

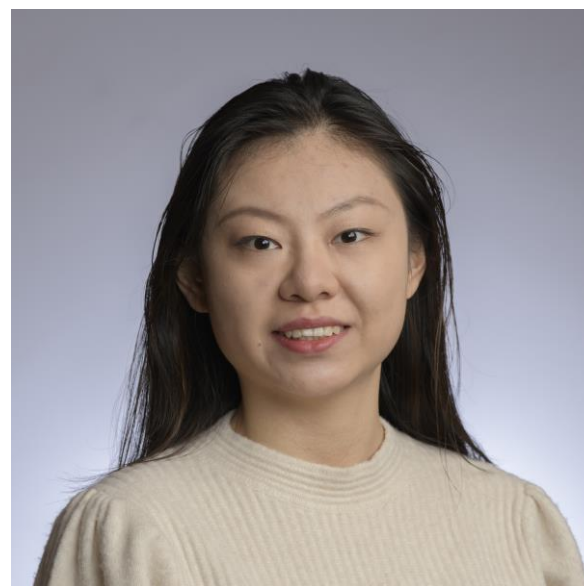
Introduce the 2021 floods impacted mental health and social well-being among older adults and their spatial distribution in the Ahr Valley, Germany



UNIVERSITY
OF TWENTE.



Chen Song, Funda Atun, Justine Blanford, Carmen Anthonj
Faculty of Geo-Information Science and Earth Observation ITC, University of Twente, The Netherlands



Contact: Chen Song
email: c.song-2@utwente.nl

Abstract: Protecting human health is a fundamental priority in contemporary society. According to the World Health Organization (WHO) Constitution, "Health is a state of complete physical, mental, and social well-being, and not merely the absence of disease or infirmity" (WHO, 1946). While the physical health of older adults often receives considerable attention after flooding events, their mental and social well-being remains underexplored (Song et al., 2025).

- The 2021 floods in the Ahr Valley, Germany, had a devastating impact on local communities, particularly on older adults who are more vulnerable to the aftermath of natural disasters.
- This study explores the perceptions of floods among individuals aged 65 and older, focusing on their mental health and social well-being.
- Our findings highlight the multifaceted challenges faced by this population, including heightened psychological distress, disruption of social networks, and concerns over long-term recovery.

