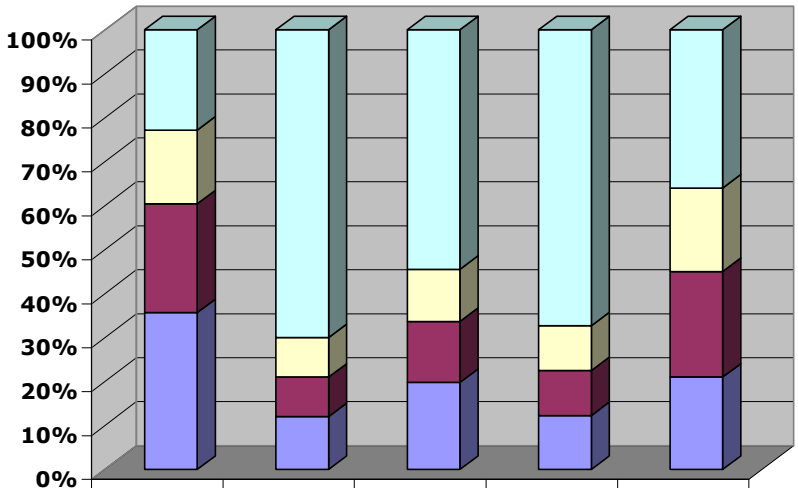
D. Home Safety, Mitigation and Damage

1. Beliefs about Safety of Home

Respondent were asked a series of questions to gauge their beliefs about the safety of their homes from hurricanes of varying intensities. The questions were worded as follows: "I want you to think about a hurricane threatening this area with sustained winds over 155 mph. That would make it a category 4 hurricane on the Saffir-Simpson scale, nearly a category 5 – what meteorologists would call a very dangerous hurricane. If a hurricane like that made landfall near your location with sustained winds of 155 mph and then passed directly over your home, do you believe that your home would be flooded by storm surge, wave action, or river flooding severe enough to pose a threat to your safety if you stayed in your home?" This was followed by a second question asking about safety from wind. The questions were then repeated for two more examples – sustained winds of 125 mph, and then 100 mph. The following two figures indicate the responses related to flooding and wind damage by region.

Figure 39. Perceived Flooding Risk from Hurricanes of Varying Intensities by Region



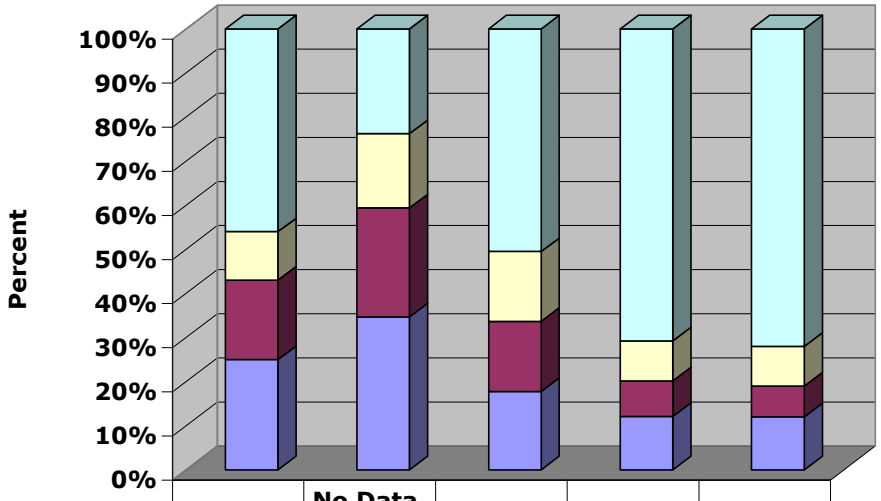
	LA	AL	MS	FL Pan.	FL Keys
No Flood Risk	23	70	55	66	36
Safe in 155 mph Storm	17	9	12	10	19
Safe in 125 mph Storm	25	9	14	10	24
Safe in 100 mph Storm	36	12	20	12	21

Interpreting these results poses a challenge. For example, it seems unusual that 36% of Monroe County and 23% of Coastal Louisiana residents believe their homes pose no flood risk in spite of the fact that most of the land is at or near sea level. One explanation could be that they live in the upper stories of buildings; however, only 17% of Monroe County and 17% of Louisiana

respondents live in multiple units. Others may feel safe because their homes are built on pilings; yet, it is quite conceivable that a storm surge could exceed the height of the pilings. It would appear that a considerable number of Monroe County residents have unrealistic views of their flooding vulnerability.

The next figure looks at the results across risk zones. Some regional variation may result from the fact that the question combined "storm surge, wave action, or river flooding". As expected, those from the more vulnerable areas are more concerned about flood risk.

