

**United States Department of Commerce  
National Oceanic and Atmospheric Administration  
Regional Integrated Sciences and Assessments Program**



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## **1. Program Goals and Objectives**

Climate variability and change significantly influences the health, prosperity, and well being of the people of the United States. Most recently, this has been demonstrated by several high impact events such as Hurricanes Andrew and Floyd, the 1997-98 El Niño event, and droughts in Texas (1998) and the Northeast (1999). Over the past decade there has been significant progress in understanding longer term climate patterns that influence these events, such as the El Niño-Southern Oscillation, the Pacific Decadal Oscillation, the North Atlantic Oscillation, and the Arctic Oscillation. Increasingly, attention is being paid to the cumulative impacts of regional climatic events driven by decadal-scale modulations of these phenomena.

The major climatic forcings, mentioned above, occur at the global scale. Local environments result from the interaction of these patterns of atmospheric, cryospheric, and oceanic variability superimposed on many different timescales and land surface conditions. Much recent research has shown that enabling effective responses to environmental variability and change requires assessment at both the global-scale and at the appropriate scales of action i.e. the region and the locale (NRC, 1999a).

As identified at the Federal level and in academia, there is a need for credible, unbiased assessments of the status and trends of environmental patterns and processes (U.S. Congress, 1994). At the same time there are calls for more and better structured processes to identify, assess and meet national, regional, private and local climate-related needs, and to foster the timely adoption and effective use of commercially valuable information and technology throughout the U.S. economy (U.S. Congress, 1998). These issues have found resonance at the NOAA Constituents meetings and in the National Assessments.

Ideally, the end goals of the NOAA/OAR/OGP RISA-sponsored activities are to expand the range of choices available to private and public communities in a region, by cooperatively identifying and enabling practical decisions using available, but possibly fragmented, research-based knowledge and, by filling the gaps where needed. As defined

here, assessments raise questions and express judgments on the reliability of knowledge about linkages and projections at the climate-environment-society interface and on the robustness of the data e.g. What are the "critical" issues and how are they identified? What is known and what do we need to know? How do these relationships change over time? Do we know them well enough for effective decision-making? How can social and economic benefits be maximized? etc. This problem-focused orientation has the added impetus of identifying alternative paths to decisions and the consequences of those decisions.

## **2. Scientific Rationale**

The need for integrated assessments or appraisals of integrated knowledge about climate variations, climate impacts, applications, and consequences, has been identified through decades of research and experience in many fields (NRC, 1999b). Advances in our appreciation of complex systems have allowed for a reframing of the climate-society interface as a set of multidimensional problems in which studies of larger-scale climatic forcings and regionally-focused assessments of impacts all proceed simultaneously (i.e. co-evolve with feedback among the components). Included in this framing are: (1) the need to include appropriate human components (i.e. Economics and Human Dimensions) in environmental research, (2) the need for more effective information infrastructures to enable significant advances in communication, data management, modeling, synthesis and dissemination of information, and, (3) the need to refine the relationship between Federally-funded efforts in climate services and the University, non-governmental, and private sectors.

The major lesson has been that different degrees of impact, change, and surprise, result from a variety of climatological, social, economic and ecological circumstances interacting over different spatial and temporal scales. New knowledge, new problems and opportunities continuously arise as events unfold. Integrated scientific assessments constitute the sum of efforts to (1) characterize the state of knowledge of climate variations and changes at appropriate scales of interest, (2) identify knowledge gaps and linkages in selected climate-environment-society interactions, and (3) provide an informed basis for (a) responding to climate-related risks, and for b) establishing priorities in basic research investments to meet these needs. To achieve the goals of meeting these evolving needs, assessments must be forward looking and anticipatory, and broad enough to evaluate the potential for scientific surprises.

