
DECISION CENTER FOR A DESERT CITY II STRATEGIC PLAN

2010-2015

INTRODUCTION

The Decision Center for a Desert City (DCDC) at Arizona State University (ASU) was established in 2004 by the National Science Foundation (NSF) to advance the scientific understanding of environmental decision making in the face of deep uncertainty. Under newly awarded NSF funding, DCDC II will expand its already extensive research agenda, engage the policy-making community and build stronger links between scientific knowledge and action. New DCDC research will develop fundamental knowledge about decision making under uncertainty from three interdisciplinary perspectives: climate impacts, urban dynamics, and adaptation decisions. Simulation modeling and boundary organization studies cut across these themes and are a core component of DCDC activities.

DCDC II is focused on developing, implementing, and studying an integrated decision-support process for environmental decision making based on social science principles. Through an integrated approach to research and education, DCDC will train a new generation of scientists who can work successfully at the boundaries of science and policy, and produce innovative solutions to society's pressing environmental challenges. To accomplish these goals, DCDC II will build a dynamic bridge between ASU and local policy communities and seek global solutions for urban climate adaptation. This plan articulates DCDC's vision and mission, describes key tasks and outlines a process of evaluation based on both standard and innovative metrics.

INSTITUTIONAL CONTEXT: SUSTAINABILITY AT ASU

DCDC II benefits from its connection to ASU's Global Institute for Sustainability (GIOS), which has developed highly visible, trans-disciplinary research projects that convene faculty members from different units and link environmental science, social science, and policy. As the intellectual home of DCDC II, GIOS offers access to resources on the leading edge of sustainability science and practice—a field centered on the *interconnectedness* of economic, social, and environmental systems. Through a wealth of local, national, and international partnerships, GIOS facilitates DCDC II's efforts to build scientist-stakeholder relationships and disseminate the principles of managing environment risk more widely. ASU's Decision Theater, managed by GIOS, offers a decision laboratory and visualization space for experimenting with, and applying these science-based solutions for societal problems. GIOS fosters solutions to important societal problems through interdisciplinary centers, such as the Central Arizona Phoenix Long Term Ecological Research (CAP LTER) project, and offers degree programs in sustainability at its School of Sustainability. GIOS' focus on urban systems examines the potential for broader impacts in a world where more than half the population, 3.3 billion people, live in cities and, as such, produces interdisciplinary research that directly supports the vision and mission of DCDC II.

VISION, MISSION AND STRATEGIC GOALS

The vision, mission, and strategic goals are established by the DCDC *Co-Directors* and *Executive Committee* in consultation with the *External Advisory Committee* with guidance from the National Science Foundation. The vision, mission, and strategic goals establish priority objectives for core research, education, and outreach activities. This plan is implemented by internal leadership groups – faculty, students, and staff - and success is measured by metrics that track progress and accountability.

DCDC II VISION

- DCDC II is an interdisciplinary research center advancing knowledge, education, and community outreach for urban climate adaptation.
- Within the Center’s activities:
 - Research, learning and outreach are synergistic activities that feed upon and reinforcing one another.
 - Discovery occurs at the intersection of basic and applied research where new strategies are found to address real-world societal problems.
 - New data collection and analysis is adequately mixed with synthetic discoveries based on integrating existing data, models, and knowledge.
 - Problem solving is adaptive and reflexive, building upon past experiences and lessons learned in other centers engaged in the newly evolving field urban climate adaptation.
 - Emphasis is placed on feedbacks and nonlinearities that produce unintended consequences and reveal hidden vulnerabilities in complex urban resource systems.
 - Scenarios, simulation modeling, and principles of decision making under uncertainty build capacity to anticipate the future.

DCDC II MISSION

- Develop new understandings of how complex urban systems will function in a changing climate.
- Translate climate modeling and research into tools for managing complex urban systems in the face of climate change and other environmental risks.
- Build a boundary organization in which science is informed by and informs policy and decision making.
- Develop and implement learning opportunities at the boundary of science and policy for students interested in urban climate adaptation.
- Communicate the need for urban climate adaptation to decision makers and larger public audiences.

