

RESPONDING TO CLIMATE CHANGE SIGNALS AND IMPACTS: CASE OF SRI LANKA

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OUTLINE

- Climate change signals in Sri Lanka – observed changes
- What will the future hold? – projected changes
- Impacts
 - On water resources
 - On agriculture
- Climate change vulnerability hotspots?
- Responding to climatic changes
- Knowledge gaps

→ Food Security

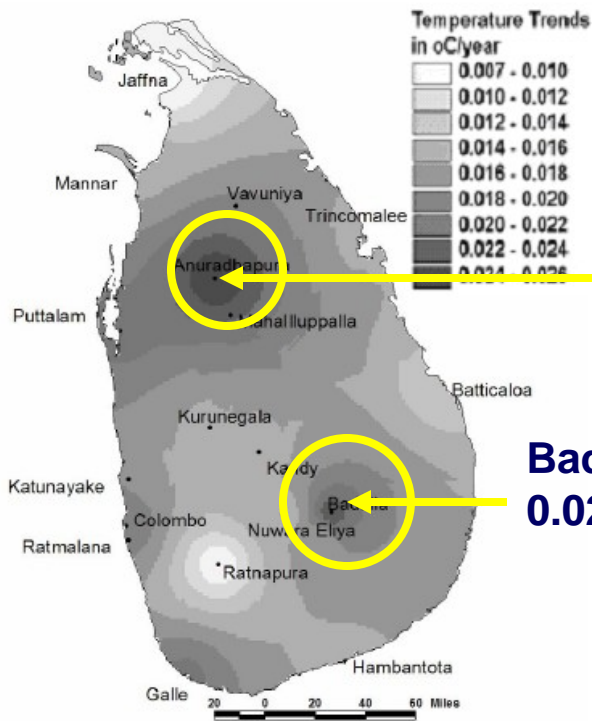
INFORMATION SOURCES



CLIMATE CHANGE SIGNALS (OBSERVED CHANGES)

Temperature

Warming trends (°C/year)
1961-2000



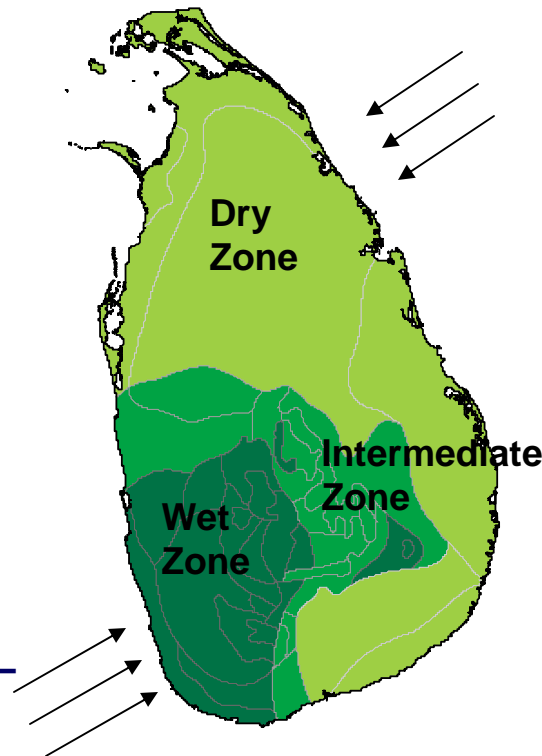
Anuradhapura
0.024-0.026

Badulla
0.022-0.024

Source: Zubair et al. 2005

Rainfall

No significant change in Mean Annual Rainfall Amount



North-East Monsoon (Dec – Feb):
reduced & variability increased
(Maha)

South-West Monsoon (May – Sept):
Stable
(Yala)

