**RCN-SEES: Climate, Energy, Environment and Engagement
in Semiarid Regions (CE^{3}SAR)**

1. INTRODUCTION AND OVERVIEW

The proposed research coordination network (RCN) – Climate, Energy, Environment and Engagement in Semiarid Regions (**CE^{3}SAR**) – will develop an innovative model for conducting interdisciplinary, region-specific, sustainability research closely tied to the needs of highly-engaged local stakeholders. RCN CE^{3}SAR will build **a research network in South Texas** that aggregates **regional research capacities** specific to sustainability in semiarid climates contiguous to the Gulf of Mexico while **leveraging research expertise from outside the region**. It will be a comprehensive partnership of researchers advancing the understanding of science, engineering and education for sustainability (SEES). The network also will focus on regional engagement and education by engaging regional communities, government and private-sector stakeholders *throughout the process*. By aligning regional capacities that heretofore were largely disconnected, RCN CE^{3}SAR will bring focus and synergy to a range of research that will profoundly impact the region and its socioeconomic future.

The network will be led by **Texas A&M University-Corpus Christi** (**L. Cifuentes, PI;** Harte Research Institute; Conrad Blucher Institute), in partnership with **Texas A&M-Kingsville** (NSF CREST Center for Research on Environmental Sustainability in Semi-Arid Coastal Areas; Caesar Kleberg Wildlife Research Institute), **Texas A&M International University** (Binational Center), **University of Texas-Brownsville, University of Texas-Pan American** (Sub-Tropical Research Center), and **Texas State University** (River Systems Institute), all Hispanic-serving or minority-serving institutions. Partners bringing expertise to the network from outside the region include the **Southwest Research Institute** in San Antonio and **Texas A&M University** in College Station (Texas Water Resources Institute, Texas Center for Climate Studies, Institute for Science, Technology & Public Policy, and the Center for Housing and Urban Development). Additional partners from institutions within and outside the region will be recruited throughout the five years of the project in accordance with the network's strategic plan.

GOALS, OBJECTIVES AND RATIONALE

The proposed CE^{3}SAR RCN will focus on the *regional convergence and interrelated impacts* of changes in climate, energy production and the environment – especially the availability and use of water – in the South Texas region over the *next twenty years*, specifically as they intersect with the rapidly growing Hispanic (81%) population of 4 million in a region larger than many states. The South Texas region comprises 28 counties, 8 of which border Mexico and 8 the Gulf of Mexico, where coastal environments transition to semiarid regions (**Figure 1**). Here, the convergence of changing **climate, energy and the environment** will profoundly affect South Texas socioeconomic factors, geographic distribution patterns, and educational and cultural institutions in myriad ways (**Figure 2**).

While much of the science of sustainability is focused on the global scale, **local communities and institutions** in South Texas and elsewhere will have to make critical decisions over the next 20 years related to *water, energy and use of space*. In order for sustainability science to inform those decisions, scientific knowledge must be available at relevant

Figure 1. RCN CE^{3}SAR will focus on sustainability in South Texas, a region the size of many states. Blue dots show initial RCN institutions

scales, and the **science must be understood and accepted by the community**. For that to happen, *the community must be engaged by and with scientific research*, and researchers must have strong connections with the community.

Experience has shown that the model of importing researchers from outside the region with little connection to the community to conduct their research, leave and publish in a scholarly journal results in low acceptance of research results by local decision-makers and by the community (Kellstedt, Ahran and Vedlitz, 2008). Residents in South Texas have been historically isolated and are suspicious of "outsiders." It has become clear that in order for sustainability research to have a local impact, it must be advanced by regional researchers who may draw on national and international expertise.

Figure 2. RCN CE[3]SAR will focus on the impact of climate change, growing population and a changing energy landscape as they interact with complex socioeconomic variables in a coastal-semiarid region.

The overarching goal of the proposed CE[3]SAR network is to form a robust research, educational and engagement network of regional universities and research centers and institutes focusing on the use of sustainability science to meet the regional needs of this **historically underserved region**. Because these universities, research centers and institutes are immersed in the region's cultures and communities, they are strategically positioned to recognize region-specific sustainability research needs and have associations with the stakeholder communities that are vital to effective engagement. This goal will be achieved through a **5-year strategic plan** to define operational goals using a *charrette* process led by network members during the initial period of the grant. Our long-term vision will be to use a strategic, iterative process to **integrate existing and consolidate new network collaborators** among a multitude of disciplines and domains related to sustainability, and conduct regional engagement activities that meet stakeholder needs specific to South Texas. This networking process will blend institutional capacities resident in South Texas and recruit national and international expertise to build an energized, aligned, and synergistic research network that will advance sustainability science in the South Texas region ***and engage affected populations in this process.***

The networked research and educational capacities will focus on critical domains and intersections among a range of regional sustainability variables including: **physical variables** such as climate, water and energy***; spatial variables*** such as scale, geographies and community locations***; and socioeconomic variables*** such as populations, cultures and institutions. Moreover, just as social, economic, and ethical issues are addressed as elements of "environmental justice," there are what might be called "**sustainability justice**" issues that are functions of economics, education, culture, geography, and scaling among population groups. ***To address these issues, it is critical that the proposed network make knowledge-based sustainability science relevant and accessible to all of South Texas' populations, socioeconomic groups and cultures.*** Moreover, RCN CE[3]SAR will be well positioned to advance common research agendas related to the Gulf of Mexico with the United Mexican States, particularly given that a range of climate drivers dynamically impact coastal waters and the Rio Grande/Rio Bravo del Norte watershed. Robust enabling infrastructures exist among RCN CE[3]SAR members for quickly establishing **RCN-specific partnerships with counterparts in Mexico.** For example, CE[3]SAR co-PI Jorge Vanegas was inducted as a member of the Pan American Academy of Engineering in 2010. Members of the Harte Research Institute advisory board are well connected with high-ranking officials of academia, government and industry in Mexico. The River Systems Institute is collaborating with Mexican researchers on a United Nation's funded collaborative project to develop a regional framework for sustainable use of the Rio Bravo. Finally, most members of RCN CE[3]SAR live in close proximity to Mexico, geographically as well as culturally, and have had decades of successful research partnerships with Mexican counterparts.

