

Muddy waters

30 Sep 2005



Few had anticipated the 2004 Indian Ocean tsunami and its catastrophic impact on some of the less economically developed and most poorly-prepared regions of the world. But when Hurricane Katrina hit the Gulf Coast of the USA on Monday 29 August 2005 it was perhaps the most anticipated and prepared-for hazard event in the world. New Orleans has long been an American disaster waiting to happen. "If there is any place that was programmed for a disaster, this was it," says flood disaster expert J. David Rogers, a professor of geology at the University of Missouri-Rolla.

When *Geography in the News* reported last year on four major hurricanes – Charley, Frances, Ivan and Jeanne - it seemed, on the face of it, that accurate and effective disaster prediction and hazard management had avoided a catastrophe in the southern states in 2004.

But did it really?

Was New Orleans prepared for Katrina?

30 Sep 2005



The coasts of Louisiana, Mississippi, Alabama and part of Florida, seen from space on October 15, 2001. Original photo from NASA

Certainly geographers have been discussing the possible effects of a direct hit by a large hurricane on New Orleans since Hurricane Betsy in 1965 and Camille in 1969.

But perhaps it was luck that saved New Orleans. According to geographer Dr. Ben Wisner, on the night Hurricane Ivan approached the USA, 20,000 low-income people without private vehicles sheltered in their homes below sea level. It is now clear that a direct hit could have drowned them. At that time a US Army Corps of Engineers computer simulation calculated that 65,000 would die in the city of New Orleans, in the event of a direct hit by a slow-moving category 3 hurricane.

Fortunately, Ivan veered away from the city at the last moment, but still killed 25 people elsewhere in the U.S. south. There was no plan for the public evacuation of low-income residents who do not own cars other than

the now questionable shelter provided by the Superdome.



Less than a year later as Hurricane Katrina loomed large it became obvious that New Orleans was, again, not prepared for an event of this magnitude (in the United States, there have been only 3 Category 5 hurricanes: one on (US) Labour Day holiday in 1935, Hurricane Camille in 1969, and Hurricane Andrew in 1992) and that the city's levees (flood barriers), built to protect against massive storm surges, were NOT expected to protect against Katrina. Instead, the levees were overtopped and partially breached, letting water in but blocking its natural recession, instead trapping the floodwater for weeks, hindering the rescue and relief effort. A full evacuation of the city was ordered but by this time 80% of New Orleans was underwater.



Those who did not, or could not leave, were either surrounded by water or herded along with thousands of other 'refugees' to the Superdome. Anger mounted over the delay in getting aid to people in New Orleans and what was seen as an inadequate response from the federal government. A week after the hurricane hit, as fears grew that the city had descended into anarchy, every survivor was moved out in the largest airlift operation in US history and the dead bodies were left behind. Over 1,000 people died in New Orleans and along the gulf coast, oil production was disrupted impacting on global crude prices and damage to casinos, shrimp boats and other business left 68,000 unemployed. Repairing gaps in the levee and pumping the water back out into the Mississippi was the only way to dry out New Orleans before the rebuilding of neighbourhoods and lives could commence. Just as residents started to return to New Orleans along came Rita.

Hurricane Katrina - most destructive hurricane to ever strike the U.S.A

Although Katrina will be recorded as the most destructive storm in terms of economic losses, it will likely not exceed the human losses in storms such as the Galveston Hurricane of 1900, which killed as many as 6,000-12,000 people, and led to almost complete destruction of coastal Galveston. Katrina has killed up to 1,000 people.

Hurricane Andrew, in 1992, cost approximately \$21 billion in insured losses (in today's dollars); whereas estimates from the insurance industry say the storm could cost the Gulf Coast states as much as an additional \$125 billion. There have been 68,000 extra unemployment claims as result of the storm.

Sources NOAA and BBC News

Data	New Orleans	Louisiana	USA
Population, 2003	484,674 (2000)	4.5 million (1.5% of US total)	291 million
Persons under 18 years old, percent, 2000	26.3% (2004)	27.3%	25.7%
Persons 65 years old and over, percent, 2000	11.3% (2004)	11.6%	12.4%
White persons, percent, 2000	28.0% (2004)	63.9%	75.1%
Black or African American persons, percent, 2000	67.9% (2004)	32.5%	12.3%
White persons, not of Hispanic/Latino origin, percent, 2000	Unknown	62.5%	69.1%
Persons of Hispanic or Latino origin, percent, 2000	3.2% (2004)	2.4%	12.5%
High school graduates, percent of persons age 25+, 2000	82.9% (2004)	74.8%	80.4%
Homeownership rate, 2000	Unknown	67.9%	66.2%
Persons below poverty, percent, 1999	23.2% (2004)	19.6%	12.4%
Median household income, 1999	\$31,369 (2004)	\$32,566 (77.5% of national average)	\$41,994

