Risk perception associated with the evacuation and return-entry process of the Cedar Rapids, Iowa flood

A Quick Response Research Report for the Natural Hazards Center, Boulder, Colorado

Laura K. Siebeneck and Thomas J. Cova
Center for Natural and Technological Hazards
Department of Geography
University of Utah
260 S. Central Campus Dr., Rm. 270
Salt Lake City, UT 84118-1955
(801) 581-7930
FAX: (801) 581-8219
laura.siebeneck@geog.utah.edu

1. Introduction

Return-entry is the movement of an evacuated population back to an area following the issuance of an all-clear message. When compared to evacuation studies, there has been significantly less research conducted on the return-entry topic. Furthermore, there is little mention of the return process in the hazards literature (Stallings, 1990). Stallings notes that the decision to evacuate and the management of pre-disaster strategies are viewed to be more problematic than the events that occur in the aftermath of a disaster. Zelinski and Kosinski (1991), suggest that the single greatest problem associated with the management of hurricane-induced evacuations may be managing the return movement.

This study examines the evacuation and return-entry process associated with the June, 2008 Cedar Rapids, Iowa flood. Reports by the news media indicate that the return-entry process for this event was problematic. Many residents were frustrated that they could not return home immediately following the subsidence of the floodwaters. In addition, many evacuees expressed difficulty in understanding the return-entry plan. These initial reports provided justification for studying the return-entry process for this event. There are two primary goals of this study. The first was to gather information about the problems evacuees experienced during the return-entry phase in order to provide suggestions for ways to improve return-entry planning. The second was to examine similarities and differences in the evacuees' risk perception during the evacuation and return-entry process.

2. Return-Entry Background

Several studies address issues related to the return-entry process. Dash and Morrow (2000), found that delays in issuing the all-clear message may have a negative impact on compliance with future evacuation orders by those who learned of negative return-entry experiences through secondary sources. However, this did not hold for those who actually

experienced the delayed return-entry. The results of this study suggest that the management of return-entry process can impact future evacuation decision-making behavior.

Lane, Tobin, and Whiteford (2003) examined problems associated with the evacuation, return, and recovery of Baños, Ecuador during the forecasted volcanic eruption of Mount Tungurahua in October 1999. During this event, residents remained evacuated for 2.5 months until members of the tourist industry, whose businesses were losing money due to the prolonged evacuation, confronted security forces assigned to keep people out of the city, and forced their way back into Baños. In summary, this study found that the need for economic well-being could be a significant factor in making the decision of when to return.

Mitchell et al. (2005) found that evacuee return dates varied between areas that were under a mandatory evacuation order and areas comprising the evacuation shadow in the 2005 Graniteville, South Carolina, chlorine spill incident, in that residents that were under the mandatory evacuation returned later .

Studies of the return entry process have become more prevalent since Hurricanes Katrina and Rita in 2005. Landry, Bin, Hindsley, Whitehead, and Wilson (2007) examined evacuation migration issues that affected the decision of whether to return home following Hurricane Katrina in 2005. Through a series of surveys conducted on evacuees located in Houston, Texas, they found that factors affecting return migration include household income, age, education level, employment, marital status, and home ownership status. In addition, they found that "connection to place" was not a factor in evacuees' decision to return and rebuild. Elliott and Pais (2006) found that one month following Hurricane Katrina, evacuees' exhibited a significant amount of uncertainty about the likelihood of returning home. They also found that homeowners and evacuees with lower incomes were more likely to return, and those evacuees whose homes had been destroyed were less likely to return home and rebuild. In addition, variables such as race, gender, age, timing of return, children, and employment status were not found to be significant predictors of return. Siebeneck and Cova (2008) studied the return-entry process associated with Hurricane Rita and found that a relationship exists between distance evacuated and return-entry date, in that the farther a household evacuates, the more likely it will return at a later date. In addition, evacuees returning to areas that sustained damage were more likely to comply with return-entry orders than residents returning to areas that did not sustain damage.

3. Study Area

Cedar Rapids is the second most populated city in Iowa, with a population of 123,944. The city is located in east-central Iowa and sits on the banks of the Cedar River. A large residential area of the city lies within the National Flood Insurance Program (NFIP) 500-year flood plain. Heavy rainfall throughout the state caused significant flooding to the Cedar River, as well as to other rivers in Iowa. On June 11, 2008, local emergency

managers issued the first mandatory evacuation order for residents within the 100-year flood plain zone. The next day, the mandatory evacuation order was extended to all households residing in the 500-year flood plain zone. Late on June 13, the river crested at 31.1 feet, approximately 19 feet above flood stage. (NWS, 2008). This resulting in the inundation of an estimated 438 city blocks. In all, the Associated Press estimates that as many as 20,000 people evacuated this area (Ferran, 2008).

