

URAdapt

Managing Water at the Urban-Rural Interface for climate change resilient cities

Urban vulnerability and resilience to water mediated climate impacts

1. Definitions
2. Developing Vulnerability Assessment Framework
3. Accra Exposure Risk Mapping

Liqa Raschid-Sally

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Review and Definitions

- Body of literature on vulnerability:
 - Climate scientists focus on hazards
 - Planners and Policy makers focus on susceptibility of city
 - Economists focus on economic consequences of adaptation measures
- Lack of city focused quantitative assessments

Working Definition

- **Vulnerability** : degree of susceptibility, extent to which a system suffers harm.
 - It is the product of the exposure of people or systems to the impacts of climate change which is influenced by the constraints they face in being able to reduce or minimize this exposure, and their sensitivity and resilience
- **Sensitivity**: degree to which a system is affected
- **Resilience**: amount of change system can undergo without changing state

Vulnerability influenced by physical, social and environmental factors

Vulnerability Assessment Framework (work in progress)

Objective

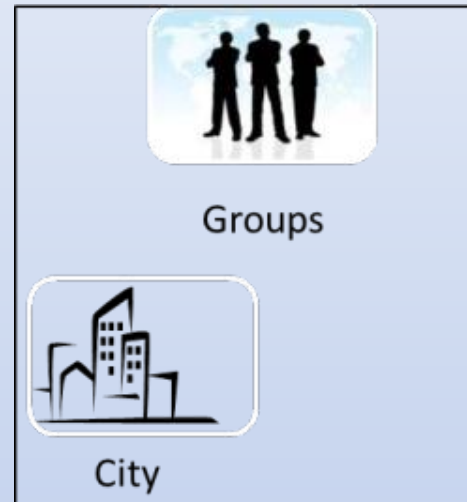
- To identify and assess the vulnerability of systems and groups within cities in order to propose adaptation responses that need to be addressed through both policy and city level interventions.

Vulnerability can be viewed from the broader perspective of systems as well as narrower perspective of individuals and groups

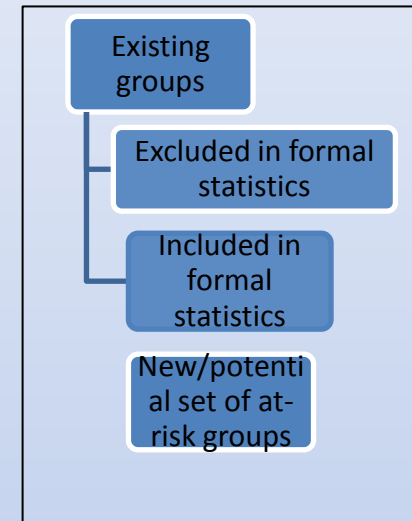
Conceptual framework of categories for urban vulnerabilities to Climate Change