Federal funds and grants, 2002 (\$1000)	Unknown	\$29.99 billion (1.6% of US total, \$6,664 per capita)	\$1.9 trillion (\$6,529 per capita)
Persons per square mile, 2000	Unknown	102.6	79.6

Source: <http://uspolitics.about.com/>

Broken levee blues? 30 Sep 2005



Desperate struggles. Prompt action prevents many breaks. In: "The Mississippi River Flood Problem," by John A. Fox, 1915.
Credit: NOAA Photo Library

Levees exist up and down the Mississippi River valley. Breaches, and the damage and heartbreak that follows, are ingrained in southern folklore. For example, "When the Levee Breaks" is the name of a 1929 blues tune by Memphis Minnie, made famous by Led Zeppelin. The lyric warn:

"Now, cryin' won't help you, prayin' won't do you no good, When the levee breaks, mama, you got to move,"

[Download the original track and listen \(mp3\)](#)

Memphis Minnie - "When the Levee Breaks"

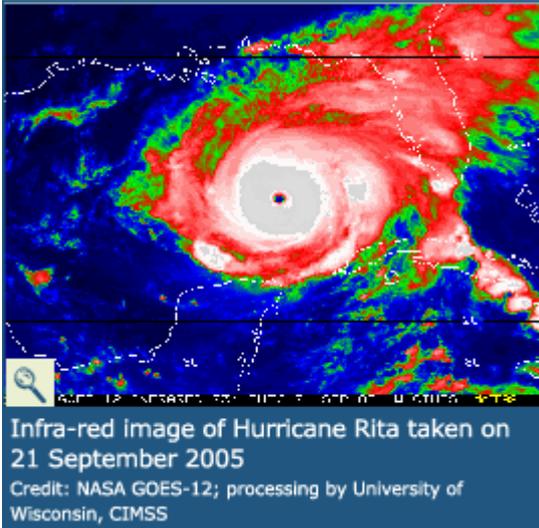
*If it keeps on rainin', levee's
goin' to break
If it keeps on rainin', levee's goin' to break
And the water gonna come in, have no place to stay
Well all last night I sat on the levee and moan
Well all last night I sat on the levee and moan
Thinkin' 'bout my baby and my happy home
If it keeps on rainin', levee's goin' to break
If it keeps on rainin', levee's goin' to break
And all these people have no place to stay
Now look here mama what am I to do
Now look here mama what am I to do
I ain't got nobody to tell my troubles to
I works on the levee mama both night and day
I works on the levee mama both night and day
I ain't got nobody, keep the water away
Oh cryin' won't help you, prayin' won't do no good
Oh cryin' won't help you, prayin' won't do no good
When the levee breaks, mama, you got to lose
I works on the levee, mama both night and day
I works on the levee, mama both night and day
I works so hard, to keep the water away
I had a woman, she wouldn't do for me
I had a woman, she wouldn't do for me
I'm goin' back to my used to be
I's a mean old levee, cause me to weep and moan
I's a mean old levee, cause me to weep and moan
Gonna leave my baby, and my happy home*

Many blues artist wrote about flooding of the Mississippi River as the black communities they were part of were the communities living closest to the levees, most effected by flooding and ironically, on hand to help fix the gaps in them. For example: Blind Lemon Jefferson's "Rising High Water Blues", or Barbecue Bob's "Mississippi Heavy Water Blues", not to mention Bessie Smith's classic "Back Water Blues". The anger and sense of abandonment felt by the black communities during the 1927 floods contributed to the discrediting of the government ethos of the day. During the 1927 disaster 700,000 people were displaced, including 330,000 African-Americans who were moved to 154 relief camps. Over 13,000 refugees near Greenville, Mississippi were gathered from area farms and evacuated to the crest of an unbroken levee, and stranded there for days without food or clean water, while boats arrived to evacuate white women and children. Many African-Americans were detained and forced to work at gunpoint during flood relief efforts.

The flood's aftermath may have been cultural in terms of the blues music produced but it was also geographical - a factor in the mass rural to urban migrations of African-Americans to the industrial centers of the Northeast and Midwest.

Educating Rita - lessons learned?