The "regional scale" offers a useful organizational unit on which to coordinate and evaluate research cognizant of socio-economic needs and geophysical and jurisdictional boundaries. Assessment of critical climate-sensitive issues, in this setting, is the iterative process of integrating interdisciplinary knowledge and experience about risks and vulnerabilities in a region commensurate with the design and support of effective responses. The Integrated Sciences component informs the assessment function by focusing ongoing research on (1) linkages between critical components of physical systems (e.g. climate-fisheries interactions), (2) linkages between social and economic activities (e.g. climate and energy production) and relevant variations and changes in these systems, and (3) linkages between this integrated knowledge, and decision processes and resources objectives. RISA projects do not advocate one set of policy options over another but seek to evaluate the implications of different choices under varying and changing climate conditions (see project summaries).

## **3. Directions and Strategy**

The NOAA Regional Assessments Program was initiated as an activity within the Climate and Societal Interactions element. In the last year the Regional Assessments Program has been changed to "Regional Integrated Sciences and Assessments" to

emphasize interdisciplinary research as a necessary basis for effective assessment. From the NOAA perspective, Regional Integrated Sciences and Assessments involve the intersection of three major coordinates, (1) Climate and environmental monitoring and research, (2) Economic and Human Dimensions research, especially on trends and factors influencing climate-sensitive human activities, and (3) Applications and decision support i.e. the transformation and communication of relevant research results to meet specific needs in a region (Figure 1). The objective of the Regional Integrated Sciences and Assessments (RISA) Program is to inform the development of place-based decision support and services in responding to and mitigating physical and attendant technological risks. Enabling such services, within any region and at any point in time requires a critical mass of knowledge and of capacity to apply knowledge, e.g. tailoring information to meet local needs, implementing communication networks and infrastructure etc.

