

Integrated Approaches to Creating Community Resilience Designs

We propose to develop pre- and post-disaster planning and adaptation tools for coastal communities to increase resilience. These efforts will enable vulnerable communities to plan, react, and recover more quickly and effectively in areas facing repetitive disturbance. The goals of the program are to improve emergency response with regard to protecting vulnerable infrastructure and populations, and to reduce repetitive loss by providing accurate impact data to community planners in the immediate aftermath of an event.

➤ Provide assistance in pre- and post storm decision making

PI: **Robert Twilley**, Executive Director, Louisiana *Sea Grant* College Program

Brant Mitchell, Director, Stephenson Disaster Management Institute LSU

Jeff Carney, Director, Coastal Sustainability Studio LSU

Traci Birch, Assistant Research Professor, Coastal Sustainability Studio LSU

Carola Kaiser, IT Consultant, Center for Computation and Technology LSU



Project Overview

- ❖ Incorporate enhanced consequence modeling to a storm surge model to show how flood risks will impact people, industry, and coastal infrastructure
- ❖ Utilize these tools to inform community planners on impact analyses that will reduce repetitive loss by guiding crucial land use and redevelopment decisions following a flood disturbance.
- ❖ Trusted outreach community to help communities incorporate guidance that mitigates risks and rebuild for maximum future risk reduction.

The work is innovative by our multi-discipline approach that combines

- disaster research & response (SDMI),
- coastal hazard modeling (CCT, CERA),
- planning & design (CSS),
- and outreach (Sea Grant)

Together, this group will develop:

- ❖ (1) modeling and visualization tools to communicate flood risks during a tropical cyclone event by identifying vulnerable populations and structures that are susceptible to storm surge;
- ❖ (2) post-landfall search and rescue grid system with prioritization based on socio-economic vulnerabilities;
- ❖ (3) planning tools that visualize aggregated risks to include hurricane force winds, storm surge, and inland flooding along with vulnerable populations based on socio-economic status;
- ❖ (4) methodology for helping community planning departments and recovery planning teams effectively utilize and implement changes to their built environment through effective resilience based planning

Translation Activities and End Users

- ❖ CERA (over 100 subscribers)
- ❖ Coastal Sustainability Studio (has worked with more than 30 communities to develop the LA Resiliency Assistance Program - LRAP)
- ❖ Sea Grant (connections to all parishes across the coast of LA with focus on coastal resiliency programs) has expanded coastal resilience specialist in Law and Policy Program (Niki Pace, Floodplain Management Specialist)
- ❖ SUMREX: We supported a student summer intern position at the CSS at LSU, 6 weeks, 40hrs, 2016

Planning/Emergency Preparedness Outreach

- ❖ A major outcome of this project for Year 1 was an aggressive outreach component to ensure local, state and federal planners and emergency managers were aware of this project and its potential to influence their decision-making and planning processes.
- ❖ The project team has completed several outreach opportunities that include the **State of Louisiana American Planning Association** and the **Louisiana Emergency Preparedness Association's** general sessions.

LEPA panelists representing the land use planning realm:

- ✓ Chris Pulaski (Planning Director Terrebonne Parish)
- ✓ Bob Rivers (Planning Director Orleans Parish)
- ✓ Sam Brody (Planning Professor and Director of the Institute for Sustainable Coastal Communities at TAMU)



Our partners

Pre- and post-disaster planning and design tools directed to federal, state, and local community planners

- ❖ National Weather Service, Slidell LA
- ❖ Lower Mississippi River Forecast Center, Slidell LA
- ❖ USCG, New Orleans LA
- ❖ FEMA - Federal Preparedness Coordinator
- ❖ DHS Federal Protective Services
- ❖ LA National Guard - **MAJ Roger Fudge**
- ❖ LA GOHSEP, Deputy Director for Operations - **Christopher Guilbeaux**
- ❖ LA Office of Community Development, Director – **Patrick Forbes**
- ❖ LA Coastal Restoration & Protection Authority, Director - **Chris Ellis**
- ❖ LA Dept Wildlife and Fisheries, Deputy Director – **Patrick Banks**



Our partners

Pre- and post-disaster planning and design tools directed to federal, state, and local community planners

Emergency Managers –

- ❖ **John Rahaim**, Director – St. Bernard Parish
- ❖ **Earl Eues**, Director, Terrebonne Parish
- ❖ **Kevin Savoie**, Sea Grant Agent - Camaron Parish

Our partners

Pre- and post-disaster planning and design tools directed to federal, state, and local community planners

Local Planners –

- ❖ **Bob Rivers**, Planning Director – City of New Orleans
- ❖ **Louissette Scott**, Planning Director – City of Mandeville, LA
- ❖ **Chris Pulaski**, Planning Director – Terrebonne Parish, LA
- ❖ **Doug Burguires**, Assistant Planning Director, Lake Charles, LA
- ❖ **Jennifer Gerbasi**, Terrebonne Parish Recovery Planner
- ❖ **Dexter Accardo**, Director - St. Tammany Parish OHSEP

