130 years VU UNIVERSITY AMSTERDAM

Impact of climate change, land use change, and residential mitigation measures on damage and risk assessment

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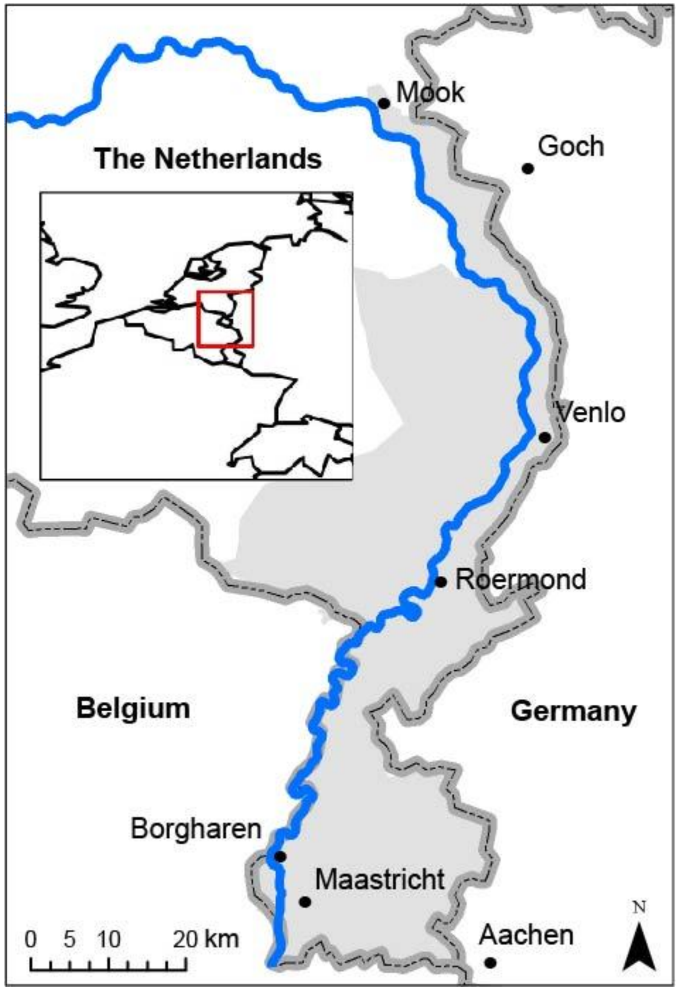
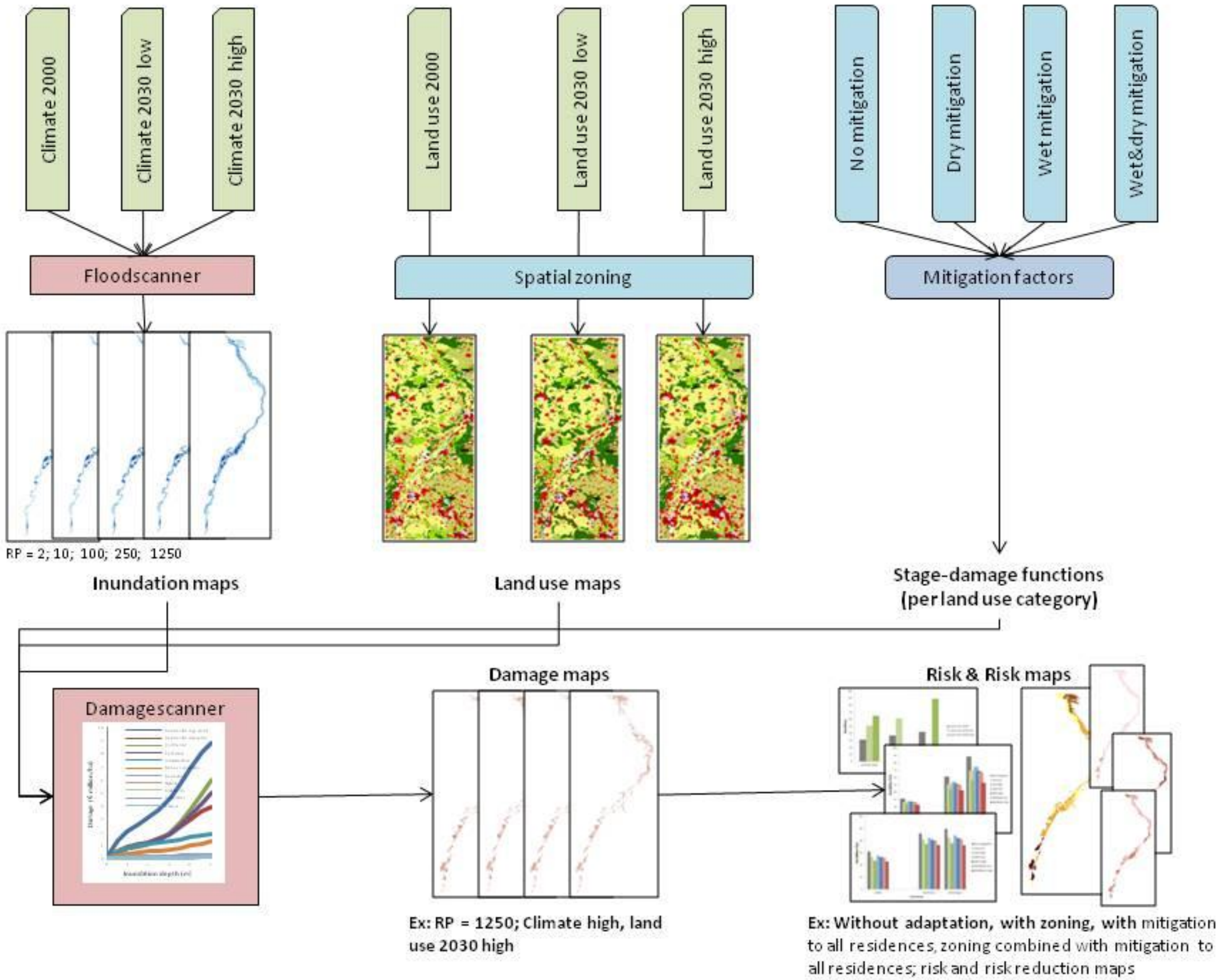
Introduction and case study area

- River Meuse: Section between border of Belgium and the Netherlands to near village of Mook

- Research:
  - Relative changes in risk between present and 2030: climate change and land use change (Bubeck et al., 2011)
  - Potential of spatial planning and flood risk reduction measures by households

