Information about Project on
How prepared are Swedish detached houses to adapt to Climate Change?

Hur förberedda är svenska småhus för att anpassa sig till klimatförändringar?

Besmå Conference

8th Nov 2022

By

Brijesh Mainali, Associate Professor/ Docent

Krushna Mahapatra, Professor

Shashwat Sinha, PhD researcher

Institutionen för byggd miljö och energiteknik; Linnéuniversitetet

351 95 Växjö

Project Background I

- Climate change is bound to occur despite of many ongoing mitigation efforts.
- Global warming has far-reaching consequences on several climate parameters, including extreme high or low precipitation, extreme temperature rises, heat waves, storms and sea level rise.

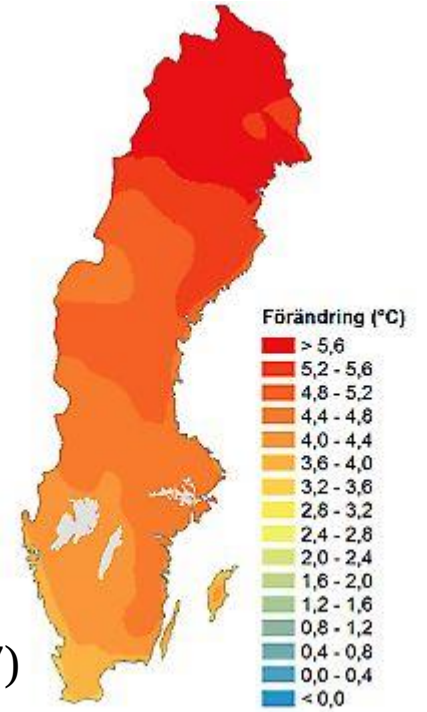
Ett bostadsområde i Gävle täckt av vatten den 18 augusti 2021

Ett hus i Helsingborg förstördes delvis av Storm den 30 Nov 2015

Fotokälla: The local Se

CHANGES IN SWEDISH CLIMATE (TEMPERATURE)

- Increases 2-4 degrees by 2050 (up to 6 degrees by the end of century)
- Days with snow in the North will decrease by 40-80 days
- 20% rise in heavy rainfalls all over Sweden



Source: SMHI (2017)

Prediction based upon IPCC Representative Concentration Pathways (RCP 4.5)-medium and (RCP 8.5) high GHG emission

Climate change adaptation in Swedish Municipalities

- Of Sweden's 290 municipalities, 131 have coasts or shores with the four largest lakes and seas.
- Climate change adaptation may be of more relevant to a greater extent in coastal municipalities than in inland municipalities.

Results from the risk classification of the proportion of municipalities and proportion of coastline

Climate effect	Risk class				
	0	1	2	3	4
Flooding	71%	6%	8%	15%	
Flooding – lakes and watercourses	50%	43%	5%	2%	
Flooding – torrential rain		100%			
Landslides	69%	3%	7%	8%	13%
Erosion	99.5%	0.5%			

* 4 being the most high risk

Source: National Strategy for Climate Change Adaptation Bill, 2017

Project Background II

- The 2011 cloudburst in Copenhagen (Denmark) resulted in more than 800 million Euro in insurance payouts and the 2014 cloudburst in Malmö (Sweden) resulted in more than 600 million SEK of damage.

Fotokälla: Craft Sweden

- Higher humidity and higher temperatures increase the risk of mold, rot and insect infestation in the building which requires more maintenance costs.

- How, and to what extent, the climate impact can vary throughout Sweden depending on the climate zone.

(Mobini et al, 2021)

Climate Damages: Whose responsibilities?

- Climate and Vulnerability Inquiry report - **Six million sqm of construction land** alongside watercourses on risk being flooded on average once every 100 years
- The area and frequency will probably increase significantly due to climate change

- Civil Protection Act & Water Service Act- Sweden
  - Municipality Responsibility for building being positioned in developmental plan in a secure land (low risk); sewage system planning (10-20 years returns)
  - Preventing and limiting damage, rescue the citizen during natural calamities
  - but not ultimately replacing destroyed property

Its homeowner's and the associated insurance companies' responsibilities to main the destroyed properties

Climate Damages: Whose responsibilities?

"When a risk of damage is deemed to be too high, it may become impossible to insure. The first such case in Sweden happened in 2018, when the Länsförsäkringar insurance company informed the owner of a coastal property in Kristianstad that they would no longer be able to insure the property."