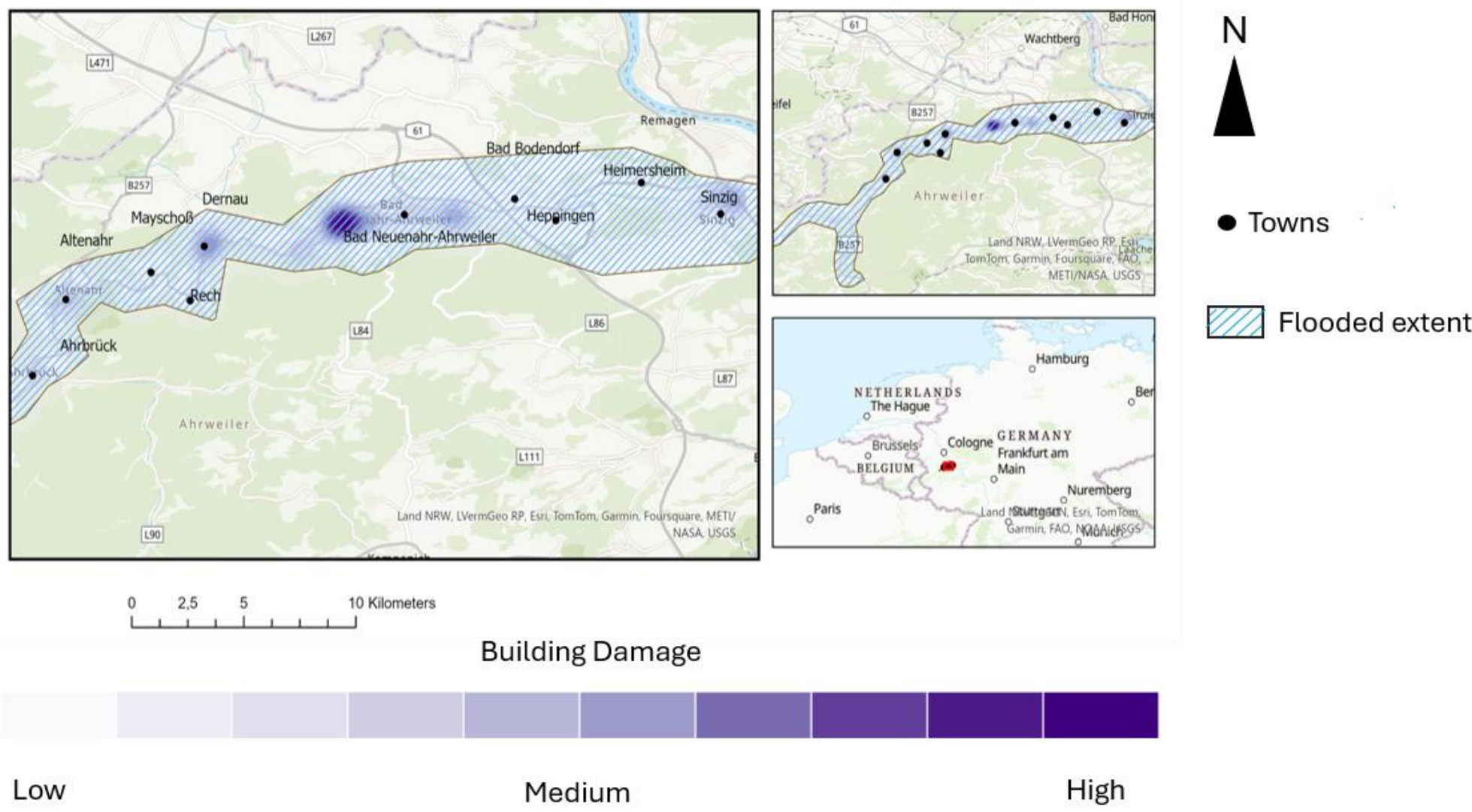


Figure 1. Study area: Ahr valley.

Study area: This study is being conducted in the Ahr Valley, Germany (Figure 1). Ahr River flood extent (hatched blue areas) with the concentration of damaged buildings (highest= dark purple). (A) zoomed in on the area with the highest concentration of building damage and the towns surveyed in this study. (B) The Ahr river and flood extent; (C) Study area location in Germany;

Method: This study adopts a mixed-method empirical research.

- Questionnaire surveys
- One-on-one interviews
- Group discussions

Preparation work:

- ✓ Ethical approval due to human participation: All interviews and surveys were conducted with written informed consent from participants. (Approval Number: 230088, April 09, 2024).
- ✓ Translation of documents from English to German. And a Pre-test questionnaire with older German adults

Surveys: The surveys were distributed:

- Convenience sampling and snowball sampling are used to target participants from neighboring streets and senior citizen groups.
- A total of 600 surveys were distributed across the Ahr Valley (Figure 1), with 198 responses returned (Figure 2).



Figure 2. Deliver the questionnaires



Figure 3. Participant recruitment

Interview and group discussion participants were recruited through:

- Snowball sampling from senior citizen groups.

- Individuals voluntarily contacted us to join the interviews through flyers posted along the river.
- Interviews took 30 to 90 minutes and were audio-recorded upon informed consent.

Results:

Survey questionnaire

Flood Levels:

Flood levels the older adults perceived in their houses ranged from 0 to 700 cm, with the highest levels reported in Altenahr, Mayschoß, and Dernau (red color areas in Figure 4).