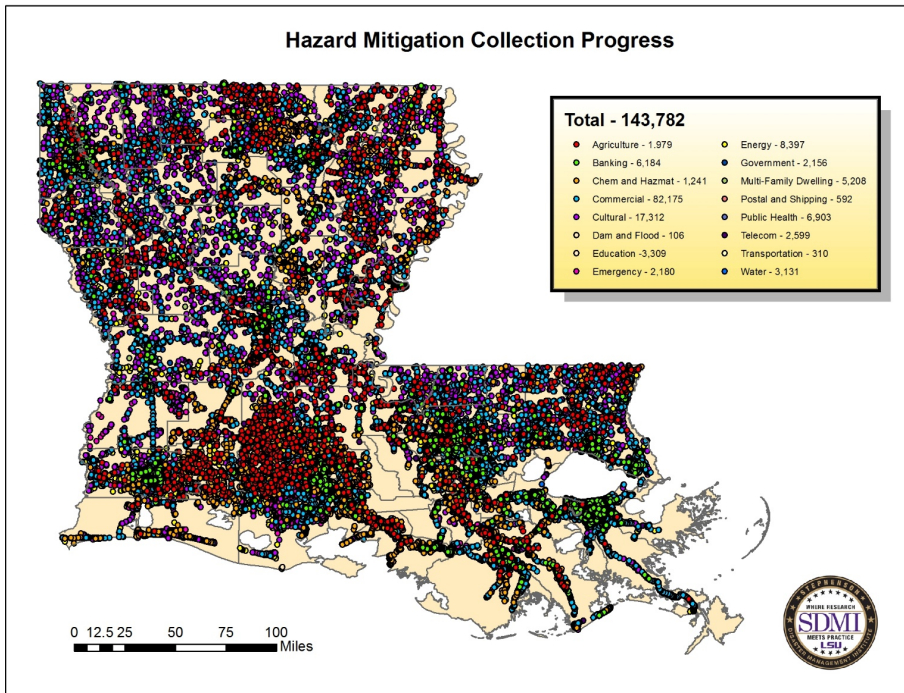
Anticipated Outcomes (Jan 1, 2016 – June 30, 2016)

- ❖ Initiate plans to develop the CERA-Consequence Model to capture the diversity of coastal infrastructure and assets in the Mississippi River Deltaic Plain (MRDP). (June 2016)
- ❖ Conduct preliminary analysis of hurricane impact scenarios to capture the diversity of recovery and adaptation needs in the MRDP. (June 2016)
- ❖ Determine available data to be used in building the Consequence Model. Collect information to integrate in the development of pilot parish(es) for Storm Surge Social Vulnerability Index (SSVI). (June 2016)

Anticipated Outcomes (July 1 2016 to June 30, 2017)

- ❖ Design and build an automated model in ArcGIS to interpret outputs of CERA to analyze the consequences of expected storm surge. (Jan 2017)
- ❖ Export CERA website information to consequence analysis of SDMI. Complete cyberinfrastructure development to transfer information from CERA to Consequence Model (GIS platforms) to expand the utility of products associated with critical infrastructure along the coast. (June 2017)
- ❖ Test Model utilizing 143,000 point infrastructure database for the State of Louisiana and historical storms to determine effectiveness of consequences. (June 2017)

<http://hm-portal.sdmi.lsu.edu/>



A FEMA's Hazard Mitigation Grant Program to GOHSEP funded GIS Hazard Mitigation project to accomplish the following:

- 1) the collection of 6 inch high resolution imagery for the entire state; and
- 2) collection of critical infrastructure for all 64 parishes.
- 3) additional imagery consisting of 4 inch resolution for all cities in the state with a population of at least 10,000 and 3 inch resolution for the metropolitan areas of New Orleans and Baton Rouge was also captured in 2014.

COASTAL RESILIENCE CENTER

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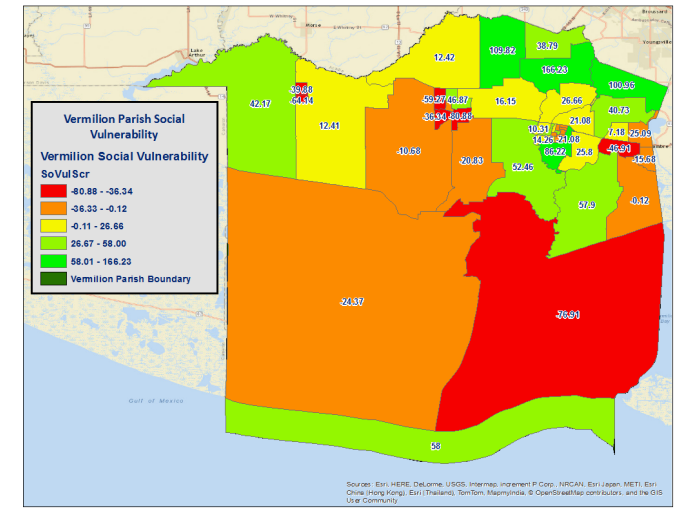
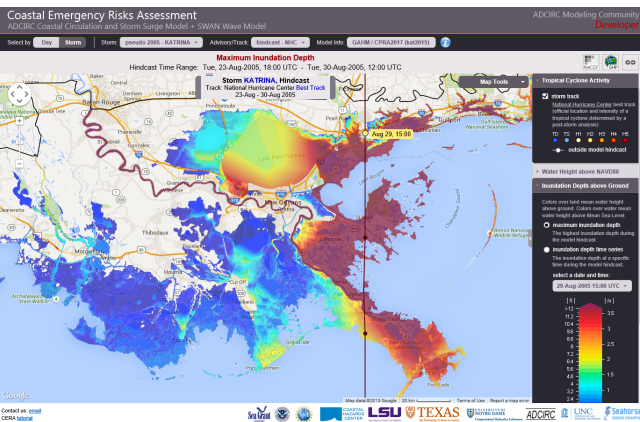
<http://hm-portal.sdmi.lsu.edu/>

Hazard Profile	Social Vulnerability	Proximity to Life Sustaining and Support Facilities
Storm Surge MOMs - Cat 1-4	Personal Wealth	Parish Pickup Points
Hurricane Wind Fields – Cat 2-3	Gender	Police Station
100 Yr Flood	Age	Fire Station
	Race and Ethnicity	EMS
	Manufactured Houses	National Guard Staging Area
	Nursing Homes	Hospitals
	Government Housing	
	Apartments	

