



The Imperative for Multi-Level Cooperation in Adapting to Sea-Level Rise: A case study in San Francisco Bay

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Sea-level rise is happening now

Miami



<http://assets.nydailynews.com/>

NYC

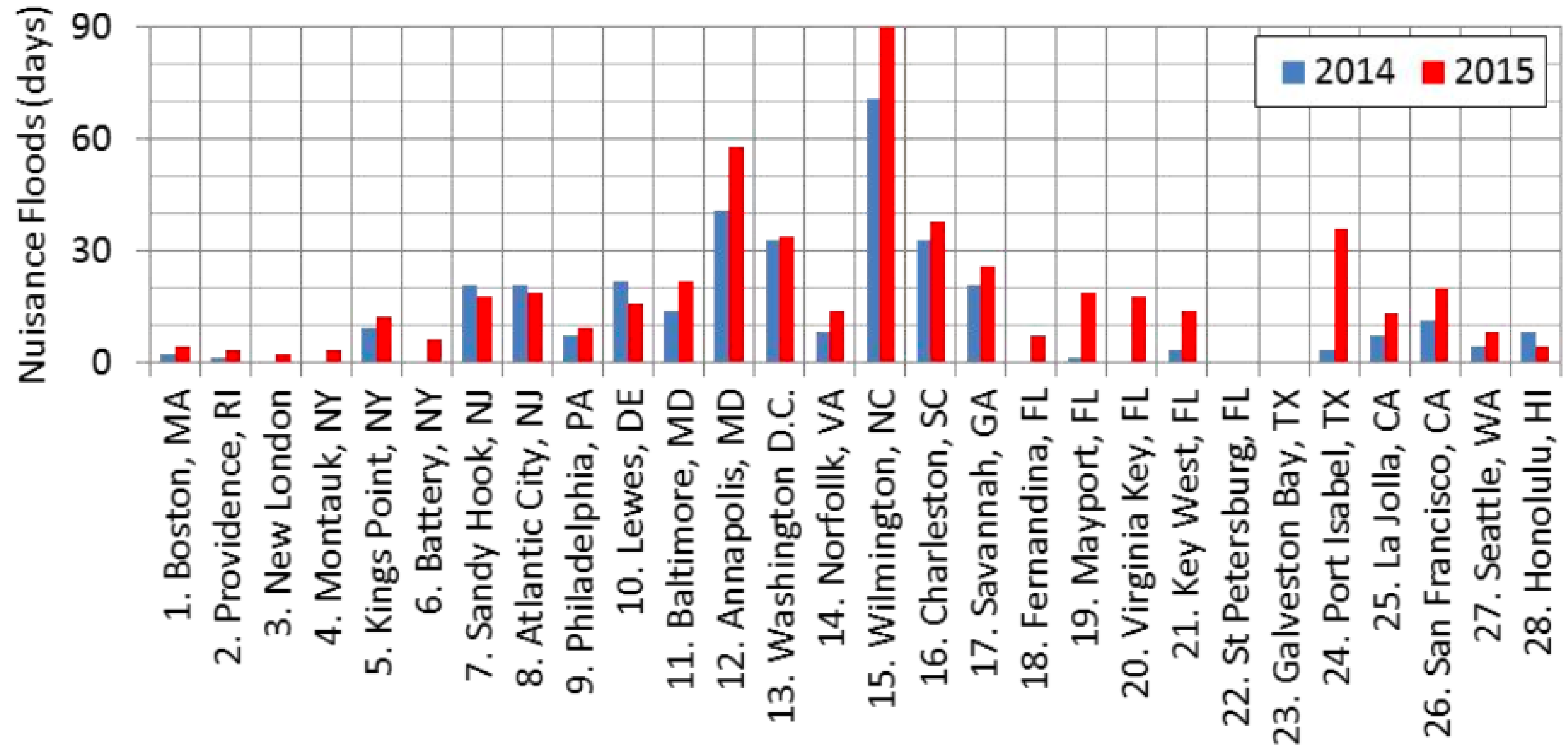


<https://ny.curbed.com/2016/12/8/13883544/nyc-climate-change-rockaways-coney-island>



