

160 **Preface**

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171 **P.1 REPORT MOTIVATION AND GUIDANCE FOR USING THIS SYNTHESIS**

172 **AND ASSESSMENT REPORT**

173 The core mission of the U.S. Climate Change Science Program (CCSP) is to “Facilitate

174 the creation and application of knowledge of the Earth’s global environment through

175 research, observations, decision support, and communication.” Toward accomplishing

176 this goal, the CCSP has commissioned 21 Synthesis and Assessment products to

177 summarize current knowledge and evaluate the extent and development of this

178 knowledge for future scientific explorations and policy planning.

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180 These products fall within five goals, namely:

- 181 1) Improve knowledge of the Earth's past and present climate and environment,
182 including its natural variability, and improve understanding of the causes of
183 observed variability and change;
- 184 2) Improve quantification of the forces bringing about changes in the Earth's climate
185 and related systems;
- 186 3) Reduce uncertainty in projections of how the Earth's climate and environmental
187 systems may change in the future;
- 188 4) Understand the sensitivity and adaptability of different natural and managed
189 ecosystems and human systems to climate and related global changes; and
- 190 5) Explore the uses and identify the limits of evolving knowledge to manage risks
191 and opportunities related to climate variability and change.

192 CCSP Synthesis and Assessment Product 5.3 (CCSP 5.3) is one of three products to be
193 developed for the final goal.

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195 This product directly addresses decision support experiments and evaluations that have
196 used seasonal forecasts and observational data, and is expected to inform (1) decision
197 makers about the experiences of others who have experimented with these forecasts and
198 data in resource management; (2) climatologists, hydrologists and social scientists on
199 how to advance the delivery of decision-support resources that use the most recent
200 forecast products, methodologies, and tools; and (3) science and resource managers as
201 they plan for future investments in research related to forecasts and their role in decision
202 support.

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204 **P.2 BACKGROUND**

205 Gaining a better understanding of how to provide better decision support to decision and
206 policy makers is of prime importance to the CCSP, and it has put considerable effort and
207 resources towards achieving this goal. For example, within its Strategic Plan, the CCSP
208 identifies decision support: as one of its four core approaches to achieving its mission¹.
209 The plan endorses the transfer of knowledge gained from science in a format that is
210 usable and understandable and which indicates levels of uncertainty and confidence.
211 CCSP expects that the resulting tools will promote the development of new models, tools
212 and methods that will improve current economic and policy analyses as well as advance
213 environmental management and decision making.
214 CCSP has also encouraged the authors of the 21 synthesis and assessment products to
215 support informed decision making on climate variability and change. Most of the
216 Synthesis and Assessment Products' Prospectuses have outlined efforts to involve
217 decision makers including a broad group of stakeholders, policymakers, resource
218 managers, media, and the general public as either writers or have encouraged their
219 participation through special workshops/meetings. Inclusion of decision makers in the
220 Synthesis and Assessment reports also helps to fulfill the requirements of the Global
221 Change Research Act (GCRA) of 1990 (P.L. 101-606, section 106), which directs the
222 program to "produce information readily usable by policymakers attempting to formulate
223 effective strategies for preventing, mitigating, and adapting to the effects of global
224 change" and to undertake periodic science "assessments".

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¹ The four core approaches of CCSP include science, observations, decision support, and communications.

226 Finally, in November 2005, the CCSP held a workshop to address the potential of those
227 working in the climate sciences to inform decision and policy makers. The workshop
228 included discussions about decision-maker needs for scientific information on climate
229 variability and change, as well as future steps, including the completion of this product,
230 for research and assessment activities that are necessary for sound resource management,
231 adaptive planning, and policy formulation. The conference was well received as over 260
232 abstracts were submitted and approximately 700 individuals from the U.S. and abroad
233 attended. The audience included representatives from academia; governments at the state,
234 local and national levels; non-governmental organizations (NGO); decision makers,
235 including resource managers and policy developers; Congress; and the private sector.

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237 **P.3 FOCUS OF THIS SYNTHESIS AND ASSESSMENT PRODUCT**

238 In response to the 2003 Strategic Plan for the Climate Change Science Program Office,
239 which recommended the creation of a series of Synthesis and Assessment product
240 reports, the National Oceanic and Atmospheric Administration (NOAA) took
241 responsibility for this product. An interagency group comprised of representatives from
242 NOAA, National Aeronautic and Space Administration, Environmental Protection
243 Agency, U.S. Geological Survey and National Science Foundation wrote the Prospectus²
244 for this product and recommended that this synthesis and assessment product should
245 concentrate on the water resource management sector. This committee felt that focusing
246 on a single sector would allow for a detailed synthesis of lessons learned in decision-
247 support experiments within that sector. These lessons in turn would be relevant,

² The Prospectus is posted on the Climate Change Science Program website at:
<http://www.climatescience.gov>.

