of scientists who study the science of ecology through webinars, newsletters, listservs and virtual meetings. Ecologists from academic and private sectors in various career stages ranging from graduate students to emeritus professors contributed to the ESA response. A dedicated group of members appointed by the ESA Governing Board president facilitated the development of the responses to the NNA Request for Information.

NNA Question 1

Assessments can be tailored to inform a wide range of audiences. Who are the key audiences for, or users of, the NNA? Who should find the information that the NNA provides useful?

ESA Question 1 Response:
Overall, the key audiences and users are (1) government decision makers (i.e., federal, state, local, tribal policy and management entities); (2) the public sector (e.g., concerned community members, academics, practitioners, educators, landowners, public health professionals and medical doctors, environmental activists, NGOs and any of a wide array of individuals and groups who are interested in the status, drivers and fate of America's nature); and (3) commercial

interests (e.g., fishers, farmers, agribusiness and eco-tourism operators, ranging from the individual to the national and even international nature-based businesses and industries).

Among these three audiences, the public sector is viewed as the most important because many segments of the public have fewer, consolidated resources (human and social capital) to cope with changes to nature that affect their well-being and livelihoods. Although the public sector understands various aspects of the nature around them, the NNA could engage with the public sector to create a dialogue to facilitate knowledge sharing among the three audiences.

NNA Question 2

USGCRP understands that the creation of a use-inspired assessment will require ongoing engagement with the potential users of the NNA. This RFI is one of the first ways USGCRP is reaching out to potential users.

a. What engagement processes should be used so that the audiences identified above are best able to participate in the development process?

b. What forms or formats of engagement (*e.g.,* in-person town hall meetings, virtual conversations, community workshops, social media events, calls for stories or art) are likely to help USGCRP meet its principle of inclusivity and best inform the assessment?

ESA Question 2a (Process) & b (Forms or formats of engagement) Response:
A broad range of engagement forms and formats can be utilized and tailored to groups with diverse perspectives. For example, locally available nature experts can provide frequent NNA updates through webinars, conferences and regular calls for public commentary that will enhance local context and active engagement.

For some segments of the public sector, community meetings, town halls, online questionnaires, polls, boosted advertisements on major social media sites and, where possible, door-to-door social surveys may be primary means to do outreach. Creativity in and around engaging new voices and perspectives is necessary. One example is to support participatory art–nature dialog and projects around the country.

Professional or affinity group associations can serve as a nexus: they can host and facilitate engagement platforms and outlets as well as gather feedback and increase outreach. Self-organized groups such as local cattlemen's associations, Future Farmers of America chapters, 4-H clubs, urban gardens, Friends of National Parks groups, marine fisheries groups, and neighborhood and lake associations can assist in broadening engagement.

NNA Question 3

Use-inspired assessments are tailored to their intended use.

3a. What decisions should the NNA help inform, and what information is needed for those decisions?

3b. What needs can the assessment fill, and how should information be provided to fill them?

3c. What questions should the NNA answer? What do you wish you knew about nature in the United States?

ESA Question 3a Response-Informed decisions:
The NNA could identify "hot spots" where enhanced efforts to preserve nature can be focused and provide aspects of managing ecosystem processes that are impaired by the loss of nature. It can inform how to best use "nature-based solutions" to mitigate climate change, land use change and other human-derived effects. The NNA can also identify areas where education and outreach—and in-reach—efforts would leverage further actions to enhance nature.

ESA Question 3b Response-Needs the assessment can fill:
The NNA can provide a clearer description of how nature is critically important to support livelihoods and the well-being of life around us.

The NNA can provide information, resources and guidelines to facilitate decision-making that balances human society's dependency on nature with the sustainable use of its provisioning, regulating, cultural and supporting services. These services are key to a healthy, sustainable future for the American people. The NNA should include an assessment of how nature "works" relative to ecosystem function and structure, as well as documenting biodiversity. The NNA could provide a greater understanding of how nature supports life and how nature is essential to the well-being of people. The NNA will also have an opportunity to fill the information gap by soliciting and providing useful and accessible information on what nature is, how it is changing and what are the key influences changing nature. This information must be available to the media, for outreach and public relations to facilitate engagement with and dissemination of its products.

