PROJECT SUMMARY:
OUTPUTS AND RESULTS

MOVING FORWARD
Adaptation and Resilience to Climate Change, Drought, and Water Demand in the Urbanizing Southwestern United States and Northern Mexico

Supported by the National Oceanic and Atmospheric Administration
Sectoral Applications Research Program
NOAA/SARP Award # NA08OAR4310704
(2008-2010, with one-year no-cost extension to 6/30/2011)

and

INFORMATION FLOWS AND POLICY
Use of Climate Diagnostics and Cyclone Prediction for Adaptive Water-Resources Management Under Climatic Uncertainty in Western North America

Supported by the Inter-American Institute for Global Change Research
Small Grants Program for the Human Dimensions
IAI Project # SGP HD 005 (2007-2009; 2010-2011)

And

University of Arizona (UA)

July 2011

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Collaborating Scientists
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1) PROJECT OVERVIEW
Project Overview: http://udallcenter.arizona.edu/sarp/

Workshop summaries, photos, and selected presentations: http://udallcenter.arizona.edu/sarp/workshops.php

Border Climate Summary (most recent issue): http://www.climas.arizona.edu/outlooks/bcs

Working Paper Series (Case Studies) on Water and Climate in Arizona-Sonora Region:
http://udallcenter.arizona.edu/sarp/

2) PROJECT-RELATED PUBLICATIONS from SARP/CLIMAS/IAI Border Water and Climate Projects

STATUS	YEAR	TOTAL
In Progress	2011	38
Forthcoming or in press	2011	19
Subtotal in progress or forthcoming		57
In Print	2011	13
	2010	23
	2009	38
	2008	14
Subtotal In Print		88
TOTAL PROJECT-RELATED PUBLICATIONS 2008-2011		**145**

See attached outputs list for details.
These figures include only the publications of SARP or IAI team members (some of whom are also CLIMAS Co-PI's, including only Wilder, Garfin, and Frisvold). The publications include two edited books by SARP team members (Varady; Scott).

Peer-reviewed journals include:
Annals of the Association of American Geographers
Bulletin of the American Meteorological Society
Climate Research Critical Planning
Ecological Applications
Ecology and Society
Ecosphere
Energy Policy

Environment and Planning C
Environment and Urbanization
Environmental Science and Planning
Environmental Science and Policy
EOS
Geoforum
Geofísica Internacional
J. Environmental Policy and Planning
International J. of Climatology
International Negotiation
Natural Resources Forum
Natural Resources J.
Región y Sociedad
Revista Hidrica (Arg.)
Sonárida
Water International
Water Resources Research

3) PRESENTATIONS AT ACADEMIC AND PROFESSIONAL MEETINGS

MEETING TYPE	TOTAL	EXAMPLES
International	60	UNESCO (Paris); IHDP (Bonn); WorldWater Congress (Recife); World Water Forum (Mexico); World Health Orgaization (Ghana); French Research Ctr. (Jerusalem); Int'l Scientific Congress on Clim. Chge (Denmark); IAI Global Change Research (Uruguay, Panama; Mexico); Earth Systems Goverance (Amsterdam); Rosenberg Int'l Forum on Water Policy (Spain); AGU Joint Assembly (Mexico); Urbanization & Glob. Env. Chge & Glob. Land Use Program; also, Resilience Alliance (Arizona); ASLO Aquatic Society (France); Salam Ctr Theor. Physics (Italy)
National	43	AGU; American Forestry; International Drought Symposium; AAG; Applied Anth. CLIVAR Annual Summit; AMS; Colo. R. Symposium; Puentes Consortium; Univ. of Wisconsin-Madison; Univ. of Redwoods
University/Local/Regional/State	36	AZ Hydrological Society; Nat'l Weather Svce.; multiple university talks in AZ and Sonora
TOTAL	139	

4) URBAN WATER AND CLIMATE CASE STUDIES

We have published the case studies on vulnerability and adaptation from these studies as a Working Series on Water and Climate in the U.S.-Mexico Border Region.

Studies can be viewed and downloaded from the NOAA-SARP Project at the Udall Center for Studies in Public Policy at: http://udallcenter.arizona.edu/sarp/

Available for Download:

- Introduction to Case Studies (including theoretical framework, definitions, research design, and methodology)
- Ambos Nogales Case Study
- Puerto Peñasco Case Study
- Hermosillo Case Study (avail 8/31/2011)
- Tucson Case Study (avail. 8/31/2011)
- Executive Summary (avail. 8/31/2011)

5) SUMMARY OF STAKEHOLDER WORKSHOPS

WORKSHOP	LOCATION	DATE	ATTENDANCE
NOAA-SARP/CLIMAS/IAI "Moving Forward" Project Launch	Tucson, Arizona	Sept. 26, 2008	50
Water and Climate Workshop	Hermosillo, Sonora	Nov. 8, 2008	60
Information Flows and Climate Diagnostics for the U.S.-Mexico Border Region	Jiutepec, Morelos	July 9, 2009	50
Water and Climate Workshop and Research Team meeting	Puerto Peñasco, Sonora	October 2-3, 2009	75
Water and Climate Workshop	Hermosillo, Sonora	May 10, 2010	60
Climate Risk and Water Security	San José del Cabo, Baja California Sur	Feb. 27 – Mar. 2, 2011	40
TOTAL ATTENDANCE			**390**

OVERALL WORKSHOP RESULTS:
Development, field-testing, and refinement of Binational Climate Summary/Resumen del Clima de la Frontera, currently in its 10th issue.

Development of new binational networks of water managers (local, state, federal) and multidisciplinary group of researchers from Arizona, Colorado, Sonora and Baja California. Approximately 390 participants in series of 6 workshops in project.

