PROTECCT-GLAM: Providing Risk of The Environment's Changing Climate Threats for Galleries, Libraries, Archives & Museums.

The PROTECCT-GLAM project is a three-year research project conducted by Dr. Edward Benoit, III, Associate Director, School of Library & Information Science, Louisiana State University, Dr. Jill Trepanier, Associate Professor, Department of Geography & Anthropology, Louisiana State University, and Dr. Jennifer Vanos, Associate Professor, School of Sustainability, Arizona State University. This applied research project proposal requests $473,243 from the National Leadership Grants for Libraries under Program Goal 4 and Objective 4.1. The research will develop a national categorical climate change risk assessment scale for galleries, libraries, archives, and museums (GLAMs) through a geographic information system (GIS) analysis of existing climate change threats and models. The project will also develop a prioritized research agenda to address the associated challenges through hosting a working institute of academic faculty, doctoral students, and GLAM practitioners.

Occurring over three years, the project will incorporate two main phases with three years of graduate student support. The research will address the following questions: What are the climate change-related risks most likely to provide threats to GLAMs? How can climate change risk for GLAMs be understood as a categorical scale when combining those threats most likely to need significant consideration? What are the GLAM-specific climate change challenges? How can a collaborative research agenda best address these challenges with input from practitioners and academics?

<u>Project Justification</u>

Broad Needs

For decades, climate scientists have attempted to warn society about potential significant threats related to a changing climate as an attempt to call for action. Unfortunately, many did not take the danger's immediacy seriously, and the risks have now moved from potential to present. According to the 2021 Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report, widespread and rapid changes in the atmosphere, ocean, and biosphere have already occurred. The predominant evidence of these changes can be noticed in extreme behavior of heatwaves, heavy precipitation, droughts, and tropical cyclones, which will all continue to increase in severity and frequency into the future.[1] The nine U.S. regions considered by the Fourth National Climate Assessment all have increased threats from these events into the future, regardless of which future climate scenario is considered.[2]

More than ever before, cultural heritage institutions must assess their unique climate change-related threats to their collections and missions as part of their overall disaster and emergency management plans. According to the 2019 Heritage Health Information (HHI) Survey, 58% of institutions do not have a disaster plan, with 75% lacking both a plan and staff training to implement a plan.[3] Furthermore, the HHI report indicated an increased attribution of damage between 2017-2019 due to water or moisture (56%), with natural disasters accounting for 10%.[4]

This proposed project would help repositories identify their associated risks from a changing climate and direct a future research agenda toward meeting GLAM's specific challenges. Recent history demonstrates a self-awareness of the lack of institutional preparedness for climate-related disasters and general uncertainty of how to initiate such preparedness work. Academic librarians noted evidence of these issues after assessing the damages

---

[1] IPCC, in press.
[2] Black & Brown, 2020.
[3] IMLS, 2019.
[4] Ibid.

of Hurricane Katrina in 2005. While disaster management and safety plans did exist, there was an explicit acknowledgment of inadequacy in handling large-scale climate-related storms.[5] Harris County Public Libraries sustained widespread damage when Hurricane Harvey ravaged Texas in 2017. One month following the August storm, libraries faced extensive damages, with four branches closed because "estimated damages to technology, collections, furniture, and supplies at these locations alone amount to roughly $4.5 million."[6]

Project Target Group

Although existing projects and scholarship discuss climate change risks for cultural heritage institutions, the majority of studies focus primarily on a single institutional type or risk factor.[7] The proposed project takes a more holistic approach through exploring climate change manifestations and compounding risks factors across all repository types. The project will leverage a target group of over 92,000 cultural heritage intuitions within the United States, including art museums, children's museums, history museums, natural history museums, science museums, zoos and nature centers, historical societies, historical sites, college and university archives, community archives, corporate archives, governmental archives, religious archives, tribal archives, academic libraries, public libraries, school libraries, special libraries, and government libraries.

It also brings together researchers from diverse scientific backgrounds providing unique insights to understanding climate change threats to institutions tasked at protecting the nation's most vital historical resources. Historically, assessments of environmental risks from weather events or the changing climate have been conducted by physical scientists (e.g., meteorologists, physicists, and mathematicians), but in recent years, the need for pairing their information with social scientists has grown. Climate change impacts will not be the same everywhere. This means human populations will not be affected the same way across all regions. By incorporating societal needs and considering variations in vulnerability across human groups, this project will provide detailed assessments of local and regional climate threats that can be used to increase the resiliency of respective social systems.[8] Overall, the proposed project's target group will also serve as the primary beneficiaries of the resulting research.

Previous Work

The proposed project builds off previous GLAM climate change research.[9] Prior research provided foundational evidence reinforcing GLAM's awareness of climate change effects from a diverse array of phenomena, including sea-level rise, storm surge, surface flooding, precipitation, temperature change, and humidity.[10] Prioritizing action has typically begun with identifying those GLAMs whose geographical locations make them most vulnerable to the destructive force of climate change effects. According to Nsibirwa, Hoskins, and Stillwell (2013), "the degree of vulnerability of buildings, based on the strength of the wind, needs to be considered especially in areas prone to hurricanes, tornadoes, and tsunamis."[11]

Mazurczyk et al. acknowledged that the majority of climate risk in cultural heritage research prior to 2018 focused on archaeological sites, buildings, and heritage sites, often European and coastal.[12] Additionally, the previous research did not address adaptation, preservation, and planning. Mazurczyk et al. analyzed archival locations,

---

[5] Diamond, 2006.
[6] Eberhart, 2017, p. 21.
[7] For example, Mazurczyk et al., 2018.
[8] Thomas et al., 2019.
[9] Bertolin, 2019; Tansey, 2015; Gordon-Clark, 2012; Gordon-Clark & Shurville, 2010; Charney & Hauke, 2020; Meyer, 2008; Sutton, 2020; Hamilton & Christian Ronning, 2020.
[10] Mazurczyk et al., 2018.
[11] Nsibirwa, Hoskins, & Stillwell, 2013, p. 116.
[12] Mazurczyk et al., 2018.