Methodological foundations that will guide our strategic plan and create new partnerships and products generated by network activities will be based on **two key tools** (below) and the enabling capacities each brings to the process, from strategic planning, to evolving network partnerships, to long-term regional engagement. (**Figure 3**)
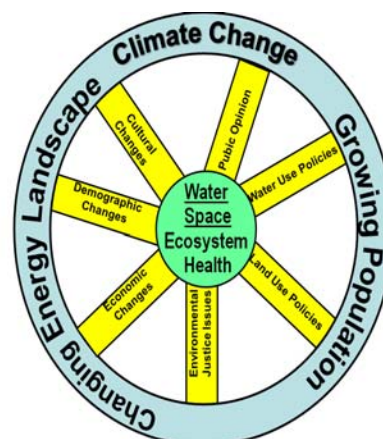
1. Scenario and strategic planning will identify key areas of focus for the network, allowing a planned rather than a reactionary process. It will ensure that there is a continuous feedback loop as new knowledge allows development of better scenarios and ensures that key knowledge is not lost to future events, particularly catastrophic events such as those that have impacted the Gulf coast in recent years. The RCN will use tools and models (e.g., Shell Oil Company's classic work in energy scenario planning) as well as capacity within the CE³SAR network (J. Vanegas), to apply a scenario-planning methodology to conduct network strategic planning during startup. The result of the scenario and strategic planning process will be a *five-year operational plan and the twenty-year vision* for RCN CE³SAR that will engage the South Texas region, its institutions and populations.

2. Geographical information systems (GIS) will capture, manage, analyze and display research data as geographically-referenced information, which will better equip the RCN to reveal research relationships, directions, patterns and trends among key variables identified in scenario and strategic planning. This will allow predictive analysis and linking of research data, expertise and domains at different scales to enhance understanding of how people live in "space" and what happens in those spaces as changes in climate, energy and environment interact. GIS also will play a key role in the network as an integrator of disciplines, particularly the social and behavioral sciences. It will illuminate intersections among disciplinary, natural and public domains and facilitate dissemination of new

Figure 3. GIS will act as the integrating platform for bringing together the research of a multidisciplinary group of scientists and students to inform proactive planning for the South Texas region.

knowledge. GIS will provide a method for engaging communities through the visual presentation of complex information that will lead to better understanding of issues critical to sustainability at regional scales.
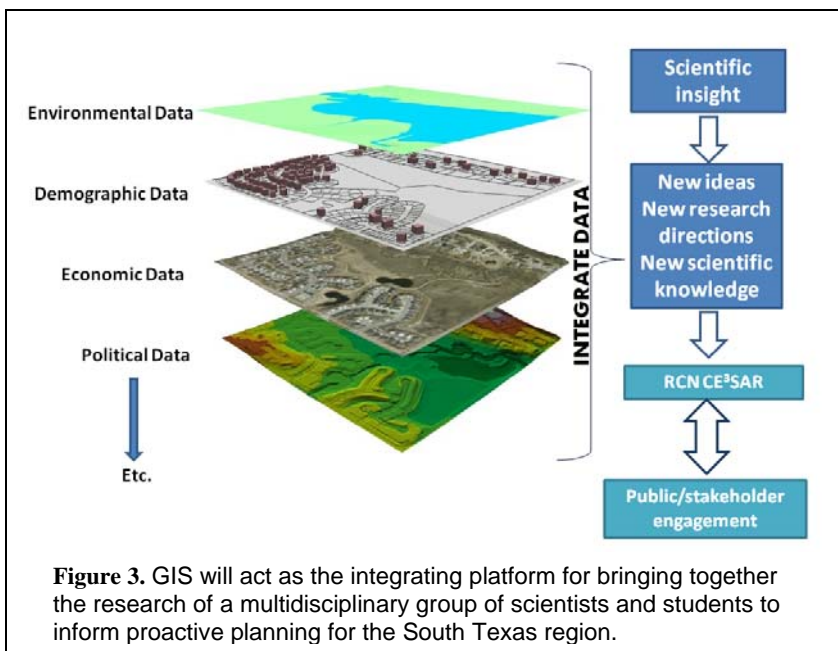
OVERVIEW OF ACTIVITIES, MANAGEMENT AND COORDINATION STRATEGY

The activities, management and coordination of the proposed RCN CE³SAR are structured to implement a five-year strategic plan for a South Texas-focused network whose development will inform and enable a twenty-year vision for coordinated research in sustainability science as it affects the regional culture, institutions and populations in South Texas. Defining expected outcomes over the five-year project period is the key issue that the network will address during startup. Several expected outcomes are clear now, while others will be defined over time as the network evolves. **The clear five-year outcomes are these:**

- Establish a robust and *sustainable regional network* of researchers in universities, centers and institutes, predominantly in South Texas, better able to communicate and coordinate their research efforts across disciplinary and institutional domains, engage new researchers in the network, and train and engage students in research. In so doing, the RCN will develop research and educational partnerships that will position them to be competitive for collaborative research grants funded by federal and State agencies, foundations and private industry, particularly center-level research grants.
- Establish a robust, mature and **sustainable regional network** of researchers in universities, centers and institutes predominantly in South Texas that can successfully translate sustainability science issues related to climate, energy and environment at various scales in South Texas. This will advance consensus-based engagement by the predominantly Hispanic and diverse regional populations, cultures and institutions.

- Establish robust, mature and **regionally sustainable** research and educational collaborations among the partner institutions, particularly the six HSI/MI lead universities, that will engage undergraduate and graduate students in network research, develop new curriculums, promote student research in sustainability science, and translate for dissemination research information to the public as one way of ensuring realization of the twenty-year vision.
- Establish a robust, mature and more nuanced understanding of the intersection of sustainability research and implementation in predominantly Hispanic South Texas with the socioeconomic, cultural and historic factors that will significantly influence acceptance.

ROLES OF PARTICIPANTS

The model used for engaging network partners in the initial development of this proposal will form the starting point of an evolving process of participant engagement for network implementation. This process began with extensive development discussions with initial participants of the proposed RCN conducted over a two-month period prior to submittal of this proposal. A network-capacities matrix was developed of sustainability-related research and education expertise across all RCN institutions. This matrix was then distilled to four thematic intersection areas based on research strengths and interests of the initial network participants: **climate, energy, environment and engagement**.

Members of the steering committee were selected, in part, because of their connections to existing networks in their disciplines and to international collaborators, federal and state agencies, industry, and NGOs. This model of distributed leadership will help transcend disciplinary silos by recruiting key individuals who function as "brokers" in the social network, facilitating collaboration among previously unconnected groups (Gray, 2008). Many steering committee members are directors of centers; for example, **Dr. Gary Jeffress** and **Dr. Venkatesh Uddameri** were chosen for the clear synergy inherent in their decades-long research in geographic information systems as applied to the coastal Gulf of Mexico and sustainability (**Jeffress**) and in environmental systems modeling and informatics (**Uddameri**).

Dr. Jeffress directs the **Conrad Blucher Institute (CBI) for Surveying and Science** at Texas A&M University-Corpus Christi (TAMUCC). CBI conducts a number of monitoring and research projects for federal, state and local government related to coastal sustainability sciences. The Texas Spatial Reference Center (TSRC) at CBI conducts geodetic surveying and mapping research in the Gulf Coast region and has conducted numerous research projects, including mapping shoreline for beach erosion, and hydrographic mapping using new technology sensors designed at TAMUCC. In addition, the **Division of Nearshore Research** at TAMUCC oversees the **Texas Coastal Ocean Observation Network (TCOON)**, a series of real-time sensors along the Texas coast that collect environmental data utilized to determine littoral boundaries as well as supporting other sciences.

