Climate and Social Stress: Implications for Security Analysis

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SUMMARY

The U.S. intelligence community is expected to provide indicators and warnings of a wide variety of security threats—not only risks of international wars that might threaten U.S. interests or require a U.S. military response, but also risks of violent subnational conflicts in countries of security concern, risks to the stability of states and regions, and risks of major humanitarian disasters in key regions of the world. This intelligence mission requires the consideration of activities and processes anywhere in the world that might lead, directly or indirectly, to significant risks to U.S. national security.

In recent years, with the accumulation of scientific evidence indicating that the global climate is moving outside the bounds of past experience and can be expected to put new stresses on societies around the world, the U.S. intelligence and security communities have begun to examine a variety of plausible scenarios through which climate change might pose or alter security risks. In 2010, as part of its ongoing work with the National Academy of Sciences/National Research Council (NAS/NRC) on issues related to climate and security, the U.S. intelligence community asked the NAS/NRC to organize the study whose results are described in this report.

The central purpose of the study, as defined in its statement of task, was "to evaluate the evidence on possible connections between climate change and U.S. national security concerns and to identify ways to increase the ability of the intelligence community to take climate change into account in assessing political and social stresses with implications for U.S. national security." The study committee was tasked to "focus on several broad questions, such as: What are the major social and political factors affecting the relationship between climate change and outcomes relevant to U.S. national security? What is the basis for this knowledge and how strong is it? What research and measurement strategies would strengthen the basis for this knowledge?" In response to this charge, this report presents a conceptual framework for addressing such issues, offers an evaluation of the available evidence, identifies key factors linking climate change phenomena to security concerns, and offers conclusions and recommendations related to: (a) improving understanding of climate–security linkages; (b) improving monitoring and analysis of the factors linking climate change to social and political stresses and to security risks; and (c) improving the ability to anticipate potential security risks arising from climate phenomena.

As the study developed, and upon consultation with the study's sponsors, we focused our efforts in three specific ways. First, we focused on social and political stresses outside the United States because such stresses are the main focus of the intelligence community. Second, we concentrated on security risks that might arise from situations in which climate events (e.g., droughts, heat waves, or storms) have consequences that exceed the capacity of affected countries or populations to cope and respond. This focus led us to exclude, for example, climate events that might directly affect the ability of the U.S. military to conduct its missions or that might contribute directly to international competition or conflict (e.g., over sea lanes or natural resources in the Arctic). We also excluded the security implications of policies that countries might

undertake to protect themselves from perceived threats of climate change (e.g., geoengineering to reduce global warming or buying foreign agricultural land to ensure domestic food supplies). These kinds of climate–security connections could prove highly significant and deserve further study and analysis. They could also interact with the connections that are our main focus; for example, an action such as buying foreign agricultural land might go almost unnoticed at first, only creating a crisis when the country where the land is located experiences a crop failure it cannot manage with imports. Third, , we concentrated on the relatively near term by emphasizing climate-driven security risks that call for action by the intelligence community within the coming decade either to respond to security threats or to anticipate them.

Although these choices of focus helped bound our study, they left it with some notable limitations. Climate change is a global and a long-term phenomenon. Events within the United States and those outside the country affect each other, indirect links between climate and conflict can be related to direct ones, and the effects of climate change will not stop beyond a 10-year horizon and, in fact, can be expected to increase at an increasing rate. Thus a complete security analysis should project the risks of climate change beyond the next decade in order to inform U.S. government security policy choices in the near term that will prepare the nation for events in later decades.

Our study includes the full range of potentially disruptive events that are becoming more likely because of climate change, whether or not a particular event can be unequivocally attributed to human-caused climate change rather than to natural variation. We made this choice because any such climate events can become disruptive and create a need for U.S. government action regardless of whether they can at this time be uniquely attributed to anthropogenic climate change.

KNOWLEDGE ABOUT CLIMATE–SECURITY CONNECTIONS

Anthropogenic climate change can reasonably be expected to increase the frequency and intensity of a variety of potentially disruptive environmental events—slowly at first, but then more quickly. Some of this change is already discernible. Many of these events will stress communities, societies, governments, and the globally integrated systems that support human well-being. Science is unlikely ever to be able to predict the timing, magnitude, and precise location of these events a decade in advance, but much is already known that can inform security analysis, including details about the character of events that are becoming more likely and about the general trajectory of increasing risk.