Source: https://www.klimatanpassning.se/en/effects/impacts-by-sector/insurance-1.166044

So in such cases its homeowner's responsibilities to main the destroyed properties

Research Questions

The central research question is:

How prepared are Swedish detached houses to adapt to Climate Change?

This research will

- Prepare spatial map of the climate change risks and damages in detached house across Sweden using GIS tools and explore the adaptation measures of houses exposed to high climate risk zones. (LNU)

- Assess impacts of climate change on the hydrothermal (moisture) and energy performance of some typical detached houses in various climatic zones. (Lund University/NTNU))

- Examine the market implication of the climate change to the property prices and the financial benefits of doing climate smart retrofits (LNU)

- Analyze perceptions and preparedness of demand & supply side actors and develop collective strategy for both actors to combat with climate change (LNU)

Hypothesis

We believe:

- ❖ It is important to take climate change into account when renovating houses for a sustainable future.
- ❖ Deep renovation of buildings provides an opportunity to address both climate adaptation and climate mitigation

Fotokälla: Martin Wikman

Project Implementation

Project led by: Linneaus University (Brijesh Mainali)

Academic Partners: Linnaeus University, Lund University, Norwegian University of Science and Technology

Other Partners: Sparbanken Eken, Svensk fastighetsförmedling, Villaägarna Länsförsäkringar fastighetsförmedling, Fastighetsbyrån, Klimatfastigheter Småland AB

Financier:

FORMAS – Swedish Government research council for sustainable development

Timetable: **2022 - 2025**

Budget: **ca 8 Million SEK**

Work Packages (WPs)

- WP 1: Administration and Project Management (Lead: LNU supported by all)
- WP 2: Preparedness of Swedish homeowners towards climate change (Lead: LNU supported by all)
- WP 3: Mapping of Climate risk and damages (Lead: LNU supported by all)
- WP 4: Impacts of climate change on detached houses and adaptation scenarios (Lead: LU supported by all)
- WP5: Market implications of the climate change & climate-smart renovation(Lead: LNU supported by all)
- WP 6: Analyzing preparedness of the DH*-market sector for climate change (Lead: LNU supported by all)
- WP 7: Research Communication and Dissemination (Lead: LNU supported by all)

* DH- Detached House

What does this research offer?

- The results will be crucial in understanding the readiness for climate adaptation in the detached house sector (overall)

- Small and medium-sized construction companies will be able to prepare or adjust their marketing strategies for detached homes (with a focus on the climate adaptation strategy).

What does this research offer?

- The results can be crucial for
  - Insurance companies (for adjustment of insurance premiums)
  - Bankers (for evaluation of credit investment risk)
  - Real estate (For property valuation)

The project will develop strategies to improve the small house sector's resilience to climate change.

- Projects Academic Contribution
  - 1 Doctoral Thesis
  - 5 Master Theses and
  - 6-8 Scientific Publications

WP 3: Mapping of Climate risk and damages

Methodology

1) Literature Mapping
   - Global- Disaster Risk management and climate change Adaptation
   - Swedish context
2) Identification of research gaps
3) Spatial Model creation