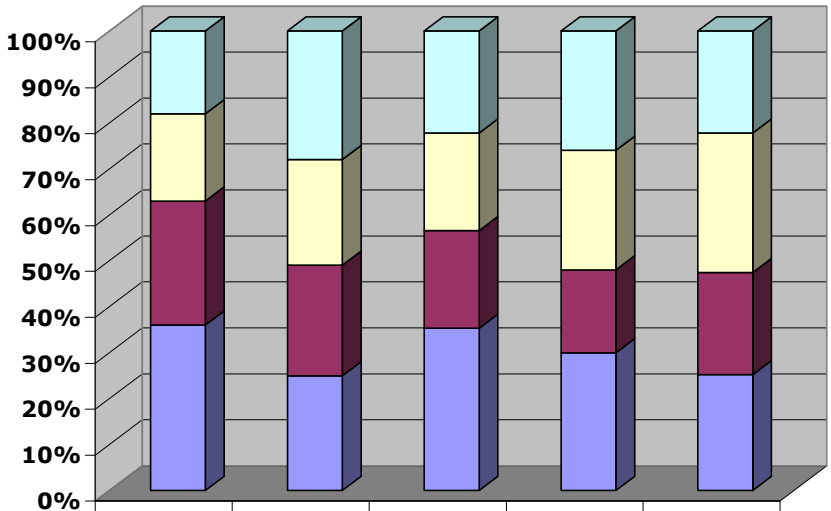
Figure 40. Perceived Flooding Risk by Risk Zone



	Cat 1+	No Data, Assume Evac Zone	Cat 3+	Cat 4+	No Evac
No Flood Risk	46	24	51	70	72
Safe in 155 mph Storm	11	17	16	9	9
Safe in 125 mph Storm	18	25	16	8	7
Safe in 100 mph Storm	25	35	18	12	12

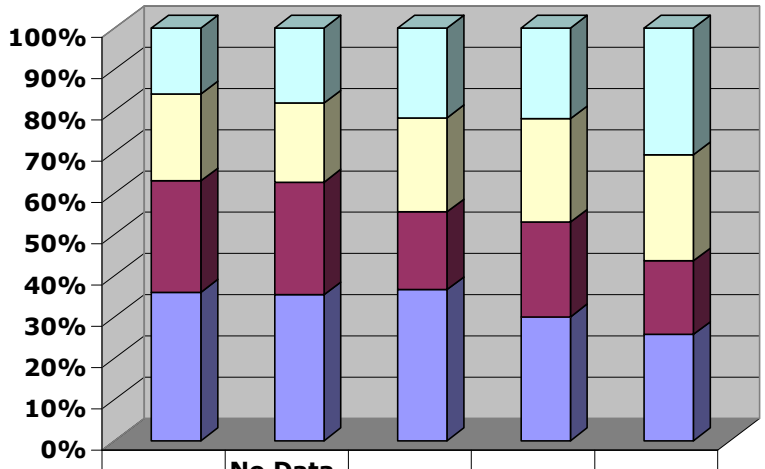
The next set of questions asks about risk for wind damage from storms of different intensities. There are no major differences either by region or by risk zone.

Figure 41. Perceived Wind Risk from Hurricanes of Varying Intensities by Region



	LA	AL	MS	FL Pan.	FL Keys
No Wind Risk in Any Storm	18	28	22	26	22
Safe in 155 mph Storm	19	23	21	26	30
Safe in 125 mph Storm	27	24	21	18	22
Safe in 100 mph Storm	36	25	35	30	25

Figure 42. Perceived Wind Risk from Hurricanes of Varying Intensities by Risk Zone



	Cat 1+	No Data, Assume Evac Zone	Cat 3+	Cat 4+	No Evac.
No Wind Risk in Any Storm	16	18	22	22	31
Safe in 155 mph Storm	21	19	23	25	26
Safe in 125 mph Storm	27	27	19	23	18
Safe in 100 mph Storm	36	35	37	30	26

Again, there are some disturbing responses. The extent to which residents in all regions believe their home would be safe in a 155 mph storm, or any size storm, appears unrealistic.

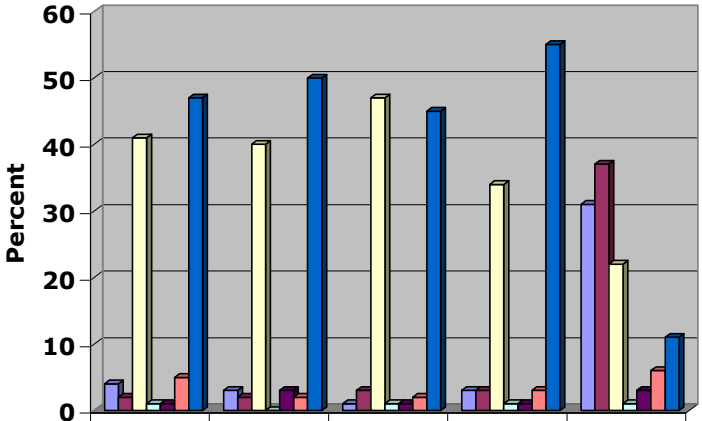
2. Mitigation

Respondents were asked several questions about various preparation or mitigation activities they may have taken, either prior to hurricane season or before Ivan.

a. Window Protection

Respondents were asked what, if any, window protection they had before Ivan. The responses about protection are illustrated by region and risk zone in the next two figures.