Conclusion 3.1[1] *Given the available scientific knowledge of the climate system, it is prudent for security analysts to expect climate surprises in the coming decade, including unexpected and potentially disruptive single events as well as conjunctions of events occurring simultaneously or in sequence, and for them to become progressively more serious and more frequent thereafter, most likely at an accelerating rate. The climate*

[1] Conclusions and recommendations are numbered to indicate the chapter where they appear and their ordering within that chapter.

surprises may affect particular regions or globally integrated systems, such as grain markets, that provide for human well-being.

The conjunctions of events will likely include clusters of apparently unrelated climate events occurring closely in time, although perhaps widely separated geographically, which actually do have common causes; sequences or cascades of events in which a climate event precipitates a series of other physical or biological consequences in unexpected ways; and disruptions of globally connected systems, such as food markets, supply chains for strategic commodities, or global public health systems. The surprises are likely to appear first as unusually severe extensions of familiar experience. Some of them are likely to be felt in regions remote from where the actual climate events take place. It is prudent to expect that some of these events will create or exacerbate conditions affecting U.S. national security.

It makes sense for the intelligence community to apply a scenario approach in thinking about potentially disruptive events that are expectable but not truly predictable. For example, when climate models disagree about the direction of a climate trend even when the fundamental science strongly suggests that change is likely, it may make sense to consider the security implications of two or more plausible trends as a way to anticipate risks.

Conclusion 4.1 *The overall risk of disruption to a society from a climate event is determined by the interplay among several factors: event severity, exposure of people or valued things, and the vulnerability of those people or things, including susceptibility to harm and the effectiveness of coping, response, and recovery. Exposure and vulnerability may pertain to the direct effects of a climate event or to effects mediated by globalized systems that support the well-being of the society*. The security risks are unlikely to be anticipated by looking only at climate trends and projections.

Each of the factors affecting disruption is changing, and several are changing in ways that can be projected with some confidence for a decade or more at the country level or below. Because risk reflects the interactions among these factors and not only the magnitude of climate events, events of a magnitude that has not been disruptive in the past can cause major social and political disruption if exposure and susceptibility are sufficiently great and response is inadequate or widely seen as such. The other side of this coin is that unprecedentedly large climate events do not necessarily lead to security threats if actions have been taken to reduce exposure or susceptibility or increase coping capacity and if authorities are seen to be actively responding to events.

Conclusion 4.2 *To understand how climate change may create social and political stresses with implications for U.S. national security, it is essential for the intelligence community to understand adaptation and changes in vulnerability to climate events and their consequences in places and systems of concern, including susceptibility to harm and the potential for effective coping, response, and recovery. This understanding must be integrated with understanding of changes in the likelihoods of occurrence of climate events.* Knowledge from several scientific fields provides useful general insights about the components of vulnerability and how they shape the effects of climate events on social and political systems. Much remains to be done, however, to advance this knowledge and make it operational for assessing the risks of climate change to social and political systems in particular places.

Conclusion 5.1 *It is prudent to expect that over the course of a decade some climate events—including single events, conjunctions of events occurring simultaneously or in sequence in particular locations, and events affecting globally integrated systems that provide for human well-being—will produce consequences that exceed the capacity of the affected societies or global systems to manage and that have global security implications serious enough to compel international response. It is also prudent to expect that such consequences will become more common further in the future.*

Conclusion 5.2 *The links between climate events and security outcomes are complex, contingent, and not understood nearly well enough to allow for prediction. However, the key linkages, as with societal disruptions, seem prominently to involve (a) exposures to potentially disruptive events directly or through globally integrated systems affecting human well-being and (b) vulnerabilities (i.e., susceptibility to harm and the effectiveness of coping, response, and recovery efforts). In addition, security outcomes depend on the reactions of social and political systems to actual or perceived inadequacies of response.*

Available knowledge of climate–security connections that feature societal vulnerabilities indicates that security analysis needs to develop more nuanced understanding of the conditions—largely, social, political, and economic conditions—under which particular climate events are and are not likely to lead to particular kinds of social and political stresses and under which such events and responses to them are and are not likely to lead to significant security threats.