On June 15, emergency management officials announced a plan to allow residents back into the impacted areas. This plan consisted of dividing the flooded area into 10 sectors, with each sector having a specific entry checkpoint that residents had to report to in order to gain access to their homes. Law enforcement and members of the National Guard ensured that: 1) no vehicles entered the perimeter, 2) only 3 people per residence were allowed in, 3) residents could only take as many items as they could carry, 4) no carts or wagons were allowed in the perimeter, and 5) only one trip per household was permitted. Residents were required to show identification, and only residents returning to homes that were deemed to be safe by inspectors were allowed to return. In addition, a curfew was enforced that only allowed residents to be in the impacted area from 7:00 AM until 8:00 PM.

Various news agencies reported problems encountered by evacuees during the return-entry process. An ABC News article provided the following example of an evacuee frustrated at one of the entry checkpoints: “It’s my property. I own it!" yelled Cedar Rapids, Iowa, resident Rick Blazek as authorities kept him and dozens of other residents from returning to their flood-ravaged homes. "Why can't I go in and inspect it?" Because Blazek refused to comply with the return plan and attempted to maneuver his vehicle around the barricade, police drew their weapons and arrested Blazek (Ferran, 2008). The Gazette (the local Cedar Rapids newspaper) message board had numerous evacuees commenting on the return process. One resident noted the “…it was chaos with people yelling and getting upset at the lack of info…” Another asked “…how do you know that they (police and inspectors) are not digging through your belongings, taking your weapons and valuables?” Moreover, another resident commented “…The whole plan seems like it is setup for stress. People won’t know if their houses have been “cleared” until you wait through the line…” Many more examples of problems associated with the return process have been reported by the news media and on various message boards, thus suggesting that the return-entry process of this area may indeed have been more problematic that the evacuation process.

4. Methods

The data was collected using a mail-out survey technique similar to the methods utilized by Picou and Martin (2006) and Mitchell et al. (2005) for their Quick Response Research Grants. The questionnaire is modeled after a return-entry survey conducted by Siebeneck and Cova (2008) that addressed factors affecting return compliance during the return process for Hurricane Rita, 2005. This survey includes questions about the evacuees risk perception before, during and after the event, questions about the communication of both

evacuation and return-entry plans, and open-ended questions that will gather information about the return experience.

The questionnaires for this study were mailed to residents of the Cedar Rapids flood evacuation zone two weeks after the event. The questionnaire was three pages in length and included both closed and open-ended questions. Applying a modified version of Dillman's Tailored Design Method (Dillman, 1990), two postcards were sent to remind the participant to fill out the survey. The first postcard was mailed out two weeks following the initial distribution of the survey. A second postcard reminder was sent to individuals who had not yet responded to the survey four weeks after the original survey mail-out date. If the participant did not return the survey after two reminders, no further attempt was made to contact the household.

5. Sample Characteristics

Survey packets were mailed to 1000 households located in the mandatory evacuation zone. Of the 1000 surveys mailed out, 196 were completed and returned. One hundred ninety-two surveys were also returned due to insufficient addresses, primarily caused by a large number of homes made vacant by the flood, thus achieving an overall response rate of 24.2%. Four of the 196 returned surveys were not sufficiently completed, thus reducing the number of usable surveys to 192. However, of the 192 completed surveys, 162 survey respondents indicated that they evacuated from the flood, while 30 respondents did not evacuate. This limits the return-entry analysis to 162 surveys, or a response rate of usable surveys to 20.0%.

The demographic characteristics of the survey respondents were primarily middle –aged (arithmetic mean age (M = 53.7), married (47.4%), Caucasian (83.3%), homeowners (89%) with a mean annual income of $35,000. The households averaged 2.3 people and one-third of the households reported having children at home. Of the respondents, 65% are female and 35% are male. When compared to the 2000 census data for the city of Cedar Rapids, Iowa, the sampled population was a good representation of the local demographics, however, there were more responses from female residents and a higher percentage of the residents were homeowners than compared to the census demographic data.

6. Evacuation and Return-Entry Descriptive Statistics

The following descriptive statistics reflect the responses pertaining to the evacuation process. All results are reported at a 95% confidence level. The majority of respondents evacuated on June 11 (43.2% ± 7.0 %) or June 12 (33.5% ± 6.7%)**.** Personal vehicles were the most common form of transportation (88.8% ± 4.6%) The average evacuation group size was 2.2 (± .1) people and 1.8 (± .1%) vehicles. The median distance evacuated was 6.0 miles and the average travel time to reach the evacuation destination was 36 minutes. Most evacuees stayed with family (60.8% ± 5.8%), followed by friends (23.5% ± 5.0%) then hotel or motel (9.8% ± 3.5%).

