Impact Chain Analysis and Climate Rationale

Objectives for this Section

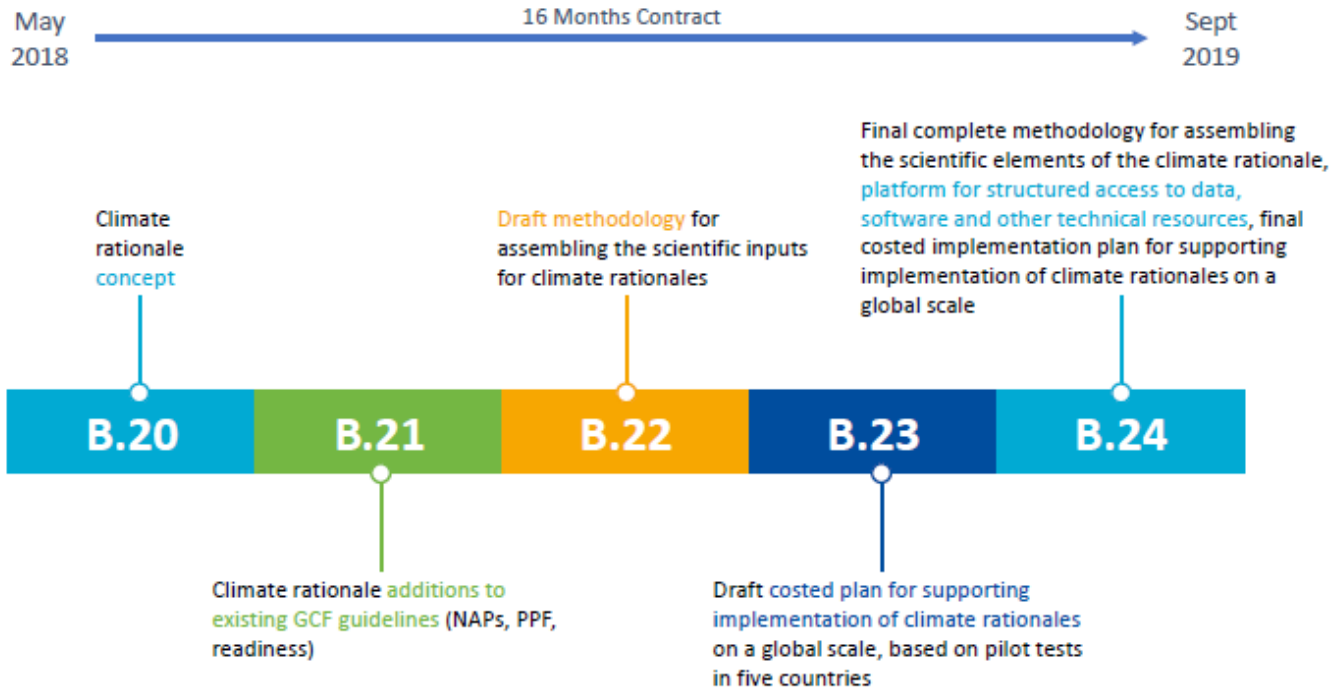
1. Understanding GCF's current work on climate rationale
2. Demonstrating **climate change impact analysis** as a tool for developing the climate rationale
3. Developing an **evidence based climate rationale** for climate change policies and projects

What is “Climate Rationale”?

- “The climate rationale provides the **scientific** underpinning for **evidence-based** climate action decision making and the **theory of change** of all kinds of activities funded by the GCF. It ensures that the set of **causal linkages between climate and climate impacts and between action and societal benefits** is fully grounded in the **best available climate data and science** concerning the most relevant climatic factors” (from GCF draft guidance on climate rationale)

NAP-GSP
NATIONAL ADAPTATION PLAN GLOBAL SUPPORT PROGRAMME

Outputs / Deliverables



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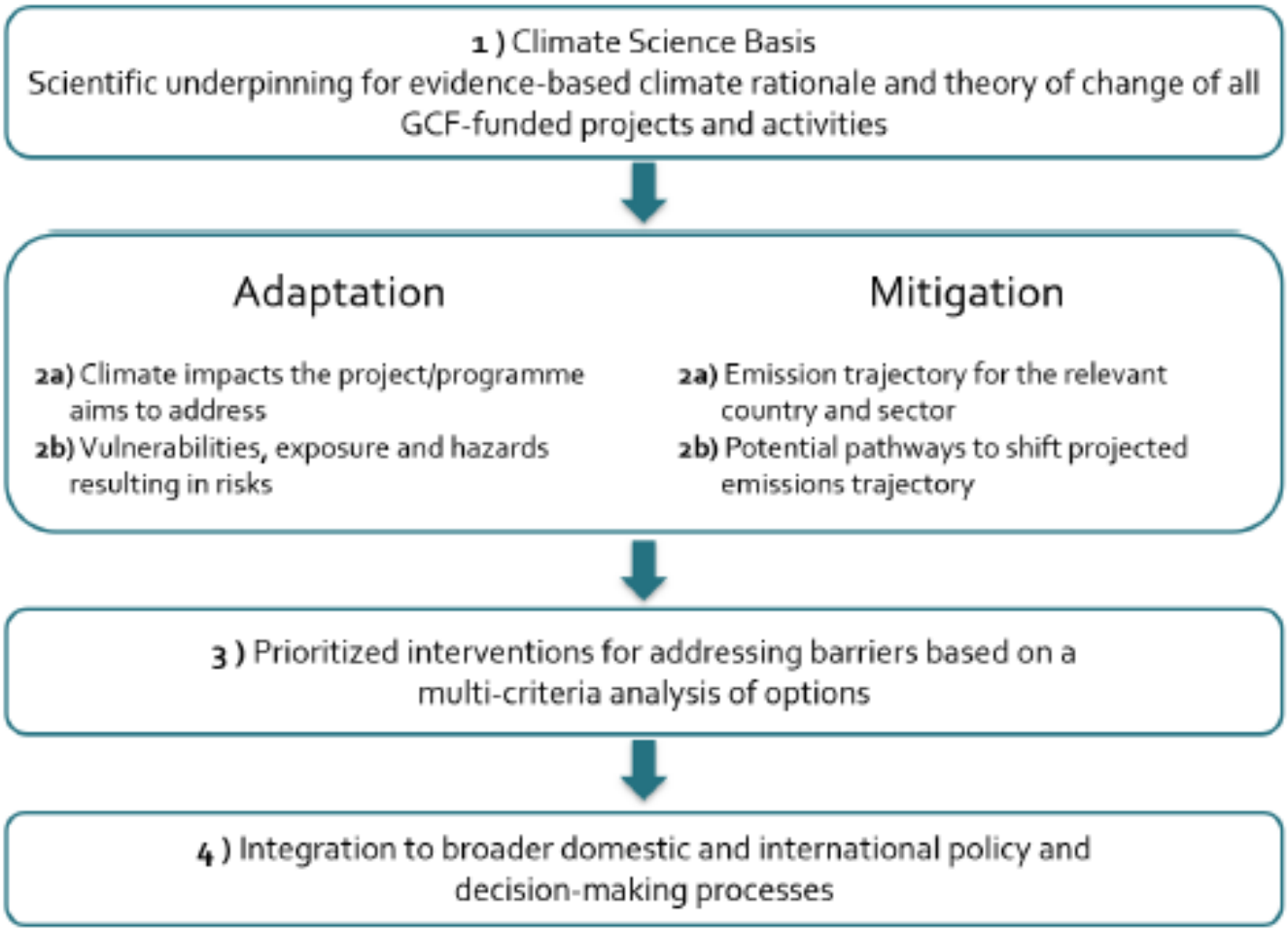

