Flood Risk Perception on Lands “Protected” by Levees

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Floodplain Management Association: November 13, 2012

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Flooding is the number one disaster in the world
Despite a U.S. policy aimed at reducing risk

Flood damages are rising

NOAA photo library

New Orleans 1927
New Orleans 1965
New Orleans 2005
Despite a U.S. policy aimed at reducing risk

Flood damages are rising,
A fatal flaw in policy:
land behind levees no longer considered official “floodplain”

→ increasing development (risk) behind the levees.
Risk = likelihood X consequences
In the United States, Levees Increase Risk
55% U.S. Population Lives in Counties Protected by levees - Times Picayune 2010

Sacramento “Pocket”
California Dept Water Resources
Flood Insurance Act 1968

Goal: to reduce federal expenditures in disaster relief

- Prevent further development in floodplains
- Offer flood insurance to those already at risk
FEMA Flood Insurance Act 1968

Adopted an *insurance standard* of 1/100yr flood
How it works

“In the floodplain”
No new development
Insurance required
“floodproof” houses

100-year floodplain

Special Flood Hazard Area
Sound Idea: identify flood-prone lands, map them, and prohibit development therein.

“Devil is the the Details”

- Land behind levees treated differently

“In the floodplain”
No new development
Insurance required
“floodproof” houses

“Out of the floodplain”
No insurance required
No building requirements

100-year floodplain
Special Flood Hazard Area

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The story of Bill and Bob

**Bill** is ‘safe’ behind a FEMA–accredited levee

**Bob** has to buy flood insurance

Graphic: John Cain

Graphic: John Cain

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Does not account for **residual risk**

\[ P(f_{\text{overtopping}}) = 26\% \text{ over 30 years} \]
How well do residents “protected” by 100-year levees understand their true level of risk?

Other studies:
Terpstra and Gutteling (2008): Netherlands
Siegrist and Gutscher (2006): Switzerland
Why does it matter?

**Behavior** in an emergency is tied to **risk perception**

Flood **losses** tend to be **larger** where people are unaware

Exposing people to **involuntary risk** means people cannot choose to avoid the threat
The Question

Why does it matter?

In a **floodplain**: water levels rise slowly
Behind a **levee**: wall of water

Gulf of Mexico, New Orleans

Sacramento River, upstream of the Delta

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The Question

Factors influencing risk perception

Experience
Misunderstanding terminology

“100-year flood?”

Trust in structures

Trust in administration

Trust in administration

Media

Benefits

Denial

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• New development (2000)
• 1300 houses
• Reaccredited “100-year” levee (2006)
• 30,800 houses slated for development in San Joaquin County that face a flood threat

(Fridirici, 2008)
Lands from 0 to -12ft below sea-level
Most households earn $80,000/year

Most households have a 4-year university degree

Ethnically diverse
Method

Survey questions: awareness, preparation, concern, flood knowledge, experience

What do YOU think about flood risk in Stockton?

Thank you very much for your participation in this survey. When you are finished, please place the questionnaire in the enclosed self-addressed envelope and drop it in the mail. Any question you would prefer not to answer may be left blank. Please attach additional pages if needed. For any clarification, please email us at judy@berkeley.edu. Thank you very much.

1. How long have you lived in your current home? (check one)
   - 0-2 years
   - 3-5 years
   - 6-10 years
   - 11-20 years
   - more than 20 years

2. How much longer do you estimate you will live in your current home? (check one)
   - 0-2 years
   - 3-5 years
   - 6-10 years
   - 11-20 years
   - more than 20 years

3. How long have you lived in the Stockton area? (check one)
   - 0-2 years
   - 3-5 years
   - 6-10 years
   - 11-20 years
   - more than 20 years

4. Do you rent your home, own it, or some other arrangement? (check one)
   - Rent
   - Own
   - Other (please explain)

   If you own your home, do you have a fixed mortgage? (check one) 
   - Yes
   - No

5. What are the five most important reasons you choose to purchase (or rent) your home? (please rank on a scale from 1 (being the most important) to 5 (being the least important))
   - Close to the schools
   - Close to work
   - Close to the family
   - Low price compared to similar houses elsewhere
   - Always lived in the Delta region
   - Close to the river
   - Character of area (e.g., environment, landscape, etc)
   - Architectural style of home
   - Other (please explain)

6. Do you have flood insurance? (check one)
   - Yes
   - No

7. Do you consider your property to be at high, medium, or low risk of flooding? (check one)
   - High
   - Medium
   - Low

8. Have you ever experienced flooding? (check all that apply)
   - In your past residence
   - In your current residence
   - In a temporary residence (e.g., on vacation)
   - No

   If you answered "Yes, when was it?" (write in date/year)
   - What happened? (please explain)

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Survey Results

Residents **not aware** of flood risk

**Not told** they are at risk

**Unprepared** for a flood
Risk Perception

Is your property at risk?
- high
- moderate
- low
- no

Confidence in levee protection
- not at all
- somewhat
- confident
- very

Concern of flooded property
- very concerned
- concerned
- somewhat
- not at all
If a levee broke and your property flooded, how deep would it get?

