

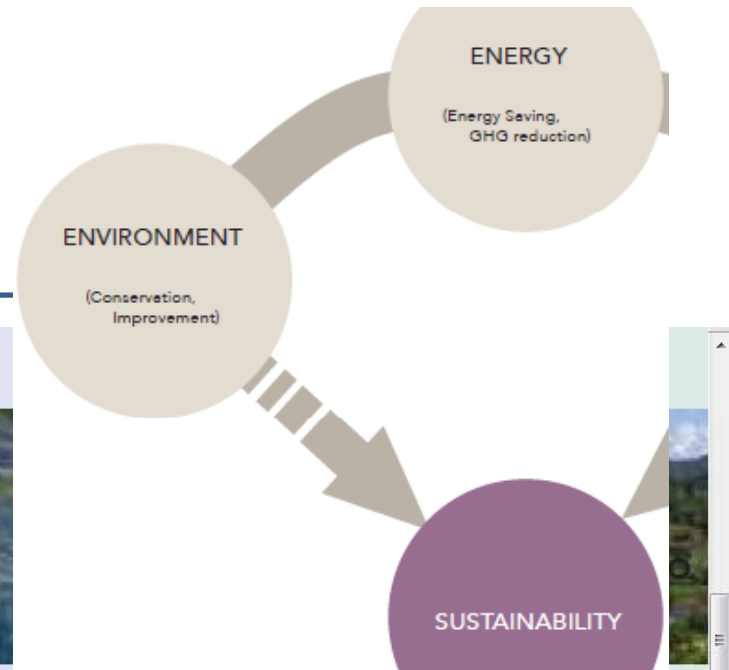
Some steps for sustainable development – Sri Lanka

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Department of Civil Engineering
University of Peradeniya

Kick-off Meeting:
AP Regional Initiatives on 3E Nexus for Sustainable Development
24-25 February 2014, Male

3E NEXUS INITIATIVES

WORKSHOP THEME - ENVIRONMENT



cy, saving and conservation,
rgy, Storage batteries, Smart
community, High-efficiency
rgy management, Energy
ump, combined heat and
ower generation, Energy from
wer generation, Ocean
on, Fuel for transportation,
oduction, Fossil fuel
clean technology, Clean coal
n-fossil fuel, Energy
industry, Electric power,
control and management,

ENVIRONMENT



Environment protection, Solid Waste Management and Utilization, Global climate change, Urban Development, Rivers, lakes, seas and oceans, Environmental Laws and Polices, Advances in Natural Resource Utilization and Conservation, Carbon Emission Reduction Strategies, Air Pollution Measurement and Control Technologies, Emerging Pollutant Removal from Water and Wastewater, Novel Wastewater Treatment Technologies, Noise Pollution Reduction Techniques, Quality of water, Groundwater flow engineering, Environmental modeling.

Endangered Species Preservation, Biodiversity as a Resource, Dynamics, Role of Humans, Role of Ecology in Urban Development, Biodiversity and Biological Health Risk Assessment, Ecological Sustainability, Effects of Pollution on Ecosystem, Loss in Biodiversity, Anthropogenic Activities, Protection of cultural heritage

Some Actions for sustainable development – Government initiatives

Ministry of Environment and Renewable Energy has with the mandate for policy developments for management of environment and natural resources



Environmental protection

Energy saving

Ecosystem conservation

While facilitating country progressing towards:

High standard of living (poverty alleviation)

Food, energy, water security

Disaster risk reduction (safety)



Home + About us

About Us

The Ministry of Environment and Renewable Energy of Sri Lanka remains committed for the management of the environment and natural resources of the country, maintaining the equilibrium between the trends in rapid economic development and use of natural resource base.

Social and economic behavior of the increasing human population has put a major threat in achieving these objectives. The ministry has framed key policies for adoption in management of environment and natural resources of the country. These policies are implemented with the participation of stakeholders including government, agencies, NGO's and communities.

Our Vision

A healthy and pleasant environment sustaining nature for the well being of the people and the economy.

Our Mission

Provide Leadership to manage the environment and natural resources in order to ensure national commitment for sustainable development for the benefit of the present and future generation.



Open Government
Data Sets





மெசல சரிசர ஐதிகாரீச
மத்திய சற்றாடல் அதிகாரசபை
Central Environmental Authority



Search...

(National Environmental Act No: 47 of 1980 amended by Acts No 56 of 1988 and No 53 of 2000)

Issues the Environmental Protection License (EPL)

- a regulatory/legal tool

- To prevent or minimize the release of discharges and emissions into the environment. To ensure cleaner production, waste minimization, use new technologies for pollution abatement, efficient resource utilization/ protection, etc.

Introduce regulations for:

- Wastewater discharge

- Noise and vibration control,

- air pollution control, vehicle emission control,..