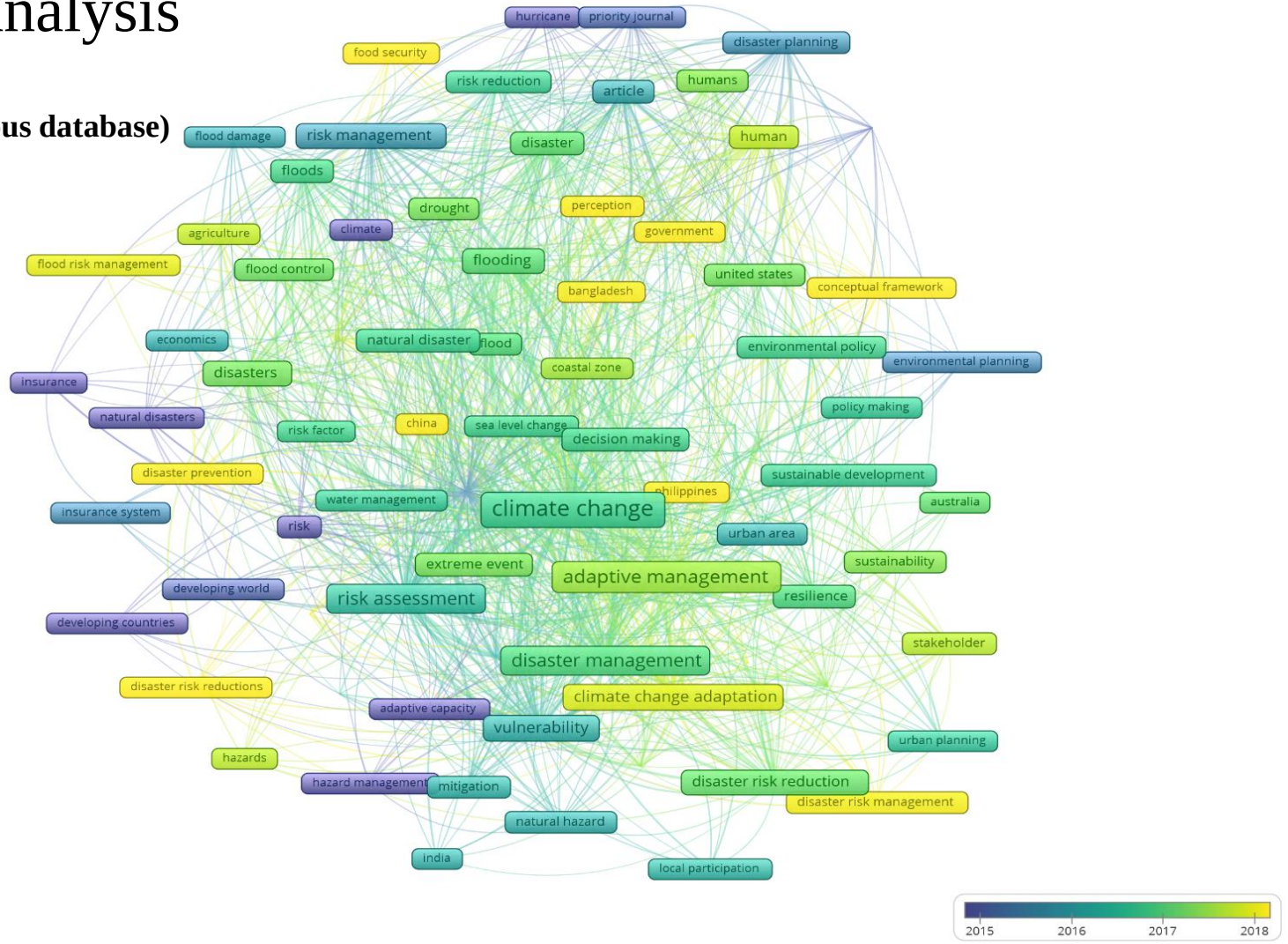
Mapping of Literature on
Disaster risk management & Climate change adaptation

- Literature search based on above theme appearing in Title, Abstract and Key words. (Searched in Scopus)
- Filtering 1: Based on your interest (For eg: Only English paper included)
- Number of papers: ca 1000
- Exported these papers in RIS / CSV format.
- Filtering 2: Based on similar (synonym) keywords
- Used **VOSviewer Software** for biometric network analysis (To see the key-word connection and clusters)
- The map are based upon the words appearing in the Abstract, Title and Keywords

Bibliometric analysis

Research keywords (Scopus database)
Disaster risk management
climate change adaptation

Occurrence:
at least 20 times



Bibliometric Analysis

- Up to 2015 mostly articles on disaster and risk management were discussed in the contest of Developing countries
- 2016-2017 most studies focused on flooding risk management/ mitigation, Climate change
- Recent papers are mostly focus on disaster risk reduction/prevention ; climate change adaptation (mainly in Bangladesh, China , Philippines)

Bibliometric analysis

Research keywords (Scopus Database)
Disaster risk management
climate change adaptation

Occurrence:
at least 20 times

Bibliometric Analysis

- We have identified 4 clusters:
  Cluster 01 (in blue):

is about disaster planning considering **social aspect (** government, policy and human)

