

**BERKE: UNC-CH
MASTERSON: TAMU
DHS COASTAL RESILIENCE CENTER
RESEARCH PROJECT
YEAR 5 PROGRESS REPORT
July 1, 2019 – June 30, 2020 (Updated 12/14/2020)**

I. INTRODUCTION

Project Title: Application of the Plan Integration for Resilience Scorecard™ (PIRS) to Practice

Principal Investigator Name/Institution: Phil Berke, University of NC at Chapel Hill

Additional Research Participants/Partners: Jaimie Masterson, Texas A&M University

Short Project Description (“elevator speech”):

We develop the *Plan Integration for Resilience Scorecard™* (PIRS) to assist local practitioners to assess the degree to which networks of local plans target geographic areas most prone to hazards and evaluate the coordination of local plans. Our research tested PIRS™ in six coastal communities and found that plans are not fully consistent and do not always address the areas in a community most vulnerable to floods or sea level risks; moreover, some plans actually increase physical and social vulnerability to hazards. For this project, our primary goal is to work directly with 4 to 5 local communities to refine the PIRS™ guidebook, training materials and plan scoring tool to ensure that they meet requirements of different communities that vary in capacity to anticipate and plan for future risks. Using a participatory action research methodology, we will document the strengths and weaknesses of PIRS based on end-user comprehension of PIRS™ concepts and tasks, and recommendations on how best to encourage use of PIRS™ by a broad range of local practitioners. We will develop metrics (quantitative and qualitative) to track outcomes of the PIRS application process across different communities. A top priority throughout the project is to continue our ongoing collaboration with federal agencies (FEMA, NIST), state agencies (New York Rising, Texas Sea Grant), and professional practice organizations to demonstrate how PIRS™ can best support their local mitigation and resilience planning programs.

II. PROJECT NARRATIVE

1. Project overview:

Communities adopt multiple interdependent plans that significantly affect future community vulnerability to hazards and climate change. The plans are almost always independently prepared by distinct government agencies and interest groups. It is not surprising that the plans are often in conflict and can actually increase physical and social vulnerability to hazards. We develop a resilience scorecard that allows local planners, emergency managers

and other officials to assess the degree to which the network of local plans integrate mitigation and recognize and respond to the physical and social vulnerabilities of geographic areas most prone to hazards. The information generated by the scorecard is used to create strategies to resolve conflicts across plans and identify missed opportunities to improve community resilience.

Success story - Rockport, a small city (population 10,000) on the southern Gulf coast of Texas, applied PIRS™ as the central tool for producing information to guide development of a new comprehensive plan in a post-disaster recovery context. Rockport officials considered the comprehensive plan to be the essential policy instrument to integrate resilience and guide community rebuilding across multiple urban sectors. To facilitate application of the scorecard, Rockport requested and received additional funding from a local non-profit organization, The Harte Research Institute for Gulf of Mexico Studies. The additional support was used to employ a part-time planning expert from the Texas Sea Grant Program to lead in the evaluation of the network of plans. The city planner participated on regular tele-conference meetings with the Texas Sea Grant planner and university experts between January 2019 and September 2019.

PIRS™ process in Rockport includes organizing a core team, often the city planner, emergency manager, floodplain manager, etc. Then we conduct a webinar or in-person training and exercise with the core team using guidebook. We facilitate monthly calls to check in on the core team progress (pulling policies, mapping district-hazard zones, scoring policies). Finally, in collaboration with local government staff, we assisted in coordinating a series of meetings to discuss the results with staff in various departments, agencies, entities applicable within community. Figure 1 illustrates the sequence of the planning process and role of PIRS™ used in Rockport.

The PIRS™ team worked with the City at the start of the comprehensive planning process one year after Hurricane Harvey to determine the optimal time to conduct the PIRS™ analysis. The city planner stated, “it’s important for us to look at how we want our community to grow in the next 20 years, especially with that memory so fresh in our minds.” The PIRS™ team shadowed the 10 planning meetings which ranged from 15-200+ participants. Goals, objectives, and policies were drafted from the community feedback. Additionally, the City with assistance from the research team applied for the American Planning Association’s Recovery Planning Assistance Team grant, to further build planning capacity. The City was awarded this grant which resulted in a downtown study focused on hazard mitigation. The research team used this study, along with the six other plans, and the draft comprehensive plan policies in the PIRS™ analysis. The comprehensive plan included a total of 170 final policies, 40 of which were edited and based on PIRS™, 73 policies are integrated with the network of plans. Figure 3 shows the composite policy scores by district hazard zone.

The research team developed two innovations within the comprehensive to visualize the benefit of PIRS™. First, reading through the recommendations the reader can find icons with acronyms that are associated with specific plans within the network of plans. There are call-out boxes throughout that describe how each recommendation and associated policy connects to other existing plans in the community. Second, the final chapter includes the compilation of all policies within the plan as the implementation table. A new column was added to this table to indicate which plans are integrated with each policy. The implementation table is used by city staff and city council to monitor progress. By including this column, it reminds staff and officials the consensus and greater impact of the policy ensuring future implementation.