<http://seaislenews.com/sea-isle-residents-plead-for-help-with-flooding/>

Coastal Flooding: the Emerging Nuisance



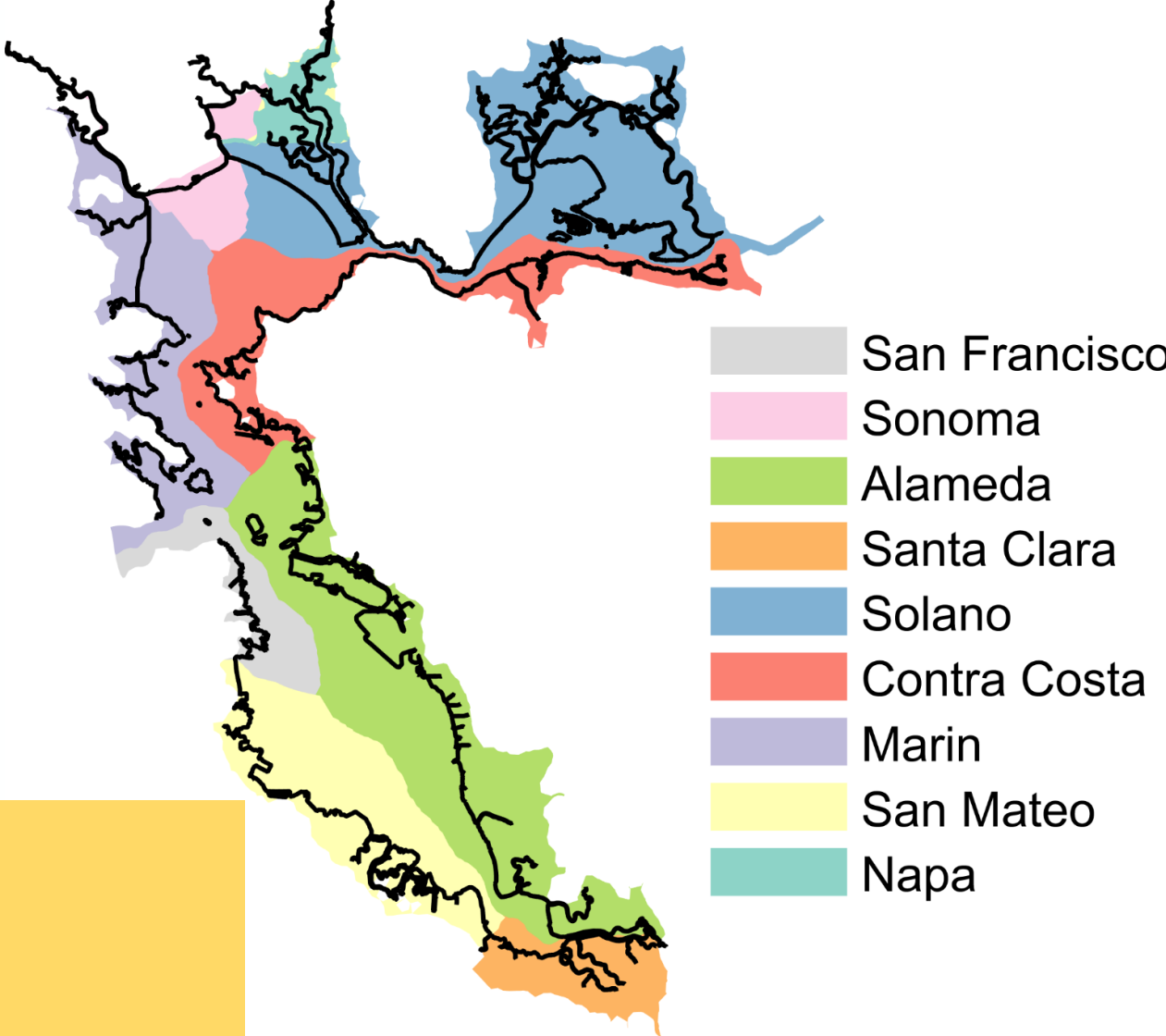
Many places start to address the threat of Sea-level Rise



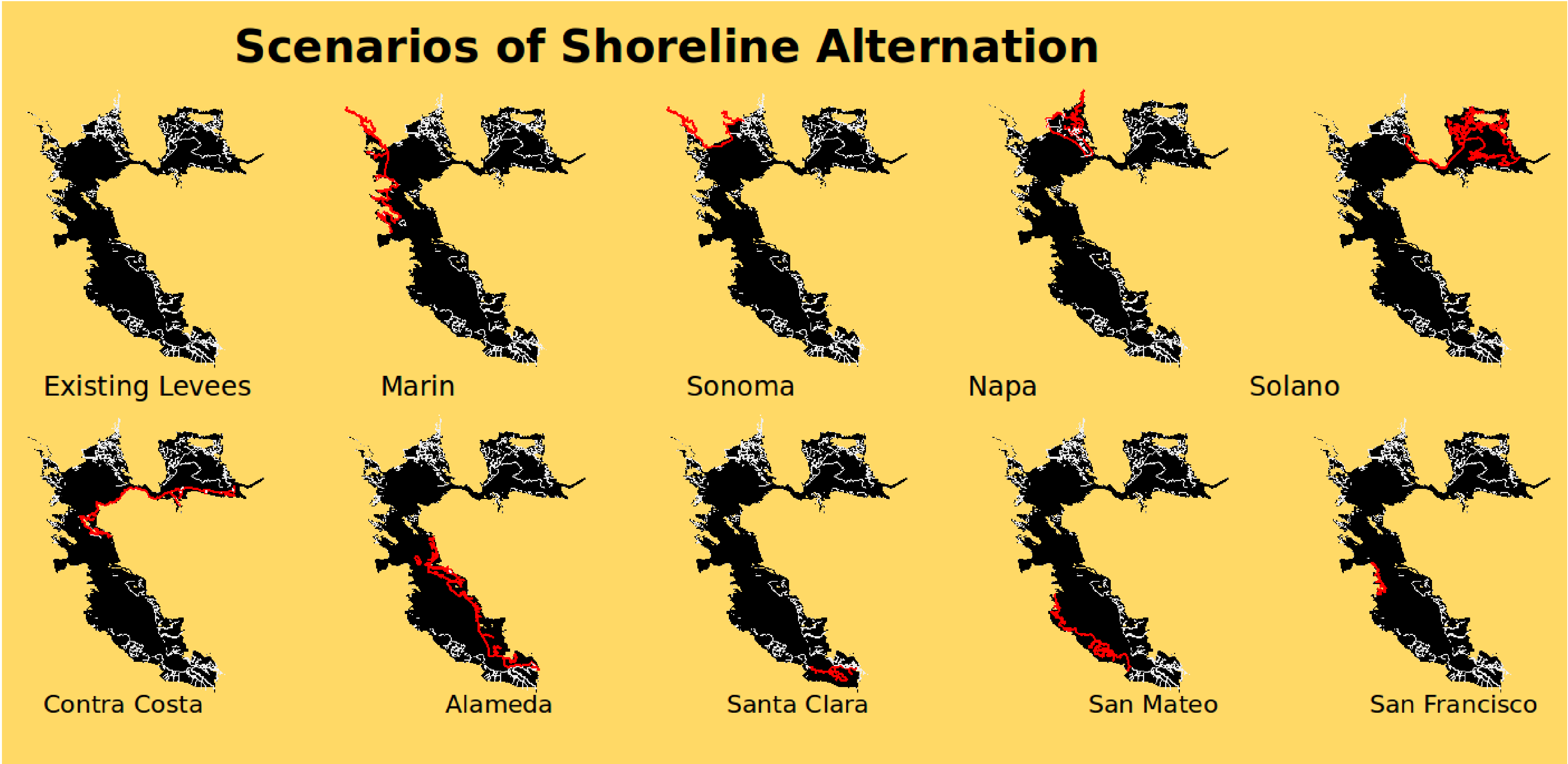
- Containment (Hardening)