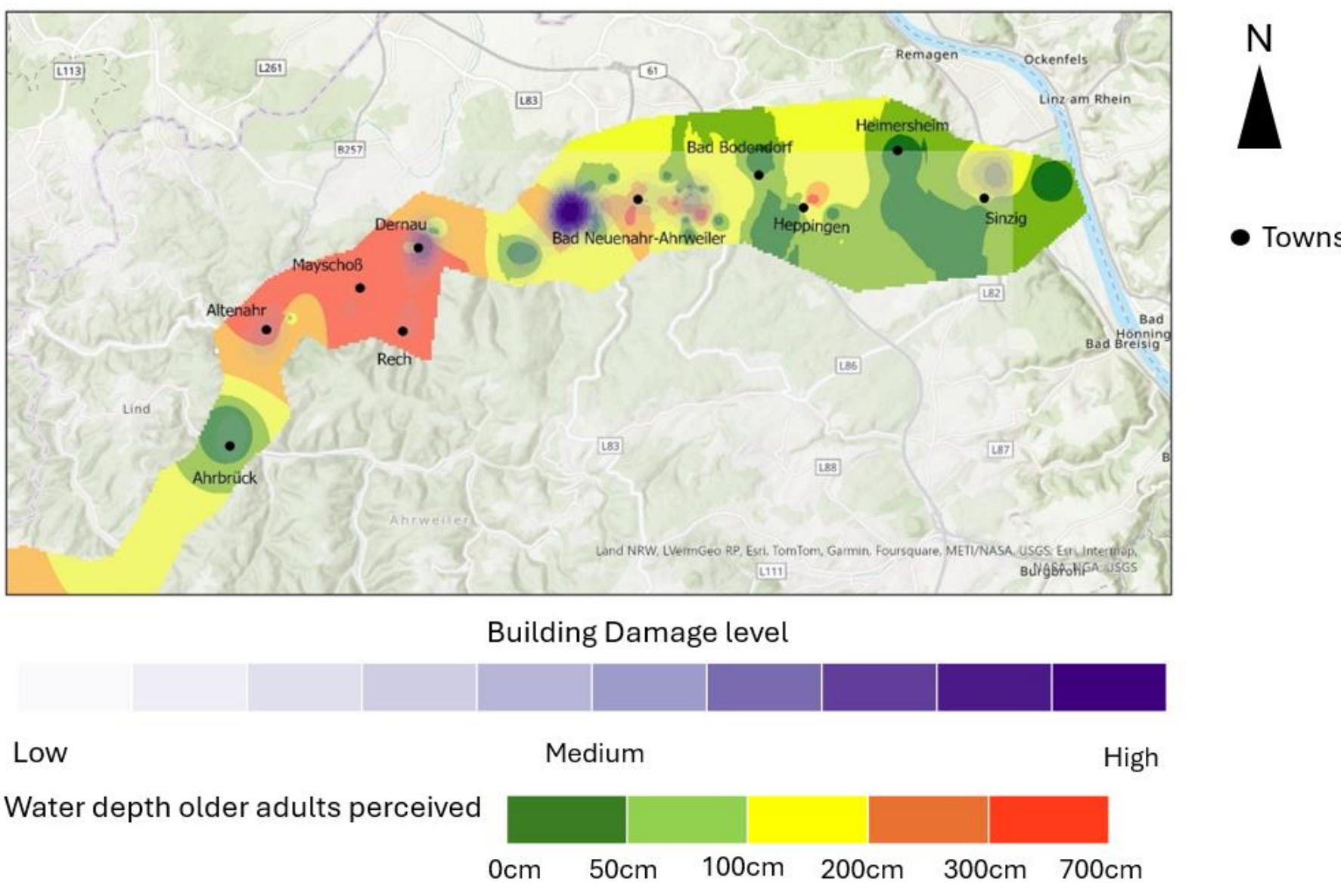


Figure 4. Water levels reported by older adults combine the building destroy density

Social Health

We have analyzed the survey data of social health outcomes and ranked "positive outcomes" by kernel density analysis, showing them on the map above (Figure 5).