One resident described the importance of having a plan that encompasses the entire city. While there had been two city-wide comprehensive plans and a downtown plan in the past, the new one “includes more factors” that were identified by the entire community, which helped to expand the scope of the project as compared to the original plan. Several residents noted that it was a benefit to have a replacement plan for the one developed years earlier and were pleased that the new plan is “well-integrated” because of PIRS™. Specifically, the connection to the county hazard mitigation plan and long-term recovery plan was important to the City. One resident, after reading through the comprehensive plan said, “I was involved with the Long-term Recovery Plan and I see it discussed here. Everything we worked on in that is not lost and is built on.” Because of the planning process and recovery efforts, the City of Rockport received a Silver Achievement Award in Resiliency Planning from the Texas Chapter of the American Planning Association in November 2019. Figure 2 shows pictures of residents actively involved in applying PIRS™ and a comment by the Rockport planner.

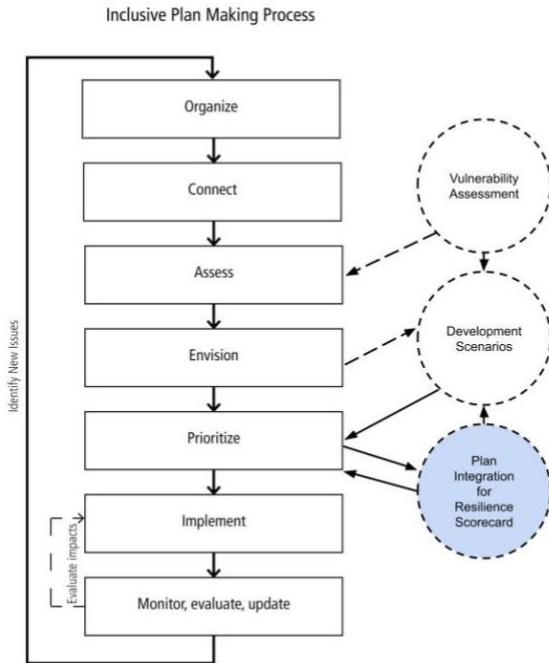


Fig. 1: Expanding the Inclusive Plan-Making Model for new plans (Masterson et al 2014). PIRS™ can be used in the development of new plans. As communities begin prioritizing goals, objectives, actions, and policies, PIRS™ can be used to understand the range of policies across the network of plans, identifying opportunities to fold other plan’s policies into the new plan, and pinpoint additional policy opportunities to be embedded into the new plan.



Community Task Force: Rockport, Texas

Figure 2: Task Force and Comment by Lead Planner

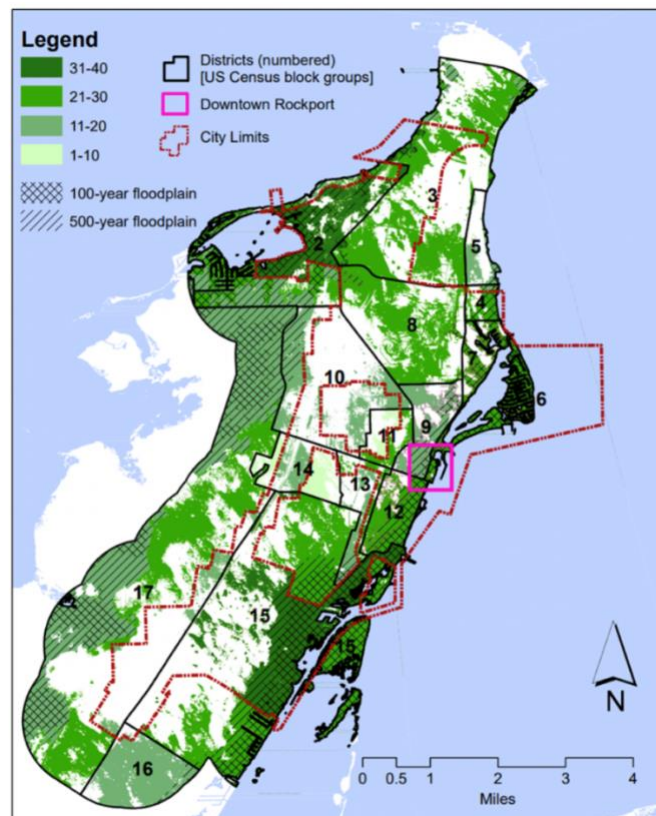


Figure 3: Composite Plan Policy Scores for All Plans by District Hazard Zone*
 *Shaded areas outside of 100-year and 500-year floodplain indicate inundation by Hurricane Harvey