Climate Change Secretariat Sri Lanka

Ministry of Environment and Renewable Energy



- CCD-Home
- DNA
- KYOTO PROTOCOL
- CDM
- History&Background
- Carbon Market
- Post Kyoto
- National Policy
- Country Portfolio
- UNFCCC
- Library
- Event Calendar
- News
- FAQs
- Site Map

Clean Development Mechanism

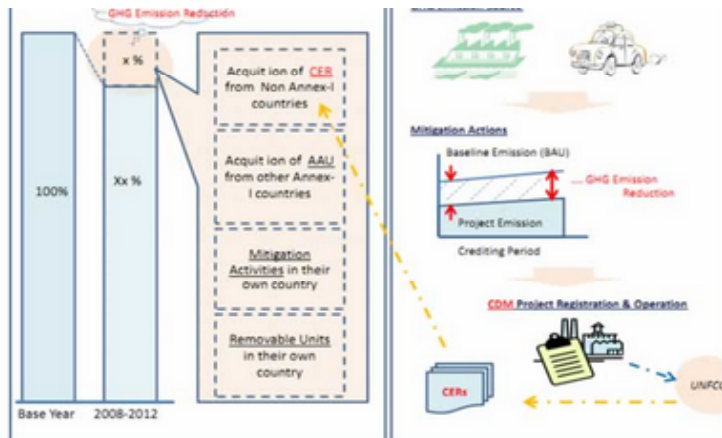
Clean Development Mechanisms or so called CDM is the only mechanism in Kyoto Protocol under United Nation Frameworks assisting Annex I parties to archive their committed amount of emission reduction, contribution for sustainable development of Non Annex I parties.

Authority to approve and authors participation by entities in CDM project
Evaluation & Approval of CDM project,
Capacity Development for CDM Project
Development and CDM Market.

Description in the Kyoto Protocol

In the Article 12, CDM is defined as; CDM Activities shall be hosted by Non Annex I parties which ratified the Kyoto Protocol, validated by Designated Operational Entity (hereinafter referred as "DOE") and registered by CDM Executive Board (hereinafter referred as "EB") after review by a Registration and Institution Board.

Designated National Authority.(DNA)



1. Keyword

Once any CDM project(s) registered under UNFCCC and completed verification conducted by DOE, The EB issue Certified Emission Reduction (CER) for quantified emission reduction from the project(s). Unit of CER is 1Co2t and all CER are numbered. CER is tradable among the Annex I Parties and public & private entities be authorized by the Annex I Parties and can be used to meet with their committed legally binding emission reduction quantity.

AAU (Assigned Amount Unit)

units issued by Parties to the Kyoto Protocol into their national registry up to their assigned amount, calculated by reference to their base year emissions and their quantified emission limitation and reduction commitment (expressed as a percentage).

Removal Units



Removal units (RMUs) are issued by Parties to the Kyoto Protocol in respect of net removals by sinks from activities covered by Article 3(3) and Article 3(4) of the Kyoto Protocol (in the land use, land use change and forestry sector).

Baseline Emission (Baseline Scenario)

the continuation of current emission levels in the absence of the CDM project activity