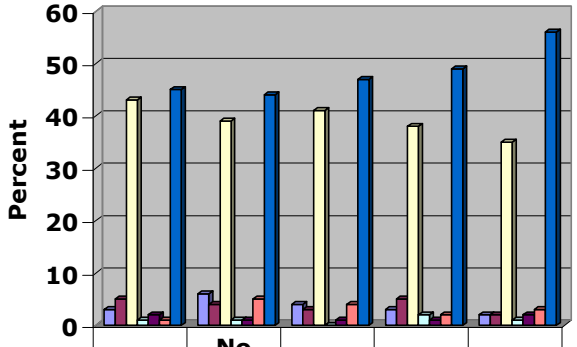
Figure 43.
Window Protection Before Ivan by Region



	LA	AL	MS	FL Pan.	FL Keys
Permanent Roll-Down Metal Panels	4	3	1	3	31
Removable Metal Panels	2	2	3	3	37
Plywood Sheets	41	40	47	34	22
Security Film	1	0	1	1	1
Impact-Resistant Glass	1	3	1	1	3
Other	5	2	2	3	6
None	47	50	45	55	11

Most homes that have any window protection have plywood panels, with the exception of Monroe County, Florida where 31% have invested in permanent roll-down metal panels and another 37% in removable metal panels. Unfortunately, there was little variation by risk zone.

Figure 44. Window Protection Before Ivan by Risk Zone

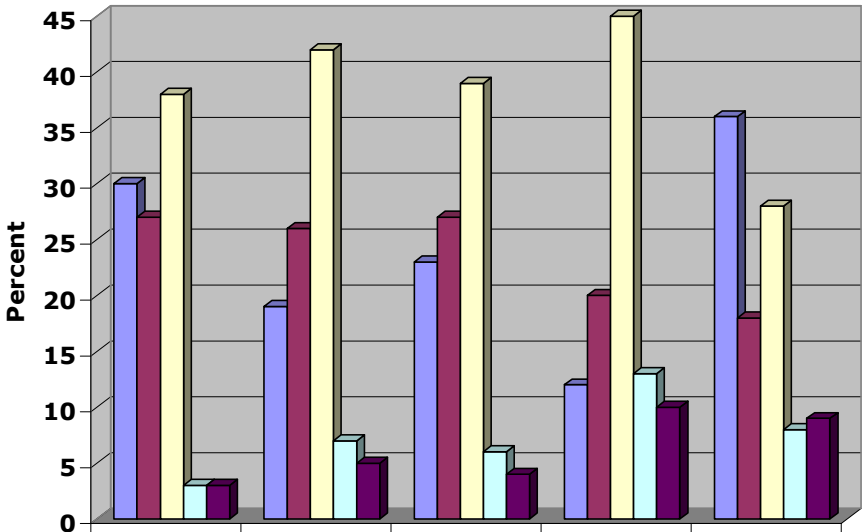


	Cat 1+	No Data, Assume	Cat 3+	Cat 4+	No Evac. Zone
Permanent Roll-Down Metal Panels	3	6	4	3	2
Removable Metal Panels	5	4	3	5	2
Plywood Sheets	43	39	41	38	35
Security Film	1	1	0	2	1
Impact-Resistant Glass	2	1	1	1	2
Other	1	5	4	2	3
None	45	44	47	49	56

b. Amount Spent on Mitigation

Respondents were then asked how much they had spent to protect their home and property from Hurricane Ivan. The results are illustrated by region and risk zone in the next two figures.