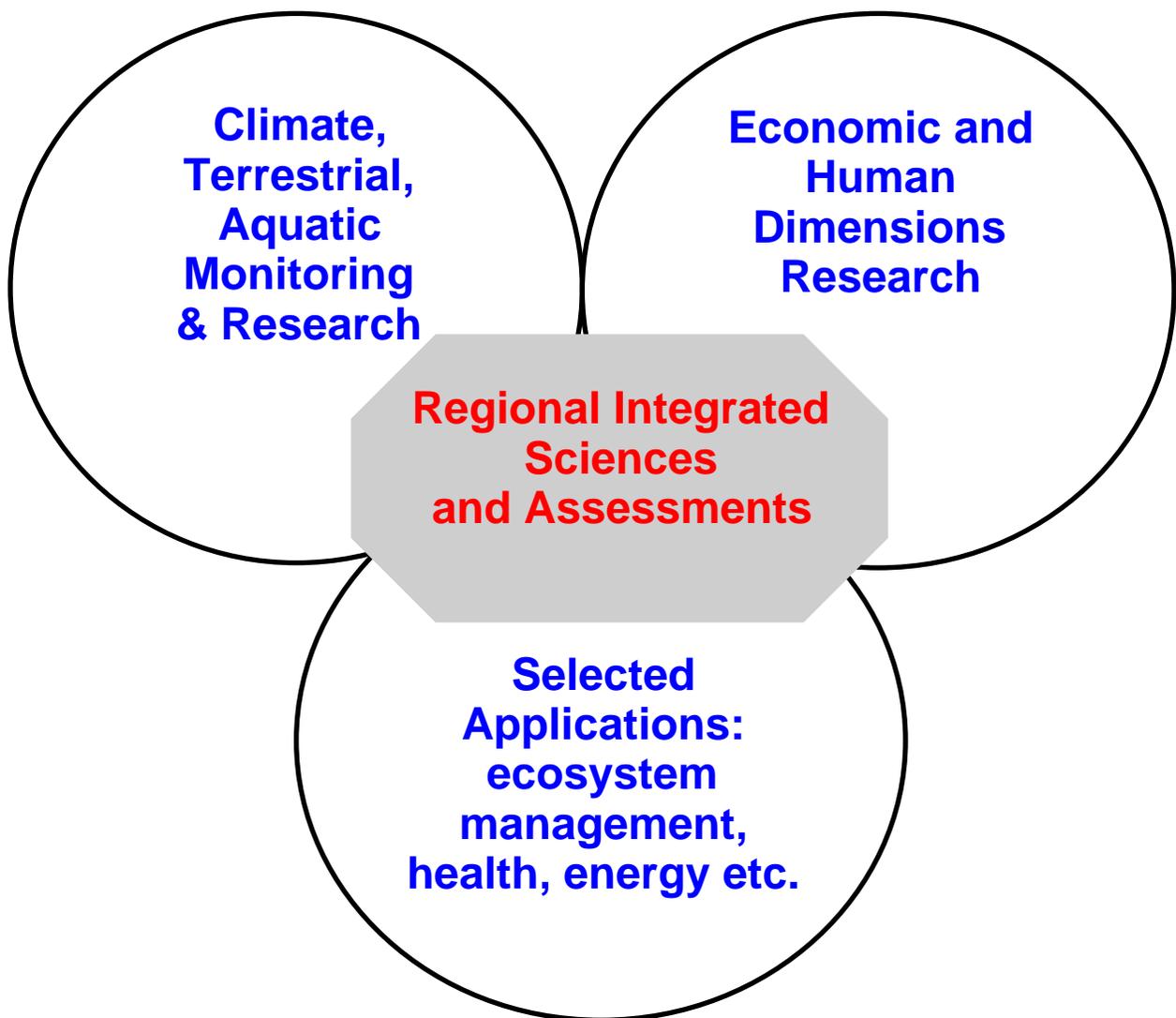


Figure 1. The Regional Integrated Sciences and Assessments concept

Implementation of RISA projects takes the form of several co-evolving tasks, including:

- Identifying climate-related critical issues/problems within region (where the problem and its level of criticality are defined by people living within the region)
- Characterizing the current and evolving state of knowledge of relevant climate, ecological and hydrologic variability and relationships on multiple time-scales
- Assessing social, economic, and ecological impacts and vulnerability to climate on multiple time-scales in selected cases. Identifying levels of criticality within 2-3 important sectors and/or groups (e.g. water resources, energy, urban areas, agriculture, fisheries etc.) in a region
- Developing pilot projects and prototypes for using environmental information and enhance collaboration among researchers, decision-makers, and the public
- Improving decision-support dialogues, openness, and developing awareness with respect to integrated climate impacts on regional and local system outputs
- Developing frameworks for structuring present knowledge and knowledge gaps. Testing these in different fora such as in responding to shorter term events and extremes in the region and, providing feedback into assessment design
- Refining mechanisms of interaction and learning among the research and Programmatic communities
- Capacity building as needed to realize the benefits afforded by developments in climate research, products and services

Each RISA activity has fulfilled these roles to varying degrees, depending on the respective times and scale of operation. Efforts are being made (see below) to draw trade-offs and lessons between comprehensive assessments across a range of issues (such as in the Pacific Northwest and the Southwest) and the vertically integrated study of one or two particular questions (such as climate and agriculture in the Southeast).

### *Project Implementation*

From the standpoint of the RISA Program, the (general) temporal phases involved in program implementation include and have included:

#### *Years 1-2*

- Team building/Regional characterization
- Inclusion of other agencies, public and private partners etc. in problem definition
- Identification of 1-3 critical interdisciplinary issues and affected groups
- Assessment of climate-related knowledge and responses to date
- Start-up pilot projects

#### *Years 2-3*

- Refining and developing preliminary studies,
- Re-definitions of region and problem focus
- Clarifying issue criticality, vulnerability, sensitivity, capacity from cause to effect (beginning vertical integration)
- Developing criteria for interaction with stakeholders and for self-evaluation etc.

- Co-developing (and progress toward meeting) criteria for evaluation with Program Management

#### *Years 4-*

- Fully integrating lines of communication and research developed in preliminary studies: standards and practices (vertical integration)
- Expansion to other sectors (horizontal integration), including enlargement of region and/or scope in previous cases if necessary
- Continued inclusion of other public and private agencies and institutions as partners etc.