The median return distance was 5.0 miles and the average return-trip time was 32 minutes. Over two-thirds of the respondents indicated that they returned home with the same group that they evacuated with (67.6% ± 6.6%) while 32.4% (± 6.6%) did not return with the same group. When making the decision to return home, 35.1% (± 6.8%) of respondents indicated that both heads of the household made the decision of when to return, followed by 24.3% (± 6.0%) male head of household, and 20.9% (± 6.3%) female head of household making the decision of when to return home. Ninety-four percent (± 3.7%) of respondents used the same mode of transportation to return as they did to evacuate. Upon returning home, 77.7% (± 7.7%) of respondents indicated that they returned home first, 9.4% (± 5.1%) returned to a relative or friends home first, and 7.9% (± 4.8) of respondents returned to their work place first. The majority of respondents returned after June 20th (47.6% ± 8.8%), while 9.0% ((± 5.1%) of respondents returned before June 15th, 8.3% (± 4.8%) returned on June 15th, 3.4% (± 3.2%) retuned on June 16th, 15.9% (6.5%) returned June 17th, 4.8% (± 3.8%) returned June 18th, and 4.1 % (± 3.5%) returned June 19th, as indicted in figure 1.

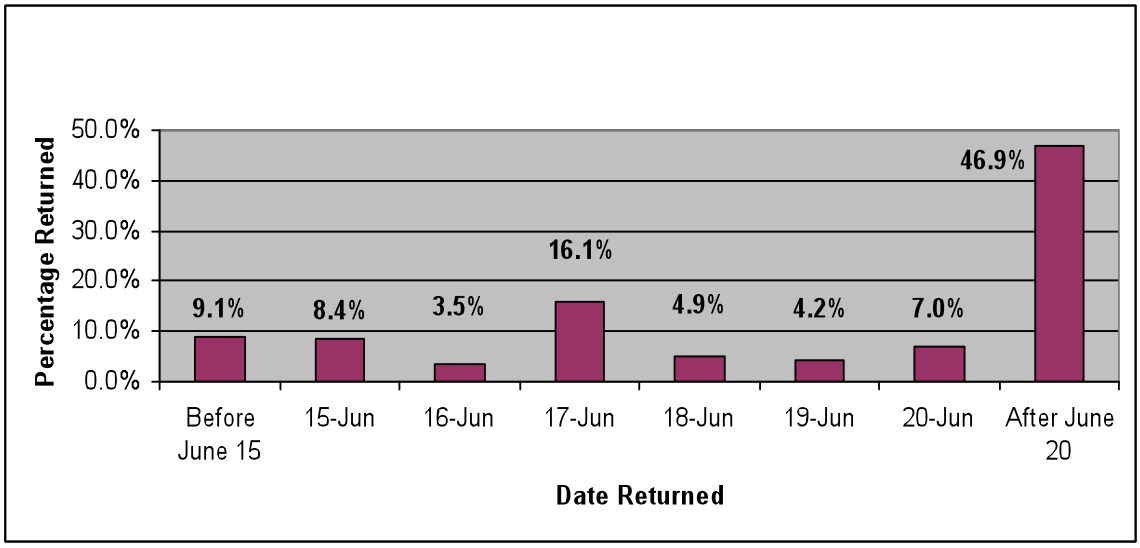

Figure 1. Return dates of evacuees.

When asked if they returned prior to their scheduled return-entry date, 23.6% (± 6.3%) indicated that they returned early and 57.1% (± 6.1%) indicated that they did not return early. The rest of the respondents (19.3% ± 8.7%)) were unsure if they returned early. When asked to rate the level of ease or difficulty of understanding the return-entry plan, 23.6% (± 7.8%) indicated that it was very difficult to understand the plan, followed by 13.5% (± 5.5%) difficult, 25.7% (± 7.0%) somewhat difficult, 14.9% (± 5.7%) somewhat easy, 14.2% (± 5.5%) easy, and 8.1% (±4.4%) noted it was very easy to understand the return-entry plan, as displayed in figure 2. Overall, 49.7% of respondents were satisfied with the management of the return-entry process, while 50.3% were not satisfied.

