Theoretical perspectives on support for coastal climate change adaptation planning

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Abstract

This study seeks to understand support for climate change adaptation planning and the influence of perceived risk, uncertainty, trust, and cross-scalar relations on adaptation and vulnerability of US coastal communities.

The assessment is based on the analysis of 27 interviews and a web-based questionnaire (n=137). Participants included city planners and engineers, regional planners, NGOs, and division heads of state government offices in Alaska, Florida, and Maryland. This group was selected for analysis because they play a critical role in the planning and management of communities, they have received limited attention in previous coastal survey-based research, and each state is involved in adaptation planning and faces diverse coastal challenges.

Ordinal regression and correlation analysis were used to understand how perceptions of risk, uncertainty, and trust relate to support for climate change adaptation strategies. The eight scales used as co-variates were perceived risk (environmental changes, climate change impacts), uncertainty (environmental changes, climate change impacts, social, and decision making processes), and trust in state government and publically funded climate scientists.

Findings indicate a higher level of perceived risk and trust in climate scientists significantly increase the odds of a higher level of support for climate change adaptation strategies. Although participants indicated there were several uncertainties in planning, a higher level of uncertainty did not significantly decrease the odds of a higher level of support for adaptation. There were also differences in the strength, direction, and significance of correlations within and between study areas, which highlight the value of addressing cross-scalar issues.

Introduction

Some states and communities across the US have developed climate change adaptation (CCA) plans to address their existing and potential risks and vulnerabilities, while the majority of other entities are less engaged in planning efforts (NOAA CSC 2012). Understanding the limits and barriers to adaptation planning, including what factors are related to behavioral changes, has emerged as a significant element of climate change vulnerability research in the past decade (Adger et al. 2009; Moser and Ekstrom 2010).

Three theories are particularly relevant to understanding support for behavioral changes in CCA planning, especially in coastal environments: perceived risk , uncertainty, and trust.

1. Perceived Risk is linked to behavioral changes in multiple arenas (Lindell and Perry 2000; O'Connor et al. 2005). The strength of the relationship is influenced by the nature and magnitude of the risk and specific behavioral change.

2. Uncertainty influences how individuals and organizations make decisions regarding their risks because it may cast doubt and affect behavior, timing, and degree of effort. Some theories suggest that the "level" of uncertainty influences decision making and others focus on peoples' willingness to bear uncertainty, which is influenced by differences in motivation and risk tolerance (McMullen and Shepherd 2006).

3. Trust plays an important role in facilitating cooperation among entities, especially when the level of risk and uncertainty are high (Laurian 2009). Individuals must have confidence in the abilities and trust in the intentions of individuals processing the information and governing institutions recommending policy changes (Earle 2010).

Research Question

How does perceived risk, uncertainty, and trust relate to support the development of, and allocation of human and financial resources for, local-level adaptation strategies that consider addressing climate impacts?

Methods Summary

1. Select participants (n = 463)
   - Participants: City planners and engineers, regional planners, NGOs, and division heads of state planning offices
   - Study areas: Alaska, Florida, and Maryland
2. Conduct semi-structured interviews (n = 27)
   - Identify key risks, uncertainties, and dimensions of trust
3. Implement web-based questionnaire
   - Dillman's (2000*) Tailored Design Method*
   - Response rate (30%; n= 137)
4. Assess support for CCA planning (2 questions)
5. Analyze scales of risk perception (2), uncertainty (4), and trust (2)
   - 53 questions
6. Detect influence of scales on support for climate change adaptation (CCA)
   - Ordinal Regression and Spearman's Rho

This work was pilot tested in South Carolina (March – September 2010)

