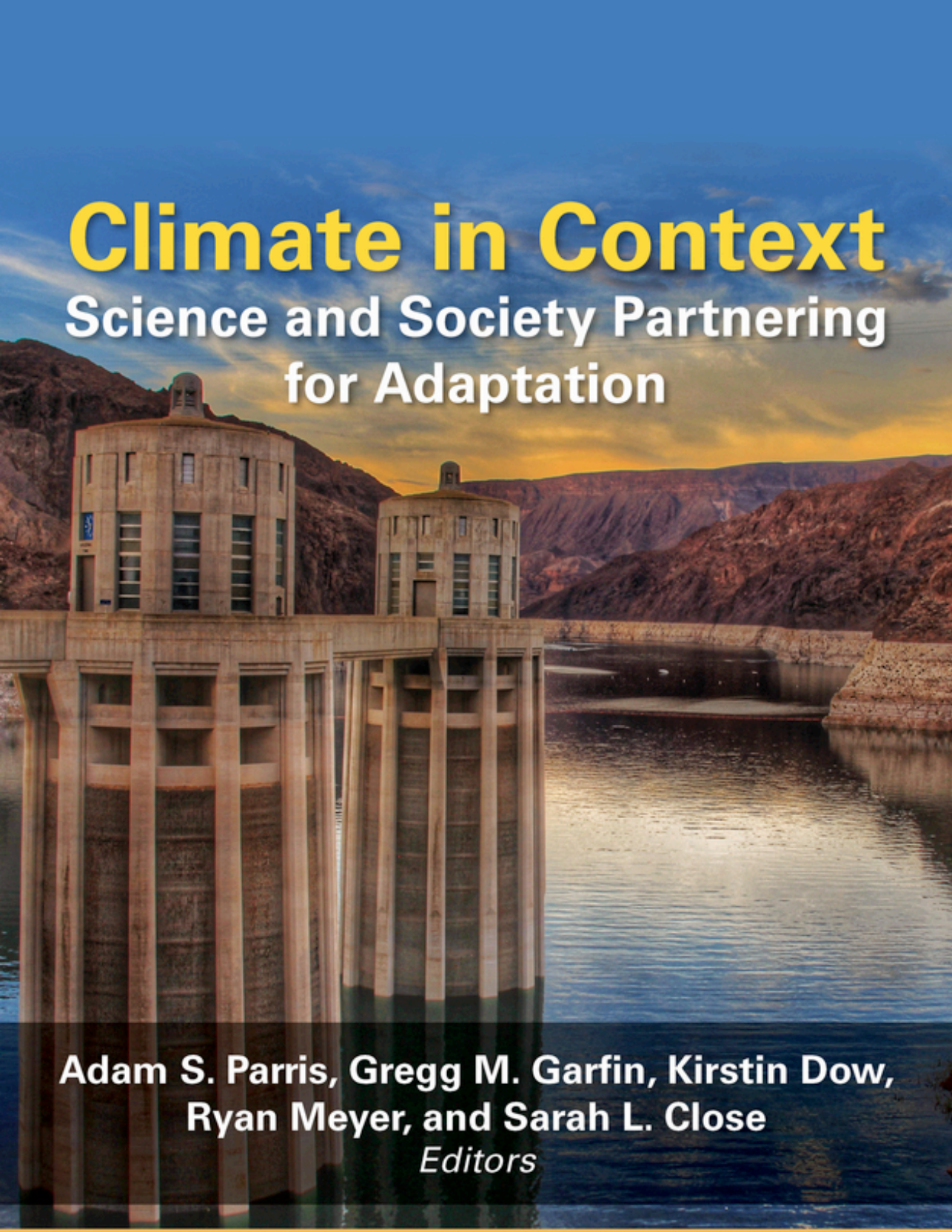
Climate in Context

Science and Society Partnering for Adaptation



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Climate in Context: Science and Society Partnering for Adaptation

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Foreword

From the beginning, the Regional Integrated Sciences and Assessments (RISA) program has been an experiment. Unlike other experiments in climate-related services and in connecting science with decision-making, it has survived and thrived since 1995, despite numerous challenges. A partnership between the National Oceanic and Atmospheric Administration (NOAA), universities and stakeholders, RISA is focused on place-specific problems and solutions and explores the space between research and decision-making. It is designed to respond in a flexible way to the chain of requests for climate-related information at multiple time scales that has risen from regions and sectors across the United States.