2. Results:

- Working with Rockport, TX in post-disaster recovery. The Harvey inundation area was used as the primary hazard zone for scoring plans. Rockport applied the scorecard to guide preparation of the city's new comprehensive plan to assure alignment of multiple post-Harvey recovery initiatives in the city with the vision and strategies included in the plan.
- Working with the Port of Corpus Christi- The Port of Corpus Christi Authority is collaborating with communities that experience growth related to port expansion in applying the resilience scorecard in order to better coordinate plans to reduce hazard vulnerability.
- Working with a community-based organization (CBO) in poor minority neighborhoods in Houston that is using the scorecard to track how well county, city and neighborhood plans (stormwater, housing, transportation, mitigation) meet needs after Hurricane Harvey.
- Finalized maps that display results from PIRS evaluation for Nashua, NH
- Nashua's Integrated Crosswalk for Resilience Planning: PIRS™ + NIST + FEMA
- We are using the TM icon to establish a trademark of PIRS™.
- Conducted a series of trainings and outreach

- Sept 5, 2019- Malecha, M. & Masterson, J. “Integrating Resilience into Networks of Plans” Resilience Rising Symposium, College Station, TX
- Oct 17, 2019- Scheduled meeting with NY State NY Rising
- Nov 7, 2019- Masterson, J., Thapa, J., Bennis, A., Barret, C., Miller, K. “Big Storms, Even Bigger Challenges” APA TX Chapter Conference.
- Apr 2, 2020- Jaimie Masterson visiting lecturer at University of North Carolina at Chapel Hill
- Apr 27, 2020- Masterson, Jaimie, J. Thapa, A. Torres, A. "How Post-Disaster Data Can Inform Planning." American Planning Association, National Planning Conference 2020, NPC20@Home.
- Invited Lectures
 - Berke, P. Application of the Plan Integration for Resilience Scorecard to Practice, DHS Science & Technology Directorate Showcase Summit, July 11, 2019, George Mason University, Washington D.C.
 - Berke, P. City Planning for Resilience: Networking Across Planning, Infrastructure and Social Domains, September 6, 2019, Keynote Talk, Hunan University, Changsha, China
 - Berke, P. Characteristics, Causes and Outcomes of Plans: A Review a Decade of DHS Supported Research on and Actions of Mitigation Planning, Presentation to the FEMA Planning Effectiveness Committee (PEC), Nov. 7, 2019, Washington, D.C.
 - Berke, P. Real World Results: A Guidebook + A Scorecard = An Integrative Framework for Community Resilience Planning, Panel presentation RISE 2019: Transforming University Engagement in Pre- and Post-disaster Environments, Nov.18, 2019, State University of New York-Albany, Albany, NY
 - Berke, P. Application of a Plan Integration for Resilience Scorecard: Lessons from Local Practice. Flood Apex Review Board, Jan. 22-23, Washington, D.C.
- Proposals Funded
 - NC State Historic Preservation Office \$25,000, 2020-21
 - NSF CRISP, \$2 million, 2019-2023
 - One Gulf Program (Harte Foundation), \$70,000, 2018-2020

3. End users:

- American Planning Association (APA): We are collaborating with APA to co-develop communication, outreach and training programs in year 6. We just had a roundtable panel (5/29/20) discussion with experienced proactioners representing floodplain mangagement and public works, emergency management, and urban planning. The panel reviewed the strengths and capabilities of PIRS™, and offered suggestions on developing training materials.
- National Institute of Science and Technology (NIST): We are partnering with NIST in assisting staff of the City of Nashua, NH in applying the Resilience Scorecard and NIST Resilience Planning Guide.
- FEMA: FEMA has assisted NIST and the Texas A&M group in facilitating potential work with NY Rising. While the project has not been initiated to date, we have had numerous contacts with FEMA and appreciate their efforts. We also met staff with Sullivan County that will likely take on the PIRS process with state funding.