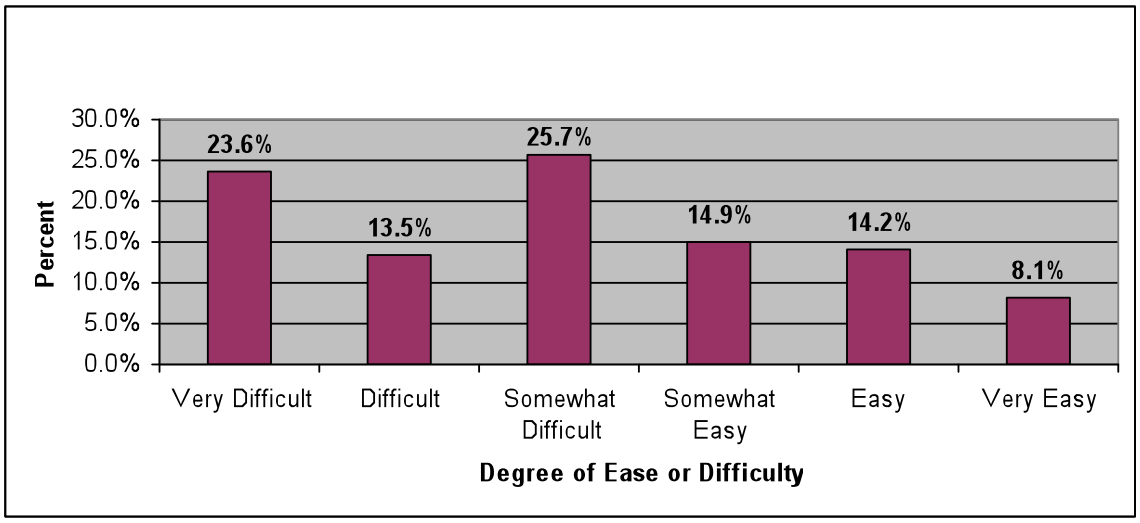

Figure 2. Ease of understanding the return plan

7. Problems Associated with the Return-Entry Process

One goal of this quick response study was to gather information about problems evacuees experienced during the return-entry process. The questionnaire asked evacuees if they experienced any problems during the return-entry. One common theme that emerged in the responses involved problems associated with the communication of the return-entry plan to the evacuees. The following are several examples of responses by evacuees pertaining to communication issues:

"Overall we were frustrated that we couldn't get even a cursory answer about the status of our neighborhood or home for many days and we were continually referred to another person or phone number"

"No one had any answers really if it was safe to go in or if we could even go in and when…"

"I think my only complaint is that they did not seem organized the first few days of re-entry and there was lots of miscommunication."

"Local Authorities and city management had poor communication. Law enforcement from other states were very helpful."

Some respondents indicated that they were dissatisfied with the return-entry plan and the management of the return-entry process. Many felt that the plan was too complicated

and that officials changed the plan with little or no notice. Several example complaints associated with the management of the return are noted below:

"No one could come up with a plan. I was not satisfied because I was told 4 times I could go see my house and was never let in!"

"It was not organized, we received the ok from local news that authorities said we could return yet when we got there we had to stand for hours before we were told they weren't going to let us in…"

"Orders and procedures were being changed throughout the day and we weren't being told of the changes, very unorganized…"

Another problem that many evacuees indicated that they experienced was the question of whether they would be able to return permanently to their homes and rebuild, or if they should re-locate elsewhere. As of two months after the flooding, many evacuees whose homes were severely damaged by floodwaters remain unsure if they will ever be able to live in their homes again. Below are several responses of evacuees regarding questions surrounding this issue:

"Nobody will tell us whether to fix house or not…"

"The city cannot decide whether the area I live will be able to return into our homes."

"We are trying to clean things out of house - we don't know if we are doing the work to be condemned - no on knows answers…"

Several respondents also noted that they were hesitant to enter their homes following returning to their properties. Damage done to their homes by floodwater made the structures unsafe to enter. Even though strike teams assessed every damaged home in the flood plain, evacuees still need to exercise caution when entering into their homes. Below are several examples of the risks evacuees faced when entering their homes:

"Flood debris, mud, no steps at home, uncertainty about my safety inside...."

"We could hardly go thorough the house. Everything was on the floor — mud was 3 inches on every flood, ceiling was falling down."

"[Our home had] mold, smelly floor starting to bend up and, well it's a mess…"

"Problems included getting our front door open- water shifted things and [the water] caused the door from to swell and jam…"

8. Differences in Risk Perceptions during the Evacuation and Return Entry Process

The second goal of this quick response research study was to examine similarities and differences in the evacuees' perception of risk associated with the evacuation and return-entry process. As noted earlier, until recently, problems associated with the return-entry process have been neglected in the hazards literature. Furthermore, very little attention has been given to the differences that exist between evacuation risk perception and risk perception associated with returning following an event.

