Descriptive Title: Co-producing Climate Knowledge and Sustained Engagement in the Great Lakes in Support of Stormwater Management Adaptation

Submission Title:

Opportunity ID: NOAA-OAR-CPO-2018-2005133

Opportunity Title: Climate Program Office 2018

Agency Name: Department of Commerce

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OMB Number: 4040-0004
Expiration Date: 10/31/2019

Application for Federal Assistance SF-424

*1. Type of Submission:	*2. Type of Application	*If Revision, select appropriate letter(s):
[ ] Pre-application	[X] New	
[X] Application	[ ] Continuation	*Other (Specify):
[ ] Changed/Corrected Application	[ ] Revision	

*3. Date Received:	4. Applicant Identifier:
	18-PAF00717

5.a. Federal Entity Identifier:	5.b. Federal Award Identifier:

State Use Only:

6. Date Received by State:	7. State Application Identifier:

8. APPLICANT INFORMATION:

*a. Legal Name: Regents of the University of Michigan

*b. Employer/Taxpayer Identification Number (EIN/TIN):	*c. Organizational DUNS:
38-6006309	073133571

d. Address:

*Street 1: 3003 S. State St
Street 2:
* City: Ann Arbor
County: Washtenaw
* State: MI: Michigan
Province:
* Country: USA: UNITED STATES
* Zip/Postal Code: 481091274

e. Organizational Unit:

Department Name:	Division Name:
University of Michigan	ORSP

f. Name and contact information of person to be contacted on matters involving this application:

Prefix: * First Name: Amy
Middle Name: Marie
* Last Name: Holihan
Suffix:

Title: Sponsored Res/Pgrm Admin Inter

Organizational Affiliation:

* Telephone Number: 734-763-2171 Fax Number:

* Email: aholihan@umich.edu

OMB Number: 4040-0004
Expiration Date: 10/31/2019

Application for Federal Assistance SF-424

Version 02

9. Type of Applicant 1: Select Applicant Type:

H: Public/State Controlled Institution of Higher Education

Type of Applicant 2: Select Applicant Type:

Type of Applicant 3: Select Applicant Type:

Other (Specify):

*** 10. Name of Federal Agency:**

Department of Commerce

11. Catalog of Federal Domestic Assistance Number:

11.431

CFDA Title:

Climate and Atmospheric
Research

*** 12. Funding Opportunity Number:**

NOAA-OAR-CPO-2018-2005133

*** Title:**

Climate Program Office 2018

13. Competition Identification Number:

2648827

Title:

SARP - Water - Extreme Events Preparedness, Planning, and Adaptation Within the Water Sector

14. Areas Affected by Project (Cities, Counties, States, etc.):

15. Descriptive Title of Applicant's Project:

Co-producing Climate Knowledge and Sustained Engagement in the Great Lakes in Support of Stormwater Management Adaptation

Attach supporting documents as specified in agency instructions.

OMB Number: 4040-0004
Expiration Date: 10/31/2019

Application for Federal Assistance SF-424

Version 02

16. Congressional Districts of:

* **Applicant:** MI-012 * **Program/Project:** MI-012

Attach an additional list of Program/Project Congressional Districts if needed.

17. Proposed Project:

* **a. Start Date:** 07/01/2018 * **b. End Date:** 06/30/2019

18. Estimated Funding ($):

* **a. Federal**	$174,949.00
* **b. Applicant**	$5,000.00
* **c. State**	$0.00
* **d. Local**	$0.00
* **e. Other**	$0.00
* **f. Program Income**	$0.00
* **g. TOTAL**	$179,949.00

* **19. Is Application Subject to Review By State Under Executive Order 12372 Process?**

[ ] **a. This application was made available to the State under the Executive Order 12372 Process for review on**

[ ] **b. Program is subject to E.O. 12372 but has not been selected by the State for review.**

[X] **c. Program is not covered by E.O. 12372.**

* **20. Is the Applicant Delinquent On Any Federal Debt? (If "Yes", provide explanation.)**

[ ] Yes [X] No

If "Yes", provide explanation and attach

21. *By signing this application, I certify (1) to the statements contained in the list of certifications and (2) that the statements herein are true, complete and accurate to the best of my knowledge. I also provide the required assurances** and agree to comply with any resulting terms if I accept an award. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties. (U.S. Code, Title 218, Section 1001)**

[X] ** I AGREE

** The list of certifications and assurances, or an internet site where you may obtain this list, is contained in the announcement or agency specific instructions.**

Authorized Representative:

Prefix: Mr. * **First Name:** Craig

Middle Name:

* **Last Name:** Reynolds

Suffix:

* **Title:** Director

* **Telephone Number:** 734-763-2171 **Fax Number:**

* **Email:** aholihan@umich.edu

* **Signature of Authorized Representative:** * **Date Signed:**

OMB Number: 4040-0006

Expiration Date: 07/30/2010

BUDGET INFORMATION – Non-Construction Programs

SECTION A – BUDGET SUMMARY

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. Climate and Atmospheric Research	11.431			$174,949.00	$5,000.00	$179,949.00
2.						$0.00
3.						$0.00
4.						$0.00
5. Totals		$0.00	$0.00	$174,949.00	$5,000.00	$179,949.00

SECTION B – BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY				Total (5)
	(1) Climate and Atmospheric Research	(2)	(3)	(4)	
a. Personnel	$38,786.00				$38,786.00
b. Fringe Benefits	$7,761.00				$7,761.00
c. Travel	$20,000.00				$20,000.00
d. Equipment	$0.00				$0.00
e. Supplies	$500.00				$500.00
f. Contractual	$51,676.00				$51,676.00
g. Construction	$0.00				$0.00
h. Other	$3,000.00				$3,000.00
i. Total Direct Charges (sum of 6a-6h)	$121,723.00	$0.00	$0.00	$0.00	$121,723.00
j. Indirect Charges	$53,226.00				$53,226.00
k. TOTALS (sum of 6i and 6j)	$174,949.00	$0.00	$0.00	$0.00	$174,949.00
7. Program Income					$0.00

SECTION C - NON-FEDERAL RESOURCES				
(a) Grant Program	**(b) Applicant**	**(c) State**	**(d) Other Sources**	**(e)TOTALS**
8. Climate and Atmospheric Research	$5,000.00			$5,000.00
9.				$0.00
10.				$0.00
11.				$0.00
12. TOTAL (sum of lines 8-11)	$5,000.00	$0.00	$0.00	$5,000.00

SECTION D - FORECASTED CASH NEEDS					
	Total for 1st Year	**1st Quarter**	**2nd Quarter**	**3rd Quarter**	**4th Quarter**
13. Federal	$0.00	$0.00			
14. Non-Federal	$0.00	$0.00			
15. TOTAL (sum of lines 13 and 14)	$0.00	$0.00	$0.00	$0.00	$0.00

SECTION E - BUDGET ESTIMATES OF FEDERAL FUNDS NEEDED FOR BALANCE OF THE PROJECT				
(a) Grant Program	**FUTURE FUNDING PERIODS (YEARS)**			
	(b)First	**(c) Second**	**(d) Third**	**(e) Fourth**
16. Climate and Atmospheric Research	$174,949.00			
17.				
18.				
19.				
20. TOTAL (sum of lines 16 - 19)	$174,949.00	$0.00	$0.00	$0.00

SECTION F - OTHER BUDGET INFORMATION	
21. Direct Charges: $121,723	**22. Indirect Charges:** $53,226
23. Remarks:	

OMB Approval No.: 4040-0007
Expiration Date: 07/30/2010

ASSURANCES - NON-CONSTRUCTION PROGRAMS

PLEASE DO NOT RETURN YOUR COMPLETED FORM TO THE OFFICE OF MANAGEMENT AND BUDGET. SEND IT TO THE ADDRESS PROVIDED BY THE SPONSORING AGENCY.

NOTE: Certain of these assurances may not be applicable to your project or program. If you have questions, please contact the awarding agency. Further, certain Federal awarding agencies may require applicants to certify to additional assurances. If such is the case, you will be notified.

As the duly authorized representative of the applicant, I certify that the applicant:

1. Has the legal authority to apply for Federal assistance and the institutional, managerial and financial capability (including funds sufficient to pay the non-Federal share of project cost) to ensure proper planning, management and completion of the project described in this application.
2. Will give the awarding agency, the Comptroller General of the United States and, if appropriate, the State, through any authorized representative, access to and the right to examine all records, books, papers, or documents related to the award; and will establish a proper accounting system in accordance with generally accepted counting standards or agency directives.
3. Will establish safeguards to prohibit employees from using their positions for a purpose that constitutes or presents the appearance of personal or organizational conflict of interest, or personal gain.
4. Will initiate and complete the work within the applicable time frame after receipt of approval of the awarding agency.
5. Will comply with the Intergovernmental Personnel Act of 1970 (42 U.S.C. §§4728-4763) relating to prescribed standards for merit systems for programs funded under one of the 19 statutes or regulations specified in Appendix A of OPM's Standards for a Merit System of Personnel Administration (5 C.F.R. 900, Subpart F).
6. Will comply with all Federal statutes relating to nondiscrimination. These include but are not limited to: (a) Title VI of the Civil Rights Act of 1964 P.L. 88-352) which prohibits discrimination on the basis of race, color or national origin; (b) Title IX of the Education Amendments of 1972, as amended (20 U.S.C.§§1681-1683, and 1685-1686), which prohibits discrimination on the basis of sex; (c) Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. §794), which prohibits discrimination on the basis of handicaps; (d) the Age Discrimination Act of 1975, as amended (42 U.S.C. §§6101-6107), which prohibits discrimination on the basis of age; (e) the Drug Abuse Office and Treatment Act of 1972 (P.L. 92-255), as amended, relating to nondiscrimination on the basis of drug abuse; (f) the Comprehensive Alcohol Abuse and Alcoholism Prevention, Treatment and Rehabilitation Act of 1970 (P.L. 91-616), as amended, relating to nondiscrimination on the basis of alcohol abuse or alcoholism; (g) §§523 and 527 of the Public Health Service Act of 1912 (42 U.S.C. §§290 dd-3 and 290 ee- 3), as amended, relating to confidentiality of alcohol and drug abuse patient records; (h) Title VIII of the Civil Rights Act of 1968 (42 U.S.C. §§3601 et seq.), as amended, relating to nondiscrimination in the sale, rental or financing of housing; (i) any other nondiscrimination provisions in the specific statute(s) under which application for Federal assistance is being made; and, (j) the requirements of any other nondiscrimination statute(s) which may apply to the application.
7. Will comply, or has already complied, with the requirements of Titles II and III of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (P.L. 91-646) which provide for fair and equitable treatment of persons displaced or whose property is acquired as a result of Federal or federally-assisted programs. These requirements apply to all interests in real property acquired for project purposes regardless of Federal participation in purchases.
8. Will comply, as applicable, with provisions of the Hatch Act (5 U.S.C. §§1501-1508 and 7324-7328) which limit the political activities of employees whose principal employment activities are funded in whole or in part with Federal funds.

9. Will comply, as applicable, with the provisions of the Davis-Bacon Act (40 U.S.C. §§276a to 276a-7), the Copeland Act (40 U.S.C. §276c and 18 U.S.C. §874), and the Contract Work Hours and Safety Standards Act (40 U.S.C. §§327-333), regarding labor standards for federally-assisted construction subagreements.
10. Will comply, if applicable, with flood insurance purchase requirements of Section 102(a) of the Flood Disaster Protection Act of 1973 (P.L. 93-234) which requires recipients in a special flood hazard area to participate in the program and to purchase flood insurance if the total cost of insurable construction and acquisition is $10,000 or more.
11. Will comply with environmental standards which may be prescribed pursuant to the following: (a) institution of environmental quality control measures under the National Environmental Policy Act of 1969 (P.L. 91-190) and Executive Order (EO) 11514; (b) notification of violating facilities pursuant to EO 11738; (c) protection of wetlands pursuant to EO 11990; (d) evaluation of flood hazards in floodplains in accordance with EO 11988; (e) assurance of project consistency with the approved State management program developed under the Coastal Zone Management Act of 1972 (16 U.S.C. §§1451 et seq.); (f) conformity of Federal actions to State (Clean Air) Implementation Plans under Section 176(c) of the Clean Air Act of 1955, as amended (42 U.S.C. §§7401 et seq.); (g) protection of underground sources of drinking water under the Safe Drinking Water Act of 1974, as amended (P.L. 93-523); and, (h) protection of endangered species under the Endangered Species Act of 1973, as amended (P.L. 93-205).
12. Will comply with the Wild and Scenic Rivers Act of 1968 (16 U.S.C. §§1271 et seq.) related to protecting components or potential components of the national wild and scenic rivers system.
13. Will assist the awarding agency in assuring compliance with Section 106 of the National Historic Preservation Act of 1966, as amended (16 U.S.C. §470), EO 11593 (identification and protection of historic properties), and the Archaeological and Historic Preservation Act of 1974 (16 U.S.C. §§469a-1 et seq.).
14. Will comply with P.L. 93-348 regarding the protection of human subjects involved in research, development, and related activities supported by this award of assistance.
15. Will comply with the Laboratory Animal Welfare Act of 1966 (P.L. 89-544, as amended, 7 U.S.C. §§2131 et seq.) pertaining to the care, handling, and treatment of warm blooded animals held for research, teaching, or other activities supported by this award of assistance.
16. Will comply with the Lead-Based Paint Poisoning Prevention Act (42 U.S.C. §§4801 et seq.) which prohibits the use of lead-based paint in construction or rehabilitation of residence structures.
17. Will cause to be performed the required financial and compliance audits in accordance with the Single Audit Act Amendments of 1996 and OMB Circular No. A-133, "Audits of States, Local Governments, and Non-Profit Organizations."
18. Will comply with all applicable requirements of all other Federal laws, executive orders, regulations, and policies governing this program.

