Climate Change, Protected Areas and Biodiversity

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Climate change impacts across sectors

Changes in:

- Temperature (highest daytime; lowest night-time, # hot days; # cool nights)
- Precipitation (evaporation, transpiration, infiltration, run-off)
- Frequency & intensity of extreme weather
- Sea level, Ocean circulation and Acidity

PUBLIC HEALTH

Infectious, respiratory, water-borne, vector-borne diseases, heat

AGRICULTURE

Less predictability, changing yields, changing irrigation demand, pest infestations

FORESTRY

Forest composition, range, health & productivity

WATER RESOURCES

More variability in water supply, changes in water quality/ distribution, competition

COASTAL SYSTEMS

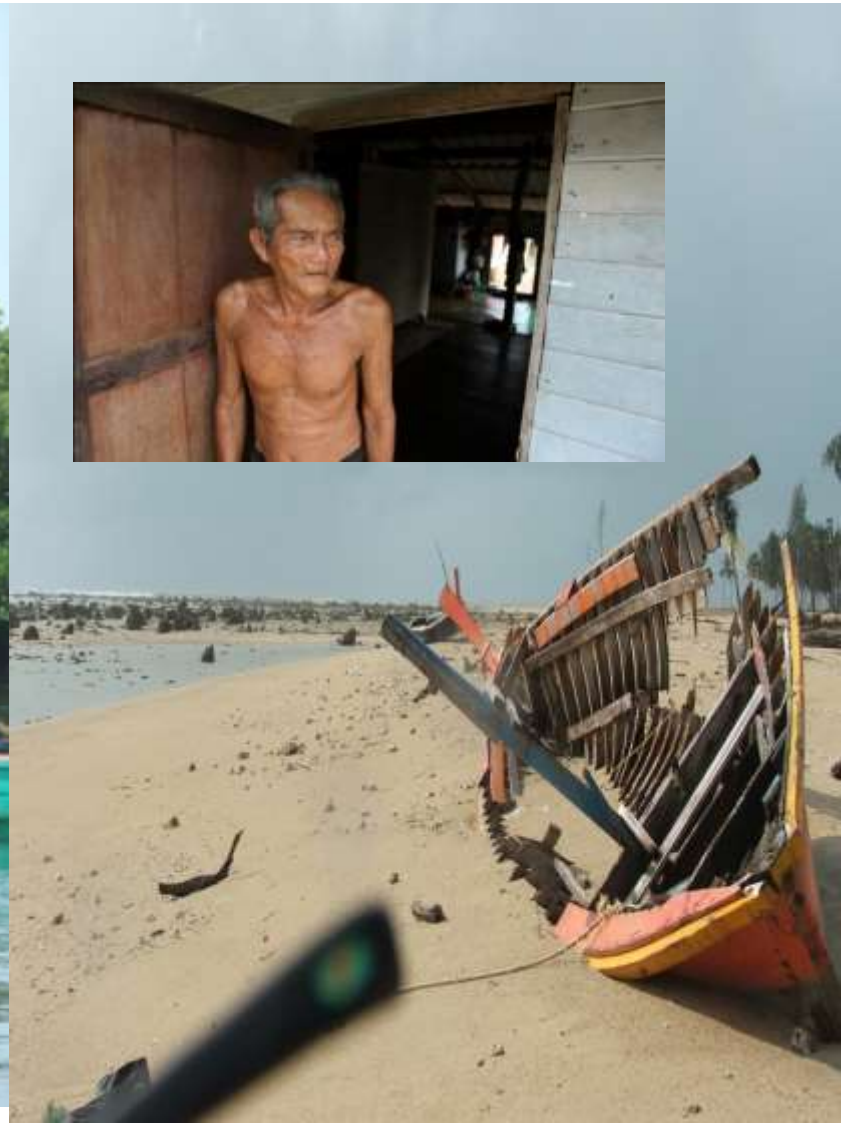
Erosion, inundation, salinisation, acifidication, stress on mangroves, marshes, wetlands, sea-grass and corals

ECOSYSTEM SERVICES

Loss of habitat & species, migration

Source: OECD, 2009

climate change impacts on the coast



What impact will climate change have on the coastal zone?