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Climate 2030 low
Climate 2030 high
Land use 2000
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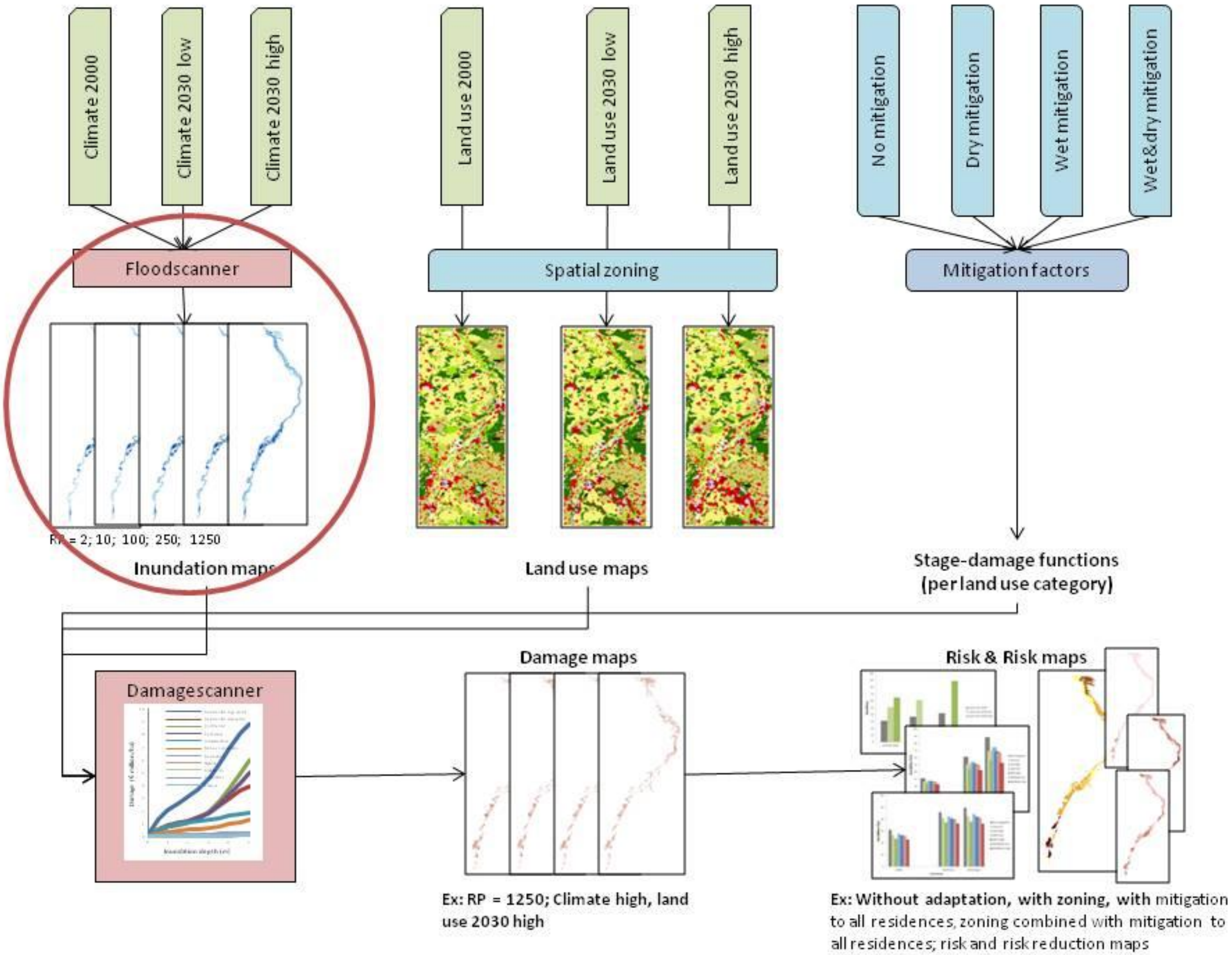
Land use 2030 high
No mitigation
Dry mitigation
Wet mitigation
Wet&dry mitigation
Floodscanner
Spatial zoning
Mitigation factors
RP = 2; 10; 100; 250; 1250
Inundation maps
Land use maps
Stage-damage functions
(per land use category)
Damagescanner
Damage maps
Risk & Risk maps
Ex: RP = 1250; Climate high, land use 2030 high
Ex: Without adaptation, with zoning, with mitigation to all residences, zoning combined with mitigation to all residences; risk and risk reduction maps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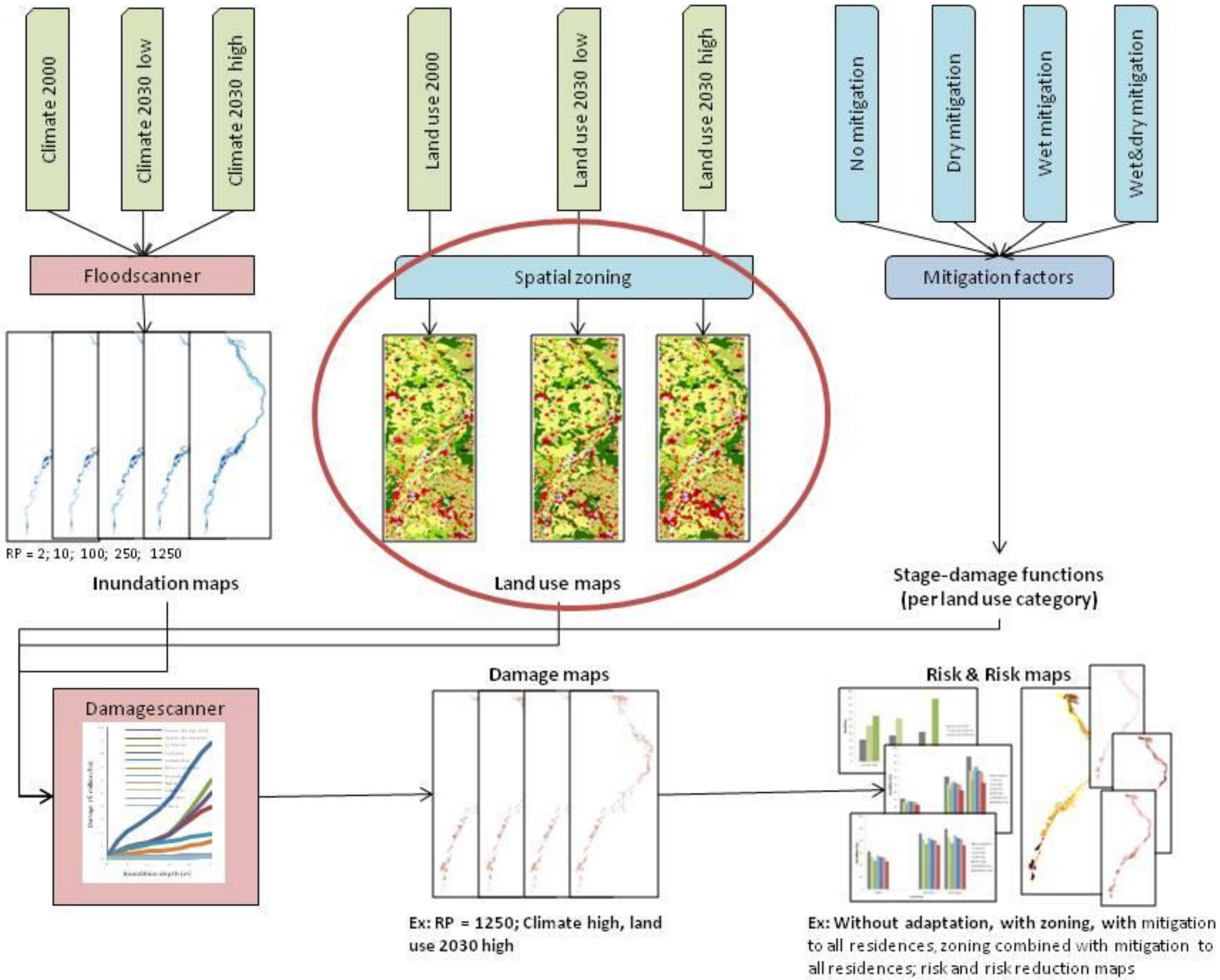