Citations

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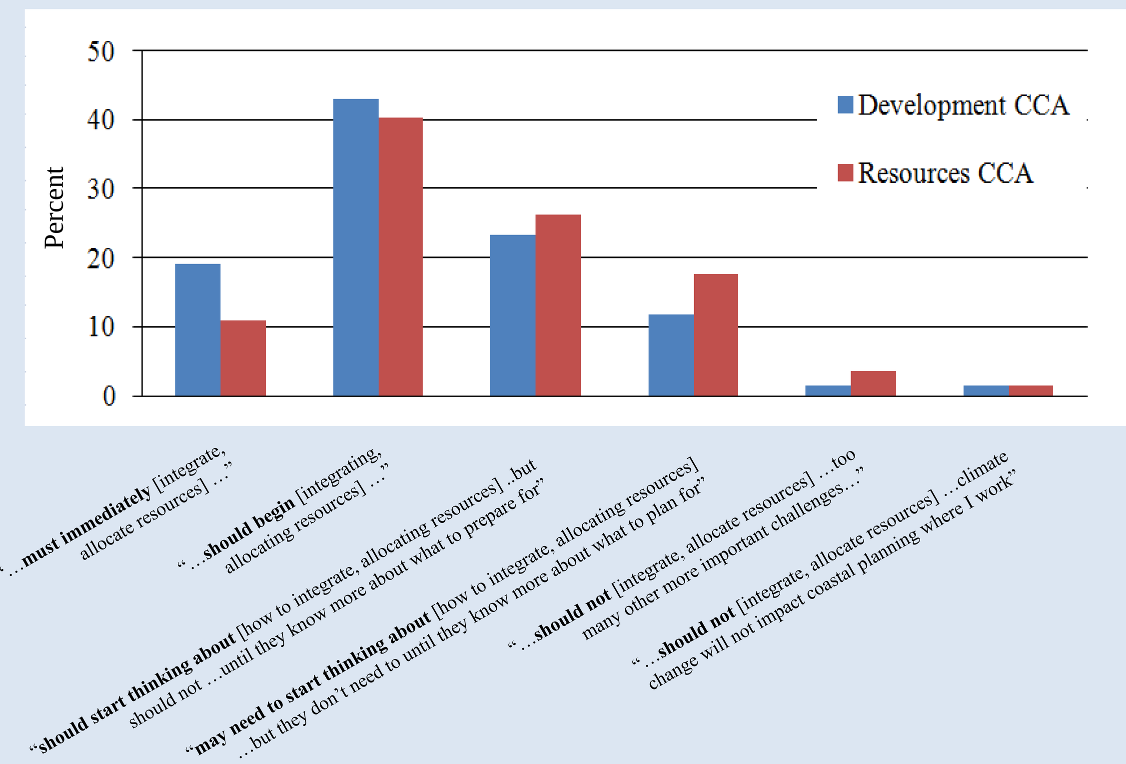
Support for Climate Change Adaptation Planning

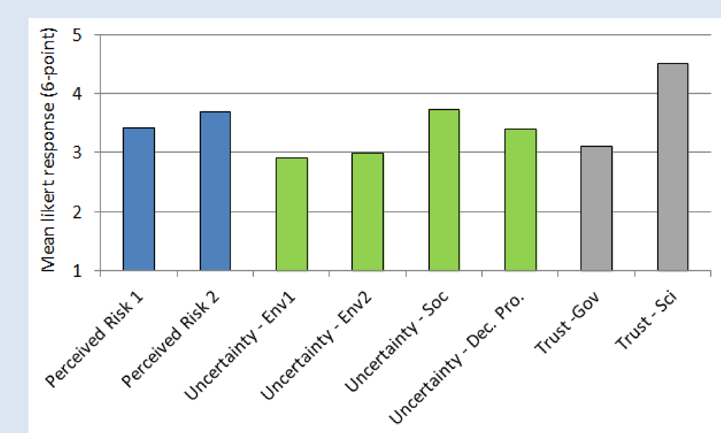
- "Which statement best represents your level of support for the development of local-level adaptation strategies in your area that consider addressing the potential impacts of climate change."
- "Which statement best represents your level of support for the allocation of financial and human resources to implement local-level adaptation strategies in your area that address potential impacts of climate change."



