DEFINING RISK AND ITS ROLE IN DISASTER MANAGEMENT

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Since 2005

FIDS 25
CELEBRATING 1989 - 2014

2000-02
RISK

Hazard or threat and uncertainty

Expected loss

Uncertainty, elements at risk, community perception

Probability, impact

Frequency, consequences, preparedness

Likelihood and exposure to hazard

Probability, vulnerability, social factors
Here, $R = risk$;
$H = hazard$, determined as a probability (or likelihood) of the occurrence of hazard;
$V = vulnerability$ (also loss, impact or consequences).
<table>
<thead>
<tr>
<th>Risk evaluation equation</th>
<th>Variable other than probability and impact</th>
<th>Proposed by</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R = p \cdot L^x$</td>
<td>$x (&gt; 1) = \text{people’s perception}$</td>
<td>Whyte and Burton (1982)</td>
</tr>
<tr>
<td>$R = P \cdot S$</td>
<td>$S = \text{severity}$</td>
<td>Government of Michigan (2001)</td>
</tr>
<tr>
<td>$R = p \cdot V \cdot n$</td>
<td>$n = \text{social consequences}$</td>
<td>Ferrier and Haque, 2003</td>
</tr>
<tr>
<td>$Risk = \frac{H \cdot L}{\text{preparedness (mitigation)}}$</td>
<td>Preparedness or mitigation are measurable measures</td>
<td>Smith (2004)</td>
</tr>
<tr>
<td>$R = p \cdot L \cdot f(x)$</td>
<td>$f(x) = \text{risk aversion factor}$</td>
<td>Schneider (2006)</td>
</tr>
<tr>
<td>$R = H \cdot V \cdot M$</td>
<td>$M = \text{manageability or ability of humans}$</td>
<td>Noson (2009)</td>
</tr>
<tr>
<td>$R = H \cdot \text{Elements at Risk} \cdot V$</td>
<td>$\text{Elements at Risk} = \text{physically exposed assets}$</td>
<td>Smith and Petley (2009)</td>
</tr>
<tr>
<td>$R = H \cdot (V \cdot cp)$</td>
<td>$cp = \text{community perception}$</td>
<td>Nirupama (2012)</td>
</tr>
</tbody>
</table>
Disaster Risk Management

- Threat recognition - risk and vulnerability identification
- Risk analysis and assessment
- Risk control options - structural, non-structural, cost/benefit analysis
- Strategic planning - economic, political and institutional support considerations
- Resilience building, community participation
- Knowledge management, sustainable development
- Response, recovery, reconstruction, rehabilitation

Encyclopedia of Natural Hazards
Editors: Peter T. Bobrowsky
ISBN: 978-90-481-8699-0 (Print) 978-1-4020-4399-4 (Online)
Threat recognition - risk and vulnerability identification

Risk from natural and technological hazards

Recognizing vulnerabilities

Images of natural disasters and vulnerable populations.
Risk analysis and assessment – Qualitative approach

Pressure and Release Model (Wisner et al 2004)

The Progression of Vulnerability

ROOT CAUSES
Limited access to Power and Resources
Political and Economic Ideologies

DYNAMIC PRESSURES
Lack of: education and skills; local investments and markets, press freedom, ethical standards
Major forces: population growth, urbanization, debt, deforestation, environmental degradation

UNSAFE CONDITIONS
Physical: dangerous locations, unsafe buildings
Economical: livelihoods at risk, low income
Social: special groups at risk, lack of local institutions
Institutional: inadequate disaster preparedness, prevalence of health issues among population

DISASTER
Risk = Hazards $\times$ Vulnerability

HAZARDS
Hydrometeorological, geological, biophysical

Access to Resources Model
Wisner et al 2004

- **Social Relations**
  - **Households**
    - Entertainment sector
    - African Americans 67%
    - Women headed households 41%
    - Women in New Orleans 54%
    - Elderly living alone
    - Illegal immigrants
  - **Household Access Profile**
    - Limited access to: information; transportation
    - Lack of: network; capital, land; skills/education/training; food and water

- **Structure of Domination**
  - **Income Opportunities and Access Qualifications**
    - Widespread disruption due to the flooding; loss of livelihoods due to: no access to facilities; shut down of oil/gas production; lost businesses for musicians and retailers; damaged schools and hospitals (teachers, nurses)
  - **Household Choices of Livelihoods**
    - Humanitarian aid, donation funds, Government relief, borrowing from family/friends, draw from personal savings, volunteer
  - **Household Budget**
    - Economic disparities and decline; deficits