- Sea level rise
- Higher sea temperatures
- Changes in precipitation patterns and run off (water flow)
- Changed oceanic conditions; pH, warming upper layers, changes in ocean currents
- Changes in storm tracks, frequencies & intensities of storms

What will this lead to?

- Displacement of coastal lowlands & wetlands
- Increased coastal erosion
- Increased flooding & drought conditions
- Saline intrusion
- Impacts on habitats & species

CRITICAL HABITATS AND CLIMATE CHANGE

Mangroves

Sensitivity:

- Mangroves have the potential to be affected by both rising sea and air temperatures
- Processes such as respiration, photosynthesis and productivity will be affected by changes in both water and air temperature
- Mangrove systems particularly vulnerable to rising sea levels
- Likely consequences of SLR on coastal systems in the region include landward migration of mangroves, salt marsh and salt flats up slope and changes in vegetation structure

CRITICAL HABITATS AND CLIMATE CHANGE

Adaptive capacity of Mangrove systems:

- Mangroves likely to retreat landward to maintain their preferred hyrdoperiod
- Presence of barriers behind mangroves is largest limitation to adaptation
- Filling sizable knowledge gaps in our understanding of how these environments change with rising sea level and other environmental changes should be made priority

CRITICAL HABITATS AND CLIMATE CHANGE

Coral reef systems

Sensitivity:

- Corals are extremely sensitive to temperature change- Small increases (1/2°C) in sea temperature above the long-term summer maxima destabilises the relationship between host corals and their symbiotic dinoflagellate algae (zooxanthellae), on which they rely for energy and growth
- ‘bleaching’ is a stress response by corals experiencing unfavourable conditions such as high or low irradiance high or low temperatures reduced salinity and the presence of toxins such as herbicides and bacterial infections

CRITICAL HABITATS AND CLIMATE CHANGE

Sensitivity cont.

- Coral reef systems also highly vulnerable to severe weather such as cyclones, which cause extensive physical destruction as well as reduced light conditions which affect coral ability to photosynthesize
- Corals will also very likely be severely affected by low pH by severely impacting their ability to accrete calcium carbonate

CRITICAL HABITATS AND CLIMATE CHANGE

Adaptive capacity of coral reef systems:

- Three potential responses
- **to acclimatise** (a phenotypic change within the individual)- possible as corals can acclimatise to changes in their environment including seasonal temperature fluctuations
- **to adapt** (a genetic response at the population level)- very little evidence has been shown to prove this is possible and it is thought the rate of change is too quick for it to happen
- **to shift latitudes -** geographic differences in temperature tolerances have evolved over much longer time frames than the decadal scale of current changes in climate

CRITICAL HABITATS AND CLIMATE CHANGE

Seagrass habitats

- **Sensitivity:**
- Vulnerable to any climate change factor which limits light availability (e.g. storms, rain, flooding events, flood plumes from coastal run off, sedimentation, algal blooms) as they are photosynthesizing plants
- Also highly sensitive to decreased water quality as a result of pollutants, with a significant sensitivity to herbicides

CRITICAL HABITATS AND CLIMATE CHANGE

Adaptive capacity of seagrass species:

- Many examples of seagass recovering from tropical cyclones/storm damage
- Some studies suggest that seagrasses respond and recover at different rates when exposed to herbicides both in laboratory and natural settings- so lab studies cannot be taken as a completely accurate prediction of what seagrasses will do in situ
- all seagrasses are capable of adapting by altering their physiological capacity and morphological structure however whether they can adapt fast enough to climate change is unknown