CCD-Home
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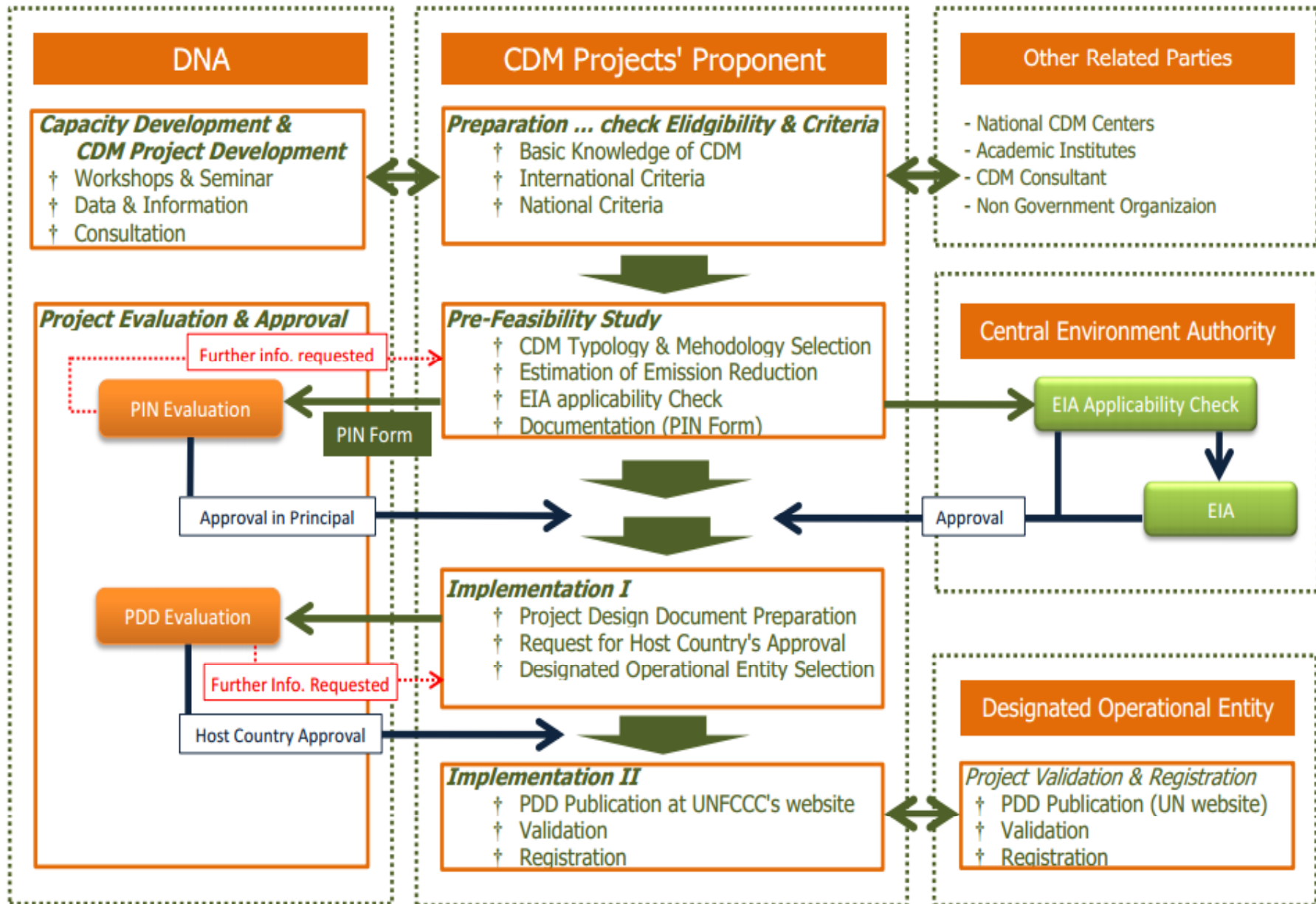



List of Registered Project

Status	Title	Participants	Other Parties	Sectors	Activity Sale	Methodologies	Amount of Reduction [*]	Registration
Registered	10 MW Biomass Power Generation Project	Tokyo Cement Company (Lanka)Ltd.	Japan Carbon Finance Ltd. (Japan)	Energy (renewable - / non-renewable sources)	SMALL	AMS-I.D. ver. 13	43 800	10/26/2009
Registered	Coconut shell charcoaling and power generation at Badalgama, Sri Lanka	Recogen Limited	Japan Carbon Finance, Ltd. (Japan)	Energy (renewable - / non-renewable sources) , Manufacturing	SMALL	AMS-III.K. ver. 3 AMS-I.D. ver. 13	43 265	3/28/2009
Registered	Sanquhar and Delta Small Hydro Power Projects	Hydro Power Free Lanka (Pvt) Ltd	VOLTALIA (Switzerland)	Energy (renewable - / non-renewable sources)	SMALL	AMS-I.D. ver. 9	5 489	12/11/2006
Registered	Hapugastenne and Hulu Ganga Small Hydropower Projects.	Eco Power (Private) Ltd. (EPL)	IFC Netherlands Carbon Facility (INCAF) (Netherlands)	Energy (renewable - / non-renewable sources)	SMALL	AMS-I.D. ver. 5	44 842	10/30/2005
Registered	Small Hydropower Projects at Alupola and Badulu Oya.	Hydro Power Free Lanka (Pvt) Ltd	IFC Netherlands Carbon Facility (INCAF) (Netherlands)	Energy (renewable - / non-renewable sources)	SMALL	AMS-I.D. ver. 5	25 109	10/30/2005
Registered	Magal Ganga Small Hydropower Project	Eco Power (Private) Ltd. (EPL)	IFC Netherlands Carbon Facility (INCAF) (Netherlands)	Energy (renewable - / non-renewable sources)	SMALL	AMS-I.D. ver. 5	34 179	10/30/2005
Rgistered	Adavikanda, Kuruwita Division Mini Hydro Power Project	Alternate Power Systems (Pvt.) Ltd.	Mitsubishi UFJ Securities Co., Ltd. (Japan)	Energy (renewable - / non-renewable sources)	SMALL	AMS-I.D. ver. 13	13 484	

Very few! ??

Flowchart for CDM Project Development





SEARCH

Energy is Life

make the most of it



RENEWABLE ENERGY

INTRODUCTION TO RENEWABLE ENERGY

WHAT IS RENEWABLE ENERGY?

A natural resource is called an energy resource if it can be converted to a usable form of energy. An energy resource is known as an 'indigenous energy resource' when it originates within the country. It is known as non-indigenous if it originates outside the country. Renewable Energy is a form of energy resource that is replaced by a natural process at a rate that is equal to or faster than the rate at which that resource is being consumed.