Dr. Uddameri directs the NSF-funded *Center for Research Excellence in Science and Technology (CREST) (**Research on Environmental Sustainability of Semi-Arid Coastal Areas**)* and has received $10 million in NSF funding over the past 10 years. The center is organized around three integrated research subprojects: Living Laboratories for Academics and Research, Environmental Systems Modeling and Environmental Informatics. One of the CREST center's principal goals has been to serve as a **major environmental sustainability research resource in South Texas and the border region**.

2. BACKGROUND AND JUSTIFICATION

THE SCIENTIFIC NEED

The proposed RCN CE^{3}SAR will bring together researchers from a number of South Texas universities and connect them with each other as well as with the expertise and resources at research institutions outside the region. While CE^{3}SAR will focus specifically on the coastal/semiarid South Texas region, it is expected that this approach will **serve as a model for other regions on how to build on the capabilities of regional universities, leverage national expertise and engage local communities to proactively address sustainability challenges and impacts on various stakeholders.**

Initial questions that will drive the RCN strategic planning process will begin with those that arise from the three convergent domains key to addressing sustainability in the South Texas region: climate, energy and environment. **The "founding" questions of the proposed RCN CE^{3}SAR include**: *What does sustainability mean in a semiarid region? What are sustainable boundaries for population groups in semiarid regions? How is sustainability in South Texas impacted by political, cultural and religious*

assumptions? What tools are needed to address sustainability at community level? How can sustainability be viewed at various spatial scales? How does sustainability affect those without education or socioeconomic resources? How is the issue of water – the "currency" of sustainability (the "canary in coal mine indicator") –best addressed in South Texas? How does public opinion affect how energy, water and geographical space are used? How do South Texas political systems affect decisions and policies that affect sustainability? How can research results be effectively communicated to local communities (taking into account demographic, cultural, language and economic changes in the region)? Addressing these questions demands bringing together researchers from a wide range of disciplines, including but not limited to climate science, communication science, economics, ecosystem science, energy sciences, environmental science, geospatial science, hydrological sciences, ocean sciences, philosophy, political science, sociology and public policy.

Geospatial technology will serve as an integrating tool to aggregate research from these various disciplines. All of the research questions are strongly linked with spatial distribution. For example, distribution of population (e.g., 2010 census data are tagged for GIS) and population growth across geographical space will strongly affect energy demand, water usage, water quality and related environmental impacts. Similarly, education, economic status and other sociological factors are spatially distributed, as are related effects on land usage, energy and water consumption and quality, and underlying policies that influence resource sustainability. Because the relationships are complex, imperfectly correlated in space and variable in time, it will be essential to integrate, analyze and display these data using GIS technologies. By this, RCN CE^{3}SAR expects to gain new, transformative research insights, and to stimulate new lines of research with powerful implications for understanding issues related to sustainability in South Texas. Specifically, the intersection of the South Texas coastal region with contiguous semiarid regions has unique characteristics related to sustainability science research. The region has limited access to fresh water, for example, with recent droughts exacerbating that shortage. Any proposed long-term solutions will be significantly impacted by the capacity of research networks to **understand and appreciate how political dynamics related to solutions will be driven by the needs and interests of often-contentious stakeholders operating at multiple scales**.

South Texas also will be facing critical decisions regarding energy resources, as dependence on oil becomes progressively less tenable in an economy significantly yoked to the production of hydrocarbon fuels and products. At the same time, the region has optimum conditions for on- and offshore wind energy, year-long climatic conditions favorable to solar energy, and some potential for geothermal energy. These counterpoised aspects of the South Texas energy landscape help define proposed RCN research objectives acknowledging that "commitment to sustainable energy policies will require development of methods to integrate scientific and technical information with social, economic and environmental concerns." (*Building a Sustainable Energy Future*, NSF/NSB-09-35)

These conditions converge in South Texas to present a complex array of environmental, social, economic, political and cultural issues that must be addressed by the RCN research objectives and vision in an integrated way. Just as the effects of climate change and population growth are seen at **multiple scales** – individual to global – decisions, behaviors and policies that will determine how successfully any region meets these challenges will be made over multiple scales – individual to regional. Most sustainability research, however, concludes at larger scales, but it is at these smaller scales where proposed RCN research can have the broadest impact; otherwise decision makers who have insufficient information may make many critical decisions at these smaller scales. Moreover, decisions at those scales are strongly influenced by socioeconomic factors (e.g., culture, language proficiency, education level, income level) and political structures (e.g., zoning boards, local government coops, regional policy bodies). The intersection of sustainability science with *all* regional conditions inherent in South Texas presents regional and national scientists from all disciplines a unique opportunity to develop a research network that maps to the larger societal domains that influence the acceptance, engagement, and implementation of scientific outcomes under the umbrella of climate, energy and sustainability science.

CURRENT STATE OF KNOWLEDGE

Climate change, population increases, changes in energy sources and other human impacts such as pollution and civil infrastructure are expected to have profound effects on South Texas. These factors will affect availability and quality of water, availability of land, wildlife, fisheries, agriculture and air quality. These changes, in turn, will have complex social, economic, political and health impacts. While many of these effects have been studied discretely, decisions made by policy makers and various communities

must take into account complex interactions of all of these factors. Science too often fails to provide concrete information policy makers and their communities need to make critical decisions. *Considering the challenges that South Texas is facing, it is imperative that scientists adopt **a new approach**, working across disciplinary lines to generate the integrated, comprehensive knowledge to inform these complex issues and conduct scenario planning.*

Rainfall: South Texas is already known as a "problem climate" because of the challenges it presents to humans and ecosystems alike. Situated between the eastern humid regime and the western Chihuahuan Desert, the region is classified as subtropical – "sub-humid to semi-arid." With its often humid weather and wind-blown landscapes of cactus- and mesquite-filled brushland, it has been called a "desert jungle" [Norwine and John, 2009]. Climate change is expected to exacerbate many of the region's challenges. Predictions with a 2/3 likelihood are that South Texas will warm at the about the same rate as the global average [North, 2009]. The region's infamous variability in rainfall is expected to increase accompanied by prolonged droughts and extreme rainfall events [Norwine and John, 2009]. Tropical summers will be longer, and rivers will have increased difficulty reaching the Gulf of Mexico, presenting additional problems for estuaries and habitats that depend on them [North, 2009].