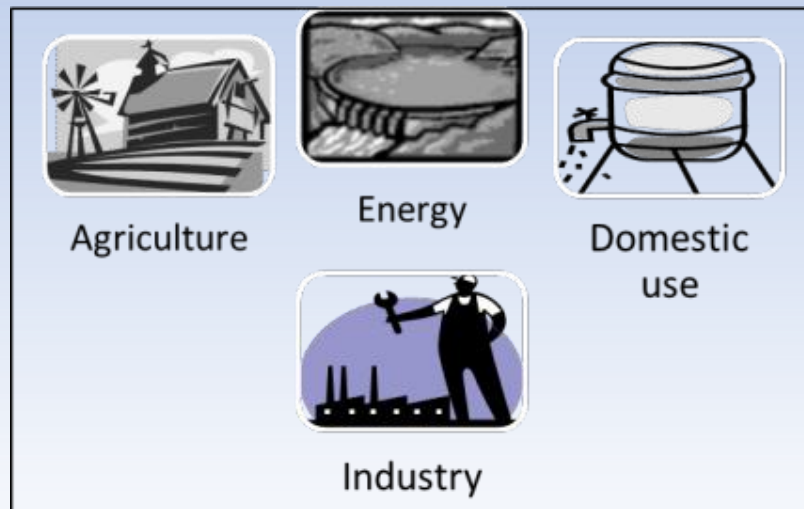
Pathways/media



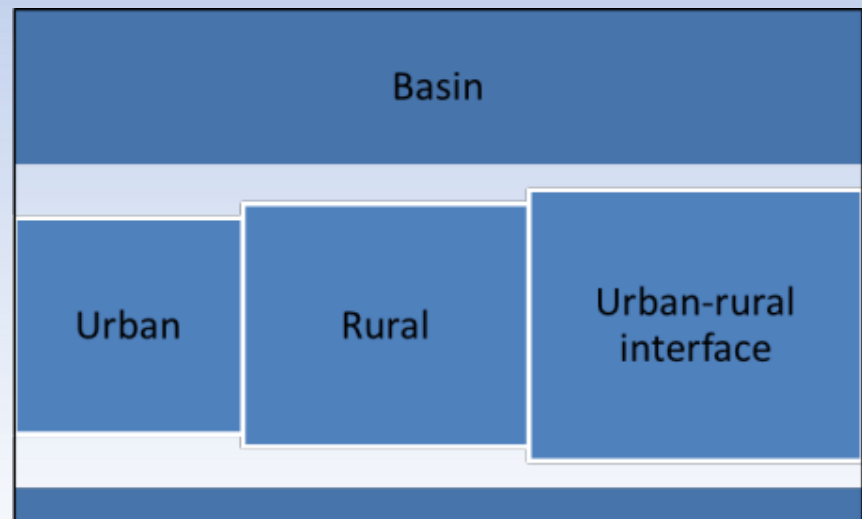
Levels



Groups



Sectors



Spaces

Mapping Exposure Risk Accra

In order to deal with urban
vulnerability to climate change

Vulnerability to climate change

- People's vulnerability to climate change consists of a combination of the following factors:
 - The extent of exposure (rate):
frequency/magnitude/duration
 - Their sensitivity : human/envt conditions
 - Their resilience: adjustment/coping strategies

Climate Change Exposure Rate

- The exposure rate is the most easily understood factor of vulnerability.
- The effects of climate change that Accra will (probably) be exposed to include:

Scenario:

Magnitude: More extreme weather events, thus more extreme droughts and more extreme rains.

Duration : longer

Frequency : more often

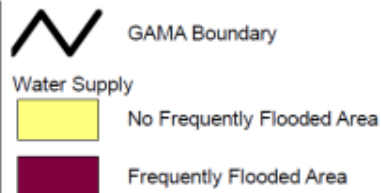
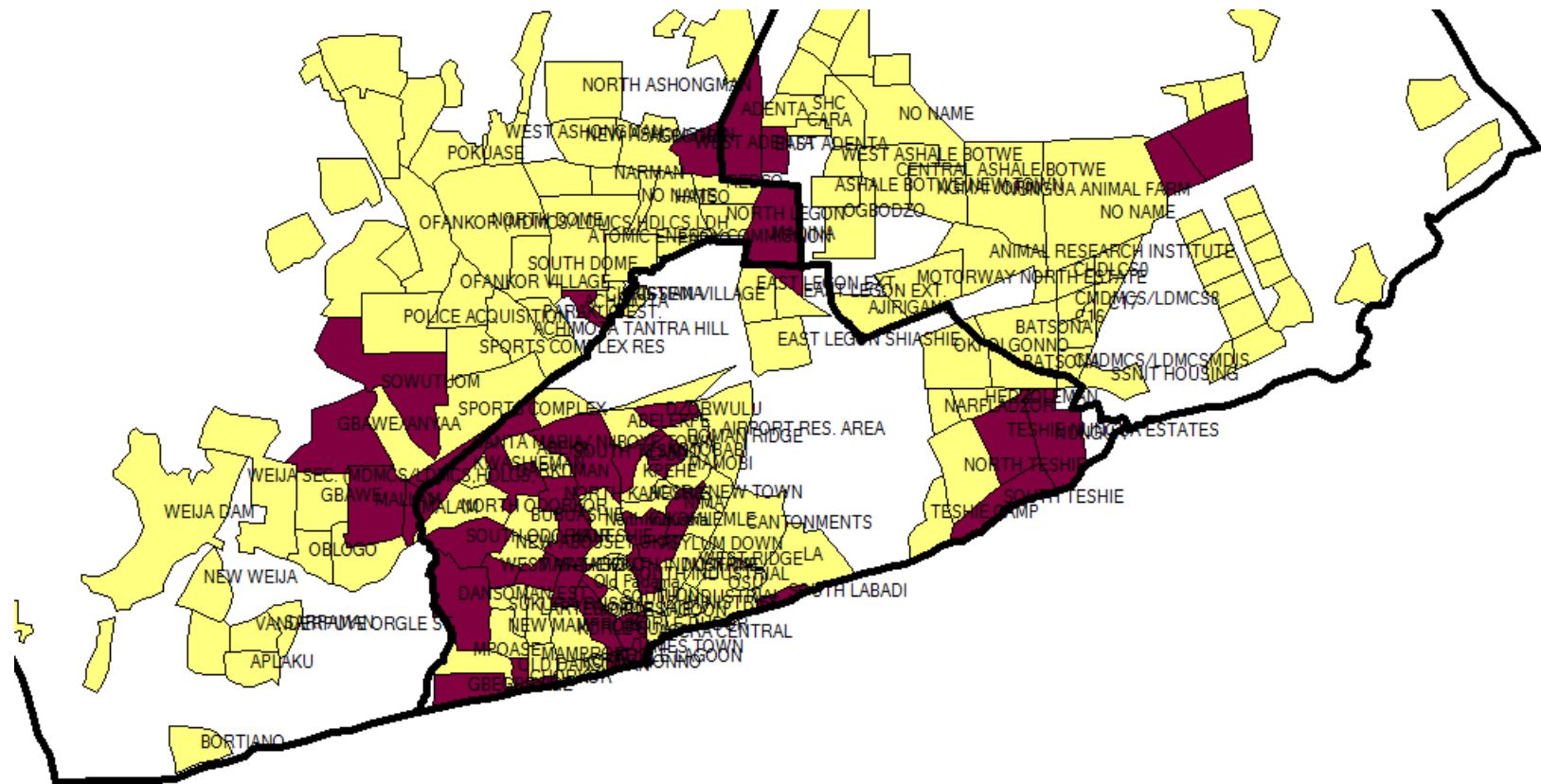
Mapping Accra's Exposure Risk