- 85% of planners think we should at least start thinking about *developing strategies*
- 77% of planners think we should at least start thinking about *allocating human and financial* resources to implement strategies
- Support for development of CCA is significantly higher (p-value: 0.001)than support for the allocation of human and financial resources to implement CCA (Wilcoxon-signed rank test)

Risk Perception, Uncertainty, and Trust Scales

- Perceived risks to climate change impacts were slightly greater than perceived risk to changes in environmental conditions
- The perceived level of uncertainty was significantly higher (p-value: 0.001) for social and decision making processes than for climate change impacts (Wilcoxon-signed rank test)
- There were higher levels of trust in the abilities and intentions of climate scientists than state-level government



The Influence of Perceived Risk, Uncertainty, and Trust

	Covariates	Estimate	Std. Error	Wald	Sig.	Odds Ratio
Model 1 Development CCA	**Perceived Risk**	.905	.202	19.964	**.000**	0.405
	Uncertainty Env1	-.086	.207	.171	.679	1.089
	Uncertainty Env2	-.284	.229	1.546	.214	1.329
	Uncertainty Social	.262	.232	1.282	.257	0.769
	Uncertainty Dec. Pro.	-.195	.151	1.668	.197	1.215
	Trust Scientists	.650	.237	7.512	**.006**	0.522
	Trust Gov.	-.020	.238	.007	.932	1.020
Model 2 Resources CCA	**Perceived Risk**	.908	.203	19.951	**.000**	0.403
	Uncertainty Env1	-.149	.208	.515	.473	1.161
	Uncertainty Env2	-.044	.229	.037	.847	1.045
	Uncertainty Social	.179	.231	.597	.440	0.836
	Uncertainty Dec. Pro.	-.264	.152	3.019	**.082**	1.302
	Trust Scientists	.601	.237	6.417	**.011**	0.548
	Trust Gov.	-.332	.240	1.915	.166	1.393

Nagelkerke Pseudo R^2: Model 1: 0.420; Model 2: 0.392)

- Higher levels of perceived risk and trust in climate scientists significantly increase the odds of a higher level of support for CCA planning strategies
- Higher levels of perceived uncertainty do not significantly decrease the odds of a higher level of support for CCA (except for Decision Processes in Model 2)
- Higher levels of trust in state government do not significantly increase the odds of a higher level of support for CCA

- Perceptions of risk and trust in climate scientists are significantly correlated (positive) to support for CCA across study areas and levels of management
- Perceived environmental uncertainties are significantly correlated (negative) to support for CCA for:
  - All planners in Alaska and Florida, but not in Maryland
  - All local-level planners
- Trust in government is significantly correlated to support in Maryland (positive) and Alaska (negative), and not correlated in Florida.

		Study Area			Level of Management			Total
	Scale	AK	FL	MD	Local	State^	NGO	
Model 1 Development CCA	Perceived Risk	0.585**	0.467***	0.553***	0.51***	0.316	0.478*	0.529***
	Uncertainty Env1	-0.423*	-0.381**	-0.136	-0.304**	-0.144	-0.289	-0.366***
	Uncertainty Env2	-0.456*	-0.384**	-0.352*	-0.4***	-0.215	-0.305	-0.399***
	Uncertainty Social	-0.313	0.009	-0.47	-0.046	-0.153	-0.288	-.129
	Uncertainty Dec. Pro.	-0.215	-0.157	-0.426**	-0.277**	-0.315	0.106	-0.306***
	Trust Scientists	0.454*	0.394***	0.338*	0.242*	0.427*	0.401	0.414***
	Trust Gov.	-0.308	0.007	0.402**	-0.022	0.328	-0.24	.030
Model 2 Resources CCA	Perceived Risk	0.598**	0.507***	0.42**	0.477***	0.442*	0.583**	0.517***
	Uncertainty Env1	-0.528**	-0.284*	-0.18	-0.258**	-0.295	-0.243	-0.334***
	Uncertainty Env2	-0.361	-0.272*	-0.247	-0.24*	-0.216	-0.281	-0.297***
	Uncertainty Social	-0.202	-0.054	0.122	-0.022	0.047	-0.346	-.107
	Uncertainty Dec. Pro.	0.028	-0.296**	-0.383*	-0.243*	-0.233	-0.043	-0.282***
	Trust Scientists	0.395*	0.354**	0.376*	0.274**	0.491*	0.409***	0.376***
	Trust Gov.	-0.445*	-.120	0.452**	-.129	.183	-.232	-.051

Spearman's rho (ρ) correlation coefficients   Significant levels: *0.05; ** 0.01; ***0.001

^ The "state" level of management only contains responses for Maryland and Florida because the Alaska Coastal Management Program was not reauthorized in July 2011, before the questionnaire was implemented.

