

The Climate Assessment for the Southwest (CLIMAS) project, funded by NOAA-OGP, is an integrated assessment that seeks to build sustainable relationships with stakeholders through interactive, iterative investigation of processes underlying climatic variability and the impacts of that variability in the U.S. Southwest. Specifically, CLIMAS aims to improve capacity in the region to address the impacts of climatic changes occurring at seasonal, interannual, decadal, and centennial time scales through provision of more and better climate information and forecasts. To achieve its goals, CLIMAS engages in interdisciplinary research on past, current and future climates in order to understand how different climatic conditions and sequences of conditions affect specific people, places, and resources. The knowledge gained from these activities, in turn, provides the basis for developing and disseminating knowledge and products to stakeholders. Through ongoing interactions with constituents, CLIMAS evaluates how well the information provided meets articulated needs and identifies new or additional research tasks.

CLIMAS maintains close linkages with other climate- and water-related research initiatives in the Southwest, including UA's NSF-supported Science and Technology Center for Semi-Arid Hydrology and Riparian Areas (SAHRA), the Southwest Regional Earth Science Applications Center (RESAC), and the Hydrologic Data and Information System (HYDIS). CLIMAS also cooperates with climate impacts assessments carried out elsewhere in the United States and around the world, thus sharing knowledge, techniques, and experience with regard to art and science of integrated assessment.

THE ORIGINS OF CLIMAS

Initial insight into what types of climate impacts are most important in the Southwest, and stakeholder needs for climate information, emerged from a 1997 climate change symposium and workshop, *Climate Variability and Change in the Southwest*¹ sponsored by the U.S. Department of Interior and the U.S. Global Change Research Program. The results of this symposium provided the foundations for the research proposal submitted to and approved by the Office of Global Programs (OGP) of the National Oceanic and Atmospheric Administration (NOAA). The project was initiated in February 1998 with grant funding from NOAA-OGP to open the Core Office. This office serves as the organizational focal point for the project as well as for outreach to stakeholders. Research began in late Spring 1998, with a pilot survey of stakeholders. This survey, which involved interviews with some 70 individuals in southeastern Arizona, supplemented information gathered at the 1997 symposium and workshop, and provided additional information about stakeholders' use of, and need for, climate information. The results of the first year's research provided important information that continues to inform subsequent research and outreach activities. The specific initiatives undertaken by CLIMAS scientists are outlined below.

¹ See Merideth, Robert, Diana Liverman, Roger Bales, and Mark Patterson (eds.), 1998, *Climate Variability and Change in the Southwest: Impacts, Information Needs and Issues for Policymaking*, Final report of the Southwest Regional Climate Change Symposium and Workshop, September 3 - 5, 1997, Tucson, Arizona, July 1998, Udall Center for Studies in Public Policy, University of Arizona, Tucson, Arizona.

CLIMAS INITIATIVES

CLIMAS team members are engaged in an array of initiatives, reflecting specific needs and interests articulated by stakeholders in the region. Over the project's first three years, these initiatives have included:

- Vulnerability assessment of the ranching sector
- Vulnerability assessment of communities in the Middle San Pedro and Sulphur Springs Valleys of southeastern Arizona
- Sensitivity, vulnerability and institutional assessment of the urban water sector
- Binational pilot vulnerability assessment of stakeholders on the U.S.-Mexico border; and outreach efforts among Native American communities in Arizona and New Mexico
- Assessment of the interactions between climate and Valley Fever incidence in the region
- Comprehensive assessments of climate and hydrologic forecasts
- Research on the North American monsoon, including identification of important predictive signals
- Development of fine-resolution climate datasets for stakeholders
- Paleoclimatic research into patterns and trends in the Pacific Decadal Oscillation over the past 1,000 years
- Workshops and other outreach activities aimed at improving stakeholder understanding of, and capacity to effectively use, climate forecasts

CLIMATE VULNERABILITY, SENSITIVITY, ADAPTABILITY

The climate vulnerability initiatives described below are currently being spearheaded by researchers associated with the Bureau of Applied Research in Anthropology, Latin American Area Studies Center, Department of Geography, Arizona State Museum, and Institute for the Study of Planet Earth. The vulnerability analyses are organized around a set of fundamental research questions. These research questions, listed below, provide a framework for designing field research, interpreting results, and communicating those results to members of the CLIMAS project as well as to stakeholders and others.