RISA's origins lie in the vision of a few important leaders in the federal government and in academia; they include J. Michael (Mike) Hall, the former director of the Office of Global Programs at NOAA and a widely influential visionary in the U.S. government; Edward (Ed) Miles, the director of the first RISA, the Climate Impacts Group at the University of Washington; and Claudia Nierenberg, who served as the first program director for RISA. Of course, there have been literally dozens of visionary leaders associated with the program since the early days, but without the contributions of these three people, the program would not be what it is today. A strong vision from the beginning, a flexible management approach, and strong central coordination and leadership have all played a major role in building the program.

The 11 RISA program "experiments" across the country are linked to a multi-institutional network managed centrally in the Climate Program Office at NOAA. Each RISA has evolved in response to the interests and capabilities of Principal Investigators (PIs) within the partner universities as well as to the interests and needs of its regional stakeholders. Because there are so many issues related to climate impacts, vulnerability assessment, and building relevant decision-support products over a range of time and space scales, there is a need for multiple different approaches across the United States.

Clearly, the seed funding provided by NOAA has provided incentives to take the experiments in particular directions, but in virtually all cases, a highly leveraged program has evolved that includes a range of different local, regional, and federal funding sources and partnerships. This flexibility and diversity is one of the institutional strengths of RISA. Although the

program has always been underfunded, RISA is widely acknowledged as a success story in providing decision-relevant science products. It has been a constant challenge to maintain and/or grow the program over time. Program funding has been threatened for a variety of internal (agency) and external reasons, but it has continued to provide incentives for interdisciplinary and transdisciplinary work that has been truly groundbreaking. In some cases, the interdisciplinary teams have been together for almost 20 years, and in all cases the opportunity to do longitudinal studies and engage with stakeholders over years-to-decades has been instrumental in building an understanding of both the art and science of connecting science and decision-making.

The fact that each of the RISAs has different topical focus areas and different strengths in engaging with stakeholders is an important part of the success of RISA as a system, and there are many examples of how the system itself has evolved as an institution over time. Not only are there far more collaborative projects across the RISA network now than there were historically, but there are also purposeful efforts to design the research in ways that fill both social and physical science gaps in the whole network. This approach is unprecedented in federal science programs and likely has no parallel globally, though there are now many examples of science networks that emulate portions of this approach.

Although there is an ongoing debate within the RISA community about where on the "science-to-action" continuum the work should focus, part of the rationale has always been to experiment with the space between research and applications, building an understanding of the role of science in policy and the role of academia and government investments in building science-based solutions. In building local communities of practice that are linked to a truly functional network of practitioners, there have been contributions to the careers of researchers and students who have been funded by the program as well as to the careers of external stakeholders who have been drawn into the experiment.

Building communication and planning tools, reporting back to the larger RISA community about successes and failures, and a significant dose of self-reflection have been the hallmarks of the program. In fact, self-reflection has been strongly encouraged. This willingness to openly expose weaknesses and identify the needs for improvement is extremely unusual in government-sponsored programs. There has been significant stress underlying all of the progress that has been made, but in many cases that stress has provided for enhanced learning opportunities (see also, RISA in a Nutshell).

RISA contributions in the national and global context: climate services, assessments, and adaptation

Given the well-documented observation that climate variability and climate change are already causing costly damages in every region and sector of the United States and the globe, and that there are many unrealized economic opportunities as well (National Climate Assessment, 2014), it has been clear to most of the climate community for two decades that climate information services at multiple time scales (subseasonal to interannual to decadal and beyond) are needed. The need for climate services mirrors the need for weather information but with longer time scales and larger consequences. Despite this fact, building a U.S. climate service has been very controversial. Without explicitly intending to do so, RISA has emerged as one of several highly leveraged attempts to fill in the gaps associated with the lack of a climate service in the United States. It also provides a good model for regional climate service activities that could be developed by other countries.

