Regional Integrated Sciences and Assessments (RISA) Program
FY 2013 Information Sheet

The NOAA Climate Program Office's (CPO) Regional Integrated Sciences and Assessments (RISA) program supports research teams that conduct innovative, interdisciplinary, user-inspired, and regionally relevant research that informs resource management and public policy. CPO funds eleven different RISA teams across the United States (US) and Pacific Islands, many of which are a model for interdisciplinary science and assessment.

NOAA's RISA program is overseen by CPO's Climate and Societal Interactions (CSI) division. CSI provides leadership and support for decision support research, assessments and climate services development activities in support of adaptation. In addition to RISA, CSI's programs include the International Research and Applications Project (IRAP), the Sectoral Applications Research Program (SARP), the National Integrated Drought Information System (NIDIS), and the Coastal and Ocean Climate Applications program (COCA).

CSI is also an active partner in the NOAA National Climate Data Center's (NCDC) efforts to build an integrated regional climate services partnership. NCDC employs six Regional Climate Services Directors (RCSDs) to coordinate and lead this partnership bringing together NOAA offices and close external partners such as RISA teams, Regional Climate Centers, State Climatologists, and Sea Grant. The partnership will help make climate information relevant and accessible to people across the US. NOAA seeks to marshal climate assets and partners towards the common goal of assessing regional needs and vulnerabilities and then supporting the development and delivery of timely climate services that aid adaptation and mitigation choices.

RISA and CSI activities address the societal challenges identified in NOAA's Next-Generation Strategic Plan (NGSP): i) climate impacts on water resources; ii) coasts and climate resilience; iii) sustainability of marine ecosystems; and iv) changes in the extremes of weather and climate. These efforts support NOAA's vision to create and sustain enhanced resilience in ecosystems, communities, and economies, as outlined in the NGSP.

This information sheet contains the details of the two RISA competitions for FY 2013. Competition 1 is soliciting proposals to fund one RISA team focused on the South Central region of the US and possibly one RISA team focused on the upper Midwestern US (see section 1 below). Competition 2 is soliciting proposals only from RISA team members to conduct Regional Research Partnerships projects relevant to one of the four priority areas listed below in section 2.

1. Competition 1 - New RISA awards

Through this announcement, we are soliciting proposals to fund one RISA team in the South Central US and possibly another RISA team in the Midwest. Current RISA regions generally cover two or three states, large watershed boundaries, or issue-focused areas (e.g., the urbanized, heavily populated corridor between Boston, New York, and Philadelphia). Teams focused on regions that contain coastlines are expected to include a component that focuses on the needs of coastal resource managers and links with NOAA coastal entities and issues. For proposals that include a focus area on drought, the proposal should speak to connections with the emerging National Integrated Drought Information System (NIDIS) being developed by NOAA (www.drought.gov). For these proposals, RISAs are encouraged to engage the preparedness communities (e.g., watershed, state or county entities, regional entities, federal agencies) in developing drought-related indicators and risk management triggers for preparedness and response.

1.1. Research Priority 1 – South Central US

Contact: Caitlin Simpson (Caitlin.Simpson@noaa.gov)

We are soliciting proposals for a RISA in the South Central region of the US. A proposed RISA could cover all or portions of a region which includes the states of Oklahoma, Texas, Arkansas, Louisiana, Mississippi and Tennessee. Applicants should consider what is manageable in terms of scoping the region and being an effective RISA endeavor.

Climate variability and change will have implications for a myriad of management and planning decisions in the region. From their own research and interactions with decision makers, applicants should identify the most important climate-sensitive issues and

management challenges for their proposed region. Applicants should also consider NOAA mission-oriented topics that could benefit from the work of a RISA who could integrate information from and work across multiple issues. Some topics identified to be of importance for the South Central region include, but are not limited to:

- The implications of climate variability and change for water management issues, especially in the context of competing needs for water among vulnerable sectors
- Future changes in the frequency and magnitude of extreme events and how those might affect a variety of sectors and decisions
- Use of climate and drought information (e.g., seasonal outlooks, evapotranspiration data, early warning information) in planning
- Climate and agriculture (sustainability of grazing and pasture lands, links to private sector stakeholders such as trade organizations)
- Vulnerability of commercial and recreational fishing industries or resources to climate in the western Gulf of Mexico
- Climate change impacts on hypoxia in the Gulf of Mexico
- Drought impacts on and use of climate information for estuarine and near-shore coastal ecosystems
- Climate and energy issues along the western Gulf of Mexico coastline (Houston to New Orleans)

Applicants are also encouraged to talk to NCDC's RCSD in the Southern Central region Dave Brown (david.p.brown@noaa.gov) regarding how the priorities in the region relate to the mission of NOAA, as well as the priorities of federal, regional, state and local partners.

1.2. Research Priority 2 – the Midwestern US
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Partners: NOAA CPO and the US Department of Agriculture

NOAA, along with its partners in the USDA, is soliciting proposals for a RISA in the upper Midwestern US. A proposed RISA could cover all or portions of a region which includes the states of Iowa, Missouri, Illinois, Indiana, and Ohio. Applicants should distinguish their issue focus and, if appropriate, geographic coverage from the existing Great Lakes Integrated Sciences and Assessments (GLISA) program. Applicants should consider what is manageable in terms of scoping the region and being an effective RISA endeavor.