Sea-level Rise: Sea-level rise over the next century is expected to have a disproportionate effect in South Texas because of its flat topography [Twilley, 2001]. This sea-level rise will impact not only the health and productivity of salt marshes and bays but also human populations living in coastal areas. Estuarine-dependent species, such as oysters, blue crabs and shrimp, are expected to decline with unknown impacts on the economy and social systems dependent on the fishing economy. Coastal fisheries, a multimillion-dollar industry, also may be affected by declining water quality. Tidal flats and Gulf beach habitat are predicted to decrease in area, while estuarine marshes, mangrove and sea-grass habitats are expected to increase [Montagna et al., 2009].

Air Quality and Health: A modeling study conducted in 1999 to assess potential effects of climate change on ozone levels in South Texas predicted in the worst case an average of 34% increase in the area exceeding the National Ambient Air Quality standards for ozone in the year 2100 [Biswas and John, 2009]. However, to our knowledge, no one has explored the combined impact of climate change, increasing population (with concomitant increasing pollution) and changes in the energy landscape. (For example, what would be the effects of a new coal-burning power plant South Texas?) Further, the question remains how these impacts will affect changing demographics, which may result in greater numbers of children of low socioeconomic status, greater susceptibility to asthma and limited access to health care. What proportion of these children's families depends on fishing, and how would the potential decline of coastal fisheries likely affect their health? Much of these data exist separately, but no research has brought them together to enable modeling of these scenarios.

Agriculture: The Texas portion of the Rio Grande Valley, a center of agricultural production, is expected to more than double in population over the next 40 years. Over 85% of water demand in this region serves agriculture. Some land will be taken out of agricultural use as population increases, but municipal water demand is expected to increase significantly. Climate change will result in greater water loss due to evapotranspiration, further increasing water demand. Increasing urbanization will only aggravate these effects. [Jones, Wesselman, 2009].

International: Trends for increasing water demand in the Rio Grande Valley take into account only changes on the U.S.A. side of the border. The U.M.S. side is also expected to experience significant growth with less capacity to deal with waste. Predictions regarding the environmental future of South Texas also must take into account socioeconomic and demographic changes in Mexico.

GIS as an integration tool: Trends highlighted above are deeply interrelated and ought to be assessed concretely rather than discretely. The wide range of disciplines associated with this proposal will use geospatial technologies to integrate and organize existing data sets and planned data collection efforts to establish a composite view of the region with trends that are to be addressed. Geospatial relationships among diverse data sets can be compellingly integrated using GIS analysis tools. Geospatial analysis will provide comprehensive understanding and new insights to inform collaborative research efforts. GIS will allow extensive data mining of existing data sets from diverse local, state, and federal sources. Many local governments in South Texas have initiated GIS to assist in the management of local utility and land parcel based services. The Texas Natural Resource Information System houses an extensive array of geospatial data products on the natural environment and constructed infrastructure suitable for baseline data in the region. The 2010 federal census is producing a wealth of geo-referenced

demographic data that will give invaluable, up-to-date portraits of the South Texas population. RCN CE[3]SAR will integrate these data sets and mine them for fresh insights to inform new directions in research and advanced scientific knowledge, comprehensively understood and presented to engaged stakeholders, which will prepare the region for sustainable growth and efficient use of the resources.

EXPECTED OUTCOMES AND BENEFITS OF RCN-ENABLED RESEARCH

It is expected that research catalyzed by the proposed RCN CE[3]SAR will provide advanced scientific knowledge to inform **proactive scenario planning** in the South Texas region. This is a tool notably used by Shell Oil Company to plan for an uncertain energy future, wherein decision makers run scenarios to think about how to deal with potential future events. (Shell, 2008) The strength of this approach is that it does not depend on extrapolations of current conditions but rather envisions vastly different future circumstances. The point, according to Shell, is to avoid "the Scramble" scenario, in which policymakers have not planned and must respond reactively, by embracing a "Blueprint," for which policymakers have proactively planned.

3. MAJOR PLANNED RESEARCH COORDINATION ACTIVITIES

The key to RCN CE[3]SAR's networking strategy will be to begin (Year 1) with a **kick-off *charrette*** (collaborative sessions for inquiry-based design) involving researchers and policymakers; **stakeholder meetings**, **curriculum development** meetings, **online course** development, **collaboration visits**, a **workshop focused on international partnerships** (Year 2), and a **final summit** (Year 5). **Social networking tools and IT** infrastructures will provide communication across the network to promote research and educational collaborations, dissemination of information to stakeholders and the sharing of data and network resources. These activities will benefit significantly from the diverse backgrounds of participants, especially as they relate to developing regionally inclusive communications, dissemination and engagement processes. Participants will include local stakeholders, community leaders, policy makers, industry, nonprofit organizations, and local, regional and state officials. As a logistical and management tool, many discussions will be organized around the **themes: climate, energy, environment and engagement**. It is expected that participants will be involved in several or all of these themes. Researchers and students from RCN CE[3]SAR institutions will engage in continuous dissemination processes and strategic planning to ensure that the research focus of the network captures and melds stakeholder input. Coordination activities will be held at all participant South Texas institutions to allow key stakeholders from those regions to participate in the research network's discovery of unique factors related to local environments and socioeconomic and political institutions. Examples of specific activities are described below.

Table 1. Summary of CE[3]SAR Networking Activities

Activity	Purpose	Student Participation	
		Undergraduate	**Graduate**
Kickoff *Charrette* (4-day meeting)	Information exchange & strategic planning	Assist	Assist and act as scribes
Seven Regional Thematic Stakeholder Meetings	Information exchange and discussions with public, stakeholder community	Assist, observe	Help with organization and planning
Curriculum, Online Course & Certificate Development	Create online courses for an RCN-wide undergrad certificate program in sustainability	Take classes	Teaching Assistants
Research Development	Build a CE[3]SAR research portfolio; provide online administrative assistance to network researchers	Participation in funded research	Participation in proposal efforts and research
Virtual '*Platicas*'	RCN participants discuss ideas and build trust through informal conversations in a virtual cafe		Participate in platicas
Public Communication Training Sessions	Train faculty in best practices for issues-based communication with stakeholders,		Participation in training sessions

	public and press		
International Workshop	Year 2: focus on international partnerships	Participate and observe	Participate and assist with planning
IT Infrastructure to Support RCN CE³SAR Activities	Provide a suite of software tools to allow the public to run scenarios on the CE³SAR Web site, enable virtual platicas and facilitate collaboration	Use software tools	Use software tools
Collaboration Visits	Support visits among potential and active collaborators within the RCN CE³SAR		Participate in visits
Summit	Closing meeting to chart a forward path	Assist, participate	Help with organization and planning

STRATEGIES FOR PROMOTING COLLABORATION

Multiple-researcher networks for large projects such as centers form best from strong dyads of researchers who have worked together and published previously, according to research indicating that several key factors influence the success of scientific collaboration. (Cummings and Kiesler, 2008) The initial goal of the proposed RCN CE³SAR, therefore, will be to encourage collaboration among interdisciplinary dyads of researchers. Moreover, CE³SAR activities will include a **research development initiative** aimed at identifying opportunities to pursue funding for collaborative projects and providing online administrative assistance to network researchers. Collaborative "tie strength," the intensity of working relationships among collaborators, also are strong predictors of collaboration success. Tie strength is fortified by frequent communication and emotional closeness but is sapped by distance and lack of prior experience working together. RCN CE³SAR activities, therefore, will seek to **increase tie strength among network researchers** who have not previously worked together by providing opportunities for meaningful, informal interaction at conferences as well as through online tools. Managing long-distance collaborations requires special skills and presents predictable pitfalls. A special session for researchers will be offered at the Kickoff *Charrette* on best practices for managing long-distance collaborations based on social-network theory and the results of recent research on the science of team science. Activities are described below.

