Corals & Climate Adaptation Planning (CCAP) Project

Climate Change Working Group Report Out

Co-Chairs: Jordan West, EPA Office of Research & Development
Britt Parker, NOAA Coral Reef Conservation Program



*The views expressed in this presentation are those of the authors and do not represent official policy of the US EPA or NOAA.

A Collaborative Effort of the Climate Change Working Group

- Co-funded by EPA, NOAA, DOI
- Guidance and steering from the CCWG
- Technical team expertise from EPA, NOAA, DOI, TNC, EcoAdapt and Tetra Tech
- Partnering with practitioners/managers and scientists from 13 Federal, State, Territory agencies, local and national NGOs, academia
- Methods and tools to be hosted on the toolkit website of The Nature Conservancy's Reef Resilience Program

EPA United States Environmental Protection Agency

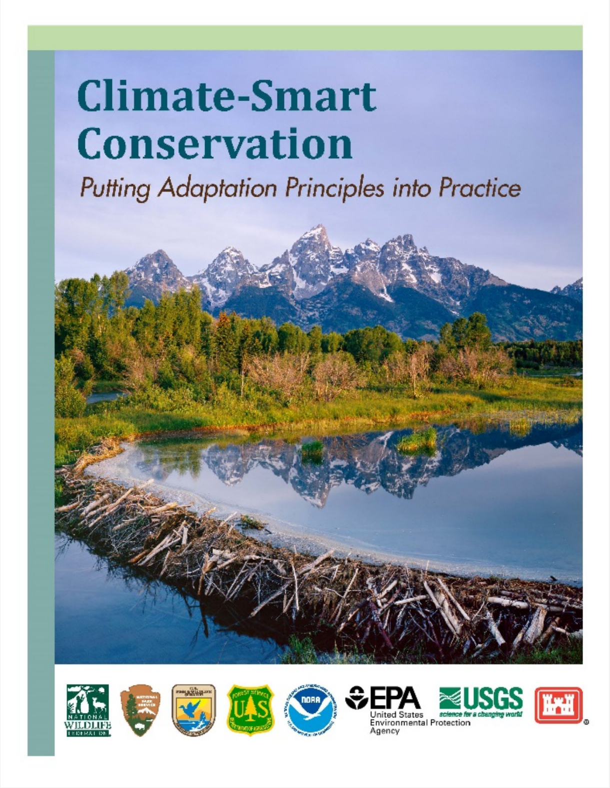
Project Inception

- Presidential Executive Order 13653 -- Preparing the United States for the Impacts of Climate Change (2013)
- President's State, Local, and Tribal Leaders Task Force on Climate Preparedness and Resilience (2014)
- General principles for adaptation to climate change (theoretical frameworks)
- Ongoing advances in assessment and planning by coral reef practitioners (real-world explorations)

Goal: tailor and test recent adaptation planning frameworks and methods specifically for coral reef management