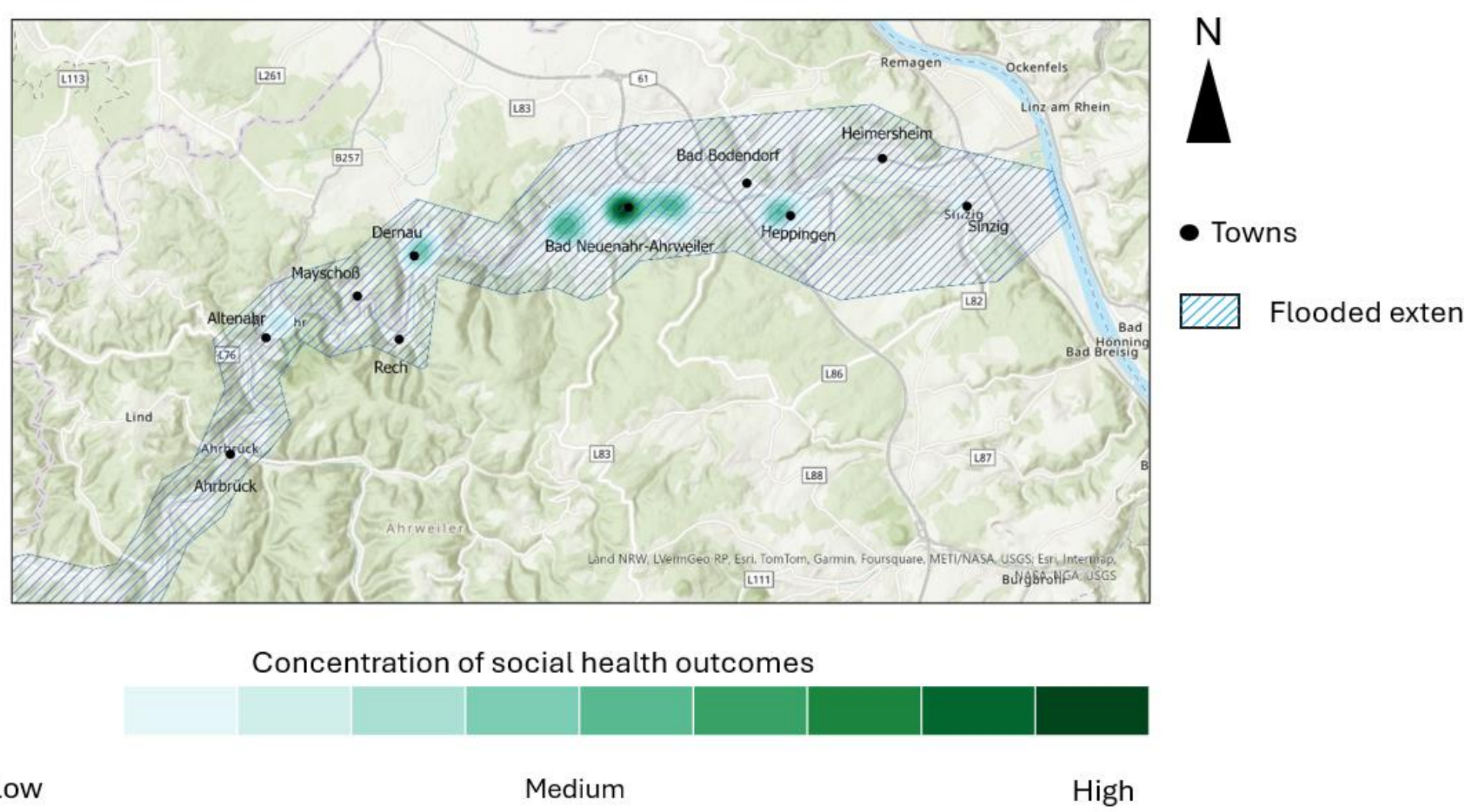


Figure 5. Social health results' concentration

Older adults with positive social health results live more concentrated in the middle and lower stream, Bad Neuenahr-Ahrweiler, Heppingen, and Dernau.

Mental Health

In contrast with the social health outcomes (Figure 5), in Dernau, the positive mental health results population has a higher density than the social health results (Figure 6).