Can a County Combat SLR Alone?



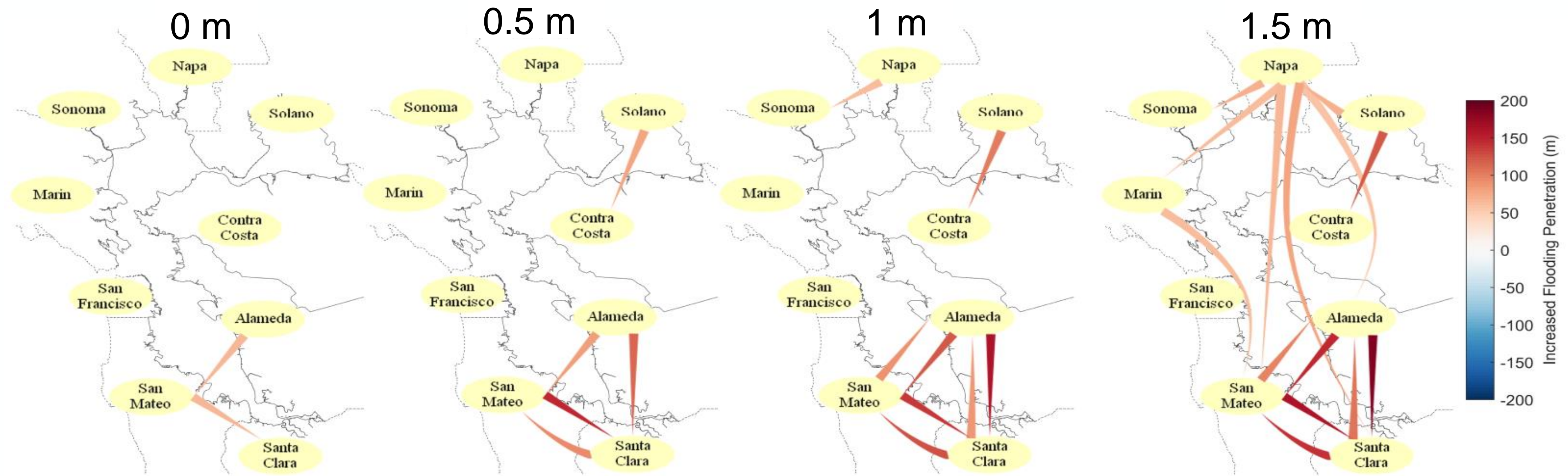
Scenarios of Shoreline Alternation



Wang et al. (2018)
Earth's Future

Interdependent Adaptation

- Defining direct influence of action by one county on flooding in another
 - ✓ County-by-county shoreline protective action
 - ✓ Quantify change in flooding in other counties for 4 sea-level scenarios