From their own research and interactions with decision makers, applicants should identify the most important climate-sensitive issues and management challenges for their proposed region. Applicants should also consider NOAA and USDA mission-oriented topics that could benefit from the work of a RISA who could integrate information from and work across multiple issues. Some topics identified to be of importance for the Midwestern US region include, but are not limited to, the affect of climate variability and change, including changes in extreme events, on:

- Sustainability of crop yields and other ecosystem goods and services, e.g., biogeochemical cycling and transport of nutrients and carbon
- Water management, especially in the context of competing needs for water and vulnerability to drought and flooding
- Impacts of future changes in the frequency of occurrence and magnitude of extreme events and the implications for risk response and preparedness
- Use of climate and drought information (e.g., seasonal outlooks, evapotranspiration data, early warning information) in planning
- Vulnerability of the agricultural, transportation, and energy industries to climate change?
- Projected impacts of weather and climate on crop yields and the resultant economic impacts under different cropping practices, crop genetic varieties, pests, etc

RISA teams are inherently networks of partnerships (see Section 1.3 – Understanding Decision Contexts and competition 2). For this region, applicants should consider how they could work with the USDA Agricultural Research Service (ARS) and National Institute of Food and Agriculture (NIFA). Applicants are also encouraged to talk to NCDC's RCSD in the Central region Doug Kluck (doug.kluck@noaa.gov) regarding how the priorities in the region relate to the mission of both NOAA and USDA, as well as the priorities of regional, state and local partners.

1.3. RISA Program Objectives

Applicants should review the Evaluation Criteria set forth in the Federal Funding Opportunity associated with this competition. These criteria include Technical Merit, Program Relevance, Costs, and Qualifications. This section includes a description for the RISA program objectives and other critical factors for addressing those evaluation criteria.

Applicants for both priorities should consider tackling interconnections among multiple issues relevant to a region as opposed to an individual project addressing site-specific analysis. For climate and conservation management issues, applicants must identify what a RISA would uniquely offer on these issues in comparison to what a Department of Interior Climate Science Center or other regional entity is or will be tackling for conservation networks.

RISAs support CSI by meeting the following objectives:

- Understand decision contexts for using climate information
- Develop actionable knowledge through interdisciplinary research
- Maintain diverse, flexible networks for sharing knowledge
- Innovate services to enhance the use of science in decision-making
- Experiment with different programmatic frameworks for connecting science with users

Understanding Decision Contexts

Climate information can support decisions to adapt to a changing environment, but only if the climate research community and decision makers work together to understand each other's needs and limitations. RISA teams are effective because they have been able to create lasting relationships with decision makers from the public and private sectors including local, regional, and state governments, federal agencies, tribal governments, utilities, the business community, and national and international non-profit organizations. Through these relationships, RISAs learn about specific decision contexts within and across different sectors of society, advancing our overall understanding of the use of science. RISA teams investigate climate impacts on sectors such as, but not limited to: fisheries, water, wildfire, agriculture, public health, transportation and coastal zone management.

Developing integrated, interdisciplinary knowledge

RISA teams use their understanding of different decision contexts to develop and co-produce knowledge tailored to suit specific needs for climate information across different timescales and, more broadly, for context-specific scientific knowledge. RISAs characterize climate extremes, variability and change using paleoclimatic records, instrumental data, and climate predictions and projections. Each method or analytical technique in this portfolio brings its set of uncertainties and particular deficiencies, some of which are large or only partly characterized and poorly quantified. Integrating information across this mixed portfolio produces a more comprehensive characterization of a changing climate including the potential for extreme events outside the range of climate change models. RISAs integrate climate science with interdisciplinary knowledge to assess impacts, vulnerability, and risks and to inform and evaluate adaptive response options and trade-offs. RISA's interdisciplinary knowledge base helps understand the interaction between climatic and non-climatic stressors.

Maintaining knowledge networks

RISAs work at the interface of science and society to increase capacity for making decisions in a rapidly changing environment. RISA processes and products are designed as systems for learning and knowledge-exchange sustained through lasting relationships between researchers and organizations or individuals engaged in climate-related decision making. As societal awareness of climate risk grows, climate information is being infused into public spheres in richer ways placing more emphasis on innovation of different methods for providing actionable knowledge. The experimental and innovative nature of RISAs extends beyond "snapshot" assessments or tools or products alone.

Innovating Services

RISA teams strengthen the development of climate services in the public and private sectors by bridging science and service communities. RISAs innovate and enhance

capabilities that can be incorporated into successful tools and practices into ongoing services. RISAs work closely with applied scientists who provide predictions and projections of weather and climate, with cooperative extension and outreach professionals, and communications experts. These experimental services include, but are not limited to:

- Climate impacts trainings
- Climate outlooks and outlook fora
- Climate extension
- Communication tools (visualization, white papers, report, etc)
- Decision support tools and information systems for drought, climate, water supply and availability, agriculture and other impacts

Experimenting with research program frameworks

RISA teams maintain diverse structures for program leadership and management. This diversity is critical for maintaining healthy relationships between multiple institutions, leveraging scientific capabilities within regions, and learning new ways to develop science in support of society. The end-to-end nature of the dialogue between the climate scientists and the stakeholder network provides the perfect setting for social scientists and outreach experts to evaluate the overarching issue of the role of science in supporting policy and decision-making, particularly climate science. RISA teams have demonstrated the importance of flexible governance structures for responding to factors that motivate interactions between scientists and decision makers including, among others, natural disasters, institutional change, climate literacy, and breakthroughs in science. It is critical for RISA teams to have staff (often Program Managers) who facilitate and manage team integration.