Results

50% were correct
50% underestimated or were unsure
Expected damage to property

“hardly any, maybe just the front lawn”

“six inches at best, I’d think”

“carpet, floors, walls, insulation...”

“gone...everything...Total loss”.
Access to information?

**60%** have **not been informed**

**60%** **rarely hear** about flooding

**30%** never hear about **flooding**

**6%** spoke with a real estate agent about flooding
Understanding of a “100-year flood”

- Yes: 2.6%
- Thought they understood, but didn’t: 31%
- Somewhat: 14%
- No: 52.4%

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Understanding of a “100-year flood”

“Levees were made to protect us for 100 years”

“A major flood that comes every 100 years, it’s a worst-case scenario.”

“The last flood came in 1950—the next one will be in 2050”
Preparation

20% households have flood insurance

13% residents took “precautionary measures”: evacuation plans, valuables on 2\textsuperscript{nd} story, disaster supply kit.

No boats.
Neighborhood Voices

“It is my understanding that my area is not in a flood zone. That the levees have been reinforced in the 1980s. If I felt or learned that a flood was eminent, I would take the steps to protect my property.”

“We’re pretty insulated and inland. I can’t imagine that we would sustain much flood damage.”
Neighborhood Voices

“Flooding is unlikely and if flooding occurs, it will be minimal”

“I would not evacuate because I am handicapped and disabled, and have trouble getting around”

“I swim very well”
Residents are exposed to **involuntary risk**

People of **all levels** of income/education are unaware

Perception that “100-year” standard protects from **all flooding**
Why aren’t residents aware?

Policy indicates it is safe?  
Trust in Governments?

(Terpstra & Gutteling 2008; Motoyoshi 2006)
Flood Insurance Rate Maps:
Don’t show areas that will flood with overtopping

Insurance:
Not required behind levees, rates too low.

Political Pressure
Fear of depressing home prices,
Discourages investment, local business
Recent Constructions: ie; West Sacramento
“We’ve lost the Pioneer spirit”
-Ron Baldwin, San Joaquin County Emergency Services

Why aren’t residents aware?

Photo: California Dept. of Water Resources
Why aren’t residents aware?

Mississippi River Gulf Outlet: Hurricane Protection Barrier

Photo: Jessica Ludy
Diverted and disconnected our rivers from the people
Engineered ourselves out of the “floodplain”
Memories of Floods

Dresden, Germany

Köln, Germany

Sächsische Schweiz, Germany

Vaison-la-Romaine, FR

Galway, Ireland
Memories of Floods

Dordrecht, the Netherlands
Memories of Floods

Memory-free subdivisions

Stockton, California, USA
Discussion: What Can we do?

How do you raise awareness in such a landscape?

Whose responsibility is it?
The United States is not alone.

There is risk everywhere, so why regulate in floodplains?
Stop controlling **floods** *(probability)*
Start controlling **risk** *(probability x consequence)*

Levees can fail catastrophically and people living behind them are not aware
Updates to State and Federal Legislation

**California**: Flood Risk Notification in levee-protected areas
200-year safety standard in urban areas

**National Flood Insurance Program**: (July 6, 2012)*
Flood Risk Notification in levee/dam-protected areas
Map residual risk (behind levees/dams)
Possible insurance requirement (in future)
California: Follow up on Flood Risk Notification
Can we measure whether efforts are successful in raising awareness and changing behavior?

Residual risk in Urban Areas behind 200-year levees is still high and residents trust governments to keep them safe.
Policy Changes:

Land use restrictions in **deep floodplains**

**Building codes** behind levees

Risk disclosure **prior** to real estate purchase

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Elevated walkways in Hafen City, Hamburg

Source: California Dept. Water Resources

Image: Jessica Ludy 2010
Solutions?

Communication Efforts:

**Development** designed to communicate risk (Japan, Germany)

Public outreach, educational programs in schools (Germany)

Involve public with its’ own emergency planning (France)

**High Water Mark Initiative** (FEMA and DWR?)

Lots of opportunities with Social Media

Can we join forces and make this issue a priority?

(USACE Nat’l Levee Safety Program, DWR, Sac District, FEMA, Local Emergency Ops, Flood Awareness/Preparedness week, etc)
“I am an owner-operator (truck driver) in construction. I transport dirt, asphalt, & road base. One year ago I was bringing dirt to a levee on 8-mile road. The dirt was, in my mind, ‘not good.’ It was sand. In the event of a break in the levee, sand will wash away.”

“The correct way of addressing flood hazard is to never allow building in a risk prone area.”

“I need information. This opened my eyes. Plus, I need to check whether this area is in a flood area.”
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United States Fulbright Program


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