* SIGNATURE OF AUTHORIZED CERTIFYING OFFICIAL	* TITLE
Completed on submission to Grants.gov	Director
* APPLICANT ORGANIZATION	* DATE SUBMITTED
Regents of the University of Michigan	Completed on submission to Grants.gov

Budget Narrative File(s)

Budget Attachment Filename(s): **Lemos_Budget Narrative_SARP2017.pdf**

University of Michigan Budget – Maria Lemos

Categories	*Amount*
Salaries	
Maria Lemos (one summer month)	$17,281
Jenna Jorns	$0
Omar Gates	$4,167
Laura Briley	$0
Student temp (communications/design)	$9,338
Student temp (outreach)	$8,000
Fringe benefits (faculty & staff)	$6,434
Fringe benefits (temps)	$1,326
Total Salaries & Fringe	**$46,547**
Other Direct Costs	
Travel-Domestic for GLCAN Partners	$10,000
Travel-Domestic	$10,000
General Supplies	$500
Hosting (workshops/meetings)	$1000
Publication	$2,000
Tuition	$0
Equipment	$0
Sub-award to HRWC < $25,000	$25,000
Sub-award to HRWC > $25,000	$26,676
Total Other Direct costs	**$75,176**
Total Direct Costs	**$121,723**
Total Indirect Costs	**$53,226**
TOTAL	**$174,949**

Huron River Watershed Council Budget – Rebecca Esselman

Categories	*Amount*
Salaries	
Rebecca Esselman (5.5 weeks) salary & fringe	$10,360
Missy Stults (8 weeks) salary & fringe	$32,000
Total Salaries & Fringe	**$41,620**
Other Direct Costs	
Travel-domestic (Esselman & Stults)	$7,780
Office and General Supplies	$500
Total Other Direct costs	**$8,280**
Total Direct Costs	**$49,900**
Total Indirect Costs – 10% on salary & fringe for Rebecca Esselman only	**$1,036**
TOTAL	**$51,676**

Budget Justification - University of Michigan (UM)

PERSONNEL SALARIES AND FRINGE BENEFITS

Principal Investigator: We are requesting one month of summer salary for Lead PI Maria Lemos. She will supervise the overall project direction and will lead the design of the three engagement treatments, the design and execution of the stakeholder interview protocol, and the identification of drivers of sustained engagement and the accompanying best practices guide. The time commitment is commensurate with the level of effort needed to accomplish the proposed work.

Co-Principal Investigator: Co-PI Jenna Jorns will lead day-to-day project management, communication with project partners and coordination with GLISA climatologists and researchers, as well as the dissemination of the results; supporting development of best practices guide. We are not requesting any salary or benefits support for Ms. Jorns. Her 0.6 calendar months of time will be provided as an in-kind contribution at an estimated rate of $4000.

Senior Personnel: Project will support one GLISA climatologist, Omar Gates, at one month of full effort over the project period proportionate to the amount of work expected. Gates will lead the collection and co-production of city-specific climate information for the customized VA templates. Climatologist Laura Briley will assist Gates and support the webinar engagements. We are not requesting any salary support for Ms. Briley.

Part-Time Temporary Students: We are requesting support for two part-time temporary students to support the project (i.e., 20 hours/week at $20/hour). One will focus on outreach to coordinate the remote and written-only engagement treatments and the second will support the development and dissemination of the best practices guide and other design of other project products such as reports, fact sheets, etc.

GLISA Graduate Student Research Assistant: Katherine Browne will support the development, execution, and analysis of stakeholder interviews, and contribute to the identification of best practices and dissemination. We are not requesting funds for her support.

FRINGE BENEFITS

The fringe benefit rate is calculated at 30% for faculty and staff and at 7.65% for students and temps based on University-wide cost estimates for the average for such positions. The standard UM benefits package for staff includes health, dental, vision, and life insurance, and a retirement contribution. Staff salaries are calculated with 1.03% annual incremental increases.

HOSTING

We are requesting $1000 for hosting for the stakeholder meetings in the cities for the face-to-face treatments and will cover basic refreshment like coffee and snacks.

GENERAL SUPPLIES

We are requesting $500 to buy general office supplies like posters, easels, markers, post-its, etc. to support the stakeholder meetings.

PUBLICATION

We are requesting $2000 over the project period to support the publication of the project's findings in peer-reviewed journals, as well as the graphic design and printing of materials for the stakeholder engagements and the best practices guide.

TRAVEL

All primary award institution travel for GLISA personnel is included in the budget item travel-domestic. In accordance with our description of the work, the project team will conduct face-to-face engagements with two of the six cities participating in the project. The proposal includes $7,000 to support this engagement treatment. This is projected to include 6 trips (i.e., three meetings in each of the two cities testing face-to-face engagement) for 2 GLISA personnel to attend these meetings. This also includes an additional 6 trips for one GLISA representative to conduct the in-depth stakeholder interviews, at one trip per city. R/T Ann Arbor to average Great Lakes city: mileage (average 417 r/t) at $0.54/mile = $225; per diem $54; lodging $110. Estimated $7,000 ($389 for 18 total individual trips). We are also requesting $3000 to support one GLISA personnel to travel to two national conferences to disseminate the project's results – the Annual Fall American Geophysical Union Meeting (2019) and the National Adaptation Forum (2019, location not yet announced). Both trips are estimated to cost $1500 each ($500 registration, $400 roundtrip airfare, per diem $54 for 4 days, lodging $110 for 3 nights, and $50 in ground transportation). We will provide additional $1000 to cover any extra costs as in-kind support.

Domestic Travel for GLCAN partner: We are requesting $10,000 support the Great Lakes Climate Adaptation Network's (GLCAN) participation in the project. The funds will be used to support travel to in-person meetings with the cities ($380/trip for 6 trips for 1 GLCAN personnel = $2,280, see calculation for GLISA travel, above). The funds will also support a special in-person meeting of the GLCAN network to disseminate the results of the project and to present the VA template. This includes travel support for 20 GLCAN members to attend an in-person meeting in Ann Arbor (at $380 per trip, see UM travel, above) and $200 for hosting (i.e., snacks and coffee, meeting supplies). The University of Michigan can provide meeting space for this event at no cost. Collaborator Matt Naud will contribute two weeks of time to supporting the city engagement, continue the work with the City of Ann Arbor, and to advise the project team.

SUB-CONTRACT

Huron River Watershed Council: $51,676

The proposal leverages the resources of expert partner, the Huron River Watershed Council through a subcontract. HRWC will support the project via supporting the engagement with cities, the development and implementation of VA template, and evaluation and dissemination of the project results.

INDIRECT COSTS:

We are using University of Michigan's federally negotiated on-campus rate for organized research of 56% on MTDC. U-M's Indirect Cost Rate Agreement (IDCRA) is attached to the full proposal.

IN-KIND CONTRIBUTION: In total, the project team is providing $5,000 in in-kind support through salary support for co-PI Jorns and domestic travel. Naud, Briley, and Browne will provide support through time commitment.

Budget Justification - Huron River Watershed Council Budget

The proposal leverages the resources of expert partner, the Huron River Watershed Council (HRWC) through a subcontract. Watershed Planner Rebecca Esselman will support the project via supporting the engagement with cities, the development and implementation of VA template, and evaluation and dissemination of the project results. Missy Stults will lead the engagement with the cities and the training and implementation of VA template. Stults will also support the identification of drivers of best practices for sustained engagement.

SALARIES AND FRINGE BENEFITS
The proposal includes 5.5 weeks of salary and fringe benefits support for collaborator Rebecca Esselman totaling $10,360. Fringe benefits covers retirement, insurance, and other employee benefits. We are also requesting 2 months of salary and benefits for collaborator Missy Stults, totaling $32,000.

GENERAL SUPPLIES
We are also requesting $500 in other direct costs (i.e., office and general supplies for printing and postage) for use during meetings and workshops.

TRAVEL
We are requesting $2,280 for Rebecca Esselman to attend the 6 face-to-face engagements with the two cities participating in this treatment and $1,500 to attend one conference to present and disseminate that results (see UM travel detail above for same meetings). Additional $4,000 is requested for Ms. Stults to attend the 6 face-to-face engagements with the two cities participating in this treatment and to attend one conference to present and disseminate that results (see UM travel, above).

INDIRECT COSTS
Huron River Watershed Council charges 10% indirect only on salaries and fringe benefits. We are requesting $1,036 in indirect costs.

Project Narrative File(s)

Project Narrative File Attachments:

Lemos_Project Narrative_SARP2017.pdf

Co-producing Climate Knowledge and Sustained Engagement in the Great Lakes in Support of Stormwater Management Adaptation

---

Lead Institution: University of Michigan		
Principal Investigator	*Affiliation & Title*	*Contact Information*
Dr. Maria Carmen Lemos *Lead Investigator*	University of Michigan; Professor and Associate Dean for Research, School for Environment and Sustainability and Co-Director, Great Lakes Integrated Sciences and Assessments	lemos@umich.edu 734-764-9315 2504 Dana Building 440 Church Street Ann Arbor, MI 48109
Dr. Missy Stults *Co- Investigator*	Private Contractor; Climate and Sustainability Specialist	missy.stults@gmail.com 917-291-0023 1100 N. Main Street Ann Arbor, MI 48104
Dr. Jenna L. Jorns *Co- Investigator*	University of Michigan; Program Manager, Great Lakes Integrated Sciences and Assessments	jljorns@umich.edu 734-764-3198 2528 Dana Building 440 Church Street Ann Arbor, MI 48109

Institutional Representative:
Amy Holihan, Project Representative
University of Michigan, Office of Research and Sponsored Projects (ORSP)
3003 S. State Street, 1056 Wolverine Tower
Ann Arbor, MI 48109
734-763-2171
aholidan@umich.edu

Federal Funding Opportunity Number: NOAA-OAR-CPO-2018-2005133

Competition: FY 2018 NOAA Climate and Societal Interactions (CSI) Program, Sectoral Applications Research Program (SARP): *Extreme Events Preparedness, Planning, and Adaptation within the Water Sector.* Addressing proposal topics:

1. Developing a seasonal to annual climate focus within community multi-hazard planning, including frameworks for reducing impacts of anticipated extreme events and building resilience for future events (i.e., mainstreaming and/or customizing climate information for decision making); and,
5. Creating methods/tools/or other creative modes to better communicate and incorporate climate science into comprehensive planning documents and activities.

Requested Funds for University of Michigan (*awarding institution)*	$123,273
Requested Funds for Huron River Watershed Council *(sub-award)*	$51,676
Total Requested Federal Funds	**$174,949**

Abstract

Project Title: Co-producing Climate Knowledge and Sustained Engagement in the Great Lakes in Support of Stormwater Management Adaptation

Competition: FY 2018 NOAA Climate and Societal Interactions (CSI) Program, Sectoral Applications Research Program (SARP): Extreme Events Preparedness, Planning, and Adaptation within the Water Sector

Introduction: Annual precipitation, extreme rainfall events, and flooding have increased in the Great Lakes region during the last century, and these trends are expected to continue. Small and mid-sized cities in the region have limited resources and lack of access to climate information, which impedes them from implementing hazard- and climate-related actions to increase their resilience. In this context, boundary organizations that support the co-production of usable information between producers and users of scientific knowledge, such the Great Lakes Integrated Sciences and Assessments (GLISA) and the Great Lakes Climate Adaptation Network (GLCAN), can play a critical role in overcoming barriers to improve decision support in cities. In doing so, however, these boundary organizations face challenges in sustaining engagement, and in scaling up processes and methods that go beyond short-term funding for local projects. Thus, there is a need to: 1) support the integration of climate information into planning at the community level through a city-driven vulnerability assessment tool, and 2) develop a tested strategy for sustained engagement that can be scaled up to other cities, sectors and regions at lower costs. GLISA has created a framework to address these challenges – the boundary chain model – that links boundary organizations and takes advantage of previous relationships and existing resources. A need exists, however, to more fully test this model to understand the context in which the various iterations of this model are most effective.

Specific Goals and Outcomes: Our proposal will engage directly with six local governments within the Great Lakes region to: 1) co-produce climate information using a comprehensive climate and social vulnerability assessment tool for stormwater management projects, and 2) assess whether our boundary chain model can reduce transaction costs for scaling up sustained stakeholder engagement and stormwater management through a series of social experiments that explore different forms of engagement with the chain, including face-to-face, webinar assisted and written/self-assisted. Outcomes will advance the resilience of stormwater management in the six project cities and the science of knowledge usability in the context of boundary organizations. Results will be shared in the RISA network, peer-reviewed publications, conferences, and with GLCAN and their national network, the Urban Sustainability Director's Network.

Significance and Broader Impacts: This proposal responds to topics 1 and 5 in the *Extreme Events Preparedness* priority of NOAA's SARP competition, and links NOAA's mission of "Science, Service, and Stewardship" to SARP's focus to "incorporate climate variability and change into planning and preparedness for a more secure economic future." By actively co-producing climate information with end-users to address near-term risks facing stormwater in the Great Lakes, we will both increase partnerships between academia, non-profits, and local governments and enhance the uptake and use of knowledge produced and supported by NOAA. Furthermore, by rigorously testing different treatments of engagement to identify drivers of best practices, and disseminating the results broadly, we will ensure the results of this project are transferred nationally both within the stormwater sector and to other sectors or planning areas such as water management, comprehensive planning, transportation, and hazard mitigation.

Results from Prior Research

Principal Investigator Lemos:

Useful to Useable (U2U) Project: Transforming Climate Variability and Change Information for Cereal Crop Producers: Lemos' research funded by USDA (2011-68002-30220) and NOAA (NA03OAR4310010) focused on the use of climate information by different sectors (i.e., agriculture, water, city planners) in the Great Lakes and Midwest regions of the U.S. This research generated a conceptual model for closing the gap between science production and use that identifies three main drivers of usability: fit, interplay and interaction (Lemos et al. 2012). Research focusing in the Great Lakes region has resulted in a novel model of stakeholder engagement—the *boundary chain model* (Lemos et al. 2014, Kirchhoff et al. 2015). Additionally, this research explored the role of knowledge networks and context in informing potential climate knowledge users needs/wants and how knowledge travels and gets situated into decision-making in different contexts (i.e., water management and agricultural) (Dilling et al. 2014, Frank et al. 2012, Kalafatis, et al. 2015). Finally, research focusing on the role of information intermediaries (e.g., extension and private crop consultants) in providing climate information to support adaptation by corn farmers in the U.S. Midwest, found that while organizational characteristics, resources, and information type critically influence advisors' willingness to provide their clients with climate information, the greatest barrier—especially for private advisors—is the potential for climate information to interfere with their profit generating related business (e.g., selling of inputs or agronomical information) (Lemos et al. 2014; Prokopy et al. 2015). Each of these projects by their stakeholder-focused nature and by their motivation have included extensive sharing of insights to both practitioner and research communities and disseminating resources supportive of work in both communities.

Extreme event impacts on water quality in the Great Lakes: Prediction and management of nutrient loading on a changing climate (NSF, 2010-2016): Lemos' portion of this 5M Water, Sustainability and Climate project focused on understanding the role of climate information use on two watersheds (Huron and Maumee) across scales (Rasmussen et al. 2017), and found that scales are critical in shaping and constraining the use of climate information in both watersheds, albeit for different reasons. A second project designed social experiments to investigate the effects of different forms of climate information communication on information uptake (Lemos et al. in review).

Collaborative research: The relative importance of generic vs. specific capacity in addressing drought vulnerability in NE brazil (NSF, 2011-2015): This project sought to understand the role of social reform, access to irrigation and climate impact in shaping the vulnerability of smallholder subsistence households in NE Brazil. It found that although social reform is a necessary condition to increase household assets it is not sufficient to reduce overall risk (Lemos et al. 2013; Eakin et al. 2014; Lemos et al. 2016, Nelson et al. 2016).