RISA has already influenced thinking outside of the U.S. borders through contributions of many of its PIs and stakeholders to the International Panel on Climate Change reports, through international colleagues who have closely followed the development of RISA-funded knowledge production, and through investments by the United States in international adaptation/resilience initiatives. For example, the influence of RISA contributions can be seen in the reports of the United States to the UN Framework Convention on Climate Change, the development of the Global Framework for Climate Services and the September 23, 2014 Presidential Executive Order on Climate Resilient International Development. Lessons learned have also influenced the evolution of the International Research Institute for Climate and Society, the Inter-American Institute for Global Change Research, and most recently, the framing of the NOAA International Research and Applications Program.

Many of the social science and process findings of RISA mirror those of other climate-focused organizations elsewhere, including the Commonwealth Scientific and Industrial Research Organization (CSIRO), Australian Government Science Program and the UKCIP (the UK Climate Impacts Program). Examples are: the need for building trusted relationships between scientists and stakeholders over time, building salience, credibility and legitimacy of products and processes in partnership with stakeholders, enhancing utility of information through co-production of knowledge, and boundary spanning activities. In addition, RISA-related findings have been extremely visible in advice to the US Global Change Research Program (USGCRP) and in multiple NRC panels (there are at least 15 reports where

RISA players and findings were influential, including the five America's Climate Choices reports).

The RISA network has also made very explicit contributions to all three US National Climate Assessments, particularly certain Synthesis and Assessment products (e.g., SAP 5.3) of the Bush Administration, and the regional components of the Third National Climate Assessment (NCA3). The contributions to the NCA3 were very substantial; RISA program managers, PIs, staff, and students played a role in virtually all of the eight regional assessment teams as well as in developing technical support documents and regional foundation reports later published as a book series by Island Press. All of the RISAs have been engaged in the discussions of the sustained approach to assessment and several are members of the NCA engagement network.

Science support for adaptation/resilience decisions is in great demand. Most of what the RISAs do, whether it is in support of agriculture, fire management, urban planning or water resources management, contributes to resilience— mostly direct investments in applied science, adaptation tools and services, climate-related communications, science translation in support of specific sectoral interests, social network analysis, and analysis of the effectiveness of decision support.

The interagency context: subsequent science networks and the needs and aspirations of federal agencies

As the costs of addressing climate-related disasters have risen, and the understanding of the climate-related drivers of these events have become more clearly understood, there has been an overall shift toward enhancing the societal relevance of the $2.6 billion annual research agenda of the 13-agency USGCRP. Although the proportion of funding that goes into decision support is very small (certainly less than 5%), the visibility of these efforts has continued to rise. Most of the movement in this direction has occurred within the last 6 years, though National Academy reports have been pushing the federal science agencies in this direction for decades and the Global Change Research Act of 1990 clearly anticipated that this transition would occur more rapidly. The lessons learned by the federal government in this arena have come in large part from lessons learned from RISAs.

Over the past decade, the demand for climate-related support from the federal government has far outstripped the capacity of the RISA system to meet the demand for decision support. Eight Climate Science Centers and 22 Landscape Conservation Cooperatives (supported by the Department of

the Interior) and 6 new "regional climate hubs" (the U.S. Department of Agriculture) mean that the capacity for engaging with stakeholders and providing relevant science support is expanding. Each of these networks has a different focus and audience, but all are dependent on using the foundational science and engagement strategies employed by RISA. Clearly, there is enough potential for better outcomes and collaboration across these systems; all three networks will benefit if they work more closely together in the future.

Conclusions

Having provided some perspective on the history and achievements of the RISA program, we believe that RISA was both *a strategic* and an opportunistic response, an approach whose time was right in the mid-1990s but whose contributions are even more relevant today. RISAs are innovative experiments in decision-relevant science and in self-conscious evaluation of engagement processes. Their contributions extend far beyond the RISAs themselves to a much broader knowledge network, including colleagues and practitioners that now include former students, stakeholders, and collaborators across the United States and globally.