The empirical knowledge base on the connections between extreme events and political instability or violence also suggests some hypotheses that are worthy of further examination. For example, available knowledge is consistent with a model in which the link of climate events to the potential for significant violence, conflict, or breakdown depends on these factors:

- the nature, breadth or concentration, and depth of pre-existing social and political grievances and stresses;
- the nature, breadth or concentration, and depth of the immediate impacts of the climate event;
- the socioeconomic, geographic, racial, ethnic, and religious profiles of the most exposed groups or subpopulations, as well as their susceptibilities and coping capacities;
- the ability and willingness of the incumbent government and its internal and external supporters to devise, publicize, and implement effective, transparent, and equitable short-term emergency response and then longer-term recovery plans;
- the extent to which emergent or established anti-government or anti-regime movements or groups are able to take strategic or tactical advantage of grievances or problems related to responses to the event;
- the type, breadth, and depth of legitimacy and support for authorities, the government, the regime, or the nation–state; and
- the coercive and repressive capacities of the government and its willingness and ability to engage and carry out repression.

TOWARD IMPROVED MONITORING, ANALYSIS, AND ANTICIPATION

The intelligence and national security communities are not the only parts of the U.S. government that need improved understanding of vulnerabilities to climate change to achieve their goals, and the U.S. government is not the only actor that has this need. Such improved understanding is among the objectives of the many federal scientific agencies concerned with climate change and will be valuable to the various federal, state, local, private-sector, and international organizations concerned with improving adaptation to climate change, reducing potential damage from climate events, and exploiting potential opportunities related to climate change. These shared needs for knowledge suggest that knowledge development is best pursued as a cooperative activity involving many organizations.

A recent report of the Defense Science Board (DSB, 2011) emphasized the need for federal interagency cooperation in dealing with issues of adaptation to climate change. It called for "a structure and process for coordination to more effectively leverage the efforts to address global problems" and "a whole of government approach on regional climate change adaptation with a focus on promoting climate change resilience and maintaining regional stability." We agree with the need for a whole-of-government approach and note that the effort should include improved knowledge and monitoring of changing vulnerabilities as well as of climate trends.

Within the U.S. government, the entity charged with developing fundamental knowledge about climate vulnerabilities is the U.S. Global Change Research Program (USGCRP). One of the five scientific objectives in its strategic plan for 2012–2021 is to "[a]dvance understanding of the vulnerability and resilience of integrated human–natural systems and enhance the usability of scientific knowledge in supporting responses to global change" (USGCRP, 2012:29). The intelligence community is an obvious potential beneficiary of this effort.

Conclusion 4.3: *Many of the scientific needs of the intelligence community regarding climate change adaptation and vulnerability are congruent with those of the USGCRP and various individual federal agencies. Intelligence agencies and the USGCRP can benefit by joining forces in appropriate ways to advance needed knowledge of vulnerability and adaptation to climate change and of the potential of climate change to create social and political stresses.*

A whole-of-government approach to understanding adaptation and vulnerability to climate change can advance the objectives of multiple agencies, avoid duplication of effort, and make better use of scarce resources. Such an interagency effort will help in anticipating the social and political consequences of climate events and in building the basis for a widely useful system for monitoring and analysis. This system would aid in anticipating security threats and could be employed by the U.S. intelligence community and other domestic and international entities to inform choices about responses to climate change.

Building Fundamental Understanding

Recommendations 3.1, 4.1, 5.1, and 6.1 *The intelligence community should participate in a whole-of-government effort to inform choices about adapting to and reducing vulnerability to climate change.*

Recommendation 3.1 *It should, along with appropriate federal science agencies, support research to improve the ability to quantify the likelihoods of potentially disruptive climate events, that is, single extreme climate events, event clusters, and event sequences. A*

special focus should be on quantifying risks of events and event clusters that could disrupt vital supply chains, such as for food grains or fuels, and thus contribute to global system shocks. This research should include efforts by climate scientists to improve fundamental understanding of the effects of climate change on the likelihoods of extreme climate events and also efforts to apply the methods of extreme value statistics to these problems, particularly the problem of estimating the likelihoods of clusters of extreme climate events that are dependent on the same underlying climatic processes. Such efforts would help in defining climate event scenarios for countries, regions, and systems that could be used as the basis for climate stress tests (see below).