- 450,000 displaced; >1,500 dead; demography changed

- **Decisions**
  - New disaster resilient standards; rebuild or relocate; disposal of assets if; back to school; address immediate livelihood issue
Quantitative Approaches
HRVA - Hazard Risk Vulnerability Assessment

Understanding the magnitude, frequency of occurrence, and severity of consequences and prioritization of risks
# Measuring Impact

<table>
<thead>
<tr>
<th>Category</th>
<th>Rank</th>
<th>Description</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatality</td>
<td>1</td>
<td>Very Low</td>
<td>0-4 deaths: 2 reported</td>
</tr>
<tr>
<td>Injury</td>
<td>2</td>
<td>Low</td>
<td>4-50 people: 24 reported</td>
</tr>
<tr>
<td>Critical Facility</td>
<td>3</td>
<td>High</td>
<td>Evacuation &lt;10,000 people: 12,500 reported</td>
</tr>
<tr>
<td>Lifelines</td>
<td>2</td>
<td>Low</td>
<td>Disruption 1-2 days without Gas &amp; Electricity</td>
</tr>
<tr>
<td>Property Damage</td>
<td>3</td>
<td>High</td>
<td>Localized Severe Damage: Contained to a 2 km radius and involved over 580 Homes</td>
</tr>
<tr>
<td>Environmental Impact</td>
<td>3</td>
<td>High</td>
<td>Localized Severe Damage: Smoke, Asbestos and Burning Metal affected residents homes &amp; businesses</td>
</tr>
<tr>
<td>Economic/Social Impact</td>
<td>3</td>
<td>High</td>
<td>Extended &amp; Widespread: Lawsuits continue for properties damaged, area residents experienced trauma and fear from threat of asbestos contamination</td>
</tr>
</tbody>
</table>
Risk Prioritization

- Frequency:
  - Very Low
  - Low
  - High
  - Very High

- Severity:
  - Frequent or very likely
  - Moderate or likely
  - Occasional, slight chance
  - Unlikely, improbable
  - Highly unlikely (rare event)
  - Very rare event

Examples:
- Risk Index: 10
  - DANGEROUS GOODS SPILL
- Risk Index: 15
  - INFRASTRUCTURE FAILURE
- Risk Index: 8
  - TRANSPORT ACCIDENT - ROAD
- Risk Index: 12
  - EXPLOSION OR EMISSIONS
Hazard Identification and Risk Assessment for the Province of Ontario

Risk = Frequency*Consequence*Changing Risk
Changing Risk = Change in Frequency + Change in Vulnerability
Measuring Impact

- Social Impacts
- Property Damage
- Critical Infrastructure Service Disruptions/Impact
- Environmental Damage
- Business/Financial Impact
- Psychosocial Impacts
## Risk Prioritization

<table>
<thead>
<tr>
<th>Level of Risk</th>
<th>Description</th>
<th>Hazards</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;50</td>
<td>Extreme</td>
<td></td>
</tr>
<tr>
<td>41 - 50</td>
<td>Very High</td>
<td></td>
</tr>
<tr>
<td>31 - 40</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>21 - 30</td>
<td>Moderate</td>
<td></td>
</tr>
<tr>
<td>11 - 20</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>&lt;10</td>
<td>Very Low</td>
<td></td>
</tr>
<tr>
<td>Category</td>
<td>Rating</td>
<td>Score</td>
</tr>
<tr>
<td>--------------</td>
<td>--------</td>
<td>-------</td>
</tr>
<tr>
<td>History</td>
<td>High</td>
<td>10</td>
</tr>
<tr>
<td>Vulnerability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>People</td>
<td>Medium</td>
<td>5</td>
</tr>
<tr>
<td>Property</td>
<td>High</td>
<td>10</td>
</tr>
<tr>
<td>Max Threat</td>
<td>High</td>
<td>10</td>
</tr>
<tr>
<td>Probability</td>
<td>Medium</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total Risk</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Risk Prioritization

Total Risk = 100

- Develop risk reduction plans for these hazards
- No immediate need to develop risk reduction plans
SMUG – SERIOUSNESS, MANAGEABILITY, URGENCY, GROWTH

SMUG RATINGS

<table>
<thead>
<tr>
<th></th>
<th>High</th>
<th>Medium</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seriousness</td>
<td>4-5</td>
<td>2-3</td>
<td>0-1</td>
</tr>
<tr>
<td>Manageability</td>
<td>&gt;7+</td>
<td>5-7</td>
<td>0-4</td>
</tr>
<tr>
<td>Urgency</td>
<td>&gt;20 yrs</td>
<td>&lt;20</td>
<td>100 yrs</td>
</tr>
<tr>
<td>Growth</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>
# SMUG Ratings