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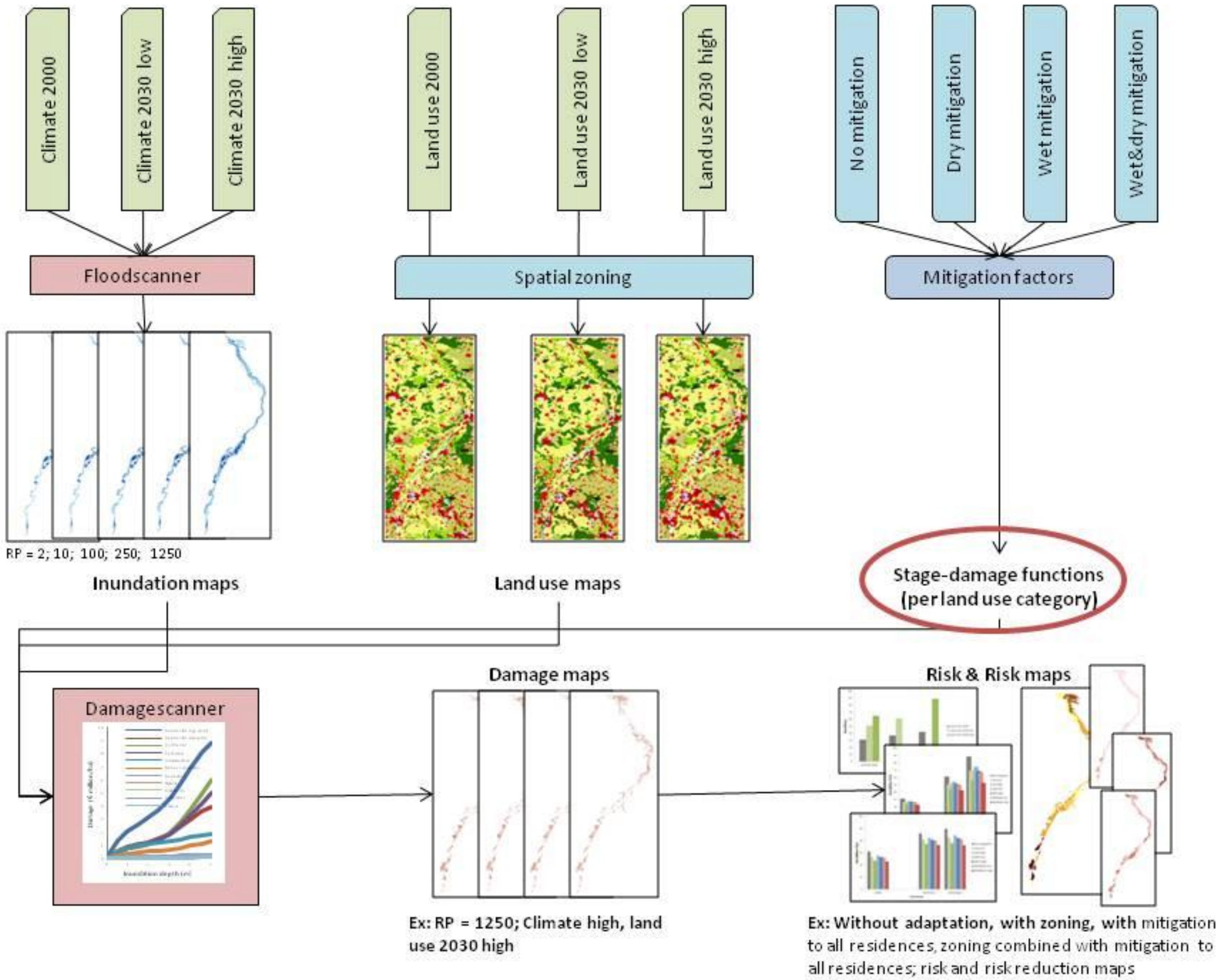
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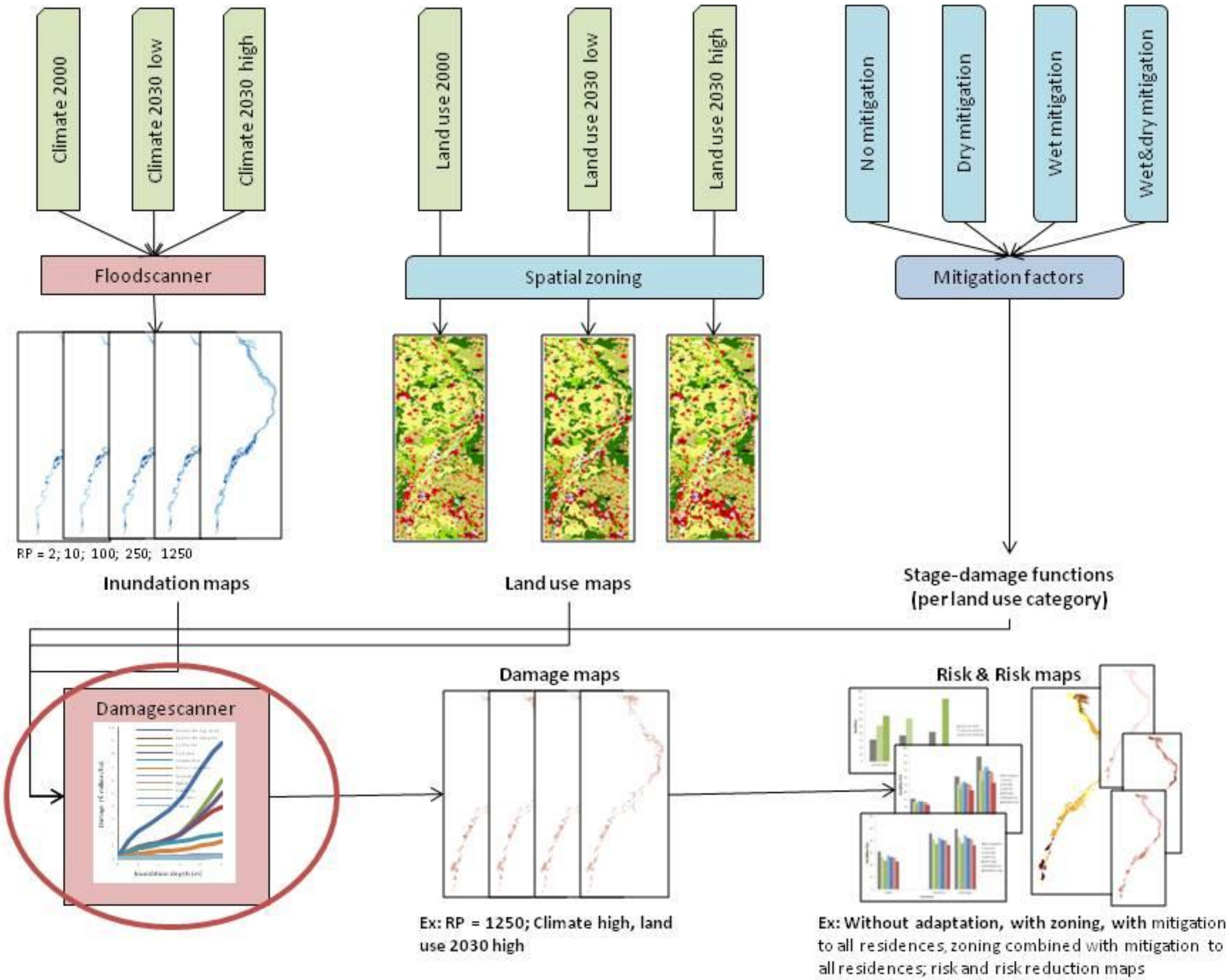