- *What are the impacts of climate variability on local populations and what sectors are particularly vulnerable?*
- *How do local populations adapt-short term and long term-to climate variability?*
- *What use is being made of climate information in the Southwest, what is the demand for improved climate information and how can climate information and uncertainty be best communicated to stakeholders?*
- *How can a better understanding of climate benefit vulnerable stakeholders in the Southwest?*
- *What are the best methods for integrating information on climate, hydrology, and vulnerability into assessments and decision support systems that respond to regional needs?*

Vulnerability Assessment of the Ranching Sector

Assessment of the ranching sector has focused on answering a series of specific questions informed by the more general questions listed above. These specific questions include:

- *What is the nature of climate impacts on the ranching community?*
- *How does the structure of ranching operations combine with climate impacts to increase or decrease vulnerability?*
- *What is the relative influence of climate vs. other factors, e.g., market prices in ranchers' decision-making processes?*

Initially focusing on cow-calf operations in the semi-arid desert and grassland areas of Pima, Cochise, and Santa Cruz counties, the ranching sector assessment has recently expanded to include contrasting geographies of climate and vegetation on the Mogollon Rim and in northern Arizona. Assessment activities include gathering information on cattle ranch operations in each of the targeted regions of Arizona, making presentations about the climate of the region and discussing current climate forecasts at cattle grower meetings, and surveying ranchers to identify their experiences with climate and their climate information needs. Local drought conditions, and drought across the border in Mexico, have been affecting ranchers over the past several years, making the initiative particularly salient to this stakeholder group right now. Research has involved the use of questionnaires, combined with follow-up interviews of agency personnel to determine specifics such as the impacts of types of ranch management on forage and water resources, especially during droughts. Interviews also allow investigation of variations in management practices and adjustments made for climate, perceptions of climate variability, and specific impacts of drought on the rancher's operations, the microclimate of that particular ranch, and the economic impacts of climatic stress. Initial findings reveal that ranching is unique in the Southwest in that it is one of very few sectors that is directly dependent upon precipitation; dryland farming--largely confined to eastern New Mexico--may be the only other sector possessing this level of dependency on precipitation. Climate vulnerability in the ranching sector is also tied to climate-influenced market conditions not only elsewhere in the United States and Mexico, but as far away as Australia. A working paper, *CLIMAS Ranching Case Study: Year 1, CL3-99*, is available via the CLIMAS website or directly from the CLIMAS Office. It is anticipated that, at the end of the current funding year, the ranching initiative will be integrated into the community assessment initiative, described below.

Community Vulnerability

Questions guiding research on community vulnerability include:

- *How does an entire community experience climate variability? Which sectors of the community are affected by climate variability? What is the extent to which different community segments are vulnerable to extreme climate events? How do local people perceive the impacts, and engage in adaptive responses?*
- *How can coping capacity be improved among the more vulnerable elements of the community?*
- *How might climate information be used by local stakeholders?*

One of the characteristics that sets CLIMAS apart from many other integrated assessments is its focus on community-level vulnerability assessment. The Bureau of Applied Research in Anthropology (BARA) at the University of Arizona has wide experience in ethnographic analysis. Researchers at BARA have developed and extensively employed an investigatory approach, called Rapid Rural Assessment, which allows the generation of a considerable amount of information at the individual and community level in a relatively short amount of time. BARA researchers are employing this technique to develop a knowledge base about the impacts of climate among community members across an entire study area, and about the use of/need for climate information. Information is gathered primarily through open-ended interviews with residents in the study area. The individuals to be interviewed may be selected on the basis of their position in the community (for example, local water provider or public lands manager for a government agency), or through a technique called "snowballing" whereby the interviewer asks each interviewee to identify others in the community who should be contacted. The information gathered from these interviews is then

summarized and synthesized using textual analysis techniques. The assessment itself involves merging this information with basic socioeconomic, demographic, climatic and other contextual data to determine the nature of vulnerability in the study area, relative vulnerability of different populations/sectors, the spatial and temporal characteristics of vulnerability, the intensity of the impacts, and buffering strategies employed to counter climatic impacts.