specifically those with climate change data representing extreme weather events.[13] The study, "combined a qualitative metric of climate risk exposure to support adaptation planning." Results of the analysis demonstrated storm surge and sea-level rise directly impacting archives and the need for the creation of disaster management plans as essential to the survival of archival repositories. Mazurczyk et al. conclude, "A cumulative risk assessment confirmed the need to understand the compounding effects of climate change on archival repositories using an evaluation process that allowed for cross-comparison."[14]

Similarly, Oliver noted the lack of climate change related research in the broader cultural heritage sphere focused on North America.[15] Nicu found only 12% of studies related to North American cultural heritage, with another study reporting 17% of publications.[16] These studies also highlighted the overwhelming focus on "architecture, and built heritage, climate and natural hazards and archeology."[17]

Hamilton and Christian Ronning argued that museums should take the role of "key convener" to museum audiences and the public as a whole on issues related to climate change as "public-facing institutions."[18] Their study utilized the National Academies of Sciences data on "community specific literacy," and compiled data from patron outreach. The results proposed a "model for engagement" for museums and patrons in which communication surrounding climate change is essential in order to move forward with advocacy and action. This is propositioned through the convergence of scientific research and findings, professional audiences, and public audiences.

Scholars put forth a call for diligent action and proposed climate change be approached in two ways: creating an immediate disaster protocol and planning collaborative approaches for ongoing impacts.[19] Furthermore, previous research highlights concerns with how GLAMs choose to preserve materials, anticipate disasters, develop "preventative conservation," and undertake restoration, as they all must work in conjunction with one another.[20] The "Libraries and Archives in the Anthropocene" colloquium in 2017 took a step towards collaboration through bringing library and archival scholars together to present their research on the role of archives and libraries in combating climate change.[21]

Following the impacts of recent natural disasters, scholars urged GLAMs of the importance of preparation interwoven into a standard workflow. Specifically focused on archivists, Tansey notes that preparedness must come in the form of consistent work that integrated into everyday operations:

> Consistent with disaster-preparedness recommendations, archivists should ensure that they have a disaster plan in place that includes "policies, procedures, and information that direct the appropriate actions to recover from and mitigate the impact of an unexpected interruption of operations, whether natural or man-made" (SAA). However, it is critical that they shift their treatment of disaster preparation from a stand-alone activity to a set of procedures that is woven into the rest of archival practice to increase professional resilience. Treating disaster preparation as separate from the rest of the archival enterprise often means it is relegated to the bottom of a to

---

[13] Ibid.
[14] Mazurczyk et al., 2018, p. 118.
[15] Oliver, 2021.
[16] Nicu, 2017; Fatorić & Seekamp, 2017.
[17] Oliver, 2021, p. 285.
[18] Hamilton & Christian Ronning, 2020.
[19] Tansey, 2015.
[20] Bertolin, 2019.
[21] Litwin, 2017.

do list, or the sole responsibility of one person, instead of the shared obligation of an archives staff.[22]

The proposed project will leverage the experiences of previous climate-related disasters, identify future risk, and prepare institutions to prepare more effectively. The PIs are equipped to facilitate such work, as the profession has evolved by adopting best practices to meet the necessities of changing technologies and trends.

Overall, previous research highlights GLAMs unpreparedness for immediate disasters, the pervasive long-term effects, and contingency plans. Implementing climate change protocols are superseded by daily issues facing institutions, along with organizational and financial challenges. Damages sustained to Philadelphia's Jewish Sports Hall of Fame Museum from Hurricane Ida in 2021 serve as an unfortunate example of what happens to institutions without contingency plans and financial support. The museum is located within the Jewish Federation of Greater Philadelphia's basement (therefore ineligible to receive insurance coverage) with no alternate emergency storage plan. When Ida's flooding created ten feet of sewage-filled water within the museum, the result was destruction to the collections estimated at $60,000 to restore.[23] The proposed institute's development of a prioritized research agenda will consider the ramifications of GLAMs lacking endowments, funding, and staff to create appropriate resources for implementing contingency plans.

Additionally, the project focuses on inter-repository and scholar collaboration. Planning initiatives must be personalized by understanding how they are "appropriate through coordination and cooperation" with institutions.[24] For example, cooperative preparation for the Museum of Fine Arts, Houston, was essential when Hurricane Harvey touched down on Texas in 2017. The museum had an existing Hurricane Planning Group that implemented sandbagging, floodgates, and stationing of emergency pumping equipment to help protect indoor collections.[25] Unfortunately, Rockport Center for the Arts in Corpus Christi suffered a much different fate when Hurricane Harvey's 130 mile-per-hour winds ravaged the 10,000-square-foot sculpture park producing devastating external damages. Outdoor museum structures and foundations present unique challenges yet to be addressed amongst institutional response efforts.

Prior studies include approaches outside of the individual GLAMs immediate resource and knowledge base. These multi-layered approaches to dealing with climate change effects ranged from reframing how materials were initially preserved to a physical relocation of institutional holdings. Therefore, evidence of climate change issues progressing and evolving call for preservation approaches to shift.[26] In-house materials may be transferred to off-site locations to create "safe havens."[27] In the case of the Washington Fire in Sonora, California, contingency plans of items being placed in storage still did not safeguard from disaster. The Sonora Fire Museum's storage facility was decimated in the Washington Fire in 2021 that "dozens of artifacts packed away in storage are now charred and almost unrecognizable."[28] The devastation of wildfires is one such challenge that most institutions are not prepared for despite their best efforts. Monetary resources to construct impenetrable structures, such as those of The Getty Center, survived the brutal devastation of wildfires. Fires developed north of Los Angeles and moved through the Getty Center in 2019. The Center's buildings are made of cement and steel, fire-resistant