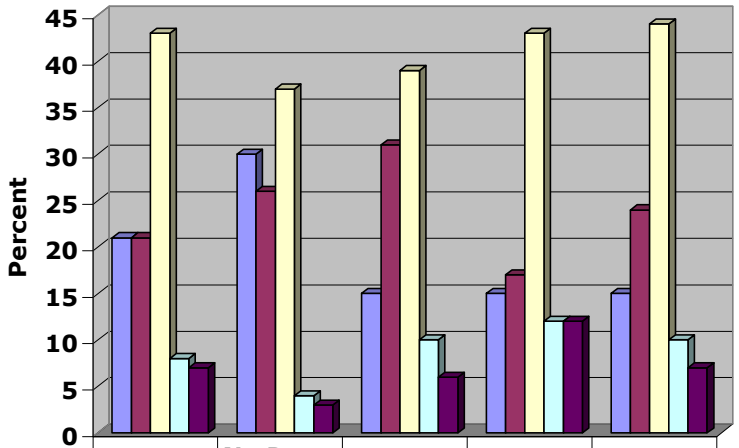
Figure 45. Amount Spent Protecting Home from Ivan by Region



	LA	AL	MS	FL Pan.	FL Keys
Zero	30	19	23	12	36
Less than $100	27	26	27	20	18
$101-$500	38	42	39	45	28
$501-$1000	3	7	6	13	8
More Than $1000	3	5	4	10	9

The most common amount given for all regions except the Keys was between $101-$500. The amount spent on Ivan in the Florida Keys was relatively low, perhaps because they had already purchased mitigation.

Figure 46. Amount Spent Protecting Home from Ivan by Risk Zone

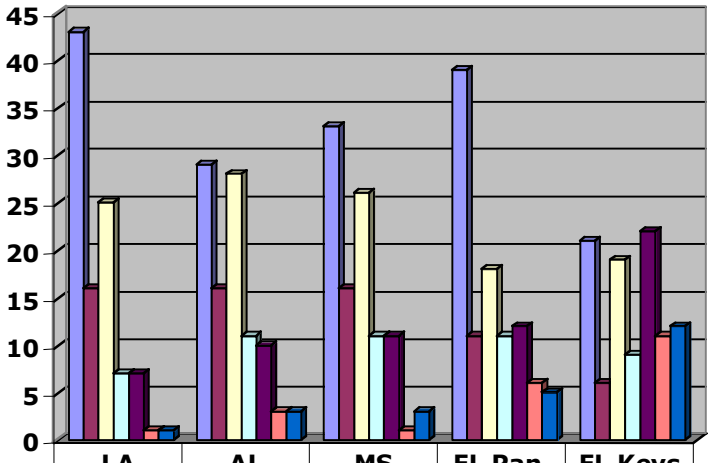


	Cat 1+	No Data, Assume Evac. Zone	Cat 3+	Cat 4+	No Evac
Zero	21	30	15	15	15
Less than $100	21	26	31	17	24
$101-$500	43	37	39	43	44
$501-$1000	8	4	10	12	10
More Than $1000	7	3	6	12	7

Interpreting these data by risk zone is difficult. It appears that people not living in an evacuation zone had in fact spent the most to protect their home and property from Hurricane Ivan. Perhaps this is because those in riskier areas had already mitigated.

To examine this possibility the next questions asked how much they had spent altogether, this year and in previous years, to protect their homes. The next two figures depict the total amount spent by region and risk zone.

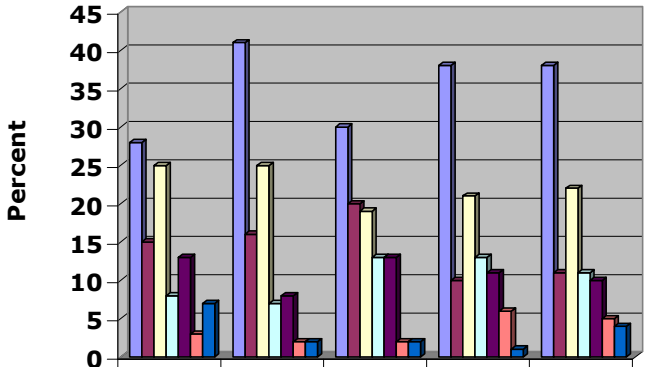
Figure 47. Total Spent on Mitigation by Region



	LA	AL	MS	FL Pan.	FL Keys
None	43	29	33	39	21
Less than $100	16	16	16	11	6
$100-$499	25	28	26	18	19
$500-$999	7	11	11	11	9
$1000-$4999	7	10	11	12	22
$5000-$9999	1	3	1	6	11
$10,000 or More	1	3	3	5	12

The most common answer across all regions except the Florida Keys was that they had spent nothing on home mitigation. As might be expected, given recent storm history, the highest reports of spending in excess of $1000 occurred in the Florida Keys and Panhandle, 45% and 33%, respectively.