Community vulnerability research was initiated in the Middle San Pedro River Valley (MSPRV), in southeastern Arizona. The area was chosen because it was a small area that was close to the researchers' home base, and thus provided a good pilot study site. This area was historically agricultural, but today is rapidly becoming an exurb of Tucson. It also serves as a destination for winter residents (known as "snowbirds"). With the recent opening of Kartchner Caverns, the area is also experiencing a considerable tourist boom. The study identified farmers as among the most vulnerable sectors of the local economy, and highlighted the importance of climate and climate forecasts for the health of the local winter visitor industry--particularly RV parks. More generally findings indicate that the Middle San Pedro River Valley has been buffered from climate vulnerability through use of technology and through livelihood diversification. These findings proved important to subsequent research efforts by sharpening the research focus. Thus, subsequent investigations have focused on identifying how the buffering process itself works through collection of in-depth oral histories from local residents who have engaged in climate-buffering activities. Oral histories have been gathered from individuals in the Middle San Pedro River Valley and the research has now been expanded into the neighboring Sulphur Springs Valley. Here, although climatic conditions are much the same as in the MSPRV, overall vulnerability is much higher, due to the much greater importance of agriculture, employment of Mexican migrant labor, and lack of substantial economic diversity to buffer downturns in agricultural markets. A report on the initial pilot project in the MSPRV, *An Assessment of Climate Vulnerability in the Middle San Pedro River Valley*, CL3-00, is available for downloading from the CLIMAS web site, or in hardcopy format from the CLIMAS Office.

Climate Impacts on the Urban Water Sector

Questions informing research into climate impacts on urban water systems include:

- *How does climate variability affect urban water resources in the region?*
- *Which types of water producers are most affected?*
- *What is the role of institutional mechanisms in impeding or facilitating providers' ability to cope with climate variability?*

The topic of climate impacts on water resources, not surprisingly, is one of the main areas where stakeholders have expressed concern. The sufficiency and dependability of urban water resources in the context of climate variability is particularly salient since most of the region's population lives in urban environments. Since its inception, CLIMAS has made urban water one of its primary focal areas for both research and outreach. Initial activities involved conducting a sensitivity analysis of water systems in five Arizona urban areas: Phoenix, Tucson, Nogales, Sierra Vista and Benson. The analysis investigated the potential impacts of one-, five-, and ten-year droughts equal to the deepest analogous droughts in the historical record for each urban area, for the year 2025. This year was chosen because, by law, three of the areas (the Phoenix, Tucson, and Nogales areas) are to demonstrate achievement of safe yield by then. Results of the analysis indicate that multi-year drought, such as that which occurred in the 1950s, would place considerable stress on those water systems. The sensitivity analysis provided a valuable foundation for assessing the vulnerability of water providers to climate variability, and analyzing institutional arrangements that impede use of effective adaptation and response to climatic stresses on urban water systems.

Results of the analysis are summarized in CLIMAS Report No. CL1-00, *Assessing the Sensitivity of the Southwest's Urban Water Sector to Climate Variability: Case Studies in Arizona*. The report is available on the CLIMAS web site, and in hard copy form from the CLIMAS Office.

A subsequent vulnerability analysis, carried out with selected providers in all of the study areas except Benson, involved a written questionnaire followed by a personal interview. Results of the survey indicate that vulnerability is very unevenly distributed among water providers in each of the study areas. Further, little use is made of climate information and forecasts in water resource planning and management by any of the interviewees. A draft report of this analysis is posted on the CLIMAS web site. Results from the sensitivity analysis and vulnerability analysis highlight the importance of institutional factors with regard to latitude to manage water resources flexibly, based on factors such as climatic conditions. To address these issues an institutional analysis has been in progress for the past year and a half. This analysis includes a review of existing laws and policies, as well as participation in a public process begun a year ago by the State of Arizona to identify needed legislative and policy changes. A report on the legal institutions affecting water management under conditions of climatic uncertainty is available on the CLIMAS web site and can be obtained in hard copy from the CLIMAS Office. Additional institutional analysis is ongoing. It is anticipated that investigation of climate impacts on water resources will be expanded to include other portions of the region, as well as an analysis of the economic costs of climate variability in this sector.