Recommendation 4.1: *It should, along with the USGCRP and other relevant science and mission agencies, develop priorities for research on climate vulnerability and adaptation and consider strategies for providing appropriate research support. The interagency effort on vulnerability and adaptation should include agencies responsible for community resilience and disaster preparedness and response domestically and internationally.* Such an interagency process does not imply that climate change should be defined as a security issue. Rather, it indicates that security issues are among those that should be considered in developing and executing a research agenda on climate change adaptation and vulnerability.

Recommendation 5.1: *It should, along with other interested agencies, support research to improve understanding of the conditions under which climate-related natural disasters and disruptions of critical systems of life support do or do not lead to important security-relevant outcomes such as political instability, violent conflict, humanitarian disasters, and disruptive migration.* Understanding the connections between harm suffered from climate events and political and social outcomes of security concern is arguably the most important aspect of climate change from a national security perspective, but it has received relatively little scientific attention until now. The disaster research community, which has been the locus of research on the political effects of climate events, has not been well connected to the climate research community.

To build the needed fundamental understanding will require the integration of knowledge of political and socioeconomic conditions in countries of interest; knowledge from climate science about the potential exposure of these countries to climate events; and knowledge from social science about the susceptibility of these countries to being harmed by those events and the likelihood of effective coping, response, and recovery at local to national levels. These sources of knowledge come from different communities of experts, which will need to communicate with each other but do not necessarily do so now. An important need is to integrate the social science of natural disasters and disaster response with other forms of analysis. This body of knowledge is particularly important for assessing the security consequences of climate change because disruptive climate events will typically be perceived and responded to as natural disasters. The recommended interagency process can help bring these communities of experts together, as they tend to associate with different groups of agencies.

Improving Monitoring and Analysis

Conclusion 6.1 *Monitoring to anticipate national security risks related to climate events*

should focus on five key types of phenomena:

1. *Climate events and related biophysical environment phenomena;*
2. *The exposures of human populations and the systems that provide food, water, health, and other essentials to life and well-being;*
3. *The susceptibilities of people, assets, and resources to harm from climate events;*
4. *The ability to cope with, respond to, and recover from shocks; and*
5. *The potential for outcomes of inadequate coping, response, and recovery to rise to the level of concern for U.S. national security.*

Given that security threats arise from combinations of all of these phenomena, indicators and monitoring systems should be developed to follow them at various levels from local to national.

Conclusion 6.2 *Developing an adequate system for monitoring the conditions that can link climate events to national security concerns will require maintaining critical existing observational systems, programs, and databases; the collection of new data; the analysis of new and existing data; and the improvement of analytic systems, leading to better understanding of the linkages over time and to improved indicators of key variables where quantitative indicators are appropriate and feasible to produce. It will typically require finer-grained data than are currently available. It will also require improved techniques for integrating quantitative and qualitative information.* We emphasize that improved understanding and monitoring of the various elements of climate vulnerability—a key link between climate events and security concerns—is an objective that the intelligence community shares with the U.S. Global Change Research Program and many other institutions at federal, state, local, and international levels. To address the challenges of monitoring, which include both new and enduring methodological problems, the intelligence community needs to draw on knowledge from the academic research community, as some current efforts are already doing.

Recommendation 6.1 *One of the objectives of the recommended whole-of-government effort to inform choices about adapting to and reducing vulnerability to climate change should be to build the scientific basis for indicators in this domain.* This effort would support activities by the research communities involved in assessing exposures and vulnerabilities to environmental change to identify a relatively small number of key variables relevant to the social and political consequences of climate events. The effort of the climate science community to identify a small number of "essential climate variables" suggests the kind of process that could be used.

Recommendation 6.2: *The U.S. government should begin immediately to develop a systematic and enduring whole-of-government strategy for monitoring threats connected to climate change. This strategy should be developed along with the development of priorities and support for research.* The monitoring should include climate phenomena, exposures and vulnerabilities, and factors that might link aspects of climate and vulnerability to important security outcomes, and it should be applicable to climate issues globally. It should also include making and periodically updating priority judgments about when and where high-resolution

monitoring is needed. Analysis will require the integration of quantitative indicators with traditional security and intelligence analytic methods.