Websites

NOAA RISA: http://www.climate.noaa.gov/cpo_pa/risa/
NIDIS: http: www.drought.gov/
National Climate Assessment: http://www.globalchange.gov/what-we-do/assessment
NOAA Next Generation Strategic Plan: http://www.ppi.noaa.gov/ngsp.html

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2. Competition 2 – Interagency Regional Research Partnerships

For this competition, we aim to encourage expansion of regional capacity for climate knowledge to action by enhancing or initiating partnerships for research. *Proposals submitted to this competition should have at least one lead investigator be a RISA scientist.* Projects applicable to only one location and/or one user are not relevant to this announcement. Other programs within CSI are more germane for advancing climate or interdisciplinary knowledge for specific decision contexts (e.g. specific locations or users).

Regions have been an organizing influence for both decision makers and scientists working on climate adaptation. Recognizable climate patterns, such as the El Nino Southern Oscillation (ENSO), emerge at the regional level where our understanding of observations and models coalesce. Critical resources for society are managed in a context of regional systems, such as water supply and human populations. Multiple scales of governance (local, state, and federal) with complex institutional relationships can be examined across a region. Climate information (e.g., data, science, research, etc) developed within these contexts and working across spatial and temporal scales resonates with people making decisions on the ground.

Two motivating factors have recently spurred rapid growth in the climate adaptation community including, particularly, the regional level. In 2009, the Obama Administration (the Administration) issued Executive Order 13514 (EO-13514) focusing on "Federal Leadership in Environmental, Energy, and Economic Performance," which required agencies to develop adaptation plans. Concurrently, the Administration convened the Interagency Climate Change Adaptation Task Force (ICCATF), co-chaired by the Council on Environmental Quality (CEQ), the Office of Science and Technology Policy (OSTP), and the National Oceanic and Atmospheric Administration (NOAA). The ICCATF includes representatives from more than 20 Federal agencies, many of which were interested in tackling climate adaptation at the regional level.

In response to these activities and the interests of Congress, the ICCATF recommends that regional climate science and service efforts of the Federal government should be better coordinated to most effectively support regional-to-local decision makers facing the impacts of climate change. Congress and the Administration want to ensure that trust between scientists and decision makers who are already working to manage climate risks is not compromised by duplicative or conflicting information. The ICCATF recommends that coordination would be best supported by a shared strategy for strengthening regional climate science and services.

After 15 years of regional capacity building and research, a key finding from the RISA program is that trust building between partners is best accomplished when using shared resources to collaborate on common goals, objectives or outcomes. Working together to solve problems brings people together to innovate lasting solutions. Furthermore, capacity (tools, information, knowledge, etc) is best sustained when the developers of

capability or knowledge are working hand-in-hand with those entities who will draw on that capability or knowledge over time. This competition is designed to stimulate partnerships by bringing people together around specific projects related to regionally relevant issues addressing climate adaptation.

Several intra- and inter-agency partners were engaged in the development and/or review of priorities for this competition including:

- The Federal Emergency Management Agency (FEMA)
- The US Army Corps of Engineers (USACE)
- The Department of Housing and Urban Development (HUD)
- NOAA Coastal Services Center (NOAA CSC)
- NOAA Office of Ocean and Coastal Resource Management (NOAA OCRM)
- The National Park Service (NPS)
- The Bureau of Land Management (BLM)
- The US Forest Service (USFS)
- NOAA Earth System Research Laboratory (ESRL)
- NOAA National Marine Fisheries Service (NMFS)

2.1. Research priority 3: Preparing for floods in urban coastal communities

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Over eight million people in the US live in areas at risk to coastal flooding (Crowell et al. 2008), and many of the nation's assets related to military readiness, energy, commerce, and ecosystems are located at or near the ocean. Urban coastal communities are particularly vulnerable to the effects of inundation, given their physical location in low-lying areas and presence of high-intensity land uses and population densities. Coastal managers and planners currently rely on inundation maps that are based on flood probabilities developed from observation-based analyses of atmospheric conditions (temperature, wind, etc.), water level (sea level, tides, storm surge, and waves), and topography and bathymetry. While some datasets used in coastal flood modeling span a century or more, several critical datasets (e.g., waves) are only robust in the last few decades. Thus, flood models and flood probabilities do not reflect longer-term climate variability and change or coastal system response to that variability or change.