- **Cluster 02 (in red):**

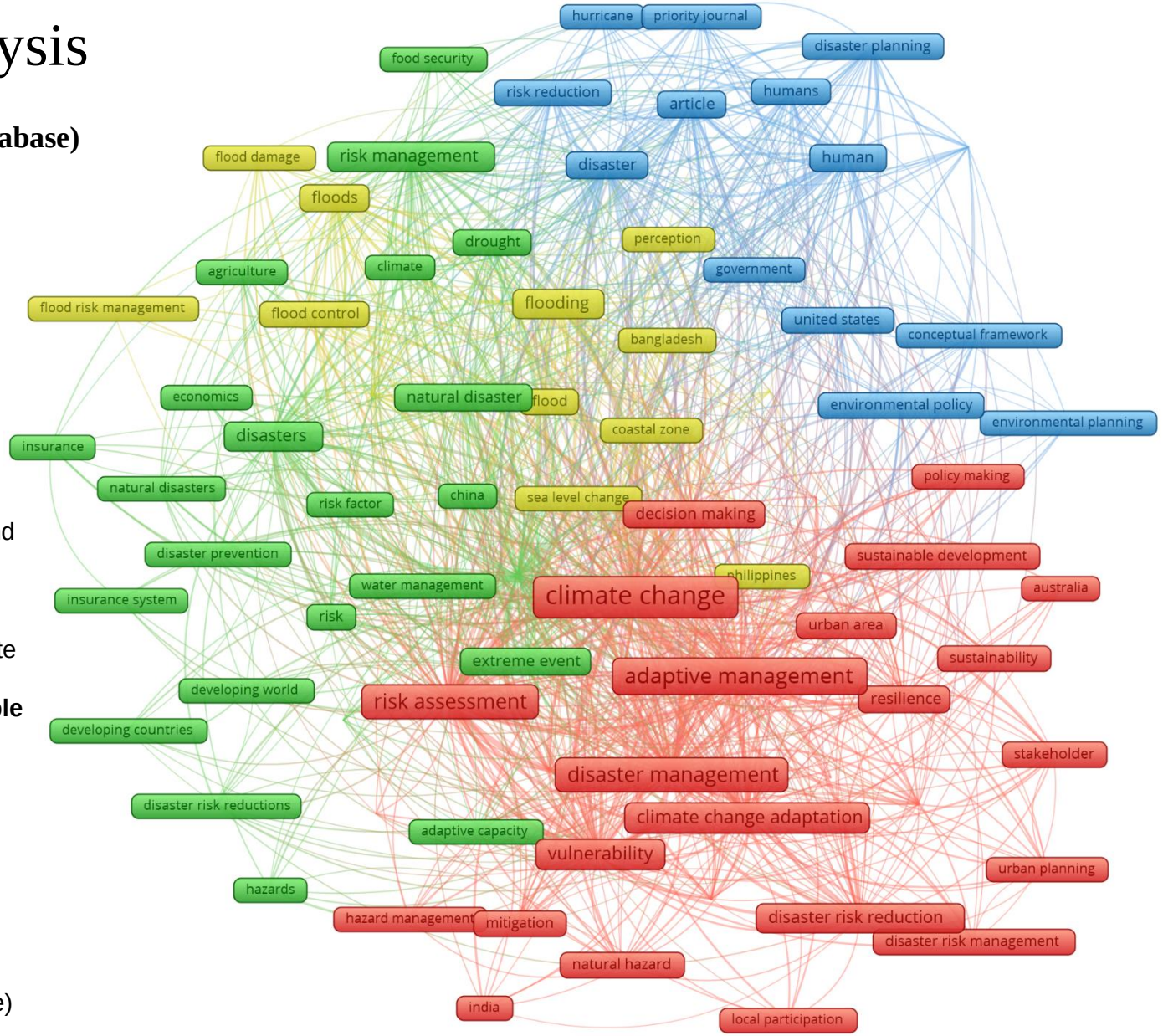
is about disaster risk management (**assessment or vulnerability**), climate change adaptation and mitigation in **urban area** considering **all Sustainable development aspects and all stakeholders**.