INTRODUCTION TO RENEWABLE ENERGY

- > What's Renewable Energy
- > RE Resources in Sri Lanka
- > Policy Targets
- > Renewable Energy Forecast
 - Grid
 - Off-Grid

SEA- Issues the Energy Permit for utilization of Renewable energy resources for generation, the facilitator for implementation of renewable energy projects

HOME ↕

ABOUT US ↕

RENEWABLE ENERGY ↕

Introduction to Renewable Energy

Hydro

Wind

Solar

Biomass

ENERGY MANAGEMENT ↕

SAVE ENERGY NOW ↕

EVENTS ↕

SRI LANKA ENERGY BALANCE ↕

DEVELOPING RENEWABLE ENERGY ↕

TENDERS ↕

E - LIBRARY ↕

SITE MAP ↕

CONTACT US ↕

National Energy Policy of Sri Lanka –

The Development Framework of the Government of Sri Lanka' requires 20% of electricity generation from NRE by 2020, with the target of 10% met by end 2016.



Public Utilities Commission of Sri Lanka NON CONVENTIONAL RENEWABLE ENERGY TARIFF ANNOUNCEMENT



Purchase of electricity to the National Grid under Standardized Power Purchase Agreements (SPPA)

Following the public consultation process that ended on 28th August 2012, the Public Utilities Commission of Sri Lanka (PUCSL) is pleased to announce the rates for electricity purchased by the Transmission Licensee; Ceylon Electricity Board (CEB) from Non-Conventional Renewable Energy (NCRE) sources for SPPAs signed on or after 1st January 2012. The tariffs and the SPPA will continue to be standardized. The tariffs will be cost-based and technology-specific, and the developers have the option of selecting either a three-tier tariff or a flat tariff. The SPPAs will continue to be applicable to projects with a rated generating capacity up to 10 MW, and will be valid for a period of 20 years and extendable by mutual consent.

These tariffs will apply to new SPPAs signed between 1st January 2012 and 31st December 2013. Tariffs for electricity produced using Non-Conventional Renewable Energy (NCRE) sources based on Standardized Power Purchase Agreements (SPPAs) would be as follows:

All prices are in Sri Lankan Rupees per Kilowatt-hour (LKR/kWh).

Technology	Escalable Base O&M rate (year 1-20)	Escalable Base Fuel rate (year 1-20)	Fixed Rate			Royalty to Govt, paid direct by the utility (% of total Tariff) Year 16-20
			Year 1-8	Year 9-15	Year 16-20	
Mini-hydro	1.93	None	16.81	6.38	5.80	10%
Mini-hydro-local	1.98	None	17.27	6.55	5.95	10%
Wind	1.30	None	22.63	8.58	7.80	10%
Wind-local	1.34	None	23.29	8.83	8.03	10%
Biomass (Dendro)	1.50(1-15 years), 1.88 (16-20 years)	12.25	9.80	3.72	3.38	None
Biomass (Agricultural& Industrial Waste)	1.50(1-15 years), 1.88(16-20 years)	6.13	9.80	3.72	3.38	None
Municipal Solid Waste	5.31	1.75	19.80	7.51	6.83	None
Waste Heat	0.52	None	10.19	3.86	3.51	None
Escalation rate for year 2012	6.14%	3.37%	None	None	None	None

Note 1: Escalation of O & M rate and fuel rate shall commence from 1st day of the month of January immediately after the commercial operation date.

Note 2: The applicable escalation rate for each subsequent year shall be the rate announced for that particular year.

Note 3: To compensate for the higher tariffs in tier 1, developers will be required to deliver in tier2, an average amount of energy at least equal to that delivered in tier 1. This obligation will be stipulated in the agreement, with corresponding penalties for non-delivery in tier 2.