RISA has been a public good, providing value to U.S. citizens for 20 years … connecting the best available science produced through government agencies and academia to real world issues like drought planning, range management, agricultural production, water management, flood control, and recovery from disasters in coastal and urban settings. These contributions span the range from fundamental physical and social science to stakeholder engagement to decision support at multiple time and space scales. The intellectual and public policy outcomes of RISA now have global implications and are fundamental to major shifts in U.S. domestic and international policies.

We would like to acknowledge the efforts of all who have contributed to RISA in the past, and those who will continue to contribute, in helping to build a more resilient future.

Kathy Jacobs
Jim Buizer
The University of Arizona

Preface

> "The local- to global-scale impacts of climate variability and change, as well as the broader issue of global change, have fueled a growing public demand for timely and accessible information about present and future changes … that can be applied directly to planning, management, and policymaking."
>
> *The National Global Change Research Plan 2012–2021 [1]*

Usable science is an enduring concept, but the practice remains elusive. It happens in muddy waters, where the controlled space of basic science meets the ever-evolving context of people and places. After 20 years of exploration through the RISA program, this book is an attempt to make the practice of usable science more transferrable by explaining key techniques.

Climate in Context documents the mechanics of fostering engaged and collaborative approaches between researchers and practitioners to inform decision-making. The book is organized around four themes of the RISA program: Understanding Context and Risk, Managing Knowledge-to-Action Networks, Innovating Services, and Advancing Science Policy. These themes represent the steps in a process of developing usable science to address persistent and/or emerging climate-environment-society management issues. Experience tells us that some of these steps may occur simultaneously, or even out of the aforementioned sequence. These themes relate to well-known advice from sources such as the National Research Council's report, "Informing Decisions in a Changing Climate" [2]. However, Climate in Context demonstrates that RISA teams have moved from articulating a course of implicit learning—a passive benefit of the interactions between researchers, intermediates, and decision-makers—to one of explicit learning, where the social capitals for learning and communication across social networks [3] are actively engaged at the outset of new projects. Leveraging the learning process is what allows researcher-practitioner partners to move from informing decisions with data and information to a keystone societal capacity—the knowledge and policy to manage risk in an increasingly uncertain world. Almost every chapter in *Climate in Context* refers to some form of learning as an essential element in understanding decision contexts, setting expectations for product development, and coproducing the knowledge needed to increase preparedness for the impacts of climate variability and change.

Unlike data and information, knowledge is not a commodity. The case studies and syntheses in *Climate in Context* show that usable science can generate the type of knowledge desired for adaptive planning and action. As shown in the chapters in this book, iterative and adaptive learning must accompany the transfer of technology and data, and it requires diverse approaches. Within the bounds of federal agency protocol, the RISA program has allowed "a thousand flowers to bloom" among the regional teams, in order to learn from the multiple geographic, political, and institutional contexts across the United States. The authors contributing to *Climate in Context* demonstrate, time and again, that partnerships are a central part of the practice of usable science. Climate science researchers aim to understand the dynamics and statistics of the climate system and develop products to support decisions, whereas practitioners seek knowledge to address time-sensitive decisions in a cost-effective manner. Fostering partnerships and managing the exchange of knowledge across the boundaries between researchers and practitioners require guidance and knowledge from social scientists and facilitators whose investigations on decision context lead the way to fostering and replicating innovation and learning. But how, specifically, do you achieve this process? When do you employ which technique? In what combination? And how do you know when you have achieved this? The answers to these questions are the substance of *Climate in Context*.

Members of the first RISA team—the Climate Impacts Group—used the phrase "a voyage of discovery" to describe this process of adaptive learning. The scientists whose contributions make up this book are some of the many voices of a growing field that is ushering further discovery. As detailed in the foreword, there is unmet demand for greater capacity in usable science. The demand reflects a modest notion that, despite its far-reaching impact, there remains a great deal of unmet potential in the ability of science to provide public value. In the face of increasing risk, society could easily retrace well-worn paths to reactive responses to climate-related disasters—costing needless loss of lives and extra billions of dollars; however, two decades of learning in the RISA program has taught us to apply usable science to proactively build capacity and increase preparedness to climate-related risks. We caution the reader: as is often the case with good intentions, the pursuit of usable science has been both controversial and prone to folly. *Climate in Context* is not an attempt to accelerate the application of rote processes, but rather to accelerate adaptive and collaborative learning to promote the expansion of usable science. It is an invitation to use these techniques and lessons learned when needs, context, and scientific insights align.