- Texas Sea Grant of Texas A&M: We continued to work with and engage three coastal planning specialists employed by Sea Grant. They worked in collaboration with our group in three Texas communities, including Rockport, Corpus Christi and Houston. City of Norfolk, VA: We completed our project with Norfolk, VA in Spring 2018. This year, we interviewed city staff in to prepare the lessons learned report (Berke et al. 2020. *Applying a Plan Integration for Resilience Scorecard to Practice*).
- Nashua, NH: In year 5, we had continual contact and provided technical assistance to city staff in applying the Resilience Scorecard. Nashua completed application of the scorecard in September 2019. Our team assisted them to finalize the set of maps after their GIS lead staff retired. We also interviewed city staff in to prepare the lessons learned report (Berke et al. 2020. *Applying a Plan Integration for Resilience Scorecard to Practice*).
- Rockport, TX: We initiated a new project with the Rockport staff in January 2019, expected completion date about September 2019. Rockport is devastated by Hurricane Harvey. We also interviewed city staff in to prepare the lessons learned report (Berke et al. 2020. *Applying a Plan Integration for Resilience Scorecard to Practice*). The core team included the city planner/floodplain manager, additional city staff, TX Sea Grant extension agent, comprehensive planning project manager. The following includes the community interactions:
 - *[May 2018- Comprehensive Planning process began]*
 - May 2019- PIRS introductory meetings
 - June- Initial training
 - July- Check in discussion
 - August- Results and comments back on policies
 - September- Policy adjustments
 - October- Staff approval
 - January- Plan finalized
 - March- Anticipated adoption
- Port of Corpus Christi Authority, TX: We initiated a new project with the port staff in May 2019. We completed the project in February 2020.
- Charity Productions: In spring 2019, we initiated a partnership with this community-based organization (CBO) to apply the scorecard in three poor minority neighborhoods in Houston that experienced significant damages from Hurricane Harvey. This CBO represents neighborhoods internal to the city with little or no formal power, but with intimate knowledge about how their neighborhoods are affected by hazards and the appropriateness of risk mitigation policy interventions that reflect the needs of socially vulnerable groups.

4. **Transition:**

- American Planning Association (APA) – Our primary transition goal this year was to integrate PIRS with APA. We had numerous discussions with senior staff at the APA to focus on how we might co-develop communication, outreach and training programs. We are happy to report that APA will work extensively in year 6 to translate the scorecard to practice in working through utilization of its extensive resources and outreach to 44,000 members and networks with allied professions.

- Advising FL Sea Grant on their funded proposal: “Quantifying the Effectiveness of Resilience Planning for Affordable Housing,” funded by National Sea Grant Program;
 - Texas General Land Office to include PIRS language into local hazard mitigation planning requirements.
 - North Carolina State Historic Preservation Office (2020-21) to fund a training program for communities by PIRS™ staff on how to integrate hazard mitigation planning with historic and cultural resource planning. The office received funding from federal funding because of the extensive damage to the state from multiple recent hurricanes.
5. Project Impact: Describe the real-world impact of your project that you accomplished or worked toward during Year 5. Include information about how your project’s outcomes advanced current technologies or capabilities, especially with regard to DHS component agencies (e.g., saves lives, saves money and/or property, increases operational efficiency)
- We produced a report that examines the changes that resulted from the PIRS™ application in three pilot cities. Details about the findings and data collection methods are discussed in Berke and Masterson et al. (2020), *Applying a Plan Integration for Resilience Scorecard™: Experiences of Nashua NH, Norfolk VA, and Rockport TX*. To guide our assessment of change, we developed a logic model to track changes. A logic model is a graphic depiction that presents the relationships among *inputs* (resources, training), *outputs* (change in organizational capacity to plan), and *outcomes* including changes in policy (plans, development standards, incentives and investments) and vulnerability (housing units relocated from hazard area, acres of hazard area conserved as open space). Figures 4, 5 and 6 (below) summarize outputs and outcomes from PIRS™ that occurred in the three pilot cities after the project was completed in each location.
 - Nashua emergency management staff successfully integrated PIRS™ with the NIST Resilience Planning Guide. The city demonstrated how both tools working together can significantly build local capacity to anticipate, plan for, and recover from an extreme event and build back better.
 - As demonstrated in the figures below, we believe that a range of local hazard mitigation planning and implementation practices supported by FEMA are directly connected to PIRS™ and can substantially improve community capacity and outcomes linked to better resilience.