Climate and Native American Communities

The primary question informing interactions with Native American communities is:

- *How can climate assessment research be integrated into Native American social, political, cultural, and ecological contexts?*

A specific focus on the climate impacts on and information needs of members of the region's Native American communities was initiated in Year 2. The addition of this task area provided an opportunity to interact directly with tribes to determine if, and how, they would like to participate in the CLIMAS project. The 1998 *Native Peoples-Native Homelands* workshop, held in Albuquerque, New Mexico under NASA auspices, initiated a dialogue with tribes regarding the impacts of natural climate variability, as well as of anthropogenically induced climate change, even though this latter subject was the primary theme of the conference.

CLIMAS team members subsequently established relations with the InterTribal Council of Arizona and the All Pueblo Council in New Mexico, with the intent of continuing the dialogue about climate and its impacts. Specific projects emerged from these interactions, including a request from the Gila River Tribe, just south of Phoenix, to examine climate and air quality issues. Another request resulted in production of a CD-ROM and informational packets, to be distributed to the tribes, on the links between climate and renewable energy. Further, interactions with tribal environmental managers have enabled CLIMAS researchers to gain a better understanding of the environmental issues of most immediate interest to the tribes, and to identify where climate fits with regard to those issues. Recent presentations on climate and its impacts to Native American high school students representing the Paiute, Tohono O'Odham, Navajo, and Apache peoples were notably successful for reinforcing links with tribes in the region. These positive interactions have resulted in a solid foundation for future collaborations. It is envisioned that these collaborations will largely involve incorporating Native Americans into sectoral studies that are of particular concern to their specific tribe(s) (for example, climate and fire). In addition, the Southern Paiute Consortium has requested assistance with an examination of traditional responses to drought and use of mitigation strategies in the Four Corners area. With assistance of Consortium director,

CLIMAS will be working with tribes from southern Utah, southern Colorado, northwestern New Mexico, and northern Arizona to carry out the research. A paper, currently in draft form on the CLIMAS web site, discusses considerations that should be kept in mind when dealing with tribes. It is anticipated that the information presented on the CD will also be made available on the CLIMAS web site.

Climate Impacts and in the U.S.-Mexico Border Region

The border studies component of the project seeks to incorporate consideration of important transboundary implications and impacts of climate variability for the U.S. Southwest. This component is guided by the following questions:

- *What are the types of forecasts being used in northern Mexico and what is the extent of their use?*
- *What are the impacts of climate variability on local populations and what sectors are particularly vulnerable?*
- *What were the impacts of the 1950's drought on northern Mexico?*
- *What is the nature of monsoon dynamics in Mexico?*

It is clear that some of CLIMAS's stakeholders are managing resources in a transboundary context, and that climatic impacts are important to the decisions being made and actions being taken on both sides of the international boundary. Hydrological and water resource management research, for example, highlights the importance of the rivers and aquifers that span the U.S.-Mexico border. Climate impacts on surface water resources are shared not only with regard to the Colorado and Rio Grande Rivers, but also with regard to much smaller transboundary streams such as the San Pedro and Santa Cruz Rivers in Southern Arizona. Further, the implications of climate sensitivity and future water demands affect border cities such as Nogales, Arizona/Nogales, Sonora as well as entire watersheds and smaller-scale natural areas such as the riparian zone of the San Pedro River. How the future plays out in these areas depends on developments on both sides of the border. For example, rapid urban growth in Nogales, Sonora, fueled by the maquiladora industry as well as other factors, is already placing a large burden on local water supplies. Likewise, near the headwaters of San Pedro River, the mine and adjacent city of Cananea, Sonora, use a very substantial amount of water, thus affecting availability for uses farther downstream. Ranching studies have shown that the economic contexts for ranching in the U.S. Southwest are quite sensitive to the kinds of climate conditions that also exist in Mexico: livestock operations on both sides of the border are very vulnerable to drought in northern Mexico. Dramatic restructuring of land tenure, water rights, and water resource management politics in Mexico is creating a complex framework. It is within this context that climate impacts must be considered.

Work on past climate and hydrological variability in the Southwest and border region provides a framework for new research initiatives in Year 3. One of these initiatives focuses on identifying and cataloguing periods of severe drought in the instrumental and proxy records, with the intent of assessing the magnitude of the impacts of drought over the past 50 years, and assessing the implications of drought conditions for transboundary climate vulnerability. A second initiative builds on the assessments of climate forecasts in the Southwest to identify the types of forecasts issued for northern Mexico and the extent of their use. Between 1996 and 2000, for example, irrigation reservoir levels have dropped to extremely low levels in Mexico, generating interest in and demand for climate forecast products. As this research unfolds, it is anticipated that it will be expanded to include collaboration with researchers at UNAM and IMADES in Mexico and colleagues at Scripps Institute in the United States, and to include an in-depth institutional analysis.