A collaborative science program for NERSS: Connecting end users throughout the applied research process (NOAA, 2014-2019) this on-going project seeks to understand the role of funding institutional mechanisms in increasing the usability of coastal resilience driven science.

Co-Principal Investigator Stults:

Using Critical Thresholds to Customize Climate Projections of Extreme Events to User Needs and Support Decisions (2017): This NOAA SARP funded project piloted a participatory process to identify locally relevant critical thresholds for extreme events, and used these thresholds to customize climate projections to community-specific needs. Identifying and better understanding critical thresholds

for extreme events is key to developing effective community responses to climate change. Stults worked as part of the Adaptation International team, which led a consortium of five organizations that worked directly with four communities in the South Central U.S.: Boulder, CO; Las Cruces, NM; Miami, OK; and San Angelo, TX. The project team conducted 10 workshops to identify, refine, and discuss extreme weather thresholds that matter to the communities. The pilot communities also received a grant to implement a resilience action.

Assessing Social and Climate Vulnerability: Stults is currently co-leading a project (estimated completion 2018) with five mid-western cities, the Huron River Watershed Council, and the Great Lakes Climate Action Network (GLCAN) to develop a universal vulnerability assessment template that simultaneously integrates climate-related vulnerabilities and social-vulnerabilities so that communities can create a holistic assessment of where and who is most vulnerable to climate and social disasters. The final tool will be shared through the GLCAN network and through the Urban Sustainability Director's Network.

The State of U.S. Local Adaptation Planning; Stults, in tandem with Dr. Sierra Woodruff, conducted an analysis of all publicly available local climate adaptation plans within the U.S., looking specifically at: 1) their overall quality (per the plan quality literature) (Woodruff and Stults, 2016); 2) the types of strategies included in each plan and how well those strategies align with the major climate impacts projected to effect each community (Stults and Woodruff, 2016); and 3) how well those plans are translating into on the ground projects that build resilience. The results have been published and a publicly available database of all adaptation strategies has been created.

Co-Principal Investigator Jorns:

Guidance to Quantify Water-Energy Greenhouse Gas Emissions in the Water Sector in Southern California: In her former position as a Policy Associate at The Climate Registry (TCR), a non-profit organization dedicated to helping organizations measure, report, and verify their greenhouse gas emissions, Dr. Jorns led TCR Policy team's development of sector-specific greenhouse gas reporting guidance for water suppliers in Southern California. The one-year project was funded in 2015 by the private utility, Southern California Edison. As part of this initiative, Dr. Jorns managed the development of TCR's 'Water-Energy GHG (WEG) Technical Brief,' a technical document that provided background on the sector and key issues in the region. Dr. Jorns presented the Brief at six in-person stakeholder workshops (with webinar participation) in Southern California – with representatives from regional public and private water utilities, non-profits, academia, industry, and local, regional, and state governments – to collect feedback on the Brief and ask targeted questions to develop the reporting guidance. Dr. Jorns authored the draft guidance based on the workshop discussions and lead the feedback process of more than 60 experts on the WEG Technical Review Panel, completing WEG Guidance Version 1.0 in December 2015 (TCR 2015). The Brief, Guidance, and recordings of workshop webinars were all made publicly available on TCR's website and were disseminated in the region at meetings and conferences, and in targeted outreach to local water utilities.

Statement of Work

Introduction

In the Great Lakes region, changes in precipitation such as increases in extreme storms are already leading to significant impacts for communities across the region. Climate change, coupled with trends in land use and agricultural practices, is resulting in a host of negative societal impacts. For example, increases in annual, seasonal, and extreme precipitation leads to contamination from runoff, flooding in urban areas and regional watersheds, and disruptions to lake chemistry in the Great Lakes (Pryor et al. 2014). As seasonal precipitation variability in the region continues to increase and extreme storms become more intense and frequent, there is a need for innovative partnerships across the science-practice interface to help inform, devise, and implement sustainable strategies to respond to a dynamic and uncertain future. One critical unanswered question is how to best integrate the use of climate information with the mainstreaming of climate-related strategies in urban policy-making and long-term sustaining partnerships, to build adaptive capacity and reduce climate related impacts to stormwater and other sectors.

To date, notable work has been undertaken to understand how climate change could impact stormwater systems, and to identify strategies for adapting to these challenges (Grace et al. 2015; Hansen et al. 2013; Liao 2013; Swaffield 2012). For example, research shows that climate-driven decision making in the stormwater sector may include assessments of possible upgrades to infrastructure and equipment to accommodate projections of extreme events, updates to stormwater management codes to account for extreme events, and a consideration of the downstream impacts of these decisions on ecosystems and infrastructure. But while the science and modeling of stormwater systems that can inform these decisions have become increasingly more sophisticated, little of this science is being used effectively by decision-makers in cities.

One approach to narrow this gap is to develop a meaningful dialogue between those producing this science and those in a position to use it. The evidence that iterative engagement between producers and users of climate information, or co-production, increases its usability and use is compelling (Lemos et al. 2012; Meadow et al. 2015). Most of this evidence originates from in-depth case studies that describe the properties and processes of co-production in great detail (Briley et al. 2015). These case studies have been instrumental in generating a number of assumptions about the factors that shape knowledge use and non-use, and a valuable list of best practices on how to improve the process of co-production itself. This literature has also suggested that co-production processes can have high transaction costs, especially in terms of financial, human and time resources, as well as trust and legitimacy-building (Lemos et al. 2014; Kirchhoff et al. 2013). Specifically, co-production processes may require intensive and repeated interaction across long periods of time to build credibility, trust and legitimacy and to shape perceptions of fit (or salience) and interplay (or how new knowledge interacts with other kinds of knowledge currently used), which requires high investments in terms of financial, human and time resources.

Based on this research, one could reasonably expect that as the need for increased usability of climate information rises, the costs of co-production will be even higher, and lack of resources

such as knowledge brokers and time may become a bottleneck. This naturally presents a dilemma – how do we serve more and more stakeholders in co-building resilience while respecting existing and lingering organizational capacity constraints?

Using this as a frame, we seek to explore the process of co-production in two ways. First, better understanding what specific characteristics enhance different dimensions of usability (e.g. communication strategy, understanding of how information fits decision needs or interplays with decision processes) may increase our capacity to reduce the costs of co-production through, for example, the streamlining of the engagement process with the use of webinars and other forms of remote communication. Second, by examining the effects of different levels of interaction on issues of accessibility, credibility and relevance so that we may be better able to evaluate other forms of knowledge sharing such as web-based decision-support tools.

In this project, our overall goal is twofold. First, practically we will co-produce climate information with six cities in the Great Lakes region using a comprehensive vulnerability climate and social assessment template for stormwater management projects. As we have identified by previous work, a literature review, and ongoing conversations with practitioners in the field, a mainstreamed approach to assess the vulnerabilities at the project-level would greatly improve the efficiency of city-level planning by integrating climate information into existing, but disparate, planning domains. Despite this knowledge, we know that city practitioners and the boundary organizations brokering climate information struggle with limited resources (i.e., human, technical, financial). As such, we propose the creation of a tool and support methodologies to help lessen these challenges. Second, theoretically and empirically, we seek to address this resource limitation and high costs of co-production by exploring how different forms of boundary organization engagement shape co-production outcomes with the aim of decreasing financial, human and trust building and legitimacy costs. We expect by integrating both goals we will identify drivers and best practices of sustained interaction and scaling up of co-production to other cities and regions.

To meet these goals, we propose an innovative approach (detailed in the Methodology section) that combines social experiments to explore the role of boundary organizations in brokering and bridging climate knowledge, the co-production of information and decision-making at the city level and the effective mainstreaming of climate impact projections into stormwater management in our targeted cities. First, we will build on a current project that capitalizes on a regional network of practitioners (city sustainability directors) to mainstream climate and social impact through a vulnerability assessment template into city planning led by GLCAN, with the support of GLISA and the Huron River Watershed Council (HRWC). Second, alongside the co-production of climate information, we will test three different forms of boundary organizations engagement—face-to-face co-production, webinar-assisted co-production and self-assisted implementation (the control treatment) to explore if and how they shape desired outcomes (e.g. ability to use climate information and mainstream climate impact into stormwater management) while reducing costs (e.g. human, financial, trust building and legitimacy). Because our sample of cities is small and the scope of this competition short (one year), we see this study as an in-depth exploration that can serve as a basis for larger ‘n’ experiments to test hypotheses such as:

1. The boundary chain approach will decrease the costs of co-production in the webinar assisted treatment by leveraging previously existing trust, legitimacy and credibility spread through the chain.
2. Compared with the control group (self-assisted), both face-to-face and webinar assisted interaction will perform better in terms of desired outcomes.
3. The more experienced a city is in regards to its climate action, the less intensive forms of engagement will be required to lead them to desired outcomes.

To explore these hypotheses, we will execute our approach in three phases:

1. **Phase 1: Engagement and Training.** Leveraging existing relationships to confirm city participation in the creation and use of the vulnerability assessment template.
2. **Phase 2: Presentation and Implementation.** Co-producing climate information with our cities to populate vulnerability assessment template and the implementation of a city-level stormwater management effort using three different forms of engagement (treatments).
3. **Phase 3: Evaluation and Dissemination.** Carrying out an in-depth qualitative evaluation of three forms of engagement (treatments) and development of best practices guide to disseminate the results at regional and national meetings and within city networks.

To carry out these phases, we assembled a project team that builds on work from GLISA, an established NOAA-funded Regional Integrated Sciences and Assessments (RISA) team, and from a successful collaboration funded by the Urban Sustainability Director's Network (USDN) which includes GLISA (Lemos and Jorns), the Great Lakes Climate Adaptation Network (GLCAN) (Naud, Stults) and the Huron River Watershed Council (HRWC) (Esselman). GLCAN, a regional network of USDN composed of local government staff and partners that work together on climate adaptation challenges in the region, serves as the recruiter and convener of city practitioners and provides a forum to disseminate project results regionally and nationally. HRWC is a respected leader in working creatively and cooperatively to improve regional watershed management and address the impacts of climate change through work with municipal governments and other stakeholders. HRWC is boundary organization uniquely positioned to address climate at the local level and has been recognized for its efficacy in this role by the American Society of Adaptation Professionals. Esselman regular works the intersection of climate and stormwater management in the Great Lakes region. PI Stults is a climate adaptation expert with experience assisting local communities with their efforts to build resilience. Stults helped develop the first local climate adaptation planning guidance and has recently created guidance on how to create a comprehensive and robust climate adaptation plan based on her analysis of all the publicly available U.S. local adaptation plans. She was also one of the lead authors for the Adaptation Chapter of the 2014 U.S. National Climate Assessment. Based on the background of the researchers and their networks, we expect the results from this work will support both research and practice to improve climate information usability and the specific technical challenges of stormwater management more broadly.

Background and Problem Identification

Recent experiences in the region have underscored the practical challenge of flood risk and water management in the Great Lakes, including chronic fecal contamination from runoff, devastating

flood events, water service shutoffs, and more frequent day-to-day challenges of handling more water than existing systems have been designed to manage. According to NOAA's National Centers for Environmental Information (NCEI) U.S. Billion-Dollar Weather and Climate Disasters website, the eight Great Lakes states[1] have all experienced at least 30 billion-dollar flooding and severe storm events since 1980. Notably, more than half of these events, in all eight states, occurred in the last ten years.[2] For example, flooding from recent extreme rainfall in July 2017 in Wisconsin and Illinois caused blocked bridges and roadways, widespread power outages, closure of a hospital, and suspended Amtrak service. Local decision makers described the events as "unprecedented" and declared that "flooding of this magnitude has not been seen before" (McCoppin 2017; Moreno 2017). While the Governor of Wisconsin declared a state of emergency in three counties, prompting the National Guard to respond, events like these are becoming commonplace in the region.

The Great Lakes region has already experienced changes in the frequency, amount, and form of precipitation. Since 1950, there has been an 11% increase in the total precipitation across the region (Figure 1).

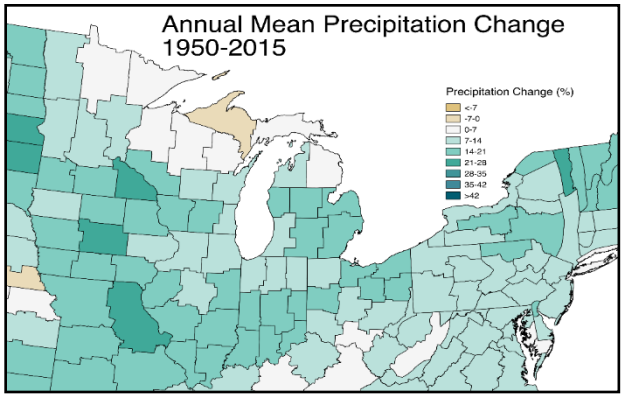

Figure 1. Annual mean precipitation changes for the Great Lakes region from 1950-2015. The outlined areas represent NOAA's NCEI Climate Divisions.

Extreme precipitation has also increased in the region during this time period. According to the Third National Climate Assessment, the heaviest 1% of precipitation days increased by 37% in the Midwest and by 71% in the Northeast[3] from 1958 to 2012 (Karl et al. 2009). As demonstrated in Figure 2, these increases vary widely throughout the region.

[1] Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin.
[2] These statistics reflect a summation of billion-dollar events for each state affected (i.e., it does not mean that each state suffered at least $1 billion in losses for each event. More information available at: https://www.ncdc.noaa.gov/billions/mapping.
[3] Regions as defined by the United States Global Change Research Program. Most Great Lakes states are in the Midwest, with the exception of New York and Pennsylvania that are in the Northeast.

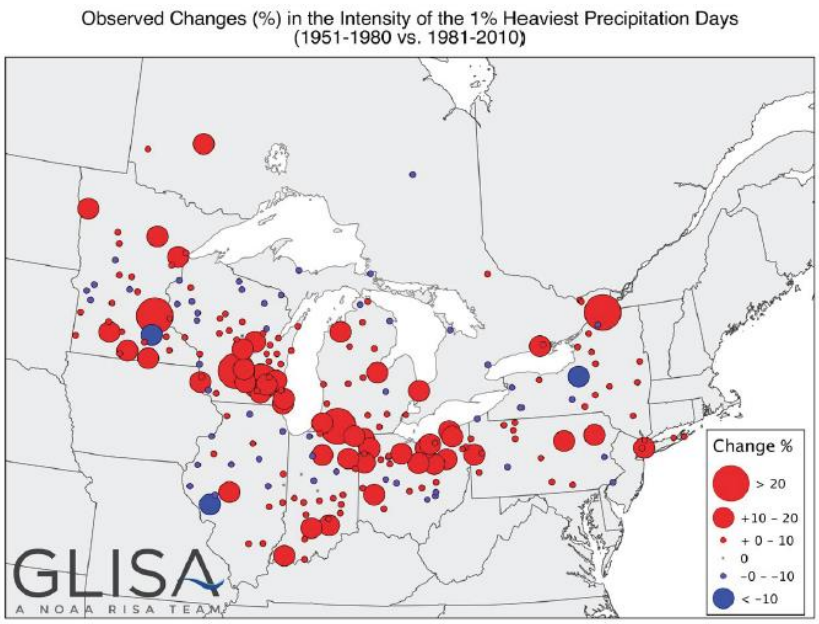

Figure 2. Observed percent changes in the intensity of the 1% heaviest precipitation days (1951-1980 vs. 1981-2010. Figure produced by GLISA.