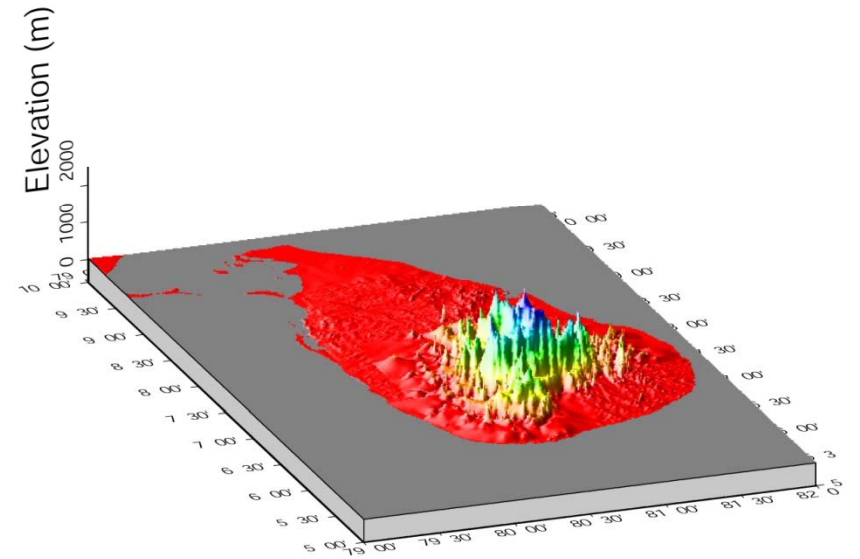
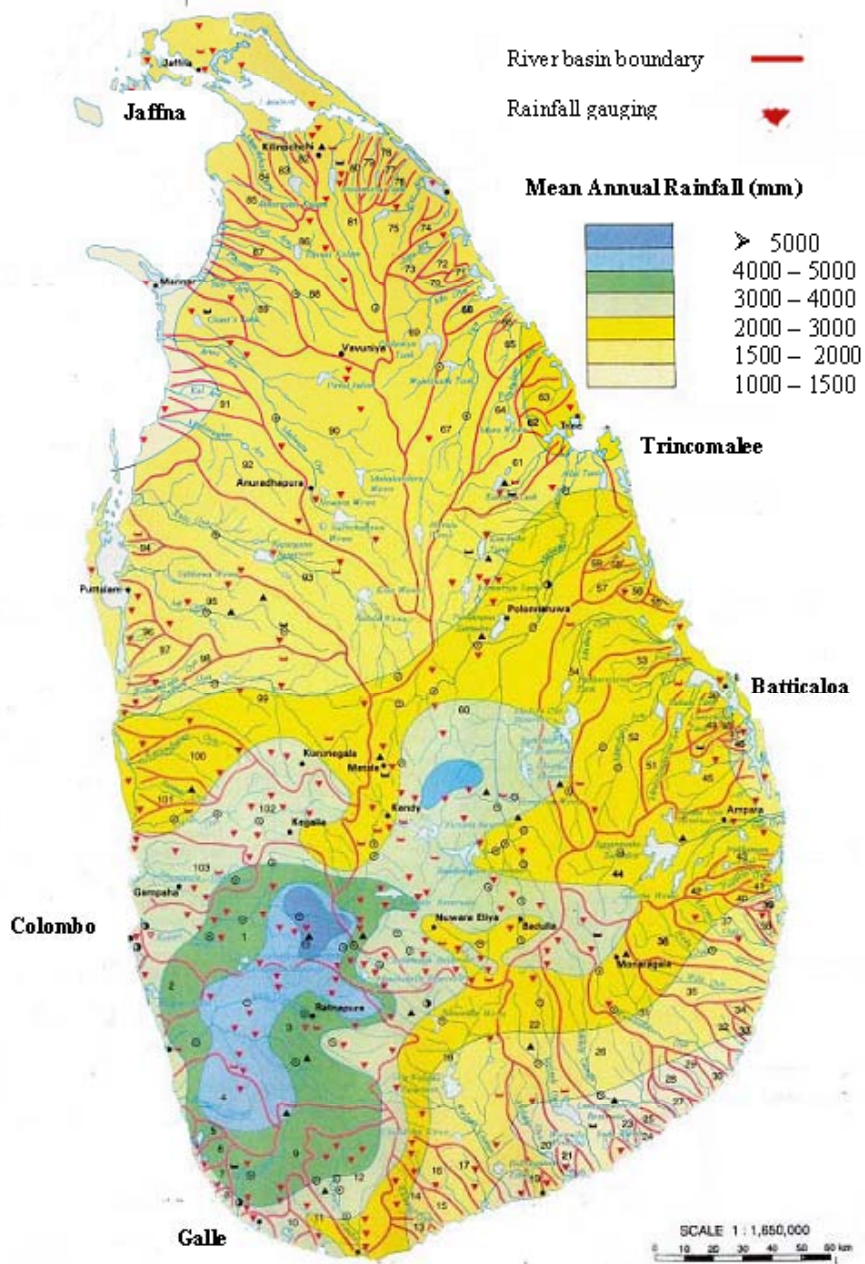
Note 4: Biomass (Dendro) means sustainably grown fuel wood.

Note 5: 'Mini-hydro – Local' and 'Wind – Local' are plants that use locally manufactured turbine equipment