1) Climate Science Basis
Scientific underpinning for evidence-based climate rationale and theory of change of all GCF-funded projects and activities
Adaptation
2a) Climate impacts the project/programme aims to address
2b) Vulnerabilities, exposure and hazards resulting in risks
Mitigation
2a) Emission trajectory for the relevant country and sector
2b) Potential pathways to shift projected emissions trajectory
3) Prioritized interventions for addressing barriers based on a multi-criteria analysis of options
4) Integration to broader domestic and international policy and decision-making processes

Elements of the climate rationale (draft)

- **"Headline climate indicators"**…physical, chemical, biological variables that characterize the Earth's climate
  - E.g. average surface temperatures, ocean heat content, atmospheric concentrations of CO2, global ocean indicators (SST, SLR), cryosphere, global precipitation
  - Sector-specific climate indices (to be developed consistent with key sectors)
  - High impact events…the change in frequency and or the intensity of climate events associated with climate variability

- **National meteorological and hydrological services** are primary sources for data and information…

Climate Indices

Health Sector	
Some Key Variables: Temperature, humidity	
Indicator	Description
Frost Days (0)	Annual count when $T_{MIN} < 0^{\circ}C$
Very Hard Freeze	Annual count when $T_{MIN} < -20^{\circ}C$
Ice Days	Annual count when $T_{MAX} < 0^{\circ}C$
Summer Days	Annual count when $T_{MAX} > 25^{\circ}C$
Tropical Nights	Annual count when $T_{MIN} > 20^{\circ}C$
Warm Spell Duration Indicator	Annual count of at least 6 consecutive days when $T_{MAX} > 90^{th}$ percentile
User-Defined Warm Spell Duration Index	Annual count of at least n consecutive days when $T_{MAX} > 90^{th}$ percentile, where $2 \leq n \leq 10$
Cold Spell Duration Indicator	Annual count of at least 6 consecutive days when $T_{MIN} < 10^{th}$ percentile
User-Defined Cold Spell Duration Index	Annual count of at least n consecutive days when $T_{MIN} < 10^{th}$ percentile, where $2 \leq n \leq 10$
Above Average Days	Percentage of days annual where $T_{MAX} > 50^{th}$ percentile
Very Warm Day Threshold	Value of 95^{th} percentile of T_{MAX}
Hot Days	Annual count when $T_{MAX} \geq 30^{\circ}C$
Very Hot Days	Annual count when $T_{MAX} \geq 35^{\circ}C$
User-Defined Consecutive Number of Hot Days and Nights	Annual count of n consecutive days where both $T_{MAX} > 95^{th}$ percentile and $T_{MIN} > 95^{th}$ percentile, where $2 \leq n \leq 10$

Climate Indices

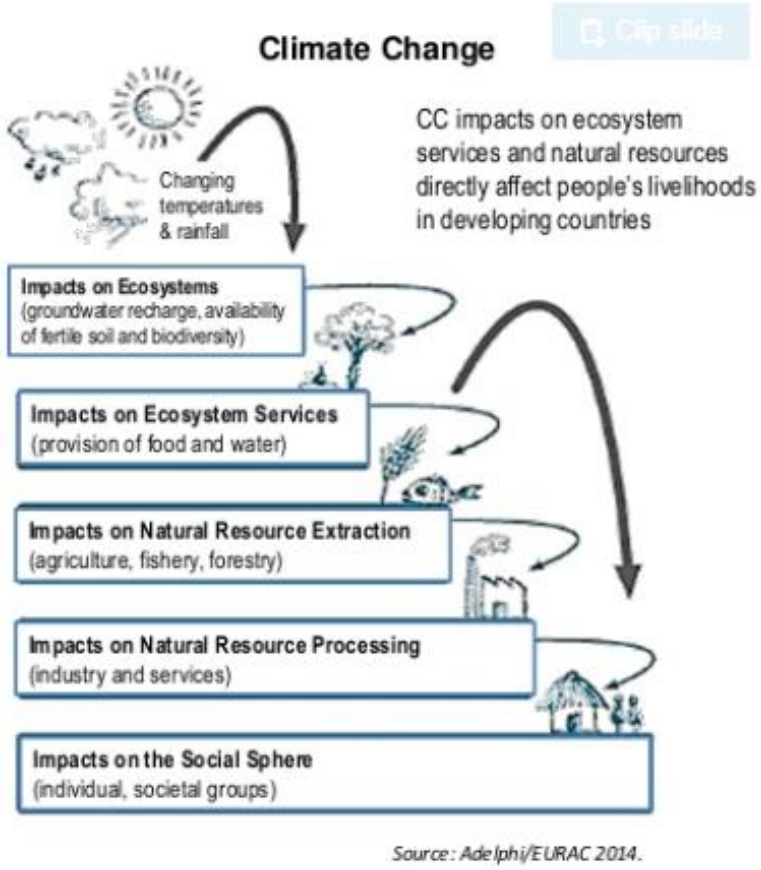
Heating Degree Days	**Annual sum of T_b - TM (where T_b is a user-defined location-specific base temperature and TM < T_b)**
Cooling Degree Days	Annual sum of TM - T_b (where T_b is a user-defined location-specific base temperature and TM > T_b)
Growing Degree Days	Annual sum of TM – T_b (where T_b is a user-defined location-specific base temperature and TM > T_b)
Consecutive Dry Days	Maximum number of consecutive days with P_{DAILY} < 1mm
User-Defined Consecutive Days Precipitation Amount	Monthly maximum consecutive n-day precipitation (up to a maximum of 10)
Standardized Precipitation Index	Measure of “drought” using the Standardized Precipitation Index on time scales of 3, 6 and 12 months. No missing data are allowed to calculate the Standardized Precipitation Index.
Standardized Precipitation Evapotranspiration Index	Measure of “drought” using the Standardized Precipitation Evapotranspiration Index on time scales of 3, 6 and 12 months. No missing data are allowed to calculate Standardized Precipitation Evapotranspiration Index.