248 transferable, and essential to other climate-sensitive resource management sectors. Water
 249 resource management was chosen, as it was the most relevant of the sectors proposed and
 250 would be of interest to all agencies participating in this process. The group wrote a
 251 Prospectus and posed a series of questions that they felt the CCSP 5.3 report authors
 252 should address in this report. Table P.1 lists these questions and provides the location
 253 within the Synthesis and Assessment Report where the authors addressed them.

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255 **Table P.1 Questions To Be Addressed in Synthesis and Assessment Product 5.3**

Prospectus Question	Report Location where Question is Addressed
What seasonal to interannual (<i>e.g.</i> , probabilistic) forecast information do decisionmakers need to manage water resources?	2.1
What are the seasonal to interannual forecast/data products currently available and how does a product evolve from a scientific prototype to an operational product?	2.2
What is the level of confidence of the product within the science community and within the decision making community, who establishes these confidence levels and how are they determined?	2.2
How do forecasters convey information on climate variability and how is the relative skill and level of confidence of the results communicated to resource managers?	2.3
What is the role of probabilistic forecast information in the context of decision support in the water resources sector?	2.3
How is data quality controlled?	2.3
What steps are taken to ensure that this product is needed and will be used in decision support?	2.5
What types of decisions are made related to water resources?	3.2
What is the role that seasonal to interannual forecasts play and could play?	3.2
How does climate variability influence water resource management?	3.2
What are the obstacles and challenges decision makers face in translating climate forecasts and hydrology information into integrated resource management?	3.2
What are the barriers that exist in convincing decision makers to consider using risk-based hydrology information (including climate forecasts)?	3.2
What challenges do tool developers have in finding out the needs of decision makers?	3.3
How much involvement do practitioners have in product development?	4.1
What are the measurable indicators of progress in terms of access to information and its effective uses?	4.3

Identify critical components, mechanisms, and pathways that have led to successful utilization of climate information by water managers.	4.4
Discuss options for (a) improving the use of existing forecasts/data products and (b) identify other user needs and challenges in order to prioritize research for improving forecasts and products.	4.4 and 5
Discuss how these findings can be transferred to other sectors.	5

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257 **P.4 THE SYNTHESIS AND ASSESSMENT WRITING TEAM**

258 This study required an interdisciplinary team that was able to integrate scientific
259 understandings about forecast and data products with a working knowledge of the needs
260 of water resource managers in decision-making. As a result, the team included
261 researchers, decision makers, and Federal government employees with varied
262 backgrounds in the social sciences, physical sciences, and law. The authors were
263 identified based on a variety of considerations, including their past interests and
264 involvements with decision-support experiments and their knowledge of the field as
265 demonstrated by practice and/or involvement in research and/or publications in refereed
266 journals. In addition, the authors held a public meeting, in January 2007, in which they
267 invited key stakeholders to discuss their decision support experiments with the
268 committee. Working with authors and stakeholders with such varied backgrounds
269 presented some unique challenges including preconceived notions of other disciplines, as
270 well as the realization that individual words have different meanings in the diverse
271 disciplines.

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273 The author team for this Product was constituted as a Federal Advisory Committee in
274 accordance with the Federal Advisory Committee Act of 1972 as amended, 5 U.S.C.
275 App.2. The full list of the Author Team, in addition to a list of lead authors provided at

276 the beginning of each Chapter, is provided on page 3 of this report. The Editorial Staff
277 reviewed the scientific and technical input and managed the assembly, formatting and
278 preparation of the Report.