---

[22] Tansey, 2015, p. 49.
[23] Tannewald, 2021.
[24] Mazurczyk et al., 2018, p. 125.
[25] Cascone, 2017.
[26] Nsibirwa et al., 2013.
[27] Gordon-Clark & Shurville, 2010.
[28] Fox 40 News, 2021.

travertine stone walls, floors, and rooftops, automatic fire doors, and a "state-of-the-art air system which has been deployed to hermetically seal the galleries and library archives from smoke."[29]

The notion of sustainability is addressed and how choices made in the present moment may translate towards the future. Tansey explains in terms of archival work that:

> Sustainability is not just about building design or waste streams—it is also about the acquisition, appraisal, processing, and outreach choices archivists make on a daily basis as part of professional practice. Sustainability and resiliency in an archival context form a complementary relationship. Sustainable choices enable archives to be resilient in the face of climate-change threats. Sustainable archival practice means making present-day archival choices that enable future archivists to carry out their jobs and ensures survival of cultural heritage.[30]

Despite these best efforts, GLAMs will continue to suffer based on location and proximity, such as galleries in New York City during Hurricane Sandy. In 2012 *The Guardian* reported:

> Galleries in the Chelsea district of the city have been particularly hard hit. Magda Sawon, owner of the Postmasters gallery, tweeted: "Chelsea is flooded up to tenth avenue... Pumping the basement." With water rising, paintings not removed from walls have been badly damaged. At Zach Feuer gallery, for instance, where water reached 5ft high indoors, the exhibition Kate Levant: Closure Of the Jaw has been "destroyed". On the pavement outside Churner and Churner gallery on Tenth Avenue, soiled paintings in bubble wrap are piled up. "I've probably lost $100,000 worth of art," says owner Rachel Churner. Gallery owners, when they are able to get to their premises, are still finding them inaccessible, with many metal doors buckled.[31]

As noted earlier, prior GLAM research primarily focuses on individual events or institutional types. The proposed project will incorporate prior experiences into defining GLAM-related threats, and the proposed institute will create collaborative opportunities for addressing these challenges.

The project is also grounded in prior climate change research. Extreme tropical cyclone wind speeds and storm surges around the coastal U.S. are expected to increase, particularly along the Gulf of Mexico. The area most at risk of extreme landfalling events are within the central Gulf of Mexico coast from New Orleans, Louisiana to Dauphin Island, Alabama.[32] More tropical cyclone events are also occurring along the northeast U.S. coastline due to warmer ocean temperatures throughout the region. It is crucial to assess the change in these events across space because the changing nature of the storms is not the same everywhere. In fact, the frequency of minor events decreases in the Gulf of Mexico while increasing along the northeast coast, but the intensity of the events is becoming more extreme.[33] There are also indications of an increasing number of rapidly intensifying tropical cyclones near the Gulf Coast, or those that rapidly increase sustained wind speed over 24 hours, further threatening coastal GLAMs.[34] There is support for increasing variability in extreme rainfall in Louisiana and elsewhere in the southeastern U.S., not necessarily related to tropical cyclone events. Texas' weather stations show the most significant increase in maximum rainfall over time.[35]

---

[29] Cascone, 2019.
[30] Tansey, 2015, p. 48.
[31] Hind, 2012.
[32] Trepanier et al., 2017.
[33] Trepanier, 2020.
[34] Benedetto & Trepanier, 2020.
[35] Brown et al., 2020.

Research also suggests that extreme heat events are increasing in intensity and duration, with humid air becoming more common, as evidenced by increasing dew point temperatures.[36] Humid heat is more stressful to the body than dry heat, particularly for the elderly and those with pre-existing conditions, and thus concerns for health, safety, and productivity across demographic groups are on the rise. From 2004 to 2018, 10,527 deaths in the U.S. resulted from exposure to heat-related conditions, with reports highlighting complex vulnerabilities due to comorbidity and health status, age, urbanization level, and socioeconomic status.[37] Heat illness and mortality are preventable, yet the physiological limits of heat tolerance are finite, and many non-physiological factors substantially reduce these limits. For example, social and economic vulnerabilities associated with heat mortality limit an individual's resilience to prevent increasing body temperatures.[38]

Project Work Plan

Occurring over three years, the project will incorporate two main phases with three years of graduate student support. The research will address the following questions: What are the climate change-related risks most likely to provide threats to GLAMs? How can climate change risk for GLAMs be understood as a categorical scale when combining those threats most likely to need significant consideration? What are the GLAM-specific climate change challenges? How can a collaborative research agenda best address these challenges with input from practitioners and academics?

Years One and Two will address the first two research questions through leveraging advanced geographic information system (GIS) analysis of existing climate change threats and models. The PIs will interpret existing research to identify GLAM-specific risks including, but not limited to, tropical cyclone wind and/or flooding damage, inland precipitation, and extreme heat signatures.

The analysis will utilize a comprehensive GLAM dataset previously developed by the PIs with assistance from 20 students between 2020-2022. The PIs leveraged existing listings of institutions and repositories such as the IMLS Museum Data Files, the 2017 Repository Data for United States Archives, the American Library Directory, and the IMLS Public Library Survey. Each entry in the combined dataset was verified or updated to include physical location if only a mailing address was initially provided. The compiled dataset includes over 30,000 galleries and museums, 36,000 libraries, and 26,000 archives compared to the 2019 HHI dataset that included 31,290 collecting institutions in the United States.[39]

While the PIs made every effort to make the dataset all-inclusive, some institutions will inherently be excluded. These exclusions may be due to the establishment of institutions after the original data was collected. Additionally, repositories that are entirely community-run may be overlooked initially. The PIs will try to offset these exclusions through posting the whole dataset and an open call for additions (or corrections) prior to its use in the analysis. The dataset will be stored in the LSU Digital Commons and linked to via the project website.[40] The dataset will include instructions for submitted user corrections and additions. The open call for additions will be sent to GLAM stakeholders, including, but not limited to, associated national and regional professional organizations such as the American Library Association, Society of American Archivists, and the American Alliance of Museums. The potential exclusion will not limit the usefulness of the resulting analysis, however, as the public interface will allow users to look up specific institutions by name or geographic location coordinates.