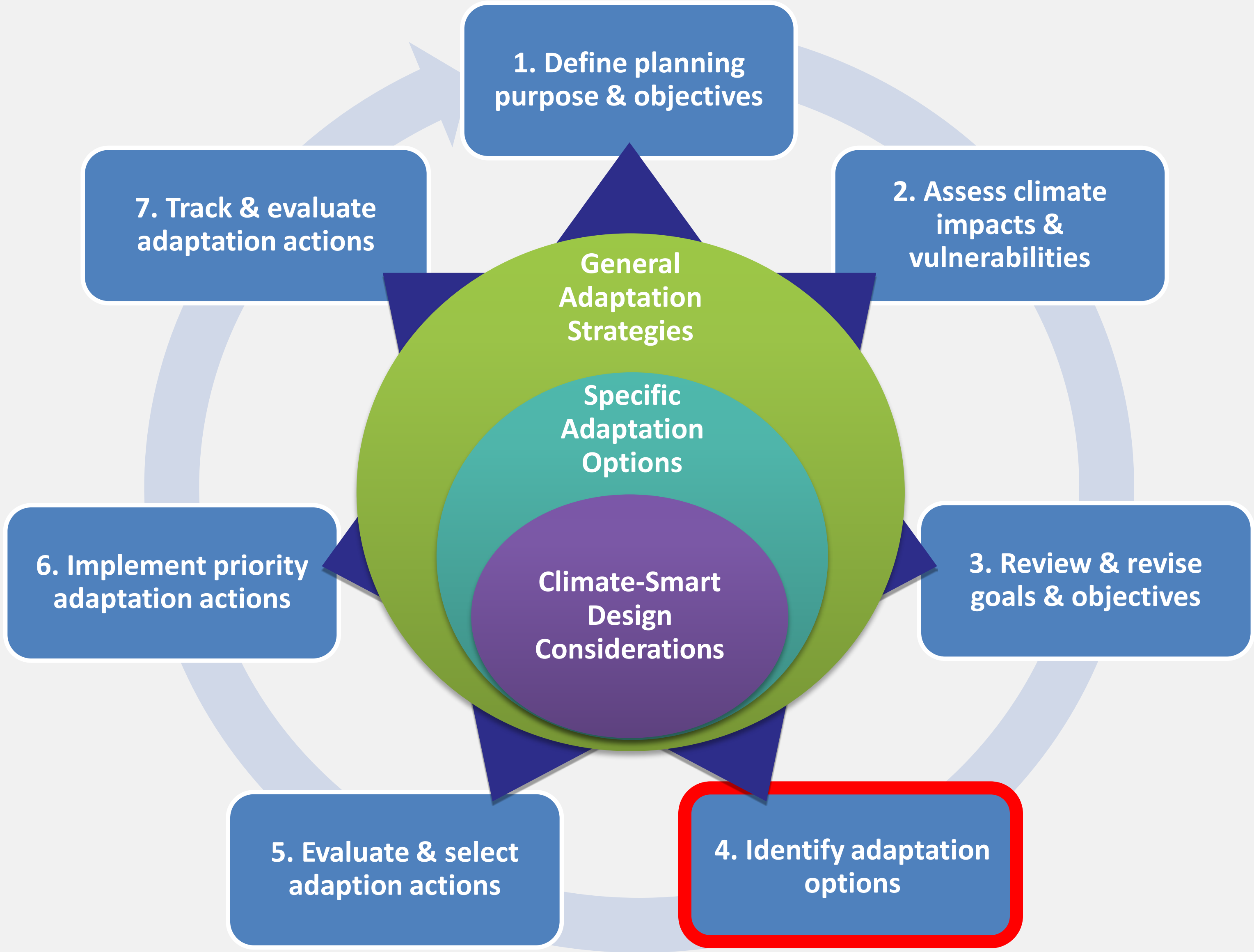
Climate-Smart Approach

- Comprehensive review and synthesis of adaptation principles for ecosystem management
- Framework for integrating climate change information into every step of the management planning cycle
- General adaptation strategies to aid in brainstorming specific actions
- Rules for designing management actions to be “climate-smart”



Stein et al. (2014)
http://www.nwf.org/ClimateSmartGuide

CCAP Framework



CCAP Framework: Coral Reef Adaptation Options

CLIMATE SMART STRATEGIES, OPTIONS AND DESIGN CONSIDERATIONS FOR CORAL REEF MANAGEMENT	
General Strategies/Specific Management Options	**Climate Smart Design Considerations**
REDUCE NON-CLIMATE STRESSES - *Minimize localized human stressors that hinder the ability of species or ecosystems to withstand or adjust to climatic events*	
i. Remove existing structures that harden the coastlines to allow inland migration of sand and vegetation	• *How will sea level rise and changes in the intensity and frequency of large storms affect coastal hydrology and erosion?* • *Given the above, which structures should be the highest priority for removal in order to allow more natural migration of sand and vegetation?*

Rules for Climate-Smart Design

Two types of design considerations are required:

- How will climate change directly or indirectly affect how stressors impact the system?
- What are the implications of this information for the location, timing, or engineering design of the management action?