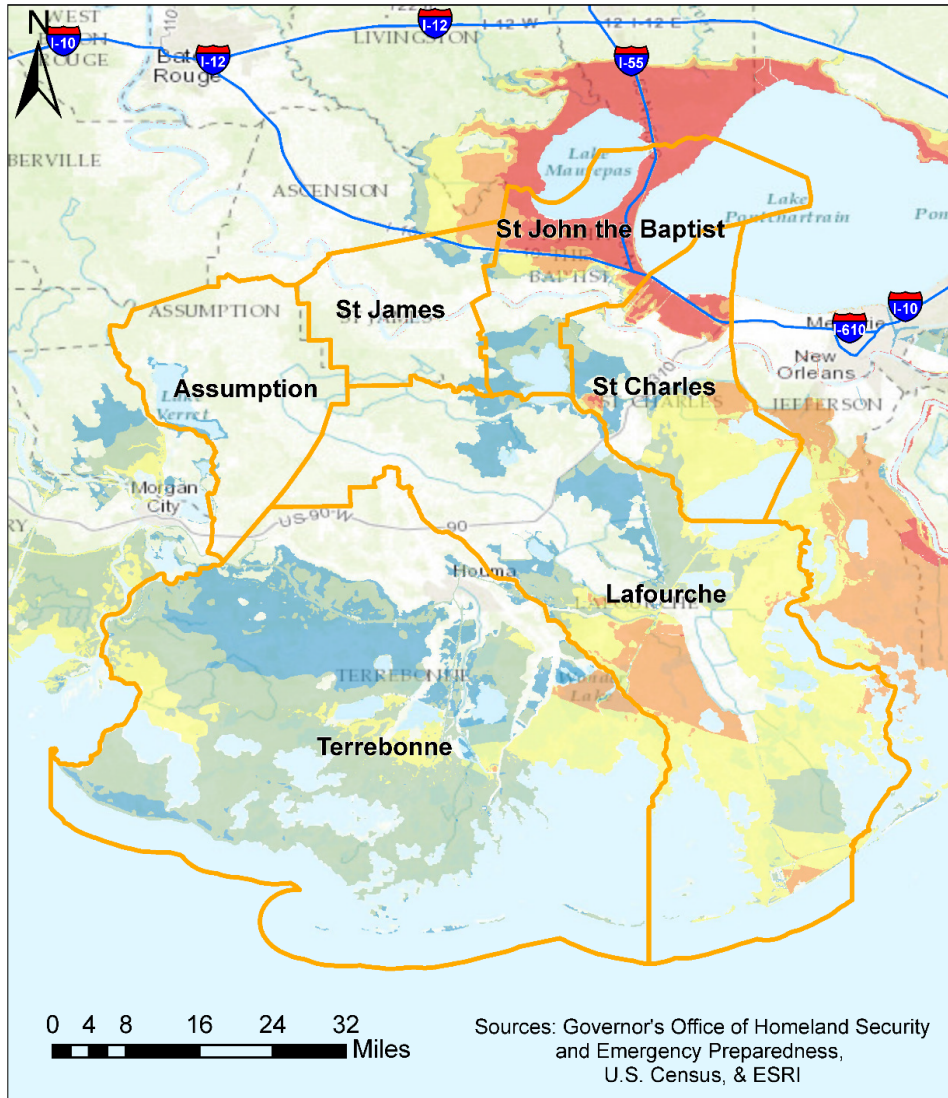
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CERA (Coastal Emergency Risk Assessment) Tool



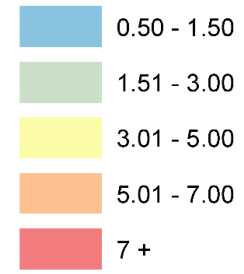
Region 3 Isaac Hindcast Impact Assessment



Potential Impacts

Isaac Hindcast Impact Assessment for Region 3						
	People	Homes	Schools	Businesses	Nursing Homes	Hospitals
Assumption	0	0	0	0	0	0
Lafourche	2,680	1,236	1	84	0	0
St. Charles	6,587	2,420	4	51	0	0
St. James	44	38	0	6	0	0
St. John	18,064	6,542	6	164	0	1
Terrebonne	8,194	3,248	0	42	0	0
Region 3 Totals	35,569	13,484	11	347	0	1