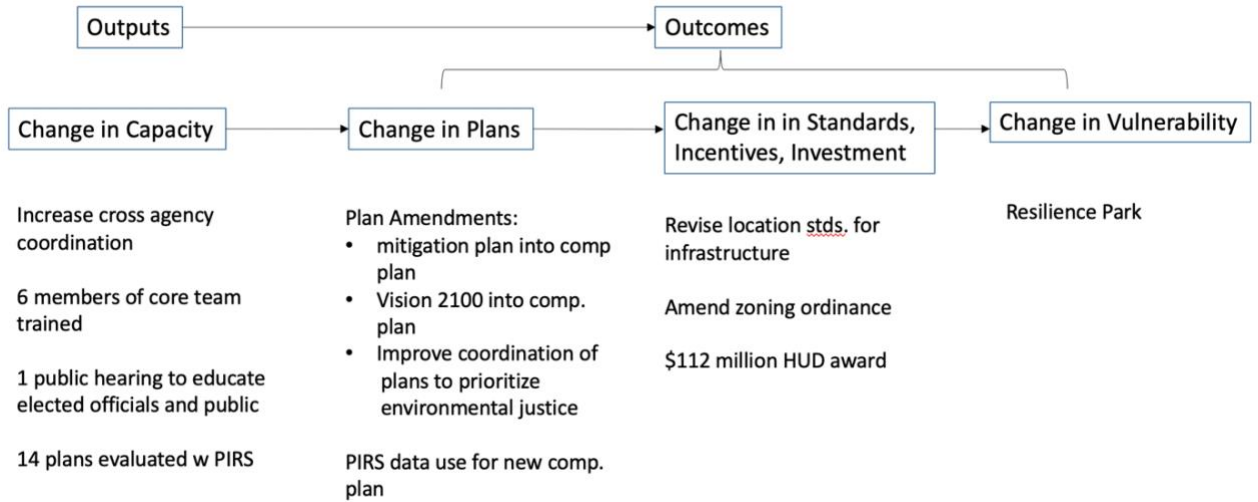


Figure 4: Changes Related to PIRS™ in Norfolk After Project Completion (March 2018)

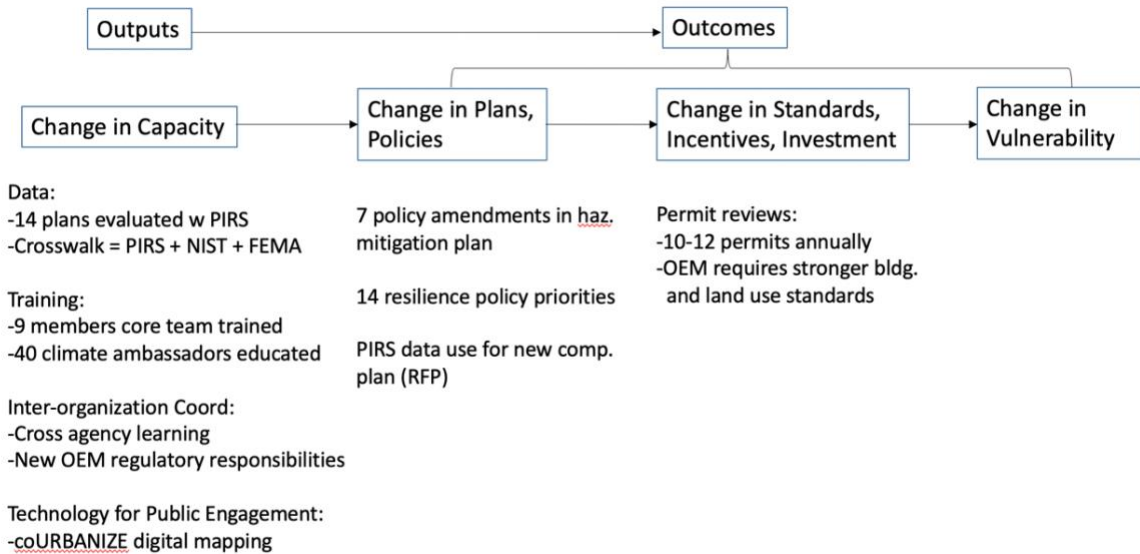


Figure 5: Changes Related to PIRS™ in Nashua After Project Completion (July 2019)

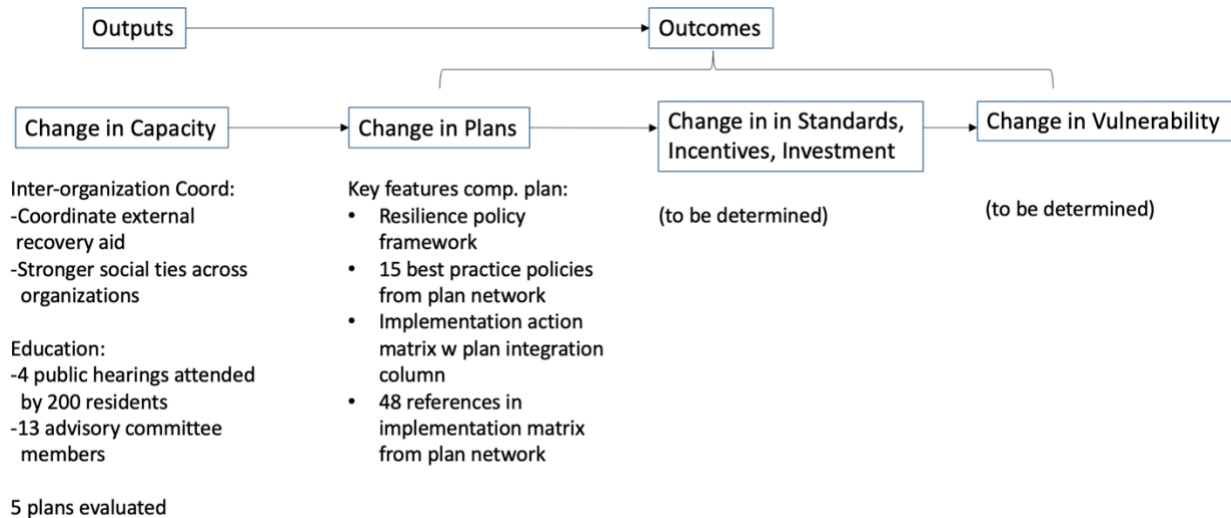


Figure 6: Changes Related to PIRS™ in Rockport After Project Completion (March 2020)

6. Unanticipated Problems:

- COVID-19 has a significant negative affect on team interactions and communications with communities.
- Shifting PI's status to Masterson was a challenge. It took a long time getting funding sorted out. Masterson had to go through a lot of hoops because she is not faculty.