DCDC II STRATEGIC GOALS

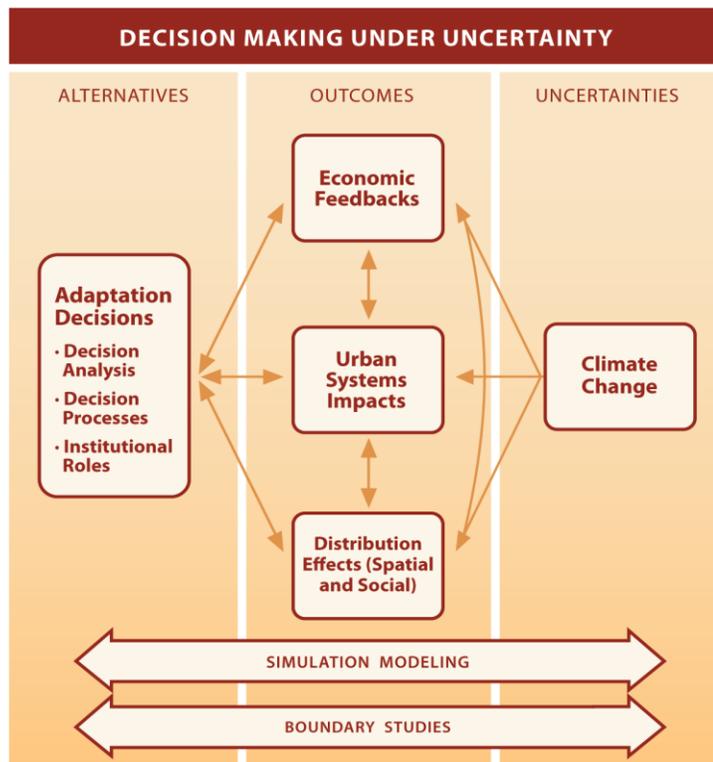
- Advance fundamental knowledge about critical linkages and feedbacks in urban resource systems.
- Apply the principles of decision making under uncertainty to water and other environmental decision making.
- Identify critical tradeoffs inherent in managing urban systems in the face of a changing climate.
- Establish best practices for developing, implementing and disseminating the concept of a boundary organization.
- Mentor the next generation of interdisciplinary scientists skilled in linking knowledge to action.

INTERDISCIPLINARY RESEARCH

GOALS, PERFORMANCE

OBJECTIVES, AND KEY TASKS

DCDC is organized around water and other environmental resource decisions in a complex, dynamic urban system. The DCDC research plan is conceptualized in terms of a decision process that links interdisciplinary research projects in a broader effort to inform urban decision makers about the evolving challenges of coping with a changing climate. DCDC's conceptual approach is illustrated in the diagram: the uncertainties of climate change affect individual and societal alternatives (adaptation decisions), but function through an urban system with economic feedbacks and distributional (social and spatial) consequences. Points of focus for DCDC's interdisciplinary research agenda are: 1) climatic uncertainties, 2) urban-system impacts, and 3) adaptation decisions. Simulation modeling and boundary studies cut across these themes and are core DCDC activities. Center research advances fundamental knowledge within disciplines while also striving for integration, synthesis and transformational new *transdisciplinary* knowledge.



DCDC Conceptual approach, research foci, and points of articulation.

INTERDISCIPLINARY RESEARCH GOAL

- Advance fundamental knowledge

PERFORMANCE OBJECTIVES

- Disseminate research through an average of 30 publications per year in books, chapters, and peer-reviewed journal articles.
- Make an average of 20 presentations to national/international conferences per year.
- Leverage DCDC II funding by developing and submitting 2-4 proposals per year where a DCDC II investigator is Co-PI or lead PI.
- Serve as key partner in 2-4 proposals per year with a DCDC II investigator in a supporting role.
- Increase the dollar value of proposal submissions by 15% over 2004-2009 levels.
- Sustain and enhance social capital between DCDC researchers and stakeholders by *doubling* the interactions between DCDC affiliates and stakeholders as measured by social network analysis.
- Increase by 50% the number of journals articles and reports co-authored by DCDC scientists and policy stakeholders.
- Increase by 25% the number of collaborative workshops that DCDC sponsors annually.
- Increase by 50% the number of joint research projects that include DCDC II scientists and community partners.
- Increase and document the impact of DCDC research on water and environmental decision making in Phoenix via structured feedback with local decision makers.

INTERDISCIPLINARY RESEARCH KEY TASKS

CLIMATE IMPACTS RESEARCH

Prior DCDC research identified and addressed the major climatic uncertainties facing Phoenix, including inter-annual drought, climate change, and the urban heat island and explored the sensitivity of urban water demand to variations in climate. DCDC I research also documented the increasing uncertainties associated with climate model results.