Future projections for the region predict an increase in average annual precipitation by 2050, as well as an increase in days with heavy precipitation (Figure 3). Lake-enhance/effect precipitation contributes to this trend (Notaro et al. 2015). As temperatures increase, evaporation also increases, leading to more water vapor in the atmosphere. The combined increase in heat and moisture are precursors to storm formation, supporting the predicted increase in more intense storms in the future (Trenberth et al. 2003).

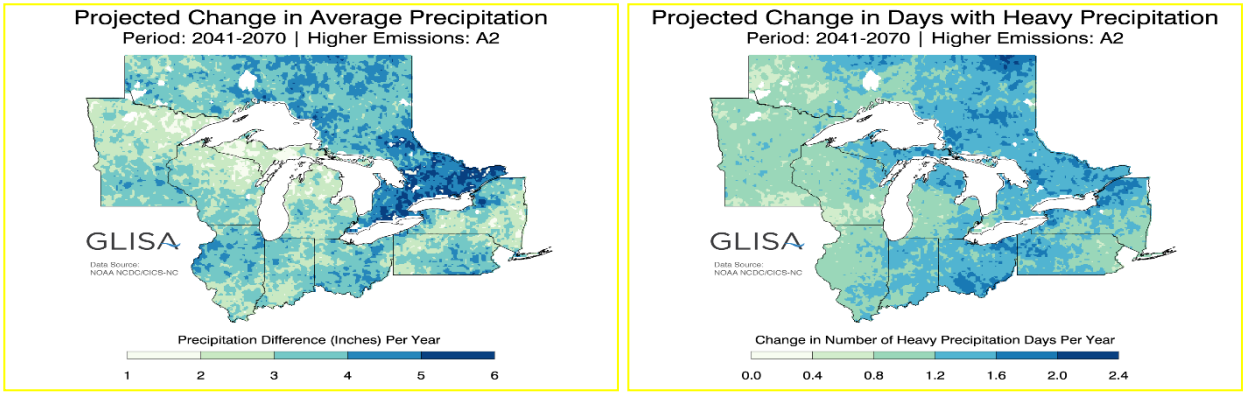

Figure 3. Projected change in the average precipitation (top panel) and days with heavy precipitation (bottom panel) for the Great Lakes region from 2041-2070. Projects based on Coupled Model Intercomparison Project Version 3 (SMIP3) A2 emissions scenario, representing a "business as usual" high emissions future. Figure produced by GLISA.

National and regional assessments have identified climate change as an important and growing stressor to managing the risk of floods and water quality in the Great Lakes region (e.g., Michalak et al. 2013; Smolek et al. 2015). An increase in annual precipitation combined with more extreme precipitation has already hindered the ability of Great Lakes cites, townships, and

villages and broader regions (i.e., watersheds) to effectively manage stormwater and its impacts to infrastructure, public health, and water supply and quality management. Projections indicate that such trends will continue alongside non-climatic factors such as aging infrastructure, increased land use pressure from suburban development, and agricultural practices that exacerbate these challenges. While the effects of climate change are best addressed at lower scales (Grothmann and Patt 2005), including the local and regional (Dietz and Bidwell 2011), decision-making at these scales is often hindered by uncertainties in down-scaled global projections (Kerr 2011; Willis and Church 2012) as well as policies and regulations at higher levels of governance (Rassmunsen et al. 2017).

In the Great Lakes region, an array of projects, organizations, partnerships, and initiatives have mobilized to respond to this increased risk and the associated new management challenges. And while many cities in the Great Lakes region have expressed their willingness to integrate and mainstream climate-risk management approaches and actions into broader city planning, policy, and natural resource decision-making, access to climate information and limited human, technical, and financial resources constrain these efforts (Barclay et al. 2013, Kalafatis and Lemos 2017, Woodruff and Stults 2016). In this context, boundary organizations that bridge and broker knowledge between producers and users, such as the Great Lakes Integrated Sciences and Assessments (GLISA) and the Great Lakes Climate Adaptation Network (GLCAN), can play a critical role in integrating knowledge and improving its accessibility and dissemination for climate adaptation decision-making in cities throughout the region.

The ability to bridge the gap between science and decision-making is an important component in increasing municipalities' capacity to prevent and respond to undesirable climate impacts, such as changes in extreme precipitation events. Yet across cities the actual use of scientific information by decision-makers at all scales, from individuals to governments, remains limited. Scholars point to numerous factors that inhibit the use of climate information in planning for natural hazards, infrastructure design, and climate action. In many cases, there are issues of fit (i.e., climate information does not fit local needs spatially or temporally), interplay (i.e., reluctance to adopt information that conflicts with other established forms of knowledge), or uncertainty (Lemos et al. 2012; Woodruff and Stults, 2016). Recent empirical research has shown that interaction between the people who produce climate knowledge (i.e., researchers) and the people who should use it (e.g., city planners and natural resource managers), as well as those who can intermediate the relationship (i.e., information brokers), play critical roles in increasing climate knowledge integration and use (Brugger et al. 2016). Moreover, cities, especially mid- and smaller sized ones, lack the resources to integrate adaptation knowledge (Woodruff and Stults 2016, Kalafatis and Lemos 2017), including knowledge stemming from the different disciplines (e.g., physical, ecological, and social sciences), databases, and methods (e.g., spatial analyses, scenario-building, socio-ecological vulnerability assessments), that they need to inform decision-making. That leaves these mid and small sized cities, which describes the majority of cities in the Great Lakes region, without sufficient support to efficiently and robustly move forward with their adaptation initiatives.

As researchers and boundary organizations seek to support cities in the integration and implementation of these actions, they face their own challenges in sustaining projects and relationships beyond short-term funding and project cycles. Current funding models are often

inadequate to support sustained engagement with a diverse array of stakeholders and to scale up findings and practices beyond the original focus of the research. There is thus an interlinked need for: 1) support for the integration and mainstreaming of climate information into planning for hazard- and climate-related municipal action, and 2) developing a strategy for sustained engagement with projects and stakeholders that can be scaled up in the region, while keeping the cost of co-production in check.

Previous GLISA research has demonstrated the challenge of sustained engagement with research-driven projects on a defined funding cycle as these projects typically provide limited opportunities for building long-term iterative relationships between producers and users of scientific knowledge (Lemos et al. 2014). And while reliance on boundary organizations such as GLISA can overcome typical barriers to knowledge use by fostering co-production—that is, the purposeful iteration between producers and users of knowledge to increase its usability—they face their own challenges. For example, co-producing knowledge typically involves high transaction costs in terms of human capital and time as well as trust and legitimacy building (Kirchhoff et al. 2013). To help offset these costs, GLISA has created a framework—the boundary chain model—that links different boundary organizations and takes advantage of their previous relationships (e.g., in building trust and legitimacy) and existing resources (e.g., human, time, and financial). By funding boundary chains through an annual small grant competition, GLISA has been able to maximize and pool its resources and engage stakeholders more efficiently than if building each of these relationships from scratch (Lemos et al. 2014; Kirchhoff et al. 2015).

In its boundary chains, GLISA has developed customized climate information products (e.g., urban climatologies and scenarios) and worked with different organizations to increase knowledge use in the region. For example, GLISA partnered with the National Park Service (NPS) from 2012-2014 to integrate climate information into NPS's scenario planning approach to evaluate potential impacts on the delicate wolf and moose ecosystems on Isle Royale (Fisichelli et al. 2013). Using existing localized climate data, GLISA helped the NPS develop four future scenarios (i.e., Least Change, Summer Drought/Wind/Fire, Warmer than Duluth, Isle Savanna) and present them in an easy-to-read table (i.e., trends for each scenario for identified key resources) for decision-makers exploring adaptation options. Based on the success of this project, GLISA and the NPS partnered again in 2014-2015 to apply the same scenario planning process to Apostle Islands National Lakeshore using glisaclimate.org, an in-house online platform for information sharing and reuse. While these projects were successful in terms of providing usable, co-produced, climate information using the boundary chain model, they failed to foster sustained engagement once the source of funding for this activity ended.

In contrast, in another more sustained example of the chain model, GLISA has worked with cities in the Great Lakes region to develop customized climate information in support of adaptation action for the past six years funded by a number of different grants.[4] In 2015, many of these cities formed the Great Lakes Climate Adaptation Network (GLCAN) to unite cities with universities in the region to move climate information to and from producers at the universities to users in the cities, as well as across cities. GLISA and GLCAN are currently working on our

[4] For more information, visit the Great Lakes Adaptation Assessment for Cities (GLAA-C) project page on GLISA's website: http://glisa.umich.edu/projects/glaac.

first funded project together in a partnership with the Huron River Watershed Council (HRWC) and climate adaptation expert PI Stults. Through support from the Urban Sustainability Director's Network (USDN) innovation funds, this team is working with five Great Lakes cities (i.e., Ann Arbor and Dearborn, Michigan; Bloomington and Indianapolis, Indiana; Cleveland, Ohio) to develop a universal climate and social vulnerability assessment (VA) template that integrates existing efforts across planning for natural hazards, land use policy, and natural resource management accounting (e.g., lake-level rise and changes in extreme events).[5] While vulnerability assessments can be powerful tools that inform and shape future land use, policy, and planning decisions, they are rarely coordinated across planning domains. As a result, communities often duplicate their work, wasting valuable staff time and resources that could otherwise be used for plan implementation. In response to this need, the template is being designed to reduce municipal workloads and save limited resources by mainstreaming existing, disparate planning domains. Furthermore, it incorporates both climate and equity information that can be applied to all types of city planning, regardless of city size or location. However, despite the success of this collaboration to secure a funded project, the long-term sustainability of this chain remains uncertain as funding exists only to build the template, not to test it, refine it, or scale its use.

Objectives and Outcomes: In this proposal, we use a collaborative approach to: 1) co-produce climate information with small and mid-sized Great Lakes cities with varying degrees of previous climate experience, using the comprehensive climate and social vulnerability assessment template currently in production by Esselman and Stults, and 2) identify drivers and best practices of sustained interaction that can be scaled up in the Great Lakes region to drive sustained and meaningful climate action. Our overall goal is to determine what method of stakeholder engagement best sustains the boundary chain model over time with lower transaction costs.

Our approach is intended to overcome the aforementioned barriers for both the integration and mainstreaming of adaptation action and engagement in the stormwater sector. In pursuing these objectives, we seek to achieve the following outcomes and outputs:

Outcome 1: An integrated, co-produced vulnerability assessment methodology that allows Great Lakes cities to mainstream adaptation for stormwater management as well as social vulnerability into city-wide as well as sectoral planning and action.

Outputs:

- Completed vulnerability assessment template for assessing climate and social vulnerability of stormwater systems, projects, and infrastructure that is populated with climate information for six cities in the region;
- Training module for vulnerability assessment template; and
- At least six city representatives trained on the vulnerability assessment template.

Outcome 2: A sustained engagement process that identifies best practices of sustained interaction, lower transaction costs, (i.e., human, technical, financial resources, trust-building and legitimacy) and can be replicated and disseminated throughout the GL region and other regions of the US.

[5] For more information, see press release on GLISA's website: http://glisa.umich.edu/news/great-lakes-cities-prepare-nation-climate-change and the project page on HRWC's website: http://www.hrwc.org/our-work/management/vulnerability-assessment/.

Outputs:

- Comparison of experiences/outcomes for the three engagement treatments; and,
- Best practices guide for sustained engagement.

We will build on the existing boundary chain established in the USDN-funded project to continue and sustain engagement with the cities already involved in the project. By working with boundary organizations with established and trusted stakeholder relationships, we will build upon this legitimacy to explore barriers and opportunities to sustained and scaled up stakeholder engagement in the Great Lakes region. We will employ in-depth qualitative methods to test three modes of engagement (described below) to explore how GLISA's boundary chain model can reduce transaction costs in support of municipal adaptation action in the stormwater sector. Being mindful of the scope of this competition, we are framing this project as building on our existing effort for a "proof of concept" experiment, ensuring our in-depth qualitative approach and small sample (six cities) yields not only preliminary data that can inform larger 'n' studies in other contexts, but also provides the richness of information produced through qualitative case studies. Moreover, by working closely with six cities, our project in practice integrates scholarly and broader impact goals by engaging these cities in the co-production of information that has the potential to critically inform the implementation of future adaptation plans.

Broader outcomes from this project promise to enhance near- and long-term resiliency within the Great Lakes region while supporting the development and evaluation of strategies that accelerate the usability and update of climate information to address critical societal concerns, only one of which is related to stormwater management.

Methodology

As described above, GLISA is currently working with GLCAN, HRWC, PI Stults and five Great Lakes cities to develop a project-based universal climate and social vulnerability assessment (VA) template that integrates existing efforts across planning domains for natural hazards and infrastructure design, land use policy, and natural resource management accounting (e.g., changes in extreme events). The proposed project directly continues and builds on this effort to allow the cities to be trained on the template and apply it to stormwater management projects or other water-resource dependent activities for both short-term (e.g., flood response and preparedness) and long-term planning (e.g., infrastructure design) efforts.

In partnership with GLCAN and HRWC, GLISA and PI Stults will engage with six small- and mid-sized cities with varying degrees of previous climate experience in the Great Lakes region to build out the stormwater utility of the VA and then test the VA's utility through application in each community. In addition to the five cities already engaged in the project (i.e., Ann Arbor and Dearborn, Michigan; Bloomington and Indianapolis, Indiana; Cleveland, Ohio), five additional cities and counties are serving in an advisory role (Buffalo, New York; Flint, Michigan; Lucas County and Toledo, Ohio; Minneapolis, Minnesota). The project team will continue working with the five cities already actively engaged in the project to build out the VA so that it is appropriate for stormwater management adaptation. In addition, the project team will partner with at least six of the cities we have previously engaged in the development of the VA project, either those serving as core team members, those as advisors, or those participating within the

GLCAN network, to test our engagement treatment methods (see GLCAN letter of support).

We will pair communities and place them into one of the three treatments. We will use the community's previous experience or action on climate change to stratify our sample, thereby that we have at least one community with limited previous climate experience and one with more extensive climate experience in each of the treatments. However, we are aware that other factors may influence the way our cities respond to the treatments, in particular their financial health and experience with the implementation of climate-related action. And although they are not formally considered in our matrix, they will inform the analysis through our in-depth data collection. While we have not yet identified which communities we will engage with, below is an example of how our engagement may look. We will only select communities that agree to engage with us, thereby controlling for willingness/interest in climate adaptation work.