7. Student Involvement and Awards:

a) Student involvement in research

- One doctoral student supported by CRC funding.
- One masters student supported by CRC fundng.

b) Student Demographics

- Two International doctoral students: China and India
- One white non-Hispanic masters student.

c) Degrees Attained.

- Zito, Francesca, Master City & Regional Planning, University of North Carolina
- Siyu Yu, PhD, Urban & Regional Science, Texas A&M University
- Matt Malecha, PhD, Urban & Regional Science, Texas A&M University

d) Student Awards

- Zito, Francesca, Best Student Award by the American Planning Association, Master City & Regional Planning, University of North Carolina

8. Interactions with CRC education projects:
N/A

III. RESEARCH ACTIVITIES AND TRANSITION MILESTONES

1. Year 5 Research Activities and Milestone Achievements:

Year 5 Research Activities and Milestones: Status as of 6/30/2020			
<u>Research Activity</u>	<u>Proposed Completion Date</u>	<u>% Complete</u>	<u>Explanation of why activity/milestone was not completed</u>
Continue to document the process in which PIRS is applied to the communities under the NIST/Texas A&M partnership, and for each community recovering from a disaster.	3/30/2020	100%	
<u>Research Milestone</u>			
Complete 3-page research summaries for communities that applied PIRS since 6/30/19. As noted, research summaries are effective conveying research results focused on the experiences in use of PIRS among end-users to mitigation practitioners and policy makers.	4/15/2020	100%	We completed a report that documents the experiences of the three pilot communities. In collaboration with APA, we will be using this report to include in the the guidebook 3.0 and post on the APA website.
Produce a manuscript that describes application of PIRS during Years 3-5. The manuscript will document local official experiences in using the PIRS tool, how the information generation by application of the tool informs the planning process, actual outcomes, and highlights the important lessons learned. The manuscript will be submitted for peer review to a high impact publication outlet.	6/30/2020	100%	

2. **Year 5 Transition Activities and Milestone Achievements:**

Year 5 Transition Activities and Milestones: Status as of 6/30/2020			
<u>Transition Activity</u>	<u>Proposed Completion Date</u>	<u>% Complete</u>	<u>Explanation of why activity/milestone was not completed</u>
Work with 1-2 additional communities to apply the PIRS tool and integrate PIRS with NIST resilience planning guide.	3/30/2020	100%	
Conduct multiple training webinars (tbd). The primary intended audience is community officials that work in local government agencies (e.g., emergency management, planning, economic development, housing, transportation, stormwater utilities, city/county management) and non-profit organizations (e.g., conservation trusts and housing trusts) charged with creating and implementing plans that influence a wide range of land use and development activities in areas exposed to hazards. A second audience includes officials of state agencies (emergency management, community development, conservation) who could learn how PIRS works and become able to advocate and work with local jurisdictions in applying PIRS. A third audience includes Sea Grant coastal extension specialists that each coastal state and NOAA jointly support to assist land and marine resource management activities of coastal communities. Every land grant university in the U.S. with a coastline is designated as a Sea Grant university.	6/30/2020	100%	
Establish a partnership with Texas Sea Grant called the Community Resilience Collaborative to undertake multiple joint activities, including training extension specialists on how to assist communities in applying PIRS (i.e., train-the-trainers), tracking outcomes, and updating the PIRS Guidebook. The CRC will be hiring (about July 2019) one of our doctoral students as a permanent full-time extension specialist whose primary responsibilities are to train other extension specialists on use of PIRS, assist Texas coastal communities in applying PIRS in local planning efforts, and disseminate PIRS throughout the national network of state Sea Grant programs.	6/30/2020	100%	
<u>Transition Milestone</u>			