Damage to Home and Risk Perception. Tests were conducted to determine if residents whose homes sustained damage during the flood perceived greater risk associated with the return-entry process than evacuees returning to undamaged homes. Survey respondents were asked to rate on a scale of 1 to 5, with 1 being a very low perception of risk and 5 being a very high perception of risk, the degree of risk they perceived while evacuating and returning. Survey respondents were also asked whether their homes sustained damage during the flood (0= no, 1 = yes). An independent samples t-test indicates that perceived risk associated with the return-entry process was higher in respondents returning to damaged homes than respondents returning to undamaged homes (t = -3.01, p = .03).

Figure 3 compares the risk perception during the evacuation and return process of evacuees whose home sustained damage versus evacuees whose home did not sustain damage. Notice that the perceived level of risk during the evacuation process between the two groups was similar. The independent samples t-test indicated that there was no significant difference in perception of risk of respondents during the evacuation process (t = -.265, p = .79). This is expected because all the respondents faced the risk of flooding to their home. However, the level of perceived risk associated with the return-entry process differs due to some homes sustaining damage while others were left undamaged. Therefore, the presence or absence of damage to a home during a disaster can influence the perception of risk evacuees may have about returning home following the conclusion of the event.

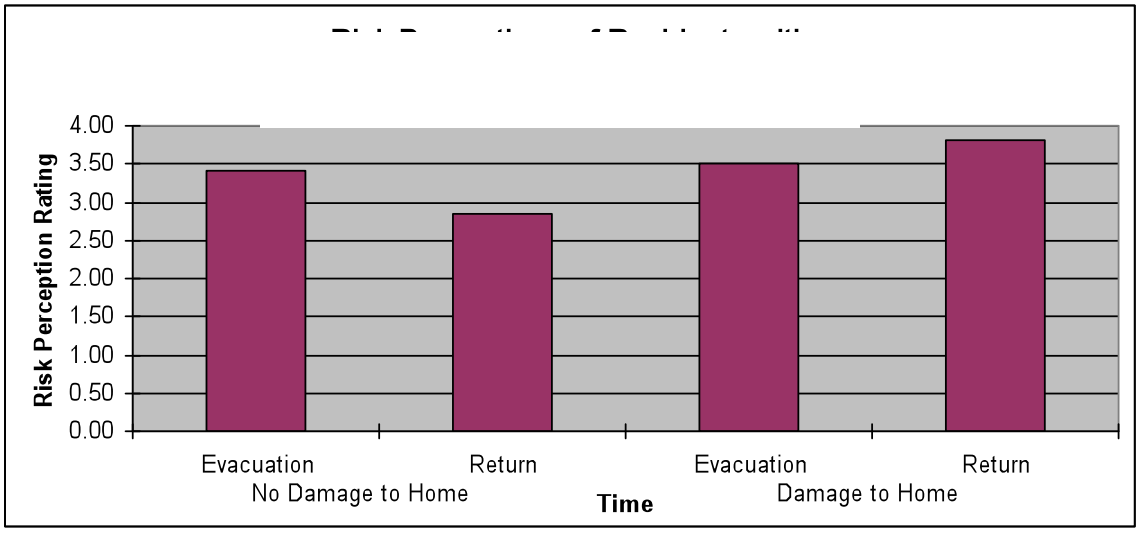

Figure 3. Risk perception of residents with damaged versus undamaged home

Risk Perception and Compliance with Return-Entry Orders. Sorensen, Vogt, and Mileti (1987) note that residents returning to their homes prior to the all-clear message can be problematic. This study collected examples of problems and dangers, such as falling roofs, mold, and debris, that residents experience upon returning home. Returning home prior to the all-clear message, and in this instance returning prior to the strike team being able to assess damage and put place-cards on individual doors, could have led to an increase in personal risk. Siebeneck and Cova (2008) suggest that non-compliance with return-entry orders may be explained by evacuees' level of risk perception when making the decision to return home, in that evacuees with a lower perception of risk associated with returning are more likely not to comply with return-entry orders. However, an Independent Samples T-test conducted on the data indicated that in this instance, there was no significant difference in the perception of risk associated with whether someone returned prior to the issuance of the all-clear message or not (t = -.47, p = .64). Figure 4 illustrates the difference in risk perception between residents who returned early and residents who complied with the all-clear message.