PROGRAMMATIC ACTIVITIES

Kick-off *Charrette*: Network activities will begin with a four-day kick-off event at which the initial participants and the steering committee will meet. This event, hosted by the Southwest Research Institute (SwRI) in San Antonio, will bring together – in many cases for the first time – leading scientists and engineers from the participating universities and research centers. The *charrette* will have **two objectives**: 1) providing a forum to allow participants to get to know each other and each other's research activities; 2) eliciting a broad spectrum of insights that will be used by the RCN steering committee to formulate a draft 5-year strategic plan for the organization. The strategic planning process will be conducted using a *charrette* approach commonly used in architecture, which brings together a diverse group of stakeholders to conduct a rigorous, cross-disciplinary, vision-driven process to produce strategies or address complex projects (Charrette Institute, 2011). *Charrettes* are characterized by: 1) a rigorous pre-conference planning process to identify well-defined objectives; 2) extensive data-gathering before the meeting so needed information is available; 3) assembly of *charrette* teams with the appropriate mix of people; 4) training of participants in the *charrette* process; and 5) an intense, interactive "design" phase in which solution alternatives are identified, discussed and tested to compose a "preferred solution," which in this case will be **a five-year strategic plan** for the network that takes into account the various disciplinary perspectives as well as the needs and perspectives of stakeholders. Significantly, non-scientist policymakers and community stakeholders will be included in this process from the outset in order to ensure that their perspectives inform the process.

Virtual Platicas: A series of RCN activities will be built around a "virtual platica" or "virtual café" model (*platica* is a Spanish word for informal conversation). Participants will gather online via Skype, blogs, wikis and other networking tools such as Second Life to learn and exchange information informally. These activities will encourage creative thinking, build trust and allow meaningful interaction among participants

from vastly different backgrounds. Regular, theme-based gatherings of RCN participants – researchers, stakeholders and the public – will be scheduled each month in various virtual venues, and smaller groups will be encouraged to meet at other times using tools provided by the RCN.

Regional Thematic Stakeholder Engagement Meetings: A series of seven regional meetings will be held on a rotating basis at each of the regional institutions. Each meeting will be programmed around a particular sustainability theme of special interest to the host institution and its community. For example, Texas A&M-Kingsville might hold a meeting focused on rangeland sustainability; Texas A&M-Corpus Christi's meeting might focus on use of GIS, and Texas State might focus on groundwater issues. All RCN participants with interests in the selected theme will be invited to participate, and a determined effort will be made to invite and engage local stakeholders. Details on regional themes and logistics will be set by the strategic planning process.

International Workshop: The primary purpose of this workshop is to engage in international partners, primarily from Mexico. The workshop will be co-hosted by Texas A&M International and the University of Texas at Brownsville. Sustainability issues on both sides of the border will be discussed, and opportunities for new collaborations will be explored. Activities will consist of brainstorming sessions, playing out of scenarios and other interactive exercises.

Research Development Support: A key strategy for building RCN CE^{3}SAR's capacity for advancing sustainability science and building an effective strategy for communicating that science to the public is to develop aligned research and educational initiatives across South Texas institutions consistent with the network's regional vision for sustainability. The network's five-year strategic plan and scenario planning will define a vision for scaled sustainability related to climate, water and energy. That vision then will be advanced by a research development effort toward federal and state agencies as well as industry and foundations. This effort will develop resources for regional sustainability research from single PI research and education grants to center grants funded by federal agencies. It will be a process of **capacity-building in South Texas**, likely beginning with discrete but aligned research grants that over time develop and represent, de facto, key research expertise that would be resident in a research center. At that point, the RCN would be sufficiently mature to compete at a national level for major center programs, particularly those at NSF, as well as mission agencies.

The key issue is to build a collaborative research-development capacity inclusive of all institutional partners. There are existing models among the RCN partners for that; most notably, the Texas A&M System System-wide collaborative for K-16 systemic STEM reform that received funding of over $100 million between 1989 and 2004. (The RCN research-development effort will be guided by PI Luis Cifuentes, who chairs a Texas A&M System committee focused on engaging its regional institutions in a system-wide research-development and training effort.). Specifically, CE^{3}SAR will provide research-development infrastructure to network participants, including notifications of funding opportunities appropriate to network members, support with developing teams to pursue new collaborative research projects and online administrative support to facilitate proposal development. The purpose of this activity is to provide focus and resources to support new collaborative projects that advance the research vision of the network. It is our experience that the focused planning required to develop a collaborative research proposal and meet a submission deadline can serve as a motivator and integrator to encourage and deepen partnerships and promote other potential collaborations aligned with a shared vision. The development of the network will identify and engage new research teaming opportunities among the partnered institutions.

This process, moreover, builds trust, advances confidence in the capacity and commitment of participants to achieve success in collaborative research efforts, and deepens inter- and intra-institutional understandings of research interests, capacities, resources and expertise. In this way, network research development leads to productive research partnerships, particularly as they advance core thematic areas identified through strategic and scenario planning as various institutional capacities are configured and reconfigured in multiple ways. At root, network research development will illuminate capacities long inherent in but often isolated among the South Texas institutional partners. As this process evolves, network participants will identify ways to aggregate their capacities for developing research opportunities offered by federal agencies and foundations that advance the research, educational vision and objectives in the core thematic areas of RCN CE^{3}SAR. One long-term network goal, for example, is to enable network partners to compete successfully for center and center-level research funding.

Social Networking and IT Infrastructure to Support Networking and Collaboration: The Texas Digital Library will provide extensive IT tools to support collaboration among RCN CE^{3}SAR participants. These include a comprehensive Web site, a blog, wikis, document-sharing services, list-serves and video conferencing tools. Training and support also will be provided to RCN participants to encourage the best use of these tools. In an effort to enable more interactive, informal interchanges, CE^{3}SAR also will experiment with the use of the Second Life online virtual-reality platform for meetings and discussions among potential collaborators. Texas A&M University has an island on Second Life and provides meeting spaces at a virtual Student Memorial Center. Training will be provided for interested participants during one of the network-wide meetings. Some of these tools will be used for RCN-wide activities and communication, and they will be made available to all participants – researchers, stakeholders, the public – who may use them for smaller group collaborations. It is expected that collaborating researchers will find different tools helpful depending on their specific situation and needs. (Olson & Olson, 2000) RCN CE3SAR's objective will be to provide a range of collaborative tools, accompanied by training, and allow researchers to choose those appropriate to their needs.