ESA Question 3c Response-What questions to answer:
Key questions should be focused on answering: What is nature? What living entities (i.e. biodiversity) does nature comprise and what services do these entities provide (e.g., producing food and fiber)? What are the monetary benefits of nature? Why is nature essential to—and how and why does it underpin—all people, society and our existence on Earth? How and why are we (humans) and our built systems part of nature? How is nature changing and why? What are the consequences of a changing and deteriorating nature to the world we will inhabit in the future? How can we contribute to natural systems resilience?

In addition, the NNA should attempt to answer the questions "How degraded (i.e., bad) is the state of nature?" and "How much time do we have to restore it?" The goal would be to motivate rapid transformation of our currently unsustainable natural systems into ecologically sustainable ones—not to scare people into nihilism or inaction. The "how bad is it" question relates to the need for a better understanding of how biodiversity is at the core of ecological functions and the ecosystem benefits (goods, services, and non-material psychological and spiritual benefits) they provide.

NNA Question 4

The scope of the NNA includes assessment of the observed trends and future projections of nature and the benefits it provides to people. Given this:

a. How far back in time should the NNA explore observed trends, and why?

b. What kinds of questions about the future should the NNA aim to answer? How far into the future should projections extend, and why?

c. What types of future scenarios would best support the recommended uses (e.g. quantitative time series, directional changes, stories)?

ESA Question 4a Response-How far back in time:
We suggest starting at least in the mid-20th century (circa 1950) when the most rapid increase of human activities affecting nature started (e.g., cropland conversion, use of new chemicals in the environment, exacerbation of air and water pollution, expansion of invasive species, profound land and water system alterations). Also, more data may be available to evaluate how nature has changed from this period to the present.

ESA Question 4b Response-Future and kinds of questions:
Looking toward 2030 and 2050 would be important, especially because of the Convention on Biological Diversity's goal of protecting 30% of nature by 2030. Also, the near-term trends for the next 25 years are urgent to clearly forecast with current drivers that are damaging nature. The kinds of questions that can be asked will depend in large part on the data available. Who is there (what is the status)? What are the patterns of change in nature across time and space? What are the likely drivers of change affecting nature? Can we use this information to predict future change?

ESA Question 4c Response-Scenarios:
The NNA has the potential to explore scenarios that focus on the urgency to protect, make resilient and/or restore nature. Employing a near-term perspective, the NNA should provide a strong footing to base consequences to nature on documented trends and put policy mechanisms in place. A 2030 to 2050 outlook would also focus on the urgency of taking immediate action to mitigate the impacts of changes in climate, land use, water resources and biodiversity that will lead to further transformation and impairment of nature. There will be adverse consequences across all sectors if we do nothing to slow the pace of the damage that humans are causing to nature.

NNA Question 5

Assessments can create a wide variety of products that help users access, understand and use the information that is provided. These can include large written reports, a series of shorter reports, online interactive settings, artistic expressions (paintings, poems, etc.), infographics, virtual or augmented reality tools, phone or tablet apps, presentations, data resources, films, podcasts, social media, events, entertainment products and many others.

a. What kinds of products can best communicate the findings of the NNA?

b. How would you like to use the findings of the NNA?

ESA Question 5a and 5b Response- Products:
The products should be creative, varied and aligned with a wide diversity of audiences and engaged partners. These might include at least three classes of products: (1) data resources organized into a single portal; (2) reports and searchable literature, including actionable interpretation of data and data analysis, as well as summaries for decision makers and findings; and (3) a wide array of public outreach products, which may include interactive displays and infographics to online teaching modules and games. These three classes of NNA products can be organized for decision-makers at all levels, the public and commerce. Products should be made relevant not only on a national and regional scale, but also at the local level as much as possible to make them actionable for communities.