30 Sep 2005



A natural disaster is usually followed by a 'lessons learned' exercise which allows for shortfalls in the management and response of the event to be assessed and addressed in order to make improvements for next time. As New Orleans recoiled from its pummeling by Katrina, Hurricane Rita began churning across the Gulf of Mexico and the U.S. authorities had to put their recently acquired crash-course in disaster management into practice 'on the job'. Here was a chance to put right the severe criticisms of the response to Katrina and to prove to the international media that the U.S.A. level of preparedness is how the world had imagined pre-Katrina.

Rita's wrath?

- Hurricane Rita veered eastwards, missing Houston and making landfall just east of the Texas town of Sabine Pass.
- The towns of Port Arthur, Lake Charles, Beaumont and Abbeville were among the worst affected. Power lines were downed, trees uprooted and cars tossed across roads.
- In Abbeville, floodwaters were 2.74m (9ft) deep in some areas.
- Officials said that the mandatory evacuations ordered for a swathe of land south of Houston had minimised the number of deaths.
- Only one person was reported to have been killed as a direct result of the hurricane.
- The cost of the damage was estimated at US\$6bn

The planned return of residents to certain areas of New Orleans was cancelled. Galveston, New Orleans and towns in south-western Louisiana were subject to mandatory evacuation orders before the hurricane made landfall. As many as two million people are thought to have fled north, away from the coast. Images of cars jamming the freeways are perhaps the icons of disaster management in the region for the foreseeable future: mass evacuations. But how long will the population and the economy put up with regular disruptions?



Houston, September 21, 2005- Traffic on US 45 was virtually one way north as Galveston citizens evacuated the coastal flood plains. Recent memories of Hurricane Katrina sent people scrambling to prepare for Hurricane Rita. Photo by Ed Edahl/FEMA

Was there a different political response to Rita? 30 Sep 2005



Outbound traffic together with some inbound vehicles form the shape of an arrow north as thousands of cars slowly make their way out of Houston, Texas on Highway 59 to escape Hurricane Rita September 21, 2005. © Reuters

(1) President Bush took an active role in monitoring preparations for Rita, traveling to a bunker in Colorado to observe how the military's Northern Command responded. During Katrina, Bush stayed in his hometown of Crawford, Texas, then traveled to Arizona and California for previously scheduled political appearances as the storm hit.

(2) For Rita, FEMA (Federal Emergency Management Agency) was more proactive in getting supplies into affected areas. As Katrina hit, FEMA said it would have 500 truckloads of water and 500 truckloads of ice for the first 10 days after the storm. The day after Rita hit, 348 truckloads of water and 275 truckloads of ice were already on hand and FEMA's acting director promised Louisiana another 200 truckloads of water and 200 truckloads of ice each day thereafter.

(3) FEMA also moved nearly twice as many search and rescue teams into the area for Rita as for Katrina. Before Katrina struck, nine rescue teams were deployed; for Rita the number was 17.

(4) Homeland Security Secretary Michael Chertoff declared Rita an "incident of national significance," more

quickly, two days before Rita struck, but 36 hours after Katrina had devastated the Louisiana and Mississippi coasts.

(5) U.S. military involvement with Hurricane Rita began while the storm was still building across the Gulf of Mexico. Before the storm hit thousands of troops were placed on alert for immediate deployment before landfall. By comparison, the Pentagon didn't activate its Katrina task force until two days after Katrina struck.

(6) The military evacuated thousands of nursing home residents, hospital patients and other frail people ahead of Rita. During Katrina, hundreds of such patients were stranded for days in water-surrounded facilities. School buses were dispatched to remove those without their own transport - following criticism that poor and old people had no way of escaping New Orleans after Katrina and that public buses were marooned amid floodwaters, unused. Ambulances ferried people from hospitals, while military helicopters were used to take sick and elderly patients.

Source: *Detroit Free Press* 26 September 2005

Katrina and Rita: five important hazard themes 30 Sep 2005

After last year's 2004 hurricane season we looked at five important hazard themes. We can now return to these theme in the wakes of Hurricanes Katrina and Rita.

(1) *The unpredictability of hurricane paths makes the effective management of this category of natural hazard exceptionally difficult.*

Hurricane Katrina's size (the storm was 500 km across) and magnitude (wind speeds as high as 240 km/s) meant that even though its path veered away from New Orleans at the last minute it still had a huge impact on the city as well as devastating the Alabama coast. When Rita loomed, fearing a repeat of Katrina 2 million people evacuated low-lying areas of Louisiana and Texas but the full intensity of the storm missed densely populated area of Galveston and Houston, after a mass exodus which blocked roads for 120 miles out of Texas' biggest city. Many evacuees reported unbearably long waits on the freeway. Will they go through this again when another Hurricane is predicted to hit? Or take a chance and stay put? Over time, repeated exposure to a hazard can result in people beginning to develop a fatalistic attitude, possibly through 'hurricane fatigue' (tiredness) and exhaustion.