Maximum Water Elevation

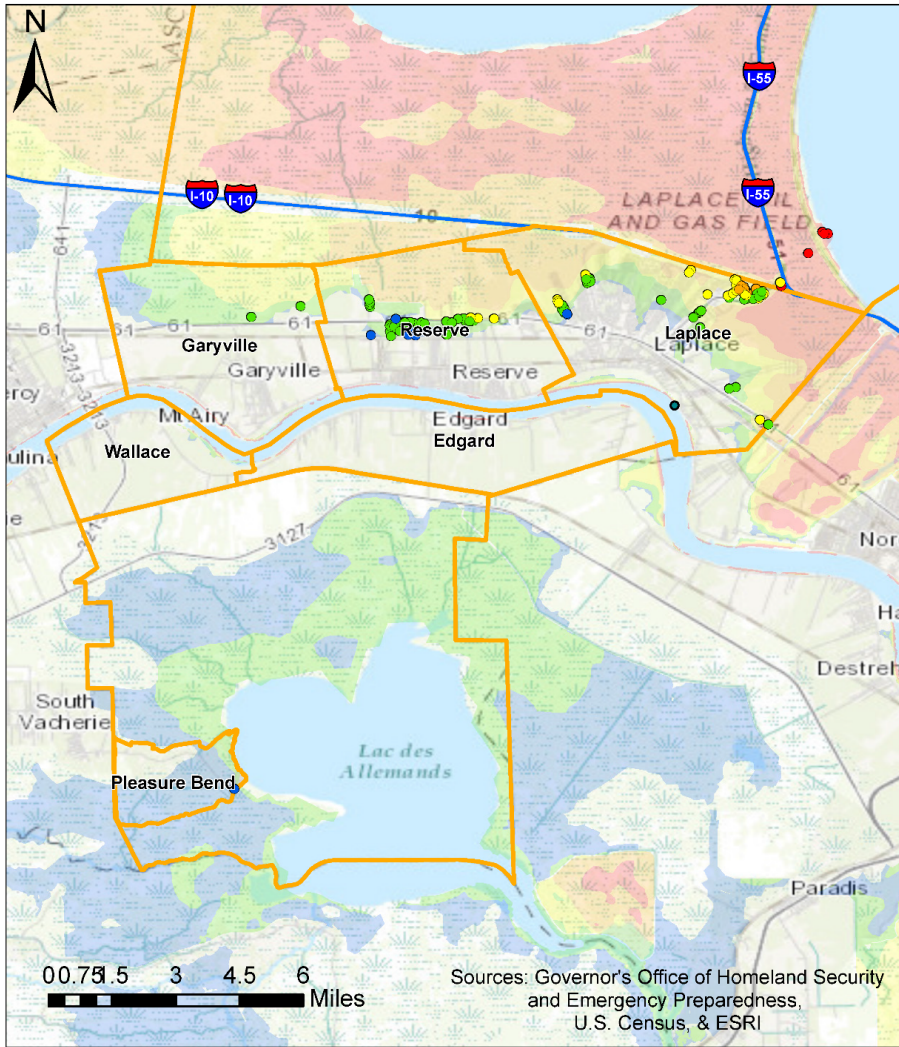


Disclaimer: This map has been compiled using the best information available and is believed to be accurate; however, its preparation required many assumptions. Actual conditions during a flood event may vary from those assumed so the accuracy cannot be guaranteed.



- ❖ Results of CERA mapped out across Region 3 with estimates by Parish as to estimated impacts on people, homes, schools, businesses, nursing homes and hospitals.
- ❖ This is example of linkage between CERA information sent to the consequence model.

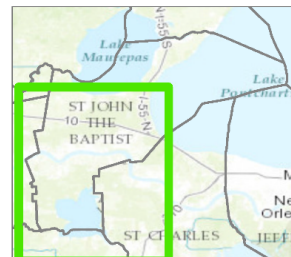
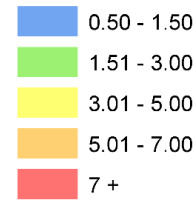
St. John Parish Isaac Hindcast Impact Assessment



Potential Impacts

	St. John				
	0.5 to 1.5 ft	1.51 ft to 3.0 ft	3.01 to 5.0 ft	5.01 to 7.0 ft	>7.01 ft
Corporated Communities	0	0	0	0	0
Edgard	0	2	0	0	0
Garyville	2	55	28	11	1
Laplace	1	0	0	0	0
Pleasure Bend	6	40	3	0	0
Reserve	0	0	0	0	0
Wallace	0	0	0	0	0

Maximum Water Elevation



Disclaimer: This map has been compiled using the best information available and is believed to be accurate; however, its preparation required many assumptions. Actual conditions during a flood event may vary from those assumed so the accuracy cannot be guaranteed.



- ❖ Results of CERA mapped out across St. John Parish as to estimated impacts at different water elevations of flooding for each corporated communities . .
- ❖ This is example of linkage between CERA information sent to the consequence model.

Base Advisory # **23**
 Time of Base Advisory: 8/26/2012 4pm

New Advisory # **31**
 Time of New Advisory: 8/28/2012 4pm

Storm Surge Consequence State Summary	Base Advisory	New Advisory	Percent Change
Total Number of People Projected to Impacted	23,301	62,635	+169%
Total Number of Homes to be Impacted	11,617	29,132	+151%
Total Number of Businesses to be Impacted	97	390	+302%



Parish and Region Status

Parish Name	Initial Advisory: Advisory 23			New Advisory: Advisory 31			Percent Change in People from Previous Advisory	Percent Change in Homes from Previous Advisory	Percent Change in Businesses from Previous Advisory
	Number of People Projected to be Impacted	Number of Homes Projected to be Impacted	Number of Businesses Projected to be Impacted	Number of People Projected to be Impacted	Number of Homes Projected to be Impacted	Number of Businesses Projected to be Impacted			
Region 1									
Jefferson	484	401	8	4,116	1,910	16	+750%	+376%	+100%
Orleans	1,007	667	0	1,008	669	0	0%	0%	N/A
Plaquemines	210	230	0	269	309	0	+28%	+34%	N/A
St. Bernard	259	440	0	271	446	0	+5%	+1%	N/A
Region 1 Totals	1,960	1,738	8	5,664	3,334	16	+189%	+92%	+100%
Region 2									
Ascension	0	0	0	2,271	933	0	NEW	NEW	N/A
East Baton Rouge	0	0	0	0	0	0	N/A	N/A	N/A
East Feliciana	0	0	0	0	0	0	N/A	N/A	N/A
Iberville	0	0	0	0	0	0	N/A	N/A	N/A
Livingston	109	73	0	5,308	3,158	0	+4770%	+4226%	N/A
Pointe Coupee	0	0	0	0	0	0	N/A	N/A	N/A
West Baton Rouge	0	0	0	0	0	0	N/A	N/A	N/A
West Feliciana	0	0	0	0	0	0	N/A	N/A	N/A
Region 2 Totals	109	73	0	7,579	4,091	0	+6853%	+5504%	N/A

- ❖ Analytics of change in consequences between two different advisories of Hurricane Issac using results from CERA sent to consequence model.
- ❖ Categories of impacts include people, homes and businesses, with an estimate of change in potential impacts from one advisory to next.