CRITICAL HABITATS AND CLIMATE CHANGE

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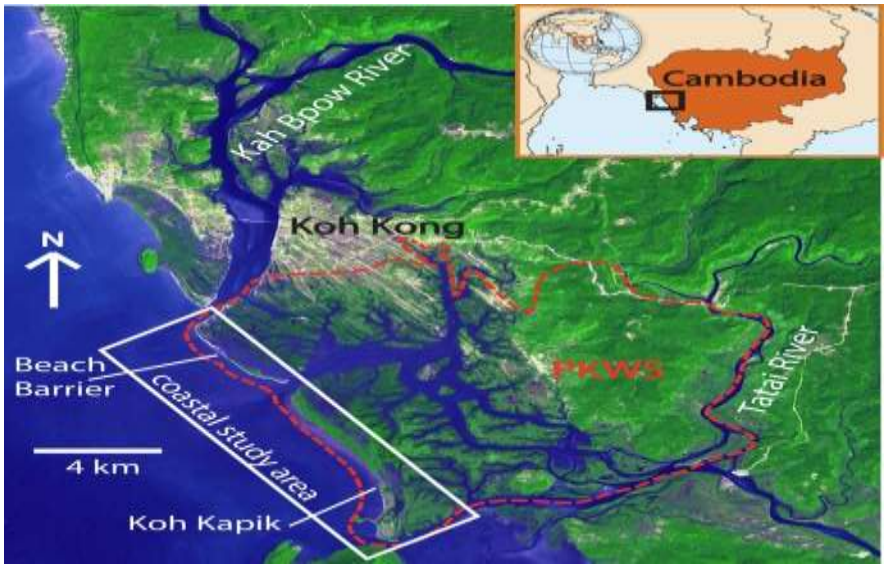
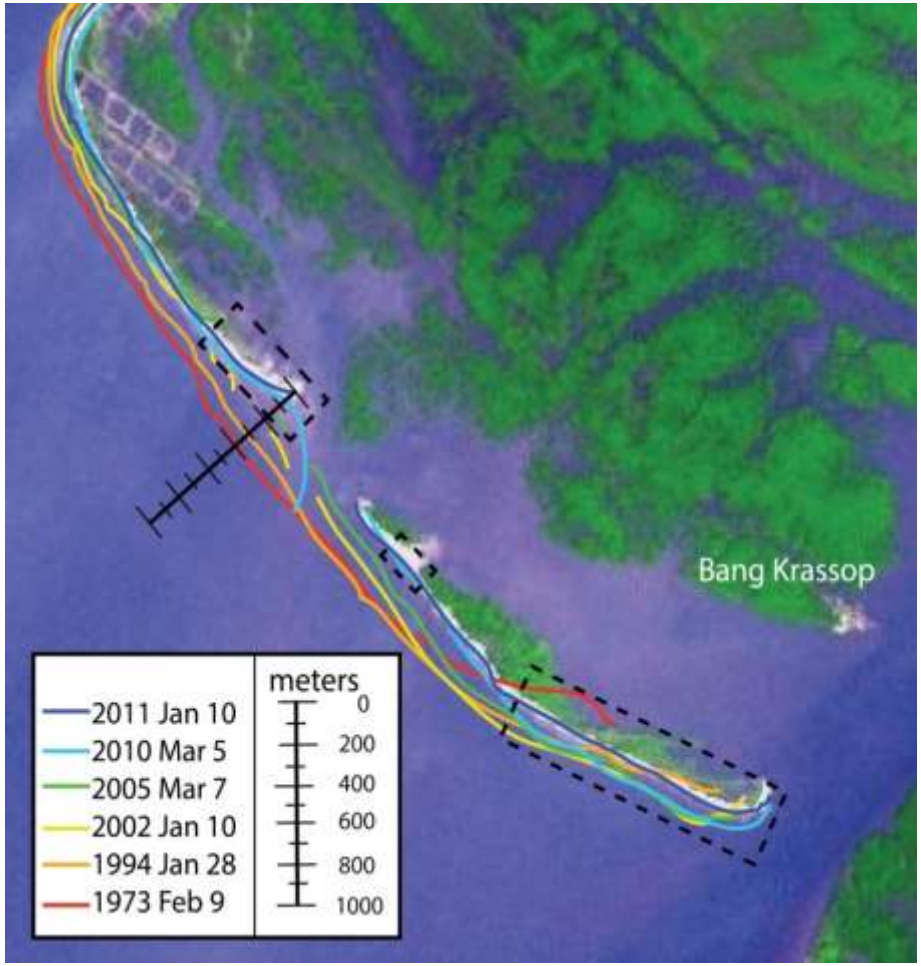
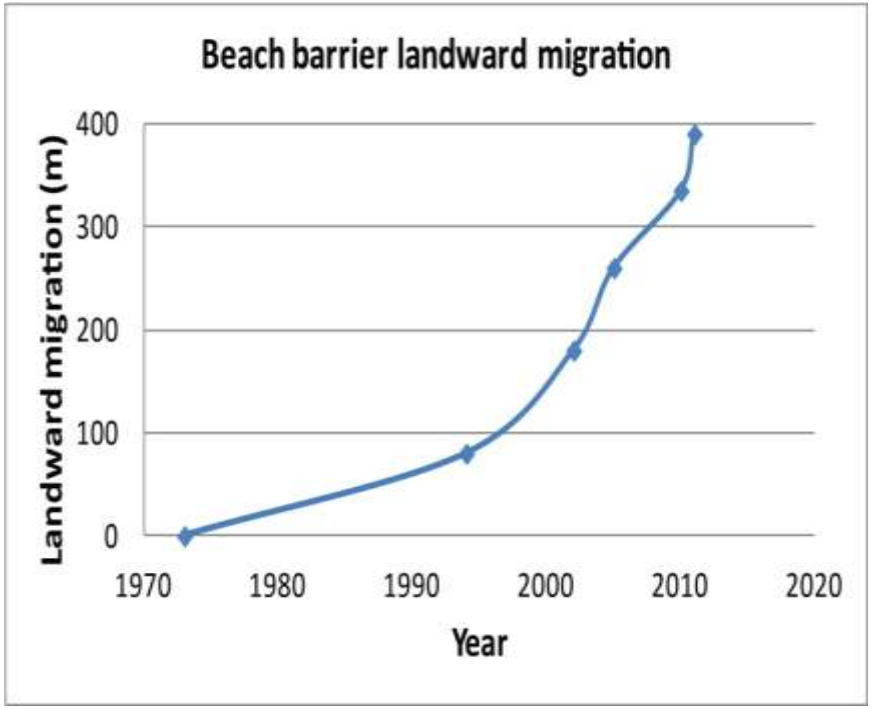
Beach Migration and Mangrove Loss in PKWS