Climate Indices

Heat Wave Number	Annual number of summer (November-March in the Southern Hemisphere and May-September in the Northern Hemisphere) heat waves where conditions persist for at least 3 consecutive days per the definition of Excess Heat Factor/Consecutive days where $T_{MIN} > 90^{th}$ percentile/Consecutive days where $T_{MAX} > 90^{th}$ percentile
Heat Wave Duration	The length of the longest summer (November-March in the Southern Hemisphere and May-September in the Northern Hemisphere) heat wave where conditions persist for at least 3 consecutive days per the definition of Excess Heat Factor/Consecutive days where $T_{MIN} > 90^{th}$ percentile/Consecutive days where $T_{MAX} > 90^{th}$ percentile
Heat Wave Frequency	The total number of days each summer (November-March in the Southern Hemisphere and May-September in the Northern Hemisphere) that contribute to all heat waves where conditions persist for at least 3 consecutive days per the definition of Excess Heat Factor/Consecutive days where $T_{MIN} > 90^{th}$ percentile/Consecutive days where $T_{MAX} > 90^{th}$ percentile
Heat Wave Amplitude	The hottest day of the hottest summer (November-March in the Southern Hemisphere and May-September in the Northern Hemisphere) heat wave where conditions persist for at least 3 consecutive days per definitions of Excess Heat Factor/Consecutive days where $T_{MIN} > 90^{th}$ percentile/Consecutive days where $T_{MAX} > 90^{th}$ percentile
Heat Wave Mean	Average magnitude of all heat wave days (November-March in the Southern Hemisphere and May-September in the Northern Hemisphere) where conditions persist for at least 3 consecutive days per definitions of Excess Heat Factor/Consecutive days where $T_{MIN} > 90^{th}$ percentile/Consecutive days where $T_{MAX} > 90^{th}$ percentile
User-Defined Consecutive Number of Cold Days and Nights	Annual count of n consecutive days where both $T_{MAX} < 5^{th}$ percentile and $T_{MIN} < 5^{th}$ percentile, where $2 \leq n \leq 10$

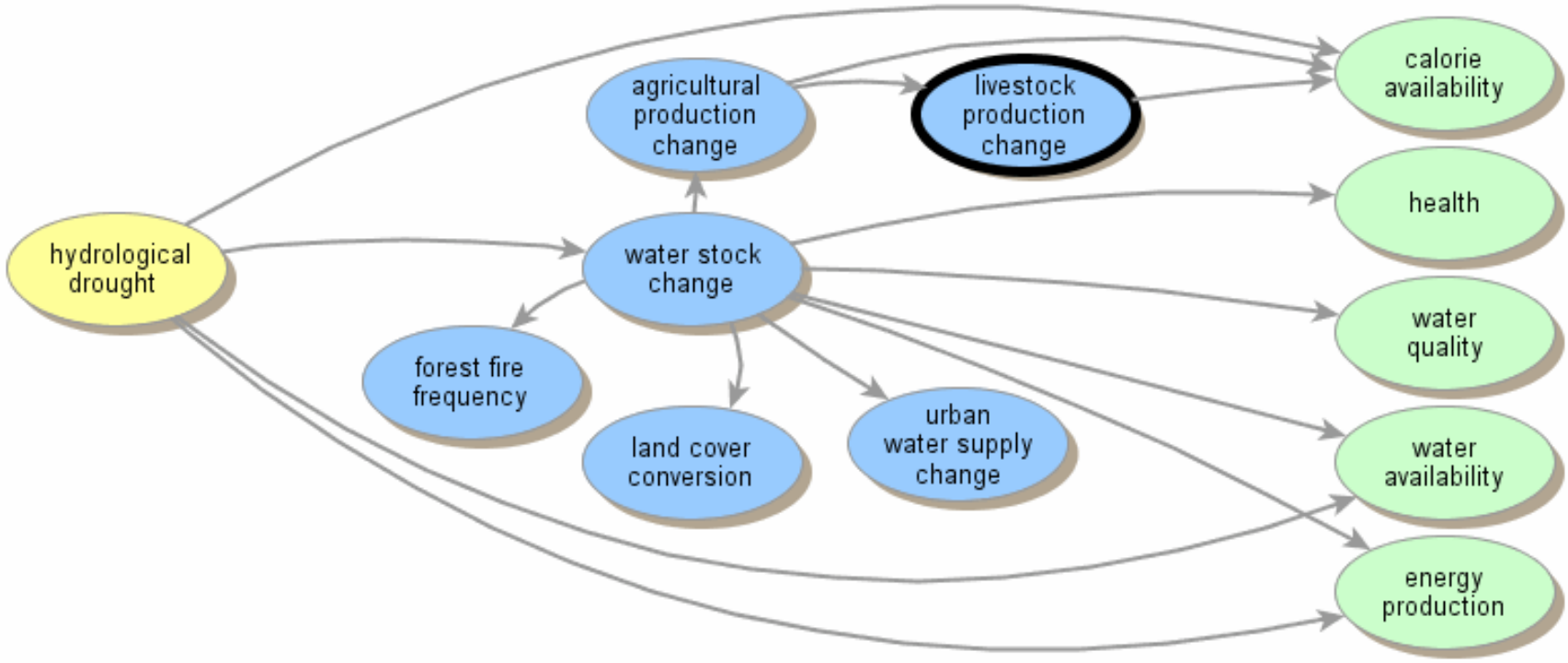
Impact Chain Analysis: A tool to inform climate rationale

- Begin with physical processes: expected and observed
- Consider the hazards and gradual changes caused, directly and indirectly by these processes
- Determine the direct impacts on ecosystems, human systems, assets, etc.
- Consider indirect impacts on the same systems