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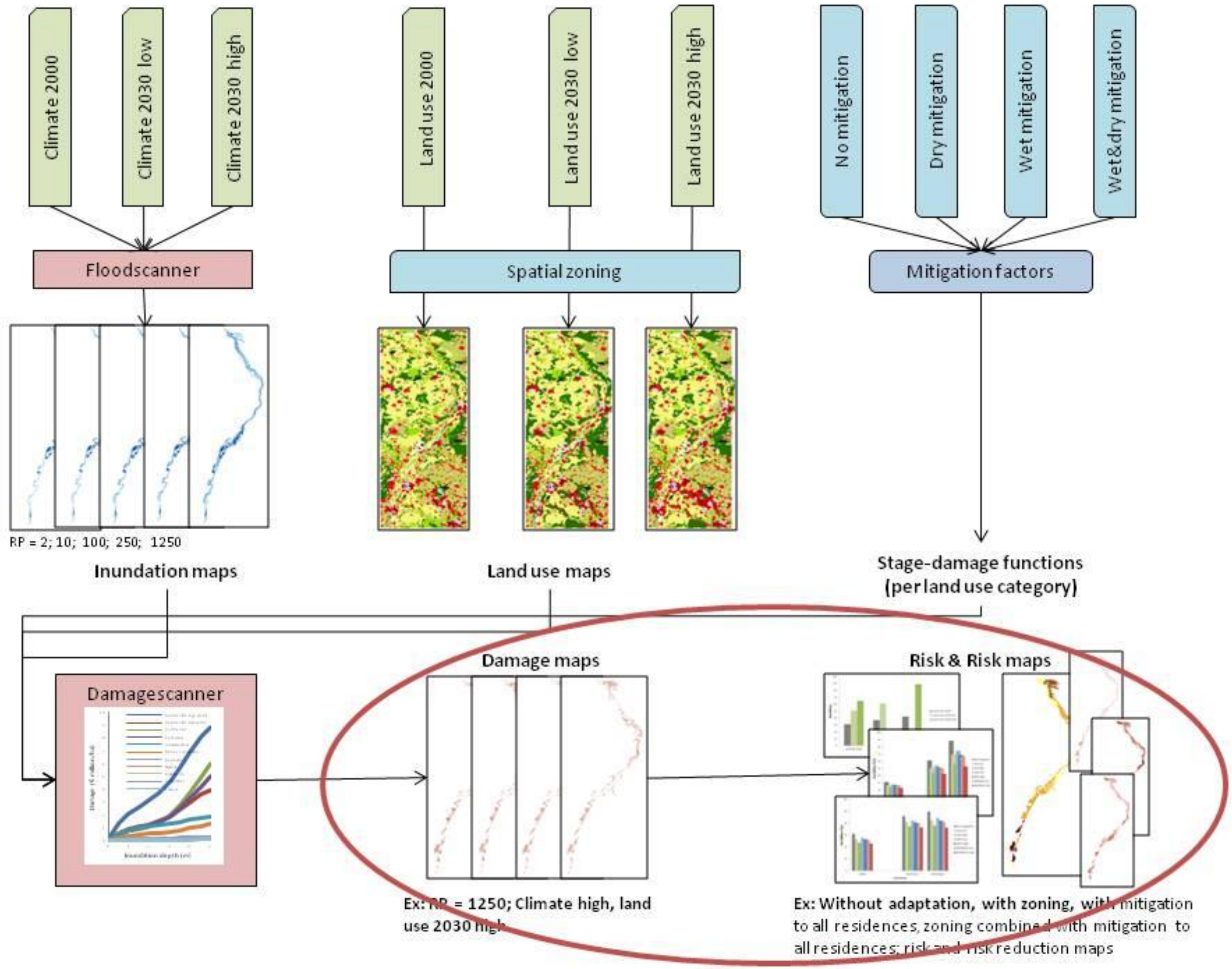

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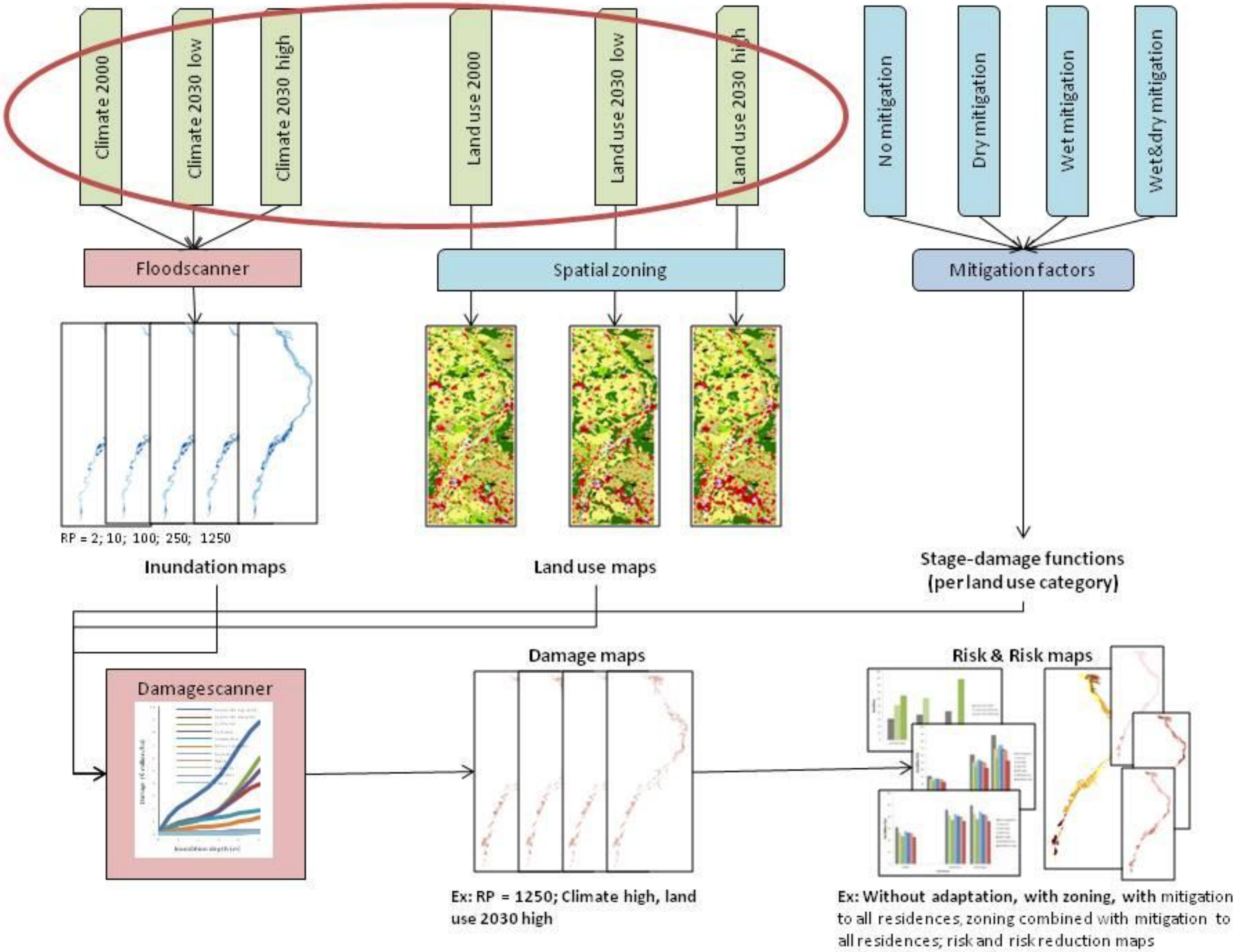