- In order to work on Accra's exposure Risk, the localities with the highest exposure risk should be known.
- CC effects are more extreme rainfall events, a direct consequence will be **floods**.
- Mapping flood prone areas is first step.
- Validated Assumptions
 - Risks that people experience during flood increases where the **sanitation** is poor (increased health risk).
 - During droughts, people with low quality of **water supply services** likely to face more risk than others.

Exposure Risk Mapping

- Thus, in order to map exposure risk, the following factors should be superimposed per locality:
 - Flood risk
 - Sanitation level (or service quality)
 - Water supply service quality

Frequently flooded areas



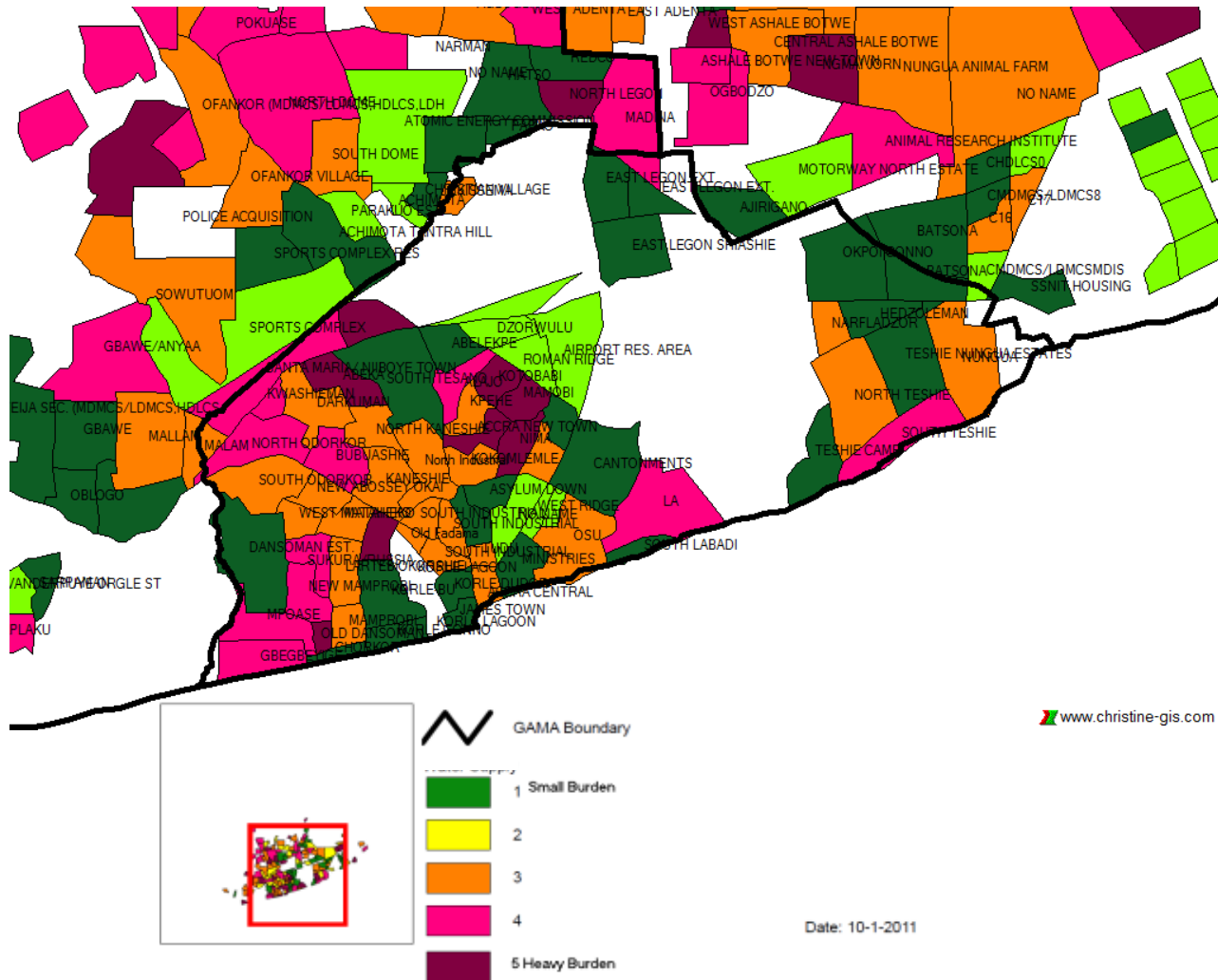
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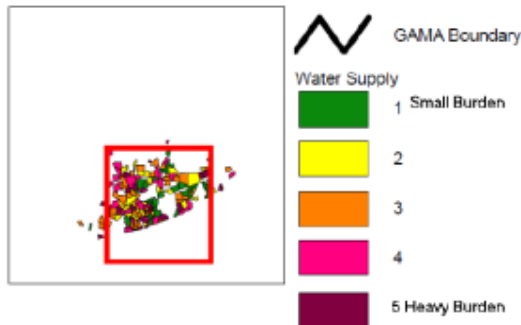
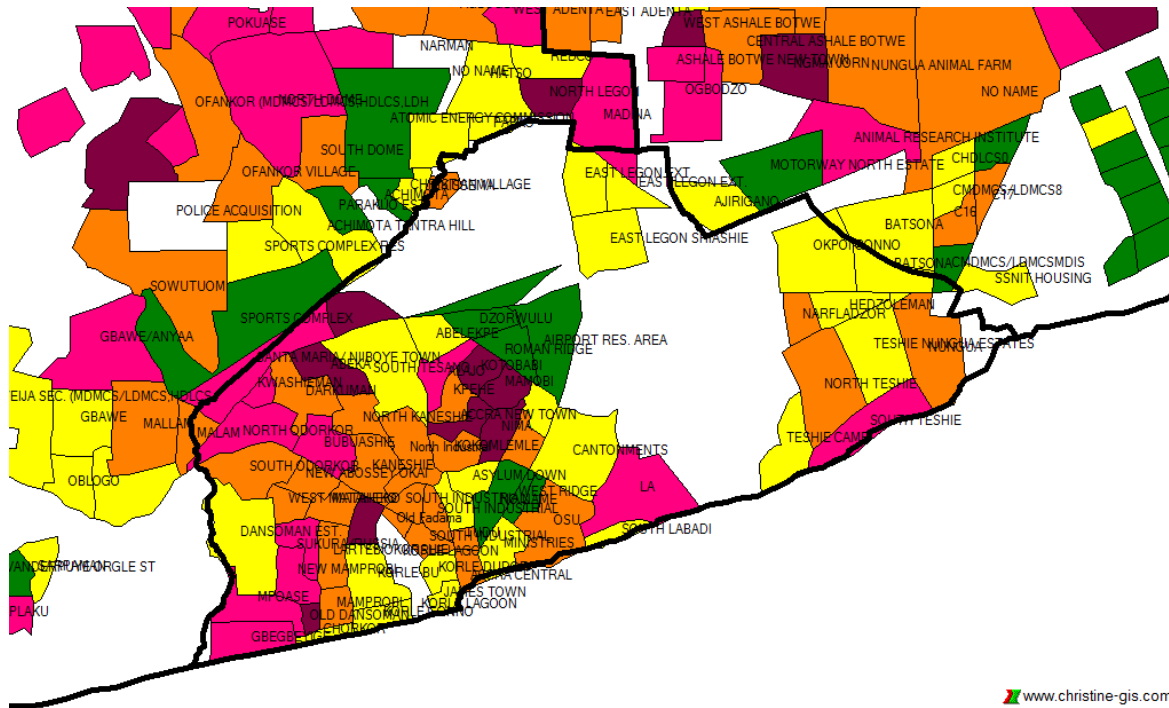
Frequently Flooded Areas Map