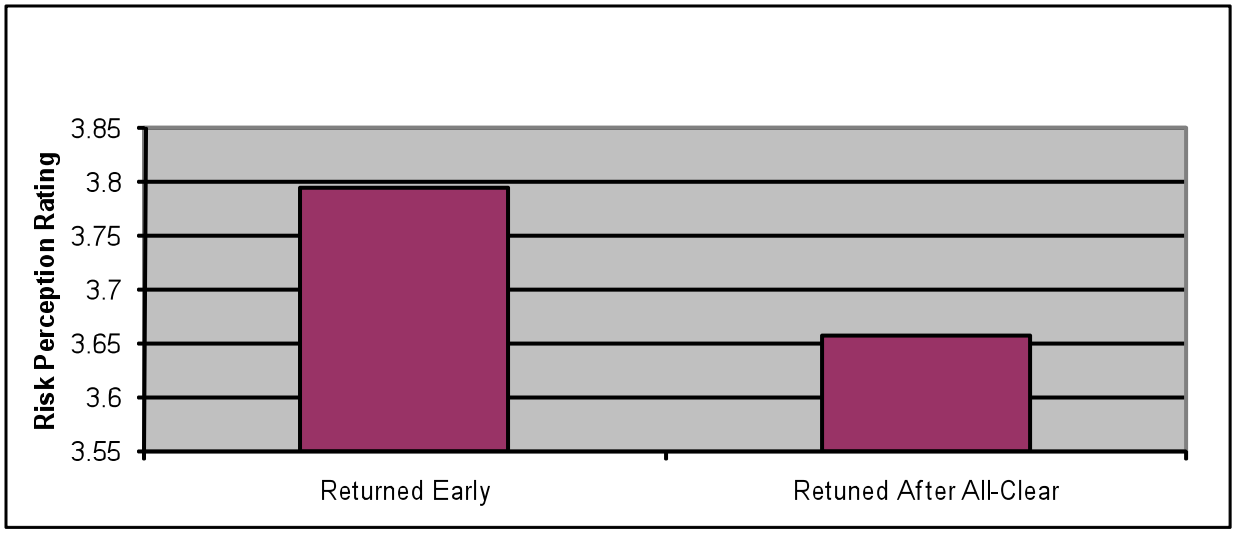

Figure 4. Risk perceptions of evacuees who complied and did not comply

The lack of differences in the perceived risk associated with return-entry compliance raises an interesting question: Why do some evacuees comply with return entry orders while others do not? The survey asked evacuees to list the factors that influenced their decision of when to return. Of the survey respondents who indicated that they returned early, the most common responses included people wanted to: 1) begin the rebuilding process as soon as possible, 2) see their home and assess damage, and 3) pick up pets left behind during the evacuation. Further examination of the variables that make a person more or less likely to comply with return-entry orders is necessary in order to determine if commonalities exists in the factors that influence non-compliance.

Location within the Flood Plain vs. Risk Perception. Peacock, Brody, and Highfield (2005) mention that relationships between location and risk perception need to be further examined in order to gain a better understanding of risk perception during a disaster event. Tests were conducted to assess how geographic location influences risk perception during the return-entry process. The first test conducted was to determine if location within the NFIP 100- year or 500- year flood plain increased the risk perception of evacuees returning following the event. In order to test this, the addresses of the evacuees' homes were geocoded and imported into a geographic information system (GIS). The addresses were then overlayed with an NFIP flood zone map to determine which homes were in a flood plain. An independent samples t-test confirmed that evacuees whose homes are within either the 100-year or 500- year flood plain perceived a higher level of risk associated with returning than evacuees whose homes were not located within the flood plain (t = -6.23, p < .01). The second test was conducted to determine if a relationship exists between proximity to the Cedar River and the risk perception of the evacuees. A bivariate correlation test indicates that the closer the evacuees' home was to the Cedar River, the higher their perception of risk they experienced during the return-entry phase (r = -.195, p > .01).

Figure 5 illustrates the location of evacuee households as well as the level of risk perception evacuees experienced during the return entry process. The map depicts both the 100-year and the 500-year floodplains for the city of Cedar Rapids, Iowa and the individual dots represent the level of risk perception evacuees had during the return-entry process.