Landward migration of barrier beach and mangrove devastation, increasing vulnerability of human settlements

Rate of Beach migration in PKWS – speeding up





Deltas particularly vulnerable to climate change

- Recently deposited sediments – naturally prone to compact
- easily eroded by intense storms and wave energy
- transgression and regression are intimately linked with sea level
- Changes in precip/temp/runoff alter the delivery of water and sediments

Funded by

European Union

Deltas already impacted by human activity

1. Drainage and subsidence
2. Destruction of protective deltaic wetlands and barrier islands
3. Dams on major rivers reduce sediment supply
4. Dykes and polders systems
5. Dredging of waterways
6. Deepening and straightening c river channels

Climate Change Impacts on Species

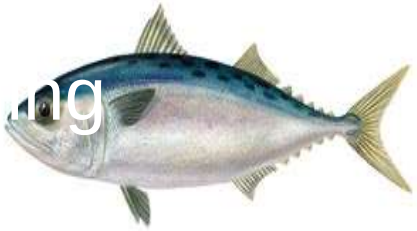
Factor	Condition	Impacts
Temperature	Mean; extremes; variabality; seasonality; sea level rise	Changing phenology; changing triggers to migration and dispersal; predator-prey, parasite-host, mutualisms; new invasives; changes in distribution; loss of habitat
Rainfall	Means; extremes variability, seasonality	Changing phenology; changing triggers to migration and dispersal; predator-prey, parasite-host, mutualisms; new invasives; changes in distribution; loss of habitat
Extreme Events	Frequency and intensity of storms, floods, droughts, fires	Direct mortality; increased physiological stress leading to decreased fecundity and/or disease susceptibility and increased mortality
CO2 concentration	Atmosphere; ocean; ocean pH	Reduced ability to form calcareous structures