<table>
<thead>
<tr>
<th>Hazard</th>
<th>S</th>
<th>M</th>
<th>U</th>
<th>G</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utility Failure - Communications</td>
<td>3</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>Flooding</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td>Public Health Emergency</td>
<td>3</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>Utility Failure - Power</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>Storm Surge</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>Transportation - Road</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Civil Unrest</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>6</td>
</tr>
</tbody>
</table>
HAZARD ZONING

• For an explosion caused by a propane storage tank of up to 9.5 tonne (5,000 USWG) capacity, the projectile distance is about 320m.
• The recommended evacuation zone is 2.5 times the projectile distance.
VULNERABILITIES

- Social
- Physical
- Economic
- Critical Infrastructure
- Environmental
PHYSICAL

\[ PV_{ji} = \frac{(MJ + C)\%DA_i}{\sum_{i=1}^{n} D(Zone_j \%DA_i)} \]

where \( MJ \) is dwellings requiring major repairs, \( C \) represents construction of the dwellings and other buildings prior to 1960, \( D \) is the number of buildings in \( \%DA \) polygonal area, \( i = \) number of DA per zone; \( j = \) number of zones.
\[ EV_{ji} = \frac{(UE + F-50)\%DA_i}{\sum_{i=1}^{n} POP(Zone_j; \%DA_i)} \]

where \( i \) = number of DA per zone, \( j \) = number of zones.
CRITICAL INFRASTRUCTURE

\[ CI_{ji} = CI_j \times \frac{\%DA_{ij}}{A_j} \]

where \( CI_j \) is the number of critical infrastructure elements in Zone \( j \), \( \%DA_{ij} \) is the polygonal area of \( \%DA_i \) in Zone \( j \), and \( A_j \) is the polygonal area of Zone \( j \).
SPATIAL RISK ASSESSMENT MODEL

- Social Vulnerability $i$, $w = 0.25$
- Economic Vulnerability $i$, $w = 0.25$
- Physical Vulnerability $i$
- Critical Infrastructure Vulnerability $i$

Total Vulnerability $i$ leads to Spatial Risk $ij$

Hazard Zone $j$, $w = 0.6/0.3/0.1$
RISK ESTIMATION

\[ R_{nj} = H_j \times 0.25 \sum_{j=1}^{3} \sum_{i=1}^{n} (SV_{ji} + EV_{ji} + PV_{ji} + CI_{ji}) \]

i = DA, j = hazard zone, and n is the number of DAs in each zone;

\( R_{nj} \) = spatial risk index of all DAs located in zone j;

\( H_j \) = relative hazard zone index;

\( SV_{ji} \) = social vulnerability component;

\( EV_{ji} \) = economic vulnerability component;

\( PV_{ji} \) = physical vulnerability component;

\( CI_{ji} \) = critical infrastructure component;

0.25 = average of the total four individual vulnerability types.
Table 1. Spatial risk estimation for Zone 1 ($j = 1$).

<table>
<thead>
<tr>
<th>DA ID</th>
<th>$DA_i$</th>
<th>Total $V_{ji}$</th>
<th>$R_{ji}; H_j = 0.6$</th>
</tr>
</thead>
<tbody>
<tr>
<td>352,021,159</td>
<td>4.638</td>
<td>0.2659</td>
<td>0.1596</td>
</tr>
<tr>
<td>352,021,160</td>
<td>0.140</td>
<td>0.0485</td>
<td>0.0291</td>
</tr>
<tr>
<td>352,021,162</td>
<td>0.187</td>
<td>0.0197</td>
<td>0.0118</td>
</tr>
<tr>
<td>352,021,165</td>
<td>0.309</td>
<td>0.0313</td>
<td>0.0188</td>
</tr>
<tr>
<td>352,021,166</td>
<td>0.167</td>
<td>0.9409</td>
<td>0.5645</td>
</tr>
<tr>
<td>352,021,167</td>
<td>0.325</td>
<td>0.3932</td>
<td>0.2359</td>
</tr>
<tr>
<td>352,021,182</td>
<td>0.358</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
</tbody>
</table>
Risk Prioritization

(red = very high risk; yellow = high risk; blue = medium risk; greyish green = low risk)
### CONVENTIONAL APPROACH APPLIED TO ONTARIO HAZARDS