Research Work and Accomplishments

- ❖ The LSU team worked with the State to select the state's 144k point infrastructure database as the basis on which to build the consequence model.
- ❖ The State currently has an infrastructure database which serves as a basis for the consequence model. Additional work is being performed with individual agencies such as DHS Protective Service and USCG District 8 on refining additional infrastructure requirements.

Anticipated Outcomes (Jan 1, 2016 – June 30, 2016)

- ❖ Develop focus groups and determine data that are not already available
- ❖ With assistance of focus group, determine sectors not already involved in process and engage in model and planning process development
Initiate plans to develop the CERA Consequence Model to capture the diversity of coastal infrastructure and assets in the MRDP.
- ❖ Develop contacts with various federal, state and local and professional organizations to establish connections that enhance the utility of products developed in this project.

Kevin Breaux – Assistant Deputy Director, GOHSEP
MAJ Neal Fudge – Louisiana National Guard
DHS Protective Services
FEMA Region 6 Hurricane Program Manager
Earl Eues – Terrebonne OHSEP Director
Becky Broussard – Vermilion OHSEP Director
Aaron Miller – Director New Orleans OHSEP Director
Lael Holten (AECOM and LA APA)
Darla Duet (Lafourche Parish Floodplain Manager)
Louisette Scott (Mandeville Planning Director)
Frank Duke (Baton Rouge Planning Director)
Chris Pulaski (Terrebonne Parish Planning Director)
Monique Boulet (CEO, APC, LA Planning District 4)
Lynn Dupont (New Orleans Regional Planning Commission)

Planning/Emergency Preparedness Outreach



The Focus Group took place on September 21, 2016 at LSU.

WORKSHOP OUTCOMES

- ❖ The focus group agreed with the initial data sets that were identified for consequence model.
- ❖ Focus group recommended that available parcel data and building footprints data be added to the consequence model.
- ❖ The also emphasized that critical to the locals would be the status of water utilities, sewer treatment plants and any surge that would disrupt their operations.
- ❖ Without the ability to provide potable water their ability to recover and sustain their populations would be greatly decreased.



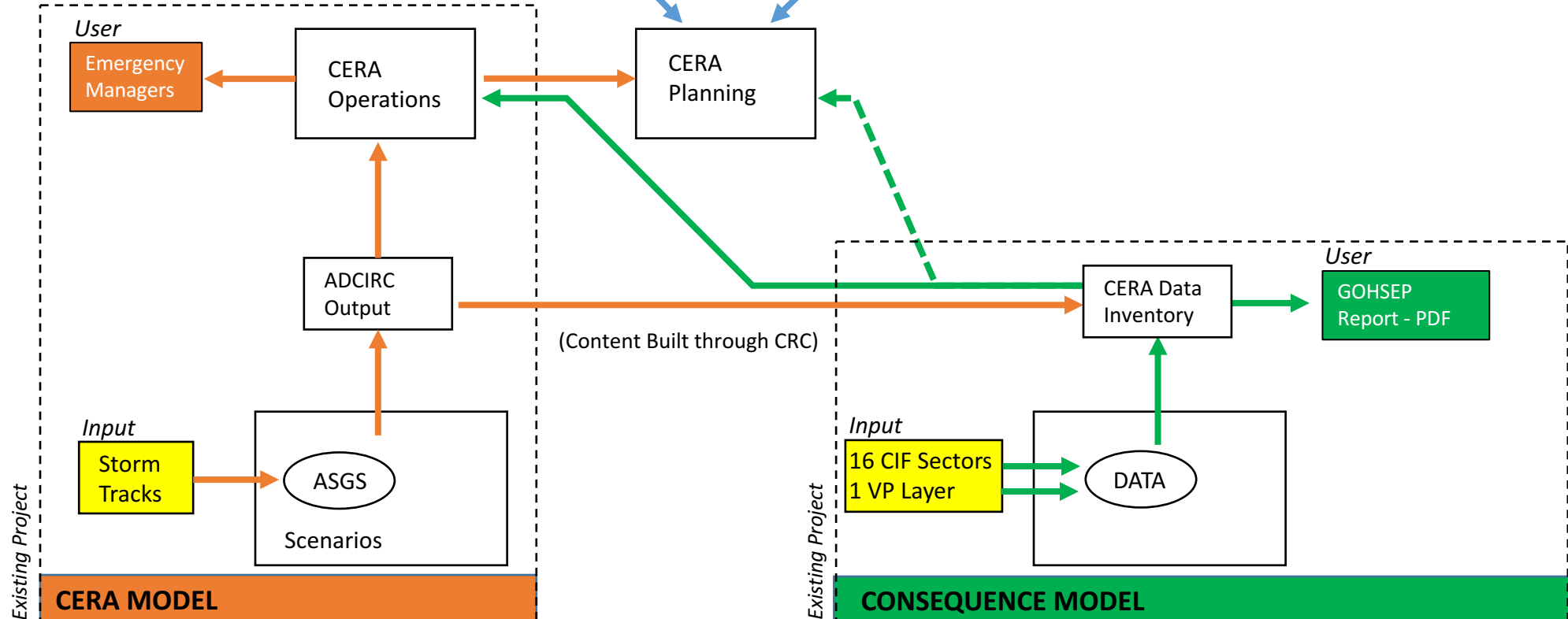
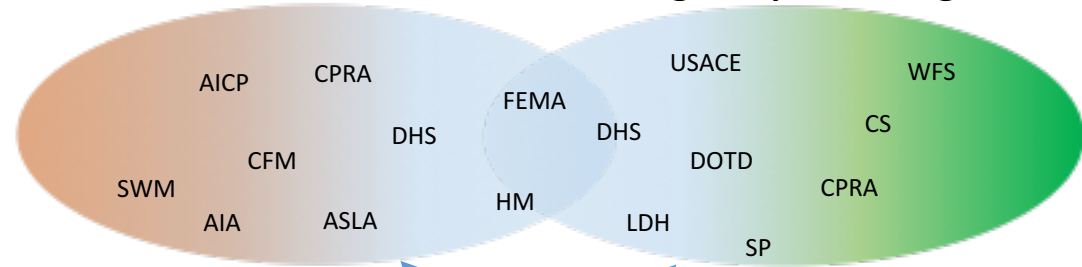
The Focus Group took place on September 21, 2016 at LSU.

