Table SI-1. Diagnostic Questions by the Stage in the Adaptation Process and the Adaptation System Components

PHASE	Barriers	Actors	Governance & Context	System of Concern
Understanding				
• Problem Detection & Initial Framing	i. Existence of a signal ii. Detection (perception) of a signal iii. Threshold of concern (initial framing as problem) iv. Threshold of response need and feasibility (initial framing of response)	- Does the actor receive the signal? - Does the actor detect, perceive or recognize the signal? - How does the actor interpret the signal? - Does the actor perceive a need to respond and perceive a response to be feasible in principle?	- Does the governance system somehow prevent sending out a signal? - How is the signal delivered and by whom? - Does the governance system fail to transmit a signal or prevent it from reaching individuals? - Do leaders, norms, or institutions dismiss the issue as a problem? - Do laws, policies and social norms support or prevent taking a problem seriously and responding to it?	- Does a signal exist and what does it mean? - What is the nature of the signal? - How is or can the signal be identified, seen or experienced? - Is the issue/problem novel or familiar? - Are there logical actors to take on the detected problem? - Is there an already agreed upon way of dealing with the detected problem or not?
• Information Gathering & Use	i. Interest and focus ii. Availability iii. Accessibility iv. Salience/Relevance v. Credibility and Trust vi. Legitimacy vii. Receptivity to information viii. Willingness and ability to use	- What values, perceptions, and beliefs, direct what information should be collected? - Is there agreement about what information should be gathered and analyzed? - Does the desired information exist? - Is the information accessible? - Is the information salient or relevant to better understanding and solving the problem?	- In what ways does the governance system restrict interest and focus in the issue to be explored? - What kind of information can be used in existing policy and decision-making processes? - Is the information compatible with existing decision-making (e.g. policy, mental/individual) processes and models? - How does the governance system influence whether information is salient, credible	- Has the target system been a problem or the focus of research previously? - How well is the system understood? - How much uncertainty is there about how climate change will affect the system?

		- Is it reliable, credible and from trusted sources? - Has the information been produced and vetted in a legitimate manner? - Are the recipients of information receptive to the information? - Do potential recipients have the understanding and ability to make sense and appropriate use of the information?	and legitimate? - In what ways do formal and informal institutions prevent actors from accessing needed information? - Is there sufficient time and expertise available to access, become familiar with, analyze, evaluate and use it?	
• Problem (Re)Definition	i. Threshold of concern (reframing of the problem) ii. Threshold of response need iii. Threshold of response feasibility iv. Level of agreement or consensus	- How do actors now interpret and assess the issue? - How do actors now assess the need and feasibility of response? - Are there any new players involved in this stage of the process? - Is agreement reached on the problem (re)definition? - How much negotiation or mediation skill is there among participants?	-Do leaders, norms, or institutions dismiss the issue as a problem? -Do laws, policies and social norms support or prevent taking a problem seriously and responding to it? -How do institutions signal (lack of) support for the process? -Does the governance system in any way require consensus or agreement on the nature of the problem?	- What is included or excluded in the system of concern? - How broad or narrow is the system that actors will focus on? - What is the nature of the problem to be addressed? - Are the impacts of concern on the target long term and (de facto) irreversible? - Are there any near-term indications of the problem? - What is the temporal scale at which the problem is defined? - What is the spatial and jurisdictional scale at which the problem is defined? - Can the problem be seen or experienced?
Planning and Decision-Making				
• Development of Options	i. Leadership (authority and skill) in leading process	- Who is leading the process? - Do leaders have formal	- What entity/organization has responsibility, authority, and	-Does the goal adequately address the complexity and