Past trends provide valuable evidence in preparing for future environmental change but, by themselves, are insufficient for assessing the risks associated with an uncertain future. For example, recent studies document an increase in the rate and magnitude of global sea-level rise (SLR) (Sallenger et al. 2012), and SLR is projected to continue through the next century (Parris et al. 2012). The amount and rate of SLR varies significantly at the national and regional level as a result of vertical land movement, regional oceanographic

conditions, and multi-decadal climate phenomena, such as the El Niño Southern Oscillation (ENSO) and the Arctic and Antarctic oscillations.

Higher mean sea levels increase the frequency, magnitude, and duration of flooding associated with episodic events, such as coastal storms, tsunamis, and astronomical high tides, which often have disproportionately high impacts in low-lying coastal regions. Thus, considering the impact of different weather and climate events combined with scenarios of SLR is crucial in developing hazard profiles for emergency planning and vulnerability, impact, and adaptation assessments. Planning for such events must include not only response, but preparedness for risks and impacts.

There are 160 US municipalities with populations between 50,000 and 300,000 people, and 20 major cities with populations greater than 300,000 people that have land areas at or below 6 meters and with connectivity to the ocean (Weiss 2011). While the scope, severity, and pace of future environmental change are difficult to predict, it is clear that urban coastal communities may be affected in profound ways (Burkett and Davidson In Press). Development, infrastructure, and ecosystem management activities will continue in urban coastal environments, and new techniques are needed to ensure that assets are constructed and maintained to be sustainable in the face of climate variability, change, and extremes (Rosenzweig et al. 2011).

It is critical to understand the viability of existing approaches for assessing risk under uncertain conditions of change and to develop new techniques that are less dependent on historical data. Currently, many governmental and private entities rely on historical data to analyze future risks and inform important planning, programmatic, and investment decisions in urban coastal areas. Additionally, it is not clear that decision makers have adequate methods for weighing common decision factors, such as location, time horizon, and risk tolerance, in the face of future change and uncertainty.

Risks associated with SLR may not be evident when considering sea level change in isolation from climate or over a narrowly defined coastal planning area. For example, power stations or airports at specific locations along the coast may be critically important to the regional or national economy and, thus, may be protected with a low tolerance for projected long-term, regional, or global scale impacts (e.g., a large levee). Such levels of protection, however, may have adverse effects on adjacent parts of the coast or create a false sense of reduced risk if sea level rises and coastal flooding increases (Smits et al. 2006, Griggs et al. 2005).

Decision makers also require enhanced capabilities for understanding and communicating with each other and with communities about risk. This communication challenge includes understanding the extent to which a proposed action may increase or reduce flood risk, as well as public perceptions and management of residual risk after an action has been taken. Since eliminating flood risk is seldom possible because of cost or feasibility issues, communities must prepare to withstand the impacts of flooding. The emergency management community at large will require enhanced disaster preparedness capabilities

around hazard mitigation, response, and recovery, as envisioned under the Presidential Policy Directive 8 on National Preparedness (US Dept. of Homeland Security 2011).

To advance the knowledge and capacity of coastal resource managers, floodplain managers, emergency managers, engineers, and other design professionals, and land-use or urban planners, priority areas of research include (but are not limited to):

Priority 3A - Improving knowledge

Worst case scenarios of flooding - Extreme weather events will continue to be the primary driver of the highest water levels. However, a consensus has not yet been reached on how the frequency and magnitude of storms may change in coastal regions of the US. Weather events interact with numerous contributing factors to influence the severity of local flooding. Therefore, significant improvements can be made in understanding actual risk through methods such as joint flood probability analysis and better hydrodynamic analysis utilizing new and improved observations (e.g. LiDAR).

Impact Analysis – Analysis of the likely impacts of a given flood event requires understanding of both physical processes and societal factors that shape the vulnerability of urban coastal communities and infrastructure systems. Such factors include land-use decisions, building techniques, hazard mitigation measures, emergency preparedness, and social and economic conditions. Decision makers' ability to understand the interactions of these and other aspects of resilience is key to accurately assessing and managing risk in this environment, as well as gaining knowledge on what actions are most effective in reducing flood risks.

Priority 3B - Enhancing knowledge networks

Decision-support tools –The limited scope of inundation analysis and maps constrains decision makers in accurately characterizing and communicating the risk of coastal flooding, assessing and planning for residual risks following risk reduction and hazard preparedness actions, and in planning for and managing coastal resources over the long term. Improved flood map visualizations, storm surge early warning systems, and other decision support tools that provide easier access to credible data and information can improve upon the limited scope of static, outdated inundation maps. Because mapping is a dynamic process, coastal communities must adopt revised water level projections with the minimum of political interference or delays. This would allow building and land use codes to more rapidly reflect new risks at the community level.

Knowledge networks – Addressing the risks of flooding in urban coastal environments will require the ongoing interaction between subject experts and decision makers at multiple levels and across different jurisdictions. The complex nature of coastal flood risks under climate variability, extremes, and change and the fragmented ownership of assets and responsibilities in this environment call for the creation of fora to facilitate knowledge sharing and decision making. Further exploration is needed, but relevant models include the Silver Jackets program (http://nfrmp.us/state/index.cfm), the Gulf of

Mexico Climate Community of Practice, or, in a different issue context, the drought outlook fora facilitated by the National Integrated Drought Information System

Risk communication – As subject experts and decision makers work to increase the accuracy and availability of flood risk information for urban coastal areas, it is important to also develop strategies for communicating that risk to the public and perform behavioral research on what motivates communities to take action.