The final configuration is anticipated to be a distributed assessment system across relatively large regions of the United States, consisting of integrated networks with sustained interaction among researchers and public and private decision makers, and that enables local and regional capacity and responsibility to address climate-related risks.

#### **4. Partnerships**

RISA activities require innovative partnerships among a spectrum of interests (Federal, State, local and private etc.) to enable organizational capacity within a region for services on an ongoing basis. As such, the RISA Program relies heavily on consolidating the results and data from ongoing NOAA and other agency research already funded in a region, into an integrative framework. While this has occurred within each activity it has yet to be fully realized across each region. Several of the researchers involved in RISA activities are or have been funded by other NOAA Main Program Elements.

RISA maintains strong links with the Applied Research Centers (in CDEP) and the Economic and Human Dimensions Program. Partnerships among RISA activities and other OGP Program Elements are in their infancy. Efforts are being engaged to identify mutual areas of research that are needed to fulfil the assessment function. For instance, two joint workshops are being planned between Human Dimensions researchers and RISA teams. The first on comparing approaches to assessing vulnerability (possibly in one particular sector such as climate and water resources) and the second on different surveying and collaborative information gathering techniques for eliciting user needs, communicating uncertainties, and for clarifying decision processes.

As anticipated (described below and in supporting documents), many of the assessment projects themselves are moving towards garnering support from regional constituents for cooperative research and applications. This is however at small amounts, thus far.

#### **5. Scientific Achievements**

At present, there are five Regional Integrated Sciences and Assessments activities funded by NOAA/OAR/OGP. These activities are focused on the Pacific Northwest, the Southwest, California, Inter-Mountain West, and the Southeast regions of the United States. As is evident in the following project description, each team devises its own problem definition and implementation plan, within the above guidelines. As expected, those funded first have begun to make inroads to meeting the goals of the Program. Those in pilot or preliminary stages focus on clarification of initially defined critical regional issues, team building, developing cooperative stakeholder linkages, and data assimilation. Pilot efforts undergo comprehensive reviews and evaluation before consideration of expansion to full assessments. Funds are also targeted, in the Program, towards research on assessment

design including comparative studies of assessment processes, transferability of approaches and lessons etc. One such effort was a workshop, coordinated by the Global Environmental Assessment Project at Harvard, on assessment design. This meeting drew on procedures and experiences in the European Community and the western Pacific region on LRTAP (the Long-Range Transport of Air Pollution), the IPCC, and ENSO impacts. The key points were on the importance of issue salience, researcher credibility, and institutional legitimacy in implementing effective assessments. Partial support for other meetings, workshops etc. are provided on a flexible, as needed, basis.

Each RISA project has provided a full summary of their activities, which will be attached as an appendix to this review. The basic frame for these summaries is problem definition, approaches, components, integrative aspects, constituencies and partners, and progress to meeting their goals. Below are brief summaries of each of the RISA activities. More comprehensive reports will be distributed to Panel Members.

### *RISA Activities*

The Pacific Northwest Assessment, now in its fifth year, is centered at the University of Washington, Seattle. This project focuses on climate and weather-related linkages to marine and freshwater ecosystems (chiefly Pacific Salmon), hydrology and water resources including hydropower, forest resources, coastal resources and health. A useful illustration of the approach articulated above is provided by research undertaken in the Pacific Northwest. By integrating information about oceanic, atmospheric, ecological, and hydrologic processes, (employing monitoring, forecasting, and observational systems funded by NOAA) researchers in this group have led to a clearer understanding of natural versus human-caused fluctuations in Pacific salmon numbers. This issue has been a source of great conflict in the Northwest. The research team has quantified the influence of climate and oceanic variability in modulating wild and hatchery salmon numbers over the last century. Previously, salmon decline was attributed to a combination of hatcheries, hydropower, land-habitat changes, and harvests. The PNW team has clearly shown that it is the interaction of these human-driven changes with climate variations that produces high extinction risks for different species of Pacific salmon. In addition, their work in this area has successfully contributed to prioritizing the PDO as an important area of focus for basic research (**Box 1**). Strong efforts have also been made to establish working relationships locally, such as with the State of Washington, Seattle Power and Light etc., and to secure external funding with resource management, cultural, and educational institutions and sectors in the region. This group's activities and plans successfully underwent an on-site review by a group of distinguished individuals (and mail reviewers) in February 1999. <http://tao.atmos.washington.edu/PNWimpacts/>