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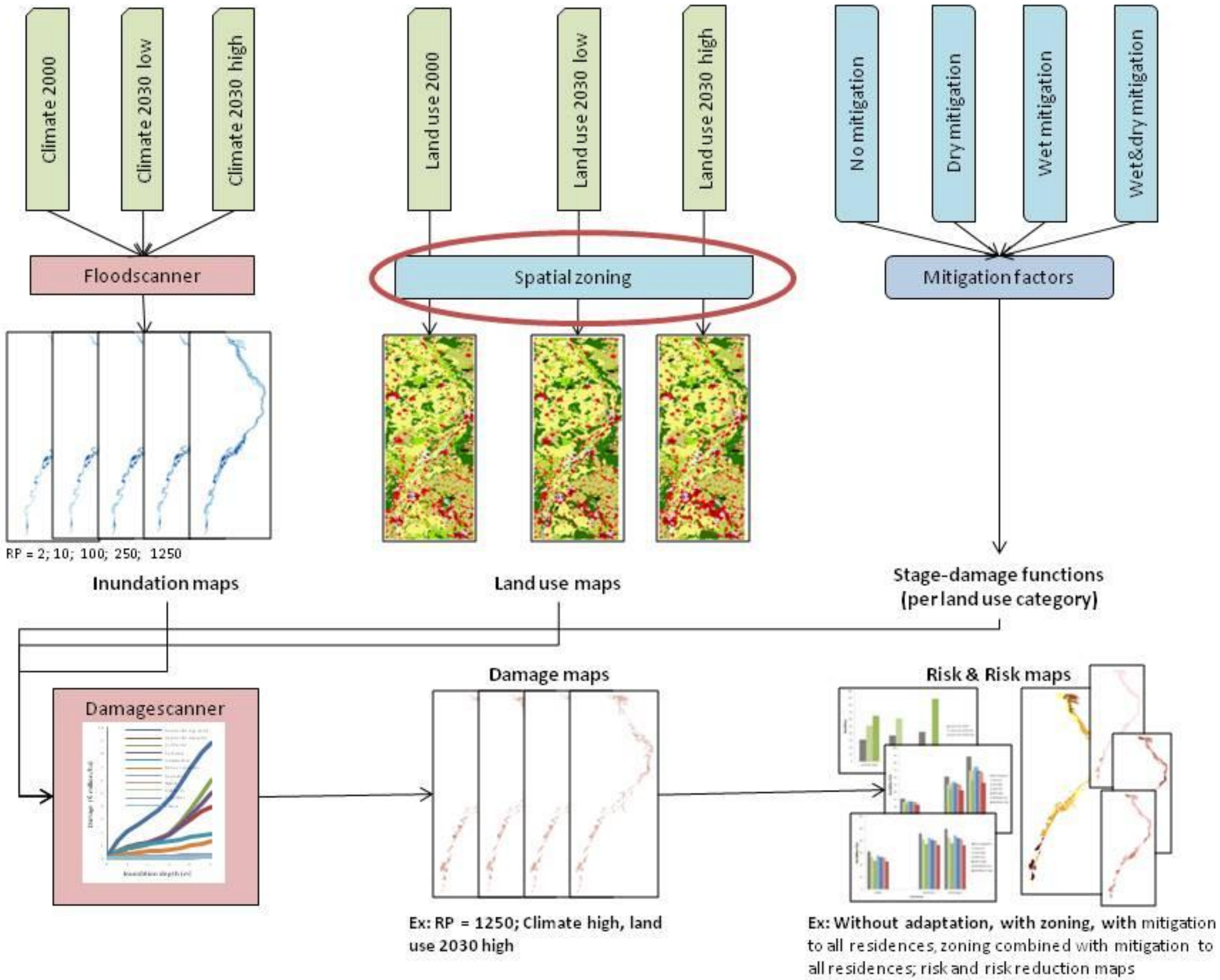
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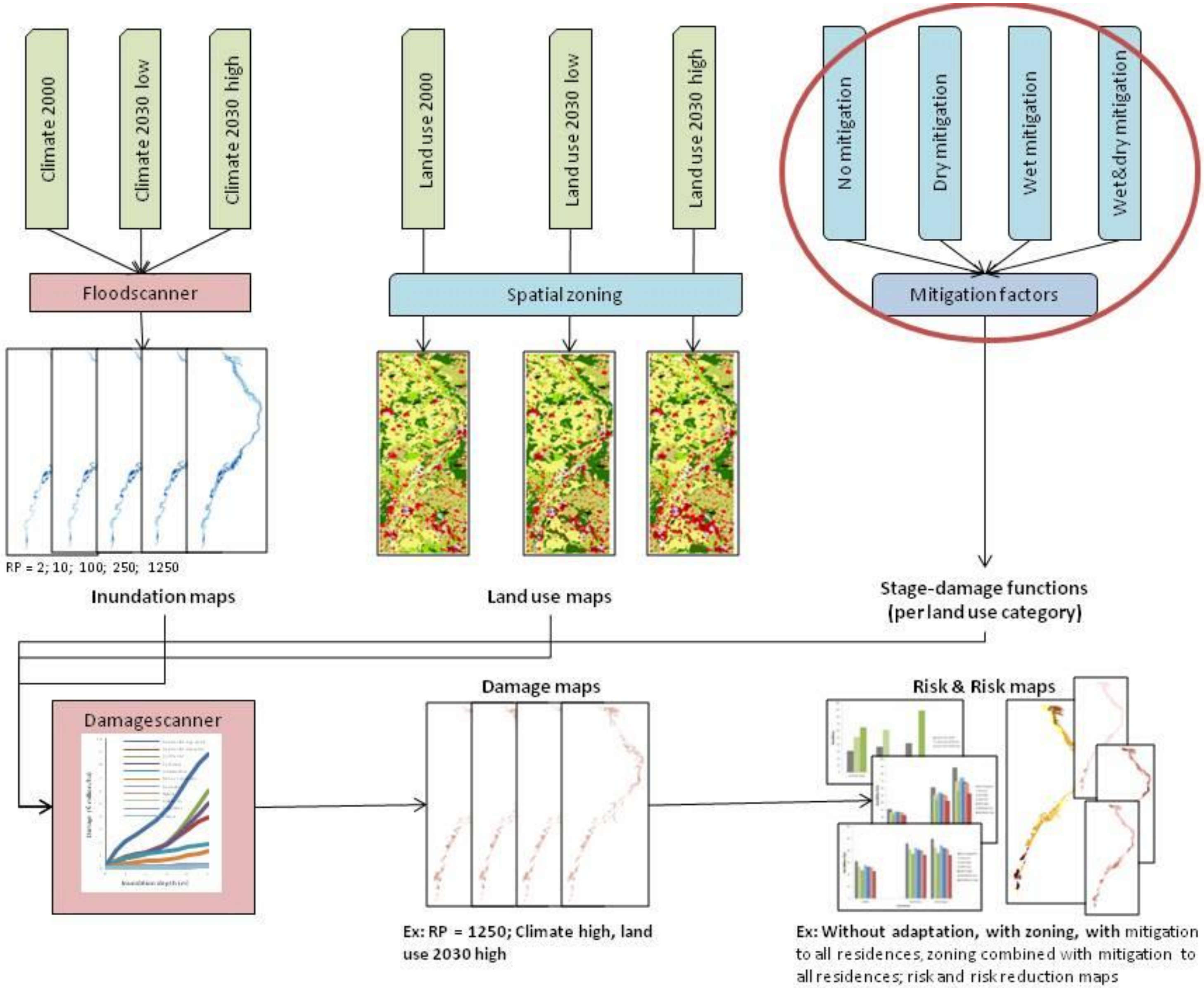