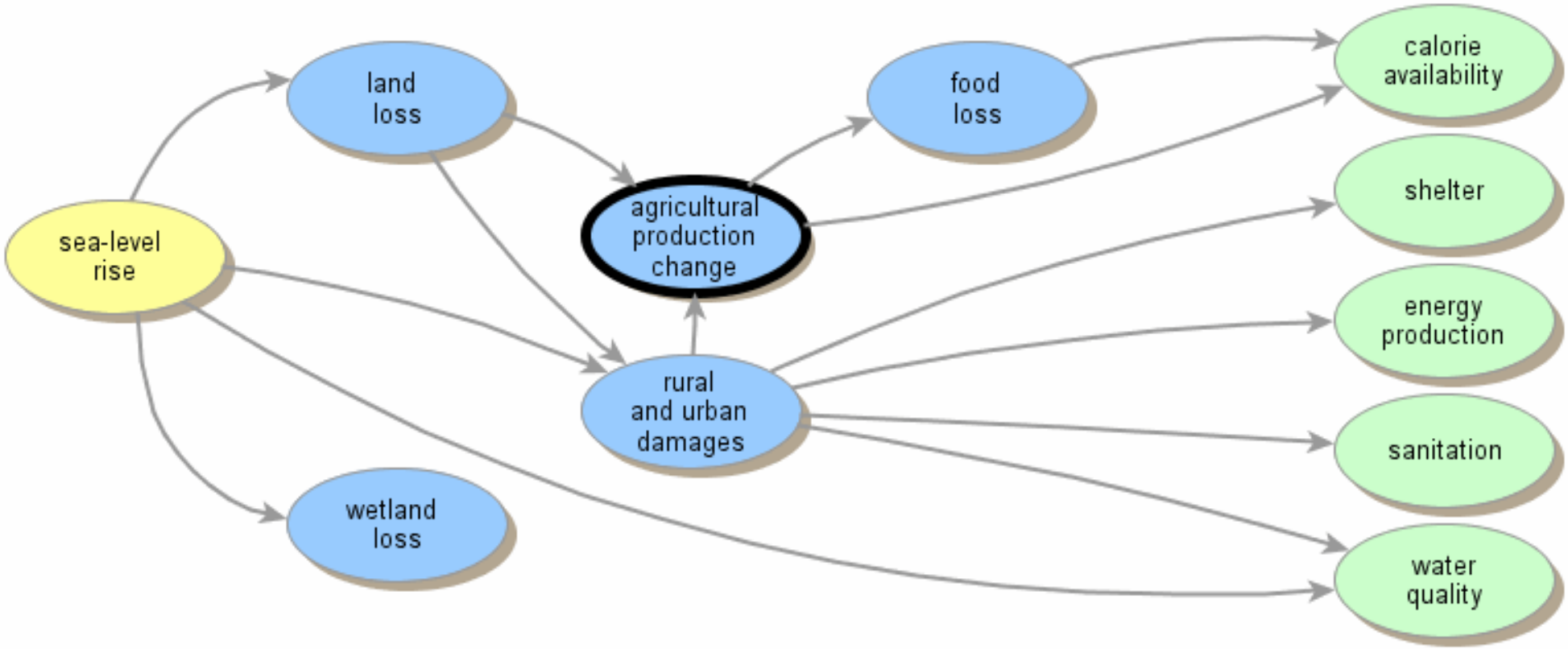


Shout Out: Dr. Rosa Perez, CCC!!!

Example: Drought (hydrological)



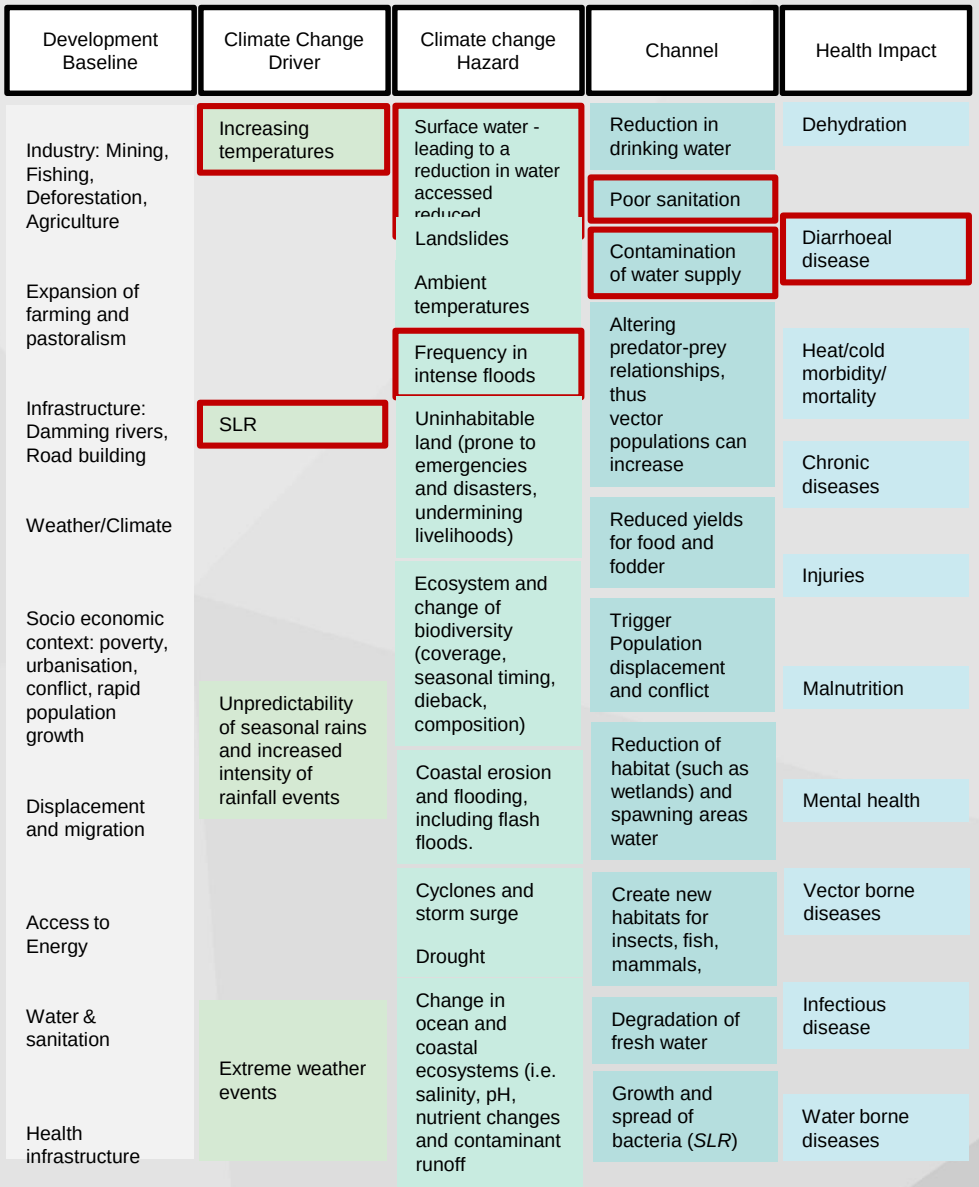
Example: SLR


land loss
food loss
calorie availability
sea-level rise
agricultural production change
shelter
energy production
rural and urban damages
sanitation
wetland loss
water quality

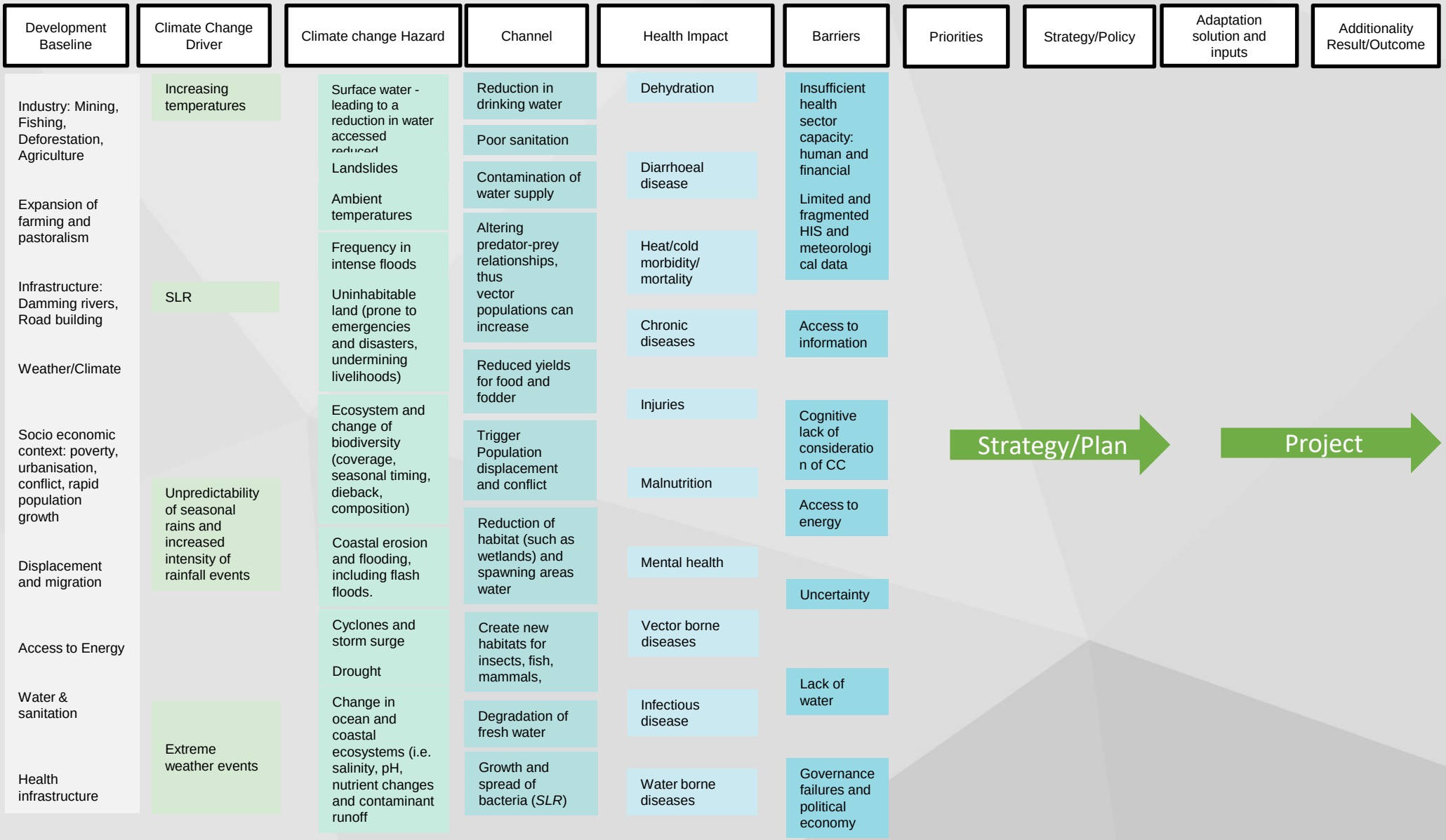
Driver=Physical Process
Hazard=Geographically specific physical “footprint”
Channel=Vector, pathway