Climate Change Impacts on Species

Not all species equally susceptible to climate change depends on life-history, ecology, behaviour, physiology, genetic make-up, etc

- IUCN study assessed 9,856 birds 6,222 amphibians, 799 corals
- 35%, birds 52% amphibians and 71% corals susceptible
- Birds 10 % threatened, 25% non-threatened species susceptible
- Amphibians 24% threatened 28% non-threatened species susceptible
- Corals 19% threatened, 51% non-threatened susceptible

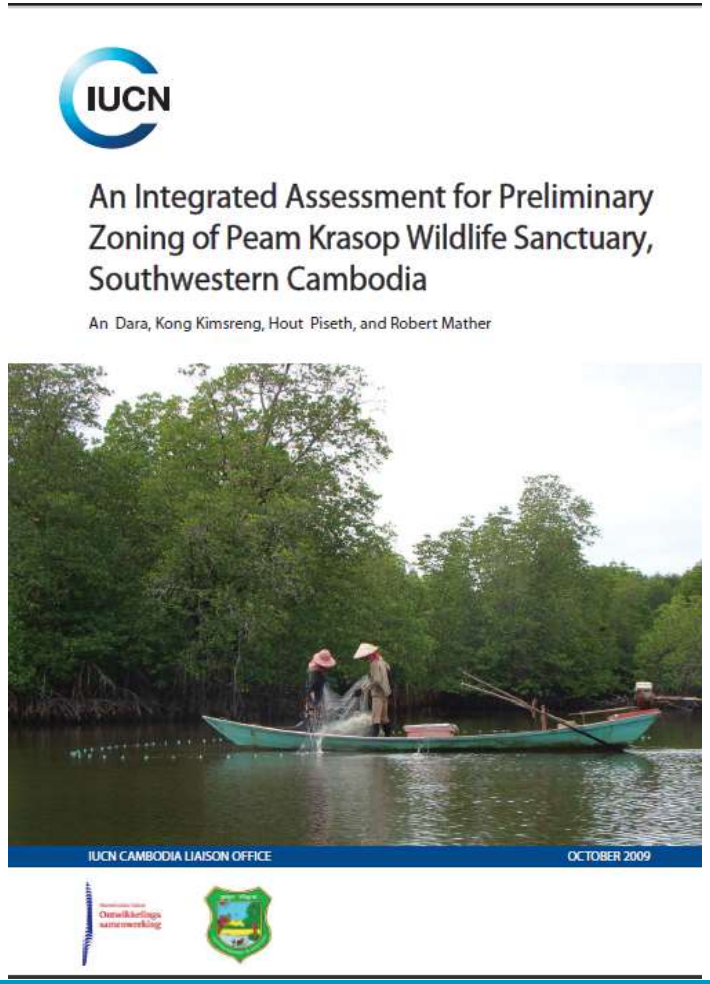
Species responses to Climate Change



- Mackerel sensitive to temperature, rely on currents for dispersal – may shift range to cooler seas
- Mud crab sensitive to temp, pH, ocean circulation -can shift range by 1,000km
- Squid very adaptable, may grow faster and replace other species
- Seabass more tolerant of higher temp than grouper snapper – up to 32◦C
- Prawns may grow faster but be more susceptible to disease

Nature-Based Solutions

Protected Area Zoning e.g. in Peam Krassop Wildlife Sanctuary, Cambodia



IUCN

An Integrated Assessment for Preliminary Zoning of Peam Krasop Wildlife Sanctuary, Southwestern Cambodia