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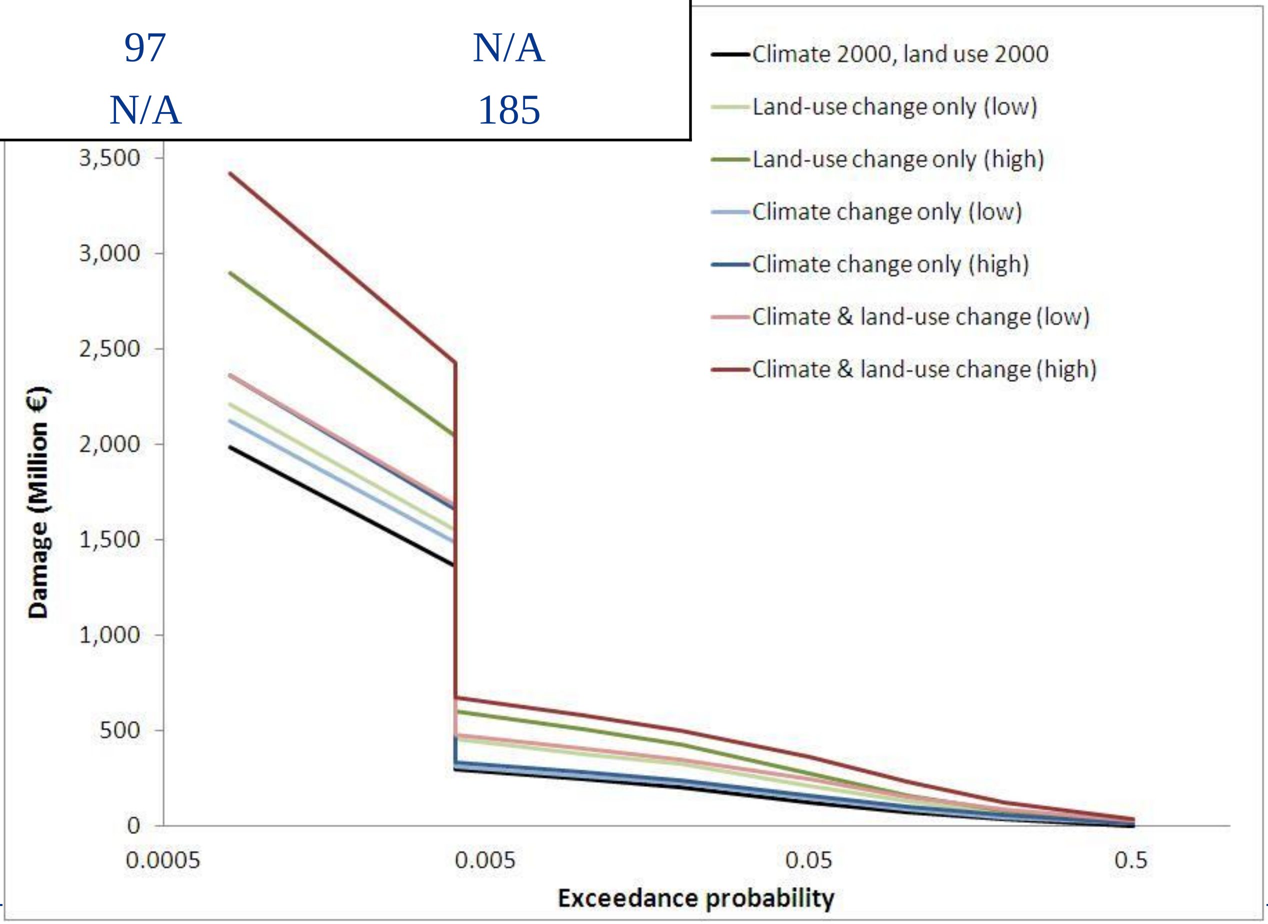
Risk and risk reduction results

Risk increase between 2000 and 2030

Land use	% Risk increase		
	Climate 2000	Climate 2030 low	Climate 2030 high
2000	N/A	20	37
2030 low	64	97	N/A
2030 high	108	N/A	185



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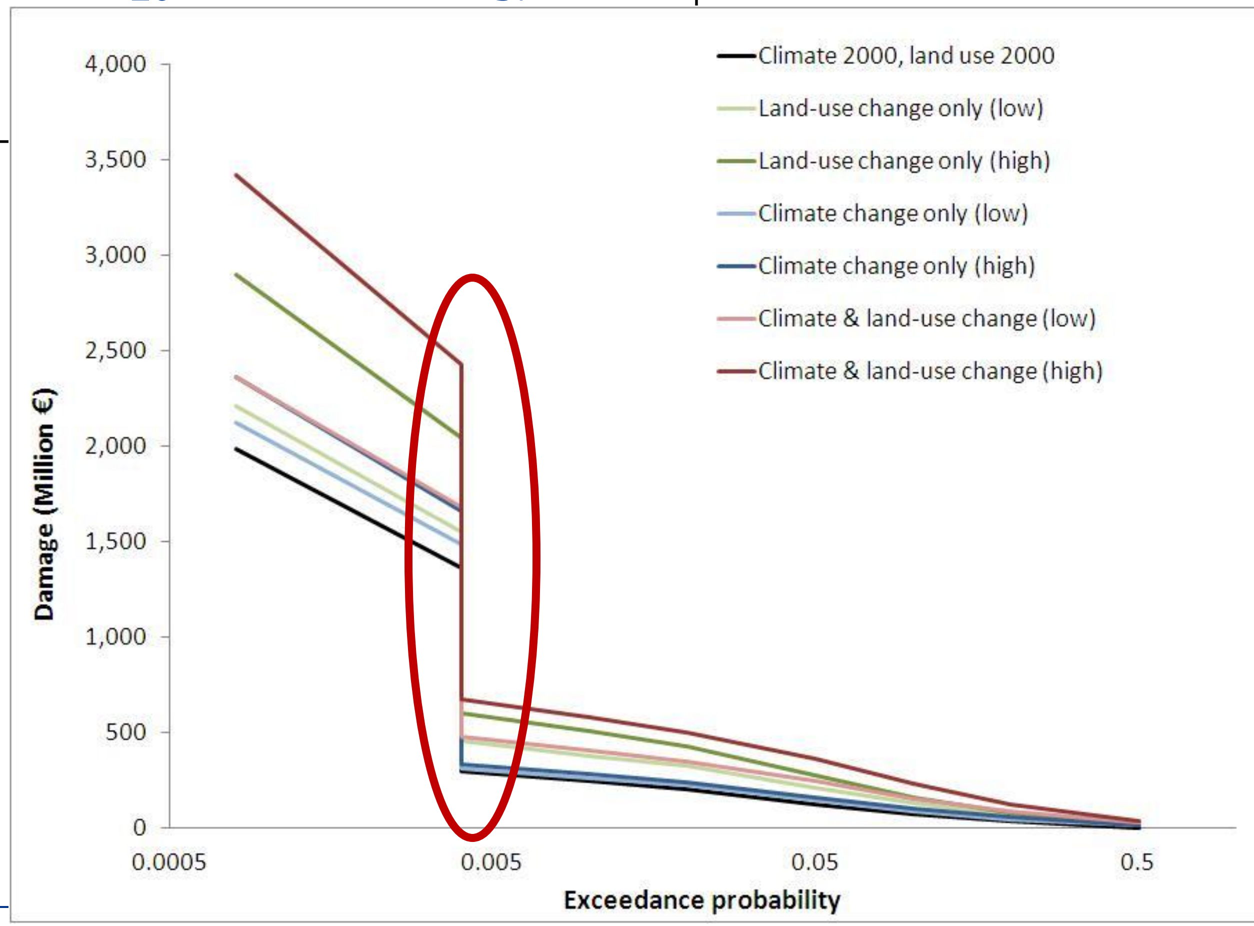
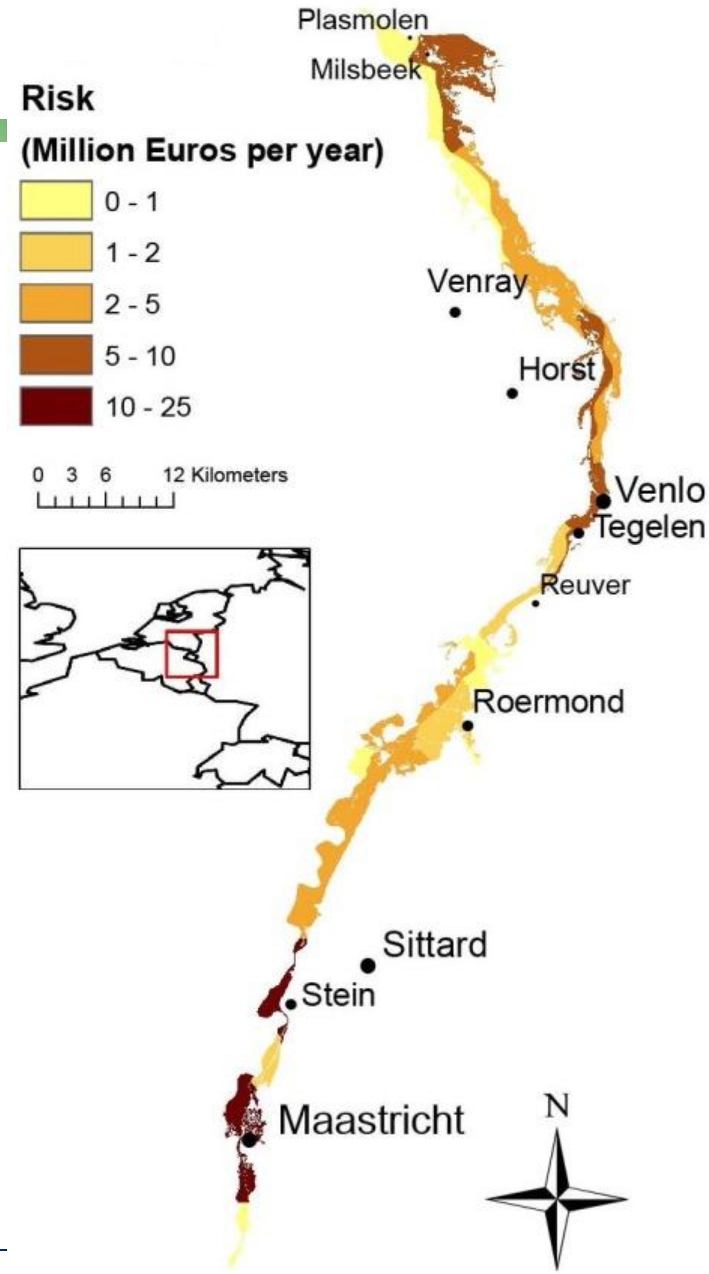