	Face-to-face engagement	**Webinars and interactive remote engagement**	**Written communication**
Limited Previous Climate Experience / Action	Traverse City, MI	Goshen, IN	Euclid, OH
Modest to Significant Previous Climate Experience / Action	Dayton, OH	Dearborn, MI	Bloomington, IN

While funding may be critical to sustain and scale up stakeholder engagement, there remains the need to investigate how a reduction in transaction costs may substantially shape the ability of boundary chains to expand their role over time. In this project, we will compare three forms of engagement with stakeholders to explore how to decrease the costs of co-production with two cities per treatment:

1. In the first mode, we will employ conventional co-production methods—that is, face-to-face interaction and access to customized products and datasets. The first mode will be executed, through at least two workshops in each city (one to present the climate information, one to train city officials to use the stormwater management template) in collaboration with GLISA to engage decision-makers in the cities in the various techniques to conduct a vulnerability assessment, including a face-to-face training how to use the VA tool.
2. In the second mode, we will use remote engagement that in principle should decrease transaction costs—in this case human, time and financial resources. The second mode will be executed using live, interactive webinars (mimicking the face-to-face experience) and GLISA's collaborative web platform, glisaclimate.org, to interact with decision-makers in the cities. In this mode, we will use remote technologies to train the participants on how to use the VA tool and begin implementing stormwater projects that are climate adapted.
3. The third, self-assisted mode, will be conducted via written communication (i.e., emails and sharing of two recorded webinars) and will serve as a control treatment. In this mode, we will provide written guidance on how to use the VA template and identify climate adaptive stormwater strategies but will not provide any additional guidance (other than answering emails or phone calls that the communities initiate).

In testing these three treatments of stakeholder engagement, we aim to both assess necessary financial, human and time resources to implement the VA template and support on the ground project implementation as well as potential tradeoffs of less costly, less intensive co-production treatments. To assess the utility of the engagement methods, we will conduct pre- and post-treatment in-depth interviews with participants from all the applied treatments to qualitatively evaluate (1) their level of satisfaction and impact of the co-production in their capacity to mainstream climate information into stormwater management, and (2) the difference between the three approaches, paying special attention to how they shape decision-makers' perceptions of the co-production process as well as their willingness to continue to interact with GLISA and GLCAN. An interview protocol will be developed and administered by the PIs to ensure consistency during the evaluation phase.

PI Stults, GLCAN, and HRWC will provide the VA template, develop training on the tool, and present and use it with cities. GLISA will support this engagement and provide customized climate information, adapted from a series of data sets, for the cities to populate the tool (see 'Data' below). One level of interaction is the incorporation of climate information, and another is the training and implementation of the template. In this way, we will explore GLISA's boundary chain model (Figure 4).

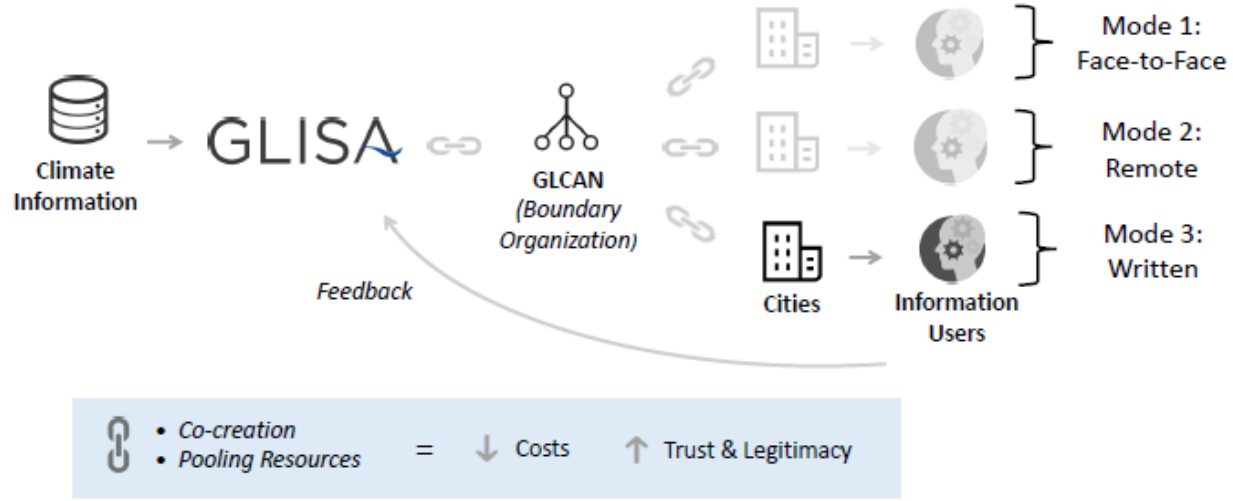

Figure 4. Configuration of boundary chain employed in proposed project. The climate information is tailored and moves through different boundary organizations (i.e., links in the chain) to connect science to users. By co-creating information and pooling resources throughout the chain, we build trust and legitimacy and decrease costs. Adapted from Lemos et al. 2014.

Workplan

This project will build on and continue the work of the USDN-funded vulnerability assessment template innovation grant, based on the existing relationships with practitioners in each of the ten cities involved in the current project as well as those that participate in the Great Lakes Climate Adaptation Network. To achieve the work, we have grouped it into three phases:

Phase I: Engagement and Training. In the first phase, the project team will leverage existing relationships from the USDN project to recruit six cities to participate in the project to continue their work developing the VA template and ensuring it is built out to assist in stormwater management adaptation. This will involve individual phone calls and/or emails explaining the project and expected roles of stakeholders, and discussing what stormwater or water resources project(s) the city is or may be considering in the future. While the team will strive to adhere to the design principles described above in 'Methodology,' we will be dependent on the capacity of city stakeholders as well as by their need and the timing to assess the vulnerabilities for a stormwater project or future planning. The team will determine which treatment to use on each city based on the level of previous climate experience/action as indicated above. We will randomly assign each interested city into one of the three treatment methods, thereby controlling for conscious as well as sub-conscious biases.

The type of stormwater project each city selects for assessment and eventual implementation will serve an early indicator for the GLISA team to start acquiring the appropriate climate information to customize the VA template. At the same time, PI Stults will lead the development of training materials for the VA template, which will be shared with all treatment groups (albeit through different means of sharing). These may include but are not limited to written guidance, infographics, webinars, videos, and face-to-face training – depending on which treatment method each community is assigned to.

Phase II: Presentation and Implementation. In the second phase, the project team and cities will work together to implement the VA template for a stormwater or related project. PI Stults will lead the presentation of the training, VA template, and climate information to the cities, with GLISA, GLCAN, and HRWC interacting with the decision-makers according to the assigned engagement treatment. In two cities, the team will participate in two face-to-face meetings, and in two other cities, they will participate remotely via live, interactive webinars (via The University of Michigan's Blue Jeans Network system that enables audio, screen sharing, and video conferencing) in two co-production meetings. For the remaining two cities, PI Stults will communicate the same information via email – providing the template, training, recorded webinars – and offering to respond to questions via phone or email.

This phase will include an introductory meeting to discuss the project process and timeline and, if needed, a discussion, facilitated by GLISA, to begin to develop the climate narrative for each city (i.e., learning what past weather and extreme events have affected the city, what observations the stakeholders have made regarding weather and climate in their city). Each of the meetings will adhere to the treatment methodology discussed above: face-to-face, webinar, or email/remote. GLISA has learned from previous projects that participation in narrative development fosters stakeholder ownership of the climatology, and that contribution to the project's technical component makes sustained engagement more likely.

The GLISA produced climate information will then be integrated into the VA template and used to assess each community's stormwater vulnerability. Once completed, PI Stults and Esselman will work with each city, according to treatment method, to identify and implement a relevant stormwater management adaptation effort.

Data: GLISA has previously provided city-specific climate information in the form of climatologies for several cities, working with stakeholders in the cities to develop a climate narrative that reflects the city's needs and priorities. GLISA has learned that by including historical weather and climate in the climatology, stakeholders link this information to personal experiences and as a result, relate more to the information and are more open to discussing future climate projections. To-date, GLISA has received feedback that the climatologies present information in a clear and usable way, and these continue to be one of GLISA's most requested products.

For the five core cities in the USDN project, GLISA will already have completed a city-specific climatology tailored to the VA template and will provide supplemental information specific to stormwater impacts. For any of the five advisory cities or other GLCAN that participate in the proposed project as test cities, GLISA will develop a similar city-specific climatology. To do this, GLISA will rely on existing NOAA datasets and other publicly available information that we have access to and experience using. The only new data the project will produce are the results from the in-depth interviews, which will be used to explore the outcomes from the different engagement treatments and to develop a best practices guide (see phase 3). GLISA will use the following existing datasets to develop the city information to populate the VA template:

- *Great Lakes Adaptation Data Suite*: includes historical station and climate division data on lake levels, water temperatures, and ice cover. Owned by GLISA; access available internally.
- *Dynamically Downscaled Climate Projections for the Great Lakes Region*: future climate data. Owned by the University of Wisconsin-Madison; access available by request.
- *National Climate Assessment future projections for temperature and precipitation:* Eighth degree-CONUS daily downscaled climate projections. Owned by the US Global Change Research Program; publicly available online.
- *Coupled Model Intercomparison Project Version 5 (CMIP5):* projections for temperature and precipitation. Owned by the World Climate Research Programme's Working Group on Coupled Modeling; access available internally or online at the World Data Center for Climate.
- *Great Lakes Dashboard*: future lake level projections. Owned by NOAA Great Lakes Environmental Research Laboratory (GLERL); publicly available online.
- *Dynamically Downscaled Projections of Great Lakes Water Levels:* future lake level projections. Owned by the Nelson Center for Climatic Research, University of Wisconsin-Madison; available via collaborator (GLISA working to acquire data in-house).
- *GLISAclimate.org:* GLISA's in-house, web-based platform for collaborative work. This website is maintained by GLISA and allows stakeholders to gain access to project pages to work on shared documents and datasets.

Phase III: Evaluation and Dissemination. In the third phase, the team (led by Lemos) will develop and administer a post-engagement in-depth interview protocol to explore and understand the differences between the three modes of engagement, focusing specifically on issues of comprehension, credibility, legitimacy, willingness to implement the VA template, and to sustain interaction with boundary chain. Decision-makers will be asked to evaluate not only the usability of the climate information and the VA template tool, but also to reflect on their experiences of

the modes of engagement themselves. These will be conducted individually for each stakeholder, with the mode to be determined during the beginning of the project (i.e., in-person, webinar, or remote). The results will allow the project team to evaluate the test methodologies and begin to identify best practices for sustained engagement and scaling up. Using the in-depth interviews, the project team will compare the three different modes across several categories—in particular costs, commitment, efficacy and potential for sustainability, transferability and scaling up. We will identify advantages and disadvantages of both modes and develop a best practices guide to share with boundary organizations in the Great Lakes region and nationally. The recommended best practices may vary by city type and experience incorporating climate information, as well as by the type of project the city is assessing.

We will develop an interview template to ensure consistency in conducting each post-engagement evaluation. The interviews will be semi-structured in nature and each will be recorded. Once complete, researchers will use an inductive coding methodology to review the text and identify themes and trends. We will have at least two members of our team review all interview recordings and conduct the inductive coding, thereby helping to control for bias. Once complete, the two researchers will reconcile codes and come up with a summary of the overall trends, themes, and prominent topics identified by program participants. These insights will be used to develop the best practice guide, to make refinements to the VA tool and associated guidance, and shared with USDN, the cities themselves, and through conference presentations.

In addition, the VA template tool itself and the best practices guide will be disseminated within GLISA's current network (i.e., boundary organizations, RISAs, other climate service providers including the Department of Interior Climate Science Centers and NOAA's Regional Climate Centers), posted on our website, and incorporated into future work. More specifically, the tool and guide will be submitted for addition to NOAA's U.S. Climate Resilience Toolkit and will be presented and/or shared at the earliest possible opportunity at regional and national conferences. At the regional level, these will include the Great Lakes Adaptation Forum (co-hosted biannually by GLISA), the annual meeting for the International Association of Great Lakes Research (annual), and a special in-person meeting of GLCAN hosted by the project team in Ann Arbor to present the findings and discuss best practices. At the national level, these will include but are not limited to the National Adaptation Forum (next event 2019), RISA in-person meeting, Urban Sustainability Directors Network events, and other regional adaptation forums. At these meetings, the results will be disseminated via presentations, side meetings, or inclusion in tools cafes, depending on the conference. Presentations at these conferences will allow our results to be disseminated at a national, as well as a regional scale. The results will also be written-up for a peer-reviewed journal article. This dissemination will continue beyond the project period, as part of the project team's regular work and travel.

Project Timeline

Phase	Activities	Leadership	Q1	Q2	Q3	Q4
1	City recruitment and project introduction	Stults	X			
	Begin developing/updating climatologies	Lemos, Stults	X			
	Make necessary revisions to VA template	Stults	X			
	Develop training for VA template	Stults	X	X		
2	Introduction meeting with each city	Stults		X		
	Completion of city-specific climatologies	Jorns		X		
	Series of facilitated city meetings	Stults		X	X	
	Develop stakeholder interview protocol	Lemos			X	
3	Conduct stakeholder interviews	Lemos			X	X
	Analyze interviews & compare results	Lemos, Stults				X
	Develop drivers of best practices guide	Lemos, Jorns				X
	Disseminate results	Jorns				X

*Q1, Q2, Q3, Q4 refer to three-month project quarters, starting 7/1/18 and ending 6/30/19.

Roles and Responsibilities of Project Team

To successfully execute the proposed project, we bring together a highly qualified team with expertise in research, practice, and navigating the boundary between these worlds. The project team has successfully worked together on the current USDN-funded project on which much of this work builds. Our team is spearheaded by PI Lemos, the Co-Director of an established NOAA-funded RISA team that is a trusted partner and expert in climate adaption in the Great Lakes region. As Co-Director of GLISA, Dr. Lemos led the development of GLISA's boundary chain model of stakeholder engagement and has overseen numerous GLISA projects to better understand how existing knowledge networks in the Great Lakes can be used to communicate climate information to end-users. In her social science research, Dr. Lemos has decades of experience leading interdisciplinary teams and working with climate scientists to convey scientific information to diverse stakeholder audiences.

The project is co-led by PI Stults, a climate adaptation expert with substantial experience in the region. Stults' expertise focuses on helping local communities and tribes understand their vulnerabilities to climate change and extreme weather and devise contextually relevant, robust, and implementable solutions. She currently co-leads the USDN project with Rebecca Esselman, is working with the City of Ann Arbor to integrate climate change into their hazard mitigation plan, is working with over 80 organizations across the nation to save as much evidence-based decision-making as possible within the current political climate, is helping the City of Aspen, CO advance their climate adaptation work, and is working with the Upper Snake River Tribe Foundation to develop a regional climate adaptation plan. She recently partnered with the 1854 Treaty Authority to create an award-winning climate vulnerability assessment and adaptation plan and developed guidance identifying what elements help explain why some adaptation plans get implemented compared to others.