CCAP Framework

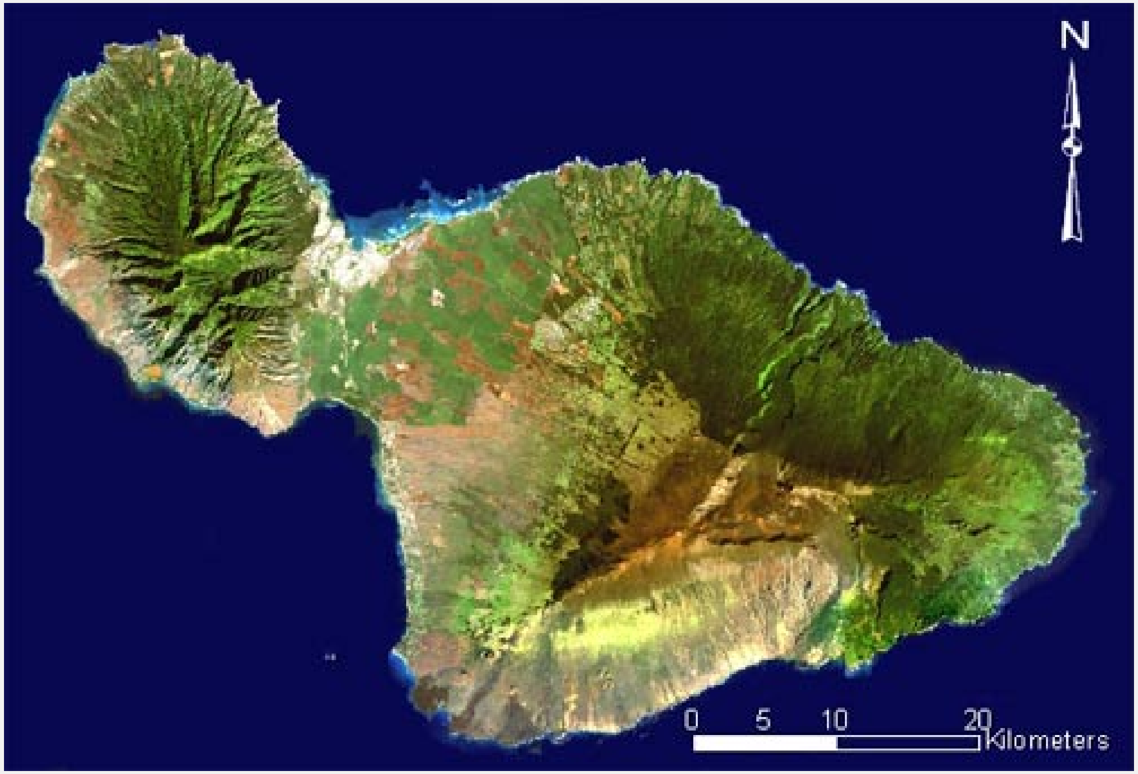
United States Environmental Protection

CLIMATE SMART STRATEGIES, OPTIONS AND DESIGN CONSIDERATIONS FOR CORAL REEF MANAGEMENT	
General Strategies/Specific Management Options	**Climate Smart Design Considerations**
REDUCE NON-CLIMATE STRESSES - *Minimize localized human stressors that hinder the ability of species or ecosystems to withstand or adjust to climatic events*	
i. Remove existing structures that harden the coastlines to allow inland migration of sand and vegetation	• *How will sea level rise and changes in the intensity and frequency of large storms affect coastal hydrology and erosion?* • *Given the above, which structures should be the highest priority for removal in order to allow more natural migration of sand and vegetation?*
PROTECT KEY ECOSYSTEM FEATURES - *Focus management on structural characteristics, organisms, or areas that represent important "underpinnings" or "keystones" of the current or future system of interest*	
i. Manage functional species and groups necessary for maintaining the health of reefs and other ecosystems	• *What is the vulnerability of functional species and groups to the interaction of climate change with other human and natural stressors, and in what locations are they most vulnerable?* • *What management options can be employed, and in which locations, to minimize impacts on the most vulnerable species and groups?*
ENSURE CONNECTIVITY - *Protect, restore, and create landscape features that facilitate movement of water, energy, nutrients and organisms among resource patches*	
i. Identify and manage networks of resilient reefs connected by currents	• *Which areas are historically or projected to be less exposed to climate change impacts such as increased sea surface temperature or increased surface water runoff and/or demonstrably better able to recover after exposure to these impacts?* • *How will climate change affect currents that provide connectivity among these areas and the benefits connectivity provides (e.g., recruitment to reefs)?* • *What are the implications of this information for design of managed area networks to maximize connectivity and maintain it into the future?*

West Maui Case Study & Workshop

Why West Maui:

- Priority watershed of the State of Hawaii, NOAA CRCP and USCRTF
- Well organized management in place
- Existing plans provide good examples
- Climate change concerns have been identified



Purpose: to explore methods for Climate-Smart adaptation within the context of existing management planning