Figure 48. Total Spent on Mitigation by Risk Zone



	Cat 1+	No Data, Assume Evac	Cat 3+	Cat 4+	No Evac Zone
Zero	28	41	30	38	38
Less than $100	15	16	20	10	11
$100-$499	25	25	19	21	22
$500-$999	8	7	13	13	11
$1000-$4999	13	8	13	11	10
$5000-$9999	3	2	2	6	5
$10,000 or More	7	2	2	1	4

When the data are examined by risk areas, the results are confusing. The lowest rates of mitigation appear to occur in those areas for which there were no evacuation zone data, but were assumed to be high risk, i.e. the Louisiana parishes included in the study, and Monroe County, Florida. As might be expected, more households in Cat 1+ areas had spent $10,000 or more on mitigation, but it was still only 7%.

c. Awareness of Government Programs

Most of the sample (85%) across all regions indicated they were not aware of any government programs to help pay for mitigation.

3. Hurricane Effects

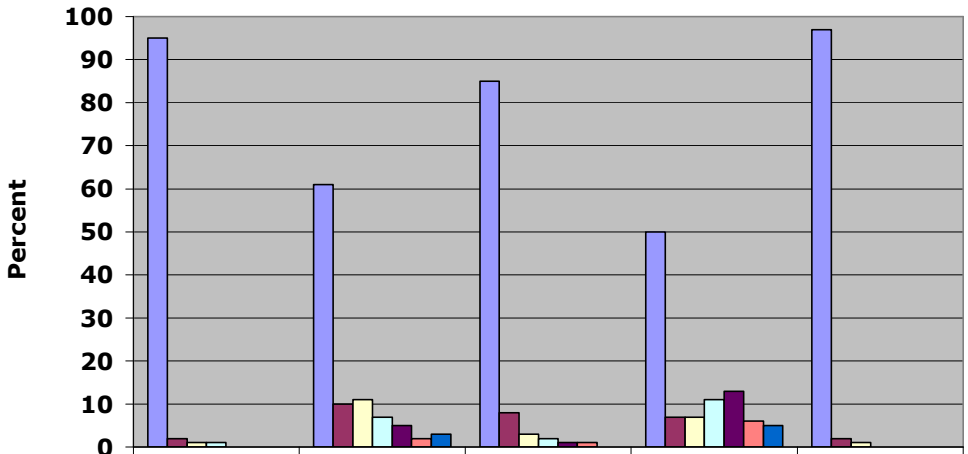
a. Jobs

Only 5% indicated that Hurricane Ivan had negatively affected their jobs. Of these, 30% reported losing less than one week of work, 16% two weeks, and 18% three weeks. About 10% said they were still out of work.

b. Home Damage

As expected, home damage from Ivan varied by region.

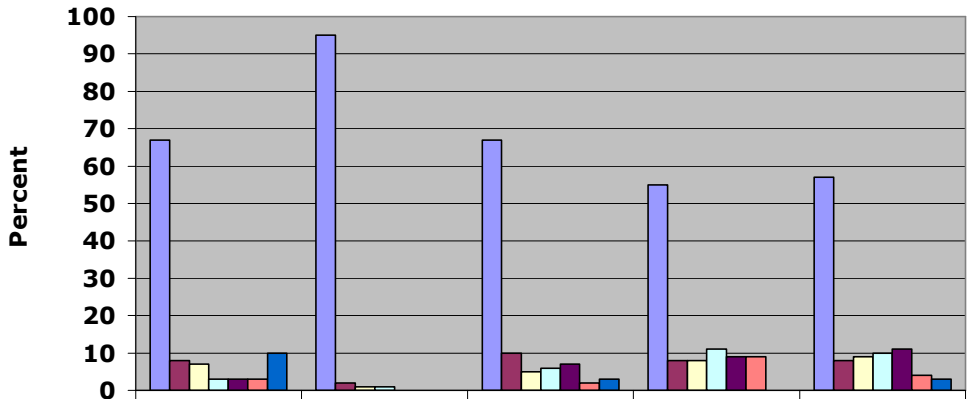
Figure 49. Damage from Hurricane Ivan



	LA	AL	MS	FL Pan.	FL Keys
None	95	61	85	50	97
Less than $1000	2	10	8	7	2
$1000-$4999	1	11	3	7	1
$5000-$9999	1	7	2	11	0
$10000-$24999	0	5	1	13	0
$25000-$49999	0	2	1	6	0
$50000 or More	0	3	0	5	0

Given the storm's path, it is not surprising that the highest reports of costly damage were for the Florida Panhandle, followed by Alabama. However, some damage from Hurricane Ivan was reported in every region.