---

[36] Vaidyanathan et al., 2018.
[37] Ibid.
[38] Vanos et al., 2020; Jay et al., 2021.
[39] IMLS, 2019.
[40] https://digitalcommons.lsu.edu/

The PIs will use the ArcGIS Pro software available through LSU and ASU to estimate climate/weather risks to GLAMS. ArcGIS Pro is the latest professional desktop GIS application that allows for exploration, visualization, and analysis of geographic data through two- or three-dimensional scenes (including story maps). The work can then easily be shared through the ArcGIS portal maintained on the LSU server for public use. The PIs will first showcase the current known risks to GLAMS throughout the U.S., focused on those most likely to cause damage to infrastructure or resources (i.e., wind and flooding related events) or cause issues in storage and maintenance (i.e., extreme heat).

Tasks in year one include a comprehensive review of the current research to understand the major threats to GLAMS and gather data associated with threats. Data sources include the National Oceanic and Atmospheric Administration's National Hurricane Center (for tropical cyclone frequency and wind data), LSU's Southern Climate Impacts Planning Program's SURGEDAT (for tropical cyclone storm surge data), the National Oceanic and Atmospheric Administration's Physical Science Laboratory (for gridded precipitation data related to tropical cyclones and other non-tropical events), and the collection of airport weather stations from the National Climate Data Center (for air temperature and humidity variables).

Tasks in year 2 include estimating the risk with statistical approaches utilized by the PIs in previous research. The statistical estimation of risk will be done in varying levels of complexity. First, essential historical records will be collected for the nine regions within the United States and its territories utilized by the Fourth National Climate Assessment (See Figure 1).
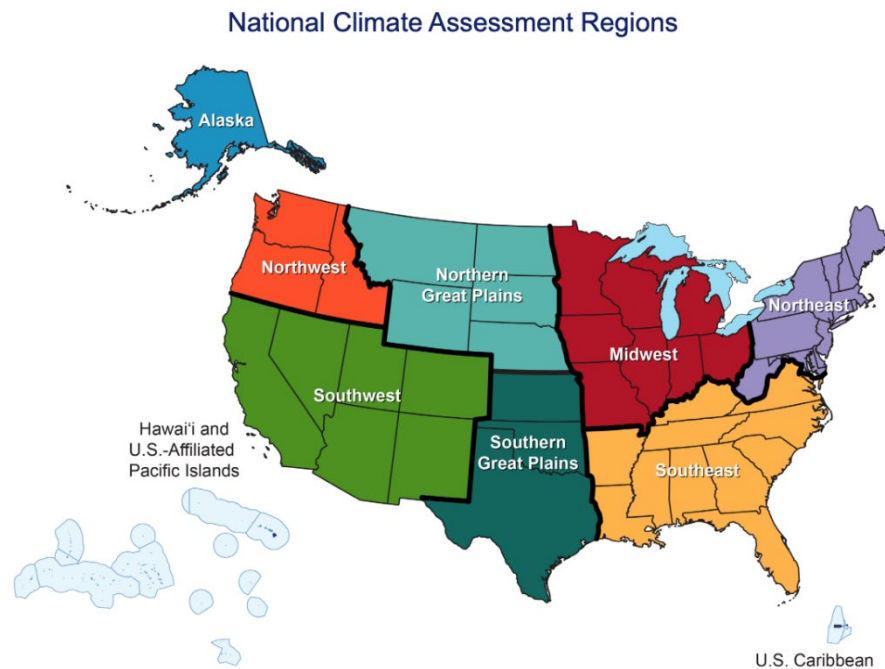
Figure 1: Map of the nine regions used throughout the Fourth National Climate Assessment.[41]

Several climate-related stressors will be evaluated in broad categories within each region, such as temperature, precipitation, and severe storm events. Maps for each individual region and each individual stressor will be produced using ArcGIS. Changes in these variables over time will also be considered to understand better whether these conditions will be expected to change in the future (i.e., become more/less intense/frequent). Second, the

---

[41] USGCRP, 2018.

combination of these stressors will be considered in each of the nine regions, and, where applicable depending on time trend results, more complex statistical approaches (e.g., extreme value theory) will be utilized to consider the future risk of specific variables (i.e., extreme heat, extreme tropical cyclone wind and surge, and extreme precipitation).

The PIs will categorize the overall GLAM risks and develop a comprehensive risk assessment scale from minimal to maximum threat level after the visualization analysis. The GLAM risk scale will function similar to existing climate and weather-related scales, such as the Storm Prediction Center's five-level risk scale: Marginal (level 1), Slight (level 2), Enhanced (level 3), Moderate (level 4), and High (level 5). The PIs will quantify the associated risks through assigning values to each risk factor with weighted multipliers for anticipated frequency and severity. The resulting scale will allow institutions to properly identify their climate-change related risks, create emergency management plans, develop short- and long-term mitigation plans, and prioritize funding opportunities.

The final year two task will be building a web interface using ArcGIS for public use, including story maps after the project ends. Working with a GIS technician, we will develop a GIS public platform through Louisiana State University's web server. It will be publicly accessible, and the link will be shared with the entire LSU network and GLAM stakeholders, including, but not limited to, associated national and regional professional organizations such as the American Library Association, Society of American Archivists, and the American Alliance of Museums. Additional promotion of the website will occur via social media. The site will be maintained by PIs Trepanier and Benoit, while they remain at LSU for the foreseeable future. In addition, when new information is released related to potential climate risks, the site data will be updated to represent the latest risk for a given region. Within the platform, the nine regions will be identified throughout the U.S. (used by the Climate Risk Assessment) to provide regional categorization of risk but will also allow for individual users to search for GLAMs or latitude/longitude coordinates to identify the risk categories for that specific locale. In this way, a practitioner might consider regional risk while also finding use with specific location risk for their own management purposes.