Geographical distribution of the risk

- Overall risk for 2000 = €31 million/yr

- Highest risk around residential areas

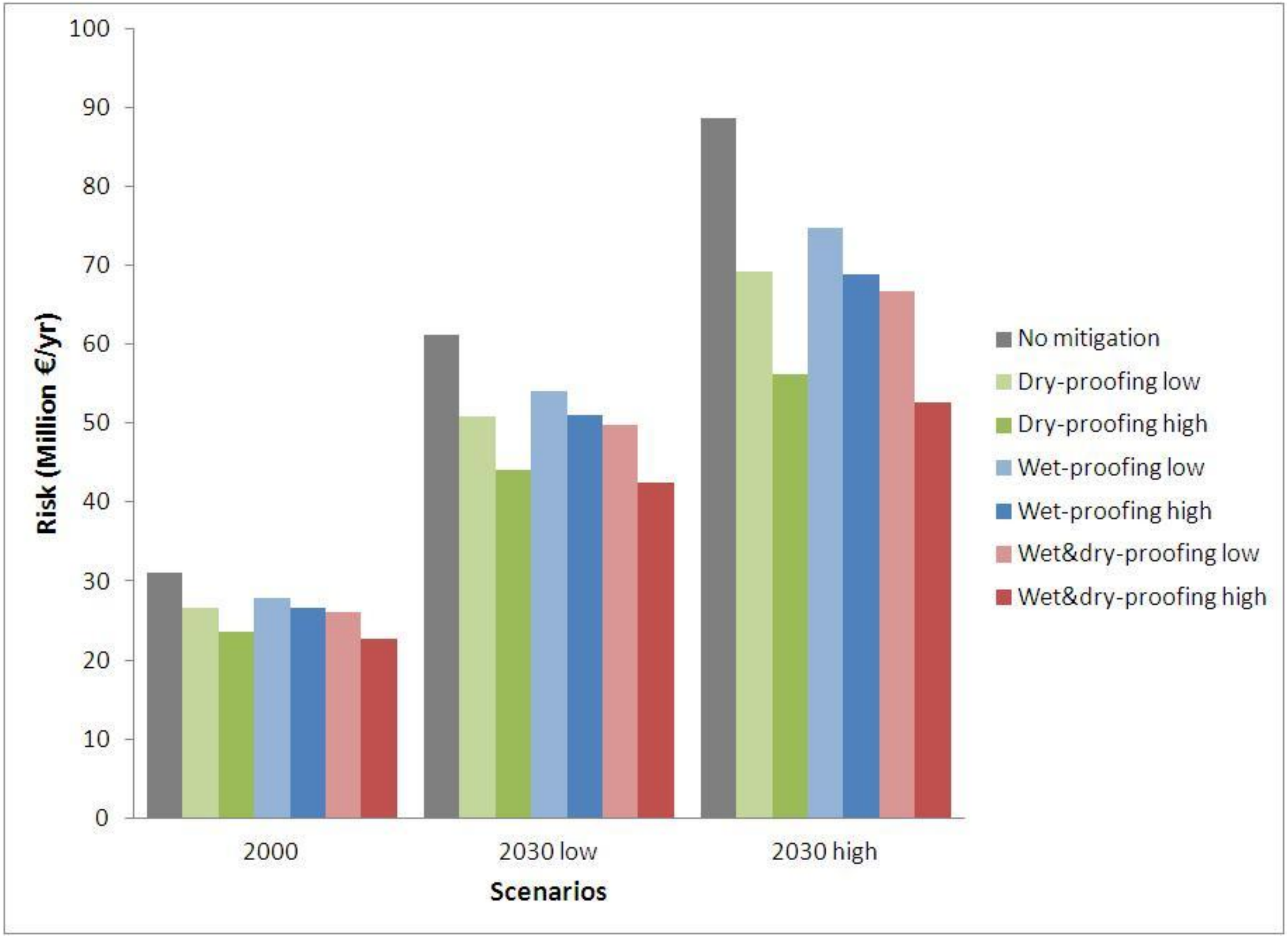


Adaptation strategies (1): Spatial planning

- Spatial planning project: BGR zoning currently implemented in Limburg

Land-use	% Risk increase (% Risk reduction of spatial zoning)		
	Climate 2000	Climate low	Climate high
2000	N/A	20 (0)	37 (0)
2030 low	23 (25)	48 (25)	N/A
2030 high	17 (45)	N/A	60 (44)

Adaptation strategies (2): Flood-proofing strategies – all residential areas



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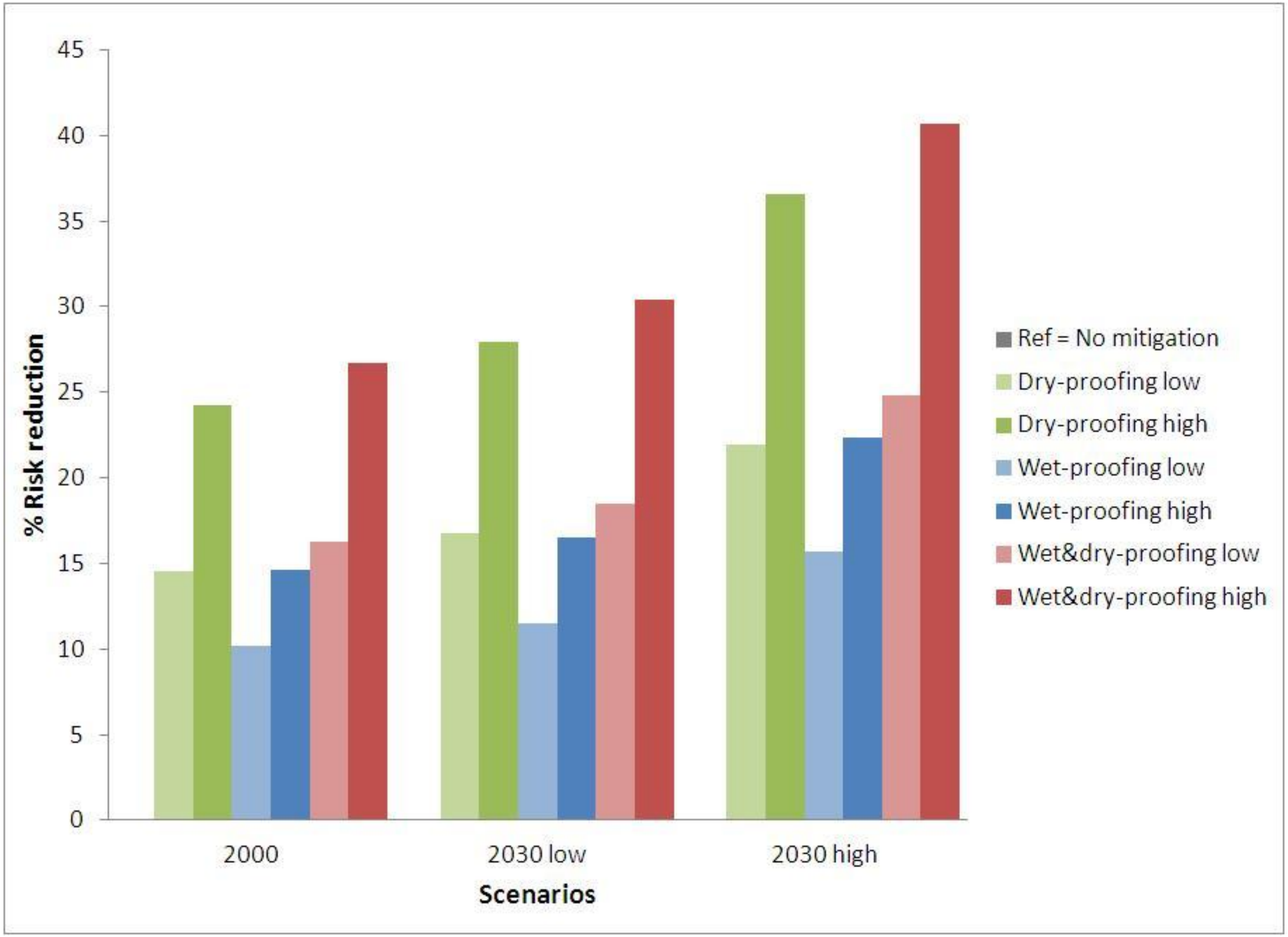