Option 2: Flat Tariff

Hydropower Development in
Sri Lanka
for sustainable development

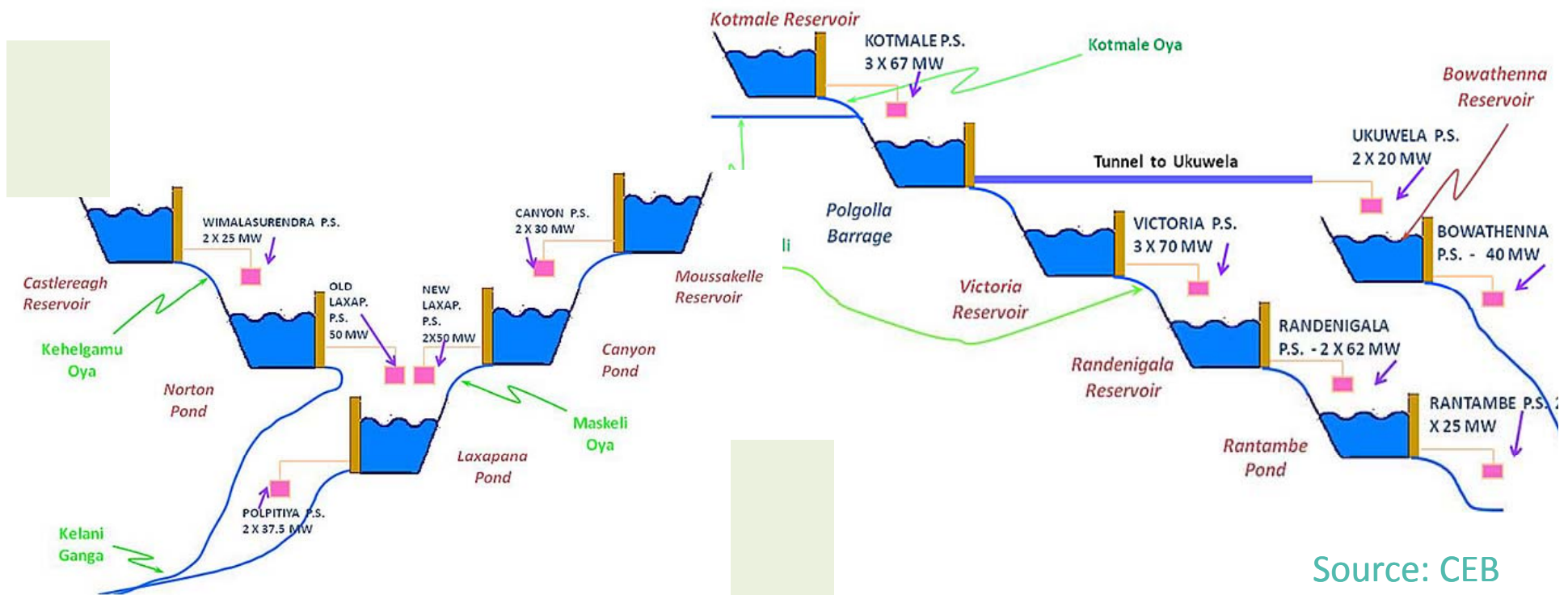
Water Resources in Sri Lanka



Major hydropower plants

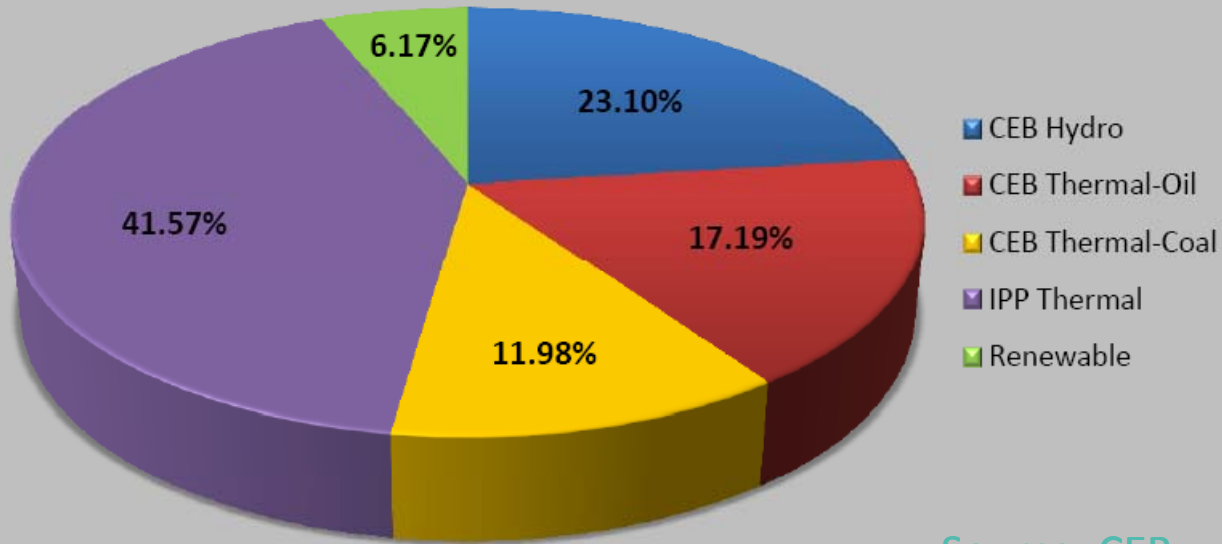
2012

Gross Generation by Source in GWh.		Installed Capa. by Source in MW.
Hydro	3291	1584
Thermal-Oil & Coal	8338	1638
NGRE	171	90
Total Generation	11801	3312