Climate Change Driver	Climate change Hazard	Channel
Increasing temperatures	Surface water - leading to a reduction in water accessed reduced	Reduction in drinking water
		Poor sanitation
	Landslides	Contamination of water supply
	Ambient temperatures	Altering predator-prey relationships, thus vector populations can increase
SLR	Frequency in intense floods	
	Uninhabitable land (prone to emergencies and disasters, undermining livelihoods)	Reduced yields for food and fodder
	Ecosystem and change of biodiversity (coverage, seasonal timing, dieback, composition)	Trigger Population displacement and conflict
Unpredictability of seasonal rains and increased intensity of rainfall events	Coastal erosion and flooding, including flash floods.	Reduction of habitat (such as wetlands) and spawning areas water
	Cyclones and storm surge	Create new habitats for insects, fish, mammals,
	Drought	
Extreme weather events	Change in ocean and coastal ecosystems (i.e. salinity, pH, nutrient changes and contaminant runoff	Degradation of fresh water
		Growth and spread of bacteria (*SLR*)

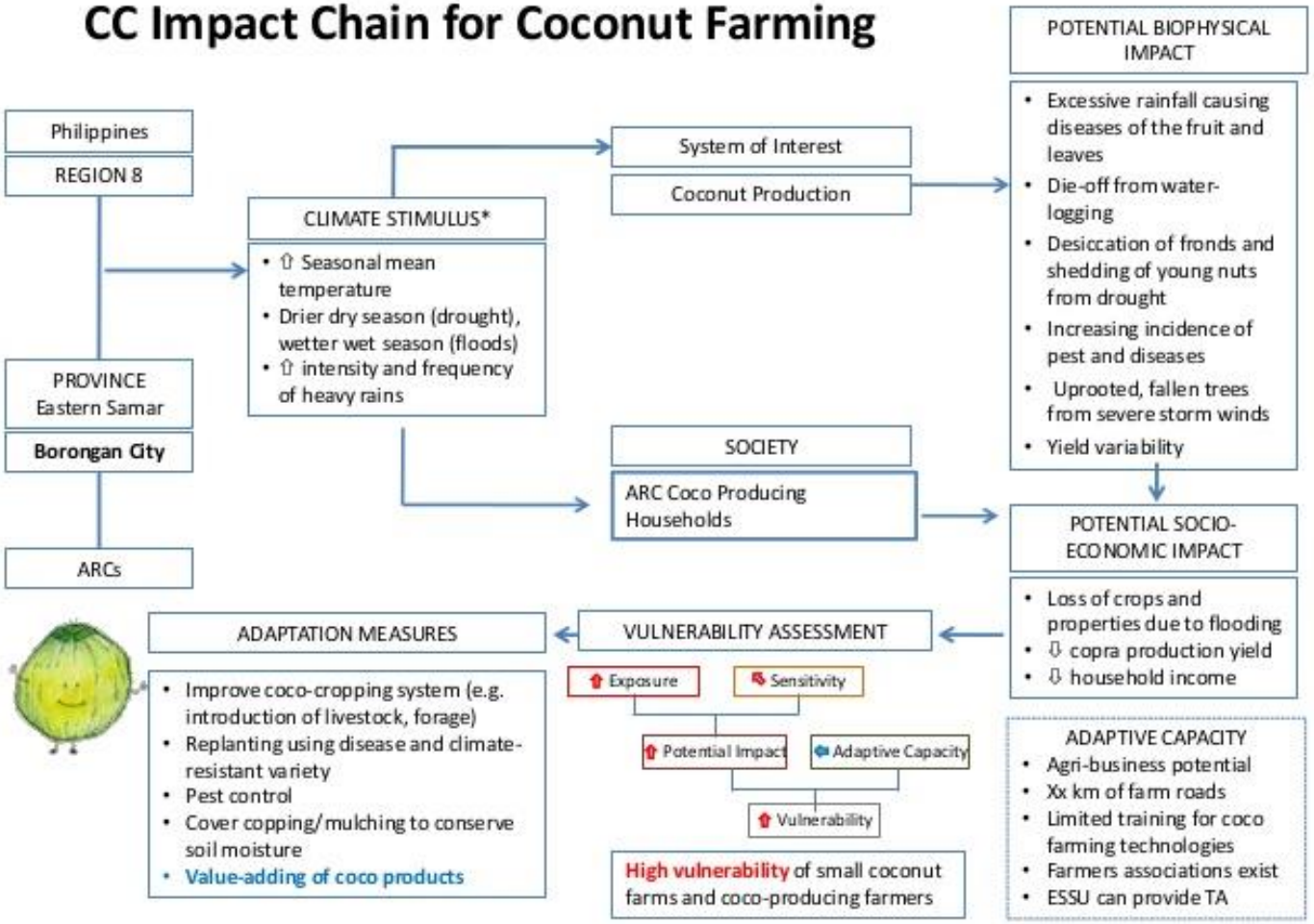
Climate rationale



Indirect pathway (health determining sectors) - Adaptation


Development Baseline
Climate Change Driver
Climate change Hazard
Channel
Health Impact
Barriers
Priorities
Strategy/Policy
Adaptation solution and inputs
Additionality Result/Outcome
Industry: Mining, Fishing, Deforestation, Agriculture
Expansion of farming and pastoralism
Infrastructure: Damming rivers, Road building
Weather/Climate
Socio economic context: poverty, urbanisation, conflict, rapid population growth
Displacement and migration
Access to Energy
Water & sanitation
Health infrastructure
Increasing temperatures
SLR
Unpredictability of seasonal rains and increased intensity of rainfall events
Extreme weather events
Surface water - leading to a reduction in water accessed
Landslides
Ambient temperatures
Frequency in intense floods
Uninhabitable land (prone to emergencies and disasters, undermining livelihoods)
Ecosystem and change of biodiversity (coverage, seasonal timing, dieback, composition)
Coastal erosion and flooding, including flash floods.
Cyclones and storm surge
Drought
Change in ocean and coastal ecosystems (i.e. salinity, pH, nutrient changes and contaminant runoff
Reduction in drinking water
Poor sanitation
Contamination of water supply
Altering predator-prey relationships, thus vector populations can increase
Reduced yields for food and fodder
Trigger Population displacement and conflict
Reduction of habitat (such as wetlands) and spawning areas water
Create new habitats for insects, fish, mammals,
Degradation of fresh water
Growth and spread of bacteria (SLR)
Dehydration
Diarrhoeal disease
Heat/cold morbidity/ mortality
Chronic diseases
Injuries
Malnutrition
Mental health
Vector borne diseases
Infectious disease
Water borne diseases
Insufficient health sector capacity: human and financial
Limited and fragmented HIS and meteorological data
Access to information
Cognitive lack of consideration of CC
Access to energy
Uncertainty
Lack of water
Governance failures and political economy
Strategy/Plan
Project

CC Impact Chain for Coconut Farming



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Impact Chain Analysis for Rice

Source: https://www.adaptationcommunity.net/?wpfb_dl=175

Rice sensitivity chart				
Climatic stimuli	Production phase			
	Germination	Growth/flowering/ fruit setting	Ripening	Harvest
Temperature	Some controversy			
Rainfall	Vulnerable to erratic rainfall			
Drought	Vulnerable			
Flooding	Vulnerable to prolonged flooding (except e.g. scuba rice)			
Tropical ozone	Harmful and leads to grain yield decrease			
Salinization	Problem in dry season			
CO_2 fertilization	Fairly strong positive effect			