The Climate Assessment Project for the Southwest was established with the goals of assessing climate variability and longer-term climate change in terms of impacts on human and natural systems in the Southwest. The Southwest Assessment, beginning its third year, is centered at the University of Arizona in Tucson. The research and applications foci are on large-scale climatic phenomena (ENSO, the SW Monsoon etc.) and their impact on floods and droughts on Native American lands, rangeland management, and on rapidly evolving trans-boundary issues, and in water resources management for urban areas (primarily Phoenix and Tucson, two of the fastest growing regions in the US). In the latter case the team has shown that assumptions about water supply for urban development had not taken into account decadal-scale modulations of climate in their planning (**Box 2**). This issue has now drawn the attention of the Arizona Department of Water Resources and the

Governors' Planning Commission. The CLIMAS activity will undergo a full on-site review in February 2001. <http://www.ispe.arizona.edu/climas/>

The California Applications Program (CAP), consists of university, federal and private agency scientists studying the hydrological impacts of climate variability and attempting to improve climate and extended weather forecasts in the California region. The Program evaluates weather and climate forecasts for California, improve local models and forecasts of energy, water resources and hazards including wildfire and health risks, and tailor and disseminate forecasts to local users in these sectors. To evaluate the utility of this information, the program has identified and is collaborating with a selected set of managers at the federal, state, and local level to address the needs of these specific applications. CAP Partners include the State of California Dept. of Water Resources, Pacific Gas and Electric, Kings River Water Agency, Southern California Edison, United Water Agency in Ventura, Bureau of Reclamation, and California Wild Fire Agencies.  
<http://meteora.ucsd.edu/~meyer/caphome.html>

The Assessment of Climate Variability and Impacts on Agriculture in the Southeast US is implemented by a Consortium of Universities (University of Florida, University of Miami, and Florida State University). Their approach involves generation and communication of information on climate and climate impacts in agriculture. These efforts are primarily focused on associations between ENSO and climate in Florida where there is an increase of over 30% of the normal winter rainfall during warm events, while cold (La Niña) events show a corresponding decrease of 10% to 30%. Several of Florida's highest valued crops and their prices are been shown to be influenced by ENSO. The Consortium has designed and initiated operational system and decision support tools to disseminate agriculturally relevant climate information. The system is the result of a close collaboration between the Consortium and the Florida agricultural extension service. The State of Florida has now designated the application of climate forecasts as a State Major Program. This Consortium plan to expand its work into other Southeastern States.  
[http://www.coaps.fsu.edu/lib/Florida\\_Consortium/](http://www.coaps.fsu.edu/lib/Florida_Consortium/)  
<http://fawn.ifas.ufl.edu/>

The Western Water Assessment is centered at the University of Colorado, Boulder. The Interior West (Colorado Plateau and its runoff basins) contains the primary headwaters for water supply to major regions, including the Colorado Front Range, the arid Southwest, California, and the western Great Plains. The NOAA/CIRES Western Water Assessment, now in its second year, was developed to address the issues surrounding climate variability and its impact on water quality and quantity in the Interior West. The initial projects were chosen with thought given to climate variability impacts on water supply and ecosystems, water demand trends, and system vulnerability. The first case study in the "Western Water Assessment" is on the South Platte Basin. Partners include the Bureau of Reclamation and various Conservancy Districts. The teams' approach to assessing regional change and vulnerability on the South Platte includes the following areas of emphases: Climate impacts on water supply and demand zones in the South Platte (where 30% of water used is transferred from the West Slope), Investigating current uses of climate information and user needs, Use of ENSO information in improving seasonal water supply outlooks and the development of short-term streamflow forecasts for specific management applications (e.g. flow augmentation requirements for the maintenance of endangered fish habitat), and implications of climate variability for low flows and dilution of discharges from point sources. <http://cires.colorado.edu/wwa/>