Source: CEB

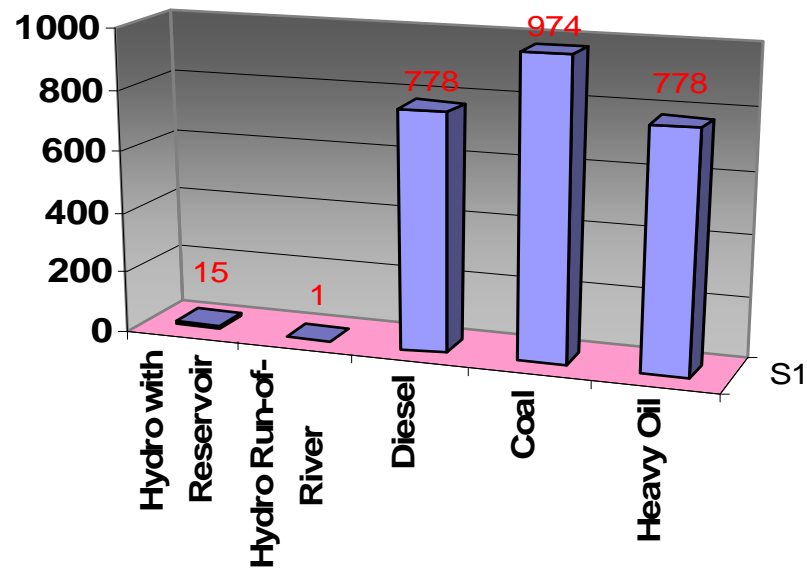
Electricity Generation Mix - 2012



Source: CEB

Renewable energy
to 10% by 2016

in kt eq. CO₂/TWh



Mini hydropower development

- Policy directions in August 1997, private sector is encouraged to develop, own and operate small/mini hydropower plants to generate domestic energy
- Electricity Board purchases hydro energy from mini/small plants under Standardized Power Purchase Agreements.
e.g. at a fixed price for 15 years
- Due to adverse impacts on social, biological and physical environments by reservoirs and due to the green energy lobbying groups, the run-of-river type hydropower plants are favoured than large hydropower plants with reservoirs.
- Small hydropower plants which are generally run-of-river type can provide many benefits to dispersed rural communities.

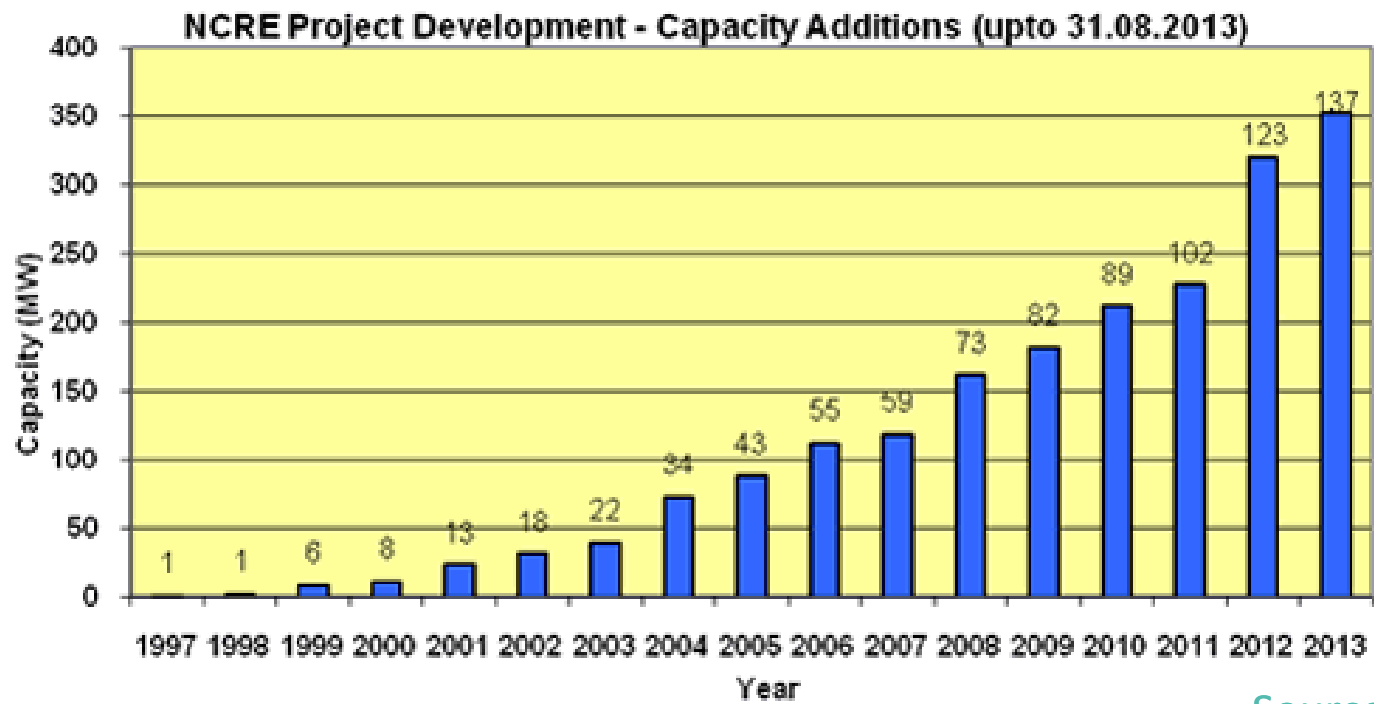
Environmental impacts of hydropower projects