- There is no single map indicating frequently flooded areas in Accra
- As a first step, we **Combined** all named localities out of the following sources, without pre-selection:
 - Ludlow, C (2009) Flood modeling in a data-poor region: a satellite data-supported flood model for accra, Ghana
 - Nyarko, B(2002) 'Application of a rational model in GIS for flood risk assessment in Accra, Ghana' , Journal of spatial hydrology, Vol 2, no 1.
 - BGR-GSD (2006) Ghana-Germany Technical Cooperation: Environmental and Engineering Geology for Urban Planning in the Accra-Tema Area, 2003-2006. Technical Reports and Maps. CD-ROM. Bundesanstalt für Geowissenschaften und Rohstoffe (BGR) and Ghana Survey Department (GSD).
 - Personal communication from Mr. W. Ametefe, Head of Drainage at the Hydrological Services Department of the Ministry of Water Resources, Works & Housing on flooded areas.
 - Personal contact with Mr C. Kagblor, Graduate Student Environmental Engineering University of Ghana,
 - National Disaster Management Organization (NADMO) (2009) ' Summary of Disaster Events in Ghana'

Sanitation Burden (Songsore-2005)



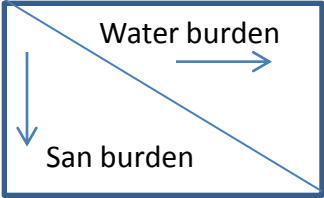
Water Supply Burden (Songsore-2005)



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Making of first exposure map