The value of monitoring efforts is likely to increase over time because of improvements in monitoring systems and because potentially disruptive climate events are expected to increase in frequency and intensity in the future. Existing open-source monitoring systems that may provide useful information on key variables should be periodically examined for their potential utility, but with critical attention paid to indicator selection, data reliability and validity, and cross-case and cross-national comparability.

For the great majority of existing and potential indicators, the required spatial and temporal resolution is finer than what is currently available. High-resolution monitoring will be especially important for highly significant and highly vulnerable locations. The appropriate level of spatial and temporal resolution for indicators varies, however, with the substantive domain. In setting priorities for indicator development and improvement, the intelligence community should take into account the gaps between the existing and the desired resolution and should invest in improved resolution of those indicators judged to be the most needed and the most useful in places of concern.

It is important to develop and validate monitoring systems now in order have baseline data for future studies of climate event impacts and for social and political stress analyses. Validation is particularly important for emerging monitoring technologies, such as those involving sophisticated data mining algorithms (e.g., of Internet postings) and remote observations that are overlaid on geographic information systems. Such techniques may produce outputs that catch the eye and are very impressive on first glance, but they are sometimes closely held by their developers and difficult to validate, especially if they involve infrequent events. Indicators and monitoring results should be interpreted with caution until these techniques develop a record of validation.

Organized international collaborations with potentially affected societies and governments and the open sharing of data will be important aspects of developing the needed monitoring systems. Such collaborations are likely to play a crucial role in gaining acceptance of higher-resolution monitoring at critically vulnerable locations. The collaborations are also likely to benefit many governments and international organizations that have a stake in reducing the risks of climate change to human and international security; the U.S. government in particular can benefit from data-gathering efforts in and by other countries. Of course, U.S. government agencies will continue to gather some kinds of information that will not be openly shared, and there will be questions about which data and information-gathering methods can and should be openly shared. Depending on part on how interagency collaborative relationships are structured and managed, there could also be suspicions related to the involvement of U.S. intelligence agencies in international information-gathering efforts related to security. Such issues will need to be addressed in ways that we have not had the opportunity to consider in this study. Nevertheless, the benefits of open, international data development and sharing should be taken seriously as work on monitoring systems proceeds. These benefits include the development of compatible concepts, databases, and indicators across countries, which helps speed scientific progress and improves the ability to learn from experiences in other countries.

Improving the Capacity to Anticipate Security Threats

Recommendation 6.3: *The intelligence community should establish a system of periodic "stress testing" for countries, regions, and critical global systems regarding their ability to manage potentially disruptive climate events of concern. Stress tests would focus on potentially disruptive conjunctions of climate events and socioeconomic and political conditions.* The intelligence community presumably already uses an analogous process to consider the ability of foreign governments and societies to withstand various kinds of social and political stresses. This recommendation calls on the community to incorporate climate risks and the associated exposures and vulnerabilities into such exercises. The concept of a climate stress test provides a framework for integrating climate and social variables more systematically and consistently within national security analysis.

A stress test is an exercise to assess the likely effects on particular countries, populations, or systems of potentially disruptive climate events. The recommended stress tests would involve analyzing the likely effects of an event at some projected time of occurrence in terms of key variables affecting susceptibility, coping, response, and recovery or the failure thereof, and the likely responses within regions or countries of interest in the event that these actions are perceived to be inadequate. The tests would draw on knowledge about the potential events and each of the other types of phenomena and would provide a major way of making knowledge about climate events, exposures, and vulnerabilities operational in security analysis.

Stress tests should assess the potential consequences for security of climate events under either of two conditions: when climate scientists can say with some confidence that the events will be increasingly likely to occur or become more severe, or when the events seem increasingly likely to occur based on a fundamental understanding of climate dynamics but available evidence is not yet sufficient for climate scientists to attach confidence to such projections. Stress tests might also be triggered by assessments indicating that event likelihood, exposure, or susceptibility is increasing or that the capacity to respond adequately to certain kinds of climate events is declining in a region or country of concern.