Participatory processes – Given the range of uncertainty in future SLR, decision makers must adopt techniques for making judgments without the benefit of full information. Communities and organizations must overcome decision-making paralysis and work collaboratively to identify and initiate actions now that may reduce future impacts and vulnerabilities. Uncertainty is not new to decision making (it is commonplace in the realms of economic policy and national security, for example) and actors can adapt approaches such as scenario planning and vulnerability and adaptation assessments for use in urban coastal planning.

Priority 3C - Preparedness and Response Strategies

Research is needed to project the long-term viability and lifecycle costs of the following strategies considered by decision makers.

> Building techniques – The development and application of sustainable building techniques and practices will require an understanding of the risks facing urban coastal environments, the requirements of human activities there, as well as opportunities and barriers to promoting adoption (e.g., standards, guidelines, and incentives).
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> Ecosystem services– As recognition grows of the challenge in maintaining traditional ‘gray’ infrastructure, coastal and city managers may also choose to restore, preserve, and enhance coastal ecosystems (green infrastructure) for the services they provide, such as flood-attenuation. However, research is needed to project the benefits of wetland restoration, living shorelines, and low-impact development under different conditions of climate and sea level extremes.
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> Integration of ‘gray’ and ‘green’ infrastructures – Across multiple scales, the most efficient strategy for intervention to manage coastal flood risks may be the integration of traditional built structures with ecosystem-based approaches to leverage the services each provides and maximize co-benefits for the wide range of activities in urban coastal settings.

Partnerships

Regional partners for this priority area might include: regional and local offices of the Federal Emergency Management Agency (FEMA), the US Army Corps of Engineers,

NOAA Coastal Services Center, and state and territory coastal programs and estuarine research reserves working with NOAA's Office of Coastal Resource Management.

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2.2. Research priority 4: Scenario and management planning processes

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Agency partners: NOAA, DOI/NPS, DOI/BLM, USDA/FS

In light of projected futures of climate and socioeconomic conditions that could be quite different from the past, the DOI National Park Service (NPS), the USDA Forest Service (FS), and the DOI Bureau of Land Management (BLM) have recognized the need to plan

now for a range of possible futures that will affect the resources they manage. The uncertainty, uncontrollability, and potentially large consequences prevalent in resource management decisions and policy deliberations associated with climate change can often stymie even the most sophisticated decision makers in these and other federal agencies. Traditional planning tools for resource management agencies frame alternatives and base decisions on expectations that future conditions are extensions of the past. Given the irreducible uncertainty associated with climate change, these traditional planning tools lack sufficient flexibility and innovation to effectively serve conservation practitioners in the 21st century. In view of the complexity of climate futures, narrowly focused, predictive studies are inadequate to fill the information gap for planners and decision makers (Peterson et al. 2003). Moreover, although many managers may believe they only need "downscaled climate projections," climate models are best viewed as "one tool among many" to help land and resource managers navigate increasingly dynamic and unpredictable circumstances (Gray 2011).

Structured dialogue between scientists and decision makers is one avenue for resource managers and planners to more effectively utilize projections of future climatic and socioeconomic conditions. The National Climate Assessment and the National Park Service both call for participatory scenario processes that bring a range of scenarios into a structured dialogue among resource managers, experts in climate impacts science, and those fluent in structuring scenario or planning processes (NCA, 2011; Weeks et al. 2011). Using climate change scenarios in planning helps to overcome management paralysis by integrating and organizing information about relatively predictable/certain, and unpredictable/uncertain decision factors or "drivers" to support analysis of plausible future conditions, thus guiding decisions required today. Climate change scenarios use qualitative and quantitative information to envision future ecosystem changes associated with climate variables and effects, as well as policies and societal directions. The use of scenarios is a relatively recent addition to the suite of tools for conservation planning and management. While traditional strategic planning methods anticipate a single future based on past conditions and behaviors (= forecast planning), scenario-based planning considers several alternative versions of the future, all of which are considered to be equally probable. Scenarios are not predictions or forecasts, but provide several divergent, plausible accounts of how the future might unfold. Within this "decision space," conservation practitioners can test ideas and explore strategies for action, whether they are robust actions (these make sense to do across all scenarios) or actions focused on one or more specific scenarios. Exploring a range of scenarios can also illuminate current activities that may not make sense in any of the plausible futures.

Managers/decision-makers need (1) science-based scenarios that utilize syntheses and interpretation of information provided by a range of sources (e.g., downscaled climate projections, paleoclimate information, information about annual-to-decadal variability, etc.) coupled with projected/plausible environmental (species, habitats, processes) and potentially socioeconomic information, (2) tools and guidance to apply these scenarios in planning and decision making, (3) mechanisms/frameworks to identify key parameters to monitor, and to acquire or produce updated scenarios as conditions unfold, such that

decisions become a continuing series of actions that "fine tune" towards desired outcomes.

