

Anonymized and synthesized Delphi method discussion notes from the 2023 Coastal Security Workshop (combined input from all discussion groups)

DELPHI METHOD SESSION 1

1. Which specific coastal location in the US is more likely to experience the most significant security problems?

- Integration of different water types: ground, coastal, surface.
- Florida is affected by climate security issues due to its water issues.
- Population density and exposure to hazards affect security.
- Locations that are less populated are also under threat.
- The emergence of significant security problems will depend on the government's ability and willingness to address coastal issues. States that don't have the political will to address and acknowledge coastal threats will be most affected.
- The local/municipal scale will play the most crucial role in responding to coastal challenges and the national one the least. NYC and Hampton Roads are better positioned to react than Florida.
- Scale of the response should be aligned with the scale of the security issue and to identify the roles and responsibilities of key actors within each scale.
- Florida was ranked at the top due to its large population in south Florida and high hurricane risk.
- The region is less important than the scale of potential security issues, especially at the local level.
- Areas with financial and political resources are better positioned to deal with coastal problems. It is the same if the locality already invests in readiness, preparedness, and infrastructure upgrades. The institutional ability to solve problems is important.
- Political capability of institutions and localities
- Focus on military resilience and critical infrastructure can attract more bipartisan and public support.
- Experiences with Hurricane Katrina and Sandy can indicate what is effective and what is not.
- Emotional/subjective elements and politics affect progress.
- Why not the West Coast (Los Angeles and San Francisco) with substantial natural hazard risk – Earthquakes and tsunamis? Maybe because episodes are less frequent and workshop has mostly East Coast representation. The risk is mostly driven by sea level rise and land subsidence. There are other locations that might be overlooked due to their isolation and size. The Great Lakes are also coastal. Compounding factors and the presence of military installations should be considered.
- Migration patterns already indicate possible trends – like Marshall Island immigrants' migration to Arkansas. Some immigrants target coastal areas.
- Other sectors are important for security: nuclear facilities, the Tech industry, etc.
- Coastal security affects food and water security issues.
- Many locations are at risk. but for different reasons, one being the ability to respond like Guam and Puerto Rico.
- The impact propagation across geographic scales is important – e.g., energy impacts for the entire country.

2. Which coastal stressor is more likely to result in security issues and should be prioritized?

- Hurricanes ranked highest in survey as more visible issue with more media coverage than sea level rise. They are sudden, intense, and immediate, while others like sea level rise and erosion and slowly creeping up.
- Chronic/repetitive disaster impacts are often overlooked.
- Coastal stressors are ranked higher based on the severity of their impacts and can add up.
- Coastal stressors might be ranked based on the impacts they cause – e.g., displacement of people, facilities, and services, with economic impacts. Impacts on supporting facilities like shipyards are important as they affect military operations.
- All coastal stressors are somehow linked - sea level rise, tidal flooding, hurricanes, storm surge, erosion, and water table.
- Water table changes affect septic systems and underground infrastructure. Salinization can further augment the problem and lead to corrosion.
- Solutions to deal with chronic vs episodic issues need to be synchronized.
- Other issues exist: Algal blooms, eutrophication, vector-borne diseases, public health issues, the Great Lakes, drought, fire, non-tropical rain/flooding, monsoonal atmospheric river flooding, extreme rainfall, impacts on fisheries, landslides on the Alaska coast, California, PNW coasts, and permafrost melt in Alaska.
- Erosion and land loss are underrepresented issues with substantial impacts on human system tied to sea level rise and storm surge.
- Focus should be on how these stressors interact and relate to each other, as well as what is the root cause of the problem (climate change).

3. Which coastal human system important for security will be most affected by the coastal stressors listed in the previous question?

- Conflict can emerge if inland communities have to pay taxes for flood-control infrastructure in coastal urban areas.
- It is important to map the critical vulnerabilities and their cascade impacts. Some vulnerabilities can have cascading effects on apparently distinct elements, e.g., losing a port that affects the regional economy.
- Regional stability needs cooperation between otherwise self-governing communities – the benefits and repercussions of working together need to be apparent.
- Each coastal region has its unique vulnerabilities.
- Some critical coastal stressors emerge from problems unrelated to the coast, like temperature change and draught. Coastal places deal with climate change issues like other non-coastal places and additionally have problems associated with the ocean.
- Public awareness of the connectedness of problems across geographies and scales could improve support and will for actions to deal with coastal issues.
- As expected, critical infrastructure was ranked high, but unexpectedly, the military was not.
- It was surprising that politics and governance were ranked lower. Short-term thinking is a problem – localities focus on resolving immediate problems and don't always have the capacity to think about the big picture.
- It is important to discern what exactly counts as a critical infrastructure and its support functions.
- Urban versus rural divide shapes human impacts in these two settings.
- Direct physical impacts are ranked higher but neglect the potential for cascading impacts.