FUTURE? (PROJECTED CHANGES) - 1

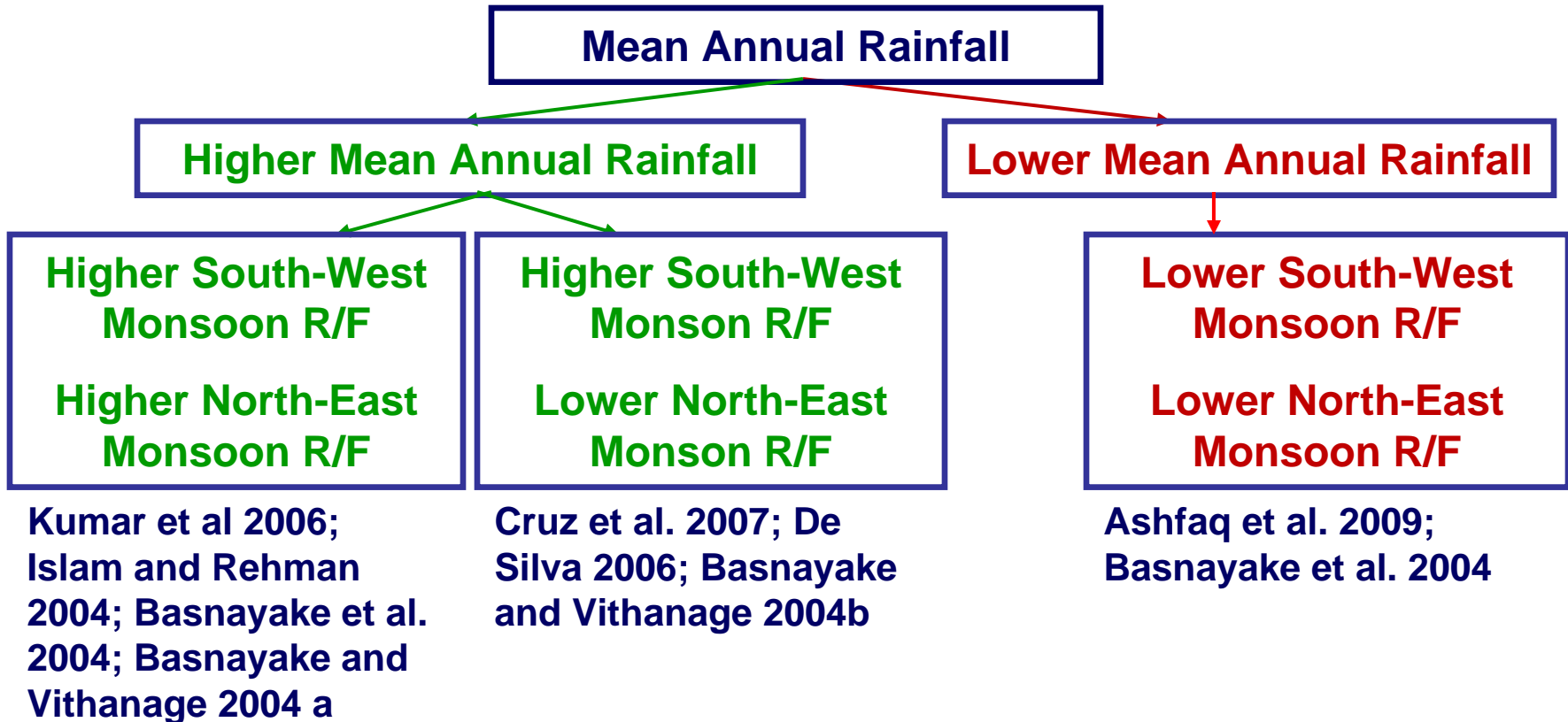
Temperature

- **General consensus: increasingly warmer in 21st century**
- **IPCC: stronger warming than the global mean in South Asia**
- **Projected magnitude of change: differs from study to study**

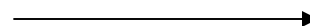
Source	Model	Scenario	Base Year	Change at end 21 st century
Cruz et al. 2007	AOGCM	A1F1, B1	1961-1990	+ 2.93-5.44 °C
Kumar et al. 2006; Islam and Rehman 2004	Regional Climate Model-RCM	A2, B2	1961-1990	+ 2-4 °C
Basnayake et al. 2004; De Silva 2006	Statistical Downscaling of GCMs	A1F1, B1, A2, B2	1961-1990	+ 0.9-3 °C

FUTURE? (PROJECTED CHANGES) - 2

Rainfall- Projections for this century confusing and contradictory!



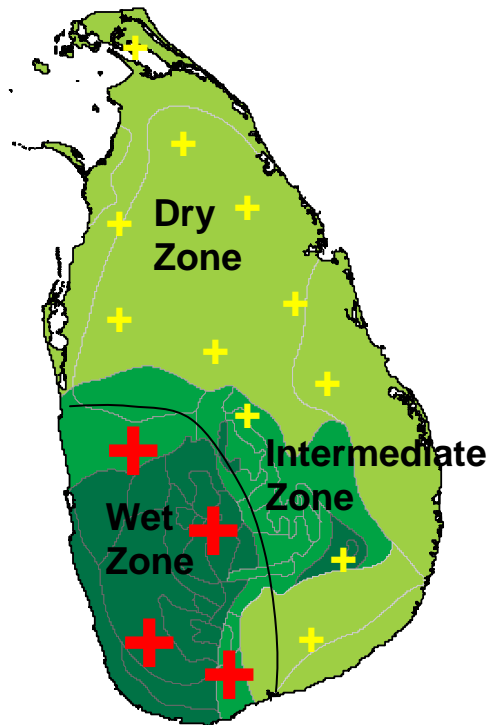
Increased Variability



Increased Floods & Droughts

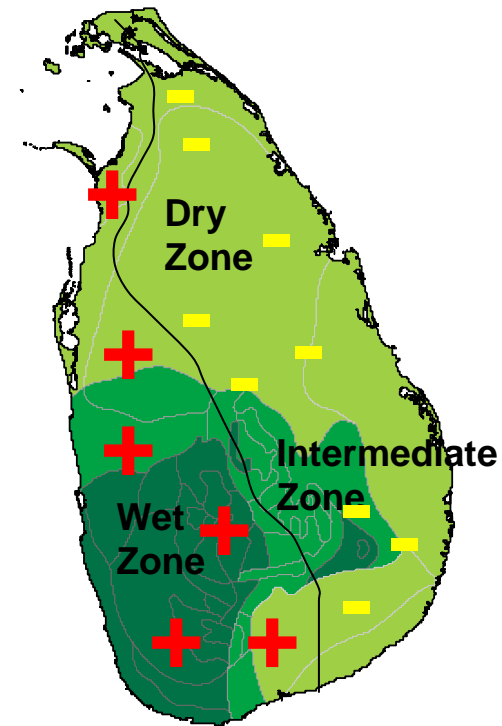
Spatial Pattern of Rainfall Projections for 2050s