The standard products of synthesis reports such as the NNA would include summaries for policymakers, smaller reports and peer-reviewed publications (freely available or in journals). These materials are important for the dissemination of the NNA findings among scholars and decision-makers. Products that reach the public sector will be of profound importance if the NNA is to be effective in engaging the public as well as changing public attitudes, perceptions, values and understanding of nature, including its importance to well-being, its status and its trends. Such products could include online readily accessible data portals that can serve researchers, government agencies, NGOs, businesses, educators and more. A data portal would maximize the utility of data gathered by the NNA.

In addition, it would be useful to take innovative, creative and alternative approaches designed to reach as many people and sectors as possible in ways and places that resonate with diverse groups. While the current younger population may gather information from web-based outlets, such as YouTube, podcasts and other social networking applications, other products that "meet them where they are" could be in the form of games, film, online interactive platforms, online dashboards, mobile apps, artistic expression, social media events and other forms that will be more effective in communicating the importance and urgency of the NNA's findings and recommendations.

The enduring value of the work of the NNA, however, may come from engagement with K-12 students and especially teachers through education modules or materials that cover what the NNA is, what its key findings are, the significance of its work and how people can be involved. In addition, nature tours for schools and for seniors could engage people who can share experiences across ages. Infographics and other media products, including blogs, podcasts and other social media products would disseminate NNA findings in the public sector.

The ecological community can use the NNA in research and to recommend land and water management strategies to preserve and restore biodiversity/nature.

NNA Question 6

Past assessments have used various approaches to organizing findings. Some give information for each region of the country (e.g., findings for the southeast, northwest, southwest, the Arctic). Others give information for different types of ecosystems (e.g., kelp forest, desert, temperate forest) or levels of ecological organization (e.g., species, communities, ecosystems). Still, others organize findings for specific audiences (e.g., government, businesses, landowners, resource users

like fishers, hunters, hikers), or specific decision-making contexts (e.g., NEPA requirements, corporate ESG reporting, financial risk disclosure, research prioritization). The NNA is tasked to assess the connections between nature and the benefits it provides, and so findings could also be organized by benefit (e.g., public health, equity, economy) or by sector (e.g., agriculture, transportation, health, housing, energy).

a. Given that the scope of the NNA is quite broad, how should information in the assessment be organized?

b. What format would best match the ways you think the NNA should be used?

ESA Responses to Questions 6a and 6b:
We recommend that the NNA start with its story a stand-alone narrative that is accessible and well-illustrated that would lay out the rationale, history and motivations of the NNA. It should start by answering what nature is and why nature is important to everyone, followed by the importance of key elements of nature, biodiversity and ecosystem functions in support of nature. This in turn would lead to an overview of how nature supports life and provides goods and services in support of various livelihoods. Another section would highlight the urgency to restore nature for the well-being of society and the factors that are contributing to the destruction of nature.

With its “story” in place, the NNA might be organized by distinct characteristics or features; by ecosystem, ecoregion, geopolitical boundaries, biocultural regions, socioeconomic regions, natural resource regions (e.g., watersheds, grazing lands, fisheries, etc.) and more. There are key sectors that nature supports directly, such as outdoor recreation, hunting and fishing, agriculture and nature watching. In addition, nature has a role to play in mitigating impacts and changes to our environment such as erosion control, landscape and watershed restoration, fire responses and recovery, fishery recovery, etc. This would be a useful linkage to “nature-based” solutions.

Decision-makers require NNA output that is organized geopolitically, as their jurisdiction and influence align with geopolitical boundaries. However, adjustments may be necessary if multiple geopolitical regions occupy or cross system boundaries. To ensure the sustainable use and management of nature for its benefits, a more ecologically-informed approach is necessary. This means that NNA resources must be co-organized by "bioregion" or "ecoregion."

To achieve this, the NNA could coordinate and, where possible, parallel the approaches used by the National Climate Assessment. By doing so, decision-makers can make informed decisions that take into account the ecological impact of their actions. This approach recognizes that nature is not confined by geopolitical boundaries and requires a holistic understanding of ecosystems.