- **Cluster 03 (in green):**

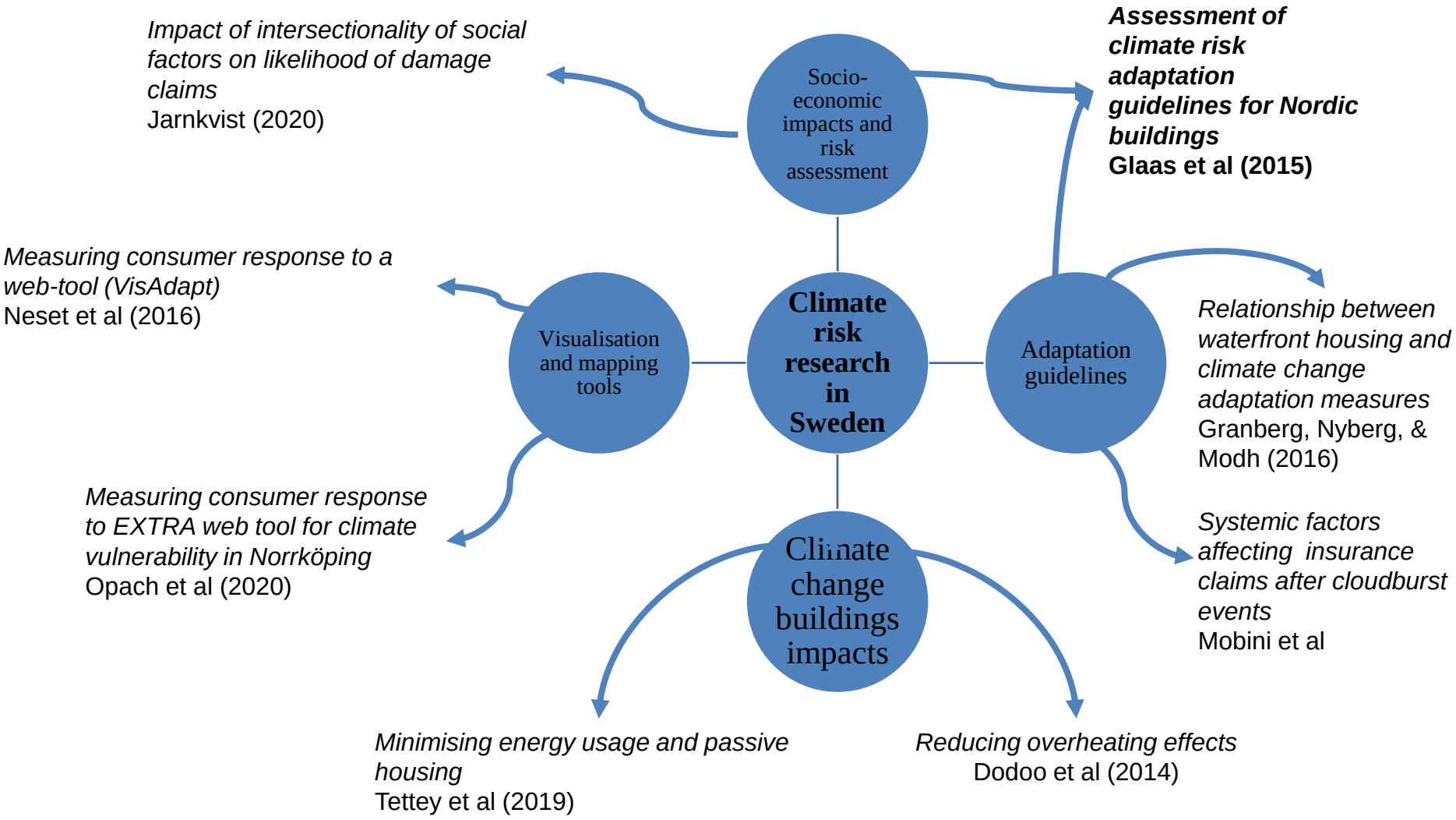
is about disaster **risk assessment** in **developing countries** considering **economic** aspect (mainly **insurance** system).

- **Cluster 04 (in yellow):**

is focused mainly in flood risk management (see level, flood damage) mainly in coastal areas.



Swedish context



Impact of intersectionality of social factors on likelihood of damage claims
Jarnkvist (2020)

Assessment of climate risk adaptation guidelines for Nordic buildings
Glaas et al (2015)

Measuring consumer response to a web-tool (VisAdapt)
Neset et al (2016)

Relationship between waterfront housing and climate change adaptation measures
Granberg, Nyberg, & Modh (2016)

Measuring consumer response to EXTRA web tool for climate vulnerability in Norrköping
Opach et al (2020)

Systemic factors affecting insurance claims after cloudburst events
Mobini et al

Minimising energy usage and passive housing
Tettey et al (2019)