The results of stress tests would inform national security decision makers about places that are at risk of becoming security concerns as a result of climate events and could be used by the U.S. government or international aid agencies to target high-risk places for efforts to reduce susceptibilities or to improve coping, response, and recovery capacities. The stress testing process would also help advance understanding through an accumulation of data on potentially disruptive events and their social, political. and security consequences.

Countries, regions, and systems of particular security interest should be prime targets for periodic stress testing. Given the joint criteria of significant potential for climate change impacts and importance to U.S. national security, it is likely that no more than 12 to 15 countries will need to be monitored and subjected to periodic stress tests over the next decade, many of which are likely to be in critical, and often shared, watershed areas in South Asia, the Middle East, and Africa. If the criteria for importance to the United States are expanded to include foreign policy and humanitarian concerns, the number of countries to be monitored and stress-tested regularly over the next decade may rise to between 50 and 60. Stress testing should also be applied periodically to global systems that meet critical needs, including food supply systems, global public health systems, supply chains for critical materials, and disaster relief systems.

Decision science techniques should be used and further developed to ensure that the stress tests make the best use of the available information. Stress testing might draw on various

methods, including the qualitative interpretation of available knowledge, formal modeling, and interactive gaming approaches. Decision science techniques should be employed to design the processes and interpret the input from different kinds of expertise and modes of analysis in order to make the best possible use of information. The stress-testing exercises should themselves be monitored and critically evaluated so that stress-testing methods can be improved over time.

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PREFACE

Core features of the climate change situation are known with confidence. The greenhouse effect associated with the carbon dioxide molecule has been measured, as has the dwell time of that molecule and its concentration in the atmosphere. We also know that the rate at which carbon dioxide is currently being added to the atmosphere substantially exceeds the natural rate that prevailed before the rise of human societies. That means that a large and unprecedentedly rapid thermal impulse is being imparted to the earth's ecology that will have to be balanced in some fashion. We know beyond reasonable doubt that the consequences will be extensive. We do not, however, know the timing, magnitude, or character of those consequences with sufficient precision to make predictions that meet scientific standards of confidence.

In principle the thermal impulse could be mitigated to a degree that would presumably preserve the current operating conditions of human societies, but the global effort required to do that is not being undertaken and cannot be presumed. As a practical matter, that means that significant burdens of adaptation will be imposed on all societies and that unusually severe climate perturbations will encountered in some parts of the world over the next decade with an increasing frequency and severity thereafter. There is compelling reason to presume that specific failures of adaptation will occur with consequences more severe than any yet experienced, severe enough to compel more extensive international engagement than has yet been anticipated or organized.

This report has been prepared at the request of the U.S. intelligence community with these circumstances in mind. It summarizes what is currently known about the security effects of climate perturbations, admitting the inherent complexities and the very considerable uncertainties involved. But under the presumption that these effects will be of increasing significance, it outlines the monitoring activities that the intelligence community should be developing in support of improved anticipation, more effective prevention efforts, and more decisive emergency reaction when that becomes necessary.

The report was prepared by the members of the committee, all of whom helped shape the assessment presented and many of whom drafted elements of the text. The burden of constructing a coherent whole from individual contributions fell primarily to Paul Stern and Jo Husbands as the principal editors of the report. Alicia Jaramillo–Underwood and Mary Ann Kasper provided essential administrative support. National Research Council Fellow Andrei Israel and intern Zafar Imran provided research support and assisted in the preparation of parts of the text. I am personally grateful for all of these contributions.

John D. Steinbruner, *Chair*
Committee on Assessing the Impacts of Climate
Change on Social and Political Stresses

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This report has been reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise, in accordance with procedures approved by the National Academies' Report Review Committee. The purpose of this independent review is to provide candid and critical comments that will assist the institution in making its published report as sound as possible and to ensure that the report meets institutional standards for objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the process.

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Although the reviewers listed above have provided many constructive comments and suggestions, they were not asked to endorse the conclusions or recommendations, nor did they see the final draft of the report before its release. The review of this report was overseen by Warren M. Washington, Climate Change Research Section, Climate and Global Dynamics Division, National Center for Atmospheric Research, and Thomas J. Wilbanks, Environmental Sciences Division, Oak Ridge National Laboratory. Appointed by the National Academies, they were responsible for making certain that an independent examination of this report was carried out in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content of this report rests entirely with the authoring committee and the institution.

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