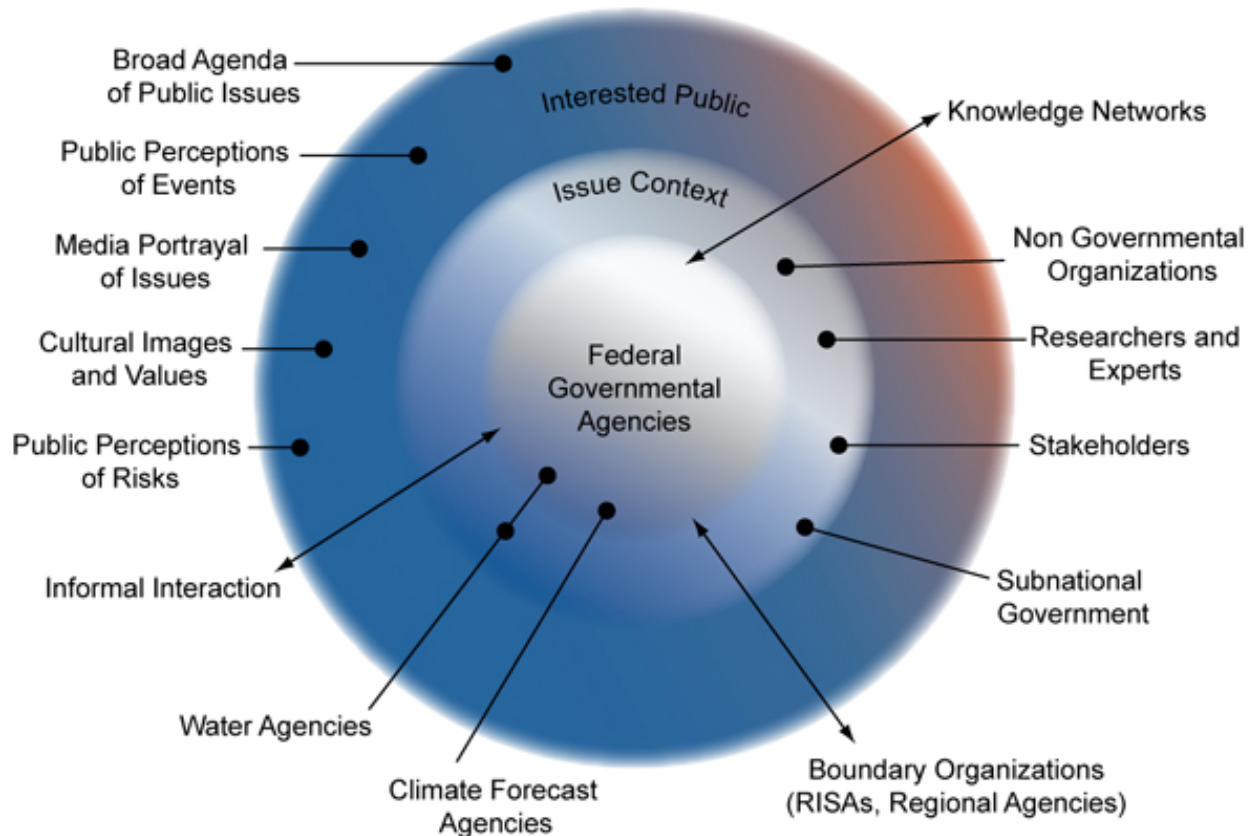
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280 **P.5 HOW THIS SYNTHESIS AND ASSESSMENT PRODUCT IS ORGANIZED**
281 **AND WHY**

282 In discussions of how water resource management decisions are made within a climate
283 context the author team identified several major influences. Figure P.1 portrays the
284 different contexts that the authors of this product identified in which climate variation
285 and change information is considered.

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Multiple and Interacting Contexts for Interpretation and Use of Seasonal to Interannual Forecasts and Observational Data



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288 **Figure P.1** Contexts for interpretation and use of seasonal forecasts and observational data. The layers of
 289 the circle are described in the text below. Several organizations and approaches span multiple contexts,
 290 indicated by the arrows.
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292 The innermost circle contains federal climate and water related agencies, which provide
 293 the initial climate forecasts and climate and water resource operational data. As described
 294 in Chapter 2, climate forecasts are generally produced by national centers at larger scales
 295 in terms of space and time and are meant to serve a broad-range of uses. On the other
 296 hand, hydrologic forecasts are generally produced by regional and local agencies and
 297 tend to focus on water supplies.

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299 The intermediate circle represents the context in which the forecasts and data are received
300 and interpreted. The same forecast in two different locations would be interpreted
301 according to the conditions and prevailing values of those locations. Factors such as the
302 public's perceptions of risk, cultural images and values, and even the media portrayal of
303 the event all influence the policy and decision makers' actions in response to these
304 forecasts and data. Chapters 3, 4 and 5 discuss the conditions necessary for uptake of new
305 information, and the knowledge-to-action networks that exist to provide information
306 dissemination to individuals and interest groups, equity implications of receiving and
307 using this information, and nature of science citizenship in participation of science-based
308 decision making.

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310 The outer circle encompasses the attentive public and the interested actors for whom
311 climate information is of regular concern. Within the interested public are stakeholder
312 groups and entities concerned with climate in state and regional governmental entities.
313 Informal interaction and cooperation, as well as more formalized boundary organizations
314 are depicted as arrows going both inward and outward. This level of intermediate context
315 is described in Chapters 3 and 4. Decision support experiments within the water resource
316 management sector are also described in Chapters 3 and 4, as well as the barriers and
317 opportunities for better integrating these experiments into decision making. Chapter 5
318 discusses the lessons learned within decision support experiments and research areas that
319 are critical for progress.

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321 Finally, some terms used in this Report may be unfamiliar to those not trained in the
322 physical or social sciences; a glossary and list of acronyms is included at the end of this
323 Report.

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