	ii. Ability to identify and agree on goals iii. Ability to identify and agree on a range of criteria iv. Ability to develop and agree on a range of options that meet identified goals and criteria v. Control over process vi. Control over options	authority and/or the necessary skill and ability to facilitate the process? - Do leaders and others involved have the ability and willingness to develop a set of criteria to judge options? - Are the goals made explicit to those involved in developing the options? - Do actors have control over the process of developing options? - Are the developed options within the actor's sphere of influence?	lead control over the process? - What formal procedures may exist to guide the process? - How do social norms, organizational culture, and informal ad-hoc agreements on procedures affect the process? - Which organizations/entities influence process? - Do resources (financial, technical, staff time) to develop options and facilitate the process exist (or are they perceived to exist)? - Do the mandate of the lead entity and stakeholder interests align or diverge? - Do the options fit within the existing public or policy agenda? - Do pre-existing policy agendas pre-determine the range of options being developed?	source of the defined problem and target system? -At what level of intervention (e.g., local, state, national) do the options focus? -Do the identified options match or fit within the boundaries of the defined system? -Can defined criteria be measured and addressed?
• Option Assessment	i. Availability of data/ information to assess options ii. Accessibility/usability of data iii. Availability of methods to assess and compare options iv. Perceived credibility, salience and legitimacy of information and methods for option assessment v. Agreement on assessment	-Is there expertise to do the assessment? -Is there a well-connected and knowledgeable leader to identify and gather the necessary resources to adequately support an option assessment? -Are other participants in the process adequately trained? -Are values, preferences, and differences in risk aversion among stakeholders	-Are adequate resources made available to conduct an options assessment? -Is sufficient time given to this process and what other timing issues affect the time available for the assessment? -Does the experience and expertise exist in participating organizations to conduct assessments? -How have governments, institutions, and other	- What is the level of understanding and information availability about a system? - How much uncertainty is there in understanding the current and future state of the system? - Is the problem novel or familiar? - Can the needed information be produced?

	approach vi. Level of agreement on goals, criteria, and options	adequately addressed in the assessment process? - Do the involved agree on the selected approach to assessing options? - Do actors agree on goals, criteria and resulting options?	funding agencies influenced the availability of research funds and the development of human resources? - How do institutional mission, policy agendas, historical legacies, procedural rules, social and professional norms, or even customarily consulted information sources shape the assessment?	
• Selection of Options	i. Ability to reach agreement on selecting option(s) ii. Sphere of influence/ responsibility/control over option iii. Threshold of concern over potential negative consequences iv. Threshold of perceived option feasibility v. Clarity of authority and responsibility over selected option	- Who are all the people (and jurisdictions) that should or need to be consulted and involved in the selection process? - Are there conflicting values and preferences that do not allow for consensus or agreement? - Do adaptation options raise concerns over unintended negative consequences? - Is there a leader that can facilitate the selection process and help mediate among different interests and agendas? - Is the highest ranked alternative viewed as feasible by those in charge of the selection process? - How do responsibilities for implementation influence the selection? - Are people risk-averse or risk-seeking in their selection process?	- What are the laws that govern certain options and do they favor or inhibit the selection of certain options? - What are the actual institutional and legal constraints of selecting certain options? - What are the perceived institutional and legal constraints of selecting certain options? - Are there conflicting mandates among entities involved in the selection process? - Are the lines of authority over the selection process clear? - Is the favored option socially acceptable in a given context? - Does the governance system in any way require consensus or agreement on selecting the option(s)?	- Does the system cross jurisdictional boundaries or not match jurisdictions? - Is understanding of the system so limited or uncertain that there is a high probability of unforeseen (particularly negative) consequences? - What is the cause and nature of the uncertainty about the system? - Does the system of concern have attributes that are valued uniformly or differently by stakeholders?

Managing the Problem				
• Implementation	i. Threshold of intent ii. Authorization iii. Sufficient resources (fiscal, technical, etc.) to implement iv. Accountability v. Clarity/specificity of option vi. Legality and procedural feasibility vi. Sufficient momentum to overcome institutional stickiness, path dependency, and behavioral obstacles	-Is there actual intent to implement the option? -Does the actor have the (perceived) adaptive capacity or any cognitive biases for or against implementing the option? -Are there sufficient financial resources to realize the selected option(s)? -Does the actor perceive or anticipate lack of social acceptance, lack of political will, or negative political ramifications from implementation? -Do actors perceive themselves to be accountable to others for implementation? -Does implementation require explanation, education, and skill building? -Is implementing the option within the responsibility or authority of the actors? -Does the human capital exist to implement the strategy? -Is the selected option or strategy clear and specific enough for actors to implement?	-Are there legal and institutional requirements or limitations that undermine the intent to implement? -Is the option to be implemented legal and feasible within existing policies, laws, rules, regulations, programs and mandates? -Do existing social norms help or hinder a needed behavior change or implementation of a novel or uncommon option? -In what ways is the decision maker formally accountable to others to implement? -Is there enough social and/or political support for the selected strategy? -Are there perceived and/or real negative consequences that may result from implementation? -Was an implementation strategy developed as part of the planning process? -Does implementation require authorization, review, and/or oversight from institutions? -Are there common practices or policies within the actor's institution that overlap with or contradict the adaptation strategy? -Can the implementing agency	-How reversible or irreversible is the selected option or strategy? -How sensitive or fragile is the system to human intervention? -How robust are the selected strategies to different climatic changes and system configurations?