Year Three will address the final two questions through hosting a working institute gathering key practitioners and academics from the GLAM communities to discuss challenges and the research needed to address them. The institute structure closely aligns with the Archival Education and Research Institute (AERI) model whereby faculty, doctoral students, and practitioners engage in a working institute to nurture and promote state-of-the-art scholarship and encourage the development of innovative solutions to climate change challenges. The AERI model's success in meeting its initial goals provides a solid foundation to build upon for climate change research. The proposed four-day institute will leverage the results from the project's first phase to serve as its foundation. The institute will include academic faculty, doctoral students, and practitioners from across the GLAM space based on an application process. Calls for participant applications will be sent to email listservs and fora of national and regional GLAM professional organizations, such as the American Library Association, Society of American Archivists, and the American Alliance of Museums; academic listservs such as JESSE; and circulated via social media. Following the application deadline, the PIs, in consultation with the advisory board, will select attendees to ensure equitable representation and access to participation in the institute. Faculty and doctoral student participants will be expected to present their own research (or works in progress) during the institute. While practitioners will be given the opportunity to present as well, they are not required to do so. All institute participants will collaborate and develop a future research agenda, prioritized timeline, and communication plan to best address the identified GLAM climate change-related risks through small working groups during the institute. A preliminary schedule for the institute is provided in the supplemental documents.

Following the AERI model, participants will stay at LSU on-campus housing during the institute in Cypress Hall, a LEED-certified residence hall, and share most meals together to promote networking and community building

throughout the institute. Additionally, the use of campus space and infrastructure significantly reduces the costs associated with an institute. LSU provides unique opportunities for participants including:

- The LSU Center for River Studies which houses a 10,000 square foot movable bed model of the Mississippi River Delta that is able to replicate the flow, water levels and sediment transport of the river.
- The Water Campus is the first major center dedicate to the study of coastal restoration and sustainability. Located along the Mississippi River, it includes more than 1.6 million square feet of labs, research facilities, and commercial space.
- The LSU AgCenter LaHouse Resource Center is a permanent showcase house with 7 acres of landscape exhibits highlighting practical and proven solutions for green, durable, healthy, practical, and convenient approaches to sustainable buildings and landscapes.

The project will cover institute attendance costs for 50 in-person attendees, including a travel allowance, lodging, and meals. The PIs anticipate an additional 10-15 local participants who will not receive a travel allowance or lodging, including Southern Climate Impacts Planning Program representatives, LSU and Southern University faculty and students, and regional practitioners. As noted above, the PIs will recruit participant applications through a combination of direct invitation and promotion on professional organization fora.

The PIs have prior experience transitioning an in-person conference to a virtual format and are prepared to do so in case of the current (or future) pandemic issues.[42] While an entirely virtual option is available, if needed, the institute will function better in person as the participants will remain more engaged throughout the institute leading to more organic community-building and collaboration. Elements of the schedule will be live-streamed and recorded for interested parties who cannot travel, including plenaries. In keeping with the spirit of the institute, the project will provide $5,000 in carbon offsets for the impact of participant travel and lodging (equivalent to 1,000 metric tons of CO_2).

Throughout the project, the PIs will meet regularly with an advisory panel to receive feedback on the project's progress and development. Formal meetings will occur 2-3 times per year via Zoom. Such meetings will occur at critical stages in the project, including codifying the list of associated risks, developing the GLAM risk model, institute planning and recruitment, and disseminating project findings. The PIs will also periodically request feedback via email outside of the formal meetings. Each board member will be compensated $500 per year of the project for their time and expertise. The advisory board will include practitioners representing each institutional type (galleries, libraries, archives, and museums) who engage in climate-change related scholarship. The PIs will also include a climatologist on the advisory board to provide feedback on the use and application of climate-modeling during the project. The initial membership of the board includes:

- Dr. Vincent Brown, Director of the Southern Climate Impacts Planning Program (SCIPP), Geography and Anthropology, Louisiana State University
- Ben Goldman, University Archivist, Eberly Family Special Collections Library, Penn State University
- Eira Tansey, Digital Archivist and Records Manager, Archives and Rare Books Library, University of Cincinnati
- Patrick Hamilton, Director of Climate Change, Energy and the Environment, Science Museum of Minnesota
- Madeleine Charney, Research Services Librarian, University of Massachusetts Amherst Libraries

---

[42] LSU SLIS hosted the Society of Southwest Archivists 2021 conference in an entirely virtual format.

<u>Diversity Plan</u>

The project's focus on climate change impacts will inherently incorporate geographical diversity. Unfortunately, marginalized communities are more at risk due to their geographic locations near coasts, low-lying and/or low-income areas, and in hotter areas within cities. The proposed institute in year three will prioritize participants from marginalized and underrepresented communities affected by these extremes. Finally, students from underrepresented groups will be given hiring preference for the project's positions. This particular project is unique due to the blend of information science and climate science, perfectly positioning it to provide opportunities for students to learn more about their environment while also learning about how to utilize resources available to them.

<u>Project Results</u>

The anticipated findings from the project's first phase will be publicly disseminated through an online portal. GLAM practitioners will be able to interact with the project's ArcGIS map to identify their institution's potential risk. All data and analysis will be openly available to any interested user from the project website and the LSU Digital Commons. In addition to the web-based interactive ArcGIS map, the website will include a series of story maps highlighting examples of different risk types and important areas of concern.

The project website will also include recordings of all institute plenaries. Additionally, the website will provide access to all the institute's presentations, working group discussion summaries, findings, and action items. The PIs will publish a comprehensive white paper focused on best practices and preparation suggestions for individual repositories utilization, the proposed research agenda to address grand challenges, and the subsequent prioritization of research as decided by the institute participants. The institute's research agenda and project results will be used to secure additional funding from governmental or private sources through collaborations developed during the institute. Finally, the project results will be communicated to non-GLAM communities through enacting the institute's communication plan to governmental agencies at the federal, state, and local levels, print and electronic media outlets, and other interested community groups.