Anticipated Outcomes (July 1 2016 to June 30, 2017)

- ❖ Link Consequence Model and SSVI with recovery/adaptation planning model (CERA – Planning) to expand the resilience of industry, critical infrastructure, and communities along the coast. (June 2017)
- ❖ Use HAZUS to augment the actual CI/KR structures that will be part of the Consequence Model output and to provide estimates on actual damages (June 2017)

Planning User

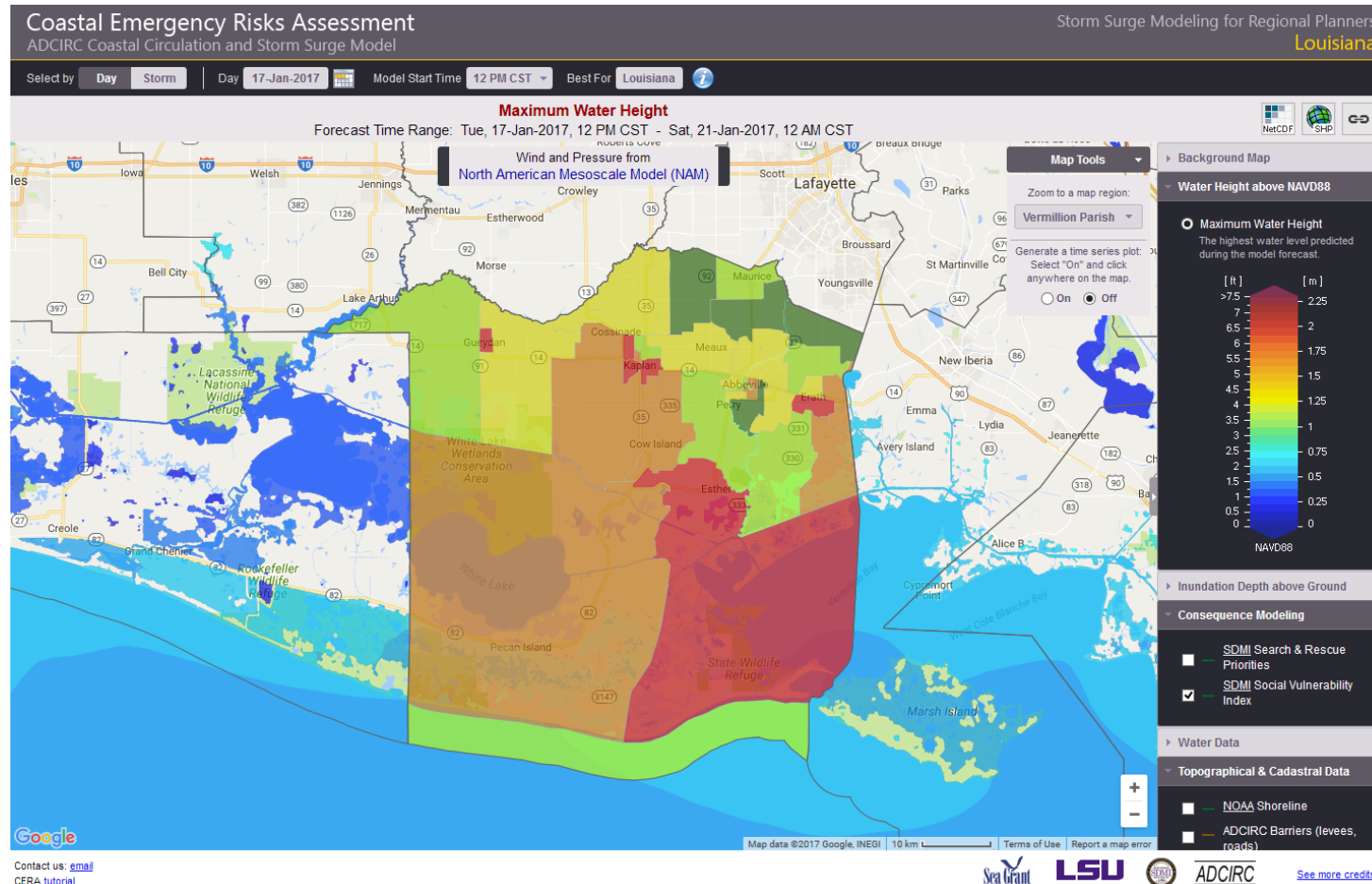
Emergency Management User



Research Work and Accomplishments

<http://cera-planning.cct.lsu.edu/>

Coastal Emergency Risks Assessment (CERA) – Visualization Tool for Regional Planners