An Dara, Kong Kimsreng, Hout Piseth, and Robert Mather

IUCN CAMBODIA LIAISON OFFICE OCTOBER 2009

CO-MANAGEMENT

State management	Co-management		Community management
Control by Government Agency	Shared control (government agency and stakeholders)		Community control
	Negotiating specific agreements	Sharing authority and responsibility in a formal way	

- Local communities and local authorities share responsibility and authority for the management of a given area through a negotiated agreement
- Provide local communities with some benefits through legal and secured access while ensuring effective protection

Restoration/rehabilitation – e.g. beach re-vegetation

Promoting Local Innovation (PLI)

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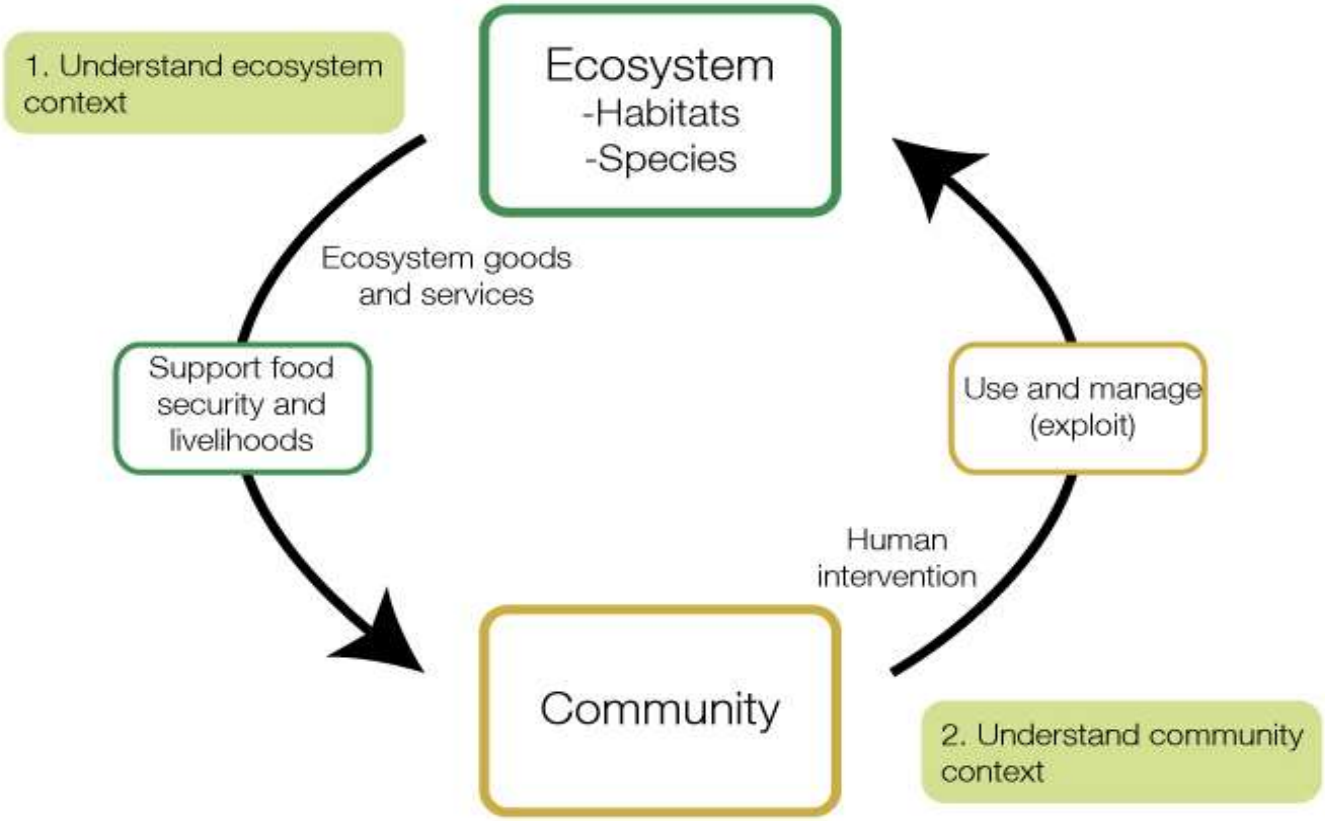
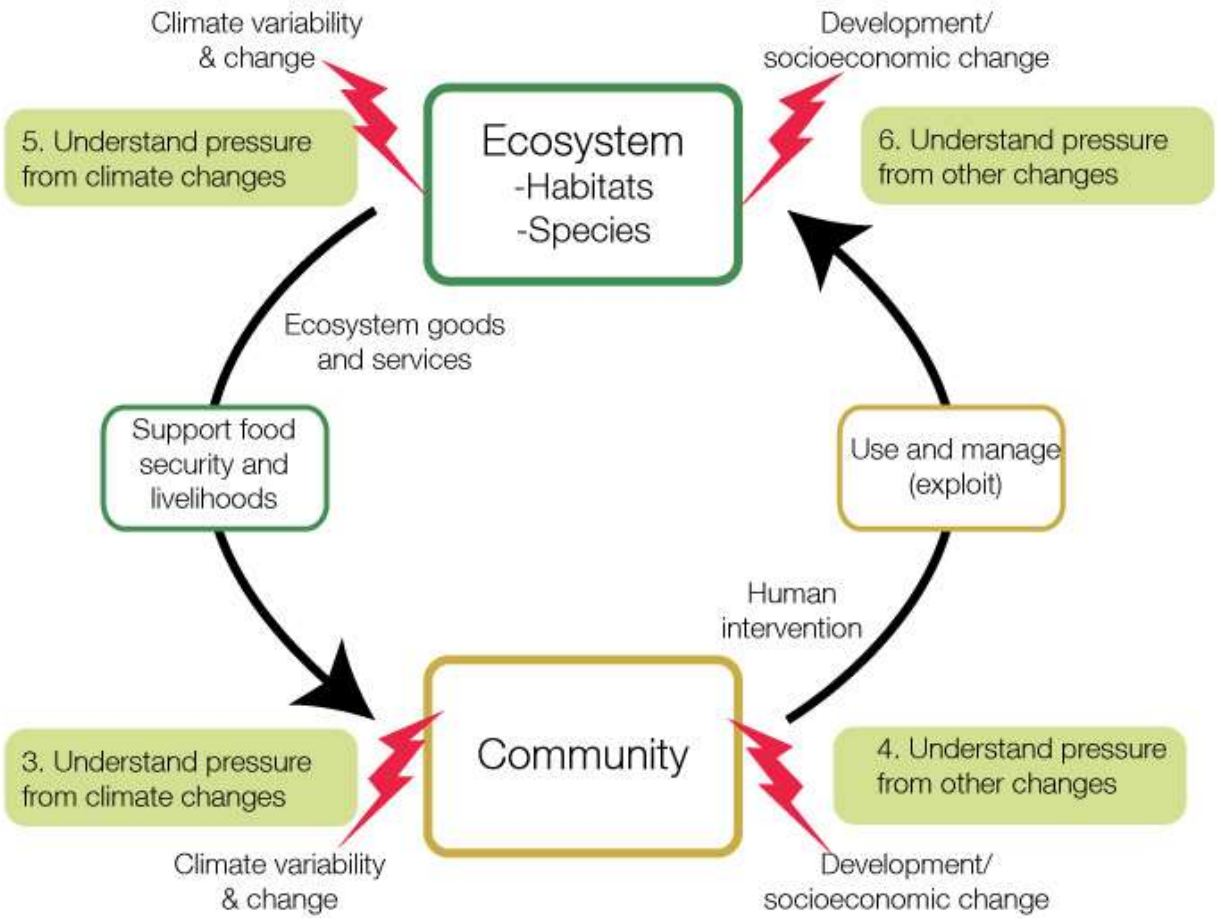
Protected Areas
Ecosystem & community