- Availability bias affects the ranking of impacts on human systems, overemphasizing more familiar and visible impacts
- Specific sectors like military have the resources to address the stressors, but many local governments and states might not have the same capacities.
- It is important to distinguish between critical infrastructure and critical facilities. New infrastructure in coastal areas like offshore windfarms can create new vulnerabilities.
- Ongoing system upgrades do not always help reduce the problem – e.g., reconstruction in Puerto Rico after the hurricane disaster did not improve resilience.
- Politics and governance are important – collective action is needed.
Crime and public safety were listed at the bottom, likely due to disciplinary bias in the room. Post-disaster infrastructure failure, lack of services, and disruption lead to crime and public safety issues.
- Sea level rise would affect migration differently than hurricane events, leading to different spatiotemporal scales of population migration
The supply chain is also a part of mobility that will be affected, especially if transportation routes are affected.
Access to healthcare and schools will be affected too, leading to disruptions in quality of life
- Commuting will be affected differently depending on whether it is vehicle-based or primarily relies on public transport.
Thus, critical infrastructure is rated higher as it underlies many other impacts on the list. There is a difference between emergency and safety and impacts on the lifestyle. Critical facilities are important for both, but especially the first one. It is more challenging to adapt infrastructure compared to an economy that is more responsive.
Jobs and livelihood should move up on the list because they affect everybody, as seen with the COVID-19 pandemic.

4. Which of the following security types are more likely to be affected by coastal stressors?

- There are many definitions of different types of security from various sources, and they can conflict with one another. There is no consensus on the definitions.
- The cost of protecting different types of securities differs.
- Environmental security was highly ranked, and other types could fall under it.
- Security issues are community-specific, so each community needs to identify its priority. They are location-specific and impact each other in complex ways.
- There is disagreement among participants on the definition of security issues, especially environmental security, based on disciplinary perspective.
- Energy security is undervalued in survey rankings but represents essential critical infrastructure elements (e.g., impacts of hurricane disaster on oil production and distribution). It also has broader geographic implications.
- Participants were surprised that national security was ranked as high as it represents an outcome of other cascading failures
- It would make sense to rank securities in a cascading order and map possible cascades – no energy, water, or food... What is the first order of cascading events, and where do they start?
- Some rankings were surprising. Environmental security was ranked too high. For some securities, it would take longer for a problem to evolve into a critical issue.
- Food security is ranked lower on the risk but has many elements: food processing plants, agricultural yields, distribution, affordability, and access.
- Global stressors could affect US national security externally if they cannot cope with coastal stressors. Insecurity in other countries of strategic importance is relevant for the US.

- Not all agreed that environmental security should be ranked at the top. It also depends where is the source of the problem. For example, water issues must be mostly resolved locally, while food scarcity can be addressed by outsourcing to different places around the globe.
- The rankings should be fluid.

5. Which one of these concerns is more pressing for coastal security?

- Location-specific hazards are important and differ among locations.
- Coastal cities tend to be wealthy and economically important. Do they share similar security concerns, and how do these concerns differ from the hinterland?
- There is potential for cascading economic impacts across scales.
- Different security concerns are interconnected.
- Human systems emerged at the top. Are security issues human-centric?
- The real impact of coastal disasters is often undervalued.
- Each action to deal with problems will have some consequences on other systems, like reorganizing transportation, which can lead to gentrification.
- Behavioral and financial barriers that are preventing progress in finding solutions
- People associate better with the problems that directly impact them. Some cannot do anything about it due to their socioeconomic status and lack of knowledge and resources.
- Degradation of the ecosystem driven by consumption and development priorities
- Wastewater treatment, pumps, and stormwater management are critical. Electricity is also needed to keep pumps running during flood events.
- Public health is also important – related to failed wastewater treatment and septic tanks, contaminated and standing water, vector-borne illnesses...
- It is important to distinguish between short- and long-term stressors.
- Where do people get their water from – pipes or wells? What are the associated risks?
- It all depends on the frequency and severity of impacts – it might take months to recover resources after the major storm, and if there are consecutive events much longer.
- Plans are there but often cannot be implemented due to other priorities and issues that also need resources.
- Need to know more about the mobilization of contaminants from the Brownfield sites and contamination from other sources
- Land use changes are not aligned with the risk information. Development is still ongoing in many high-risk coastal areas.
- Beach loss and implications on tourism and flood risk. Who should pay for beach nourishment?

6. Which two of the following uncertainties will be the most detrimental for emergence of coastal security issues?

- Uncertainties depend on the timescale and the system (when, where, and how impacts will unfold).
- There are many uncertainties related to GHG emissions and human activities, which will drive the extent of the problem and the need for solutions.
- Adaptation responses might unfold faster than climate mitigation.
- Political dimensions are serving as a barrier to dealing with coastal problems effectively.
- Need to improve predictive power – many processes and interactions are still poorly understood.
- The human system is poorly understood – human behavior is still a mystery compared to physical processes.