<p>Finalize PIRS guidebook and related training materials. A final set of updates will be incorporated into the guidebook and related training materials. Investigators will document ways to improve the PIRS work based on local officials' comprehension of resilience planning concepts, experience in organizing local staff that supports inclusive engagement and efficiency in carrying out technical analyses. Successful aspects of our collaboration with NIST in conducting application of PIRS and the NIST resilience planning guidebook will be incorporated into the PIRS training materials. The primary aim is to improve the PIRS in ways that encourage use by key organizations that operate at the local level, and are influential in land use and development planning and decision making (local government agencies, non-profit organizations). Other target organizations include state agencies, professional practice organizations, and Sea Grant coastal land and marine resource management specialists.</p>	6/30/2020	50%	<p>We continue to work with American Planning Association (APA) to update the PIRS Guidebook – 3.0. We will integrate pilot community experiences, and APA contributions during year 6.</p>
<p>Finalize website that will house PIRS (mitigationguide.org). The updated website will significantly facilitate use by end-users based on lessons learned from real world applications of the guidebook, plan evaluation tool, and associated training materials during year-5. The investigators will work with engagement staff of the Institute for Sustainable Communities to include the updates on the website. The final version of the website will be designed to be user-friendly and made available to a wide array of practitioners. The website will include materials that will help local officials undertake a self-evaluation of their community's local network of plans, as well as educational materials that enable training by professional practice organizations, state agency staff, and Sea Grant specialists.</p>	6/30/2020	50%	<p>We made some changes to the current website [mitigationguide.org], including inclusion of pilot community experiences, and research publications.</p> <p>Significant changes still need to be made based on the work with APA.</p>
<p>Present <u>final version</u> of the PIRS tool and examples of demonstration communities at one national conference linked to mitigation planning practice (e.g., APA conference, ICMA conference, ASFM conference, National Hurricane Center Conference), or FEMA workshop</p>	6/30/2020	100%	<p>We presented <u>version 2.0</u> of the PIRS guidebook, and the Rockport case study at NPC20@Home. Ideally we would have liked a longer more in-depth training, but COVID-19 limited our outreach.</p>
<p>Transfer PIRS website and related training materials with the Community Resilience Collaborative (CRC) of Texas Sea Grant. CRC will maintain and update the website as real world applications by communities yield new knowledge and best practices</p>	6/30/2020	0%	<p>We decided against making the transfer to Texas Sea Grant. Rather, we are working with APA to develop an advanced version of a</p>

<p>that need to be incorporated into the guidebook and related training materials, and new sources of hazards exposure and vulnerability data become available. In addition, the investigators will request various professional practice organizations (e.g., American Planning Association, National Hazards Mitigation Association, Association of State Floodplain Managers), FEMA, state emergency management and planning agencies, and others to post links to the PIRS website. We also will work with NIST, FEMA and New York Rising to maintain and update the PIRS website with the intent of integrating PIRS into ongoing resilience planning programs of these organizations.</p>			<p>website to house PIRS guidebook and training materials.</p>
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3. **Research Project Product Delivery.**

Table: Research Project Product Delivery

Product Name and Function	Brief Product Description, including type (e.g., software, algorithm, guidance document, knowledge product)	Date Delivered (or projected date of delivery)	Recipient or End User(s)
Plan Integration of Resilience Guidebook™ – Version 2.0	Local government guidebook for evaluating networks of plans.	Fall 2019	-FEMA and NIST -Local government practitioners charged with planning in different urban sectors (e.g., planning, emergency management, floodplain management, historic preservation)
<i>Applying a Plan Integration for Resilience Scorecard to Practice: Experiences of Nashua, NH, Norfolk, VA, Rockport, TX.</i> pp. 40.	Report that documents experiences and outcomes generated by application of PIRS™ by local officials in three pilot communities.	May 28, 2020	Same as above.

IV. PUBLICATIONS AND METRICS

1. Publications:

- a) Publications

Year 5 Publications

Berke, P., M Malecha, S Yu, J Lee and J Masterson. 2019. Plan Integration for Resilience Scorecard: Evaluating Networks of Plans in Six US Coastal Cities, *Journal of Environmental Planning and Management*. 62(5): 901-92. DOI: [/full/10.1080/09640568.2018.1453354](https://doi.org/10.1080/09640568.2018.1453354) (published)

Berke, P., S Yu, M Malecha, J Cooper. 2020. Plans that Disrupt Development: Equity Policies and Social Vulnerability in Six Coastal Cities. *Journal of Planning Education and Research* doi.org/10.1177/0739456X19861144 (published online).

Other Publications

Berke, P., J Masterson, M Malecha, Matt, S Yu. 2020. Evaluation of Networks of Plans to Hazards and Climate Change: Application of Plan Integration for Resilience Scorecard™ in Norfolk, VA, *Carolina Planning Journal* (forthcoming).

Berke, P., J Masterson, M Malecha, Matt, S Yu. 2020. *Applying a Plan Integration for Resilience Scorecard to Practice: Experiences of Nashua, NH, Norfolk, VA, Rockport, TX*. pp. 40.