**BOX 1: The Pacific Decadal Oscillation (PDO):  
An Emerging Research Priority**

The phrase “Pacific Decadal Oscillation” was first coined by Mantua et al (1997), within the Pacific Northwest RISA Group. In its’ positive phase, the PDO is a pattern of Pacific SST, with cold anomalies in the central northern Pacific and warm anomalies along the eastern edges of the basin (i.e., the west coast of North America). The PDO was in the negative phase from 1900 (when the first reliable SST records are available) to 1925 and from 1945-1977 and in the positive phase from 1925-1945 and from 1977. The RISA team established that the PNW climate signal is dominated by a combination of the ENSO phenomenon (cool/wet, warm/dry) on a seasonal/interannual time scale, and the PDO. The most pervasive climate-driven impacts are generated by the PDO, and the impacts are magnified whenever the PDO and ENSO are in phase with each other. Annual streamflow is the single most sensitive terrestrial signal of climate variability in the PNW, and almost all climate impacts are mediated through the regional hydrology. Depending *solely* on whether the PDO is in the cool or warm phase, small changes in temperature (-0.2F to +0.3F) and precipitation (-4% to +2%) generate large changes in: snowpack (-15% to +17%), streamflow (-9% to +6%), survivability of Washington coho salmon (-16% to +19%), and frequency of forest fires (-49% to +65%). Depending *only* on ENSO, the impacts are on snowpack (-14.7% to +9%) and streamflow (-12% to +8%). When PDO and ENSO conditions are *in phase*, the impacts are enhanced for snowpack (-29.7% to +26%) and streamflow (-17% to +14%). More than half of the variations in annual salmon catch in the U.S. is associated with the PDO. The general pattern is that Alaskan fisheries do worse during the negative phase of the PDO (e.g., 1945-1977) and better in the positive phase (e.g., 1925-1945), while fisheries in Washington, Oregon, and California do worse during the positive phase and better in the negative phase. The implications of these findings are that management of many western salmon stocks are more vulnerable to (and constrained by) climate variations than managers had realized.

These efforts of the Pacific Northwest Climate Impacts Group have fed directly into research priorities for the US Climate Variability and Predictability (CLIVAR) program. The ultimate goal of NOAA’s participation in CLIVAR is to develop an understanding and skillful predictions of climate variability on seasonal-to-interdecadal time scales and regional space scales for optimal use in resource planning. Partly as a result of the implications of the research above, CLIVAR Pacific now invites work to understand PDO, particularly its mechanism and predictability, the role of air-sea interaction in setting its time scale, its influences on continental climate and connection to modulations of the ENSO cycle.

**BOX 2: Sensitivities of the Southwest's Urban Water Sector to  
Climate: Arizona case studies**

The CLIMAS project analyzed the water budgets of five Arizona cities to determine how severe the impacts would be from the deepest one- (1900), five- (1900-1904), and ten-year droughts (1946-1955) on record. Case study sites included the Phoenix Active Management Area and the Tucson Active Management Area (AMA). AMAs are areas in Arizona where stringent groundwater management is mandated under the 1980 Arizona Groundwater Management Act. The CLIMAS study showed that in each of these areas, even under assumptions of continuation of "average" climate conditions, issues persist regarding the possibility of achieving safe-yield (i.e., renewable supply and demand are in balance) by the year 2025, as articulated in the Act. The water sectors in the Phoenix and Tucson AMA are constrained by availability of both surface water, including Colorado River water delivered via the Central Arizona Project (CAP), and groundwater resources. Phoenix continues to be one of the fastest growing urban areas in the country. Here, serious water conservation efforts are notably lacking, even in the context of a relatively arid environment and continued high population and economic growth. The Tucson AMA encompasses the second-largest population concentration in the state. This AMA remains reliant on groundwater, although much of the area is making the transition to blending recharged CAP water with groundwater. Groundwater levels have fallen as much as 200 ft in the AMA since 1940.

