Two-Year Post-Hurricane Matthew Field Study in Lumberton, North Carolina
Business Recovery Survey 2020

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1. Explain who will be surveyed and why the group is appropriate to survey.

The Center of Excellence (CoE) field studies team in conjunction with NIST researchers conducted a quick response field study in Lumberton, North Carolina, which experienced major flooding damage due to Hurricane Matthew in early October 2016. The purpose of that field study was to explore the interconnectivity between structural damage (buildings, roads, bridges, power, water) school closures and student displacement, and housing dislocation and evacuation patterns. In January 2018 a one-year post-Hurricane Matthew Business Recovery Survey was conducted in addition to further exploration of the structural damage, school closures, and housing dislocation and recovery patterns. At that time many business survey respondents had not yet completed recovery from Hurricane Matthew. In April 2019, a two-year post-Hurricane Matthew Business Recovery Survey was conducted. The survey contained questions not only about recovery from Hurricane Matthew, but about the impact of and recovery from Hurricane Florence. The team found that many businesses had not recovered from Hurricane Matthew before being impacted by Hurricane Florence. Based on the results of the 2018 and 2019 survey efforts, we posit that: 1) many businesses have yet to recover from the impacts of Hurricanes Matthew and/or Florence, and 2) the impacts from the COVID-19 pandemic are hampering recovery efforts. Thus, the goal of this current survey collection is to determine the status of recovery for these businesses vis-à-vis the COVID-19 pandemic. Furthermore, Hurricane Florence (2018) resulted in another significant flood event and had structural and financial effects on these businesses. As such, continuing to assess long-term recovery of these businesses is vital to the longitudinal Lumberton field study. The information collected in this business interruption survey instrument will augment findings from January 2018 and April 2019. The data from this survey will contribute to the business interruption modeling in the IN-CORE community resilience modeling environment.

Businesses that are registered with *ReferenceUSA* and functioning in flood vulnerable areas of Lumberton, NC is the population that will be surveyed. Flood vulnerable includes areas of town that experienced inundation when the levee failed during Hurricane Matthew plus a buffer of 100 meters and areas of town included in the 100-year flood plain. This sample was identified in preparation for the January 2018 Lumberton field study. The business sample for this collection is the same as the one-year post-Hurricane Matthew business survey collection with additions to the sample as described below. There are records indicating 2,017 for-profit businesses in Lumberton in 2016 (pre-Hurricane Matthew); in this survey, non-profits, government agencies,

and other business that do not generate profit are excluded. The sampled businesses are taken from the areas of Lumberton recorded to have been inundated with flooding after Hurricane Matthew. Additionally, all businesses that fall within a 100-meter buffer around the inundation area have been induced in the sample (n=222). The FEMA 100-year floodplain was also identified, and businesses have been taken from this area for the sample. We are expanding the sample for this data collection effort by including a refreshment sample of 215 businesses situated *inside* the floodplain and inundation areas as well as a random sample of 135 of the businesses situated *outside* of the flood plain and inundation areas. The total sample number of businesses is 572. We drew a random sample of businesses in the northern portion of the FEMA floodplain to reach the desired sample of 572 for-profit businesses. The sample will be spatially and temporally ordered to make the field work as efficient, logical, and safe as possible.

There is minimal primary data on business interruption following a large-scale natural hazard event, especially in the period of mid-term recovery (~12-18 months following the event). Additionally, there is minimal primary data on longitudinal business recovery to understand factors that affect long-term recovery and sustainability of businesses affected by hurricane events. Lumberton provides a unique case for analyzing medium- and long-term business recovery in the face of multiple hurricane events (i.e., Hurricane Matthew – 2016 and Hurricane Florence—2018) and the COVID-19 pandemic. Pandemic conditions likely have interrupted recovery from Hurricanes Matthew and Florence; thus, understanding the impact of COVID-19 on the Lumberton business community is important to the on-going research activity.
The survey respondents are either owners or managers of businesses in Lumberton who were surveyed in the Post-Hurricane Matthew surveys conducted in January 2018 and April 2019; some of these businesses have been directly affected by Hurricane Matthew and/or Hurricane Florence and related utility outages, while others were not. It was important that these businesses be surveyed within the timeframe of 18-24 months post-Hurricane Matthew and 6-12 months post-Hurricane Florence. Within those timeframes, owners and managers still retained information about recovery activities from Hurricane Matthew immediately before Hurricane Florence hit the community and immediately after Hurricane Florence, which was recorded and collected for data analysis. At each establishment, one individual familiar with the recovery efforts was surveyed — either 1) the owner or 2) the manager (in some cases the same individual will both own and manage a business). In cases where there was the potential to talk to both the owner and manager, it was preferable to speak to the individual who owns the business since this person is likely to know the most about the history of the business and the full recovery process.