Social Vulnerability Index:

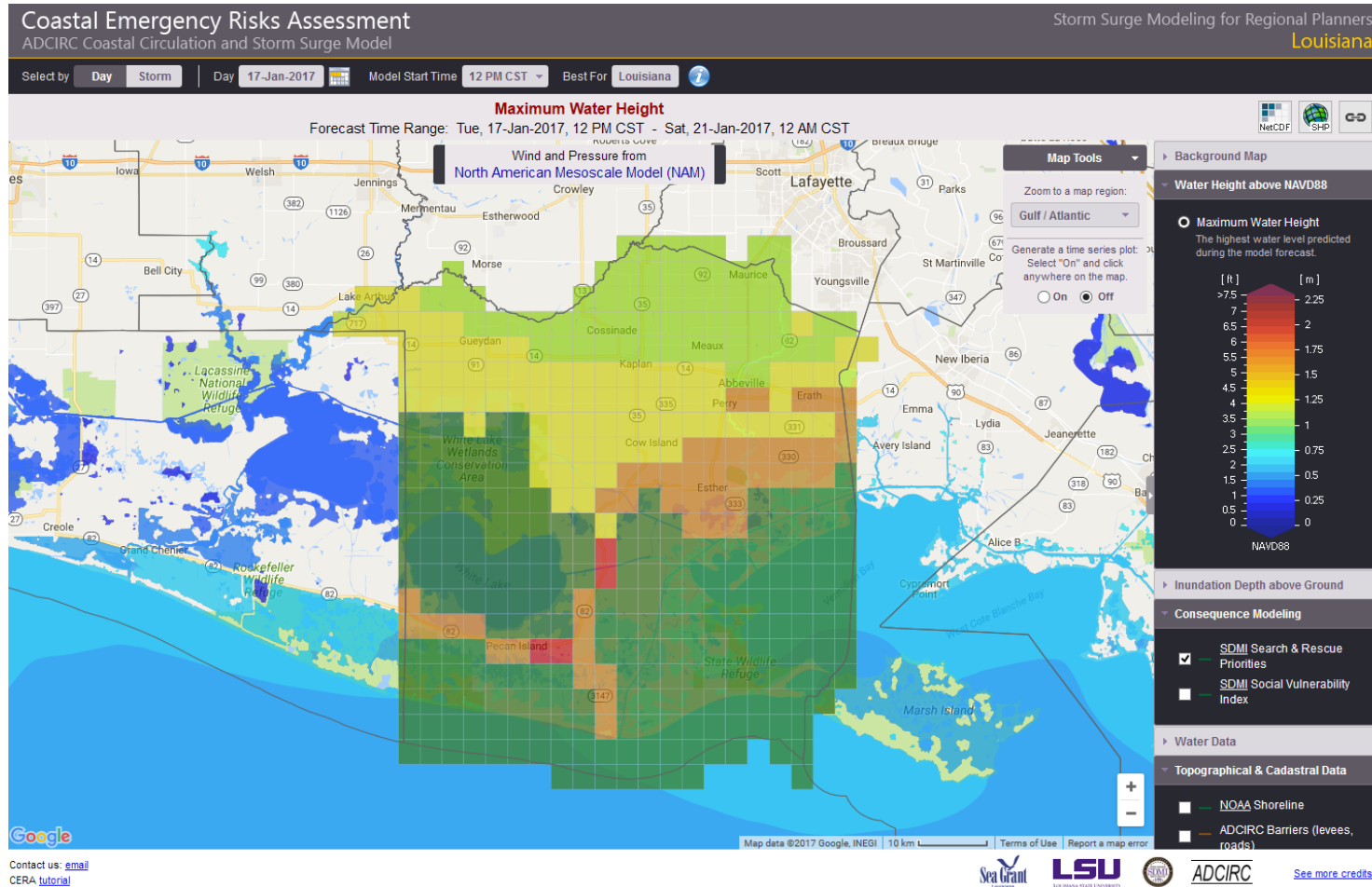
This data layer serves as input to create search & rescue priorities and to identify areas with higher risks for regional planners

Credit: Stephenson Disaster Management Institute @ LSU

Research Work and Accomplishments

<http://cera-planning.cct.lsu.edu/>

Coastal Emergency Risks Assessment (CERA) – Visualization Tool for Regional Planners