Visits: Support for faculty visits across the network will build sustainable research collaborations and assist participating faculty to better their understanding of the expertise, resources and research interests of network colleagues elsewhere. Building research and educational partnerships takes time, particularly since they must be built on mutual trust, research compatibility, performance assurances and professional confidence. These relationships can be strengthened using virtual environments, but initial *personal* interaction among researches is the preferred way to start the networking process. As the network matures, multiple potential research-partnership configurations will be explored at various scales, i.e., from network-wide to more narrowly focused inquiries best explored initially through faculty visits across institutional sites. Once established, these research and educational partnerships work very well using electronic platforms for communications.

Faculty Research Ambassadors: As part of this network's engagement effort, RCN "faculty research ambassadors," one from each South Texas institution, will be trained in issues-based public communications to better engage community and public institutions on the outcomes of sustainability science. Faculty ambassadors will take RCN science into public meetings, schools, informal science settings and other venues to represent the objectives of the five-year research plan and twenty-year vision. This will broaden the CE^{3}SAR network among affected communities and overcome some historic difficulties of extending scientific knowledge into the policy and public domains. The goal is to develop trust across regional "constituencies" and the various scales of South Texas communities. It is fundamental to the mission of the proposed RCN of regional institutions integrated with their communities.

Curriculum, Distance Learning Courses and Certificate Program Development: RCN CE^{3}SAR faculty will engage undergraduate and graduate students in network-wide activity to develop courses and course modules to be shared across the network. These online materials will allow continuous updating of materials online to reflect the evolving nature of sustainability science and the specifics of that science to the South Texas region and its students.

Six distance-learning courses will be developed by selected CE^{3}SAR faculty and linked with their research interests. The courses will be aimed at undergraduates and will focus on sustainability issues taking a multidisciplinary approach. These courses, which will be team taught by faculty from the applicable disciplines and made available to participating institutions, will form the basis of a certificate program on sustainability. The courses will be offered through the Trans-Texas Television Network. In addition, the Binational Center (BINC) will develop a certificate program of 12 semester credit hours to be made available to stakeholders, including community members, government officials and NGO personnel on both sides of the border. BINC will create an integrated certification program, available in English and Spanish, to educate stakeholders on the problems and potential solutions for environmental issues affecting the border; and, perhaps more important, to invite interested stakeholders to participate in an ongoing dialogue regarding sustainability in the border region. Certificate courses, offered as hybrid or wholly online, will be marketed to stakeholders, and, depending on institutional preference, available to students in Mexican universities. (Distance learning technology is developing rapidly in Mexico. Universidad Autonoma de Tamaulipas in Nuevo Laredo is preparing to launch in August 2011 a new facility with 45 distance classrooms, including TTVN technology.) Another eventual outcome is coursework, extension services and distance learning opportunities to undergraduates, graduate

students, international students, practicing professionals, and community volunteers leading to degrees or certificates in the work, management and administration of nonprofit organizations who deal in sustainability.

The Role of Students: RCN CE³SAR will provide students with an interdisciplinary educational experience that will energize them and prepare them to lead the next generation of researchers who will address sustainability issues using an interdisciplinary, integrative approach. Graduate and undergraduate students will participate in the research coordination activities (Table 1). Students also will participate in research emerging from RCN activities.

Final Summit: In the last six months of the funding period, RCN CE³SAR will hold a Final Summit, at which researchers and students will present results of research stemming from network coordination. It is assumed that the RCN will have served as a starting point, so planning for continued growth and strengthening of research collaborations will be given serious consideration as the summit's final goal.

INTERNATIONAL PARTICIPATION

The vital importance of soliciting the input and active participation of Mexican scholars, officials and citizens cannot be overstated. The health, well-being and economic stability of the South Texas border region are historically embedded with that of northern Mexico. (Current disturbances in Mexico make that interaction more challenging but no less crucial.) RCN CE³SAR will leverage existing relationships with Mexican universities and government officials to create a working group focused on shared information among scholars and stakeholders along the U.S. border with *Estados Unidos de Mexico*.

Co-PI Jorge Vanegas, dean of the College of Architecture at Texas A&M, who has been inducted as a member of the Pan American Academy of Engineering, has expertise in built-environment sustainability and advanced strategies and tools for integrated capital asset delivery. Additionally, the Binational Center (BINC) at Texas A&M International University in Laredo, directed by RCN- CE³SAR steering committee member Carol Walters, has developed long-standing engagements with Mexican universities and researchers and government agencies. BINC's International Executive Seminar program, consisting of day-long weekend exchanges between U.S. and *E.U.M.* government officials, provides a forum for international collaboration on issues important to this coalition. Communication is facilitated with the use of simultaneous translation. All events are open to NGOs that interact with local communities and serve as vehicles for education and policy support in various areas of Mexico.

RCN- CE³SAR researchers will be able to gather data from communities on either side of the border, including sites that are not in major metropolitan areas. For example, in 2009-10, with travel in Mexico restricted and hazardous, BINC and A&M International's Center for Earth and Environmental Science (CEES) worked with Mexican NGOs in Mexico to acquire accurate GIS data never before available to gather key infrastructure information through trusted NGO agents. This project resulted in creation of a "Commander's Field Guide" for first responders in English and Spanish.

INFORMATION AND MATERIAL SHARING

Individual members of RCN CE³SAR institutions will have full rights to results of research projects that emerge from collaborations developed through the network. Participants also will be expected to share results and data with other network participants. As outlined in the Data Management Plan, the Texas Digital Library will provide the infrastructure to archive research data and make it available. Moreover, the common GIS platform provided to RCN CE³SAR participants will facilitate data-sharing and integration of research findings. Texas A&M-Corpus Christi (TAMUCC) will provide network access to a suite of GIS tools. TAMUCC has expertise in developing innovative geodetic solutions, including a Mobile Online Intelligent Decision Support System (MOIDSS™) real-time GIS solution developed for NASA. MOIDSS™ utilizes wireless technologies for field personnel to send and receive digital data via a real-time geographic information system (GIS). The system ingests data sequentially from a variety of input sensors, provides initial field verification of data, and distributes the data to various nodes and servers at collection, processing and decision hub sites. Field interface devices for the system include biometric capability for password protection and relational tracking of data. MOIDSS™ uses geospatial technologies to access digital imagery and has GPS location capabilities to display the rendering of vector and raster data with sufficient size and resolution for easy understanding and modeling. Finally, educational materials, including curricula and course materials, will be made available through the CE³SAR Web site. The Web site will also include extensive outreach and educational materials for K-12

students and the general public. A special feature will be a scenario planning tool, with which users can plan scenarios related to environmental and policy choices and see predicted results.