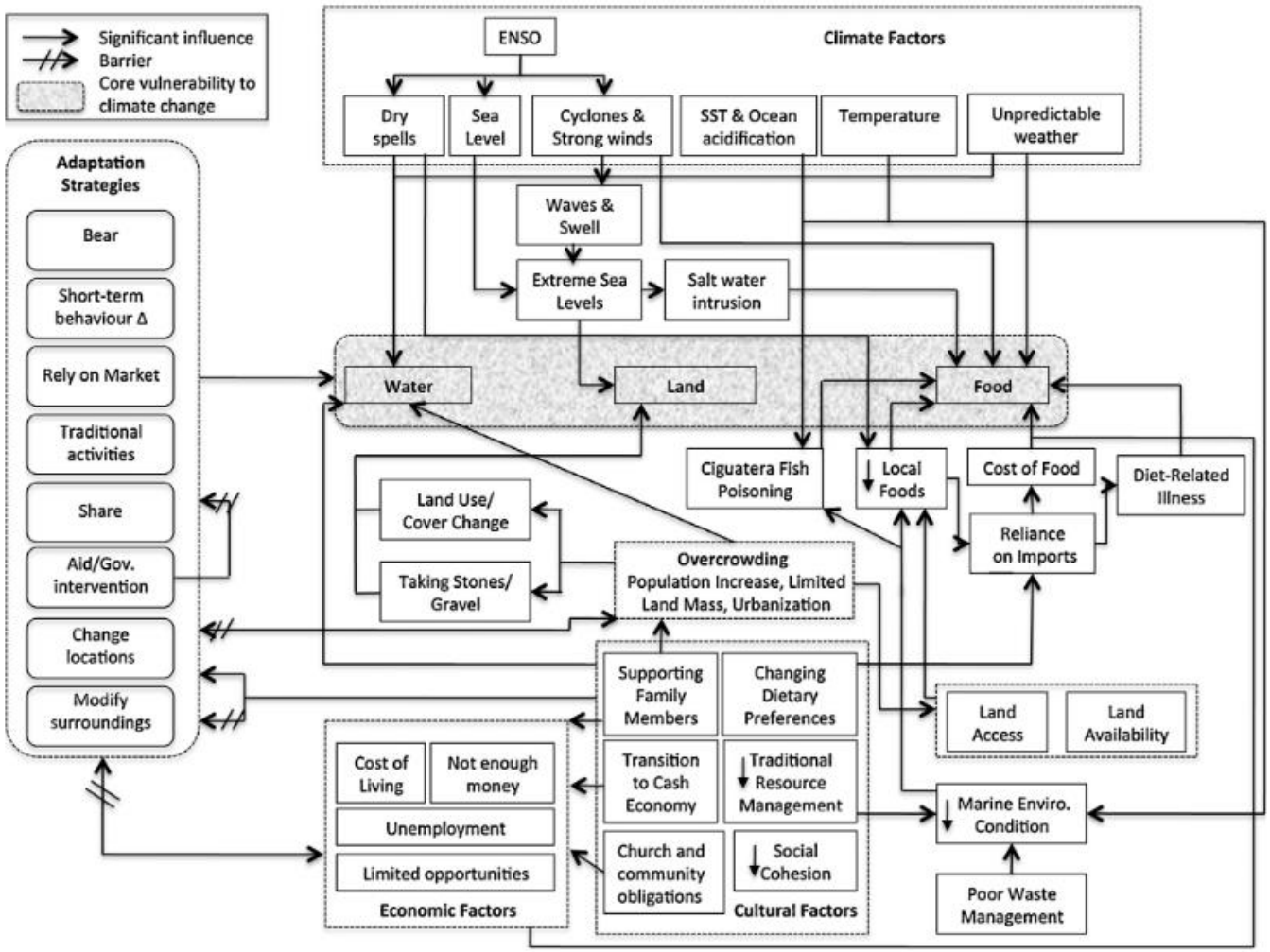
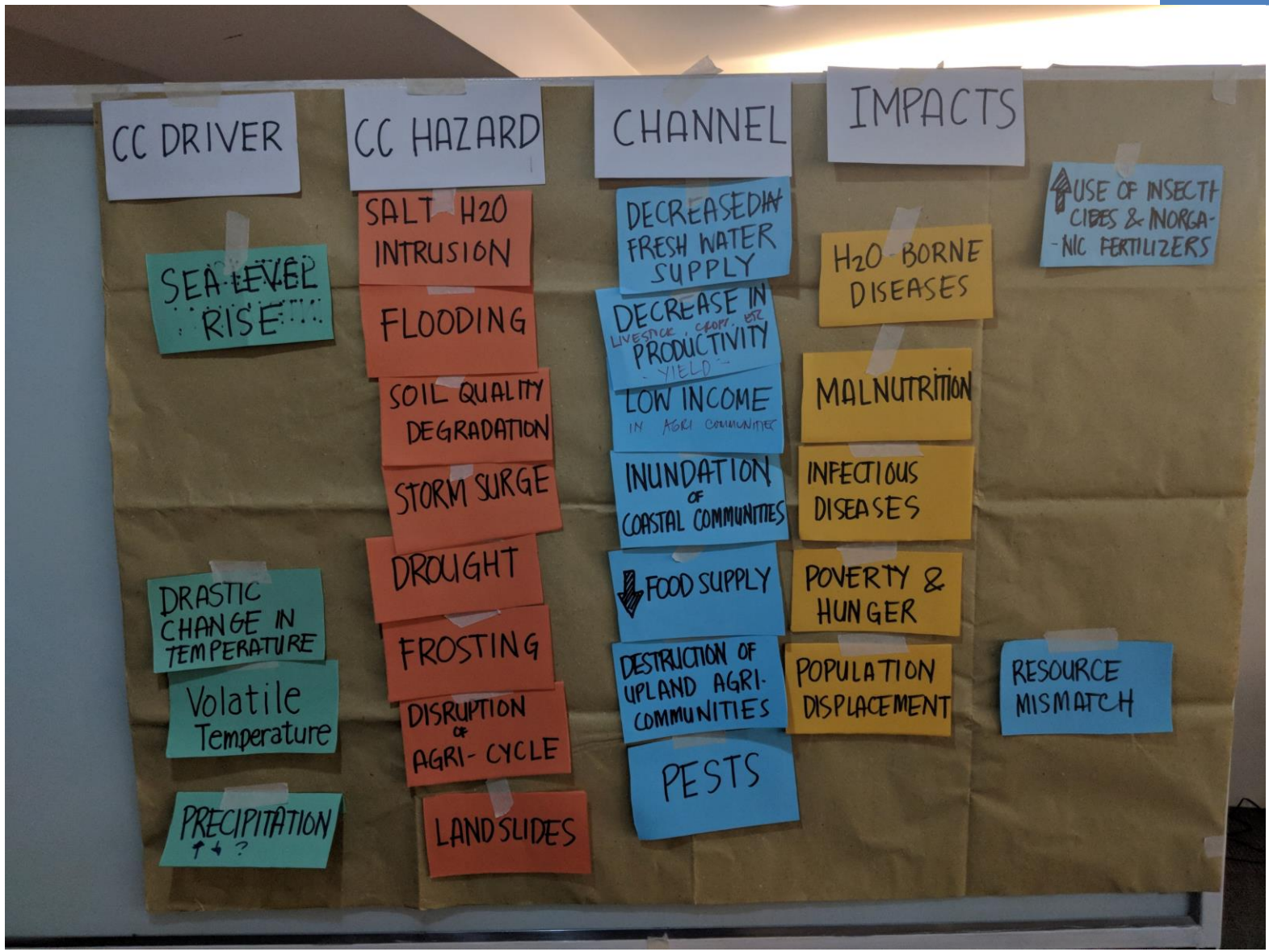