Schedule of Completion: August 2022-July 2023

Task Name	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23
Open application for GA & student workers	■											
Interview & hire GA & student workers	■											
Initial meeting with Advisory Board	■											
Identify and interpret existing research to identify GLAM risks	■	■	■	■	■							
Prepare activity report & data management audit					■							
Meet with Advisory Board for feedback						■						
Post full data set and call for additions							■	■				
Collect climate threat data									■	■	■	■
Prepare activity report & data management audit											■	
Meet with Advisory Board for feedback												■

Schedule of Completion: August 2023-July 2024

Task Name	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23	Jan-24	Feb-24	Mar-24	Apr-24	May-24	Jun-24	Jul-24
Estimate risk of climate threats in seven regions	■	■	■	■	■	■						
Prepare activity report & data management audit			■									
Meet with Advisory Board for feedback				■								
Create maps for each region and each stressor in ArcGIS						■	■	■				
Prepare activity report & data management audit							■	■				
Meet with Advisory Board for feedback								■				
Estimate changes of these threats and create future maps									■	■		
Combine threat/stressors and categorize GLAM risk with assessment scale											■	■
Prepare activity report & data management audit											■	
Meet with Advisory Board for feedback												■

Schedule of Completion: August 2024-July 2025

Task Name	Aug-24	Sep-24	Oct-24	Nov-24	Dec-24	Jan-25	Feb-25	Mar-25	Apr-25	May-25	Jun-25	Jul-25
Build web interface using ArcGIS for public use	▓											
Provide Advisory Board access to web interface for testing		▓										
Prepare activity report & data management audit		▓										
Meet with Advisory Board for feedback			▓									
Adjust web interface			▓	▓								
Recruit Institute participants			▓	▓	▓	▓						
Prepare activity report & data management audit						▓						
Review Institute participant applications with Advisory board							▓					
Organize institute activities			▓	▓	▓	▓	▓	▓	▓	▓		
Prepare activity report & data management audit									▓			
Meet with Advisory Board for feedback										▓		
Host institute											▓	
Disseminate best practices discovered from institute												▓
Disseminate audiovisual recordings from institute												▓
Disseminate GIS interface to the public												▓
Meet with Advisory Board for feedback												▓
Draft manuscript detailing best practices for GLAMS												▓
Deposit all project data into LSU Digital Commons												▓

PROTECCT-GLAM: Providing Risk of The Environment's Changing Climate Threats for Galleries, Libraries, Archives & Museums.
Digital Products Plan

Type
The project will utilize existing data sources and import them into the LSU instance of ArcGIS. These data sources include: georeference location data of galleries, libraries, archives, and museums in the United States; the National Oceanic and Atmospheric Administration's National Hurricane Center (for tropical cyclone frequency and wind data), LSU's Southern Climate Impacts Planning Program's SURGEDAT (for tropical cyclone storm surge data), the National Oceanic and Atmospheric Administration's Physical Science Laboratory (for gridded precipitation data related to tropical cyclones and other non-tropical events), and the collection of airport weather stations from the National Climate Data Center (for air temperature and humidity variables). These data sources will be stored in a file geodatabase within ArcGIS.

Following data analysis, the project will create a public-facing interface as a website. Such a website will allow users to interact with the data visualization overlaid on a GIS mapping of the United States.
Finally, the project will create several assets as part of the institute, including audio and video recordings of the institute plenaries in mp3 and mp4 formats; research presentation materials (PDF); working group meeting summaries (PDF); and an institute white paper (PDF).

Luke Driskell, Computer Analyst for the Department of Geography & Anthropology at Louisiana State University (LSU), will be responsible for creating the public-facing ArcGIS website and managing the ArcGIS data associated with the project utilizing the LSU instance of ArcGIS and LSU Servers.

The audiovisual recordings of the institute will use equipment from LSU School of Library & Information Science's audiovisual recording lab, including a Panasonic AG-CX350 recorder, GVM-800D-II professional lighting; and Polsen CAM-2W wireless microphone system. The subsequent files will be processed by the PIs using Audacity and Camtasia. PDF materials will be generated using the LSU license for Adobe Creative Cloud.

As noted earlier, the project's GIS analysis will create a range of file formats, including a public-facing website using HTML and XML; a file geodatabase within ArcGIS; and Keyhole Markup Language (KML) data. The institute-related static content will be created using PDF-A format and standard, and the audiovisual content will be recorded simultaneously in wav and mp3 audio formats with 24-bit/192 kHz resolution. The moving image recordings will be made with 1920 x 1080p resolution at 60fps in AVCHD format.

The recording files will include complete Exif metadata associated with their capture. All digital files will include descriptive metadata adhering to Dublin Core (as prescribed by the LSU Digital Commons) and preservation information based on PREMIS metadata.

Metadata will be created at the time of file generation including the creation of use copies. The research team will only use software applications that maintain embedded metadata and ensure that non-embedded metadata files remain attached to their associated files when moved between storage systems. After the award period, the digital materials and associated metadata will be submitted to the LSU Digital Commons, which will maintain and preserve the files.

Availability
All digital content will be deposited and made available through the LSU Digital Commons (DC) (https://digitalcommons.lsu.edu/). Additionally, they will be linked on the project website. The public-facing ArcGIS website will also provide user access through a web service for use by other applications such as ArcGIS Pro, other ArcGIS Online apps, or apps/websites completely unrelated to the ArcGIS platform (QGIS or a Google Maps API app, for example).

The PIs will adhere to LSU Policy 68, whereby all intellectual property rights will be assigned to the university with a royalty-free license issued to IMLS and other governmental agencies. IMLS will own the IP arising directly from the project; however, LSU owns all other IP developed.

Access

The public-facing ArcGIS website will be openly available for use by anyone. Additionally, all project data will be openly available for use via the LSU Digital Commons and will be posted on the project website. Institue recordings and PDFs will also be made openly available through YouTube and the project website. No specialized hardware or software will be required to access or use these data.