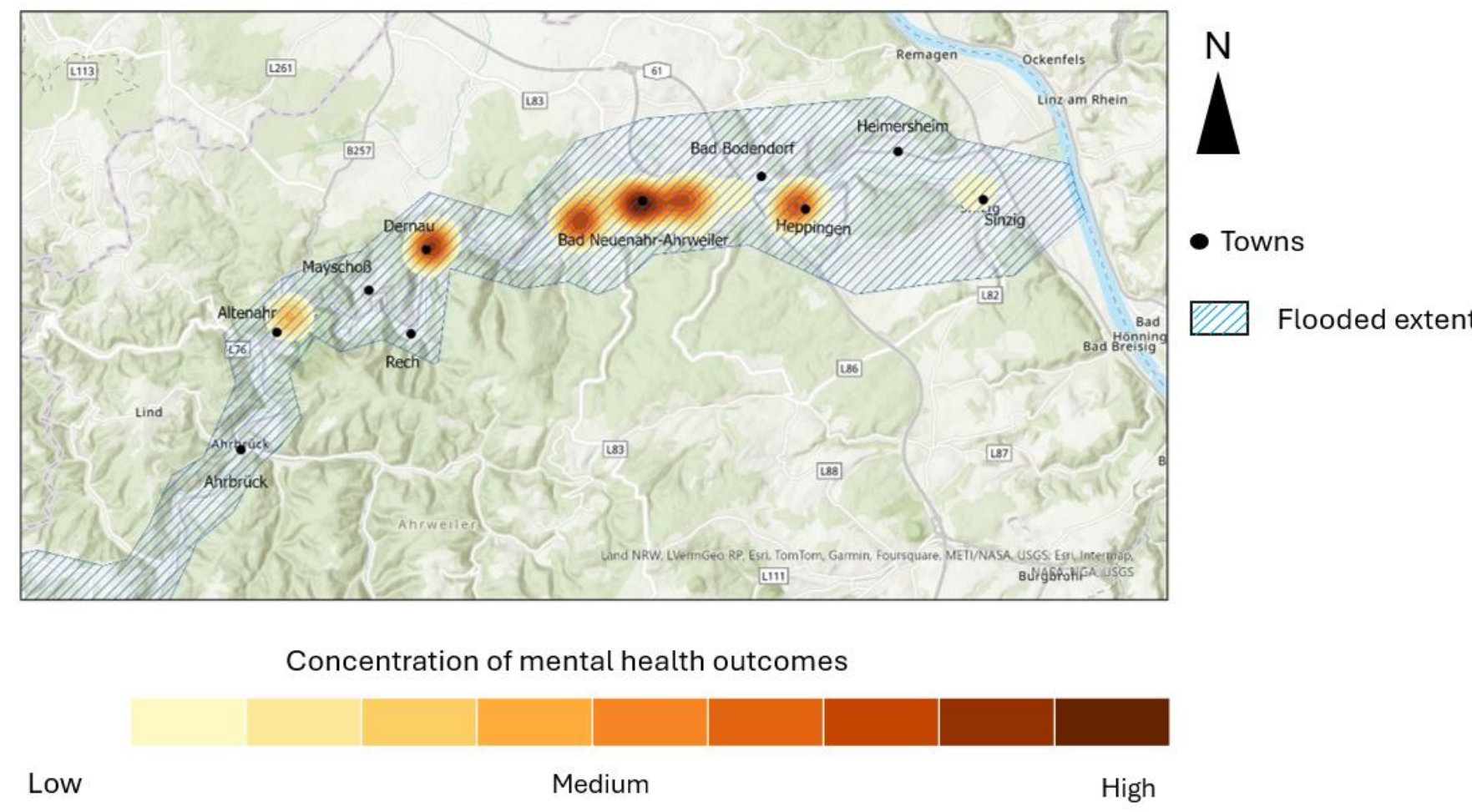


Figure 6. Mental health results' concentration

One-to-one interview

- Several interviewees reflected on how memories of the flood evoked emotional distress.
- Participants reported feeling unprepared when the floodwaters arrived, with little or no prior warning.
- While some individuals did receive warnings, these often came too late and were insufficient to facilitate a safe evacuation.