In summary, decision-makers must consider the geopolitical and ecological factors when utilizing NNA resources. By adopting an ecologically-informed approach and organizing resources by bioregion or ecoregion, we can ensure the sustainable use and management of nature for its benefits. To better serve the public, it is recommended to organize public-outreach products by groups, such as educators, NGOs, grassroots, indigenous peoples, and others and map them into

ecoregions. This approach recognizes that cultures often vary by bio- or ecoregion, making it more useful to organize by both group and ecoregion rather than just one or the other.

For commerce, organize by "benefit," such as recreation, provisioning services or wildlife. The term "benefit" is a complex one, and while the NNA should focus on the science, it should facilitate how its scientific findings can be translated into what people perceive as the benefits and costs of nature.

To make the NNA data more user-friendly, it should allow users to sort/filter according to their interests. For example, filter by geopolitical region, sort ecosystems within a region, list taxa or habitats within ecosystems.

NNA Question 7

What does nature mean to you?

ESA Question 7 Response-Define Nature:
From an ecological perspective, nature includes the physical, chemical and biological properties of a place, whether on land, above or below ground, in the atmosphere, in water or at the interface of these systems. Nature also represents the interactions between the biotic and physical-chemical components of a place as represented by the biodiversity and ecosystem functioning that is present. Nature can be defined in reference to spiritual, cultural, as well as the biological and physical-chemical aspects of the world in which we live. Nature is dynamic and is reflective of the complex interactions between the biotic and physical-chemical environment over time and space.

NNA Question 8

What should the definition of nature used in the NNA be sure to address or include, and why?

ESA Question 8 Response:
While there are many definitions of nature, the NNA should focus on the definition that captures the importance of the diversity of life and the ecosystem properties and functions, including their feedbacks, inherent within and across locales. By doing so, this definition allows for the assessment of the state of nature, its role in socioenvironmental processes, and trends. This definition also incorporates the dual importance of biodiversity and ecosystem processes in how these components shape nature.

Ecosystem services are ecosystem functions that benefit people and nature, which include processes inherent in determining the integrity of ecosystems. These include material goods related to food, fiber, energy and water resources; water and air filtration and purification; soil fertility; pollination; the regulation of pests and pathogens; and biotic interactions that further modify and maintain biodiversity within a particular area. Nature also provides benefits to communities and peoples who hold nature-based cultural and spiritual connections, for recreation, spiritual enlightenment or other non-material or intangible values.

Many people believe that nature possesses an inherent value that is not contingent upon human values. In other words, nature has value regardless of whether or not we acknowledge it. When evaluating nature in this manner, we are assessing the health and well-being of nature based on

various components. This includes the state of biodiversity, ecosystem structure and processes, and environmental integrity that supports life and nature in these areas.

Dynamism of Nature

Nature is not static, but it changes over time. Nature is modified by changes in the physical-chemical and biological properties that characterize it. During the Anthropocene, human activities have been the predominant force that has resulted in the most rapid changes to nature, including such phenomena as dramatic alterations in land use, water quality and quantity resulting in the emission of greenhouse gases that cause climate change, introduction of new species, and polluting compounds. The definition and the assessment of nature need to consider the changing conditions determining the state of nature in time and place.

Biodiversity Aspects of Nature

The biological aspects of nature are determined, in part, by the biological diversity (or biodiversity) of an area. The processes that maintain—or alter, diminish or destroy—the biodiversity of a place are important aspects of how nature changes and responds to changes. As human activities (e.g., greenhouse gas emissions leading to climate change, land use changes, introduction of pollutants, etc.) influence the maintenance of biodiversity, they also affect the state of nature in that place and time.

Ecosystem Aspects of Nature

Ecosystem structure and function (e.g., exchange of matter, energy and information within and among systems) provide key aspects of what nature is and how nature is used, viewed and maintained. Ecosystem structures (e.g., the distribution and abundance of species and the web of interactions that connect them) literally provide the physical (often visual) aspect of what nature is to people and are identified as a forest, meadow, beach, marsh or ocean landscape. Collectively, ecosystem structure and function embody the biodiversity of a place, and include the soil, lake and marine sediment, invertebrate, vertebrate, plants and microbiota that make up the ecosystem.