GLISA Program Manager and PI Jorns manages the day-to-day operations of GLISA and its team and brings considerable experience leading stakeholder engagement processes in energy

efficiency and the water sector. Jorns' experience focuses on leading consensus-based stakeholder processes to develop sector-specific greenhouse gas management accounting methodologies. She recently completed a project in Southern California where she led a year-long effort to develop guidance to account for the greenhouse gases embedded in the delivery of urban water. This included conducting background research, facilitating six stakeholder engagement workshops in the region, drafting the guidance with the support of a Technical Review Panel and public comment period, and piloting the guidance with local water agencies. She also supported a similar effort on a larger scale to draft the Principles and Operating Rules for a National Energy Efficiency Registry under a Department of Energy State Energy Program Award to Tennessee, Michigan, Minnesota, Pennsylvania, Georgia and Oregon.

The rest of the project team includes a number of experts that will be engaged throughout various elements of the project. The GLISA team, composed of social scientists and climatologists, will build on their experience providing customized climate information for stakeholders while also analyzing the engagement and communication of that information. GLISA will build on our productive working relationship with the City of Ann Arbor and GLCAN, specifically on our previous work with the GLAA-C project and the aforementioned VA template project. We will also continue our partnership with HRWC to build capacity to adapt to climate change in the region. The project team all resides in or close to Ann Arbor, Michigan, and will check-in regularly (i.e., biweekly) via in-person or conference call meetings.

The list below includes the team's positions, affiliations, and roles and responsibilities:

- Dr. Maria Carmen Lemos: Professor and Associate Dean, University of Michigan (UM) School for Environment and Sustainability (SEAS)
    - *Role:* Principal Investigator, overseeing project direction and activities by leading the design of engagement treatments, design and execution of stakeholder interviews, identification of drivers of sustained engagement, and development of best practices guide.
    - *Estimated commitment:* 1 month of effort over project, requested in budget
- Dr. Missy Stults: Climate and Sustainability Expert, Private Contractor
    - *Role*: Co-Investigator, leading engagement with the cities; leading training and implementation of VA template; supporting evaluation and the identification of drivers of best practices for sustained engagement
    - *Estimated commitment*: 2 months, requested in budget
- Dr. Jenna Jorns: Program Manager, GLISA
    - *Role:* Co-Investigator, leading day-to-day project management, communication with project partners and coordination with GLISA climatologists and researchers, as well as the dissemination of the results; supporting development of best practices guide
    - *Estimated commitment:* 0.6 month of effort over project, in-kind contribution detailed in budget
- Rebecca Esselman, Watershed Planner, Huron River Watershed Council
    - *Role:* Supporting engagement with cities, development and implementation of VA template, and evaluation and dissemination
    - *Estimated commitment:* 5 weeks of effort over project, requested in budget
- Matt Naud: Environmental Coordinator for the City of Ann Arbor, GLCAN Co-chair

    - *Role:* Supporting the recruitment and engagement of cities, developing guidance materials on the VA template and advising the project team
    - *Estimated commitment:* 2 weeks of effort over project, not requesting salary support
- Laura Briley: Climatologist, GLISA
    - *Role:* Supporting accessing and providing climate data, webinar engagements, populating VA template
    - *Estimated commitment:* 2 weeks of effort over project, not requesting salary support
- Katherine Browne: Graduate Student Research Assistant, UM SEAS
    - *Role:* Supporting development, execution, and analysis of stakeholder interviews, supporting identification of best practices and dissemination
    - *Estimated commitment:* 2 months of effort over project, not requesting salary support
- Omar Gates: Climatologist, GLISA
    - *Role:* Leading climatology development by accessing and providing climate data, and populating VA template with climate information, supporting dissemination
    - *Estimated commitment:* 1 month of effort over project, requested in budget

Relevance to SARP Competition and NOAA's Long-term Climate Goals

The proposed project fully embraces the mission of NOAA's Climate Program Office. Through informed engagement with regional stakeholders, we seek to further both the science of climate change and the application of scientific information for informed decision making. Concurrently, we plan to identify best practices for sustained engagement to better understand how usable information is produced, transferred, and integrated most efficiently.

National Oceanic and Atmospheric Administration Next Generation Strategic Plan[6]

Long-term goal: Climate Adaptation and Mitigation:

- *Objective:* Assessments of current and future states of the climate system that identify potential impacts and inform science, service, and stewardship decisions. Stated evidence of progress includes: potential climate impacts and key international, national, and regional vulnerabilities are identified and inform the development of useful climate services.
- *Objective:* Mitigation and adaptation efforts supported by sustained, reliable, and timely climate services. Stated evidence of progress include: national, state, local, and tribal governments and water resource managers are better able to prepare for, adapt, and respond to drought and flooding, and can more confidently manage water resources; and decisionmakers prepare for and adapt to climate extremes, including deviations in temperatures and precipitation patterns.

[6] http://www.performance.noaa.gov/goals

Proposed contribution: The proposed project will engage external partners in local governments in the Great Lakes region to assess the vulnerabilities of planned stormwater management projects to climate variability and change, more specifically to the increase in extreme precipitation events. The project team will provide climate services (i.e., co-produced customized VA templates incorporating climate and socioeconomic data) to allow stormwater managers to make more informed decisions to adapt to the observed and projected impacts from extreme events (i.e., flooding). Furthermore, the proposed work builds directly on a current project being undertaken by the project team, supporting the goal of sustained and reliable engagement. The dissemination of the best practices guide for sustained engagement will allow our project's results to be transferrable to other cities, locations, and sectors.

Climate and Societal Interactions (CSI) – Sectoral Applications Research Program[7]

- *Objective:* Support for innovative and applicable and transferable approaches for decision making, especially for risk characterization in the context of a variable and changing climate; and,
- *Objective:* Establishment of a network of regionally scoped, long-term efforts to inform climate risk management and decision making; and,
- *Objective:* Promotion and transfer of climate knowledge, tools, products, and services within NOAA, across the federal government, nationally, and internationally.

Proposed contribution: The proposed project fits squarely within CSI and SARP's goals by developing transferrable approaches for decision making and continuing long-term, regional efforts to inform climate risk management. The VA template will be a mainstreamed tool to identify and manage climate risks associated with specific projects, and the GLCAN boundary chain model of sustained, regional stakeholder engagement allows best practices to be shared within the network to better inform decision making. The project will apply NOAA data and enhance data usability and visibility to simultaneously address critical resilience questions (see 'Data' section).

More specifically, the project addresses proposal topics 1 (i.e., developing a seasonal to annual climate focus within community multi-hazard planning to mainstream and customize climate information for decision making) and 5 (i.e., creating methods/tools/or other creative modes to communicate how to better incorporate climate science in comprehensive planning documents and activities). We address the first topic by developing training for and implementing a comprehensive VA template that incorporates seasonal to annual climate projections and socioeconomic information across currently disparate municipal planning domain, with the ultimate goal of mainstreaming climate information in city planning. By co-developing and applying the template to stormwater projects with six cities, we not only develop the tool but also a mechanism to maintain the adoption of climate information into all types of city-level decision making. The fifth topic is addressed by using an existing tool (the VA tool) to test different modes of stakeholder engagement to identify the most effective and efficiency (i.e., in terms of time and funding) to get adoption of climate information in planning.

[7] Climate and Societal Interactions FY18 Information Sheet.

Broader Impacts

This research aims to contribute to one of the most challenging aspects of climate change adaptation – increasing the adoption of climate information in decision making. By developing more effective and efficient ways of producing and disseminating usable climate information, climate scientists can help communities reduce their vulnerabilities to increasing extreme precipitation events. This project will serve as proof of concept to scale up sustained engagement with lower transaction costs to other communities in the Great Lakes, as well as to other regions via existing NOAA networks (e.g., the RISA network, Regional Climate Centers) and city networks (e.g., GLCAN, USDN).

As described above, increases in precipitation and in extreme events have become a growing concern not only for people immediately affected but also for decision makers tasked with preparing for and responding to these events. While the systems that manage stormwater are typically out of sight, the increasingly routine disruption of day-to-day business as usual activities due to these activities have become a reality. To take action to prevent these disruptions, actionable information and feasible tools are needed to inform, devise, and implement adaptation strategies. A main goal of this project is to help speed this process by accelerating the informed consumption of climate information through a mainstreamed tool. Improved stormwater management practices to address emergent risks due to climate change will help safeguard public and probate investments from flooding, avoid public health and safety risks, and reduce other vulnerabilities.

By extending the dissemination of our results beyond participating cities, our impacts will be conveyed to additional cities and regions across the U.S. to iteratively build climate resilience in our nation. Our aim to identify drivers of best practice for sustained engagement intends to direct future co-production work to make the most efficient use of funding. For example, if remote engagement is as effective, or close to as effective, as in-person engagement, the same amount of funding can be used to work with a greater number of stakeholders. This will directly inform how we proceed with our work and possibly allow us to significantly scale up the number of communities we are able to serve.

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Woodruff, Sierra C., and Missy Stults. "Numerous strategies but limited implementation guidance in US local adaptation plans." *Nature Climate Change* (2016).

Data Sharing Plan

Roles and Responsibilities: GLISA will be responsible for coordinating and directing the retention and sharing of any data generated during the course of the project. The faculty and staff affiliated with GLISA have substantial experience in the generation of scientific datasets and the documents gathered by these types of projects. The project team also understands the importance of ease of access to project outputs and data stewardship.

Expected Data: Climate data and information collected during the project will consist of, but not necessarily be limited to, digital data, metadata, data narratives, manuscripts, and reports. Specific proposed project outputs include evaluation data (i.e., interview transcripts and analysis) and data on stakeholder needs, preferences, and experiences. Any information gathered from interviews with human subjects will comply with IRB approval requirements; we will follow all IRB and academic standard protocols for obtaining, coding, and protecting these data. Additional outputs will result from analysis of data to develop best practices for sustained engagement and guidance products to disseminate research results.

Formats and Metadata: Available data formats will depend on the type of data. Formats for gridded datasets will rely on NetCDF standards, with adherence to Climate and Forecasts standards. Datasets intended for distribution to clients will typically be provided in Excel, rather graphics, shapefiles, etc. We will strive to adhere to metadata standards developed for the National Climate Assessment and otherwise, when appropriate, community metadata standards. The VA template, papers, and other documents will also be made available in PDF format.

Dissemination & Policies for Public Access, Sharing, and Publication: Data and products will be made publicly available as soon as possible after they have been created, evaluated, and documented. Exceptions to this sharing will be limited by law, regulation, policy, privacy, or security.

Retention, Storage, and Preservation of Access: Data produced by the project will be retained during the life of the project (i.e., one year). Deliverables such as documents, publications, and dissemination resources intended for public use will extend beyond the life of the project. The project team takes responsibility for developing translation information and assuring that it is linked to digital data whenever possible. Our plan for data services (i.e., archiving and distribution) is to utilize GLISA's existing resources, thereby reducing cost. The primary means to share this information will be on GLISA's website (glisa.umich.edu), hosted by UM's School for Environment and Sustainability. GLISA's website already makes similar data publicly available in many formats. Any digital data will be freely available by request from GLISA, fulfilled by a GLISA staff member. The only associated costs would be shipping of user-provided storage media (I.e., CDs, hard drives) if the amount of data prohibits electronic transfer.

Methods and policies for providing access, enabling sharing and increasing usefulness. All paper records, including tabulations of data and results, and associated metadata, will be converted to electronic form (i.e., scanned PDF files) and archived with other electronic data collected during the project. Informed consent, if applicable, will not include language that precludes data sharing, although every procedure will be employed to protect the confidentiality of individuals (e.g. review of disclosure of risk with limited access when risk is high, deidentification of data when possible and solicitation of consent, when possible).

Statement of Diversity, Inclusion, and Broader Impacts

The project team recognizes the importance of diversity, equity, and inclusion and will strive to address them through the research itself and the composition of the project team. The proposed project focuses on small- and mid-sized cities in the Great Lakes region with diverse locations, populations, and economic situations. Smaller cities often do not have the resources of larger cities to consider and incorporate climate information into planning, so not only does our approach address this for the test cities, but also will provide a template tool and best practices to conduct such assessments in other locations. Several target cities are "rust belt" or "legacy" cities that need opportunities to use climate change to grow their economies, instead of suffering the consequences of negative impacts associated with changing climate conditions. Furthermore, the vulnerability template being employed in the project incorporates socioeconomic information alongside climate information, encouraging communities to jointly evaluate future climate conditions in tandem with socio-economic data when making planning decisions.

The proposed project team is composed of several underrepresented minorities in science (i.e., women, African American, LGBT), as well as several early career professionals. The team will also include a Doris Duke Conversation Scholar during the summer of 2018. Housed at the University of Michigan's School for Environment and Sustainability, the Doris Duke Program sponsors summer undergraduate research to diversify the conservation workforce by developing the next generation of land, water, and wildlife professionals among traditionally underrepresented groups. The program also provides scientific and professional development training. GLISA mentored a Doris Duke scholar in the summer of 2017 and looks forward to continuing work with the same student during her second summer in the program in 2018. Finally, by working together and with the clients, the project team will increase partnerships between academia, regional non-profit organizations, and local governments to better sustain engagement over time.

Qualifications of Project Team

Matt Naud
Environmental Coordinator and Assistant Emergency Manager, City of Ann Arbor (MI)
Co-Chair, Great Lakes Climate Adaptation Network

Naud staffs the City of Ann Arbor's Environmental Commission and makes recommendations to the City Administrator, Mayor, and City Council on a broad range of sustainability issues. Recent projects include the City's Sustainability Action Plan, green rental housing, negotiating a solar installation with the DTE Energy, and managing remediation and closure of a city landfill. He is a member of the Urban Sustainability Director's Network (USDN) where he serves on the Planning Committee, Innovation Committee, and Small Cities User Group. He is also the Co-Chair of the Great Lakes Climate Adaptation Network (GLCAN), a regional network of USDN. Naud is a member of the USEPA Board of Scientific Counselors – Sustainable and Healthy Communities Subcommittee. This board provides advice, information, and recommendations to EPA's Office of Research and Development on technical management issues of its research programs. His work is centered in identifying ways to incorporate sustainability into local government organizations and actions. Naud's unique skill set couples a strong science background with public policy analytical tools. He has 16 years of experience working for local government on sustainability and emergency management issues, 11 years or private and public sector environmental, emergency management, and transportation consulting experience, and 4 years of academic and industrial research experience. Naud has been a lecturer at the University of Michigan Taubman College of Architecture and Urban Planning. He holds masters degrees from the University of Michigan in biology and public policy and an undergraduate degree in psychology from Boston College.