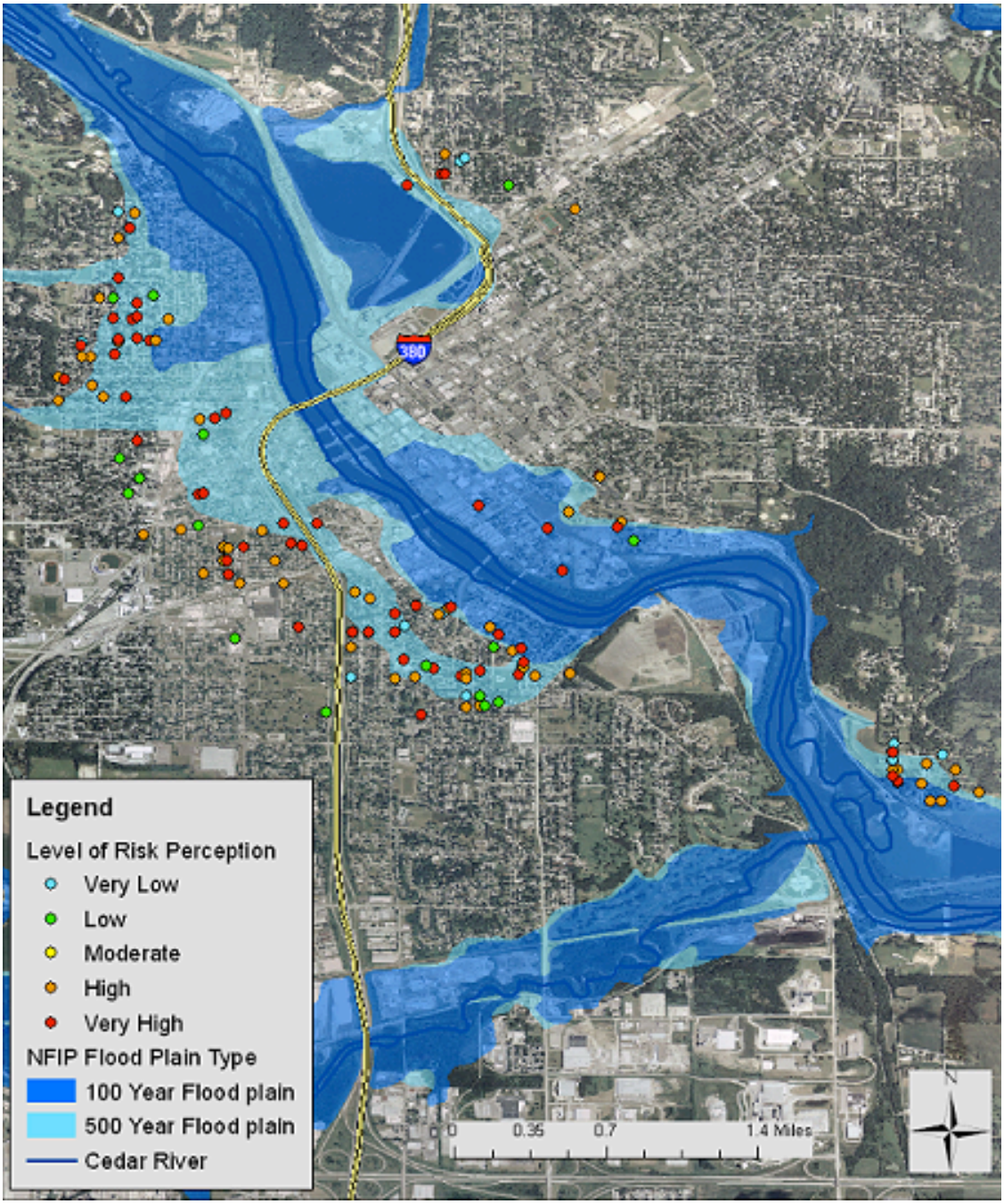

Figure 5. Risk perceptions of return based on proximity to threat**.**

8. Conclusion

Compared to evacuation there has been little mention of the return-entry process in the hazards literature, although this topic is of growing interest to researchers. Furthermore, research has not yet identified many of the problems that evacuees encounter during the return-entry process. This study surveyed flood evacuees in Cedar Rapids, Iowa in order to gather information about the problems and challenges they faced during their return home. One problem residents encountered during their return was a lack of effective communication of the return-entry plan by authorities. Siebeneck and Cova (2008) noted that communication during the return-entry phase might be more challenging than during the evacuation due to the geographic dispersion of evacuated residents over a large area. In this instance, many residents were aware that a return-entry plan existed; however, they noted that changes and updates made to the plan were not communicated to effectively to residents. In addition, many respondents also noted that they did not understand the return plan. Future research can explore what methods are most effective in communicating return-entry orders and recommendations to evacuees. In addition, research pertaining to the effectiveness of the return message content could assist emergency managers in the formulation of better and clearer return-entry plans.

Many respondents expressed dissatisfaction with the management of the return-entry plan. They noted that there was a lack of consistency in the content of the plan. In addition, many evacuees expressed frustration with being told they could return, only to arrive at their designated checkpoint to be notified that the plan changed and that they could not return until a later time. Communication of return-plans between authorities creating the plan and individuals enforcing the return plan (i.e. law enforcement, National Guard) is necessary in order to minimize confusion and frustration of evacuees as they move through the return process.