Year 4 Publications

Newman, Galen, Malecha, Matt, Yu, Si, Qipao, Z., Horney, Jen, Lee, Daemyung, Kim, Young., Lee, R.J., & Berke, Philip. 2019. Integrating a Resilience Scorecard and Landscape Performance Tools into a Geodesign Process. *Landscape Research*. DOI: 10.1080/01426397.2019.1569219 (2020 Certificate of Research Excellence, Environmental Design Research Association)

Publications Prior to Year-4

Berke, P., Lee, J., Newman, G., Combs, T. Kolosna, C., Salvesen, D. 2015. Evaluation of Networks of Plans and Vulnerability to Hazards and Climate Change: A Resilience Scorecard, *Journal of the American Planning Association* 81(4): 287-302. DOI: [1080/01944363.2015.1093954](https://doi.org/10.1080/01944363.2015.1093954)

Berke P., Malecha M., Yu S., Lee J., Masterson J. (2018). Plan Integration Scorecard for Resilience: Evaluating Networks of Plans in Six US Coastal Cities, *Journal of Environmental Planning and Management*, DOI:[10.1080/09640568.2018.1453354](https://doi.org/10.1080/09640568.2018.1453354).

Malecha, M., Brand, A., & Berke, P. (2018). Spatially evaluating a network of plans and flood vulnerability using a Plan Integration for Resilience Scorecard: A case study in Feijenoord District, Rotterdam, the Netherlands. *Land Use Policy*, 78, 147-157. DOI: [10.1016/j.landusepol.2018.08.011](https://doi.org/10.1016/j.landusepol.2018.08.011)

Masterson, J., Berke, P., Malecha, M., Yu, S., Lee, J., & Thapa, J. (2017) Plan integration for resilience scorecard: How to spatially evaluate networks of plans to reduce hazard vulnerability.

College Station, Texas: Institute for Sustainable Communities, College of Architecture, Texas A&M. http://mitigationguide.org/wpcontent/uploads/2013/01/Scorecard_3Oct2017.pdf

b) Student theses and dissertations

Zito, Francesca. 2020. *Applying the Plan Intehgration for Resilience ScorecardTM: New Bern, NC*. Master City & Regional Planning, University of North Carolina-Chapel Hill. Primary Advisor: Philip Berke

Malecha, Matt. 2019-December. *Enahncing Communiy Resilience to Flooding through the Spatial Evaluation of Plans, Policies, & Regulation*. PhD, Urban and Regional Science, Texas A&M University. Primary Advisor: Philip Berke

Yu, Siyu. 2019-August. *The Influence of Plan Integration on Community Vulnerability and Ecological Resilience to Natural Hazards*. PhD, Urban and Regional Science, Texas A&M University. Primary Advisor: Philip Berke

Kim., You Jung. 2019-May. *Advancing Scenario Planning to Prepare for Uncertain Climate Change: Future Urban Growth Prediction and Flood Vulnerability*. PhD, Urban and Regional Science, Texas A&M University. Primary Advisor: Dr. Galen Newman, Committee Member, Philip Berke

2. Performance Metrics

Berke: Performance Metrics:

<u>Metric</u>	<u>Year 1</u> (1/1/16 – 6/30/16)	<u>Year 2</u> (7/1/16 – 6/30/17)	<u>Year 3</u> (7/1/17- 6/30/18)	<u>Year 4</u> (7/1/18- 6/30/19)	<u>Year 5</u> (7/1/19- 6/30/20)
HS-related internships (number)	0	0	0	0	0
Undergraduates provided tuition/fee support (number)	0	0	0	0	0
Undergraduate students provided stipends (number)	0	0	0	0	0
Graduate students provided tuition/fee support (number)	2	2	2	2	1
Graduate students provided stipends (number)	3	3	3	0	2
Undergraduates who received HS-related degrees (number)	0	0	0	0	0
Graduate students who received HS-related degrees (number)	0		0	2	0
Graduates who obtained HS-related employment (number)	0		0	1	1
SUMREX program students hosted (number)	0	0	0	0	0
Lectures/presentations/seminars at Center partners (number)	0	3		8	0
DHS MSI Summer Research Teams hosted (number)	0	0		0	0
Journal articles submitted (number)	0	2	2	2	2
Journal articles published (number)	0	0	2	2	3
Conference presentations made (number)	3	5	2	4	9
Other presentations, interviews, etc. (number), webinars	1	6	2	1	3
Patent applications filed (number)	0	0	0	0	0
Patents awarded (number)	0	0	0	0	0
Trademarks/copyrights filed (number)	0	0	0	0	0
Requests for assistance/advice from DHS agencies (number) (FEMA, NIST)	0	1	2	2	2
Requests for assistance/advice from other agencies or governments (number)	0	9	3	8	10
Dollar amount of external funding	\$200,000	\$250,000	\$2,490,000	0	\$175,000
Total milestones for reporting period (number)	2	2		5	7
Accomplished fully (number)	2	1	4	3	3
Accomplished partially (number)		1	1	2	3
Not accomplished (number)	0	0	0	0	1