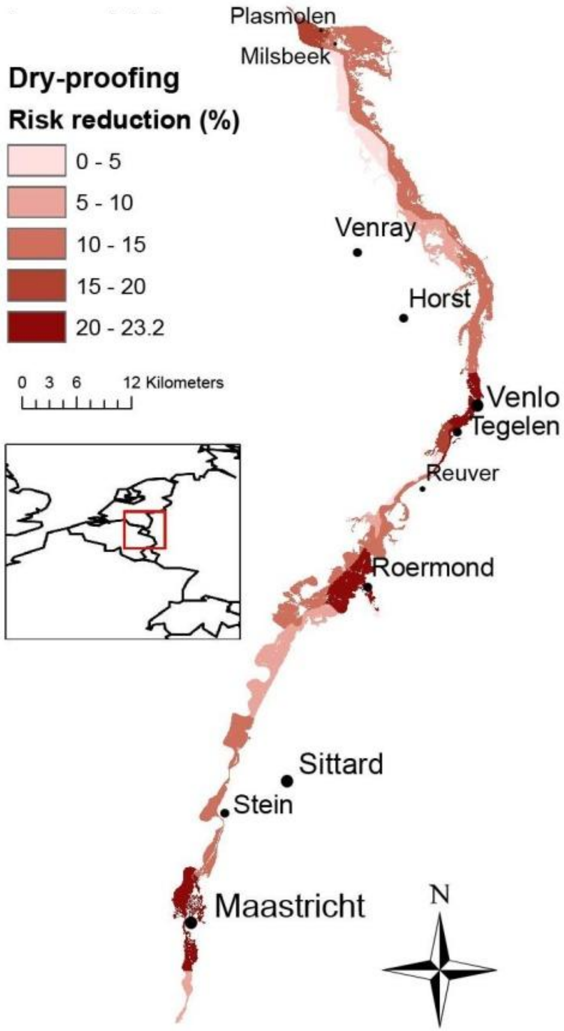
Adaptation strategies (2): Flood-proofing strategies – all residential areas

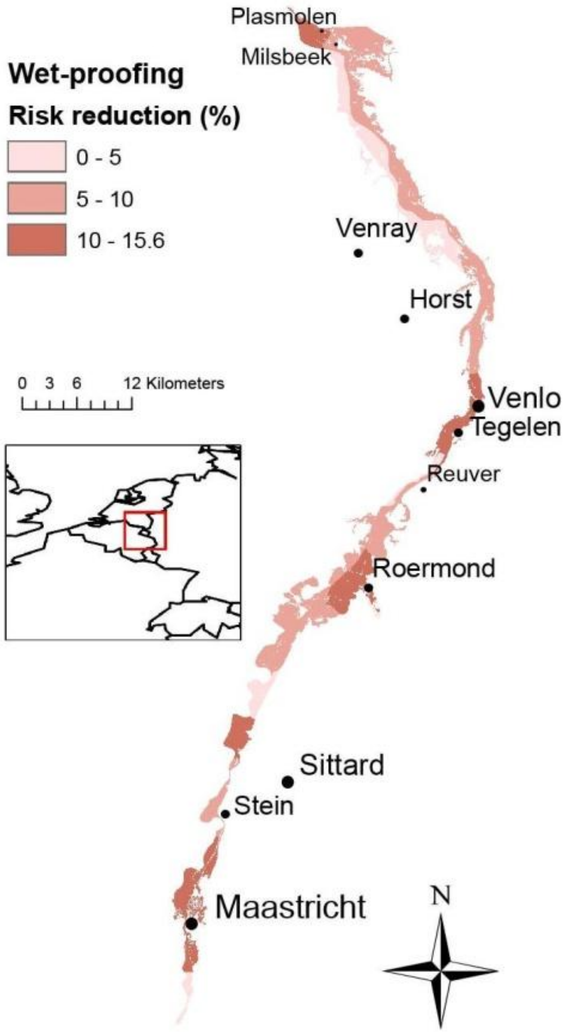
- Risk decrease from €61 and €89 million/yr for 2030 low and 2030 high scenarios to €43 and €53 million/yr when wet&dry-proofing strategy implemented

$\Rightarrow$ 30% to 40% decrease in risk

- Reduction in risk ranges from 10% (wet-proofing strategy) to 40% (wet&dry-proofing strategy)

Adaptation strategies (2): Risk reduction % for 2030 high scenarios





Adaptation strategies (2): New buildings in 2030 only

- Risk results higher: from €53 to €70 million/yr (compared to €43 and €53 million/yr when applied to all residential areas)

- Risk reduction percentages lower: from 7% to 21% (10% to 40% when all residential areas are flood-proofed)

Combination of adaptation strategies 1 & 2

- Without adaptation: 2030 low and high scenarios, risk = €61 and €89 million/yr

- When combine spatial zoning with wet&dry-proofing strategies – to all residential areas: decrease risk to €36 million/yr year for both 2030 low and high scenarios

⇒ 40% decrease for 2030 low scenario

⇒ 60% decrease for 2030 high scenario

Conclusions

- Changes in simulated land use and climate lead to increase in Meuse flood risk by 2030 up to 97% to 185% - large geographical differences
- Impact of land use change on risk increase greater than that of climate change
- Spatial planning projects, such as the BGR zoning in Limburg, can limit increase in risk - by up to 25% to 45%
- Flood-proofing measures at residential level capable of reducing risk - by up to 30% to 40% of overall risk
- Geographical differences in risk reduction results
- Combining both spatial zoning and flood-proofing strategies could significantly reduce the overall increase in risk by 2030 – by up to 40% to 60%

References

Bubeck, P., De Moel, H., Bouwer, L.M., Aerts, J.C.J.H., 2011. How reliable are projections of future flood damage? Nat Hazard Earth Sys, 11: 1-14.

Poussin, J.K., Bubeck, P., Aerts, J.C.J.H., Ward, P.J. Potential of non-structural adaptation strategies to reduce future flood risk: Case study for the Meuse. Submitted.

Thank you