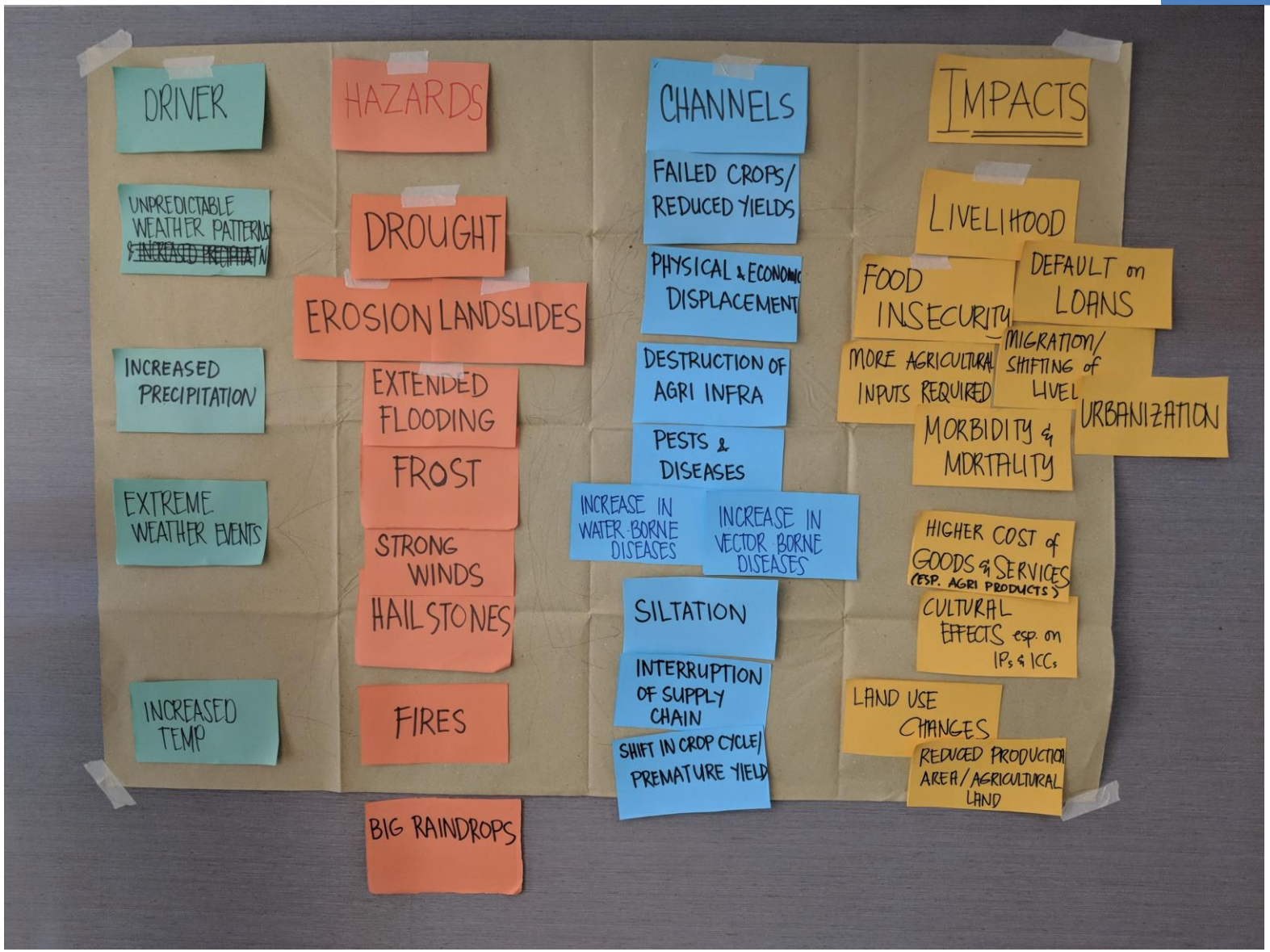
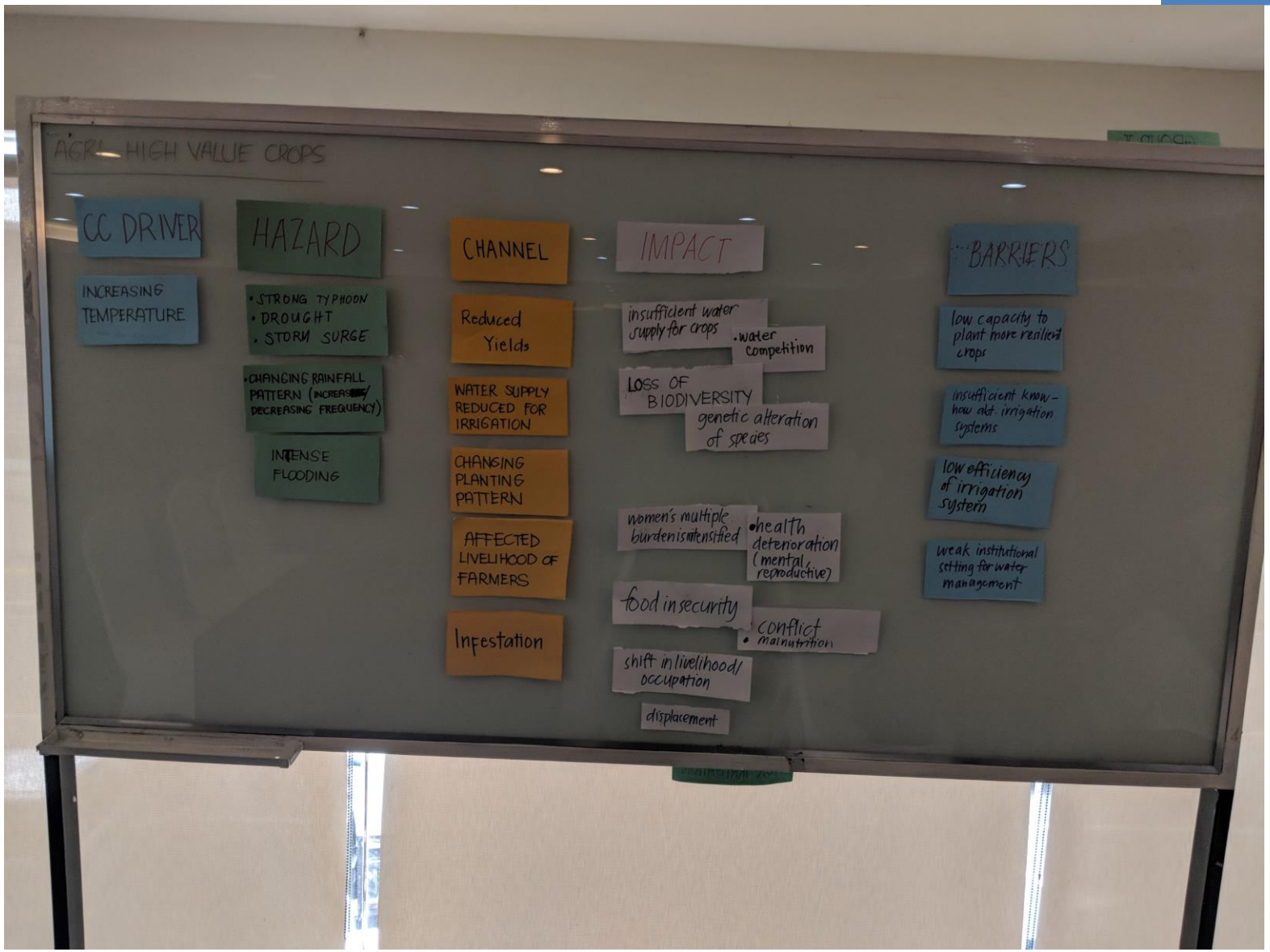