Ecosystem processes provide essential resources within and among ecosystems in support of nature and are critical to maintaining productivity; the cleansing of air, water, and soils; and the restoration of nature. These processes include, but are not limited to, photosynthesis (carbon fixation), decomposition, evapotranspiration, nutrient cycling, herbivory and predation.

Ecosystem Services

Nature offers a plethora of ecosystem services that are highly beneficial to society. These services include the provision of goods, the regulation of material and energy flows, the support of biodiversity and the spiritual and cultural experiences that nature provides. The contributions of these ecosystem services are numerous and significant. They include ensuring food security, providing access to potable water, facilitating the use of renewable energy, supplying building materials and maintaining the delicate balance of life on our planet.

NNA Question 9

What should the definition of nature used in the NNA be sure to leave out or exclude, and why?

ESA has no reply to question 9.

NNA Question 10

Indigenous Knowledge (IK) is an important body of knowledge that contributes to the scientific, technical, social, and economic advancements of the United States and to our collective understanding of the natural world. Responsive to this recognition:

a. How can USGCRP best engage with Tribes and Indigenous Peoples in the development of the NNA?

b. How should IK be woven together with other forms of knowing in the NNA?

ESA 10a Response-Engage:
Recognizing Indigenous Peoples' involvement in developing the NNA is critical for people and nature. ESA agrees with the White House efforts to fully engage with Tribes and Indigenous Peoples for co-stewardship goals for waters, fisheries and other resources of significance and value to Tribes.

All NNA efforts by the USGCRP should follow the guidance for federal agencies as stated in the Joint Executive Order 3403 to ensure that the agencies are managing Federal lands and waters in a manner that seeks to protect the treaty, religious, subsistence and cultural interests of federally recognized Indian Tribes including the Native Hawaiian Community; that such management is consistent with the nation-to-nation relationship between the United States and federally recognized Indian Tribes; and that such management fulfills the United States' unique trust obligation to federally recognized Indian Tribes and their citizens.

USGCRP can further engage directly with Tribes and Indigenous Peoples by participating in STEM-related conferences such as the Society for the Advancement of Chicanos/Hispanics and Native Americans in Science conference and the ESA annual meeting along with the National Congress for American Indians and other relevant gatherings.

ESA 10b Response- Ways of knowing:
IKs are a complete way of knowing that span long-term observations, prediction, learning and adaptation, data management and intergenerational knowledge transmission. In important ways, IKs diverge from "Western" science. One of the most important aspects of Indigenous societies is the reciprocal relationship between humans and nature. While humans benefit from nature, they are also responsible for its sustainable stewardship. This perspective stands in stark contrast to the Western view that nature is a resource to be exploited. Furthermore, non-human beings are considered relatives with inherent rights, and should be honored and respected. While there are other differences, these are particularly critical.

It is useful to remember that IKs are not just another dataset, but a different way of relating to the world and weaving or braiding may not be the best metaphor. Perhaps adding together or using in parallel insights from different ways of knowing is more appropriate because each is developed independently based on very different philosophies. In light of the history of exploitation and oppression experienced by Indigenous communities, it is particularly important to represent IKs only on terms acceptable to Indigenous communities and knowledge holders, in ways that are mutually beneficial to all parties. Indigenous communities must set the terms of knowledge sharing and use, with full respect for Indigenous rights and sovereignty, including data sovereignty.

The NNA will assess lands, waters, wildlife and benefits (economic, health, justice, national security). Integral questions will be: What do those conducting the NNA want to know? What is already known, and what key knowledge might derive from IKs? Because IKs are always place-based and deeply rooted in history, there may be a well-developed understanding of system dynamics embedded in local cultural traditions. There are numerous examples, as well, of keen awareness of anomalous dynamics caused by disturbances to the system (e.g., fire suppression in forests in western states, climate change-induced altered seasonality/phenology, ice cover in the Arctic or inland waters). The NNA needs to follow an ethical approach to develop agreements with local communities and Tribal members (and not limited to federally recognized Tribes) about what specific knowledge will be shared, what form that might take, who will have access to the data, and how the data will be used. One key element of such agreements must be that Indigenous communities will maintain control over their data: it must not be appropriated for uses by anyone or for any reason not defined in a formal agreement.