These steps develop divergent scenarios that collectively bound a range of plausible futures as a platform to explore implications ("what problems or opportunities would this future present?"), actions ("what actions would be relevant under the circumstances of this future?"), "what actions would we take now if we knew this future would develop?"), and parameters to monitor ("what indicators will tell us if a particular scenario is evolving?"). Efforts such as the approach to scenarios in the new NCA process will endeavor to support the development of these elements across the US at various scales and including those needed at the NPS, FS, and BLM management scales.

Proposals are being solicited to do one or more of the following:

Priority 4A - Develop and implement processes with NPS

Design and undertake participatory processes that involve RISA scientists, National Park Service (NPS) managers, and experts in structuring scenario-based planning in order to address climate adaptation decisions. Applicants are encouraged to build on progress made through the participatory processes of the NPS climate change program and to couple this work with a strategic plan (example: Resource Stewardship Strategy), or decision analysis for an implementation plan (example: Fire Management Plan) facing a National Park Service manager(s). Applicants are also highly encouraged to include managers of land, waters, or coasts adjacent to or nearby national parks. Work would involve: (a) synthesis of projections from downscaled models (and other relevant climate information), coupled with information regarding potential ecological effects derived from the literature or from expert opinion (and possibly including sociopolitical parameters as well) to produce several plausible scenarios for park management; (b) guidance to managers and planners on how to use the scenarios in planning; (c) ultimately development of multiple tools, frameworks, guidance for managers and planners on how to interpret the science, and how to use various scenario methods to inform the decision(s) at hand, and (d) to work with the NCA leadership and work groups to provide this information in a way that may be incorporated into a coordinated and robust approach to scenarios in the National Climate Assessment process.

Priority 4B - Develop and implement processes with USFS

Develop and implement processes to bring RISA scientific (climate, ecosystem, socioeconomic, etc.) expertise to existing Forest Service (FS) resource management planning exercises to improve the capacity of FS managers to prepare for and adapt to a changing climate and disturbance regimes. This could be done in the context of the new USFS Planning Rule (http://www.fs.usda.gov/planningrule) and build off of the Resources Planning Act Assessment (http://www.fs.fed.us/research/rpa/) and other efforts including the climate change scorecard, climate project screening tool, watershed vulnerability assessments, etc. Work could be conducted through collaborations within

the current planning processes of the FS and/or involving FS researchers and managers in NPS scenario planning processes.

Priority 4C - Develop and implement processes with BLM

Develop and implement processes to bring RISA scientific expertise to existing Bureau of Land Management (BLM) resource management planning activities to enhance the capacity of BLM managers to prepare for and adapt to climate variability and change, with a particular emphasis on long-term drought. This should be done in the context of the Landscape Approach to Managing the Public Lands the BLM is implementing, including the Rapid Ecoregional Assessments the BLM is currently funding (http://www.blm.gov/wo/st/en/prog/more/Landscape_Approach.html). Work could be conducted in collaboration with FS and NPS processes.

Partnerships

Proposals that undertake a planning process that involves managers from multiple agencies (e.g., BLM, FS, NPS) are highly encouraged. Proposals can also include parks associations and other relevant land management entities. Applicants are encouraged to include, where appropriate, some members of teams involved in designing and implementing NIDIS pilots (http://www.drought.gov/drought/content/regional-programs/regional-drought-early-warning-system) so that the NIDIS pilot activities might learn from the scenario and management planning processes that the NPS, BLM, and FS are undertaking to incorporate climate information into their resource management decisions.

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2.3. Research priority 5: Drought monitoring and prediction products to support decision making

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Drought directly threatens a society's existence. Without advance warning and effective monitoring, the deep socioeconomic consequences of drought cannot be ameliorated. This is especially true given the increasing stress on water resources as well as expectations of ever-more-robust domestic agricultural productivity. The US Drought Monitor (http://droughtmonitor.unl.edu/) provides weekly assessments of drought conditions in the United States; data on regional drought conditions are determined in the same manner across the country with little attention to factors unique to regions (e.g., socioeconomic, land use, etc.).

Region-specific drought monitoring and prediction information products and services are critical to support policy, planning and decision making at the regional, state, county and local level. In many areas, diverse and well-plumbed water supplies complicate current abilities to characterize, monitor or predict current and future drought conditions. Thus, the varied expressions of drought conditions by region, time of the year, and length raise challenges for effectively predicting, monitoring and reporting drought. Furthermore, natural variations in atmospheric circulation impacting precipitation and temperature patterns as well as the influence of the enhanced greenhouse effect may alter the frequency, severity, and location of future droughts. This complex combination of factors presents significant difficulties for monitoring and predicting drought, and utilizing meteorological and climate information for adaptation. The extreme socioeconomic consequences of drought are well understood; this research call aims to spur improvements in our nation's capacity to provide accurate, useful, and actionable regional information for decision makers.

Proposals are solicited to develop experimental regional drought monitoring and prediction information products in support of decision making in a specific region. Research should focus on one (or both) of the following issues:

Priority 5A - Drought indicators

Evaluation and/or development of drought indicators for monitoring and prediction to support regional decision-making. There has been proliferation of drought indicators, developed by the drought research and monitoring communities. These indicators may not be well suited to describe and predict drought conditions in complex landscapes that have irrigated and non-irrigated drainage networks; natural ecosystems; urban or rural land cover; or local, imported, or ground-sourced water. Research projects in this area should focus on evaluating the utility of existing indices of drought in a particular region, or, if necessary, on the development of a new drought index that is suitable for regional applications. The emphasis of either approach should be on indices that can be both monitored and predicted.