On behalf of the editors, Adam Parris and Gregg Garfin

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Acknowledgments

Like its subject, this book is a community effort. The development of the book alone has spanned a few natural disasters, a presidential election, the third National Climate Assessment, and a change in NOAA leadership. Editors and authors have changed jobs, started families, finished graduate school, and moved to new regions. Among the editors, we include the able and patient editorial and production staff of Wiley & Sons, Inc., especially Rachael Ballard, with whom we first developed the idea for a book on the RISA program. Taken in sum, this book is a testament to the collective endurance of a community of practice, within and outside the RISA program. Funding and management from NOAA remain a critical element of this endurance.

Ryan Meyer and Kirstin Dow deserve special recognition for their wise and patient contributions to the editorial working group, which has overseen the life of the project. Their devotion to exceptional editorial rigor improved all of the chapters. Sarah Close provided critical input and dedication in the tough final stages. All of the authors showed dedication and persistence, and we gratefully acknowledge the many experts who provided external peer review. The book does not capture many worthy and important RISA efforts, some of which have been formally submitted as chapters; we thank those authors for devoting time to the book at its nascent stage as well as to the RISA program. We also wish to recognize all of the scientists and experts who have contributed to RISA, both directly and indirectly, including the pioneers in the Climate Impacts Group at the University of Washington.

The foreword to this book rightfully acknowledges several key individuals for their foundational efforts in establishing RISA, though, by dint of modesty, fails to mention the substantial contributions of James Buizer. We wish to dedicate this book to two of those individuals, J. Michael Hall and Edward L. Miles.

Disclaimer

The scientific results and conclusions, as well as any views or opinions expressed herein, are those of the authors and do not necessarily reflect the views of NOAA or the Department of Commerce

Background on RISA

Twenty years ago, a team of researchers began what would become a series of projects aimed at understanding how climate information can better inform decisions to adapt to a changing environment. It began with the establishment of the first Regional Integrated Sciences and Assessments (RISA), Climate Impacts Group (CIG) at the University of Washington in 1995. From there, the National Oceanic and Atmospheric Administration's (NOAA's) RISA program, managed from NOAA's Climate Program Office (formerly the Office of Global Programs), has grown to a network of 11 regionally based teams (Figure. I.1) around the United States. To this day, the RISA program supports interdisciplinary research teams that help expand and build the capacity of those seeking to prepare for and adapt to climate variability and change.

In the early stages of the program, RISA teams were developed through deliberate consultations between RISA program management at NOAA and university-based scientists around specific issues or focusing events in a region. In 2006, the program transitioned to a competitive funding model in which each region is competed on a 5-year cycle. RISA teams developed diverse research areas and management structures, allowing for experimentation and learning across the network. Throughout the 20-year history of the network, the hallmarks of RISA work have been a central commitment to partnerships, process, and building trust.