Web-Based Questionnaire

This section details the 53 survey questions used to assess for risk perceptions, uncertainty, and trust. Planner responses were combined into eight scales (see below) by averaging Likert item questions for each set of questions. Six response options were available for each survey question.

Perceived Risk

"Please rate your level of concern that the following [*environmental changes or climate change impacts*] will occur in your community over the next 15-20 years (approximately 2030)."*

1. Environmental changes (6 questions) α = 0.76
Sea level rise; land subsidence; more extreme precipitation events; stronger hurricanes and coastal storms; an increase in surface temperature; permafrost melt

2. Climate change impacts (8 questions) α = 0.89
More intense flooding events; more frequent flooding events; public health and safety issues; saltwater intrusion; economic issues (jobs, business, tourism); beach & dune loss; loss of wetland & marsh habitat; infrastructure & property damage

*Both Risk Perception scales were combined into a single scale because they were significantly correlated (α = 0.90)

Perceived Uncertainty

"Please rate the extent the level of uncertainty associated with changes in [environmental conditions, climate change impacts, social conditions, or decision making processes] over the next 15 to 20 years (approximately 2030)."

3. Environmental Conditions (Env1) (6 questions) α = 0.83
Sea level rise; land subsidence; more extreme precipitation events; stronger hurricanes and coastal storms; an increase in surface temperature; permafrost melt

4. Climate Change Impacts (Env2) (8 questions) α = 0.89
More intense flooding events; more frequent flooding events; public health and safety issues; saltwater intrusion; economic issues (jobs, business, tourism); beach & dune loss; loss of wetland & marsh habitat; infrastructure & property damage

5. Social (8 questions) α = 0.84
People and organizations in coastal management, predictability of budgets, population growth and development, political environment, cost of insurance for homeowners, stakeholder priorities and values, changes in local coastal policies, changes in state coastal policies

6. Decision Processes (4 questions) α = 0.95
How the climate is changing, the level of change in climate that is dangerous, adaptation goals and needs, how to assess and compare adaptation options

Trust

"Please rate your level of agreement for the following statements related to trust in [publically funded climate scientists or state government]."

7. Climate Scientists (6 questions) α = 0.83
Scientists have the necessary skills to measure historical changes in climate, scientists have the necessary skills to measure land subsidence & rebound, the values of scientists studying climate change are similar to mine, climate scientists are too influenced by industry & private interests, climate change related data & findings are distorted by scientists.

8. State Government (7 questions) α = 0.65
The state has sufficient resources to implement climate change adaptation (CCA) policies, the state has financial resources to enforce CCA policies, the state has sufficient staff expertise to implement CCA policies, the state is too influenced by industry and private interests, the state takes into account many perspectives when making a decision, the state provides all of the available information to the public when making a decision, the state has similar opinions and ideas as I do regarding CCA.

Conclusions

1. **The influence of factors on potential behavioral change varies throughout the adaptation planning cycle**
   - A higher level of perceived risk and trust in scientists both significantly increased the odds of a higher level of support for the development of, and allocation of resources for, CCA strategies. However, correlations for decision making processes uncertainties were only significant (and negative) for the allocation of human and financial resources.
2. **Correlations between each scale and support for CCA were not uniform across planning entities**
   - Trust in government differed in magnitude and direction across each study area, highlighting the importance of comparative studies, rather than just national-level surveys.
3. **The level of perceived uncertainty for social and decision making processes is significantly higher (p-value: 0.001) than for environmental changes and for climate change impacts.**
4. **Sources of uncertainty do not significantly decrease the odds of support for CCA**
   - Support for CCA is linked more to peoples' willingness to bear uncertainty under conditions of high risk potential, rather than the perceived level of uncertainty.