Risk perception is a significant topic in the evacuation literature that has resulted in numerous studies. However, the extent to which risk perception influences return-entry behavior has not been sufficiently explored. Understanding differences in perception of risk during the evacuation and return-entry process can assist researchers in gaining a better comprehension of evacuee behavior before, during, and after a disaster event. In addition, Peacock, Brody, and Highfield (2005) note that, "The role of proximity and geographic location is indeed an under-examined variable in explaining the perception of risk," and that, "…comparatively little research has been conducted on the influence of the respondent's location and proximity on the perception of risk…" This research explored the relationship between a home's location relative to the Cedar River and risk perception. The results indicated that a relationship does exist between the proximity of the home to the threat and the evacuees' perception of risk about returning home. Further research of return-entry risk perception, especially how geographic variable influence both the evacuee and returnee behavior, will lead to an increased knowledge of the entire evacuation and return process.

Initial analysis of the data was unable to find a significant relationship between non-compliance with return-entry orders and perception of risk associated with returning.

More research is necessary in order to explain why some evacuees ignore return-entry orders. Better understanding of the factors that contribute to the decision-making process of evacuees during the return-entry process may assist emergency managers in the creation of strategies to maximize compliance.

This study demonstrates that the return-entry process can be problematic, especially in instances when an area has sustained damage due to a disaster. Studies examining the return-entry process provide an opportunity for hazards researchers to explore a topic that has been under-examined in the hazards literature. Better understanding of the return-entry process can lead to the creation and implementation of more effective return-entry plans, as well as make the return process safer and more efficient for evacuees.

References

Dash, Nicole and Betty Hearn Morrow. 2000. "Return Delays and Evacuation Order Compliance: The Case of Hurricane Georges and the Florida Keys." *Environmental Hazards* 2(3): 119-128.

Dillman, Don. 2000. Mail and Internet Surveys: The Tailored Design Method. New York, New York: John Wiley & Sons, Inc.

Elliott, J.R., and Pais, J. (2006). Race, Class, and Hurricane Katrina: Social Differences in Human Responses to Disaster. Social Science Research 35: 295-321.

Ferran, Lee. "Toxic Runoff "Dangerous as Anything." ABC News 17 June 2008. 17 June 2008 http://absnews.go.com/GMA/story?id=5183234&page=1.

Here are the Entry Points for Flooded Areas. (2008, June 16). *Cedar Rapids Gazette.* Accessed June 16, 2008. <http://www.gazetteonline.com/apps/pbcs.dll/article?AID=/20080616/NEWS/228678791/1001/NEWS>.

Landry, Bin, Hindsley, Whitehead, and Wilson. 2007. Going home: Return-migration decisions of Hurricane Katrina survivors. White paper by ECU Department of Economics.

Lane, L.R., Tobin, G.A., Whiteford, L.M. (2003). Volcanic hazard or economic destitution: hard choices in Baños, Ecuador. Environmental Hazards (5) 23-34.

Mitchell, Jerry T., Andrew S. Edmonds, Susan L. Cutter, Mathew Schmidtlein, Reggie McCarn, Michael E. Hodgson, and Sonya Duhé. 2005. *Evacuation behavior in response to the Graniteville, South Carolina, chlorine spill*. Quick Response Research Report 178. Boulder, CO: Natural Hazards Center, University of Colorado. http://www.colorado.edu/hazards/qr/qr178/qr178.html

National Weather Service. (2008). Advanced Hydrologic Prediction Service. Accessed 19 June , 2008. http://www.crh.noaa.gov/ahps2/period.php?wfo=dvn&gage=CIDI4&view

Peacock, W.G., Brody S.D., and Highfield, W. (2005). Hurricane Risk Perceptions Among Florida's Single Homeowners. Landscape and Planning. 73 (120-135).

Piccau, J.S. and Martin, C.G. 2006. "Community Impacts of Hurricane Ivan: A Case Study of Orange Beach, Alabama. Quick Response Research Report 190. Boulder, CO: University of Colorado Natural Hazards Center. http://www.colorado.edu/hazards/research/qr/qr190/qr190.html

Siebeneck, L.K, and Cova, T.J. (2008). An Assessment of the Return-Entry Process for Hurricane Rita 2005. International Journal of Mass Emergencies and Disasters. (In press).

Sorensen, J.H., Vogt, BM., Mileti, D.S., 1987. Evacuation: an assessment of planning and research. Federal Emergency Management Agency, Washington, DC.

Stallings, R.A., 1991. Ending evacuations. International Journal of Mass Emergencies and Disasters 9 (2), 183-200.

Zelinsky, Wilbur, and Leszek A. Kosinski. (1991). *The Emergency Evacuation of Cities*. Savage, Maryland: Rowman & Littlefield, Inc.