Rebecca Esselman
Watershed Planner, Huron River Watershed Council

Esselman leads Huron River Watershed Council's (HRWC) work in climate adaptation and watershed management. Esselman engages with practitioners and decision makers in water sectors to create the climate knowledge necessary to facilitate climate informed decision making and work across sectors to build capacity to develop and implement projects that prepare cities and ecosystems for climate impacts. In this role, she also leads watershed management planning and implementing of strategies for improving water quality and ecosystem function – for stormwater management, green infrastructure, and stream restoration – and works with diverse constituencies to improve climate readiness of the watershed for both natural and human communities. Prior to joining HRWC, she spent ten years with The Nature Conservancy working in conservation planning and knowledge sharing and three years at the University of Michigan as a Landscape Ecologist to quantify watershed land use using spatial pattern analysis and statistics. Esselman has 15 years of professional experience working across sectors to build climate adaptation capacity and to inform climate-informed decision making. She has also facilitated numerous multi-stakeholder working groups and published several peer-reviewed publications and adaptation guidebooks and tools. She holds a Master of Science in conservation ecology and sustainable development from the University of Georgia, where she focused on watershed issues, and Bachelor of Science in Environmental Biology/Botany from Michigan State University.

Omar Gates
Climatologist, Great Lakes Integrated Sciences and Assessments, University of Michigan

In his role, Gates gathers and processes climate data in standardized outputs for GLISA staff, faculty, and students. He developed and is the curator of the Great Lakes Adaptation Data Suite for GLISA, a compilation of over-land and over-lake observational datasets. Gates also provides consultation to GLISA partner organizations and stakeholders and mentors graduate and undergraduate students at the University of Michigan on their thesis projects. Gates leads GLISA's communication with tribal communities in the Great Lakes region, working to continue GLISA's climate adaptation work with these communities and strengthen these relationships. He also communicates GLISA's work and conducts outreach and engagement through presentations at regional and national conferences and events. Gates has a Master of Science in Atmospheric Science and a Bachelor of Science in Meteorology, both from the University of Michigan.

Katherine Browne
Doctoral Student, School for Environment and Sustainability, University of Michigan

Browne is a doctoral student in the School for Environment and Sustainability at the University of Michigan and a Graduate Student Research Assistant with the Great Lakes Integrated Sciences and Assessments (GLISA). Browne supports GLISA research through grant development, publication review, and field work. Her research is broadly focused on the social consequences of climate change and global-to-local linkages in international climate policy. Prior to joining GLISA, Browne worked for the University of Michigan's Energy Institute REFRESCH project, leading in-country coordination, community outreach, and research development in central Gabon. She received an M.S. in Environmental Justice from the University of Michigan's School of Natural Resources and Environment, a certificate in Science, Technology, and Public Policy from the Ford School of Public Policy, and a B.A. in Religious Studies from the College of Charleston.

Laura Briley
Climatologist, Great Lakes Integrated Sciences and Assessments, University of Michigan

In her role, Briley works to distill raw climate data and scientific information into useful, useable resources for community leaders, government officials and other researchers in the Great Lakes region. She works closely with stakeholders to identify climate information needs and to continuously improve techniques for incorporating climate information into decision-making, maintains and develops inventories of observational and projected climate data for stakeholder use and applied climate science research, and conducts applied climate research to support climate adaptation efforts in the region. She synthesizes this information into resources that effectively communicate climate science online, in-person and in print. Briley leads GLISA's Great Lakes Ensemble project to provide high quality climate projects for the Great Lakes region. She also mentors graduate students in the Applied Climate Engineering Program at the University of Michigan. Her technical skills include Python, Ultrascale Visualization – Climate Data Analysis Tools, OpenClimateGIS, Quantum GIS – and Drupal.

COLLEGES AND UNIVERSITIES RATE AGREEMENT

EIN: 1386006309A1

ORGANIZATION:

University of Michigan
3032 Fleming Administration Building
503 Thompson Street
Ann Arbor, MI 48109-1340

DATE:11/04/2016

FILING REF.: The preceding agreement was dated 05/10/2013

The rates approved in this agreement are for use on grants, contracts and other agreements with the Federal Government, subject to the conditions in Section III.

SECTION I: Facilities And Administrative Cost Rates

RATE TYPES: FIXED FINAL PROV. (PROVISIONAL) PRED. (PREDETERMINED)

	EFFECTIVE PERIOD				
TYPE	**FROM**	**TO**	**RATE(%)**	**LOCATION**	**APPLICABLE TO**
PRED.	07/01/2016	06/30/2018	55.00	On Campus	Organized Research
PRED.	07/01/2018	06/30/2020	56.00	On Campus	Organized Research
PRED.	07/01/2016	06/30/2020	54.00	On Campus	Instruction
PRED.	07/01/2016	06/30/2020	29.00	On Campus	Other Sponsored Activities
PRED.	07/01/2016	06/30/2020	26.00	Off Campus	All Programs
PROV.	07/01/2020	Until Amended			Use same rates and conditions as those cited for fiscal year ending June 30, 2020.

*BASE

Modified total direct costs, consisting of all direct salaries and wages, applicable fringe benefits, materials and supplies, services, travel and up to the first $25,000 of each subaward (regardless of the period of performance of the subawards under the award). Modified total direct costs shall exclude equipment, capital expenditures, charges for patient care, rental costs, tuition remission, scholarships and fellowships, participant support costs and the portion of each subaward in excess of $25,000. Other items may only be excluded when necessary to avoid a serious inequity in the distribution of indirect costs, and with the approval of the cognizant agency for indirect costs.

SECTION II: SPECIAL REMARKS

TREATMENT OF FRINGE BENEFITS:

The fringe benefits are specifically identified to each employee and are charged individually as direct costs. The directly claimed fringe benefits are listed below.

TREATMENT OF PAID ABSENCES

Vacation, holiday, sick leave pay and other paid absences are included in salaries and wages and are claimed on grants, contracts and other agreements as part of the normal cost for salaries and wages. Separate claims are not made for the cost of these paid absences.

OFF-CAMPUS DEFINITION: For all activities performed in facilities not owned by the institution and to which rent is directly allocated to the project(s) the off-campus rate will apply. Grants or contracts will not be subject to more than one F&A cost rate. If more than 50% of a project is performed off-campus, the off-campus rate will apply to the entire project.

EQUIPMENT DEFINITION:
Equipment means an article of nonexpendable, tangible personal property having a useful life of more than one year and an acquisition cost of $5,000 or more per unit.

FRINGE BENEFITS:

FICA
Retirement
Disability Insurance
Life Insurance
Health Insurance
Benefits Administration
Graduate Tuition Grant Program
Transportation Subsidy

Effective July 1, 2010, animal care cost will be included in the F&A rate MTDC base.

Your next F&A proposal based on actual costs for the fiscal year ending 6/30/2019 is due in our office by 12/31/2019.

SECTION III: GENERAL

A. LIMITATIONS:

The rates in this Agreement are subject to any statutory or administrative limitations and apply to a given grant, contract or other agreement only to the extent that funds are available. Acceptance of the rates is subject to the following conditions: (1) Only costs incurred by the organization were included in its facilities and administrative cost pools as finally accepted: such costs are legal obligations of the organization and are allowable under the governing cost principles; (2) The same costs that have been treated as facilities and administrative costs are not claimed as direct costs; (3) Similar types of costs have been accorded consistent accounting treatment; and (4) The information provided by the organization which was used to establish the rates is not later found to be materially incomplete or inaccurate by the Federal Government. In such situations the rate(s) would be subject to renegotiation at the discretion of the Federal Government.

B. ACCOUNTING CHANGES:

This Agreement is based on the accounting system purported by the organization to be in effect during the Agreement period. Changes to the method of accounting for costs which affect the amount of reimbursement resulting from the use of this Agreement require prior approval of the authorized representative of the cognizant agency. Such changes include, but are not limited to, changes in the charging of a particular type of cost from facilities and administrative to direct. Failure to obtain approval may result in cost disallowances.

C. FIXED RATES:

If a fixed rate is in this Agreement, it is based on an estimate of the costs for the period covered by the rate. When the actual costs for this period are determined, an adjustment will be made to a rate of a future year(s) to compensate for the difference between the costs used to establish the fixed rate and actual costs.

D. USE BY OTHER FEDERAL AGENCIES:

The rates in this Agreement were approved in accordance with the authority in Title 2 of the Code of Federal Regulations, Part 200 (2 CFR 200), and should be applied to grants, contracts and other agreements covered by 2 CFR 200, subject to any limitations in A above. The organization may provide copies of the Agreement to other Federal Agencies to give them early notification of the Agreement.

E. OTHER:

If any Federal contract, grant or other agreement is reimbursing facilities and administrative costs by a means other than the approved rate(s) in this Agreement, the organization should (1) credit such costs to the affected programs, and (2) apply the approved rate(s) to the appropriate base to identify the proper amount of facilities and administrative costs allocable to these programs.

BY THE INSTITUTION:

University of Michigan

(INSTITUTION)

Nancy A. Hobbs

(SIGNATURE)

NANCY A. HOBBS

(NAME)

ASSOCIATE VICE PRESIDENT FINANCE

(TITLE)

11-11-16

(DATE)

ON BEHALF OF THE FEDERAL GOVERNMENT:

DEPARTMENT OF HEALTH AND HUMAN SERVICES

(AGENCY)

Arif M. Karim -A

Digitally signed by Arif M. Karim -A
DN: c=US, o=U.S. Government, ou=HHS, ou=PSC, ou=People, cn=Arif M. Karim -A, 0.9.2342.19200300.100.1.1=2000212895
Date: 2016.11.07 07:49:59 -06'00'

(SIGNATURE)

Arif Karim

(NAME)

Director, Cost Allocation Services

(TITLE)

11/4/2016

(DATE) 5064

HHS REPRESENTATIVE: Matthew Dito

Telephone: (214) 767-3261

COMPONENTS OF PUBLISHED F&A COST RATE

INSTITUTION: **University of Michigan**

FY COVERED BY RATE: **JULY 1, 2016 through JUNE 30, 2020**

APPLICABLE TO: **ORGANIZED RESEARCH**

RATE COMPONENT:	FY 17-18 ON CAMPUS	FY 19 - 20 ON CAMPUS	OFF CAMPUS
Building Depreciation	6.1	6.3	
Equipment Depreciation	4.0	4.1	
Interest	0.4	0.5	
Operation & Maintenance	15.4	16.0	
Library	1.8	1.8	
Utility Cost Allowance	1.3	1.3	
Administration*	26.0	26.0	26.0
TOTAL	55.0	56.0	26.0

* Reflects provisions of Appendix III to Part 200 of Uniform Guidance—Indirect (F&A) Costs Identification and Assignment, and Rate Determination for Institutions of Higher Education (IHEs), C.8. dated December 26, 2013.

CONCURRENCE:

University of Michigan
(Institution)

Nancy A Hobbs
(Signature)

NANCY A. HOBBS
(Name)

ASSOCIATE VICE PRESIDENT FINANCE
(Title)

11-11-16
(Date)

Maria Carmen de Mello Lemos
School for Environmental and Sustainability, University of Michigan
Professor; Associate Dean for Research; GLISA Co-Director

SUMMARY OF SKILLS AND EXPERTISE

Dr. Lemos is a Professor and the Associate Dean for Research for the School of Natural Resources and Environment at UM and the Co-Director of the Great Lakes Integrated Sciences and Assessments (GLISA). She is a co-founder of Icarus (Initiative on Climate Adaptation Research and Understanding through the Social Sciences), which seeks to foster collaboration between scholars focusing on vulnerability and adaptation to climate change. She was a lead author of the Intergovernmental Panel on Climate Change (IPCC-AR5) and has served in a number of the U.S. National Research Councils of the National Academies of Sciences committees, including Restructuring Federal Climate Research to Meet the Challenges of Climate Change (2009), America Climate Choice Science Panel (2010) and the Board on Environmental Change and Society (2008-present).

EDUCATION

Ph.D., Political Science, Massachusetts Institute of Technology
M.Sc., Political Science, Massachusetts Institute of Technology
B.S., Economics, Universidade Federal de Juiz de Fora - UFJF (Brazil)

PROFESSIONAL HISTORY

School for Environment and Sustainability, University of Michigan	2002-present
Latin America Area Center, University of Arizona (Assistant Professor)	1997-2002
Environmental Change Institute, Oxford University (Fellow Professor)	2006-2007
J. F. Kennedy School of Government, Harvard University (Faculty Fellow)	2000-2001

SELECT PUBLICATIONS

Lemos, M. C. (2015). Usable Climate Knowledge for Adaptive and Co-managed Water Governance. Current Opinion in Environmental Sustainability, 12: 48-52.

Agarwal, A., and M.C. Lemos (2015). Adaptive Development. Nature Climate Change, 5(3): 185-187.

Lemos, M. C., Kirchhoff, C. J., Kalafatis, S. E., Scavia, D. and R. Rood (2014). Moving climate information off the shelf: Boundary Chains and the role of RISAs as adaptive organizations. Weather, Climate, and Society, 6(2), 273-285.

Moss, R. H., Meehl, G. A., Lemos, M. C., Smith, J. B., Arnold, J. R., Arnott, J. C., Wilbanks, T. J. (2013). Hell and High Water: Practice-Relevant Adaptation Science. Science, 342(6159), 696-698. doi: 10.1126/science.1239569

Kirchhoff, C. J., M. C. Lemos and S. Dessai (2013). "Actionable Knowledge for Environmental Decision Making: Broadening the Usability of Climate Science." Annual Review of Environment and Resources 38(1): 393.

Jenna Jorns
Great Lakes Integrated Sciences and Assessments (GLSA), University of Michigan
Program Manager

SUMMARY OF SKILLS AND EXPERTISE

Dr. Jorns is the Program Manager for the Great Lakes Integrated Sciences and Assessments (GLISA) at the University of Michigan. In her role, she provides day-to-day leadership and administration of GLISA operations to ensure the goals of the 2015-2020 program are being achieved. Dr. Jorns supervises staff and students and coordinates faculty research at the University of Michigan and Michigan State University. She also serves as the primary point of contact for the program and represents GLISA at local, regional, and national meetings & events.

Prior to joining GLISA, Dr. Jorns worked as a Policy Associate with The Climate Registry in Los Angeles to maintain existing and develop new greenhouse gas accounting policies by leading consensus-based stakeholder processes. She previously worked to improve energy efficiency and clean energy initiatives in Los Angeles with Global Green USA.