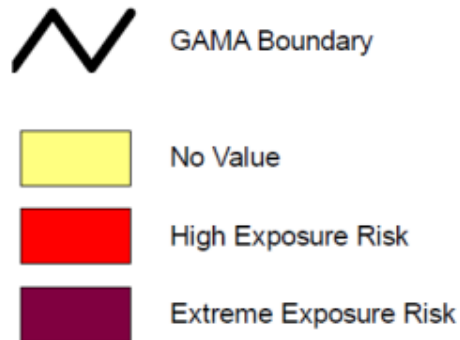
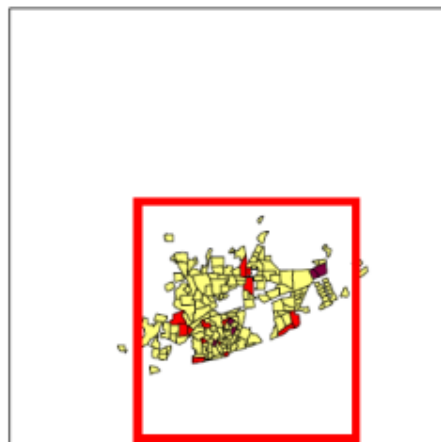
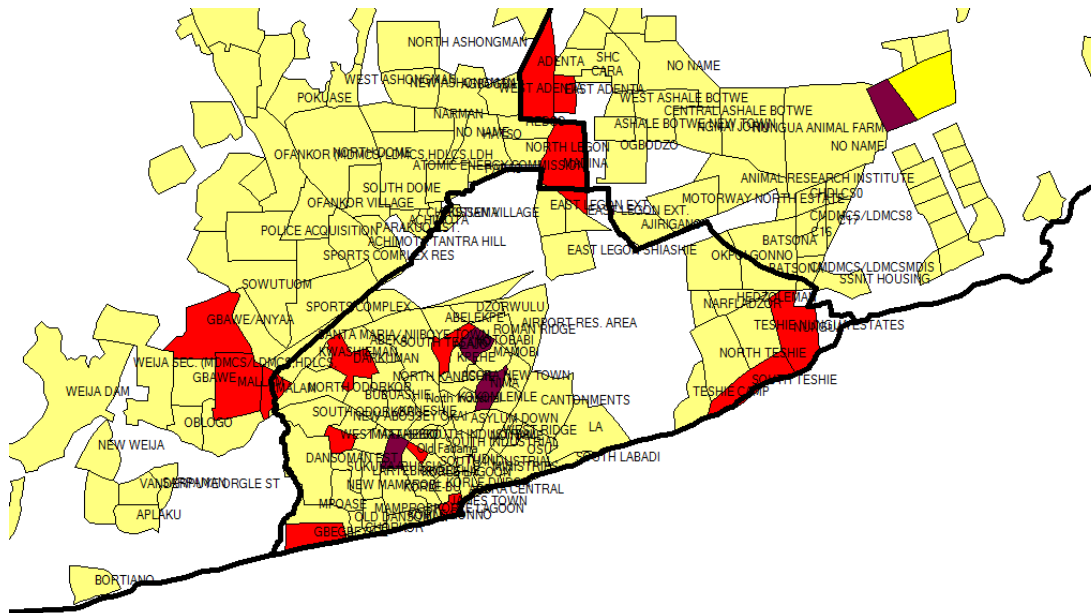
- Primary criterion: Flood Prone Area
- Secondary criterion: WATSAN burden
- Combining by simple averaging

	1	2	3	4	5
1	1	2	2	3	3
2	2	2	3	3	4
3	2	3	3	4	4
4	3	3	4	4	5
5	3	4	4	5	5

Alternative methodology qualitative combination

Water Burden Sanitation Burden	1 Very good	2 Good	3 Moderate	4 Poor	5 Very Poor
1 Very Good	1	2	2	3	3/4
2 Good	2	2	3	3/4	4
3 Moderate	2	3	3/4	4	4/5
4 Poor	3	3/4	4	4/5	5
5 Very Poor	3/4	4	4/5	5	5