PII is collected in this instrument, but information is not retrieved by personal identifiers in the system. Although this is not a Privacy Act System of Records, appropriate notice is given to the participant of the survey.

2. Explain how the survey was developed including consultation with interested parties, pretesting, and responses to suggestions for improvement.

This survey instrument was developed by the NIST-funded Resilience Center of Excellence (CoE) in collaboration with NIST researchers. The main structure of the instrument follows a series of business surveys that have been conducted in Galveston, Texas and surrounding areas for over five years by researchers in the CoE. In that sense, most of questions have been

thoroughly vetted in the field, as has the proposed data collection methodology. The only significant change to the survey is the addition of questions relating to business recovery efforts given the current COVID-19 restrictions. The majority of these COVID-19 related questions have been previously approved and used by NIST under the collection "Compound Risks – SME Recovery from a Pandemic in the Face of Natural Hazard Risks."[1]

During development, the survey instrument was reviewed by researchers interested in business interruption and recovery on both the CoE team and at NIST, specifically in the Applied Economics Office (AEO) of NIST's Engineering Laboratory (EL). This iterative collaboration created a relatively brief and thorough tool to access sources of business interruption and how recovery and mitigation (short- and long-term) were sought, particularly considering the potential impacts due to the COVID-19 pandemic.

During the quick response field study conducted by the CoE in December 2016, several best practices and lessons learned emerged that are applicable to this proposed business interruption survey tool (even though the data collection mode is different). Also, during that time (December 2016) some informal conversations with businesses closed following Hurricane Matthew took place. Finally, analysis of the formal post-Hurricane Matthew surveys (January 2018 and April 2019) conducted by the CoE in collaboration with NIST researchers has formed the basis for this current tool and key lessons learned from that collection are being employed. Furthermore, a literature review[2] of the business interruption literature was considered in development of the survey tool. Additionally, best practices from the electronic administration of the "Compound Risks – SME Recovery from a Pandemic in the Face of Natural Hazard Risks" by NIST in July-August 2020 have been considered[3,4].

3. Explain how the survey will be conducted, how customers will be sampled if fewer than all customers will be surveyed, expected response rate, and actions your agency plans to take to improve the response rate.

The survey will be administered primarily as an electronic survey with an option to complete a phone-based survey. In most cases the owner (or manger) of the business will complete the survey. The survey is expected to take a maximum of 15 minutes to complete. The respondent will have access to the electronic survey for at least a six-week period. This way, the respondent has time to organize completing the survey at a time that is most convenient to her/his work schedule. As mentioned, an optional phone-based survey will be offered to businesses preferring to respond in this manner.

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[1] "Compound Risks – SME Recovery from a Pandemic in the Face of Natural Hazard Risks". Business Recovery/Continuity Collection. U.S. Department of Commerce, National Institute of Standards and Technology. OMB CONTROL NO. 0693-0078. Expiration Date 07/31/2022.

[2] Webb, D. and S. Gilbert (2016). A Literature Review of Disaster-Induced Business Interruption and an Exploratory Analysis of the Effects of the 2004 Atlantic Hurricane Season on Florida Establishments at the Zip Code Level, NIST TN 1932. https://doi.org/10.6028/NIST.TN.1932.

[3] Helgeson, J., Pierel, E.D., Dow, K. (2020). NIST-NOAA Survey Instrument for Business Disruption and Recovery Associated with Extreme Events: General Instrument Applied to the Greater Charleston, SC Small- and Medium-sized business community post-Hurricane Irma, NIST DCI 001, Gaithersburg, MD. https:doi.org/106028/NIST.DCI001.