- How are issues perceived, and how will willingness to solve issues evolve?
- Limitations are present in climate models. There are cascading events and wildcards that we do not yet understand.
- Costs of action versus inaction are not fully evident.
- How do we move away from short-term decisions to long-term thinking? Infrastructure investments must be more critically evaluated for their long-term performance.
- How will actions in one place affect impacts in adjacent locations? What are the unintended consequences of actions across spatial and temporal scales?
- What are the cascading events of policy decisions?
- What are the emerging issues: microplastics and impacts on fisheries and human health?
- Uncertainties in physical hazards are still the key because they drive everything else.
- Very uncertain how people will respond. Knowing hazards is important but does not help if people and institutions do not respond to new information.
- Cascading impacts should be ranked higher as they don't receive enough attention.
- Physical hazards could be ranked lower as they are well understood compared to human systems/responses.
- Cascading impacts and complex systems should be prioritized.
- How much are people willing to pay to solve coastal issues?
- Adaptive capacity is very uncertain.

DELPHI METHOD SESSION 2

1. Which specific coastal location in the US is more likely to experience the most significant security problems?

- Florida is at the top due to its topography, shape, and geographic location.
- The Gulf Coast gained in importance.
- Human and political systems are important in climate response.
- In some states, many or most counties are affected, while in others, only a few, which makes a difference in terms of their security risk.
- Each location has its economic drivers that have different vulnerabilities.
- Gulf Coast moved up on the list, while NYC and Hampton Roads moved down, likely because they have resources and political support to resolve their issues.
- Islands are fragile due to their remoteness and exposure from all sides but have low population density and critical infrastructure and thus stay low on the list. They lack political voice and resources. However, the impacts there represent an existential threat.
- Perceptions of different security risks drive rankings.
- The magnitude of security risk outweighs the diversity of security risk – if uninhabitable, then it does not matter which securities could be affected.
- Responses are East Coast-centric.
- Florida and the Gulf Coast have similar risks but different topography. However, the Gulf Coast has more critical infrastructure that is vital for the region and nation (e.g., petrochemicals).
- Islands should be ranked higher – Puerto Rico, USVI, Hawaii, Guam, and those in the Pacific.
- Gulf Coast is highly ranked for a reason – NOLA's influence and economic significance, as well as compounding risks.
- Criteria matter: Number of risks, security risks, and amount of assets.

- Puerto Rico is at risk but distinct from mainland politics and policies; thus, it is receiving less attention.
- Far-reaching impacts that can propagate are important.

2. Which coastal stressor is more likely to result in security issues and should be prioritized?

- Hurricanes and coastal storms seem to be a higher priority, possibly because of expertise bias.
- Sudden versus chronic events are ranked higher, ignoring the timescale and frequency element. Recurrent stressors can be disruptive daily.
- Coastal security is focused on immediate concerns instead of future planning. How is risk-reduction infrastructure fair against hurricane versus sea level rise impacts?
- Uncertainty in predictions of both chronic and episodic events affects our ability to respond.
- What are the implications of different hazard events based on the people affected or the potential for devastation? How do people perceive them and are willing to address them?
- Acute/immediate stressors are at the top. There is a group consensus on this.
- People and policymakers are less likely to support long-term issues based on scientific projection.
- Media augments the devastating nature of storms. Thus, there is more support to deal with them.
- Sea level rise is the primary stressor for islands – slow but permanent.
- How about other storms? They can also cause substantial damage.
- Elevation and topography play crucial roles – some islands have flat topography, and people have nowhere to go.
- Other risks are important: algal blooms and technological disasters.
- Hurricane risk is sometimes much lower than tidal flooding, which is very disruptive.
- Magnitude seems to matter – coastal storms are more frequent than hurricanes. How do they compare concerning security implications?
- Tidal, nuisance flooding should be clumped together with sea level rise – it indicates what will transpire and worsen. People can see it daily.
- Terminology matters – “nuisance” suggests that this type of flooding is a minor inconvenience one can live with but might have implications for policies and funding allocations.

3. Which coastal human system important for security will be most affected by the coastal stressors listed in the previous question?

- Which elements represent the human system? How can they be classified based on their importance to support humans?
- Mobility moved up on the list, and critical facilities decreased as they have more response options. This closely relates to human behavior and willingness to evacuate or relocate away from the risk. Risk perceptions affect decision-making and change over time. How loss of critical infrastructure versus property damage compares in eliciting human response?
- What type of impacts would drive displacement? Where would displaced people go?
- Housing availability is an important driver of migration – enabling migration by providing housing and infrastructure over different timeframes will become increasingly important.
- Mobility might be less important in locations with plenty of other places to go to.
- Housing is an important element in people’s mobility – housing demand can increase in some locations.
- What is considered mobility? Is it a process or, an outcome, or a system part?