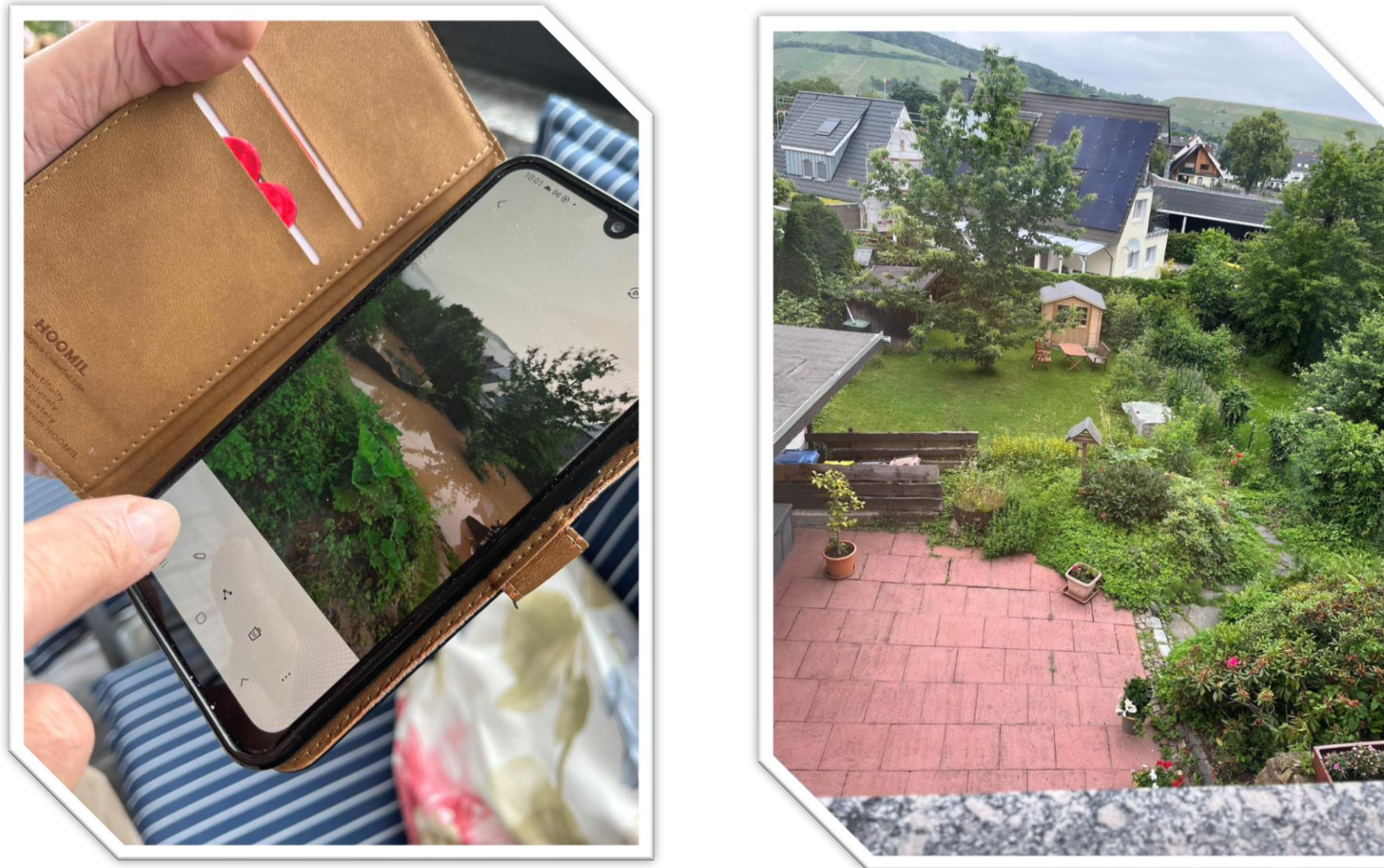


Figure 7. An older adult shows the 2021 flooding photo at home in contrast to the nowadays view

Group discussion

Many older adults expressed a strong desire to return to their homes in Ahrtal, during the flood, and after being relocated to other cities.



Figure 8. Group discussion

Conclusion

- Participants recounted their experiences of **anxiety** in the aftermath of the flood, often expressing their fear and worry in emotional and personal terms.
- **Depression**, particularly among younger adults (ages 18-25) and middle-aged individuals (ages 50-70), was found to be common.
- Both genders described specific **PTSD** symptoms, including heightened anxiety triggered by sounds or smells reminiscent of the flood.
- The **sense of place and belonging** emerged as a significant theme in interviews with older adults affected by the floods.
- **Social support and network** worked well for the older adults, receiving support from neighbors, volunteers. Isolation from the outside was not a big complaint from this study.
- A major concern raised was
 - the absence of a timely and effective **early warning system**.



Figure 9. Network buildings



References:

Song, Chen, Atun, Funda, Blanford, Justine I., & Anthonj, Carmen. (2025). Impact of flooding on the social and mental health of older adults- A scoping review. *Water Security*, 100190. doi:<https://doi.org/10.1016/j.wasec.2025.100190>
WHO. (1946). *Constitution*. Retrieved from <https://www.who.int/about/governance/constitution>