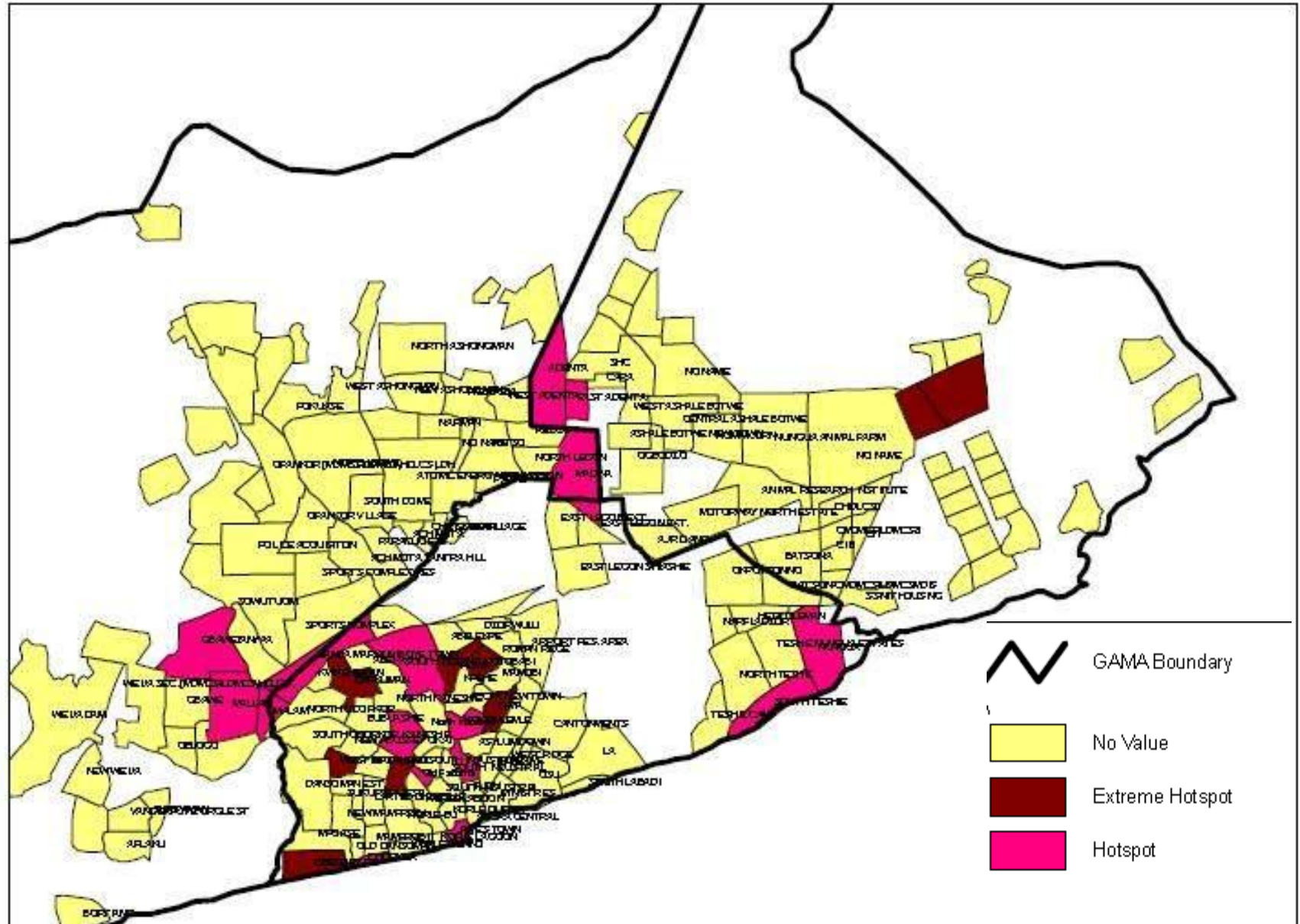
High Exposure Risk Areas



5

Date: 10-1-2011

High Exposure Risk Areas (before fieldwork, new methodology)



Next step..

- 12 high exposure areas identified
- 12 field visits conducted
- Interviews with the following types of community members
 - key persons (Assembly Men)
 - Interviews with non exposed ordinary inhabitants of the area
 - Interviews with victims (of flood, for example)
- Re-ranking as result

Ranking based on selected criteria:

Flood

- 0. No flood problem
- 1. Severe problem under extreme circumstances (water enters houses and stays at the street longer than a few hours, extreme circumstances: rain longer than 24 hours).
- 2. Severe problem under normal circumstances

Sanitation : categorised into 3 distinct groups

- No sanitation problem
- Only waste problem, not so much open defecation
- Severe problem with both waste and open defecation (and animals on the streets etc)