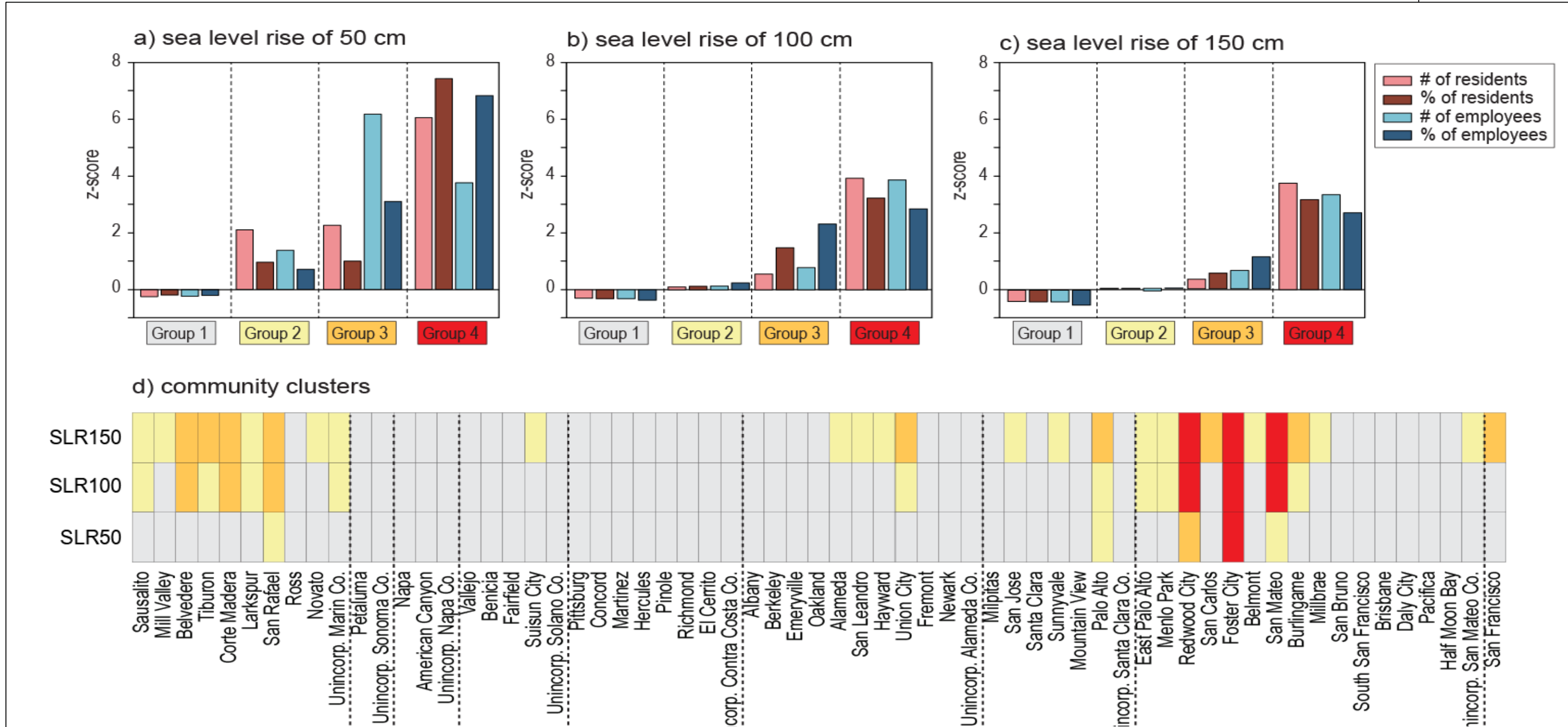
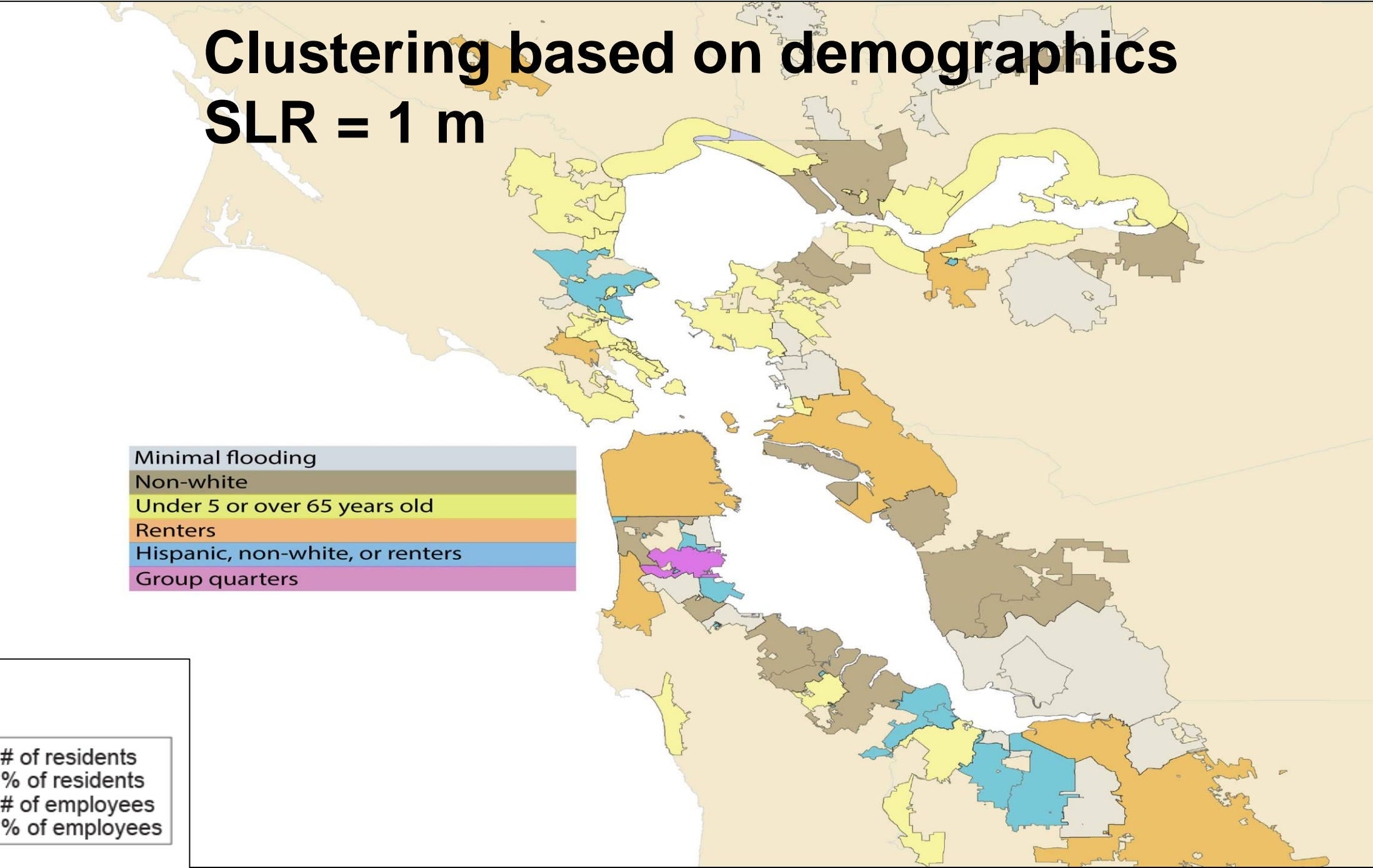