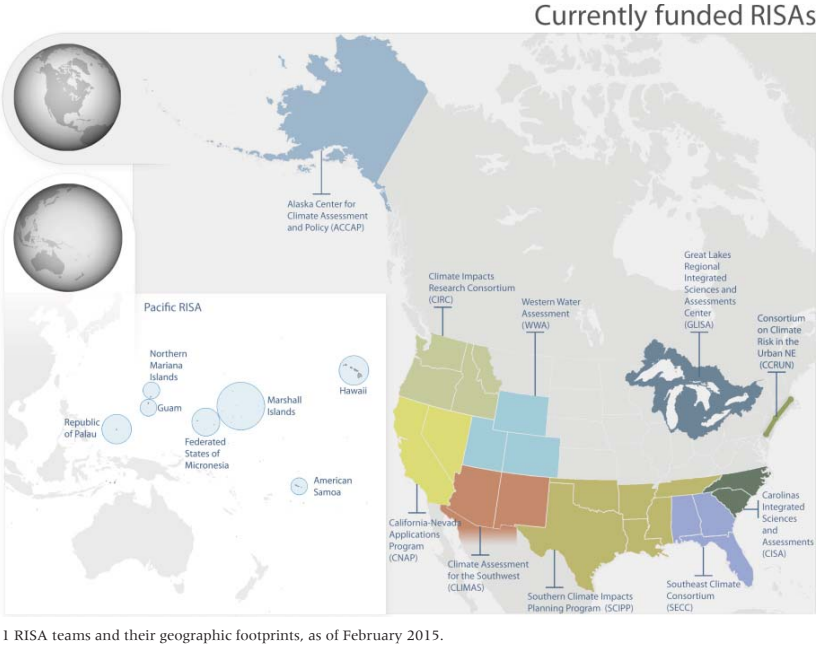

Figure I.1 The 11 RISA teams and their geographic footprints, as of February 2015.

SECTION I
Understanding context and risk

A central, enduring finding over the 20 years of the Regional Integrated Sciences and Assessments (RISA) program is that climate information can inform decisions to adapt to a changing environment, but only if the climate research community and decision-makers work together to understand each other's priorities, needs, and capabilities. This volume brings together insights and lessons on approaches to support climate decisions drawn from the experience of RISA teams and from collaborative dialogues among teams and partners. It begins by exploring, in this first theme entitled Understanding Context and Risk, the complex and evolving science needs embedded within decision contexts not exclusively related to climate, but responsive to other drivers of environmental, institutional, and societal change.

RISA experiences suggest that the task of identifying and refining climate science needs can often take years. In addressing this multidimensional issue, RISA investigators work to distinguish between what constitutes an initially perceived need and a more specific, grounded need for better comprehension of options within a range of uncertain futures. The first questions posed by decision-makers often become more precise during discussions of near-term scientific possibilities and limitations.

RISA teams build and sustain a capability for understanding emerging and evolving decision contexts informed by both advancing knowledge of how people use scientific information in the decision-making process and emerging information about projected exposure to climate-related impacts. The first chapter in this theme, by Simpson *et al.*, provides a broad overview of the capabilities developed by RISA teams to inform decisions about when to invest or redistribute research resources to meet needs within these changing contexts. They assess the multiple social science methods employed by RISA teams to build the foundation for coproduction of knowledge and policy. Their chapter highlights the evolution of research

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approaches needed as ongoing working relationships between RISA teams and practitioners deepen over time; these include reviewing documents, conducting surveys and interviews, participant observation and, more recently, investigating informal institutions, such as social and knowledge networks. For science to be actionable, it must be salient, timely, and credible. Ray and Webb reflect on the use of a time-honored framework, the decision calendar, to establish mutual understanding of the timely insertion of assessment and forecast information in climate-related decisions.

While RISAs are credited for their ability to engage decision-makers and to understand context, the complementary capacities to develop risk-based information and to support knowledge exchange often receives less recognition. Horton *et al.* show how an event such as Hurricane Sandy warranted re-allocation of time and expertise to develop risk information in support of greater resilience in an urban rebuilding strategy. In addition, the RISA follow-up work on Hurricane Sandy is intended to complement ongoing research on the exposure and vulnerability of a regional urban system to regional climatic and nonclimatic stressors, such as increasing water demands. They point out the challenges of keeping multiple risks in perspective, given urban planners' visceral experience of the hurricane, and illustrate how a RISA team advanced a better understanding of vulnerability and risk in the form of usable knowledge for New York City, ultimately building a capacity to adapt to global change.

Understanding contexts and risks, which take many institutional and methodological forms, requires expertise in forming and managing interactions among scientists and decision-makers, and among scientists from different disciplines, a topic that is further explored in Managing Knowledge-to-Action Networks. Working relationships and collaborative partnerships are established through the exchange of knowledge. In many instances, RISA social scientists consider the dynamics of these interactions and raise important questions—highlighted in the chapters of Understanding Context and Risk—relevant to expanding the scientific community's capacity to more directly serve society.