EDUCATION

Ph.D., Geosciences, Department of Geosciences, Princeton University, 2013
M.S., Geosciences, Department of Geosciences, Princeton University, 2009
B.S., Biochemistry, School of Lib. Arts & Sciences, Univ. of Illinois at Urbana-Champaign, '07

PROFESSIONAL HISTORY

GLISA, University of Michigan, Ann Arbor, MI	2017-present
The Climate Registry, Los Angeles, CA	2015-2016
Global Green USA, Santa Monica, CA	2014

SELECT PUBLICATIONS[1]

World Bank. 2016. "Greenhouse Gas Data Management: Building Systems for Corporate/Facility-Level Reporting." Partnership for Market Readiness, World Bank, Washington, DC. License: Creative Commons Attribution CC BY 3.0 IGO. *Co-author.*

The Climate Registry. 2015. "Water-Energy Greenhouse Gas Guidance: GHG Intensity Metrics for Water Suppliers in Southern California." Version 1.0. License: Creative Commons Attribution-NonCommercial-NoDerivs 3.0. *Lead author.*

M. Bankuti, B. Ellis, M. Frades, D. Kanter, J. Losh*, I. Ocko, J. Mayhew, P. Shevlin, C. Sierawski, A. Wasserman, J. Zuckerman. 2011. "Complements to Carbon: Opportunities for Near-Term Climate Action on Non-CO_2 Climate Forcers. Woodrow Wilson School of Public and International al Affairs. Princeton University. Princeton, NJ.

Losh,* J. L., Young, J. N., and Morel, F. M. M. 2013. Rubisco is a small fraction of total protein in marine phytoplankton. *New Phytologist,* 198(1): 52-58.

Losh,* J. L., Morel, F. M. M., and Hopkinson, B. M. 2012. Modest Increase in the C:N ration of N-limited phytoplankton in the California Current in response to high CO_2. *Marine Ecology Progress Series,* 468: 31-42.

[1] *****Last name changed from Losh to Jorns in 2013.

Missy Stults
Climate and Sustainability Specialist

SUMMARY OF SKILLS AND EXPERTISE

Missy is a nationally recognized adaptation and sustainability expert that has worked with dozens of local and tribal communities to advance their climate resilience initiatives. Missy is currently: working with the City of Aspen to help advance their climate adaptation efforts; supporting the development of an Intermountain West networking platform that; and collaborating with the Upper Snake River Tribes Foundation to develop a regional climate adaptation plan. She was one of the authors of the adaptation chapter of the U.S. National Climate Assessment (2014) and has authored more than a dozen papers and guides on local climate action.

EDUCATION

Ph.D., Urban & Regional Planning; Natural Resources & Environment, University of Michigan
M.A., Climate and Society, Columbia University
B.S., Marine Biology; **B.S.,** Environmental Science; University of New England

ABBREVIATED PROFESSIONAL HISTORY

Climate and Sustainability Expert, Independent Contractor,	2012 - present
Program Officer, The Climate Resilience Fund	2016 - present
Climate and Sustainability Consultant, The Kresge Foundation	2013 - 2017
Sustainability Analyst, Summit Energy Services	2011-2012
Climate Mitigation and Adaptation Director, ICLEI	2011
Adaptation Manager, ICLEI-Local Governments for Sustainability	2009-2011
Regional Program Manager, ICLEI-Local Governments for Sustainability	2007-2009

SELECT PUBLICATIONS

Stults, M. 2017. Integrating climate change into hazard mitigation planning: Opportunities and examples in practice. *Climate Risk Management*. https://doi.org/10.1016/j.crm.2017.06.004

Stults, M. and Woodruff, S.C. 2016. Looking under the hood of local adaptation plans: shedding light on the actions prioritized to build local resilience to climate change. *Mitigation and Adaptation Strategies for Global Change.* https://doi.org/10.1007/s11027-016-9725-9.

Woodruff, S.C. and **Stults, M.** 2016. Planning to be Prepared: Assessing the Content and Quality of U.S. Local Climate Adaptation Plans. *Nature Climate Change*. 1-13.

Meerow, S., Newell, J., and **Stults, M**. 2016. Defining Urban Resilience: A Review. *Landscape and Urban Planning*. 147: 38-49.

Meerow, S. and **Stults, M**. 2016. Comparing conceptualizations of urban climate resilience in theory and practice. *Sustainability*. 8(7): 701.

Rebecca Esselman
Watershed Planner, Huron River Watershed Council

SUMMARY OF SKILLS AND QUALIFICATIONS

- M.S. Ecology and 15+ years professional experience
- Competency working across sectors to build capacity to establish and advance climate adaptation goals
- Adept at co-creation of climate knowledge necessary to facilitate climate informed decision making
- Ability to coordinate and facilitate multi-stakeholder working groups
- Command of various planning methodologies, strategy development, measures and adaptive management
- Capacity building through strategic capture, packaging, and sharing of conservation knowledge
- Development, fundraise and implement programs relating to climate change including adaptation planning and strategy implementation, outreach and education
- Work with diverse constituencies to improve climate readiness of the watershed for both natural and human communities
- Watershed management planning and implementation of strategies for improving water quality and ecosystem function – stormwater management, green infrastructure, stream restoration, education and outreach.

EDUCATION

M.S., Conservation Ecology and Sustainable Development, University of Georgia
B.S., Botany; Michigan State University

ABBREVIATED PROFESSIONAL HISTORY

Huron River Watershed Council, Watershed Planner June 2012 – Present

- Development, fundraise and implement programs relating to climate change including adaptation planning and strategy implementation, outreach and education
- Work with diverse constituencies to improve climate readiness of the watershed for both natural and human communities
- Watershed management planning and implementation of strategies for improving water quality and ecosystem function – stormwater management, green infrastructure, stream restoration, education and outreach.

The Nature Conservancy, Conservation Planning and Knowledge Management Nov 2002 – May 2012
The University of Michigan, Landscape Ecologist June 2001 – Jan 2004
Michigan Department of Natural Resources, Assistant Manager, Stewardship Program May 1997 – Apr 1998

SELECT PUBLICATIONS

(In Review) Cheng, C., Tsai, J., Yang, E., **Esselman, R**., Kalcic, M., Mohai, P. and Xu, X. Risk Communication and Climate Justice Planning: A Case for Michigan's Huron River Watershed, Urban Planning.

Kirchhoff CJ, **Esselman R**, and D Brown. 2015. Boundary Organizations to Boundary Chains: Prospects for Advancing Climate Science Application. Climate Risk Management.20-29. doi:10.1016/j.crm.2015.04.001

Current and Pending Support

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Maria Carmen Lemos

Other agencies (including NSF) to which this proposal has been/will be submit-

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Co-producing Climate Knowledge and Sustained Engagement in the Great Lakes in Support of Stormwater Management Adaptation (This Proposal)

Source of Support: National Oceanic and Atmospheric Administration

Total Award Amount: $174,949 Total Award Period Covered: 7/1/2018 – 6/30/2019

Location of Project: University of Michigan

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr: 1.0

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Mcintire Stennis 2016

Source of Support: USDA NIFA

Total Award Amount: $309,402 Total Award Period Covered: 10/1/2015 – 9/30/2017

Location of Project: University of Michigan, Ann Arbor

Person-Months Per Year Committed to the Project. Cal: Acad: 1.0 Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Coastal SEES: Enhancing sustainability in coastal communities threatened by harmful algal blooms by advancing and integrating environmental and socio-economic modeling

Source of Support: National Science Foundation

Total Award Amount: $1,996,139 Total Award Period Covered: 09/01/2016-08/31/2019

Location of Project: University of Michigan, Ann Arbor

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr: 0.5

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Validating and Expanding the Great Lakes Adaptation Data Suite (GLADS)

Source of Support: GLOS/NOAA

Total Award Amount: $252,748 Total Award Period Covered: 07/01/2016 – 06/30/2021

Location of Project: University of Michigan, Ann Arbor

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Great Lakes Regional Integrated Sciences and Assessments Center

Source of Support: National Oceanic and Atmospheric Administration

Total Award Amount: $ $4,098,836 Total Award Period Covered: 09/01/2015-08/31/2020

Location of Project: University of Michigan, Ann Arbor

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr: 0.5

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*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

Current and Pending Support

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Maria Carmen Lemos	Other agencies (including NSF) to which this proposal has been/will be submit-

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

McIntire Stennis 2017

Source of Support: USDA NIFA

Total Award Amount: $309,402 Total Award Period Covered: 10/1/2016 – 9/30/2018

Location of Project: University of Michigan, Ann Arbor

Person-Months Per Year Committed to the Project. Cal: Acad: 0.5 Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

The Cooperative Institute for Great Lakes Research (CIGLR): A Proposal to the Office of Oceanic and Atmospheric Research, NOAA, for a new Regional Research Institute

Source of Support: National Oceanic and Atmospheric Administration

Total Award Amount: $20,000,000 Total Award Period Covered: 7/1/2017 – 6/30/2022

Location of Project: University of Michigan, Ann Arbor

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

NERSS A Collaborative Science Program for the National Estuarine Research Reserve System: Connecting End Users throughout the Applied Research Process

Source of Support: National Oceanic and Atmospheric Administration

Total Award Amount: $20,000,000 Total Award Period Covered: 10/01/2014-09/30/2019

Location of Project: University of Michigan, Ann Arbor

Person-Months Per Year Committed to the Project. Cal: Acad: 1.0 Sumr: 1.0

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Co-producing Climate Knowledge and Sustained Engagement in Support of Coastal City Adaptation in Michigan

Source of Support: MI Sea Grant/ National Oceanic and Atmospheric Administration

Total Award Amount: $149,953 Total Award Period Covered: 2/1/2018 – 1/31/2020

Location of Project: University of Michigan, Ann Arbor

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

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*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

Current and Pending Support

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Jenna Jorns

Other agencies (including NSF) to which this proposal has been/will be submitted.

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Co-producing Climate Knowledge and Sustained Engagement in the Great Lakes in Support of Stormwater Management Adaptation **(This Proposal)**

Source of Support: National Oceanic and Atmospheric Administration

Total Award Amount: $174,949 Total Award Period Covered: 7/1/2018 – 6/30/2019

Location of Project: University of Michigan

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Co-producing Climate Knowledge and Sustained Engagement in Support of Coastal City Adaptation in Michigan

Source of Support: MI Sea Grant/ National Oceanic and Atmospheric Administration

Total Award Amount: $149,953 Total Award Period Covered: 2/1/2018 – 1/31/2020

Location of Project: University of Michigan, Ann Arbor

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: $ Total Award Period Covered:

Location of Project:

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: $ Total Award Period Covered:

Location of Project:

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: $ Total Award Period Covered:

Location of Project:

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

Current and Pending Support

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Missy Stults

Other agencies (including NSF) to which this proposal has been/will be submitted.

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Co-producing Climate Knowledge and Sustained Engagement in the Great Lakes in Support of Stormwater Management Adaptation **(This Proposal)**

Source of Support: National Oceanic and Atmospheric Administration

Total Award Amount: $174,949 Total Award Period Covered: 7/1/2018 – 6/30/2019

Location of Project: University of Michigan

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Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

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Current and Pending Support

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Rebecca Esselman

Other agencies (including NSF) to which this proposal has been/will be submitted.

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Co-producing Climate Knowledge and Sustained Engagement in the Great Lakes in Support of Stormwater Management Adaptation **(This Proposal)**

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City of Ann Arbor Systems Planning Unit
City Hall, 5th floor
Matthew Naud
301 E Huron St
Ann Arbor, MI 48104

August 14th, 2017

Dr. Nancy Beller-Simms
Program Manager, Sectoral Applications Research Program (SARP) – Extreme Events
SARP – Coping with Drought in Support of NIDIS
NIDIS/SARP Drought Risk Management Research Center
NOAA Climate Program Office
1315 East West Highway, Room 12214
Silver Spring, MD 20910

Dear Dr. Beller Simms,

As Environmental Coordinator for the City of Ann Arbor and the Co-Chair of the Great Lakes Climate Adaptation Network (GLCAN), I am delighted to support to the Great Lakes Integrated Sciences and Assessments (GLISA) in their proposal to NOAA's Sectoral Applications Research Program 2018 Federal Funding Opportunity for Extreme Events Preparedness, Planning, and Adaptation Within the Water Sector.

I believe their project, titled '*Co-producing Climate Knowledge and Sustained Engagement in the Great Lakes in Support of Adaptation in the Water Sector*,' is a great opportunity to build on a current project GLCAN and GLISA are working on together. Funded by the Urban Sustainability Director's Network (USDN), we are developing a vulnerability assessment template for five cities in the Great Lakes region. This proposal to implement and customize the vulnerability assessment template for projects in the water sector, while also identifying drivers of best practices for sustained engagement at reduced transaction costs, will complement this and other previous efforts to integrate and mainstream climate information for resilience in the Great Lakes and beyond.

As Co-chair of GLCAN and Environmental Coordinator for one of the five cities involved in the current USDN project, I commit to this project by engaging with cities in the region through the decision-makers involved in GLCAN and to build on the work the City of Ann Arbor is already doing as part of this effort. I also commit to advising GLISA and the project team.

I look forward to continuing a productive working relationship with GLISA and to promote collaboration with cities in the Great Lakes for this project.

Sincerely,

Matthew Naud

Matthew Naud, Environmental Coordinator, City of Ann Arbor

FORM **CD-511**
(REV 1-05)

U.S. DEPARTMENT OF COMMERCE

CERTIFICATION REGARDING LOBBYING

Applicants should also review the instructions for certification included in the regulations before completing this form. Signature on this form provides for compliance with certification requirements under 15 CFR Part 28, 'New Restrictions on Lobbying.' The certifications shall be treated as a material representation of fact upon which reliance will be placed when the Department of Commerce determines to award the covered transaction, grant, or cooperative agreement.

LOBBYING

As required by Section 1352, Title 31 of the U.S. Code, and implemented at 15 CFR Part 28, for persons entering into a grant, cooperative agreement or contract over $100,000 or a loan or loan guarantee over $150,000 as defined at 15 CFR Part 28, Sections 28.105 and 28.110, the applicant certifies that to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, 'Disclosure Form to Report Lobbying.' in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure occurring on or before October 23, 1996, and of not less than $11,000 and not more than $110,000 for each such failure occurring after October 23, 1996.

Statement for Loan Guarantees and Loan Insurance

The undersigned states, to the best of his or her knowledge and belief, that:

In any funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this commitment providing for the United States to insure or guarantee a loan, the undersigned shall complete and submit Standard Form-LLL, 'Disclosure Form to Report Lobbying,' in accordance with its instructions.

Submission of this statement is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required statement shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure occurring on or before October 23, 1996, and of not less than $11,000 and not more than $110,000 for each such failure occurring after October 23, 1996.

As the duly authorized representative of the applicant, I hereby certify that the applicant will comply with the above applicable certification.

NAME OF APPLICANT

Regents of the University of Michigan

AWARD NUMBER

PROJECT NAME

Prefix:	First Name:	Middle Name:
Mr.	Craig	
Last Name:		Suffix:
Reynolds		
Title: Director		

SIGNATURE:

Completed by Grants.gov upon submission.

DATE:

Completed by Grants.gov upon submission.