The two unpredictable storm paths of Katrina and Rita affected the impact on the oil industry according to *The Financial Times* 28 September 2005. Hurricane Rita had caused more damage to oil rigs than any other storm in history. The path that Katrina took was through the 'mature' areas of the US Gulf where there are mainly oil production platforms whereas Rita came to the west where there is a lot of exploratory rig activity.

(2) *The strongest storms do not always cause the greatest damage*

The magnitude and scale of Katrina was a key factor as the flood defences were rendered ineffective. Unusually high sea temperatures in the Gulf of Mexico helped build Katrina into Category 5 storm when defences were only built to withstand a category 3 hurricane. Rita was downgraded to a 'only' a category 3 storm and its lower magnitude may have minimise the impacts, however, officials said it was the mandatory evacuations ordered for a swathe of land south of Houston had limited the number of deaths. Rita left most of the refineries that account for much of the Houston economy untouched. In New Orleans, the weaker Hurricane Rita compounded the earlier effects of Katrina, with floodwaters breaching holes in already weakened levees.

(3) *The distribution of the population throughout the region is responsible for much of the heightened natural hazard risk.*

New Orleans is a major urban centre of 485,000 people. It is a hazard prone area that has continued to attract population but as pressure on land has increased, many affluent Americans, oil industries and gambling businesses have moved into areas of hazard risk, whereas several decades ago, it was only the poorest (and often black) populations that lived in these areas or on and around the levee system. It was parts of the population without the social or economic means to leave the hazard zone in response to the threat of Katrina that became the victims.

(4) Hazard mitigation depends primarily upon the effectiveness of the social response to these natural events

There were stark differences in the two responses to Katrina and Rita. Access to cars and the location of homes seemed to have an impact on the demographic of those who were victims of the Katrina. There was no plan to use trains or other mass public transport to evacuate those *without cars or money*. *The most recent census showed that in a city 87% black and 30% poor, there were 112,000 households without private vehicles to reach the shelters of Baton Rouge. With Rita there were mandatory evacuations and provision was made to transport the elderly and those without cars from the danger zone.*

(5) LEDCs continue to lose more lives to natural hazards, due to inadequate planning and preparation.

It is interesting to note that tropical storms and a major drought crisis have killed and displaced thousands in LEDCs whilst international media attention has been focused on the US southern states, a quick search of the BBC News website brings up the following:

[Vietnam hit by powerful typhoon BBC 27 September 2005](#)

[Storms wreak havoc in South Asia 20 September 2005](#)

[India flood death toll increases 13 August 2005](#)

[Over 1,000 die in Indian floods 4 August 2005](#)

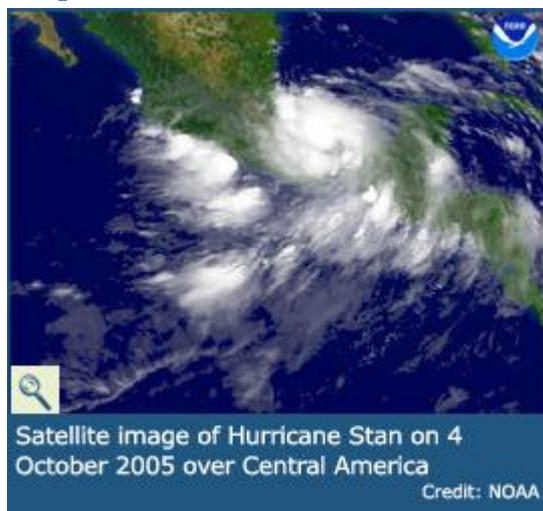
[Typhoon lashes east China coast 12 September 2005](#)

[Typhoon death toll rises in China 5 September 2005](#)

[Niger's children continue dying 23 September 2005](#)

By way of contrast, Katrina caused \$125bn total damage, the most expensive US disaster despite the relatively low death toll (up to 1,000). This toll is considered to be unacceptably high for a country wealthy as the USA – but it is small in comparison to the number of people resident in the hazard zone. Katrina's is that the victims were disproportionately the lower-income groups, communities living in poverty unable to mobilize. One might make the point that Katrina's victims were 'Less Economically Developed Communities'. Rita came along at a point of heightened preparedness for the USA (certainly in terms of political will) and showed that it could easily direct immense resources to the region to help mitigate the disaster with the result of very few fatalities.