These efforts provide an opportunity to better integrate stakeholders from the border region and northern Mexico into CLIMAS activities.

Climate and Valley Fever

This project is an initial foray into answering the following question:

- *How does climate interact with environmental factors to change relative vulnerability among exposed populations?*

Climate and Valley Fever was added to the original complement of research initiatives in Year 2 in recognition of the opportunity provided by the arrival of a graduate student who was particularly interested in investigating links between climate and this particular disease. Valley Fever, which is endemic in large portions of the region, is caused by a soil-dwelling fungus that responds to climate. While most people who contract the disease are only mildly affected, the condition can cause respiratory disease, bone and joint damage, and meningitis. Some 6,000 to 8,000 severe cases occur in the United States each year, resulting in 50 to 100 deaths.

The links between climate variability and Valley Fever are complex, but relate to the sequence of wet and dry conditions over months and years. This initiative has explicit links to stakeholders through medical experts and other collaborators associated with the UA Valley Fever Center for Excellence. Initial research has focused on identifying temporal and geographical commonalities between climate patterns and disease-incidence patterns. As a result of this research, the first (and ultimately successful) prediction of an increase in incidence of Valley Fever, based in part on antecedent climatic conditions, was issued during the late Fall of 1999. Plans call for expansion of the initiative to encompass the entire endemic zone, and for modeling of interannual to decadal-scale expansion and contraction of the zone, which may influence large cities from Los Angeles to Las Vegas to El Paso. The initial research will be published by the researcher, as her master's thesis, during the 2000-2001 academic year.

CLIMATE & HYDROLOGIC VARIABILITY AND FORECASTING

Scientists associated with the natural science component of the assessment derive their research initiatives from stakeholders' expressed needs and the vulnerabilities revealed through social-science research. Researchers currently conducting natural-science investigations represent Laboratory of Tree-Ring Analysis, Department of Hydrology and Water Resources, and Department of Geography

Climate Variability

Research on the mechanisms responsible for climate variability in the Southwest is structured around the following questions:

- *What is the nature and what are the causes of climatic and hydrologic variability in the Southwest on interannual, decadal and century time scales?*
- *How do climatic and hydrologic variability vary geographically within the region?*

A review of the status of knowledge about climate and climate processes in the Southwest region was identified as a key priority for the integrated research effort, both by CLIMAS team members and by stakeholders. This review provides a common foundation regarding the current status of knowledge about climate in the region, and provides a context for subsequent CLIMAS research. Both instrumental and paleo archives have since been incorporated into a formal working paper, *The Climate of the Southwest, CL1-99*, publicly available through the CLIMAS website or by contacting the CLIMAS core office.

Currently, considerable emphasis is being placed on downscaling and interpolation of instrumental and paleo data through neural network modeling, reanalyses of NCAR/NCEP reanalysis data, and local/regional station data. Where possible—without compromising accuracy—the data will be downscaled to a target scale of 1km. The downscaled data will provide information essential to the group's work on the nature and causes of interannual and decadal variation on the subregional level. The data will also contribute to improved prediction and better understanding of controlling processes and interactions for the summer (monsoon) and winter seasons (mid-latitude systems). Equally importantly, the downscaling and interpolation initiative responds to needs articulated by stakeholders for information specific their geographical locations. To address these stakeholder-identified needs, high-resolution products, including temperature and precipitation maps as well as time-series data, will be made available on-line. These products are being developed using a "smart interpolation" methodology developed by members of the CLIMAS team.

In collaboration with the Border Studies task group, current work also focuses on investigation of transboundary climate processes. There are two primary areas of emphasis. The first involves investigation, of mechanisms associated with the North American Monsoon. The goal is to identify predictable relationships that can improve monsoon forecasting. The first forecast, based on CLIMAS research, was issued for the Summer, 2000 season. The second initiative involves reconstructing the climate processes underpinning the 1950s drought in northern Mexico. This initiative, which relies on both instrumental and paleo data, is being carried out using neural network and statistical techniques.