In the Phoenix AMA, the capacity to draw upon multiple sources of surface water, groundwater, water banked under the Arizona Water Banking Authority, and (potentially) large amounts of effluent, provides an important buffer to drought. However, there are significant localized differences within the AMA. Each of the 31 large and nearly 80 small, water providers has a unique portfolio of water supply sources and customer base, as well as a more or less complex web of arrangements regarding treatment and recharge facilities. Longer-term, relatively severe droughts have potential to cause considerable problems in some areas, particularly those where groundwater pumping is the sole source of supply.

Unlike the situation in the Phoenix AMA, changes in water management in the Tucson AMA promise a decrease in the rate of groundwater overdraft anticipated in the near future. However CAP water is expected to account for most of this progress toward achieving safe-yield. As is abundantly clear from both paleo and historical records, the Southwest and Colorado River streamflow are characterized by very high degrees of climatic variability over annual and decadal time scales. Even if agriculture were eliminated and aquifer overdraft cut by half, withdrawals would continue to exceed renewable supplies under the drought scenarios used in this study. These results have now become a major point of attention by the Arizona Department of Water resources and the Governors Planning Commission in revising the 1980 Groundwater Management Act.

## *Project Review*

At present the RISA Program Manager convenes mail-in and on site panel reviews of RISA projects. The major coordinates for evaluating RISA projects lie on the broadly defined axes of the clarifying societal goals at the human-environment interface, on the development of a cooperative foundation for research and practice, on the distillation of lessons from comparative appraisals of current and past practices, and on the provision of usable information to public and private groups.

More specifically criteria used for evaluation on:

- Effectiveness of knowledge integration to address particular critical problems investigated in the project: To what extent are these problems defined by stakeholder or identified by researchers?
- Adequacy databases to answer questions posed
- Appropriateness of methods and scales for linking of physical and social issues
- Criteria for self-evaluation within teams: How does self-evaluation take place? Is the team spread too thinly over too many issues?
- Mechanisms for addressing varieties of “use” and of “user communities”
- Integration of temporal scales: How are short-term responses (such as a developing drought) addressed in the context of longer-term management goals?
- Education activities
- Mechanisms for providing and evaluating “services” and information transfer

## **6. Future Directions**

RISAs offer useful settings and opportunities to test, reframe, and evolve concepts such as place-based research, integrated knowledge, vulnerability, stakeholder interaction, user needs and decision-making. As these efforts evolve, the RISA Program and related research are anticipated to play central roles in developing, informing, and enabling, the delivery of relevant climate services for the social and economic benefit of the United States. The key focus for the future is on improving university/NOAA/regional relationships developed by RISA projects. The projects have uncovered or reinforced several insights in developing collaborations and partnerships between research and practitioners (**see Box 3**). Future emphasis will be placed on, (1) Strengthening each of the participation, information production, communication, dissemination and evaluation phases of the project activities, (2) Developing inter-agency partnerships, and related activities, (3) Developing collaborative projects with researchers from other research program elements of NOAA/OAR/OGP and (4) Enhancing the network of partners in a region depending on their respective areas of focus. If future funding permits then the next step is to develop new assessments pilots through regionally targeted Announcements of Opportunity.