Priority 5B - Climate change projections

Development and application of climate change projections of existing, regionally relevant, drought indicators for 21st century drought conditions to better understand and

characterize potential drought impacts to inform long-term policy, planning and decision making. Proposals focusing on this research thrust should aim to provide decision makers access to more sophisticated methods that a) use statistics and output from climate model projections of future conditions to produce regionally relevant drought indicators, or b) that blend historic and paleoclimate variability and extremes with climate model projections to produce regionally relevant drought indicators.

References

Creating a Drought Early Warning System for the 21st Century: The National Integrated Drought Information System (Report by Western Governors' Association 2004)

The National Integrated Drought Information System (NIDIS) Implementation Plan, June 2007

US Drought Portal Drought Indicators Home Page

New Jersey Water-Supply Drought Indicators

WATCH Water and Global Change Technical Report No. 24: Indicators For Drought Characterization on a Global Scale

NCDC US Drought Indicators

NDMC Comparison of Major Drought Indices: Introduction

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2.4. Research priority 6: Climate impacts on marine and Great Lakes ecosystems

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Climate variability and change impact the physical, chemical, and biological conditions in the oceans and Great Lakes, as well as the human systems that depend on them. Changes in ocean temperature, pH, circulation, and salinity are leading to changes in the abundance and distribution of marine organisms, loss of habitat, shifts in timing of life-history events, alterations in species interactions, and impacts on biodiversity and ecosystem function (Harley et al. 2006, Doney et al. 2012, Howard et al. in press). These changes are affecting the communities and economic sectors, such as tourism, recreation, and fisheries that depend on healthy oceans (Howard et al. in press). While advancements in knowledge related to climate change and associated impacts on marine and Great Lakes ecosystems are occurring, many uncertainties remain. For example, past and current responses of organisms and ecosystems to climate variability and change provide important insight into patterns, trends, and trajectories of change; however, extrapolations to future responses are challenging, given that new environmental conditions will occur. In many areas, the information on past trends and possible future climate and ocean conditions (physical, chemical) are not available at spatial and temporal scales relevant for assessing impacts on biological resources and user communities. In the cases where information related to climate impacts on marine ecosystems exists, it is often not available in formats or at scales that are useful and relevant to decision makers and managers. As a result, the identification, development, and implementation of ocean adaptation options are relatively nascent compared to other sectors (Gregg et al. 2011).

Many decision makers and sectors are affected by climate-related changes in marine and Great Lakes ecosystems. For example:

- Fisheries and protected species managers are confronting shifting distributions of species and habitats with changing conditions, making assessment and management challenging.
- Fishing industries and harbors are facing possible impacts, such as changes in location, size, and type of fishing fleets and harvests with shifting distributions of species and conditions, raising questions about future requirements and investments in critical infrastructure.
- Coastal and marine habitat restoration managers are faced with potential impacts of changing sea and lake level, salinity, pH, and temperature on project design and effectiveness.
- Federal and state regulatory agencies are making permitting decisions on placement of offshore projects, such as energy development, without access to information on future changes to ecosystem distributions.

- Public health officials, restaurants, the seafood industry, and coastal communities are concerned with seafood-borne illnesses, harmful algal blooms, and other health-related impacts from increases in pathogens associated with increasing water temperatures.
- Tourism, diving, and resource-based recreational industries are facing impacts from degradation and decline of coral reefs and other coastal habitats due to increases in water temperature and sea level.

Climate change presents not just a challenge – but also an opportunity – to revisit and improve existing plans and management strategies to make them more robust and forward-looking. Integration of climate change into marine and Great Lakes resource stewardship efforts is critical to enhancing resilience of the nation's ecosystems and the communities and economies that depend on them.

Proposals are being solicited to do one or more of the following:

Priority 6A - Future climate-related changes to species and ecosystems

Advancing coupled regional-scale climate and marine/Great Lakes ecosystem observations, models, and/or projections to inform resource stewardship and management in a changing climate

Climate-related processes are affecting the health and production of US marine and Great Lakes resources (e.g. fisheries, protected species, habitat; Kling et al. 2003, Cochran et al. 2009, Doney et al. 2012). Species can respond to climate variability and change directly (e.g. shifting distributions in response to water temperature change) and/or indirectly (e.g. through impacts to their prey, predators or habitat). These impacts can have important consequences for the population dynamics of fish stocks and protected species, the ability to assess the status of these populations, and the validity of future stock forecasts and rebuilding or recovery plans (Kraak et al. 2009). The future sustainability of biological resources and resource-dependent communities depends on understanding past, current, and projected future climate impacts, and incorporating this information into the scientific bases of management decisions (Link et al. 2010, Sumaila et al. 2011). Although some progress is being made, much work remains to ensure that fisheries, protected species and habitat managers, and other decision makers can effectively prepare for and adapt to the impacts of climate change on biological resources, as well as the communities and economies that depend on them (Hare et al. 2010, Link et al. 2010). Examples of areas of research related to the priority topic include (but are not limited to):

- Advancing integration of physical and biological observations and predictive modeling at regional scales to gain insight into future impacts of climate change on marine/Great Lakes resources;
- Interpreting global climate and ocean/Great Lakes forecasts and projections for regional applications in resource management; and
- Developing capabilities for regional assessments of current and projected impacts of climate change and ocean acidification on ocean/Great Lakes physical, chemical, biological components and human uses.