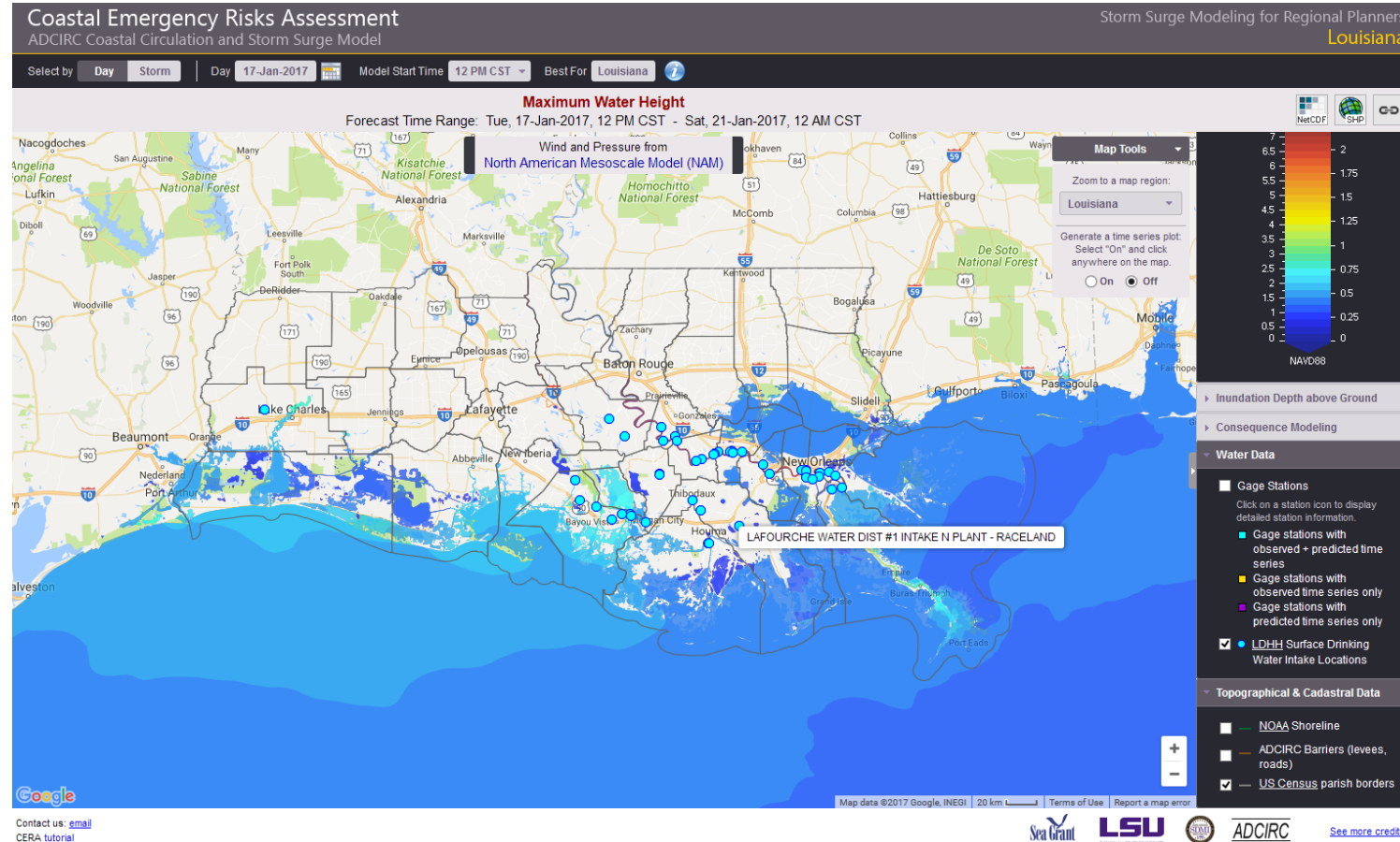
Search & Rescue Priorities:
Storm Surge Risks
Assessment for Emergency
Managers to evaluate areas
with the highest priority
after a storm

Credit: Stephenson Disaster Management Institute @
LSU

Research Work and Accomplishments

<http://cera-planning.cct.lsu.edu/>

Coastal Emergency Risks Assessment (CERA) – Visualization Tool for Regional Planners



Louisiana Department of Health and Hospitals (LDHH) Surface Drinking Water Intake Locations:

One example of an additional data layer that is valuable to EMs and Planners during and after a storm

Credit: LDHH

COASTAL RESILIENCE CENTER PROJECT IMPACTS – Leveraged Funds

A U.S. Department of Homeland Security Center of Excellence

<u>External Funding</u>			
<u>Title</u>	<u>PI</u>	<u>Total Amount</u>	<u>Source</u>
Improved Algorithms for Computing Storm Surge (STORM)	Twilley, co-PI	\$206,560	NSF
Coastal SEES Project on Accelerated Flood Risk with Delta Degradation	Twilley, PI	\$298,683	NSF
Cyber SEES – Simulation Management System for Flood Modeling	Twilley, co-PI	\$75,000	NSF
Port Resilience Index	Twilley, PI	\$20,000	NOAA
Louisiana Community Resilience Institute	Carney, PI Birch, Co-PI	\$50,000	Kresge, Sea Grant
<u>Leveraged Support</u>			
<u>Description</u>			<u>Estimated Annual Value</u>
Free office space			\$14,000
Portion of university indirect returned to project			\$13,240
Reduced rates on high performance computer			\$25,000
Support for ASGS development by Louisiana Sea Grant			\$25,000

PROJECT IMPACTS

- ❖ Several of the Principle Investigators of this project have been involved with providing guidance to recovery plans associated with the 2016 Louisiana Flood. This included the development of strategies to link flood modeling and assessment with visualization tools such as CERA to guide recovery efforts.
- ❖ Robert Twilley was on planning team for Symposium held on 7 Dec 2016



Assist with planning Louisiana response to 2016 Louisiana Flood: Symposium on Recovery and Resilience

Proposed Follow-On Work

- ❖ Outreach to various personnel and organizations has been completed; however, the initial focus has been towards Louisiana and Region VI. We will continue to expand the national relevance of this project by bringing in additional users such as the National Communications Center which is responsible for providing situational awareness for all communications infrastructure during tropical cyclones and U.S. Coast Guard – Sector New Orleans.

Proposed Follow-On Work

- ❖ Future efforts would continue developing the interface on consequences in the CERA-Planning website through working with professional planners, planning directors, and professional organizations.
- ❖ Improve the integration with city planning map layers (streets, zoning, comp plans, etc.) as part of CERA-Planning. Make these operable and reactive in GIS so that they have data attached.
- ❖ Improve how different tools interact and produce both data and graphic results of vulnerability to planners
- ❖ We could develop an AICP online course or a number of other outreach applications using CERA-Planning as a tool.