- Regional Impacts of Local Actions
 - Direct interactions means counties planning activities must account for others
 - Strongly motivates coordinated action

From: Wang et al. (2018)
Earth's Future
doi: 10.1002/2017EF000742

Shared Experiences

- Inundation map merged with census data
 - ✓ Clusters based on similarities between communities
 - ✓ Clustering varies with time (sea level) and data considered



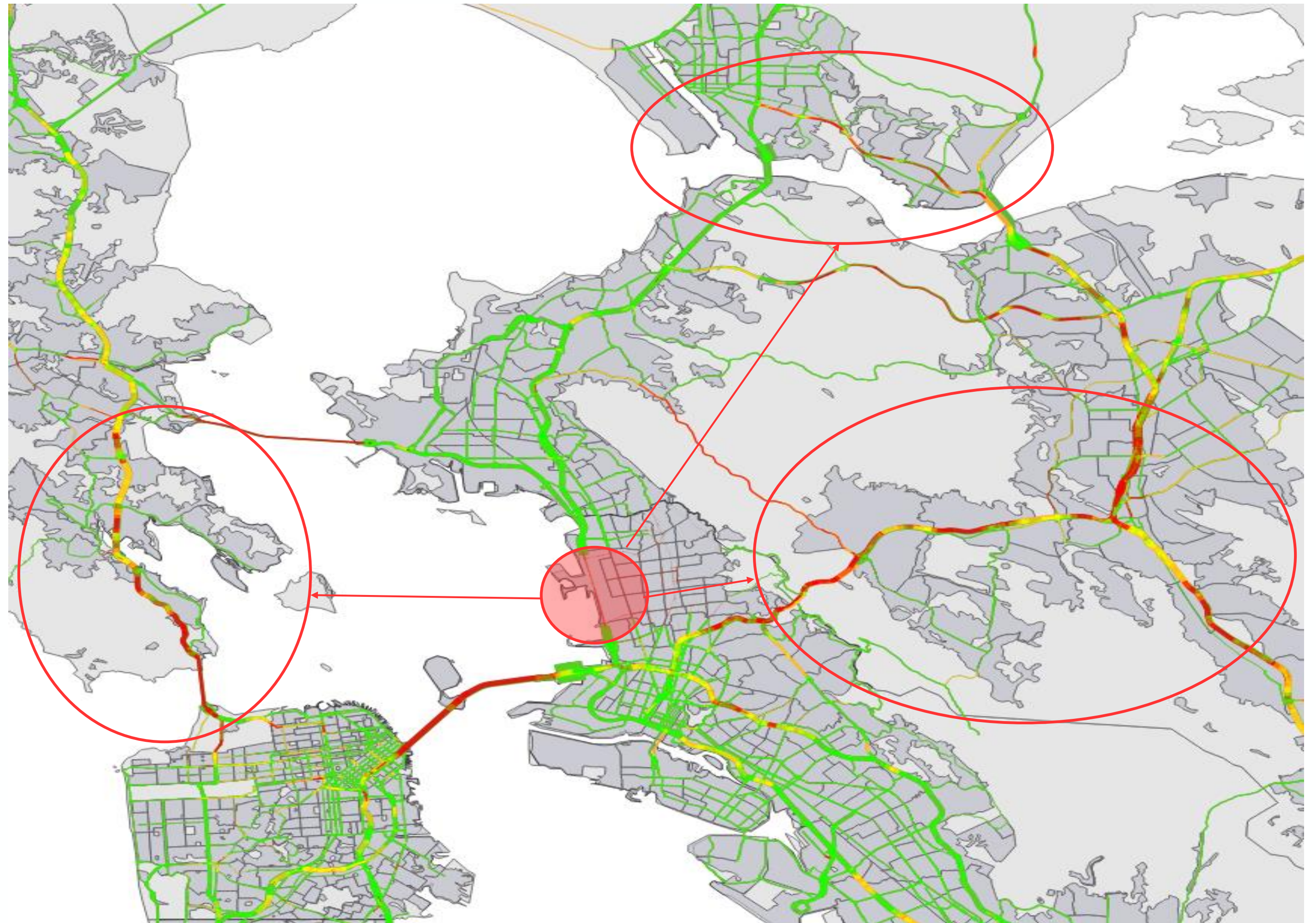
Time development of clusters

- Regional Opportunity
 - Communities with similar risks may benefit from sharing knowledge
 - Future clustering may motivate unanticipated connections

From: Hummel et al. (2017)
Regional Environmental Change
doi: 10.1007/s10113-017-1267-5

Interdependent Vulnerabilities

- Disruption by flooding on Berkeley water front
 - ✓ 90% capacity reduction
- Behavioral model adjusts traffic patterns
 - ✓ Model built from cell phone data
- Travel time increases:
 - ✓ Green: 0%
 - ✓ Orange-Yellow: 0-50%
 - ✓ Red: >50%