KEY TASKS FOR DCDC II

- Refine the hydrological model to represent the physical characteristics and hydraulic dynamics of the Phoenix watershed.
- Determine key areas that generate water supply (e.g., what happens if land use/cover changes), the importance of precipitation intensity (e.g., what happens to extremes under future climate change), the importance of snow versus rain (e.g., what happens to precipitation type under future climate change), and the potential effects of changing land-use conditions with wildfires, urban development, and agricultural policies.
- Explore the sensitivities of energy demand and production (e.g., hydroelectric) to changes in climate-change induced warming and, more importantly, the sensitivity of combined water and energy use to climate change.
- Re-conceptualize energy and water as tightly coupled resources and examine the effects of climate change on this coupled resource system.
- Simulate changing climate conditions on resource decision making in other cities (e.g. Portland and Las Vegas) and conduct more comparative studies with Phoenix.

ADAPTATION DECISIONS

Adaptation decisions involve choices at the individual and societal levels in response to climatic uncertainties. These often uncoordinated adaptations of individuals aggregate into changes in social, economic, and environmental conditions that prompt institutional responses that can function to the detriment of regional adaptation. DCDC II will advance fundamental knowledge about adaptation decisions under uncertainty from three perspectives: decision analysis, decision processes, and institutional roles in decision making.

KEY TASKS FOR DCDC II

- Establish, implement, and study the “Central Arizona Decision Forum” (CADF), host annual meetings of the CADF, and establish a virtual (web) presence.
- Apply structured decision analysis to critical tradeoffs facing local water providers in the CADF.
- Apply principles of evolutionary psychology to individual and household resource decision making in Phoenix. Apply results to the design of more innovative and effective water conservation programs.
- Use institutional analysis and social network analysis to analyze the capacity of urban governance systems to anticipate and adapt to a changing climate.
- Use spatial optimization models to explore the capacity for more cooperative institutional structures to cope with the uncertainties of climate change and share the results with CADF.

ECONOMIC FEEDBACKS AND URBAN SYSTEMS IMPACTS

Adaptation decisions affect urban systems by making them more or less resilient, distributing risk, and altering the trajectory of the economy. Adaptation decisions thus can be studied in terms of their impacts on economic feedbacks and urban-systems and the spatial distribution of the effects.

KEY TASKS FOR DCDC II

- Develop policy-relevant frameworks for evaluating the effectiveness of price and non-price responses to water scarcities.
- Integrate residential water policies into a spatially explicit equilibrium model describing how households in select communities affect water behavior and decision making.
- Model feedbacks between energy and water in urban system resource management.
- Quantify key tradeoffs in coupled human-natural systems and assess the potential effects of climate change on these tradeoffs (working with CAP LTER).
- Integrate pricing schemes and market principles into optimization modeling of spatial risk by working with GeoDa Center for Geospatial Analysis and Computation at ASU.
- Employ Vulnerability Scoping Diagram to assess risk of water shortage for providers in the Phoenix area and compare Phoenix’s vulnerability to other large cities through work with C. Polsky of Clark University.

BOUNDARY ORGANIZATIONS RESEARCH

From the outset, DCDC was conceptualized as a boundary organization designed to enhance the linkages between scientific knowledge, policy decisions, and public action. DCDC II represents an ongoing effort to implement, test, and refine boundary-organization theory and improve water and environmental management decision making under uncertainty.

KEY TASKS FOR DCDC II

- Hire *Director of Stakeholder Relations* to facilitate ongoing communication between DCDC researchers, the policy community, and other partners.
- Launch and systematically investigate the activities of the CADF.
- Establish and implement “fast track coaching” for faculty members and students working with stakeholder organizations.
- Collaborate with the ASU Morrison Institute for Public Policy to produce water and energy policy reports for their “Sustaining Arizona” initiative.
- Conduct a follow-up to Parker and Crona’s social network analysis of DCDC I to measure changes in the social organization and identify management strategies to enhance science-policy collaboration.

SIMULATION MODELING AND DECISION SUPPORT

WaterSim is a mechanism to integrate the various threads of DCDC research by communicating the importance of climate change for resource management and functions as a space for systematic investigation of science-policy collaboration. In DCDC II, it will be used to capture dynamic feedbacks between *xyxyx* in the urban system (e.g., price and growth, water conservation, and heat amelioration) and act as an anticipatory tool for risk assessment and decision support.

KEY TASKS FOR DCDC II

- Produce annual updates of WaterSim or *five new model versions over five years*.
- Implement a monthly time step to simulate seasonal water demand.
- Integrate water quality with water quantity and the way decisions about one impact decisions about the other.
- Integrate water and energy as coupled resources and illuminate critical feedbacks (and vulnerabilities) in the urban resource system.
- Increase and regularize stakeholder input to WaterSim development
- Expand stakeholder input to include land and sustainability staff from city and state agencies, the private sector, nonprofit organizations, and public at-large.
- Conduct a formal evaluation of WaterSim with key stakeholders through focus groups and survey methods in Years 2 and 4.