<table>
<thead>
<tr>
<th>SN</th>
<th>Hazard</th>
<th>Likelihood (1)</th>
<th>Impact (2)</th>
<th>Risk Index ($RI$) $(1) \times (2) = (3)$</th>
<th>$RI$ (%) $(3) \div 20 \times 100 = (4)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Winter storm</td>
<td>5</td>
<td>3</td>
<td>15</td>
<td>75</td>
</tr>
<tr>
<td>2</td>
<td>Wildfire</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>Land subsidence</td>
<td>4</td>
<td>2</td>
<td>8</td>
<td>40</td>
</tr>
<tr>
<td>4</td>
<td>Tornado</td>
<td>4</td>
<td>3</td>
<td>12</td>
<td>60</td>
</tr>
<tr>
<td>5</td>
<td>Epidemic/ pandemic</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>60</td>
</tr>
<tr>
<td>6</td>
<td>Extreme heat</td>
<td>3</td>
<td>3</td>
<td>9</td>
<td>45</td>
</tr>
<tr>
<td>7</td>
<td>Landslide</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>8</td>
<td>Expansive soil</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td>30</td>
</tr>
<tr>
<td>9</td>
<td>Hurricane</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>40</td>
</tr>
<tr>
<td>10</td>
<td>Earthquake</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>11</td>
<td>Hail storm/ wind storm</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>12</td>
<td>Flash flood from snowmelt</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>60</td>
</tr>
</tbody>
</table>

* max value of $RI$, based on max ranks of Likelihood =5 (Table 2) and Impact = 4 (Table 1)

<table>
<thead>
<tr>
<th>SN</th>
<th>Hazard</th>
<th>Likelihood (1)</th>
<th>Impact (2)</th>
<th>Community Perception (cp) (3)</th>
<th>Risk Index (RI_{cp}) (4)×(2×3) (4)</th>
<th>(RI_{cp}) (%) (4)÷100×100 (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Winter storm</td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>2</td>
<td>Wildfire</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
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<td>4</td>
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<td>1</td>
<td>8</td>
<td>8</td>
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<tr>
<td>4</td>
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<td>4</td>
<td>3</td>
<td>1</td>
<td>12</td>
<td>12</td>
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<td>4</td>
<td>5</td>
<td>60</td>
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<td>3</td>
<td>5</td>
<td>45</td>
<td>45</td>
</tr>
<tr>
<td>7</td>
<td>Landslide</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>Expansive soil</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>9</td>
<td>Hurricane</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>10</td>
<td>Earthquake</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td>15</td>
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<tr>
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<td>3</td>
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<td>1</td>
<td>3</td>
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<td>3</td>
<td>4</td>
<td>5</td>
<td>60</td>
<td>60</td>
</tr>
</tbody>
</table>

* max value of \(RI_{cp}\) - based on max ranks of Likelihood = 5, Impact = 4, and cp = 5
Risk control options - structural, non structural, cost/benefit analysis

The 1997 Red River Flood

Criteria

#1: Minimize flood depth
#2: Minimize damage - buildings, roads, crops

Alternatives

# 1: Dike to protect the City of St. Adolphe.
# 2: Raise floodway gate by 1m.
# 3: Lower floodway gate by 1m.

Multiple decision makers’ preferences

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Decision Maker’s Preference (W_i)</th>
<th>Weight set #1</th>
<th>Weight set #2</th>
<th>Weight set #3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flood depth</td>
<td></td>
<td>0.5</td>
<td>0.1</td>
<td>0.9</td>
</tr>
<tr>
<td>Damage</td>
<td></td>
<td>0.5</td>
<td>0.9</td>
<td>0.1</td>
</tr>
</tbody>
</table>
Flood depth for simulated alternative #2
Flooded buildings for simulated flood protection alternative #2
Flooded fields for simulated flood protection alternative #2
Flooded roads for simulated flood protection alternative #2
$ Damage$

Buildings

\[ y = 76879x^3 - 344873x^2 + 470283x + 538659 \]

Roads

\[ rd = 18.889L^2 + 261.25L + 300000 \]

Crops

\[ ad = \sum[(1 - yield) \times (cp) \times A \times price] \]
Water surface elevation for three alternatives

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Total discharge at floodway entry point (m$^3$/sec)</th>
<th>Water surface elevation (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dike</td>
<td>3650</td>
<td>232.89</td>
</tr>
<tr>
<td>Floodway 1</td>
<td>4730</td>
<td>233.83</td>
</tr>
<tr>
<td>Floodway 2</td>
<td>2900</td>
<td>231.71</td>
</tr>
</tbody>
</table>
Multi-Criteria Decision Making using Compromise Programming