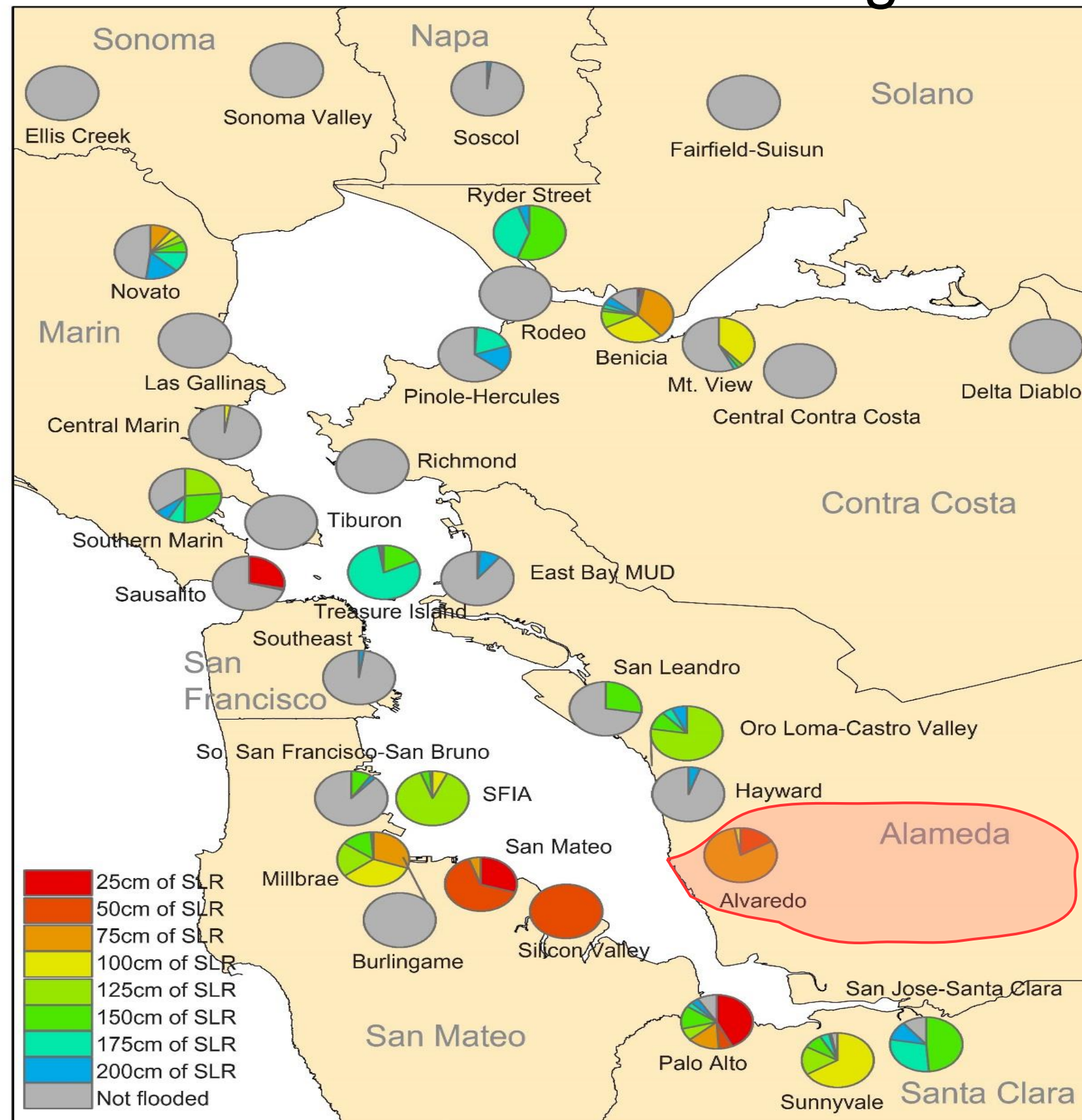
From: Madanat et al., (2019) Transport Policy