Figure 50. Damage from Hurricane Ivan by Risk Zone

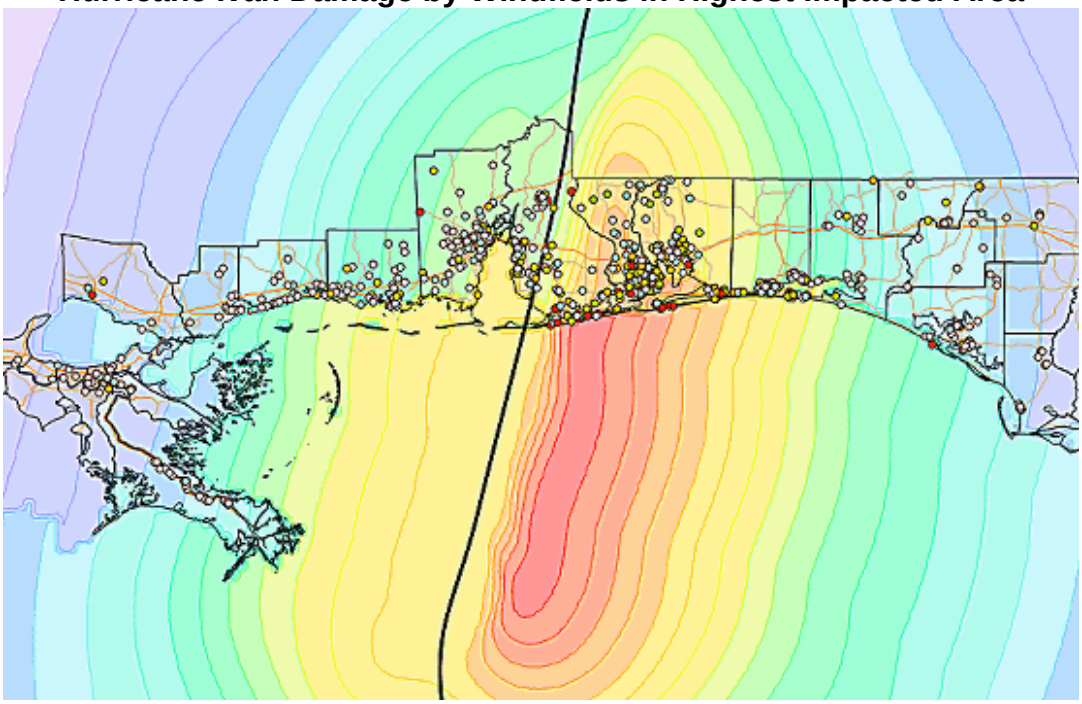


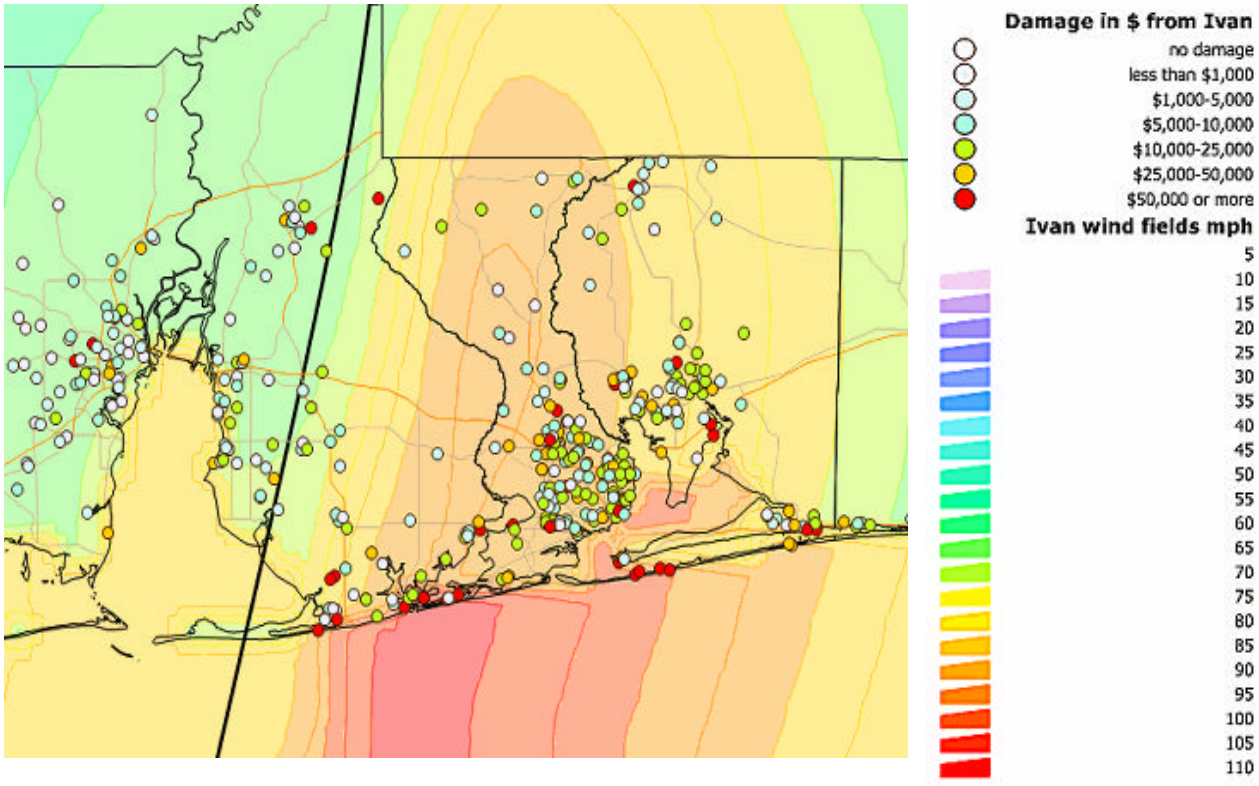
	Cat 1+	No Data, Assume Evac. Zone	Cat 3+	Cat 4+	No Evac.
None	67	95	67	55	57
Less than $1000	8	2	10	8	8
$1000-$4999	7	1	5	8	9
$5000-$9999	3	1	6	11	10
$10000-$24999	3	0	7	9	11
$25000-$49999	3	0	2	9	4
$50000 or More	10	0	3	0	3