Projection 1



Basnayake et al. 2004

Projection 2

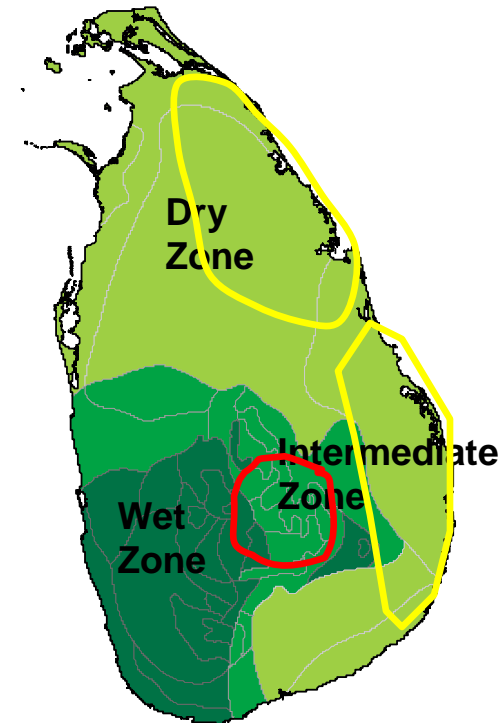


De Silva 2006

Ambiguity!

IMPACTS ON WATER RESOURCES

- **Dominant School of Thought: Gain in Mean Annual Water Availability**
- **But increased Variability + Inequitable Spatial Distribution**
- **Brunt of impact on north eastern and eastern dry zone: **May become even drier!****
- **Increase in Maximum Annual Soil Moisture Defecit in the Dry and intermediate zones by 2050 (De Silva 2006): **More irrigation!****
- **Lower water availability in the upper Mahaweli watershed by 2025 (Shantha & Jayasundera 2005): **More power cuts!****



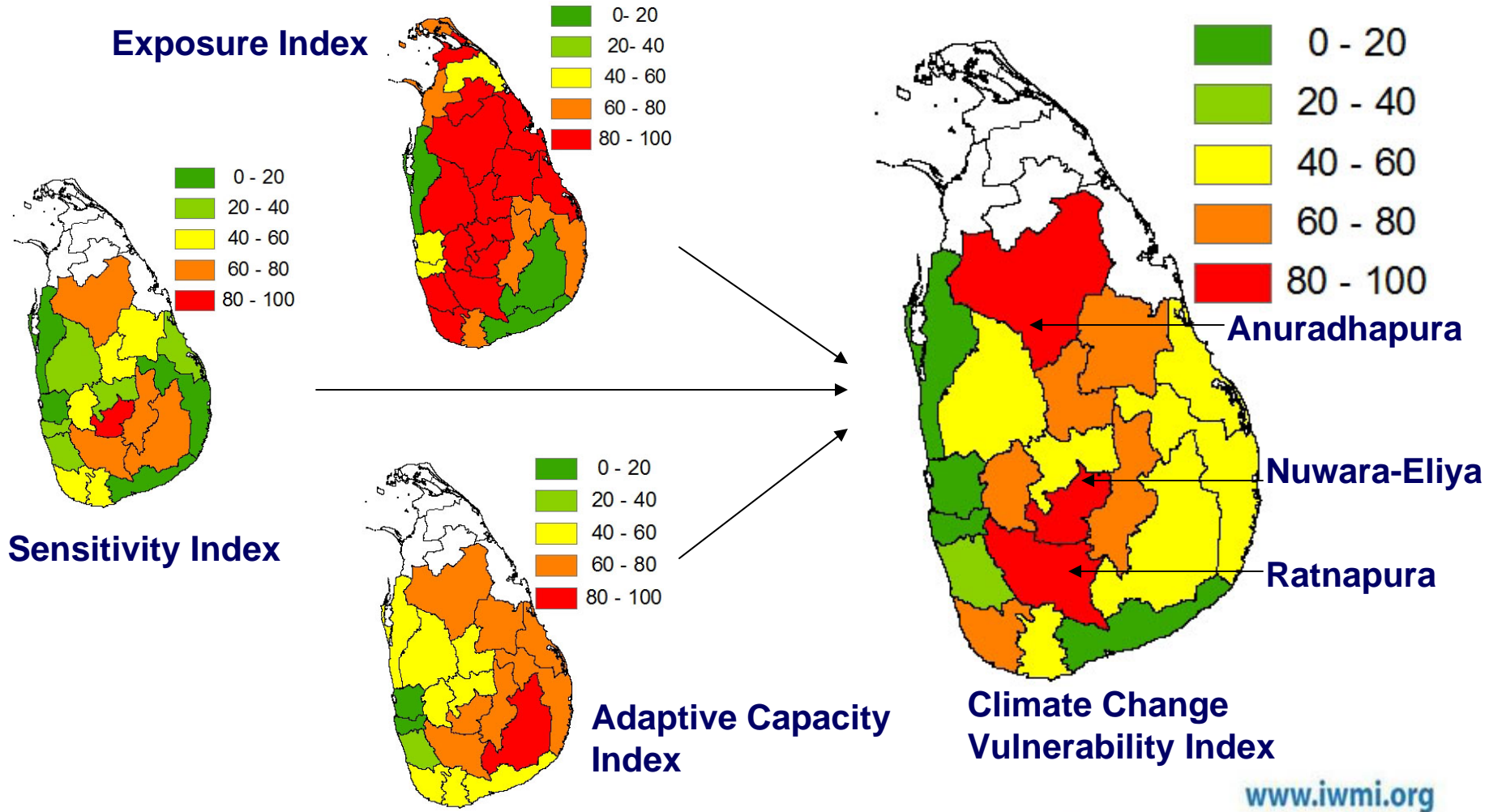
No comprehensive national study!