Figure from Sheehan and Pozdnukhov, unpublished

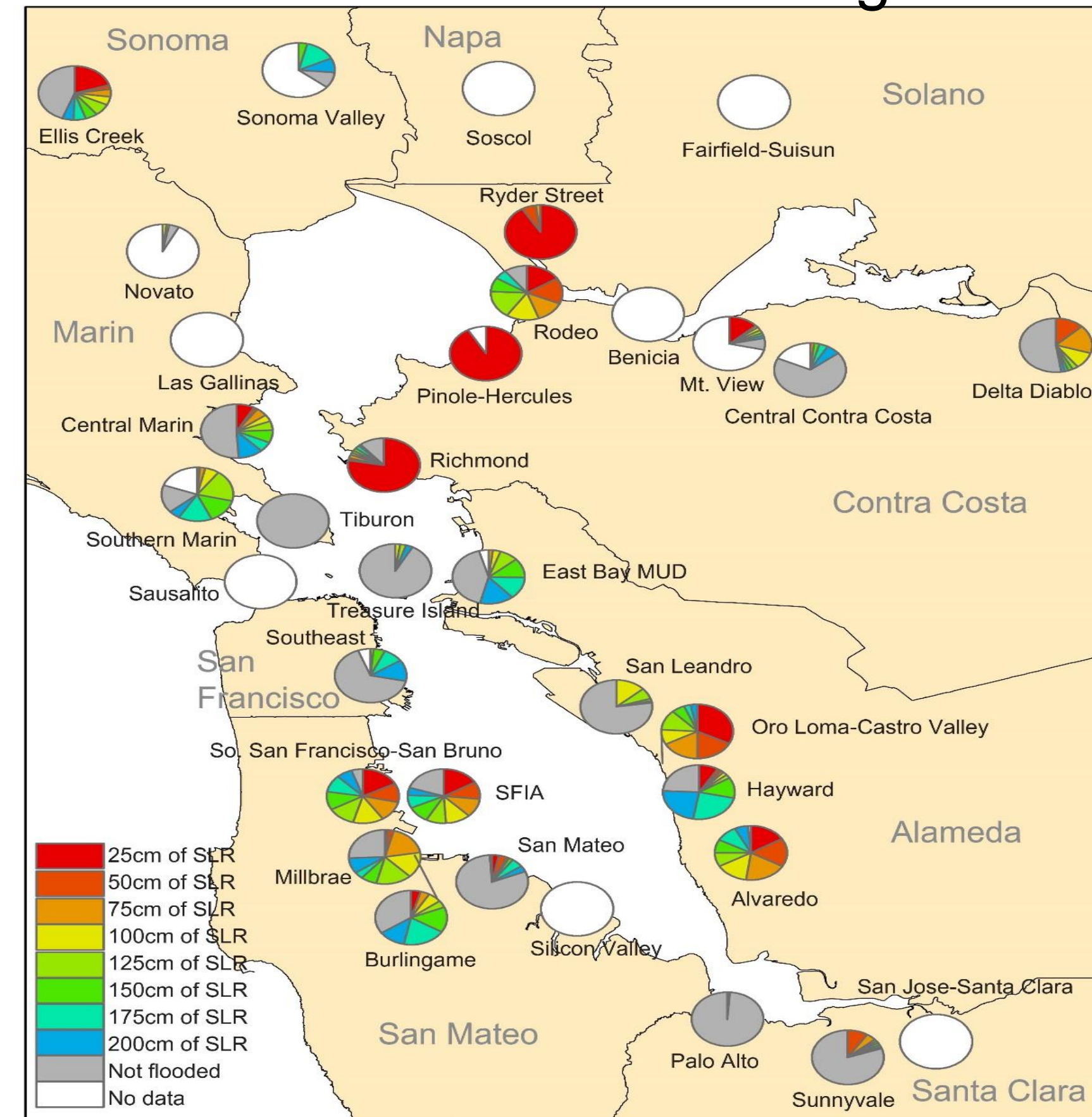
- Regional Costs due to Local Vulnerability
 - Localized inundation event creates regional changes in travel times and costs
 - Creates incentive for regional investment in local protections

Wastewater Infrastructure Vulnerabilities

Surface Water Flooding



Groundwater Flooding



- Regional Costs due to Local Vulnerability
 - ✓ Lack of redundancy in wastewater network
 - ✓ Vulnerabilities at key locations (WWTPs) create disruption for population served by facilities