Sustainability

The project ArcGIS data will be backed up locally and in the cloud utilizing the LSU server network and ArcGIS agreements. The PIs will submit the public-facing website for inclusion in the Internet Archive's Wayback Machine. The PIs will create daily backup files during the data analysis phase of the project. Each institute recording file will be uploaded to a cloud backup using the LSU Box service with an additional copy made from the originals on a portable hard drive. The institute static files will also be uploaded to Box and the portable hard drive. Once final project products are ready, the team will prepare the working files and final products from deposit in the LSU institutional repository. Through the project, the PIs will conduct a data audit three times per year to monitor adherence to the data management plan. The results of these audits will be reported to the advisory board with proposals for any necessary changes.

A long-term data sharing and preservation plan will be used to store and make publicly accessible the data beyond the life of the project. Data management for this project will be supported by LSU Digital Commons, the institutional repository for LSU: https://digitalcommons.lsu.edu/. This uses the Digital Commons software, powered by bepress, in order to disseminate and archive the scholarly output of the LSU community. Digital Commons provides full-text indexing in major search engines for discoverability of content and provides secure infrastructure for storage and preservation with multiple backups, cloud storage with Amazon Glacier, and a multi-tiered disaster recovery plan. The investigators will consult with the LSU Libraries to facilitate the ingestion of data into Digital Commons and to ensure that appropriate descriptive metadata standards are in place for all datasets and their supplementary materials. The datasets will be published in LSU Digital Commons for long-term preservation. This will provide it with unique, persistent URLs.

PROTECCT-GLAM: Providing Risk of The Environment's Changing Climate Threats for Galleries, Libraries, Archives & Museums.
Data Management Plan

SECTION I: INTELLECTUAL PROPERTY RIGHTS AND PERMISSIONS

The PIs will adhere to LSU Policy 68, whereby all intellectual property rights will be assigned to the university with a royalty-free license issued to IMLS and other governmental agencies. IMLS will own the IP arising directly from the project; however, LSU owns all other IP developed.

SECTION II: DIGITAL CONTENT, RESOURCES, OR ASSETS

The project will utilize existing data sources and import them into the LSU instance of ArcGIS. These data sources include: georeference location data of galleries, libraries, archives, and museums in the United States; the National Oceanic and Atmospheric Administration's National Hurricane Center (for tropical cyclone frequency and wind data), LSU's Southern Climate Impacts Planning Program's SURGEDAT (for tropical cyclone storm surge data), the National Oceanic and Atmospheric Administration's Physical Science Laboratory (for gridded precipitation data related to tropical cyclones and other non-tropical events), and the collection of airport weather stations from the National Climate Data Center (for air temperature and humidity variables). These data sources will be stored in a file geodatabase within ArcGIS. Following data analysis, the project will create a public-facing interface as a website. Such a website will allow users to interact with the data visualization overlaid on a GIS mapping of the United States. Finally, the project will create several assets as part of the institute, including audio and video recordings of the institute plenaries in mp3 and mp4 formats; research presentation materials (PDF); working group meeting summaries (PDF); and an institute white paper (PDF).

Luke Driskell, Computer Analyst for the Department of Geography & Anthropology at Louisiana State University (LSU), will be responsible for creating the public-facing ArcGIS website and managing the ArcGIS data associated with the project utilizing the LSU instance of ArcGIS and LSU Servers. The audiovisual recordings of the institute will use equipment from LSU School of Library & Information Science's audiovisual recording lab, including a Panasonic AG-CX350 recorder, GVM-800D-II professional lighting; and Polsen CAM-2W wireless microphone system. The subsequent files will be processed by the PIs using Audacity and Camtasia. PDF materials will be generated using the LSU license for Adobe Creative Cloud. As noted earlier, the project's GIS analysis will create a range of file formats, including a public-facing website using HTML and XML; a file geodatabase within ArcGIS; and Keyhole Markup Language (KML) data. The institute-related static content will be created using PDF-A format and standard, and the audiovisual content will be recorded simultaneously in wav and mp3 audio formats with 24-bit/192 kHz resolution. The moving image recordings will be made with 1920 x 1080p resolution at 60fps in AVCHD format. The recording files will include complete Exif metadata associated with their capture. All digital files will include descriptive metadata adhering to Dublin Core (as prescribed by the LSU Digital Commons) and preservation information based on PREMIS metadata. Metadata will be created at the time of file generation, including the creation of use copies. The research team will only use software applications that maintain embedded metadata and will ensure non-embedded metadata files remain attached to their associated files when moved between storage systems. After the award period, the digital materials and associated metadata will be submitted to the LSU Digital Commons, which will maintain and preserve the files.

The project ArcGIS data will be backed up locally and in the cloud utilizing the LSU server network and ArcGIS agreements. The PIs will submit the public-facing website for inclusion in the Internet Archive's Wayback Machine. The PIs will create daily backup files during the data analysis phase of the project. Each institute recording file will be uploaded to a cloud backup using the LSU Box service with an additional copy made from the originals on a portable hard drive. The institute static files will also be uploaded to Box and the portable hard drive. Once final project products are ready, the team will prepare the working files and final products from deposit in the LSU institutional repository.

Through the project, the PIs will conduct a data audit three times per year to monitor adherence to the data management plan. The results of these audits will be reported to the advisory board with proposals for any necessary changes.

A long-term data sharing and preservation plan will be used to store and make publicly accessible the data beyond the life of the project. Data management for this project will be supported by LSU Digital Commons, the institutional repository for LSU: https://digitalcommons.lsu.edu/. This uses the Digital Commons software, powered by bepress, in order to disseminate and archive the scholarly output of the LSU community. Digital Commons provides full-text indexing in major search engines for discoverability of content and provides secure infrastructure for storage and preservation with multiple backups, cloud storage with Amazon Glacier, and a multi-tiered disaster recovery plan. The investigators will consult with the LSU Libraries to facilitate the ingestion of data into Digital Commons and to ensure that appropriate descriptive metadata standards are in place for all datasets and their supplementary materials. The datasets will be published in LSU Digital Commons for long-term preservation. This will provide it with unique, persistent URLs. Additionally, data will be linked on the project website. The public-facing ArcGIS website will also provide user access through a web service for use by other applications such as ArcGIS Pro, other ArcGIS Online apps, or apps/websites completely unrelated to the ArcGIS platform (QGIS or a Google Maps API app, for example).