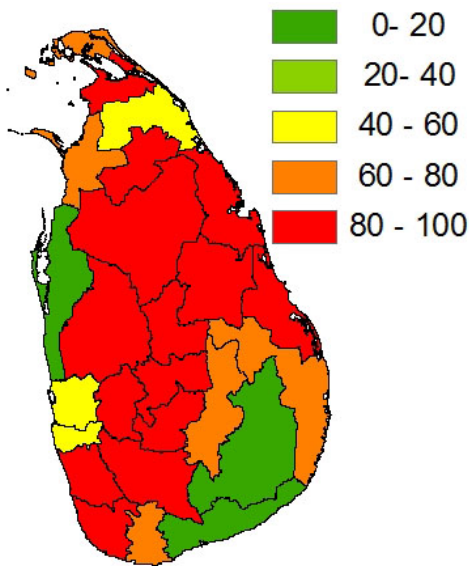
IMPACTS ON AGRICULTURE

Paddy	Tea	Coconut
<p>Yield:</p> <ul style="list-style-type: none"> • 0.1-0.5 °C temp increase: 1.2 to 5.9% reduction (Vidanage & Abeygunawardena 1994) • Temp increase + CO₂ increase: 24-39% increase (De Costa et al. 2006) 	<p>Yield:</p> <ul style="list-style-type: none"> • 100 mm monthly R/F reduction: 30-80 kg reduction in 'made' tea/ha • Increase in ambient CO₂ concentration to 600 ppm: 33-37% increase (Wijeratne et al. 2007) 	<p>Yield:</p> <ul style="list-style-type: none"> • Production after 2040: not sufficient for local consumption • Increased pest and disease problems - reduce yield (Peiris et al. 2004)
<p>Irrigation Requirement:</p> <p>13-23% increase in Maha by 2050 (De Silva 2006)</p>	<p>Spatial Impact:</p> <ul style="list-style-type: none"> • Cultivations at low and mid elevations more vulnerable (Wijeratne et al. 2007) 	<p>Economy:</p> <p>Losses in the range \$32 - \$73 million (Fernando et al. 2007)</p>

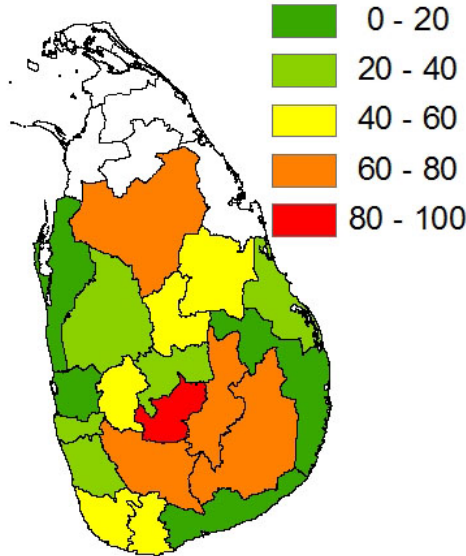
Economy: Rs. -11 billion to Rs. +39 billion by 2100 (Seo et al. 2005)

CLIMATE CHANGE VULNERABILITY HOTSPOTS-1

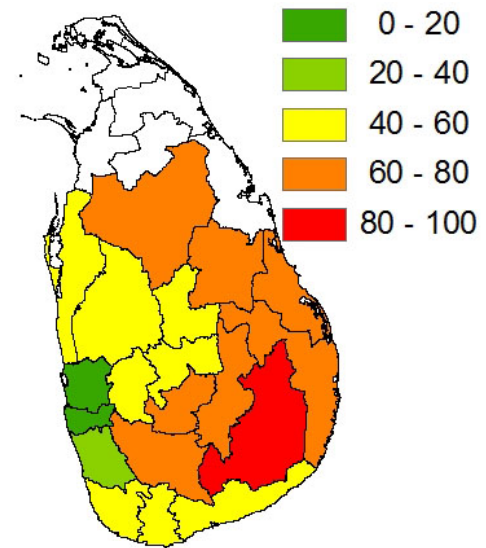




Exposure Index based on: Frequency of exposure to historical droughts, floods, cyclones



Sensitivity Index based on: Population density, % employed in agriculture, irrigation water availability, agricultural diversity (crops diversity, livestock farming, fishing)



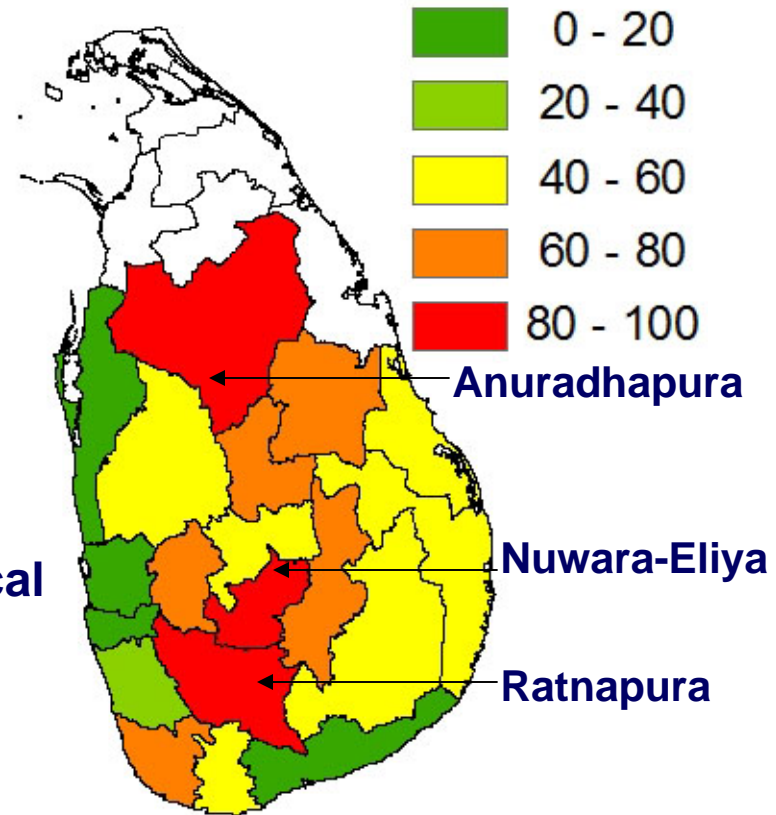
Adaptive Capacity Index based on: education level, poverty incidence, level of infrastructure development