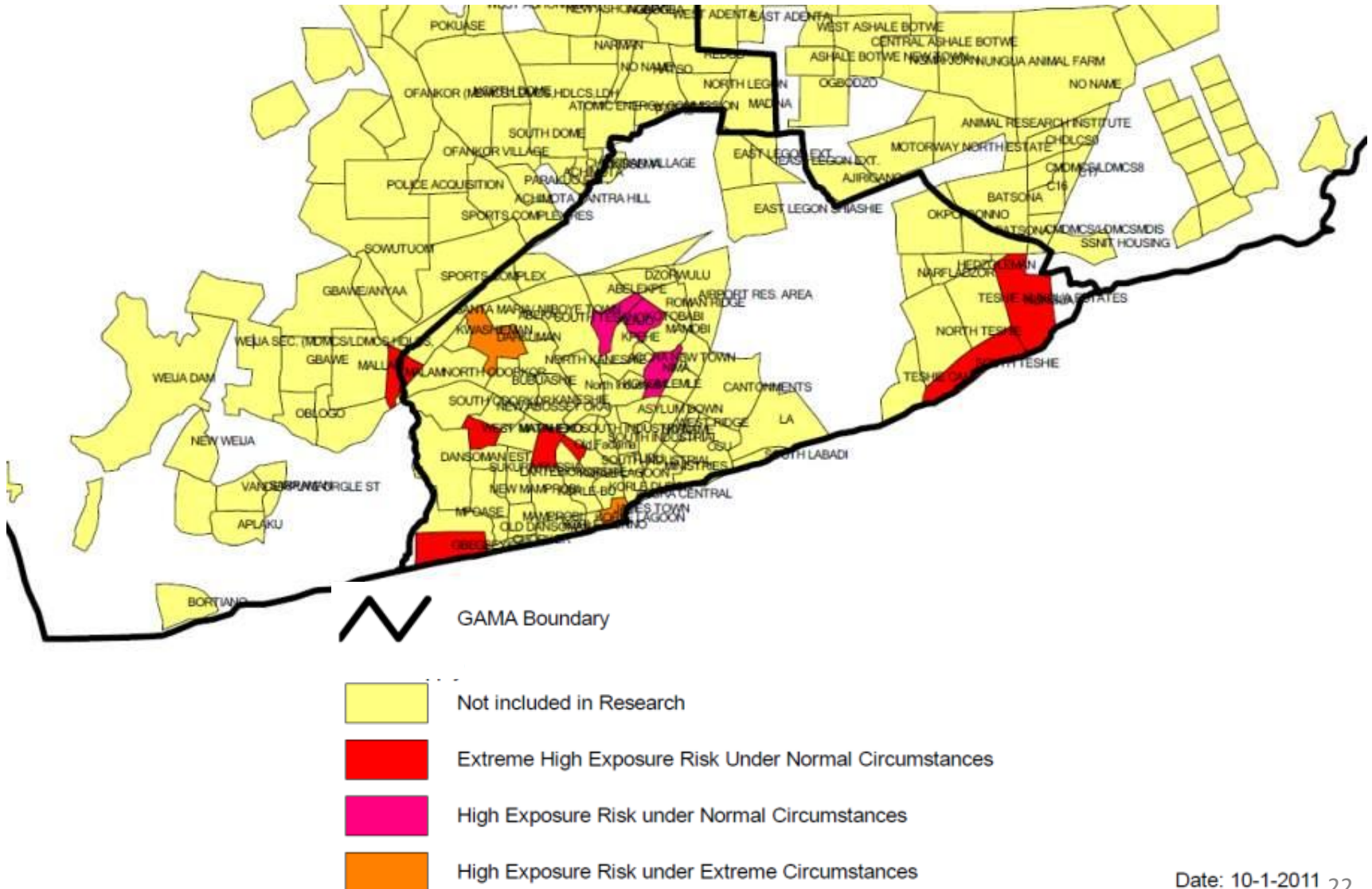
Water supply : areas classified with an either/or rating

- 1. Not considered as a problem
- 2. Considered as a problem

New Rating of Localities, 3 classes outcome

Locality	Flood	Sanitation	Water supply	New Rating
Nima	1	3	2	2
Kotobabi	1	2	2	2
Alajo	1	2	1	2
Old Fadama	2	3	2	1
Sabon Zongo	2	3	1	1
Gbegbeyige	2*	3	2	1
James Town	1	1-2	2	3
Darkuman	1	2	2	3
Mallam	2	3	2	1
Mataheko	2	3	1	1
Nungua	2	3	1	1
South Teshie	2	3	2	1

New Exposure Risk Map



Limitations of the study

- The visits were reconnaissance visits. Quality of results dependent on knowledge of people we met and therefore not really uniform across the sites (though we tried..)
- We did not interview enough people per locality to be completely sure of the value of our outcome. We cannot test our outcomes statistically.
- Different data sources described different administrative boundaries for the districts in Accra. Unable during this study to confirm which is official. This may have resulted in that we did not visit each locality completely or that we might have been in an area while we were thinking that we were still in the neighboring locality.
- The selection of the 12 field work areas is based on the first exposure risk map. This map is based on low quality data. Therefore, it could be that some areas have wrongly been excluded from the fieldwork.

Conclusion

- That said, the 7 localities are at a very high exposure risk for climate change effects and therefore very vulnerable.
- Projects to decrease Accra's vulnerability to climate change should focus on these 7 most exposed areas.



NIMA 85% use public
toilets



Gbegbeyise 70% -
100 % use public
toilets





Mallam:
solid waste
and open
defecation

Old Fadama:
No legal status



ALAJO: improvements since drains were built BUT blue arrows show areas below the edge of drain indicating poor design and construction

Thank You