[4] Helgeson, J., Fung, J., Zhang, Y., Roa Henriquez, A., Zycherman, A., Nierenberg, C., Butry, D., Ramkissoon, D. (2020). Eliciting lessons from small- and medium-sized enterprises (SMEs) for natural disaster resilience planning and recovery during the COVID-19 pandemic: SME Complex Event Resilience, NIST DCI 002, Gaithersburg, MD. https:doi.org/106028/NIST.DCI002.

The response rate expected is 15-30% (5%-10% of which is expected to completed by phone), based on response rates from the previous two post-Hurricane Matthew business survey collections. It should be noted that responding to any or all the survey is considered as a survey response. All questions are optional; thus, we expect that some businesses will answer only a portion of the questions. Assuming a 100% response rate, the total burden hours would be 143 hours (572 businesses X 15 minutes survey time/business).

We will supervise a team of undergraduate student researchers from Texas A&M University to go through the following sampling protocol for the business survey:

1. Go through the sample and find online presence for all businesses (including websites and social media), and
    a. record phone number and/or email address
    b. determine if the business is open, if so, note their operating hours
2. Send an email survey link to all viable email addresses
3. For those without email, mail a postcard to the business

Although resources (staff, time, and funds) will be limiting factors, several actions will be taken to improve the outcomes of the field study data collection. To ensure a higher response rate, the team will:

- After three weeks, a first follow-up will be sent to non-responding businesses via an email or postcard reminder,
- After a period of five weeks, a second follow-up will occur via a phone call to non-responding businesses asking the owner or manager to go through the survey over the phone, or, send the survey link via email, and
- Having the survey available online for a period of six weeks.

Additionally, in order to improve response rates, ahead of sending emails, postcards, or making phone calls, researchers plan to search for an online presence for the businesses in the sample to ensure that these businesses are still in operation. During this search, operating hours and other pertinent information about the business will be documented. The research team believes that these methods will improve response rates by reducing the possibility of attempting to contact businesses no longer in operation.

4. Describe how the results of the survey will be analyzed and used to generalize the results to the entire customer population.

It is expected that the findings of this survey will inform the understanding of the CoE field studies team in conjunction with NIST researchers in terms of business interruption and best practices and circumstances for recovery over medium- and long-term timeframes and when businesses face multiple extreme flooding events (i.e., Hurricanes Matthew and Florence) and recovery is complicated due to another disaster, namely the COVID-19 pandemic.

The data will be analyzed as a case study in the specific context of Lumberton, NC and the existing social, economic, and built infrastructure elements to the community. Statistical analysis will be used to determine trends and correlations in the data, as well as relationships between

factors that contributed to business disruption and/or business recovery. There are four main survey sections in the tool that relate to both Hurricanes Matthew and Florence and COVID-19:

1. Respondent information in relation to business
2. Damage and business interruption due to COVID-19
3. Response, Mitigation, and Preparedness
4. Social and Institutional Networks
5. Business information (e.g., year established, own or rent building, etc.)

Analyzing these types of data singularly and in conjunction is expected to extend understanding of business interruption in general and across sectors. Of particular interest to the NIST AEO researchers is enhanced understanding the effect of utilities (if and when they are restored) in business re-opening and overall recovery as well as the financial recovery and mitigation actions taken by businesses. Lumberton is a key case study for these areas of inquiry due to the longitudinal nature of the CoE and NIST collaboration on a longitudinal field study and the fact that businesses have been struck by two large hurricanes in the last three years (i.e., Hurricanes Matthew and Florence)[5].

There is not a great deal of research conducted to date with primary research concerning business interruption following large-scale natural disasters, the ensuing recovery, and impacts from pandemic protocols (e.g., mandatory closure, following safety precautions, etc.). Nor are there a great deal of geographic areas studied in detail that were affected by multiple extreme hurricane hazards in relatively quick succession. The data from this collection will contribute to the business interruption modeling in the IN-CORE community resilience modeling environment.

The data will also be used to inform conceptual and quantitative modeling of the community as a system, including interdependencies between housing, business, and school recovery, the timing of aspects of community recovery, and the resources available versus those needed.

Furthermore, it is expected that administering the survey tool will provide useful information on best practices for general field research on business interruption from natural disasters and adjusting those best practices in the face of a global pandemic.

[5] Watson, M., Y. Xiao, J. Helgeson, M. Dillard. (2020). Importance of Households in Business Disaster Recovery. Natural Hazards Review. Vol. 21, Issue 4 (November 2020).