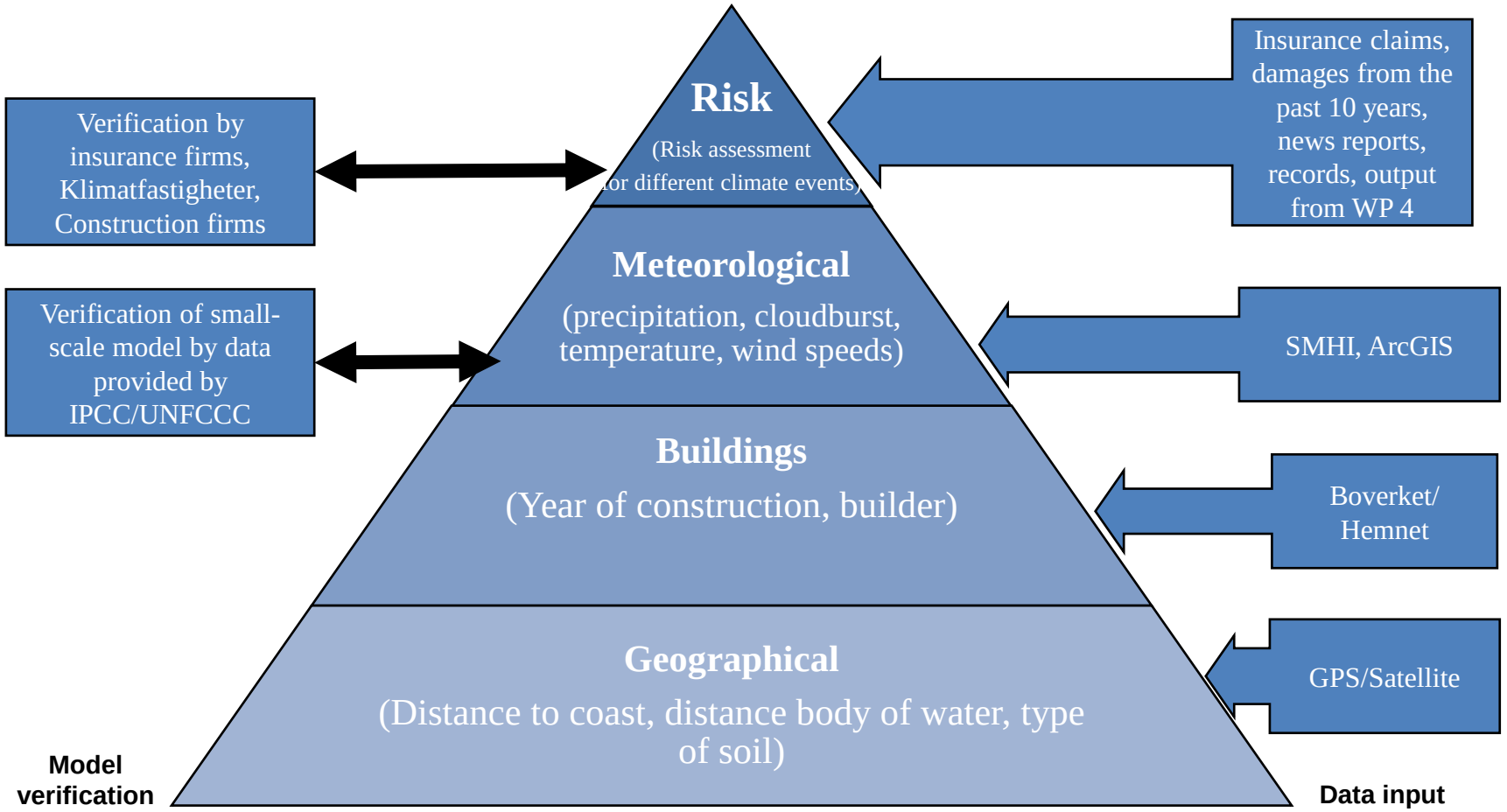
Reducing overheating effects
Dodoo et al (2014)

Some Key Findings from Swedish studies (so far…)

- Research findings
  - There is a need for updates to assessment of climate risks and home renovation adaptation guidelines for future risks resulting from newly developed IPCC scenarios for weather related changes
  - Important factors to consider for vulnerability assessment (Glaas et al, 2015)
    - Heat waves, indoor flooding, wind damage, increased precipitation
  - Aesthetic developments prioritised over stricter adaptation guidelines in lieu of improving real estate market (Granberg, Nyberg, & Modh, 2016)

- Knowledge gaps
  - Research exists for individual aspects, but no comprehensive study that links risk assessment, various types of climate damage
  - More work is needed in the spatial mapping of climate change vulnerability of buildings

Spatial mapping model and necessary data



För mer information kontakta mig

Brijesh Mainali
brijesh.mainali@lnu.se