SCHEDULE/MILESTONE CHART

Table 2. Schedule for Networking Activities

Activity	Year 1	Year 2	Year 3	Year 4	Year 5
Kickoff *Charrette*	▲				
Create networking IT	▬				
International workshop		▲			
Virtual *Platicas*	▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬
Research development	▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬
Visits	▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬
Curriculum & online certificate		▬▬▬▬▬▬▬▬▬▬▬▬			
Training sessions		▲	▲		
Regional Thematic Meetings		▲ ▲ ▲	▲ ▲	▲ ▲	
Final Summit					▲

4. MANAGEMENT PLAN

RESPONSIBILITIES OF THE LEADERSHIP

The core management responsibility for the RCN CE^{3}SAR leadership (PI, co-PIs and steering committee) will be guiding development of the network's five-year strategic plan as it is informed by South Texas scenario planning. The strategic plan will be developed with the goal of keeping the RCN sufficiently agile, flexible and dynamic to evolve to new ideas and attract new researchers. Resource allocation among the partner institutions and development of new activities that advance the RCN also will be a part of the leadership's management responsibility. Members of the steering committee are listed in **Table 3**.

Table 3. Steering Committee Members and Their Roles

Member	Institution	Position
Jude Benavides	U. Texas at Brownsville	Assist. Prof. Chemistry and Environmental Sciences Dept.
	Role: UT-Brownsville liaison, connections to **hydrology community**	
Ping Chang	Texas A&M University	Prof. Atmos. Sci.& Ocean.; Director, Texas Center for Climate Studies
	Role: Expertise in climate modeling, connections to **climate modeling community**	
Luis Cifuentes	Texas A&M-Corpus Christi	Prof. Oceanography and AVP for Research; Dean of Graduate Studies
	Role: PI, Director of RCN CE3SAR, connections with state research community	
Hudson Deyoe	U. Texas-Pan Am.	Prof. of Biology, Director, Center for Subtropical Studies
	Role: Liaison UT-Pan American, connections with **biology community**	
Fidel Hernandez	Texas A&M-Kingsville	Assoc. Professor, Caesar Kleberg Wildlife Research Institute
	Role: Connections with **wildlife research community**	
Gary Jeffress	Texas A&M-Corpus Christi	Prof. Geographic Information; Science Director, Conrad Blucher Institute for Surveying and Science
	Role: Co-PI, coordinator for the introduction of **geospatial research tools** for the analysis of physical and social location-based data sets; climate theme coordinator	

Member	Institution	Position
Wesley Patrick	Southwest Research Institute	Vice President, Geosciences and Engineering
	Role: Co-PI, coordinator for Kick-Off *Charrette*, energy theme coordinator, interface between RCN university partners and SwRI on student employment opportunities, **Connections to energy industries**	
Rudolph Rosen	Texas State University	Research Professor, River Systems Institute Director, Conservation Leadership Initiative
	Role: Co-PI, liaison for interaction with academic and research units at Texas State; help facilitate work on aquatic systems, partnerships and interaction with **nonprofit organizations and associations**; environment theme coordinator	
Rogelio Saenz	U. Texas at San Antonio	Dean, College of Public Policy
	Role: Connections to **sociology community**	
Venkatesh Uddameri	Texas A&M Kingsville	Prof. Environmental Eng.; Director, Center for Research on Environmental Sustainability in Semi-Arid Coastal Areas (NSF CREST)
	Role: Connections to **environmental engineering community**	
Jorge Vanegas	Texas A&M University	Professor & Dean, College of Architecture; Director, Center for Housing and Urban Development
	Role: Co-PI, engagement theme coordinator, facilitator for *charrettes* and workshops, liaison and coordinator for Texas A&M, CHUD, development of **international partnerships**, connections with **South Texas colonias and community leaders**.	
Arnie Vedlitz	Texas A&M University	Bullock Chair in Government and Public Policy; Director, Institute for Science, Technology & Public Policy
	Role: Connections to **political science community**, science/community engagement research	
Carol Waters	Texas A&M International	AVP for Academic Enrichment/ International Development; Director, Bi-National Center
	Role: Liaison for international collaborations, connections to **Mexican universities, government agencies and NGOs**	
Ralph Wurbs	Texas A&M University	Prof. Environmental Eng., Texas Water Resources Institute
	Role: Water resources research, connections with the **water resources community**	
David Yoskowitz	Texas A&M Corpus Christi	Endowed Chair for Socio-Economics, Harte Research Institute
	Role: Research on economics and the environment, connections with the **economics community**	

Strong leadership and clear roles are essential to the success of RCN CE^{3}SAR. PI and Director Luis Cifuentes, Professor of Oceanography and Associate Vice President for Research and Dean of Graduate Studies at Texas A&M Corpus Christi, will be responsible for overseeing the integration and coordination of all networking activities. Dr. Cifuentes will be assisted in his efforts by a management council composed of the co-PIs (**Figure 4**). The management council will meet in person or virtually at least once each month. Each co-PI will be coordinator for one of the RCN themes (environment, energy, engagement and climate). One of the first tasks at the Kickoff *Charrette* will be to identify prominent nationally-known scientists to serve as lead scientists for each theme. The network will reach beyond the region to bring in expertise that will build the research capabilities of collaborating researchers in the RCN.

MECHANISMS FOR ALLOCATING FUNDS

As detailed in Section G, *Budget and Budget Justification*, the most operationally efficient and agile way to structure the network budget is as one budget rather than multiple, budgeted sub-awards to numerous network partners. A six-member Resource Allocation Committee (RAC) led by the PI and composed of five members nominated by the entire network team for selection from among the co-PIs and steering committee members will make all budget allocation decisions across the network. The operational objectives of the RAC, whose members will serve one-year terms, is to (1) ***ensure a consensus-based process for resource allocation***; (2) ensure alignment of the resource allocation process with internal evaluation and assessment of network activities; (3) allow an agile allocation environment that ensures alignment of the resource allocation process with internal evaluation and assessment of network activities; and (4) permit evolving allocation of resources as the network grows and reconfigures programmatic activities in ways that optimize the five-year network plan.