Tropical Storm Stan



Satellite image of Hurricane Stan on 4 October 2005 over Central America

Credit: NOAA

A month after Katrina, modestly publicised Hurricane Stan, the one that didn't threaten Texas or Louisiana and in actual fact, was 'only' a Tropical Storm (a category 1 hurricane) with winds of 130km/hr brought heavy rain to Central America triggering severe landslides and flooding. Guatemala, Honduras, Nicaragua, El Salvador, Costa Rica and Mexico were affected. Up to 1,000 have died and hundreds more are thought to be missing. Landslides and swollen rivers made rescue attempts difficult and some communities have been completely cut off with no access by road and telephone communication down. In Guatemala, it is believed that 50 people in one town alone were killed by a large mudslide and officials in a number of countries affected fear more tragedies due to the saturated nature of the ground which may well lead to further mass movements. In El Salvador, the eruption of the

Santa Ana volcano on October 1 2005 compounded the problems, which led to even more destructive floods and mudslides from Stan. This was because it is a composite cone, a tall, conical volcano composed of both hardened lava and volcanic ash. The shape of these volcanoes is characteristically steep in profile because lava flows that formed them were highly viscous, and so cooled and hardened before spreading very far.

[BBC - At-a-glance: Stan's trail of destruction](#)

[In Pictures - Central American Storm \(BBC News\)](#)

[Rescuers Struggle in the Wake of Stan \(BBC News\)](#)

[Hundreds Missing after Stan Storm \(BBC News\)](#)

[The Times - Village engulfed by mudslide](#)

[BBC In pictures - struggling with Stan's aftermath](#)

Hurricane Katrina and Hurricane Rita links 30 Sep 2005

Hurricane Katrina

Risk and preparedness

["What if Hurricane Ivan Had Not Missed New Orleans?"](#) - prophetic article from Natural Hazards Research and Applications Information Center - University of Colorado website, originally written after Hurricane Ivan in 2004

["Gone with the Water"](#) - prophetic National Geographic feature written in October 2004

["Washing Away" \(NOLA.com\)](#) - A series of investigative newspaper accounts mapped out the risk in 2002

[BBC News - New Orleans: Nature's revenge?](#)

[Guardian - Katrina comes home to roost](#)

[BBC News - 'We knew it would happen'](#) - Residents return to New Orleans a month after Hurricane Katrina

Images, animations and mapping

[NASA - Hurricane resource page](#) - good satellite images and animations

[Guardian](#) - interactive guide to Katrina

[Google Earth Katrina](#) - For teachers using the powerful Google Earth you'll be delighted to know that they are adding imagery of the impact of Hurricane Katrina

[www.wvltv.com](#) - Aerial photos from New Orleans show the effects of flooding after two levees were breached

[New York Times](#) - interactive GIS graphic providing day by day satellite images, maps of New Orleans with flooding, impacts, demographic data, improvements and notes on response

[ESRI Arcweb](#) - GIS Hurricane Katrina Disaster Viewer

Interesting links and teachers' resources

[Wikipedia, the free encyclopedia](#) - lots of information and cross-links

[The Why Files](#) - Fixing nature; fixing levees - As New Orleans sinks and the seas rise, hurricanes are getting worse. Does it make sense to start restoring marshes and barrier islands that dampen the hurricanes? Could wetlands moderate the next Katrina?

[Geography Pages](#) - Katrina pages from Alan Parkinson

[Geointeractive](#) - useful, informative and powerful PowerPoint resource by Val Vannet available at this excellent resource exchange website

[My World is Geography World](#) - and what a wonderful world it is that Tony Cassidy creates - have a look at the excellent resources ideas and inspiration, including a 'reporting the news' activity

[The Geographical Association](#) - a selection of useful links to relevant resources

[GSource](#) - Geography and Environment Information Gateway

Hurricane Rita

[Wikipedia, the free encyclopedia](#) – Hurricane Rita

[BBC](#) - Images of Rita aftermath

[BBC](#) - hurricane Rita - The Impact

[Guardian](#) – in pictures Hurricane Rita

[Guardian](#) - US relieved as Rita rolls past

Curriculum links

A recent article in *The Guardian Education* (13 September 2005) provides further analysis along with some excellent suggestions for teaching at Key Stages 2, 3 and 4.

Guardian Education - **Victims of geography**

<http://education.guardian.co.uk/egweekly/story/0,,1568101,00.html>

Key stage 3

Citizenship 1a, 1h, 1i, 2a-b, 3a;

Geography 2a-g, 3a-e, 4a-b, 6c, 6e, 6j

Key stage 4

Citizenship 1a, 1h, 1i, 2a-b, 3a;

Geography Human and physical geography; global issues: population growth and urbanisation; global warming

Scottish curriculum

Environmental studies (social subjects) S1; S2 (levels D-F)