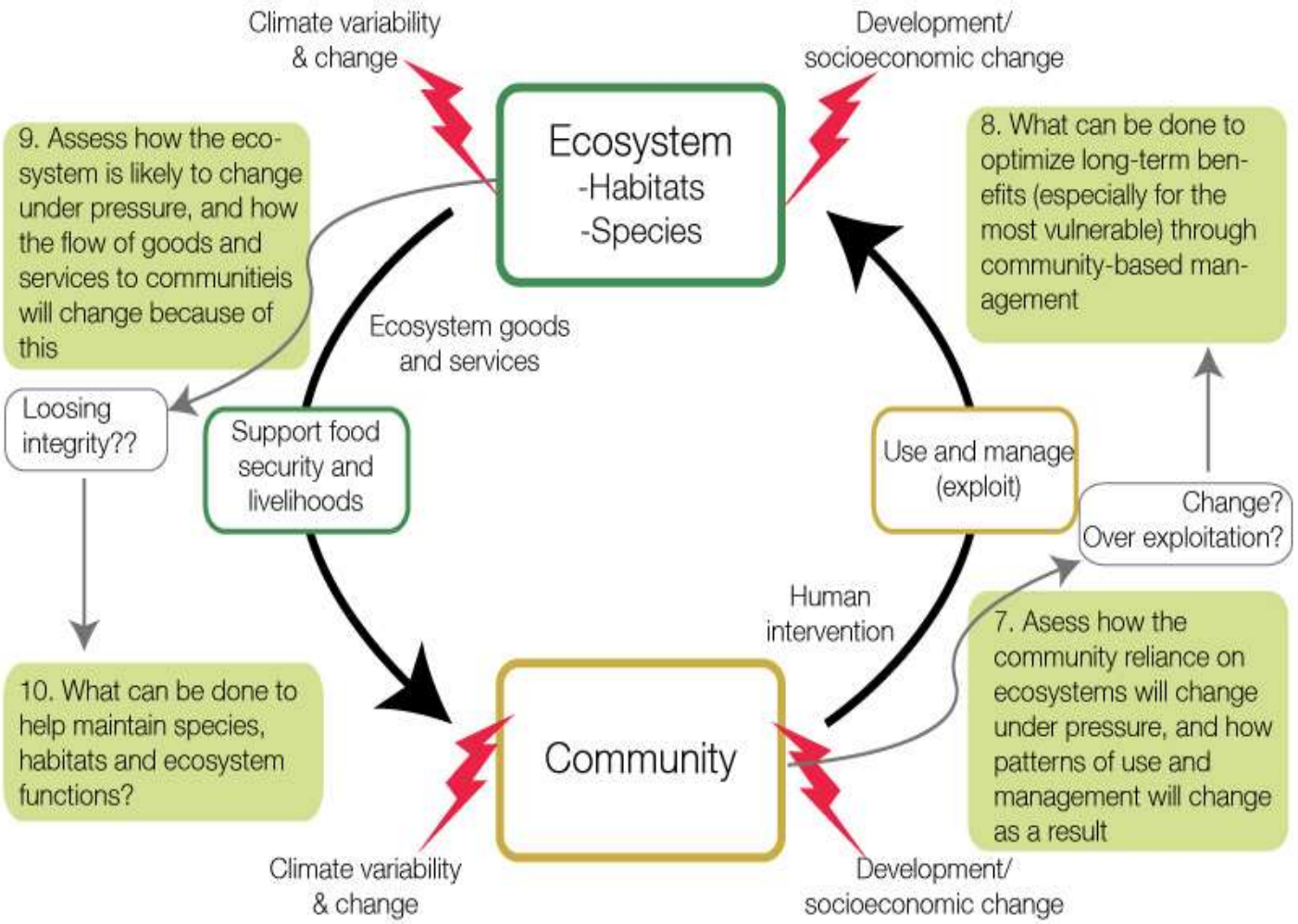
Protected Areas

Ecosystem & community under pressure



Protected Areas

Ecosystem & community adaptation



www.iucn.org/building-coastal-resilience

Thank You!