Possible solutions

Ideal point

Infeasible region

Criterion 2

Criterion 1
Criteria Image

Fuzzify Criteria Image

Fuzzify Parameter $p$ and Weights $w_i$

Apply Distance Metric Formula

$$
\tilde{f}_{1,1,1,1} + \tilde{f}_{1,2,1,1} + \ldots + \tilde{f}_{1,y,n,1} + \ldots + \tilde{f}_{2,1,1,2} + \tilde{f}_{2,2,2,2} + \ldots + \tilde{f}_{2,y,n,2} + \ldots + \tilde{f}_{x,1,1,m} + \tilde{f}_{x,2,2,m} + \ldots + \tilde{f}_{x,y,n,m}
$$

Fuzzy Distance Metric

Defuzzify Distance Metric

Rank the Alternatives by comparing Distance Metric values

Preferred alternatives
Ranking of Alternatives

[Image of a map with different colored areas representing dike, floodway 1, and floodway 2.]
Strategic planning - economic, political and institutional support considerations

Response, recovery, reconstruction, and rehabilitation

Fatalities of historical winter storms in Eastern Canada during 1900 to 2014
Residents’ Views on New Orleans Recovery...

In general the recovery and rebuilding effort in the greater New Orleans area is going in the...

Has New Orleans mostly recovered from Hurricane Katrina?

Do you think most Americans are still aware that New Orleans has not fully recovered from Katrina, or that they have forgotten about the challenges facing New Orleans?

Source: Kaiser Family Foundation, New Orleans Five Years After the Storm: A New Disaster Amid Recovery, August 2010
Knowledge management and sustainable development

\[ \text{RMI} = \left( \frac{\text{RMI}_\text{RI} + \text{RMI}_\text{RR} + \text{RMI}_\text{DM} + \text{RMI}_\text{FP}}{4} \right) \]

RMI = Risk Management Index

\[ \text{RMI}_\text{RI} = \text{risk identification, includes objective and perceived risks}; \]
\[ \text{RMI}_\text{RR} = \text{risk reduction measures including prevention and mitigation}; \]
\[ \text{RMI}_\text{DM} = \text{measures of response and recovery}; \text{ and} \]
\[ \text{RMI}_\text{FP} = \text{governance and financial protection measures}. \]

Cardona (2002)
<table>
<thead>
<tr>
<th>Land Use Classes</th>
<th>LANDSAT-1 MSS Jul 7, 1974 (%)</th>
<th>LANDSAT-5 TM Jul 23, 1990 (%)</th>
<th>LANDSAT-7 ETM Oct 30, 2000 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woods</td>
<td>24.01</td>
<td>11.98</td>
<td>13.06</td>
</tr>
<tr>
<td>Row Crops &amp; Legume Grasses</td>
<td>22.78</td>
<td>29.18</td>
<td>13.20</td>
</tr>
<tr>
<td>Small Grains or Grass</td>
<td>31.56</td>
<td>34.91</td>
<td>16.84</td>
</tr>
<tr>
<td>Fallow Land</td>
<td>4.79</td>
<td>2.34</td>
<td>30.06</td>
</tr>
<tr>
<td>Urban</td>
<td>10.07</td>
<td>16.72</td>
<td>22.25</td>
</tr>
<tr>
<td>Homestead</td>
<td>3.14</td>
<td>2.05</td>
<td>1.86</td>
</tr>
<tr>
<td>Water</td>
<td>3.65</td>
<td>2.82</td>
<td>2.73</td>
</tr>
</tbody>
</table>
Resilience building and community participation

ENGAGING PUBLIC FOR BUILDING RESILIENT COMMUNITIES TO REDUCE DISASTER IMPACT


Education

- Completed High School: 24%
- Some College/University: 22%
- Completed College/University: 15%
- Some College/University: 15%
- Other: 12%
- No Response: 2%
- Professional Degree: 3%
- Doctoral Degree: 0%
- Master's Degree: 7%
Employment

- Employed: 12%
- Not employed: 83%
- No Response: 5%
Type of Housing Occupied by the Participants

- Detached/Single: 5
- Townhouse/Semi-detached: 6
- Bungalow: 2
- Condo: 6
- Apartment: 18
- Other: 2
- No Response: 2
Proximity to Potential Risks
Transportation

- Public Transit: 64%
- No Response: 27%
- Taxi: 2%
- Other: 2%
- Personal Vehicle: 5%
- Carpool/Family/Friends: 0%
People’s perception of their safety, exposure to risk or threat, sense of belonging with their community, and preparedness to deal with emergencies.
Preferences for Seeking help when Faced with Emergencies

- No Response: 33%
- Help from Family: 35%
- Help from Friends: 20%
- Find Shelter: 8%
- Receive Aid: 2%
- Re-locate Temporarily: 0%
- No Help: 2%
CONGRATULATIONS FIDS

FIDS
CELEBRATING 1989 - 2014