A previous researcher created a basic example of the public interface of LSU ArcGIS. It does not include all of the functionality the PROTECCT-GLAM version will, but does provide a basic example. It is located at https://lsu-its.maps.arcgis.com/apps/instant/interactivelegend/index.html?appid=3baf7c91eb8f45f588fde5448b22be32

SECTION III: RESEARCH DATA

The proposed data collection and research activities does not require approval from an institutional review board, nor will the project collect any sensitive data. As noted above, the project will utilize existing data sources and import them into the LSU instance of ArcGIS. These data sources include: georeference location data of galleries, libraries, archives, and museums in the United States; the National Oceanic and Atmospheric Administration's National Hurricane Center (for tropical cyclone frequency and wind data), LSU's Southern Climate Impacts Planning Program's SURGEDAT (for tropical cyclone storm surge data), the National Oceanic and Atmospheric Administration's Physical Science Laboratory (for gridded precipitation data related to tropical cyclones and other non-tropical events), and the collection of airport weather stations from the National Climate Data Center (for air temperature and humidity variables). These data sources will be stored in a file geodatabase within ArcGIS. The initial data collection will occur during the first year of the project (August 2022-July 2023). Following data analysis, the project will create a public-facing interface as a website. Such a website will allow users to interact with the data visualization overlaid on a GIS mapping of the United States. The public-facing website will be created during the second year of the project (August 2023-July 2024). Finally, the project will create several assets as part of the institute, including audio and video recordings of the institute plenaries in mp3 and mp4 formats; research presentation materials (PDF); working group meeting summaries (PDF); and an institute white paper (PDF). The institute data will be created during the third year of the project (August 2024-July 2025).

The public-facing ArcGIS website will be openly available for use by anyone. Additionally, all project data will be openly available for use via the LSU Digital Commons and will be posted on the project website. Institute recordings and PDFs will also be made openly available through YouTube and the project website. No specialized hardware or software will be required to access or use these data. The research team will create data documentation and procedural information throughout the data collection and analysis phase. The documentation will be included in the LSU Digital Commons.

Metadata will be created at the time of file generation, including the creation of use copies. The research team will only use software applications that maintain embedded metadata and will ensure non-embedded metadata files remain attached to their associated files when moved between storage systems. After the award period, the digital materials and associated metadata will be submitted to the LSU Digital Commons, which will maintain and preserve the files. Through the project, the PIs will conduct a data audit three times per year to monitor adherence to the data management plan. The results of these audits will be reported to the advisory board with proposals for any necessary changes.

PROTECCT-GLAM: Providing Risk of The Environment's Changing Climate Threats for Galleries, Libraries, Archives & Museums.

Dr. Edward Benoit, III, Louisiana State University, School of Library & Information Science

Dr. Jill Trepanier, Louisiana State University, Department of Geography & Anthropology

Dr. Jennifer Vanos, Arizona State University, School of Sustainability

Organizational Profile

Louisiana State University includes institutions, facilities, and programs across all 64 of Louisiana's parishes. The campuses include Louisiana State University and A&M College (LSU), Pennington Biomedical Research Center, the Paul M. Hebert Law School (all in Baton Rouge) and the LSU Agricultural Center in Baton Rouge with extension offices in every parish in Louisiana; the Health Sciences Centers in New Orleans and Shreveport; and LSU-Shreveport, LSU-Alexandria, and LSU-Eunice. In addition, the LSU Health Care Services Division (HCSD) now includes public-private partnerships designed to provide new resources for patient care and teaching in six of HCSD's seven hospitals across the state.

LSU is the flagship institution for the State of Louisiana. A Carnegie classified Doctoral University: Highest Research Activity, LSU is designated by the Louisiana Board of Regents as the state's only comprehensive university, and it is one of a few universities nationally to be designated as a land-grant sea-grant and space-grant institution. As the flagship institution, the vision of LSU is to be a leading research-extensive university, challenging undergraduate and graduate students to achieve the highest levels of intellectual and personal development. The mission of LSU is the generation, preservation, dissemination, and application of knowledge and cultivation of the arts.

LSU is committed to offering a broad array of undergraduate degree programs and extensive graduate research opportunities designed to attract and educate highly qualified undergraduate and graduate students; employing faculty who are excellent teacher-scholars, nationally competitive in research and creative activities, and who contribute to a world-class knowledge base that is transferable to educational, professional, cultural and economic enterprises; and using its extensive resources to solve economic, environmental and social challenges.

With rich and very diverse cultural heritages, LSU's fall 2019 student body consists of 25,920 undergraduates and 5,841 graduate students. Since its first commencement in 1869, LSU has awarded more than 250,000 degrees and is ranked in the top 10% in the nation in the number of graduates. Accredited by the Commission on Colleges of the Southern Association of Colleges and Schools to award bachelor's, master's, doctoral and professional degrees, LSU has ten senior colleges and schools, in addition to specialized centers, divisions, and offices. Supporting these academic and research divisions, more than 1,360 full-time faculty members and a staff of more than 3,700. LSU Libraries contain more than 4.4 million volumes.

In 1926, LSU began offering summer courses in library science, and in 1931 the Board of Supervisors established the Graduate School of Library Science. The name was changed to the School of Library & Information Science (SLIS) in 1981. Through 1958, the Bachelor of Science in Library Science degree was awarded to 725 students. The Master of Science program began in 1951, the Master of Library Science in 1973, and the Master of Library and Information Science in the fall of 1986. The appropriate accrediting authority has continuously accredited the program of study in library and information science throughout its history. The American Library Association currently accredits the Master of Library and Information Science degree program.