- Can relocation be facilitated with incentives and policies? Which aspects can influence the decision to move? What are the barriers to moving, like insurance claims?
- Critical facilities are more adaptable than housing and buildings. They are more concentrated with already built-in back-up options. Moving one public building would also be easier than many individual homes.
- Mobility of all kinds will become increasingly important for successful coastal adaptation.

4. Which of the following security types are more likely to be affected by coastal stressors?

- The meaning of security can resonate differently with different audiences and indicate the level of urgency. If something is impacting the DoD, it receives immediate attention.
- Instability and international migration can lead to a national-level response.
- The US is a first responder for most global disasters.
- Individual agency versus a top-down collective response will play an important role in the outcome.
- Different types of securities are related, but one could argue that they might ultimately have national security implications.
- Homeland vs national security definition, internal vs external threats.
- Homeland security tackles more immediate problems.
- Water security stands out as it can lead to human suffering and conflict, as supported by historical examples.
- Human security is important: Human health, social equity, living with dignity, quality of life
- Surprisingly, food and energy securities were not considered as important as other security types. Energy security is important for water and food security.
- What is being secured is an important question. If its people, then they need water, food, and shelter.
- In different places, different securities might be more important to sustain the human system.
- If the focus is on hurricane risk in the Gulf, then energy security takes priority, followed by human/environmental security.
- Ports are essential to support the supply chain.
- Post-disaster contamination can slow recovery and prevent people from returning to their communities to rebuild.
- Human security should be first, followed by homeland security.
- Water security increased based on the conversation about how important it is to sustain other securities.
- Humans are not secure unless the environment is secure.
- There is no security without climate security.
- Homeland security would be ranked higher if its role in disaster preparedness and recovery is more clearly emphasized.

5. Which one of these concerns is more pressing for coastal security?

- The question is, what is perceived as more pressing/urgent, valued, and concerning?
- Some impacts have more long-term repercussions that are difficult to reverse, but people do not perceive them as such.
- Anticipated climate impacts might lead to disruption and social unrest if people do not change their behaviors correspondingly.
- The natural environment cannot move and adapt as quickly – thus, consequences can be greater.

- Military readiness and ability to respond fell to the lowest rank because they have (bipartisan) political and financial support and autonomously make decisions. However, they are not an island, and they tend to influence communities around them.
- The top rankings are closely related to political will and agendas.
- Surprisingly, ecosystems were ranked in third place, even though they are vital for human, food, and water security (fisheries and agriculture).
- The military facilities are better positioned to handle problems than the communities around them.
- In Guam, the impact on agriculture and fisheries can be a destabilizing factor. Military plans ahead and makes strategic decisions that are best for their operations and continuity, even if it means moving elsewhere.
- These inequitable impacts on local populations can disrupt social cohesion. Forced relocation can disrupt cultural identity and displace people in settings that might not support their sociocultural needs (e.g., Solomon Islanders moving to New Zealand and Kiribati residents moving to other countries, which contributed to their downfall). Islanders might move to different islands and the mainland.
- Rankings 1, 3, and 4 should be higher. Two is in a good place – there is a lot of disagreement about the best course of action. If no land is available, disputes over what is left might be common.
Disputes lead to loss of public trust, which can become a major problem. Public trust develops from the two-party system not being able to communicate effectively.
Loss of trust in trusted institutions is an issue.
The public response to the COVID-19 pandemic demonstrated distrust of science. Similarly, adaptation decisions can be made based on subjective sentiments and not science.
The media desensitizes people to disasters—information overload.

6. Which two of the following uncertainties will be the most detrimental for emergence of coastal security issues?

- The first three options are policy-related.
- Models can be used to facilitate discourse on options rather than being prescriptive.
- The human element is still highly uncertain.
- Cascading impacts are difficult to predict and map out. The same applies to imaging the worst-case scenario.
- The housing market was a good addition to the list, including its grouping with policy, politics, and societal willingness to deal with coastal issues.
- There is less uncertainty with physical hazards than policy and programmatic responses/human responses.
- Migration and the housing market are broader responses, while others are community or government responses – they can also drive human responses.
- Uncertainty in physical hazards should be ranked higher as it drives everything else – if we know storm intensity or return time, we can determine how to respond more effectively.
- Policy and human response directly respond to lived experience or understanding of the risk.
- We can model physical flood hazards and quantify uncertainties around them. Modeling human behavior is very difficult. We can measure tangible outcomes on people but not find the equation for behavioral responses.
- Rankings 1 and 4 are equal. Two refers to cascading impacts and complex systems. Discussions increased its ranking.
- How these topics interconnect might be more important than discussing them separately.