Notable advances have also been made by CLIMAS team members in reconstruction of the Pacific Decadal Oscillation, using paleo and instrumental data. Results indicate that reversals of the past few decades are rare in records dating back to AD 1000. A 73-year periodicity for the PDO has been identified over the past 1000 years, but the more recent anomaly calls into question the capacity at this time to make reasonable predictions about PDO trends in the future.

Climate and Hydrologic Forecast Evaluation

Assessment of the skill of climate and hydrologic forecasts being issued by various agencies is essential to building effective climate outreach and climate services links with stakeholders in the region. The questions structuring research in this important area of inquiry include:

- *How predictable are seasonal to interannual variations in climate and hydrology?*
- *How will better mechanistic understanding of climate and hydrology affect predictability?*
- *How good are existing forecasts?*

To establish the background knowledge needed to assess forecasts affecting the region, an intensive research initiative was undertaken in Year 1 to review of the current status of weather, climate, and hydrologic forecasting for the Southwest. The results of the review are published in CLIMAS Report No, CL2-99, *Weather, Climate, and Hydrologic Forecasting for the Southwest*. The review, which provides a baseline description of the processes, skill, and communication methods of forecasts currently used in operational contexts, is available on the CLIMAS website. A hard copy may be obtained from the CLIMAS Office.

The decision to focus on evaluation of forecasts grew directly out of the findings arising from interactions with stakeholders, including formal surveys and personal interviews conducted by CLIMAS team members and from two CLIMAS-sponsored stakeholder workshops. Further, the increasing capacity to forecast ENSO events at useful lead times highlighted the potential for addressing climate impacts through the use of climate forecasts.

Forecast evaluation using reanalysis techniques has recently been initiated. In addition, beginning last year, forecast evaluations focusing on archives of official forecast products, including CPC seasonal climate outlooks and multi-agency (NWS/NRCS) seasonal water supply outlooks were initiated.

A specially targeted case study analysis, not formally funded under CLIMAS but very useful to the project, investigated the use of forecasts during the 1997-1998 ENSO event. This study, which resulted in a master's thesis, specifically examined the use of hydroclimate forecasts, how the forecast products were interpreted and used, and how the products were integrated operational decision making and activities. Related to the forecast research, work is currently underway on evaluation of gridded snow estimates, with the goal of producing information useful in hydrologic forecast procedures. A review of the state of knowledge of hydrologic variability in the Southwest is also underway; the final product will complement the climate variability review noted above.

THE CLIMAS CORE OFFICE

The CLIMAS Core Office serves as the organizing point for the project's research initiatives, and actively works to maximize project integration. The Core Office also serves a primary liaison function between the project and external entities, as well as a bridge between the project's scientists and the region's stakeholders. The questions informing CLIMAS Core Office activities include:

- *How can climate information best be communicated to stakeholders, researchers, and the general public?*
- *What are stakeholders' information needs?*
- *How can stakeholders' needs best be addressed (i.e., through CLIMAS or reference to other activities)?*

The CLIMAS Core Office was set up to manage the project and its budget, and to integrate the natural and social science components of CLIMAS in the analysis, interpretation, and communication of climate and hydrologic information to regional stakeholders. Important initiatives include building and maintaining the CLIMAS web site, sponsoring outreach activities involving stakeholders, and network building within CLIMAS and between CLIMAS and other entities. The CLIMAS Core Office also ensures that project activities and findings are represented in a wide array of contexts, including conferences, formal and informal meetings, the media, and educational activities. The office also engages regularly in outreach activities such as publication of the *CLIMAS Update* newsletter, publication of working papers, reports, and other documents produced by team members, and organizing and co-organizing workshops, symposia, and conferences on topics related to the CLIMAS mission. Further, the CLIMAS Office schedules regular meetings for CLIMAS team members (which are open to the public), conducts stakeholder surveys to assess need for and use of climate information, and contributes to related efforts, such as the USGCRP National Assessment process.

Two of the stakeholder workshops sponsored by the CLIMAS Office are particularly notable for influencing research and outreach activities. The first, a workshop held in Summer 1998 to discuss forecasting, resulted in intensive analysis and evaluation of key climate and hydrologic forecast products. The second, held in February 2000, highlighted the connections between climatic conditions and wildfire hazard, and prompted a decision to propose a new CLIMAS research initiative on the climate-wildfire connection, beginning in Year 4.

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