EDUCATION AND RESOURCE DEVELOPMENT

Educational components of DCDC II will use interdisciplinary and community-embedded collaboration to educate graduate, undergraduate, and K-12 students and efforts to reach larger public audiences will be expanded. The aim of DCDC II is to understand water and resource decision making under uncertainty (DMUU), build skills in interdisciplinary thinking and learning, contribute to integrating work within DCDC and among all DMUU collaborative groups, and create leaders in integrated research and community collaboration. Graduate and undergraduate students will engage in a mentorship relationship with a faculty member or community partner for a full academic year and participate in year-long, interdisciplinary seminars.

KEY TASKS FOR DCDC II

- Support at least six graduate research assistants per year and sponsor them in DCDC's Community of Graduate Research Scholars seminar.
- Support at least four REUs per year and sponsor their participation in the interdisciplinary Community of Undergraduate Research Scholars seminar.
- Host annual poster symposium showcasing work of graduate and undergraduate students.
- Place and oversee at least three DCDC internships in local resource agencies.
- Establish mentoring program for students in local agencies.
- Increase the number of graduate students who serve as mentors for undergraduate students.
- Host Advanced Water Educators workshop annually.
- Develop and implement sustainability learning modules in area high schools and partner with the ASU School of Sustainability in K-12 Sustainable Schools program.

COMMUNITY AND INSTITUTIONAL OUTREACH

Reaching out to communities of students, educators, public and private agencies, and elected officials is vital to DCDC II's mission of linking science and societal action. Outreach enriches research efforts and provides valuable experiences for students.

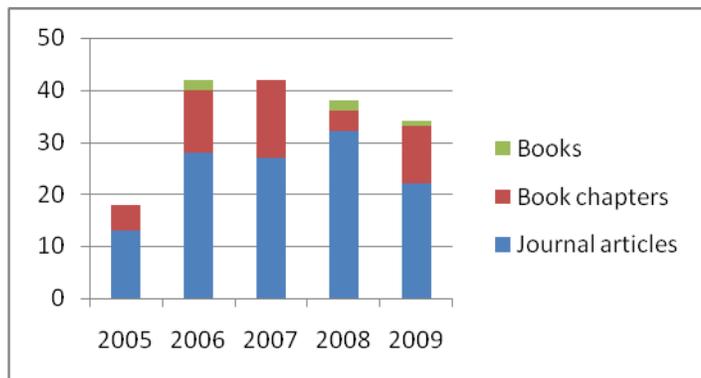
KEY TASKS FOR DCDC II

- Host 8-10 Water/Climate Briefings per year.
- Collaborate with the Sustainable Cities Network to increase the use of WaterSim for long-term water planning.
- Convene an annual Desert Cities Town Hall to increase dialogue about climate adaptation strategies.
- Continue collaborative workshops on climate modeling and adaptation with the University of Arizona.
- Produce public education materials and briefs for climate adaptation, risk management, and decision making under uncertainty.

EVALUATION AND ASSESSMENT OF THE STRATEGIC PLAN

Evaluation and assessment of federally funded research centers traditionally focuses on outcomes tied to incentives built into university systems such the number of researchers trained, research proposals submitted, grants awarded, and books, chapters, and journal articles published. DCDC II will employ these traditional measures to assess performance.

Center activities will be also evaluated by the External Advisory Council, (EAC) composed of experts representing diverse fields and organizations concerned with decision making and climate uncertainty. The EAC will meet annually to provide their perspective on center priorities and effectiveness and make recommendations on DCDC's performance in accomplishing goals for core research, education, and outreach activities.



In addition to traditional performance metrics and advisory committee feedback, an institution focused on participatory research should also consider other metrics, such as increased capacity in social networks and relevance and impact of scientific knowledge. Therefore, evaluations will also assess the extent to which DCDC activities build social capital and adaptive capacity by broadening networks of researchers and practitioners, and enhancing salience and policy-making relevance of scientific knowledge. Finally, using in depth observation and process tracing techniques, DCDC activities will be evaluated for their impact in solving society's environmental challenges. Combining outcome-based and social-capital evaluation yields a superior measure of the value of knowledge created and the social processes by which knowledge is produced and valued.

CONCLUSION

Since 2004, DCDC has been engaged in policy-relevant, interdisciplinary research, community-embedded graduate and undergraduate education, and robust collaboration with community partners. This strategic plan is designed to ensure DCDC's continued leadership in these areas to improve society's ability to adapt to a changing climate.