PLANS AND PROCEDURES FOR DEVELOPMENT AND ASSESSMENT OF ACTIVITIES

Two assessment mechanisms will be employed. Both benefit from substantive assessment expertise resident across initial network participants. As with the Resource Allocation Committee, a six-member **RCN Development and Assessment Committee** (DAC) led by a co-PI and

Figure 4. CE³SAR Organization Chart

inclusive of five members nominated by the entire network team for selection from among the steering committee and other senior personnel will conduct internal assessments to inform the budget process and align RAC scenario planning with the five-year strategic plan for the network. Administrative support for the DAC will come from experienced STEM program evaluators on staff at partner institutions. Moreover, many resources exist to help frame an effective and dynamic assessment program to gain both summative and formative perspectives on the RAC. For example, two NSF publications, *User-Friendly Handbook for Mixed Method Evaluations* and the *ERC Manual of Best Practices*, offer useful information on the proven management and evaluation protocols of highly integrative research and education programs such as that envisioned in RCN CE³SAR's five-year goals. Moreover, adapting logic models to specific programmatic objectives can be an effective way to implement integrative partnerships, such as the RCN, in a way that engages and advances consensus among the multiple institutional participants. Finally, the following stepwise process represents the template for a logic model adapted to RCN CE³SAR.

- **Inputs:** RCN investments, activities, partners, etc.
- **Outputs:**
  - Activities: the actual RCN tasks/programmatic activities
  - Participation: who the RCN serves; customers and stakeholders
- **Outcomes/Impacts:**
  - Short Term: research network, learning (awareness, knowledge, skills, motivations, engagement)
  - Medium Term: research network, learning, action (behavior, practice, decisions, policies); and
  - Long Term: research network, learning, actions, consequences (social, economic, environmental, sustainability, etc.)

New network participants will be recruited by steering-committee members based on recommendations by initial participants as well as interest expressed by potential participants. RCN activities also will be publicized via a Web site, at research conferences and through institutional networks in order to reach potential new participants. A core objective is that the RCN be dynamic and agile. Introducing new partners into the RCN is key to ensuring that objective is met is. A continuous strategic planning process informed by scenario planning will guide this process. Moreover, members of the steering committee were selected, in part, with consideration of the existing networks that can then align with the proposed RCN and thereby explore potential interactions. All of startup activities of the proposed RCN will be translated into the various ways the network will use for communications; e.g., Web site, wiki-site, digital library, etc.

Several mechanisms for self-evaluation of progress towards network goals will be put in place, including a timeline for key waypoints beginning with monthly assessment meetings of the PI, co-PIs, and steering committee for the first six months of operation and then quarterly thereafter.
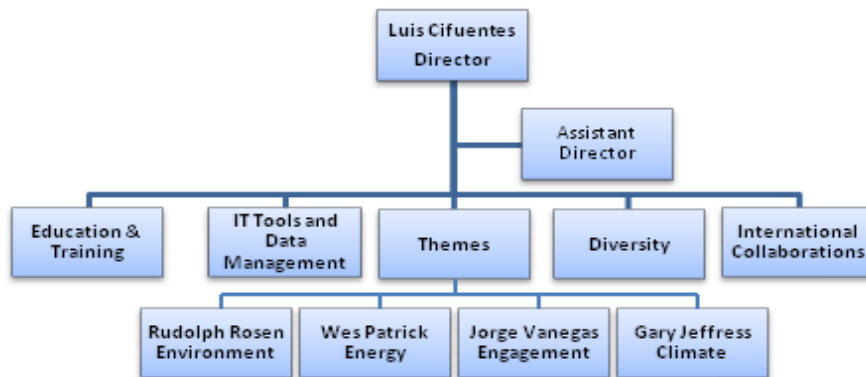
5. COORDINATION PLAN

Although a few of the participants in the network have collaborated in the past, the proposed RCN will establish an entirely new research network. To our knowledge, there are currently no similar activities focused on the South Texas region; therefore, a coordination plan is not needed.

6. PLANS FOR INCREASING DIVERSITY

A distinctive feature of RCN CE^{3}SAR is that it will be led by researchers at six Hispanic-serving institutions, four of which are also minority-serving institutions, all regional institutions with Hispanic enrollments greater than 50%. These institutions are deeply grounded in the focus region by virtue of their research and relationships with local stakeholders. The network also leverages the expertise of prominent researchers from research-intensive universities, and as the network evolves, the steering committee will maintain this mix of researchers. The clear objective is to strengthen collaborations among these researchers and **build research infrastructure at the regional institutions**. The inclusion of new researchers will be a major objective of the RCN CE^{3}SAR strategic planning process. The goal is continuous expansion, consolidation and integration of new researchers into the network. Several mechanisms will be employed to accomplish this, including: leveraging of existing research networks of the steering committee and others engaged in this process; and invitations to new researchers to participate in workshops and seminars sponsored by RCN CE^{3}SAR. A major avenue for identifying new researcher contacts will be through subsets of the original participants pursuing research funding across the sustainability science spectrum, and this also will be a mechanism for the support of post-doctoral researchers and their engagement in the network.

The network will engage graduate and undergraduate students in network activities across the university partnership. These activities will build on extensive infrastructure to promote diversity built through a long history of providing educational access to the predominantly Hispanic population of South Texas. This includes engagement in many NSF programs that advance the STEM disciplines, particularly through the Texas A&M University System's *Louis Stokes Alliance for Minority Participation*, which has been continuously funded since 1991; the H-LSAMP Scholars Program, now in its 12th year at Texas State University; and the University of Texas System's LSAMP, funded since 1993. The associated partner institutions in this proposed RCN graduate most of the STEM degrees to Hispanics in Texas; for example, TAMUK is also a longtime national leader in the graduation of Hispanic engineers and in addressing South Texas sustainability issues through its PhD granting *NSF CREST Center for Research on Environmental Sustainability in Semi-Arid Coastal Areas* over the past ten years. Moreover, RCN CE^{3}SAR lead institution TAMUCC, in partnership with several RCN partner institutions, led a range of K-12 system STEM programs, including the *South Texas Rural System Initiative, NSF GK-12 Fellows for the Texas Rural Systemic Initiative*, and the *NSF Collaborative for Excellence in Teacher Preparation*. Also, the *NSF GK-12 for Advancing Geospatial Skills in Science and Social Science* prepared and connected geospatially-skilled fellows with science and social studies teachers to collaborate on developing students' spatial thinking and problem solving. Finally, all of the RCN CE^{3}SAR partner institutions have longstanding commitments to pathways programs that support and enhance diversity, including bridges programs from high school to college, community college transition programs, research experiences for undergraduates programs, and pathways to the doctorate programs.

All of which represents an experience base in increasing diversity extending over the past two decades upon which the network will build in its research and educational activities. A key focus of the diversity plan will be to engage students in network activities and to develop educational paths that will lead them to professions and actions that encourage sustainable development in the region. It is hoped this engagement will encourage underrepresented students from the South Texas region to stay in or return to the region to gain research and graduate experiences. RCN CE^{3}SAR is designed to build regional capacities that will provide such students with top-flight scientific research experience that will have a profound impact upon the lives and communities of South Texas – their families, friends and neighbors.