Fig. 3. The complex interaction of climatic and non-climatic conditions affecting vulnerability of water, land and food in Funafuti to climate change.


CC DRIVER
CC HAZARD
CHANNEL
IMPACTS
SEA LEVEL RISE
SALT H2O INTRUSION
DECREASED FRESH WATER SUPPLY
H2O - BORNE DISEASES
USE OF INSECTICIDES & INORGANIC FERTILIZERS
FLOODING
DECREASE IN PRODUCTIVITY
SOIL QUALITY DEGRADATION
LOW INCOME
MALNUTRITION
STORM SURGE
INUNDATION OF COASTAL COMMUNITIES
INFECTIOUS DISEASES
DROUGHT
FOOD SUPPLY
POVERTY & HUNGER
DRASTIC CHANGE IN TEMPERATURE
FROSTING
DESTRUCTION OF UPLAND AGRI-COMMUNITIES
POPULATION DISPLACEMENT
RESOURCE MISMATCH
Volatile Temperature
DISRUPTION OF AGRI-CYCLE
PESTS
PRECIPITATION
LANDSLIDES


DRIVER
HAZARDS
CHANNELS
IMPACTS
UNPREDICTABLE WEATHER PATTERNS
INCREASED PRECIPITATION
EXTREME WEATHER EVENTS
INCREASED TEMP
DROUGHT
EROSION LANDSLIDES
EXTENDED FLOODING
FROST
STRONG WINDS
HAILSTONES
FIRES
BIG RAINDROPS
FAILED CROPS/ REDUCED YIELDS
PHYSICAL & ECONOMIC DISPLACEMENT
DESTRUCTION OF AGRI INFRA
PESTS & DISEASES
INCREASE IN WATER-BORNE DISEASES
INCREASE IN VECTOR BORNE DISEASES
SILTATION
INTERRUPTION OF SUPPLY CHAIN
SHIFT IN CROP CYCLE/ PREMATURE YIELD
LIVELIHOOD
FOOD INSECURITY
DEFAULT on LOANS
MORE AGRICULTURAL INPUTS REQUIRED
MIGRATION/ SHIFTING of LIVEL
URBANIZATION
MORBIDITY & MORTALITY
HIGHER COST of GOODS & SERVICES (ESP. AGRI PRODUCTS)
CULTURAL EFFECTS esp. on IPs & ICCs
LAND USE CHANGES
REDUCED PRODUCTION AREA/ AGRICULTURAL LAND


AGRI - HIGH VALUE CROPS
CC DRIVER
INCREASING TEMPERATURE
HAZARD
• STRONG TYPHOON
• DROUGHT
• STORM SURGE
• CHANGING RAINFALL PATTERN (INCREASING/DECREASING FREQUENCY)
INTENSE FLOODING
CHANNEL
Reduced Yields
WATER SUPPLY REDUCED FOR IRRIGATION
CHANGING PLANTING PATTERN
AFFECTED LIVELIHOOD OF FARMERS
Infestation
IMPACT
insufficient water supply for crops
• water competition
LOSS OF BIODIVERSITY
genetic alteration of species
women's multiple burden is intensified
• health deterioration (mental, reproductive)
food insecurity
• conflict
• malnutrition
shift in livelihood/ occupation
displacement
BARRIERS
low capacity to plant more resilient crops
insufficient know-how abt. irrigation systems
low efficiency of irrigation system
weak institutional setting for water management

Climate Rationale Best Practices

- If you take climate change out of the picture and you still have a big problem, it's not a climate change problem
- Climate rationale should be evidence based
  - Use documented observed processes and impacts, and rigorously projected future processes
- Look for emerging issues
- Look for systems being pushed beyond equilibrium
- Look for issues being pushed beyond local capacity to address the problem
- Test the logic of your pathways
- If you dress a development project in CC clothes, GCF will sniff it out.

Where to get info on physical processes?

- NDC…
- JNAP…
- Everything in session 2…