**Box 3. The RISA teams have uncovered or confirmed many important insights about stakeholder partnerships. For example:**

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- Development/maintenance of stakeholder partnerships can only take place with researchers at the local to regional level
- Partnerships can not focus on climate variability alone: Efforts must be interdisciplinary and focused on the integration of the multiple stresses relevant to the stakeholder and region
- Stakeholder partnerships, once established, must be sustained; failure to do so will jeopardize the partnership and reduce hard-earned credibility
- Stakeholders can not be considered solely as individuals or only within the context of single economic sectors; regional assessment must be able to accommodate integration across individuals and sectors
- Stakeholders need demonstration that their needs, ideas and concerns are central to problems investigated in regional climate assessment and science
- Stakeholders need the guarantee that the quality of climate knowledge, particularly at their regional- to local-scales of interest, will be ever-improving; regional stakeholder-driven science represents a major gap in climate funding

The orientation towards providing an informed basis for Climate and or Environmental "Services" is one of the major distinctions between RISA efforts and the experience of previous climate impact assessments beginning with SCOPE (1986). To further refine this idea, an all-Principal Investigators meeting was held with NOAA OGP Program Management on September 6-7, 2000, followed by a full series of presentations in Special Sessions at the American Meteorological Society Annual Meeting in January 2001.

*Priorities for the immediate future*

As pointed out by all of the RISA teams, it is important that any regional program be structured, planned and implemented over the long-term. RISAs are moving towards integrating efforts of various agencies at local, state and federal levels. Programmatic commitments to secure and distribute funds to meet the research needs of each region are necessary. The RISA activities have shown that participatory and integrative research, that fully includes stakeholders, requires commitment of resources and agency to develop true partnerships with communities. This type of activity faces considerable barriers within University environments and Federal agencies.

Together with the RISA teams and OGP management, the RISA Program will initiate the following efforts to address the cross-RISA issues and to increase the visibility of RISA activities as a mechanism for integration within the University environment and among agencies:

- An ongoing series of brief white papers will be produced by RISA teams and management. These will begin by highlighting opportunities for collaboration among RISA projects, and identify common methods and guidelines for conducting and evaluating activities. Short descriptive issue papers on the role of climate, RISA activities, constituents and partners, and results of RISA projects on particular locally and nationally salient problems will be produced for distribution and discussion at these

different levels. Issues can include knowledge to date on climate-salmon relationships, fire-climate conditions, water supply vulnerability for particular cities in the Southwest etc.)

- A RISA steering council made up of lead PIs in the activities will be set up to offer guidance on Program evolution, to assist in reporting to NOAA, and for coordinating presentations to other agencies and local groups. Parallel groups made up of academic and non-academic representatives will be developed in each region to advise each effort. It is envisioned that the Program Manager will also call on this group to identify common areas of basic research on knowledge gaps and evaluation criteria within RISA and among OGP Program elements, that will be needed to address stakeholder relevant questions. One such area is in the large-scale climate dynamics and variations in the West (SW monsoon etc.) relevant to water resources, fire conditions etc.
- Criteria for assessing and communicating the impact of RISA activities within regions will be developed  
One of the major issues surrounding evaluation has been the inability to fully describe the end-to-end utilization of information on a particular problem. This has usually been the result of the proprietary nature of much information and its use. More effective and formal mechanisms for acknowledging and documenting information importance, use, and outcomes are needed
- Ties with interagency coordination groups (especially the Federal mission agencies) will be strengthened so that each group can stay abreast of research findings in other national and regional programs. Particular effort will be made to work with Program Managers in other agencies to identify sources for cooperation on particular issues (e.g. USDA and agriculture in the Southeast)
- Initiate a series of roundtables within the Washington DC area for teams to bring cross-regional concerns and issues forward in an integrative way

An immediate next step is to articulate a role for RISA and for OGP in informing the goals and implementation of Climate Services, broadly defined. In addition to inter- and intra-agency cooperation, RISA Management will begin to coordinate a response to this issue among OGP Program Managers. These activities will also form the basis of a RISA prospectus to be submitted to the NOAA/OGP advisory Panel and NOAA management.

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