Priority 6B - Support for Regional Planning

Advancing integration of climate information into regional planning efforts to inform, address, and adapt decisions related to multiple ocean/Great Lakes uses in a way that supports ecosystem resilience in a changing climate –

Climate change will not only impact distribution and abundance of living marine resources (Doney et al. 2012) but will also impact human uses, such as aquaculture, maritime navigation, and energy production, that are affected by changing ocean and Great Lakes conditions and societal needs. Coastal and marine spatial planning (CMSP) is a science-based tool used to assist decision makers from a variety of sectors in considering how to spatially allocate multiple types of human uses of the ocean, coasts, and Great Lakes as a means to meet multiple objectives, including protection and sustainable use of biological resources (National Ocean Council 2012). CMSP provides a public process for addressing local-to-regional issues and more efficiently resolving potentially competing ocean and Great Lakes uses, such as use of biological resources (e.g., fishing, aquaculture), recreation and tourism (e.g. diving, boating), conservation (e.g. protected species, marine protected areas), energy development (e.g. renewable energy projects, oil and gas mining), transportation (e.g. maritime shipping routes), and national security (e.g. offshore training areas, submarine lanes). Decision-makers use CMSP to allocate human uses in a way that minimizes ecological, social, cultural, and economic impacts, while supporting and improving resource use and conservation goals (e.g. Halpern et al. 2008, Ehler and Douvere 2009). Many ocean and Great Lakes uses are vulnerable to climate change, and spatial patterns of human use will likely change with changing conditions. It is critical that CMSP processes incorporate past, current, and projected climate impacts into their efforts to enhance the long-term effectiveness of planning-related decisions (McLeod et al. 2009, Howard et al. in press). "Climate-ready" plans can serve as a tool for enhancing ecosystem resilience and reducing future climate-related impacts. Examples of areas of research related to the priority topic include (but are not limited to):

- Conducting regional-scale assessments of existing information on current and projected impacts of climate change and ocean acidification on physical, chemical and biological components and human uses relevant to regional marine planning;
- Developing GIS-based tools that incorporate results of integrated climate and ecosystem information and/or models to inform regional planning and management of marine and Great Lakes resources;
- Advancing integration of climate information into design strategies for protected areas as components of regional planning efforts;
- Performing needs assessments and developing transferable guidance on integration of climate information into regional planning and management of marine and Great Lakes resources.

Partnerships

Regional partners for this priority area might include: Fisheries Management Councils, Regional Planning Bodies, Regional Ocean Partnerships, or NOAA National Marine Fisheries Service (NMFS) Science Centers.

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3. Additional Factors for Proposal Preparation

This section is intended to provide additional information for successful submission for both competitions.

3.1. Letters of intent

Interested applicants for all competitions are highly encouraged to submit a one-two page Letter of Intent (LOI) outlining plans for your proposal. These should be submitted to the RISA Program Managers at RISA13@noaa.gov.

3.2. Specifics about the proposal

Proposals that can show that they are building on what is already known from the published literature about the proposed topic (e.g., value of climate information, decision making under uncertainty, use/transfer of new scientific information, integrated modeling of natural and human systems, impact of climate on sector activities, sectoral decision making analyses) prove that the PIs have a comprehension of the topic and that their proposed work will augment the existing science. Information about current and

previously funded projects is listed on the RISA website at http://www.cpo.noaa.gov/cpo_pa/index.html.

3.3. Nature of investigator teams

Multidisciplinary teams of investigators are often best suited for addressing the complex issues related to climate, society and enhanced adaptation through the use of science and technology. Previous successful projects/teams have integrated social with natural or physical science components to form a more comprehensive analysis of the dynamics of climate-human interactions. Finally, the proposal should include an explanation of the roles of the investigators and how the team will interact and integrate the multiple components. Investigators who will not be requesting funds for salaries must also be listed, along with their estimated time of commitment.

3.4. Partners

We encourage partnerships and collaborations between researchers and critical decision-making institutions in the region of study including: NOAA and other federal agencies, non-governmental organizations, boundary organizations, international organizations and regional networks, extension services, state and local governments, and representative private sector organizations. Any in-kind time should be reported within the proposal. Letters of support, or commitment, from partners are encouraged to accompany the proposals.

3.5. Cost-sharing

Cost leveraging and in-kind sharing of resources is encouraged and should be reported within the proposal.

3.6. Interaction with NOAA

Applicants whose proposals are chosen for funding will be expected to undertake an ongoing dialogue with the NOAA Climate Program Office and program managers and will be expected to submit annual reports and respond to periodic data requests. The RISA awards are anticipated to be cooperative agreements and thus will require a higher level of collaboration with CPO, as well as other entities within NOAA.