Again, as expected, the most costly damage occurred in the Category 1+ zone. It is especially interesting to see how much damage was reported in the less risky zones, however. There are several possible explanations, including the likelihood that this self-reported and unverified damage is inflated. Also, it may not take much to damage older or poorly maintained property. Past research has documented how relatively low winds can cause damage in poorer neighborhoods where the houses are likely to be less well constructed and maintained.

In order to see the relationship between wind levels and damage, the following two maps were created. There is more damage in areas of higher winds, but there are also scattered instances of damage in areas with lower wind speeds. This widespread scattered damage at all hurricane wind speeds may be one of the lessons of the 2004 hurricane season in Florida.

Figures 51 and 52.
Hurricane Ivan Damage by Windfields in Highest Impacted Area





4. Plans to Move

When respondents were asked if they had any plans to move to a place with less danger from hurricanes, about 9% of the total sample answered affirmatively. There were only slight regional differences: Louisiana 10%; Alabama 7%; Mississippi 6%; Florida Panhandle 8% and Florida Monroe County 10%.

III. Conclusions

Over the entire study area the evacuation rate was 45%, comparable to that recorded for Hurricane Georges in the same region. As expected, given the track of Hurricane Ivan, the rate was much higher this time for the Florida Panhandle (69%), and the Florida Keys (62%). The highest evacuation rates were in the highest risk zones, indicating that most people were measuring their vulnerability in a reasonable manner. However, looking at the issue another way, many people who should have evacuated, did not, including 55% from the coastal Louisiana parishes.

Over-evacuation was less of a problem, but about one-quarter (28%) of those who evacuated did not live in an evacuation zone. Some of these may be from mobile homes or other vulnerable living situations, but it appears that many people living in inland areas evacuated who probably should not have. For example, 43% of those living in a Category 4 or 5 evacuation zone left. The over-evacuation is more pronounced in areas where people do not have as much previous evacuation experience.

Belief about the safety of their homes was the primary reason given for the evacuation decisions by both evacuees and non-evacuees. Those who stayed were more likely to believe their homes were safe, and to have taken some mitigation action. Traffic was the next mentioned reason for not leaving, particularly in those areas where it has been a problem, particularly Louisiana. However, fewer people from the Keys were concerned about traffic in this survey than in the Hurricane Georges study.

Household evacuation decision-making tends to be a complex process in which more than one factor is considered. A number of variables have been found to be correlated with evacuation decisions in past research, and in this study simple correlations occurred with many of these same factors, such as an official evacuation notice, gender of decision-maker, pets, income, education, hurricane experience, type of housing unit, presence of children or older household members, and having window protection.

A unique contribution of this study is that multivariate analysis was done to determine which of these factors are unique, that is, they make a contribution toward explaining evacuation decisions irrespective of the other factors. The analysis revealed that evacuees are more likely to have heard an official notice,

to live in an evacuation zone, and to have higher income. Those who chose not to evacuate are more likely to be male, African American or black, have a household member who has to work, and have window protection.

The significance of living in an evacuation zone and hearing an official notice point out how important it is for citizens to have correct information. While about three-quarters of all respondents said they knew whether they were in an evacuation zone, this still means that many do not, including 58% in the Florida Panhandle. There is also a great deal of confusion about official notices, whether they were given, who is responsible for them, whether they are recommended or mandatory, and to whom they apply.

Most people said they would make the same decision the next time in a similar situation. This is in agreement with past evacuation studies and supports the notion of a fairly stable division between evacuees and non-evacuees. The largest rate (18%) saying they would make a different decision next time occurred with Florida Panhandle respondents who did not evacuate, and thus experienced the storm. Interestingly, about two-thirds of the non-evacuees in the total sample said they had made tentative plans to leave if the storm had gotten worse. This could result in serious traffic jams under hazardous conditions.