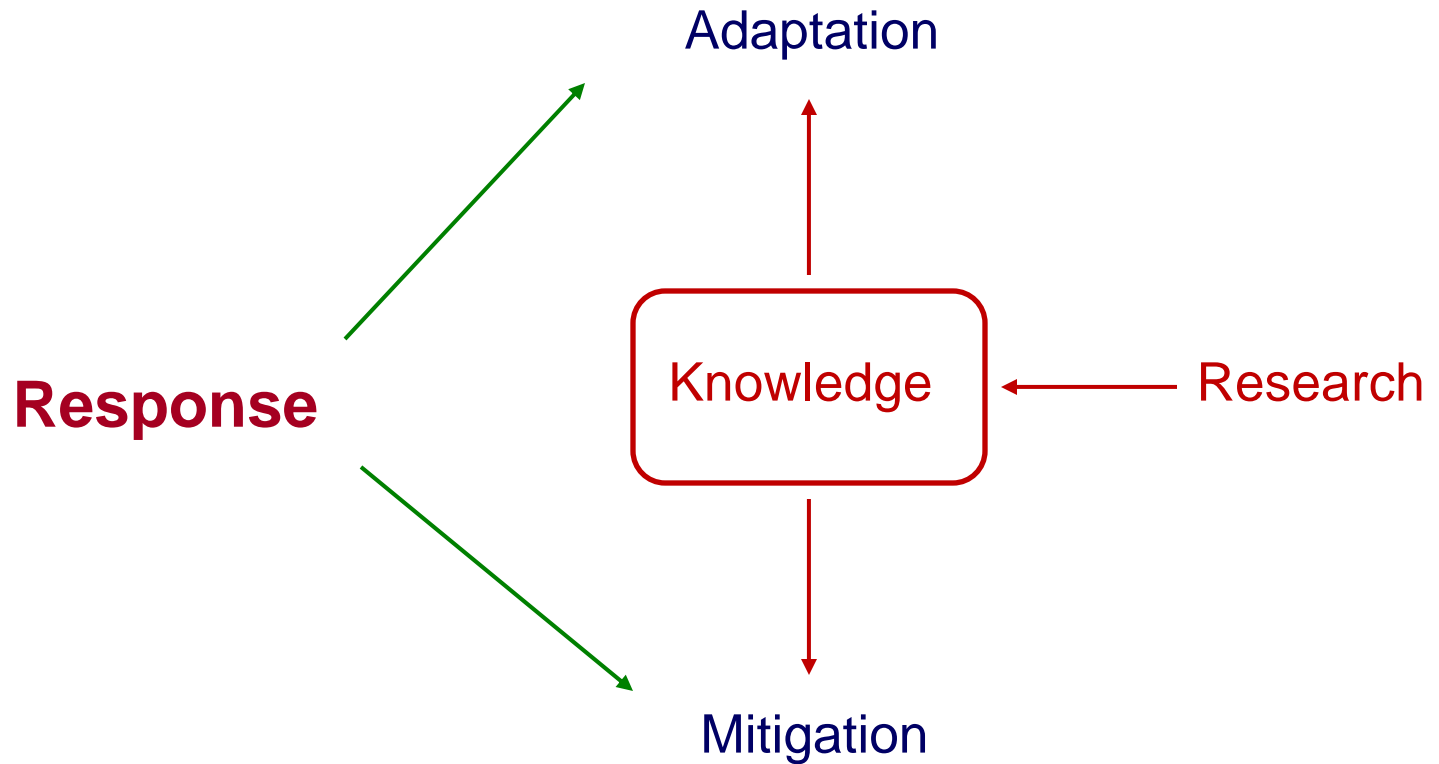
0 – lowest vulnerability

100 – highest vulnerability

Highly vulnerable areas are:

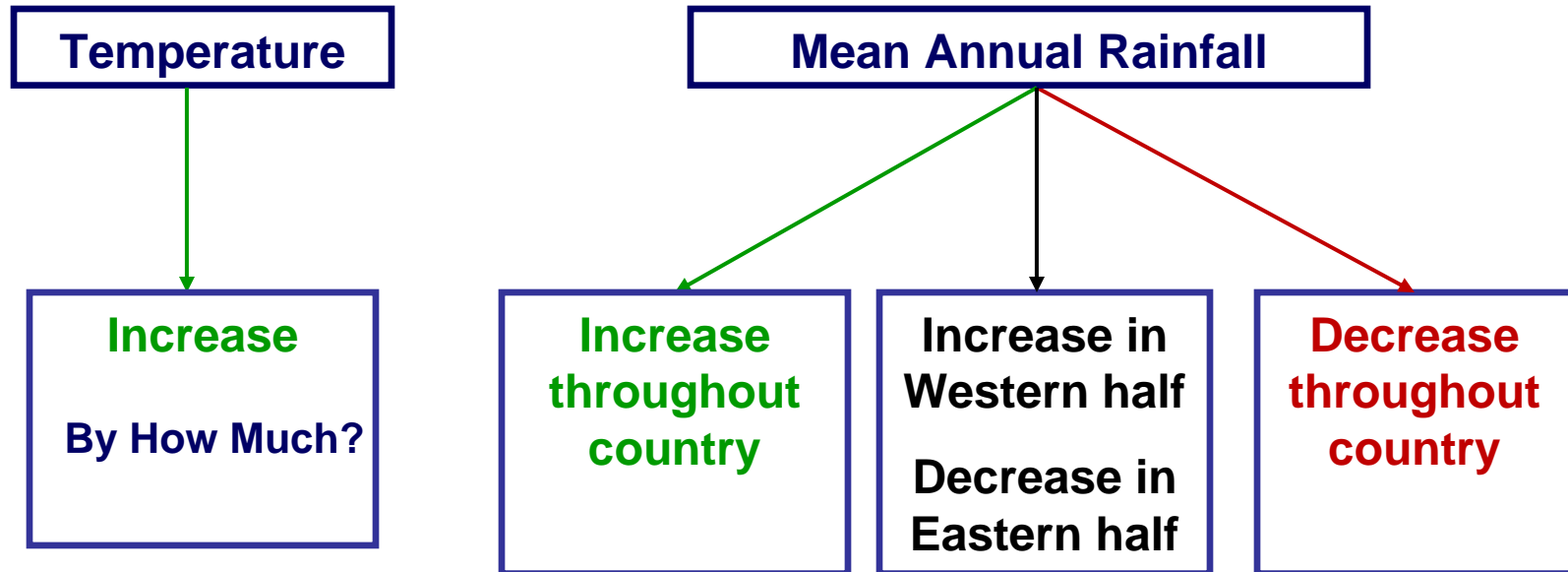
- Typical farming areas
- Have low socioeconomic and infrastructural assets (low adaptive capacity)
- Show high levels of exposure to historical climate extremes
- **Rely heavily on water availability for agriculture**



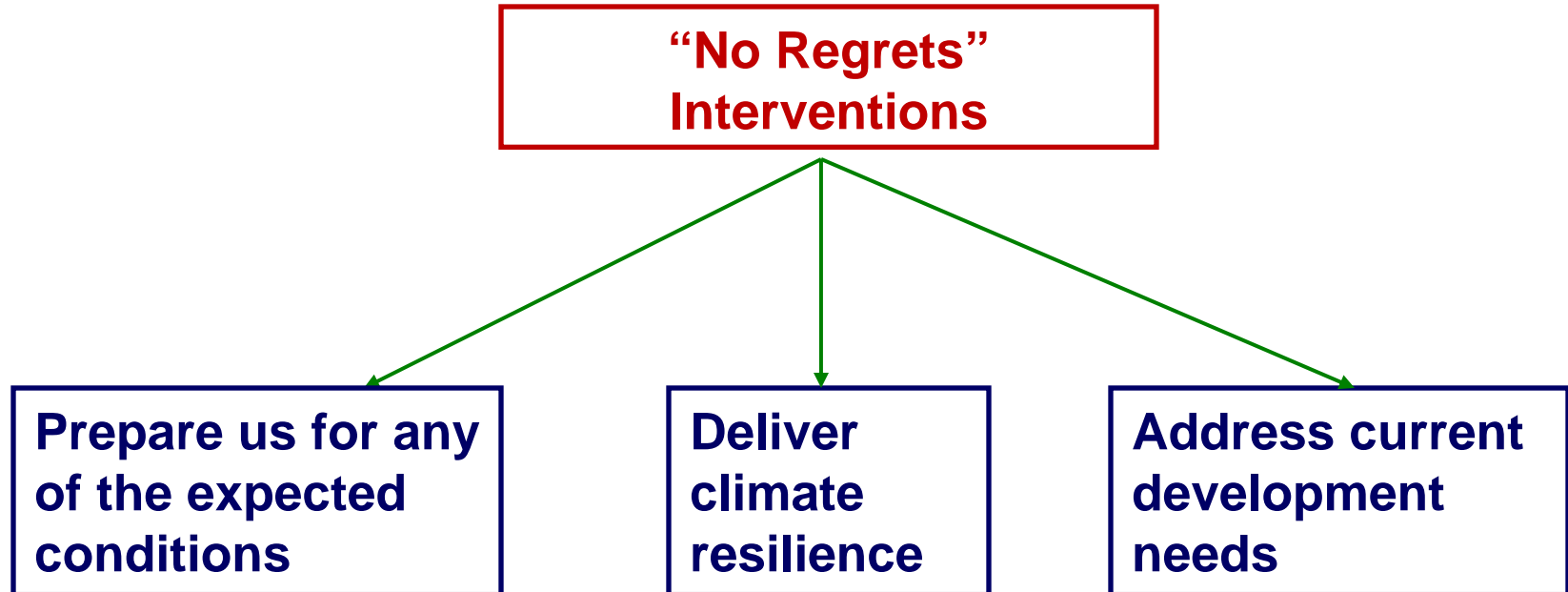


RESPONDING TO CLIMATIC CHANGES - 2

Adaptation: How do we adapt in the face of an uncertain climate?