Focused assessment of:

--adequacy of current climate information flows within agencies, among institutions, and across the U.S.-Mexico border

--water-and-climate related vulnerability of current and future water supply, focusing in particular on urban areas, peri-urban, and rural-urban interactions

The emerging recommendations on enhancing adaptive capacity cluster into four principal areas:

- First, the need and utility of forecasts and climate information products must be clearly identified, and prioritized, and steps should be taken to fill existing gaps.
- Second, distributing information is not sufficient for its effective utilization; improved understanding of information flows is essential for policy and adaptive response to climate and water uncertainty.
- Third, to be effective, programmatic responses must be built on existing agencies' mandates with careful consideration of how such initiatives will be institutionalized, including the need for new organizational forms.
- Finally, evaluation and follow-up of adaptive responses are essential; in other words, an evolutionary approach is required that continues to refine information flows, adaptation, and outcomes.

6) SUMMARY OF FIELDWORK

RESEARCH METHOD	FREQUENCY
Fieldwork visits	60
Stakeholder interviews	84
Online and on-site (at workshops) stakeholder surveys	4
Focus groups	3
Participant observation at meetings	10
Stakeholder workshops (5) and project launch (1) (390 attendees)	6

Fieldwork on vulnerability and development of case studies continued in all 4 sites. Fieldwork accomplishments: completed a total of 60 fieldwork trips (Tucson, Az, Nogales, Az, Nogales, Son., Hermosillo, Son., Puerto Peñasco, Son.), conducted 85 interviews (with a range of local and regional decisionmakers, NGOs, and residents), 2 focus groups and 4 days of participant observation with water trucks, attended 20 community and binational meetings (including the Arizona-Mexico Commission Water Committee, EPA's Border 2012; BECC Task Forces, and others), and completion of 4 stakeholder workshops. This fieldwork has resulted in solid contacts with local decisionmakers and NGOs, detailed data on municipal water use and water supply networks, information on proposals to improve, augment, or conserve the region's water supply, along with detailed ethnographic data on water supply vulnerability in *colonias*. Research assistants have also contributed to the publication and translation of the Border Climate Summary (BCS) and the production of bi-lingual webinars.

7) SUMMARY OF FINDINGS

A. **Binational Climate Summary/*Resumen del Clima de la Frontera* (BSC/RCF)**
Need for temporally and spatially specific climate information, forecasts, and products that address sub-regional levels and micro-climates within region is the key to improved utilization of such information by water managers, disaster relief planners, and other stakeholders.

Publication in Spanish is key for utilization by stakeholders in Mexico, and thus the bilingual focus (English/Spanish) of the BCS/RCF is essential.

Stakeholders are willing to engage with various BCS/RCF formats, including the current hard copy and internet-based newsletter format, as well as regional video-briefings and other formats.

Development of the BCS/RCF and sustained interaction at Cuernavaca and Peñasco workshops facilitated the creation of a new Memorandum of Understanding for future collaborations between the NOAA Office of Hydrology and Mexico's National Water Commission (CONAGUA) and National Weather Service (SMN).

B. **Vulnerability Assessments**
Arizona-Sonora study sites exhibit distinct, yet overlapping, characteristics of water-climate related vulnerability, associated with population growth and economic development (e.g., Tucson and Hermosillo); changing economy and lack of adequate urban planning and resources (e.g., Nogales, Sonora); and environmental vulnerability related to climate variability on the Gulf of California coast and the fragile coastal ecosystem and estuaries (Pto. Peñasco).

Augmentation strategies based on development of new desalination plants in both Arizona and Sonora can reduce some vulnerabilities (e.g., future water supply) while potentially increasing other vulnerabilities (e.g., equity and affordability of water; environmental).

Factors that contribute to vulnerability in Tucson and southeast Arizona include: lack of new sources of water supply to supplement existing sources; the near-exhaustion of conventional conservation strategies (Tucson) and need to develop innovative yet feasible water reuse plans; urban-agriculture conflicts over future water supply; and challenges in identifying politically and economically feasible adaptive management alternatives.

Factors that contribute to vulnerability in Hermosillo and northwest Sonora: insufficient institutional frameworks and lack of planning for climate-related reduction of vulnerability; lack of financial resources; continued centralized control of water management and financial authority; centralized generation of climate information; larger concentration of marginalized populations and incidence of poverty (than on Arizona side) creates different vulnerability characteristics.

C. **Institutional Capacity and Adaptive Management**
The emerging recommendations on enhancing adaptive capacity cluster into four principal areas:

First, the need and utility of forecasts and climate information products must be clearly identified, and prioritized, and steps should be taken to fill existing gaps. Climate information and forecasts that is specific at sub-regional level is highly desired by stakeholders.

Second, distributing information is not sufficient for its effective utilization; improved understanding of information flows is essential for policy and adaptive response to climate and water uncertainty. Communication of alerts and warnings must be tailored to

appropriate and available technologies (e.g., radio v. internet) and in the appropriate language.

Third, to be effective, programmatic responses must be built on existing agencies' mandates with careful consideration of how such initiatives will be institutionalized, including the need for new organizational forms.

Climate information and forecast products in Spanish are much more limited than in English; thus, newsletters and webinars that are available in Spanish serve an identified need.

Finally, evaluation and follow-up of adaptive responses are essential; in other words, an evolutionary approach is required that continues to refine information flows, adaptation, and outcomes. Continued formation of informal and formal networks of climate scientists, social scientists and stakeholders within the region will help facilitate this goal of sustained interactions around a goal-based theme.