United States Environmental Protection Agency

West Maui Case Study

Categories = Option Types from Table 4B (associated objectives in parentheses - see Appendix B for key).						
Run-off controls	**Water treatment upgrades**	**Non-indigenous spp. removal**	**Fishing restrictions**	**Area based management**	**Artificial shading**	**Transplantation**
Install water bars, terraces, microbasins, in dirt roads in agricultural areas *(WMP1, WMP2)*	Treat stormwater using a constructed wetland *(WMP1, WMP2)*	Remove non-indigenous algal species to preserve the integrity of coral reef communities with the super-sucker *(H2, H4)*	Improve enforcement of fishing regulations *(H1, H3)*	Protect/promote recovery of areas of high coral species diversity and cover using temporally flexible no-use zones after extreme events *(H4)*	Use artificial shading when corals are exposed to thermal stress, to protect coral sites of specific importance from coral bleaching *(H4)*	Transplant coral reef organisms among locations that are no longer connected by currents *(H4)*
Establish vegetative cover, filter strips in agricultural fields *(WMP1, WMP2)*	Install curb-inlet baskets to filter hydrocarbon and debris from the storm drains *(WMP1, WMP2)*		Enhance natural recovery processes through replenishment of native grazers that control algal growth on damaged reefs *(H1, H3)*	Protect adjacent or nearby coral reef areas that are hydrodynamically connected and can serve as recruitment sources for coral reefs in West Maui *(H4)*		
Retrofit in-stream dams to collect fine sediment *(WMP1, WMP2*	Reduce the volume of treated wastewater injected into groundwater through reuse *(WMP3)*		Promote adherence to State of Hawaii catch sizes and bag limits[CAP] *(H1, H3)*	Identify and protect species with ecological traits characteristic of low sensitivity and high adaptive capacity to climate impacts *(H4)*		
Manage watershed inputs to reef areas upstream of target reef within the dominant current flow *(WMP1, WMP2)*	Reduce the volume of treated wastewater injected into groundwater through treatment upgrades *(WMP3)*		Support fishing rules and regulations on fishing based on target species ecology and life history [CAP] *(H1, H3)*	Replicate habitat types in multiple, designated managed areas to spread risks associated with coral bleaching *(H4)*		
Reduce nutrient loads from soil runoff using timed and quantified amounts of fertilizers from agricultural and landscaped areas *(WMP1, WMP2)*			Protect spawning aggregation sites of herbivorous fisheries through seasonal fishing restrictions *(H1, H3)*	Identify and protect current and future areas that are resistant to climate change effects due to localized upwelling *(H4)*		
Reduce sediment loads from soil runoff using rain gardens *(WMP1,*			Protect aquarium fish species through species or catch	Protect areas of high coral species diversity and cover using no-		

Climate-Smart Design Tool

Option Type	Option	Stressor being addressed with option	Specific climate change impact on stressor	Direction of CC impact on stressor	Magnitude of CC impact on stressor (1, 2, 3)	How/when/where do we need to adapt option?	Adaptation potential of option (1, 2, 3)	Time constraint (longer or shorter term)	Notes
Run-off controls	Install water bars, terraces, microbasins, in dirt roads in agricultural areas	sediment/ nutrients	Due to storm events after dry period	variable	2	Need to adapt the option spatially (but may never be possible?); need to evaluate the extreme scenarios	3	short term option/urgency -uncertain of increase-need to think about mechanism	Life of these practices is only about 5-10 yrs. Rainfall in WM generally expect to increas, but John Marra thinks it might decrease
Water treatment upgrades	~~Address~~ Eliminate cesspools and upgrade septic systems ~~tanks~~	nutrients	SLR modified by storm regime (inundation); interaction with groundwater table	up	1	Upgrade occurs at time of sale	1	Septic just chipping away at the problem, no 1 silver bullet (a synergy issue, needs lots of little actions), i.e. a composite solution needed	Life cycle is 30 years; climate change concerns with SLR go into design considerations; problem should go down with time; this alone would not solve problem, will have to be a composite with other things
Area based management	Protect and manage adjacent (olowalu) or nearby coral reef areas that are connected hydrodynamically and can serve as recruitment sources for coral reefs in West Maui	hydrodynamically connected areas	sea surface temps; acidification; disease; changes in currents	up	1	Need to further prioritize, replicate, represent and increase level of protection; at greater scale	3		Reef deterioration; a great deal will hinge on research as to sources and sinks

United States Environmental Protection Agency

Grand Challenges

- Spatial and temporal scales
- Synergies, interdependencies, and conflicts among options
- Multiple levels of management planning

United States Environmental Protection Agency

Next Steps

- Refinement of Climate-Smart Design Tool and expansion to include temporal scale and synergies
- Technical team meeting (March 2015), presentation at National Adaptation Forum (May 2015), webinar for workshop participants/ other stakeholders (June 2015)
- Case study write-up and tool to be posted on The Nature Conservancy's Reef Resilience website (Late 2015)

Special Thanks

Wendy Wiltse (EPA Region 9)
Hudson Slay (EPA Region 9)
Karen Koltes (DOI)

Tova Callender (West Maui R2R Initiative)
Emma Anders (Hawaii DLNR)
Rob Parsons (Maui County Office of the Mayor)