From: Hummel et al. (2018)
Earth's Future
doi: 10.1002/2017EF000805

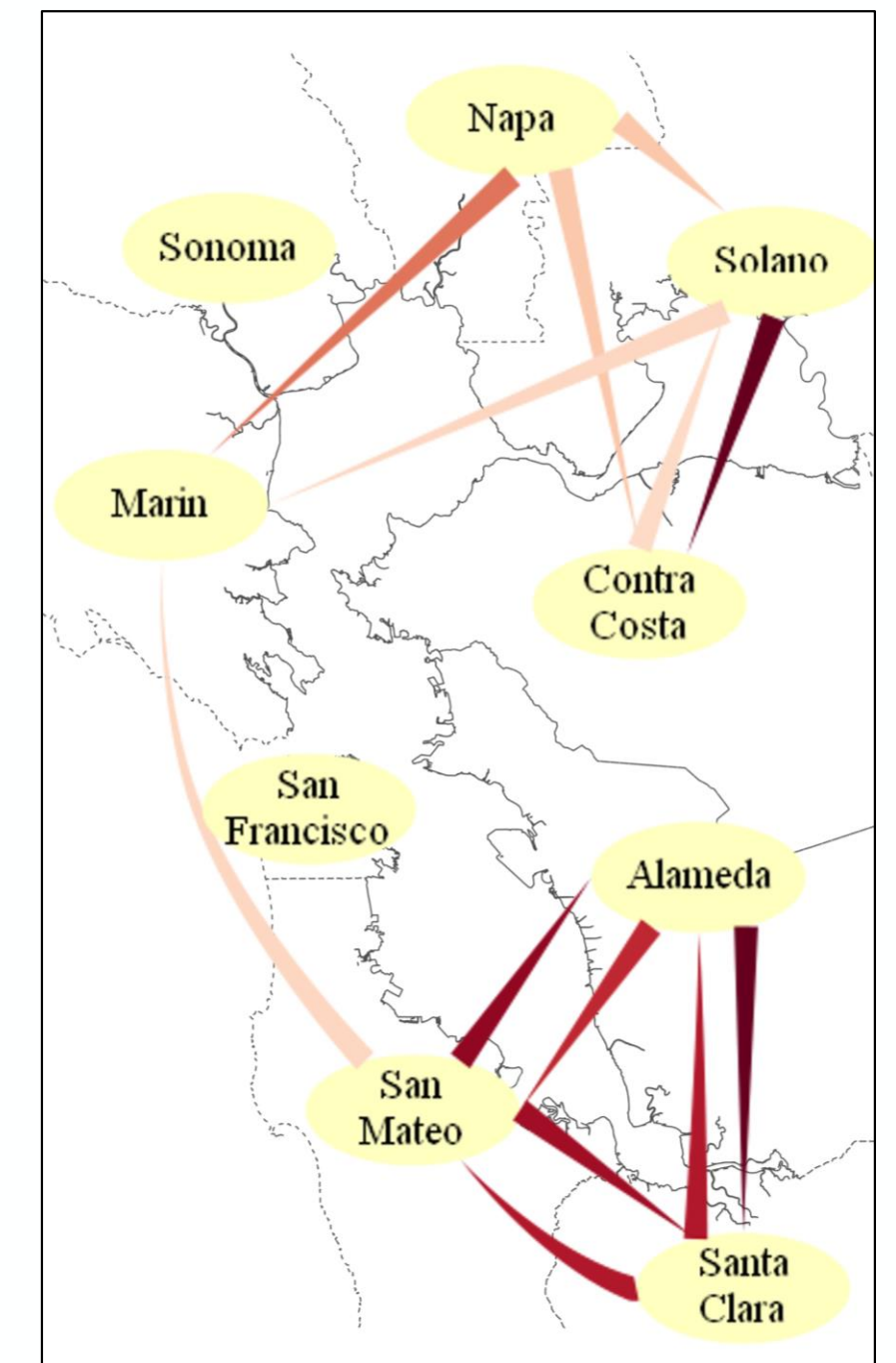
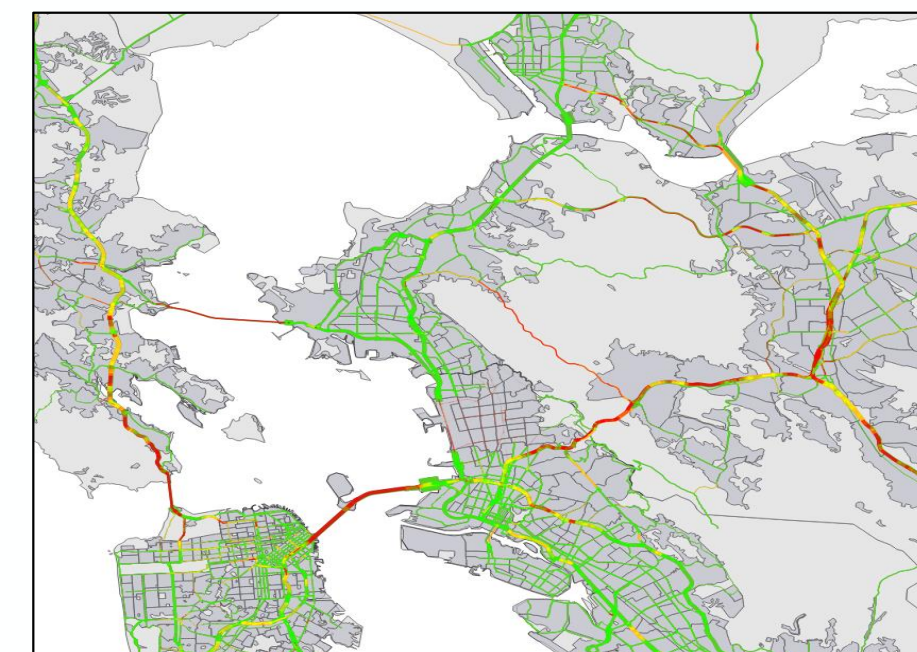
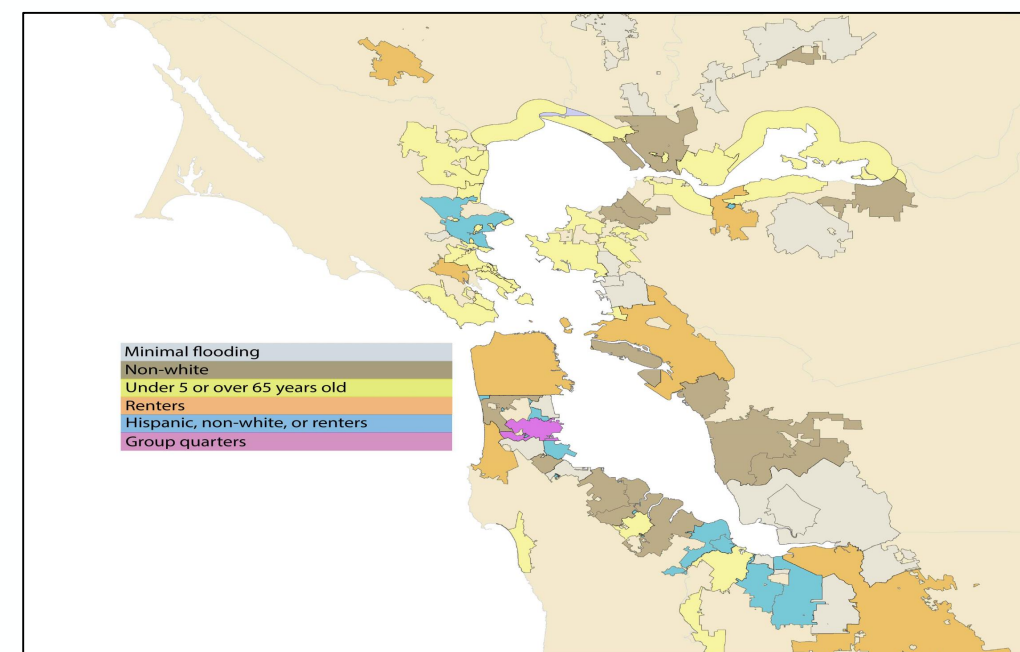
We Need Regional Coordination in SLR Adaptation

Discovery:

- Physical interdependence leads to complex social interdependence
- Local disruptions/actions could have regional impact
- Higher sea-level rise intensifies the interdependence

Suggestion:

- Understand and assess the physical and social interaction
- Exchange experience and coordinate with people who share similar risk scenarios
- Create incentives to protect key locations for regional benefits



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Thank you



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