None of this is meant to dissuade cooperation and pursuit of the common good. As inhabitants of the same planet, our destinies are intertwined, and it is crucial that we share knowledge in a manner that is respectful and mutually beneficial. Importantly, there is no single one-size-fits-all approach for combining knowledge systems. The resolution will always be context-dependent: what are the information needs, what is known and how will the information be used.

NNA Question 11

There are many ongoing assessments, and existing quantitative and qualitative data and knowledge that relate to the many aspects of nature and the wide range of benefits the NNA is charged to assess. These sources may be generated by government agencies, Tribes and Indigenous Peoples, colleges and universities, local communities, non-profit organizations, the international community, the private sector, and others.

a. What existing assessments and knowledge efforts should the NNA draw from to provide a comprehensive view of the status, observed trends and future projections of nature and its benefits in the United States, and why?

b. How can USGCRP best engage with local communities to incorporate their lived experiences into the NNA?

c. What existing datasets, knowledge sources, information or stories should USGCRP draw from in creating the NNA, and why?

d. How should the NNA be designed to add value beyond what these existing efforts and sources already provide?

ESA Question 11a Response- Existing Assessments:
There are many assessments, environmental organizations and other groups, nationally and internationally, that have been working and continue to work in areas related to the NNA. The NNA's first steps should include an "assessment of assessments." One of the major objectives of the NNA should be to create a clearinghouse for information on U.S. nature databases, organizations and oral histories. Perhaps one of the most challenging would be to comb grey literature and reports along with published peer-reviewed literature.

ESA Question 11b Response-Engage with local communities:
Engagement with local communities will be an important mechanism for the NNA—both the process and the resultant data and information. A place to start is to identify organized groups—whether neighborhood, association, management, recreation or local NGOs—to serve as focal points, and engage them from the starting point (they should be involved in this RFI, for instance).

The NNA process and outcomes can provide an opportunity to both create (co-produce) and highlight real-life stories of the benefits of nature, how nature has changed or how nature is experienced. Story boxes or podcasts with people who connect with nature as part of their livelihood or through recreation could provide an important viewpoint many people could relate to. Stories from hunters, fishers, subsistence farmers, and birdwatchers, for example, will provide various perspectives on how nature is used by various sectors. Of critical importance are Native American perspectives, which offer a view of nature as an essential component of their society and cultural beliefs.

ESA Question 11c-Response-Existing datasets:
There is a risk that the NNA could be overwhelmed by the exercise of finding new, much less assimilating and synthesizing existing data. While there are data and metadata repositories that serve the nation, existing data sets are profoundly disparate, and are often housed at or near the location from which they were collected such as field stations and marine laboratories. For examples of data sets, visit (https://www.esa.org/public-policy/get-involved/policy-resources/esa-response-to-the-national-nature-assessment-request-for-information-question-11c/)

ESA Question 11d Response-Added value:
The National Nature Assessment (NNA) has the potential to become a valuable clearinghouse for knowledge synthesis. Many individuals, including researchers, are unaware of the vast array of datasets and knowledge related to nature that could enhance their decision-making and overall understanding. By creating a platform that facilitates knowledge sharing and creation across sectors, society's ability to restore and maintain nature could be greatly enhanced. For example, understanding how nature assessment will inform maintenance and restoration of natural habitats to preserve natural capital and ecosystem services is crucial. By connecting various pieces of knowledge related to nature, the NNA could add significant value.

The NNA could enhance its design to include local demonstrations of nature at work in different parts of the U.S. These demonstration projects could be used to illustrate the benefits to nature and people, the consequences of losing nature and ways to repair or maintain nature.