			acquire the necessary resources for implementation? -How do long-standing practices and vested interests prevent resource allocation? -Is there consistency in participants involved in the process? -Is there agreement on how the strategy will be implemented? -Do necessary collaborations and lines of communication exist to accomplish an efficient and effective implementation? -What is the role of other relevant agencies, institutions, or actors who have overlapping functional or jurisdictional authorities?	
• Monitoring	i. Existence of a monitoring plan ii. Agreement and clarity on monitoring targets and goals iii. Availability and acceptability of established methods and variables iv. Availability of technology v. Availability and sustainability of economic resources vi. Availability and	- Have the actors developed a monitoring plan? - Have the actors specified and do they agree on the monitoring goals, design, targets, approaches, needed resources, and the intent and schedule for analysis and assessment of the obtained data? - Is additional capacity or expertise needed to design and implement the monitoring program?	- Do institutions (typically, government agencies) provide sufficient resources (funding, technology) to implement the monitoring plan? - Do institutions invest in providing the necessary human capital (expertise, time allocated) to carry out the monitoring program? - Do the governance system and societal interests value gathering the desired type of information?	- What is the goal of monitoring? -Are the targets clear? -What kind of baseline information exists about the system of concern, if any? -What type of monitoring does the system and implemented strategy require? -Are there time lags in the system that obscure or delay revelation of effects? -Does significant system

	sustainability of human capital vii. Ability to store, organize, analyze and retrieve data		-Do protective measures need to be taken or put in place to protect people's interests and privacy? -In what ways do funding rules, budget cycles, political turn over, and societal support allow or constrain financial support for long-term monitoring? -Is the monitoring system or monitoring plan set to trigger evaluations? -Does the institution overseeing the implementation of adaptation options allow for unexpected/unplanned evaluations?	variability and uncertainty prevent clear detection and attribution of observed changes? -Is monitoring needed continuously or periodically? -Are there known and accepted indicators for monitoring the variable or goal?
• Evaluation	i. Threshold of need and feasibility of evaluation ii. Availability of needed expertise, data and evaluation methodology iii. Willingness to learn iv. Willingness to revisit previous decisions v. Legal limitations on reopening prior decisions vi. Social or political feasibility of revisiting previous decisions and/or initiate new actions and policies	-Is anyone willing, charged or accountable to conduct an evaluation? -What is the motivation for an actor to evaluate past performance of the adaptation strategy? -Are leaders, decision-makers, and other stakeholders willing to learn from an evaluation exercise? -Are leaders willing to revisit past decisions? -Was the actor evaluating the adaptation effort directly involved, or is the evaluator	-Are there formal mandates to periodically evaluate the impacts of an adaptation policy or action? -Are (formal or informal) feedback mechanisms in place to support (or prevent) social learning and adaptive governance? -What is included and what excluded from evaluation? -Does the period between implementation and evaluation give enough time for changes to take place? -Does the evaluation occur too	-Does the system-inherent variability and uncertainty allow distinction of signal from noise? - Does the complexity of the system allow for confident attribution of cause and effect? -How well are different aspects of the system subject to evaluation currently understood?

		an outside observer? -What interests does the evaluator (or planners of the evaluation) represent?	long after implementation? -Are there sufficient resources to conduct a proper evaluation? - Are necessary resources available? -Did the process produce and monitor data that can be used in the evaluation process?	