Solution: → **“No Regrets Adaptation Interventions”**



“No Regrets” Interventions – Water Resources Sector

2 Most Effective and Easily Accomplished

Rainwater Harvesting and Storage esp. in the dry zone

Storage for use at no rainfall periods: for drinking, home gardens

Provision of a rainwater harvesting system to all households in drought prone areas – make it a pre-requisite for receiving drought relief (De Silva 2006)

Restoration of the ancient tank system

- Higher rainfall: Flood mitigation
- Lower rainfall: Stored water for agriculture
- Seepage into groundwater

Rainwater Harvesting Technology



Partly above ground tank



Above ground tank



Hexagonal tank



Run off rain tank



Plastic tanks

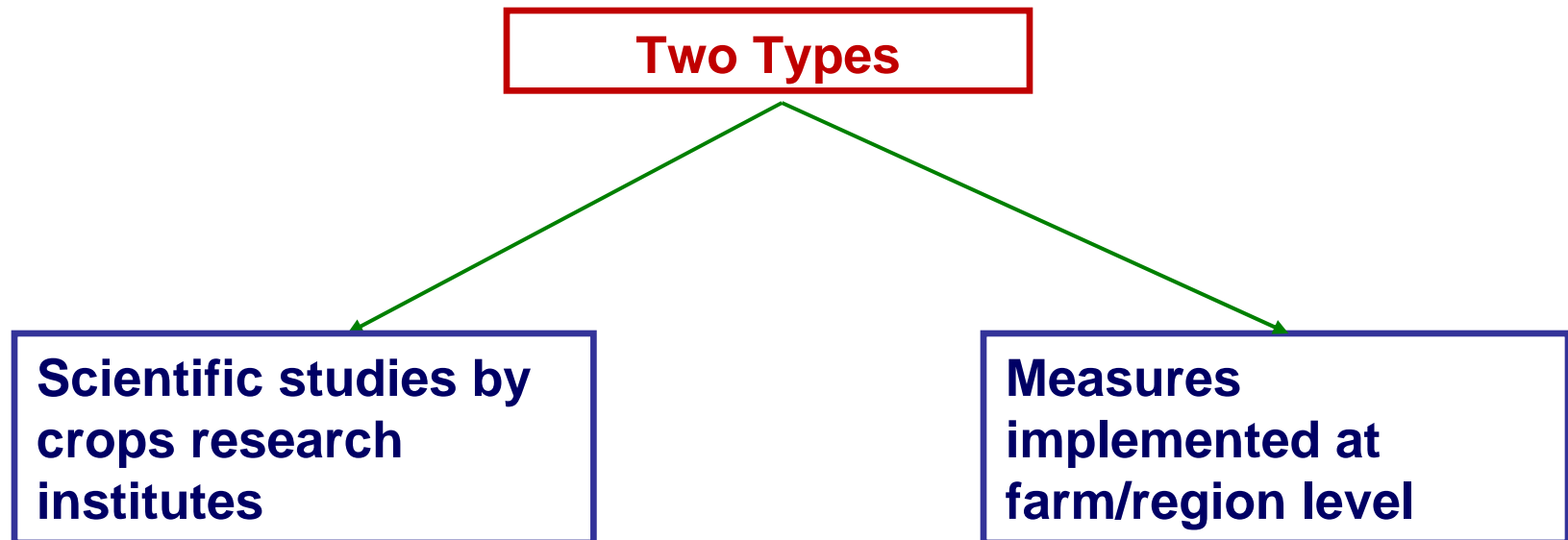
Lanka Rainwater Harvesting Forum <http://www.lankarainwater.org>

www.iwmi.org

“No Regrets” Interventions – Water Resources Sector

- **Other options under consideration:**
 - Development of sustainable groundwater
 - Use of micro-irrigation technologies
 - Waste water reuse
 - Increasing water use efficiency
 - Change of allocation practices
 - Greater shift towards alternative energy from hydropower

“No Regrets” Interventions – Agriculture Sector



“No Regrets” Interventions – Agriculture Sector

- **6 research institutes in the country : rice, field crops, horticultural crops, tea, rubber and coconut**
 - **Rice varieties that respond positively to**
 - Increased temperature and humidity
 - Increased atmospheric CO₂
 - Moisture stress
 - Increased salinity and submergence
 - **Short term (low water consuming) rice varieties suitable for shorter growing seasons**
 - **High yielding improved varieties of field crops, dry zone vegetables and fruits (irrigated and rainfed) with pest disease and drought resistance**
 - **Hardy tea clones resistant to drought, pests and diseases**

“No Regrets” Interventions – Agriculture Sector

Measures Implemented at farm/region

level

Paddy

- Shifting to areas projected to receive more beneficial rainfall (De Silva et al. 2007)
- Changing planting time to suit altered rainfall onset times (De Silva et al. 2007)

Tea

- Improvement and implementation of soil conservation measures (Wijeratne 1996)
- Proper shade management (Wijeratne 1996)

Coconut

- Adopt moisture conservation methods:
cover crops, organic manure, burying coconut husks, contour drains (Mathes and Kularatne 1996)

Micro-irrigation, Shifting from rice to field crops, Crop diversification

Other adaptation activities

Climate tools developed:

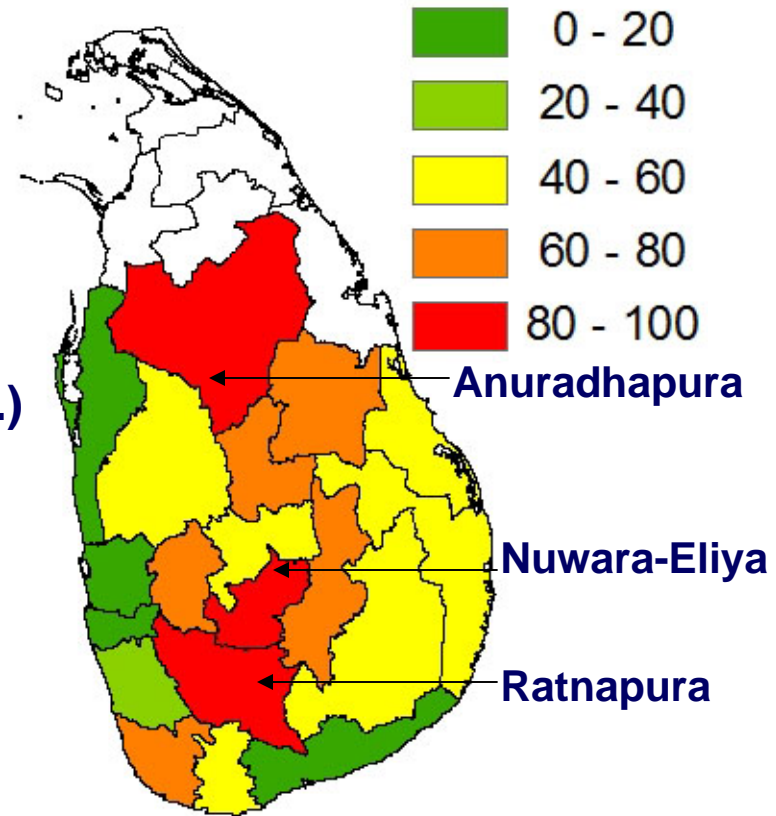
Predicting annual national coconut production
Predicting seasonal water availability within the Mahaweli scheme

Climate Change Action Plan for Sea Level Rise - Coast Conservation Department (CCD)

Building awareness and encouragement of individual and communal action

Reducing Climate Vulnerability

- Crop diversification
- Promotion of livestock and fisheries in addition to crop cultivation
- Employment diversification from primary agriculture (growth of agro-industries etc.)
- Provision of irrigation water
- Infrastructure development: roads, electricity, communication
- Discouraging over-crowding/congestion
- Education

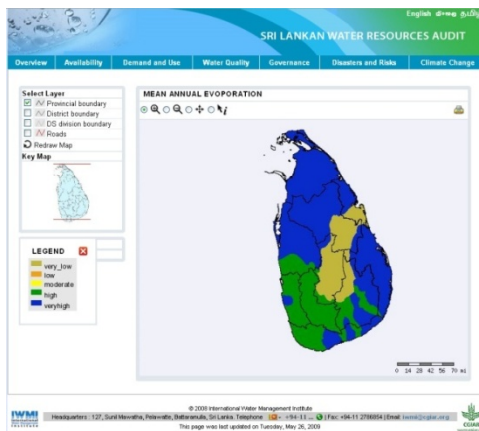


Climate Change Mitigation

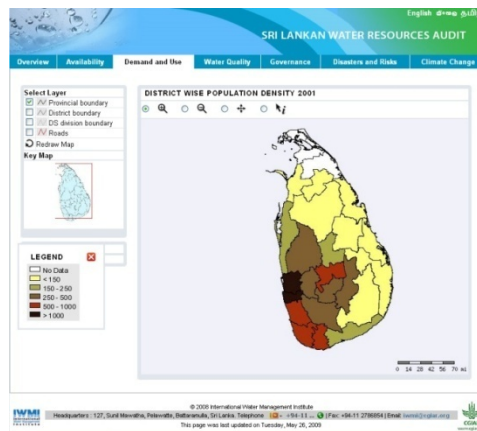
- **SL is a Signatory to UNFCCC and Kyoto Protocol**
- **Initial National Communication + GHG inventory prepared; Second National Communication underway**
- **Four small hydropower CDM projects underway**
- **A host of other activities including some innovative projects:**
 - Planting of 73,000 trees to offset carbon emissions generated by the tourism industry
 - Installation of ten trial base stations using solar and wind power by Dialog Telekom (Anderson 2009)
- **NGOs implementing community based projects aimed at reducing GHG emissions through GEF grants**

KNOWLEDGE GAPS - 1

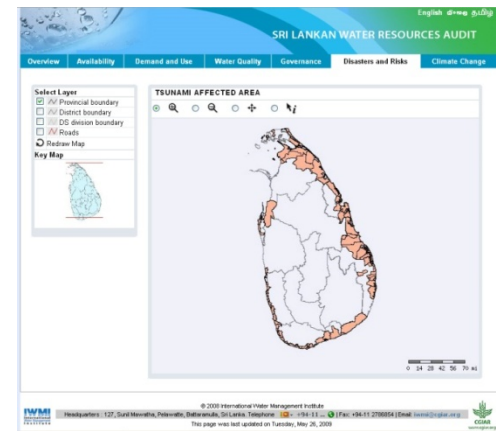
- Detailed and quality controlled climate scenarios preferably based on a regional climate model (RCM)
- National water resources audit and digital data on past natural disasters: **eg. Prototype web tool by IWMI**
<http://idistest.iwmi.org:8080/slwa/>



Hydro/meteo Data



Water Demand



Natural Disasters

- **Comprehensive national study on river basin or district scale on vulnerability of water resources and agriculture to climate change covering:**
 - Both surface and ground water
 - Water quantity and quality
 - Combined impact of enhanced CO₂ + temperature + increased/decreased rainfall on agriculture
- **Central Agency to cater to the need for data sharing and corporation: Water Resources Board?**

THANK YOU !

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