One of the most important findings of this study has to do with the timing of evacuation, particularly in relation to traffic delays. Most people in the impact area started leaving about 30 hours before the first hurricane force winds. As might be expected, those leaving at least 24 hours before the storm (as they are advised) experienced the longest delays. However, those who left less than 12 hours before the storm experienced the least delay. This is not the message officials wish to convey.

In general, traffic delays were not a serious problem during the Ivan evacuation. The average travel time was six hours and most evacuees reached their destination within the normal time period. The fewest traffic delays were reported in the Florida Panhandle and Alabama, and the most occurred in the coastal Louisiana parishes where 44% of those who left 24-36 hours before the storm experienced delays of more than six hours. Contra-flow procedures were in effect, but most of the Louisiana respondents either were not aware of contra-flow lanes, or did not use them, and they were also more likely to say they needed more traffic information. A considerable number of Louisiana evacuees (18%) said they would leave earlier next time.

As with other studies, the vast majority of households first heard about the evacuation on television. What is different is that, while still small, a growing number are turning to the internet for additional information, and this is particularly true in the Florida Keys. The NHC and NWS are valued information sources with most people paying attention to their advisories. However, there is still considerable confusion about the meaning of hurricane watches and

warnings. More people now report seeing the cone than the center track in the forecasts. This may be explained in part by the attention given to this issue after Hurricane Charley. It is interesting to note that those who reported seeing only the forecast track line were less likely to evacuate.

Most evacuees stayed with relatives or friends, and did not travel very far – the median distance was a 117 miles. Most (69%) took one car. As expected, given the geography, the longest distances and time traveled were reported by residents of the Florida Keys and Louisiana. While Keys residents tended to travel furthest (230 miles), Louisiana evacuees took the longest average time – eight hours to travel an average of 198 miles. Most spent less than $100 per day while gone, but again the exception was for the Florida Keys where about three-quarters (73%) spent more.

An important finding that is not new, but needs emphasis, is that an evacuation takes time. Even under the best circumstances it takes a minimum of several hours for households to make their decision and prepare to leave, and that time varies across households. In the case of Ivan it was more than 68 hours from the time the first person and the last person left in the Gulf regions. While the goal should be to shorten this, it must be recognized that evacuation is a several day process, especially in Louisiana and the Florida Keys.

One finding from this work that should be of concern to officials is the high rate (80%) of these respondents who said they had experienced a major hurricane in the past. Based on where they live, this cannot have been the case. Granted, some may have gained the experience while living elsewhere, but this would not account for the high rate. It is common for people who are on the fringes of a storm to later say they went through it because they experienced some heavy winds and rain. Since they have not truly experienced a hurricane's fury, they are likely to have a false sense of their home's resiliency.

Based on damage reports many homes located outside what is considered the impacted area sustained damage from wind and/or rain. This has been reported in other storms as well. Explanations include poorly constructed homes, poorly maintained homes, areas with many trees, especially if they have not been trimmed, and lack of mitigation. Inland residents tend not to feel hurricane vulnerable, but the extensive inland damage caused by the 2004 storms should be a wake-up call.

Very little home mitigation had been completed in these regions. The rates are somewhat higher in Florida, but still most had spent less than $500 total on home protection. Again Florida Keys respondents were the exception, with 5% having either roll-down shutters or removable metal panels.

In summary, Hurricane Ivan evacuation went as expected based on past behavioral studies. An important lesson emphasized in these findings is that

most people are paying attention to hurricanes. They listen to the media broadcasts, hurricane advisories, and official evacuation notices, and then make their own evacuation decisions based on a complex array of factors related to their individual households and homes. However, these decisions are not as informed as they should be. There is still considerable misunderstanding about the destructive forces of hurricanes, the relative safety of their homes, the meaning of hurricane advisories, the best traffic routes, and the concept of sheltering in place where possible.

APPENDIX A

Figure A-1. Weighted Sample Breakdown by County/Parish

		Count	Percent
County/Parish	Baldwin County	136	4%
	Bay County	178	6%
	Escambia County	346	11%
	Franklin County	13	0%
	Gulf County	17	1%
	Hancock County	41	1%
	Harrison County	179	6%
	Inland Counties	118	4%
	Jackson County	121	4%
	Jefferson Parish	435	14%
	Mobile County	370	12%
	Monroe County	102	3%
	Okaloosa County	141	4%
	Orleans Parish	454	14%
	Plaquemines Parish	24	1%
	Santa Rosa County	147	5%
	St. Bernard Parish	64	2%
	St. Charles Parish	43	1%
	St. John The Baptist	38	1%
	St. Tammany Parish	175	5%
	Walton County	58	2%
	Total	3200	100%