Positive impacts and negative impacts on social, physical and ecological environments



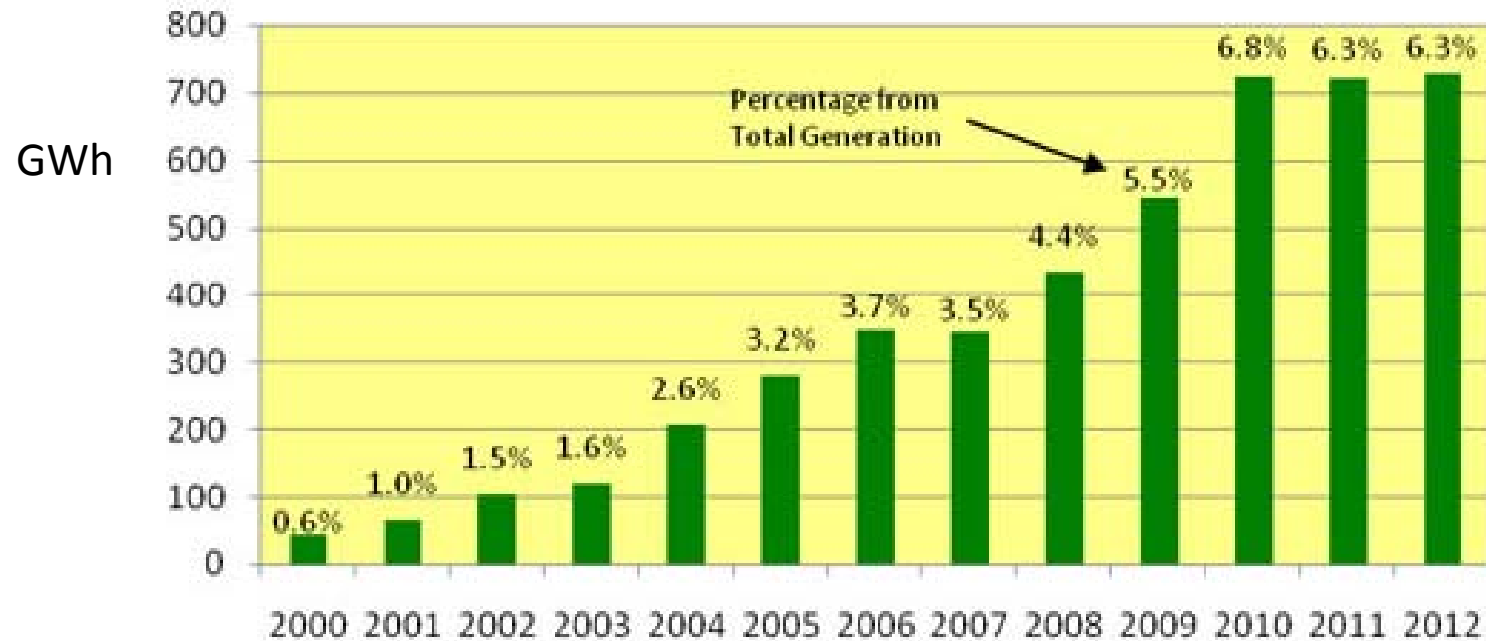
PICO- MICRO- MINI- SMALL- MEDIUM- MAJOR-
HYDROPOWER PLANTS

No	Description	Project Type	No. of Projects	Capacity (MW)
01	Commissioned Projects	Mini Hydro Power	119	255.370
		Biomass-Agricultural & Industrial Waste Power	2	11.000
		Biomass- Dendro Power	2	5.500
		Solar Power	4	1.378
		Wind Power	10	78.450
		Total - Commissioned	137	351.698
02	Standardized Power Purchase Agreements (SPPA) Signed Projects	Mini Hydro Power	64	149.802
		ind Power	3	21.100
		Biomass-Agricultural & Industrial Waste Power	2	4.000
		Biomass-Dendro Power	10	56.770
		Biomass-Municipal Solid Waste	1	10.000
		Total – SPPA Signed	80	241.672



Source: CEB

Generation addition

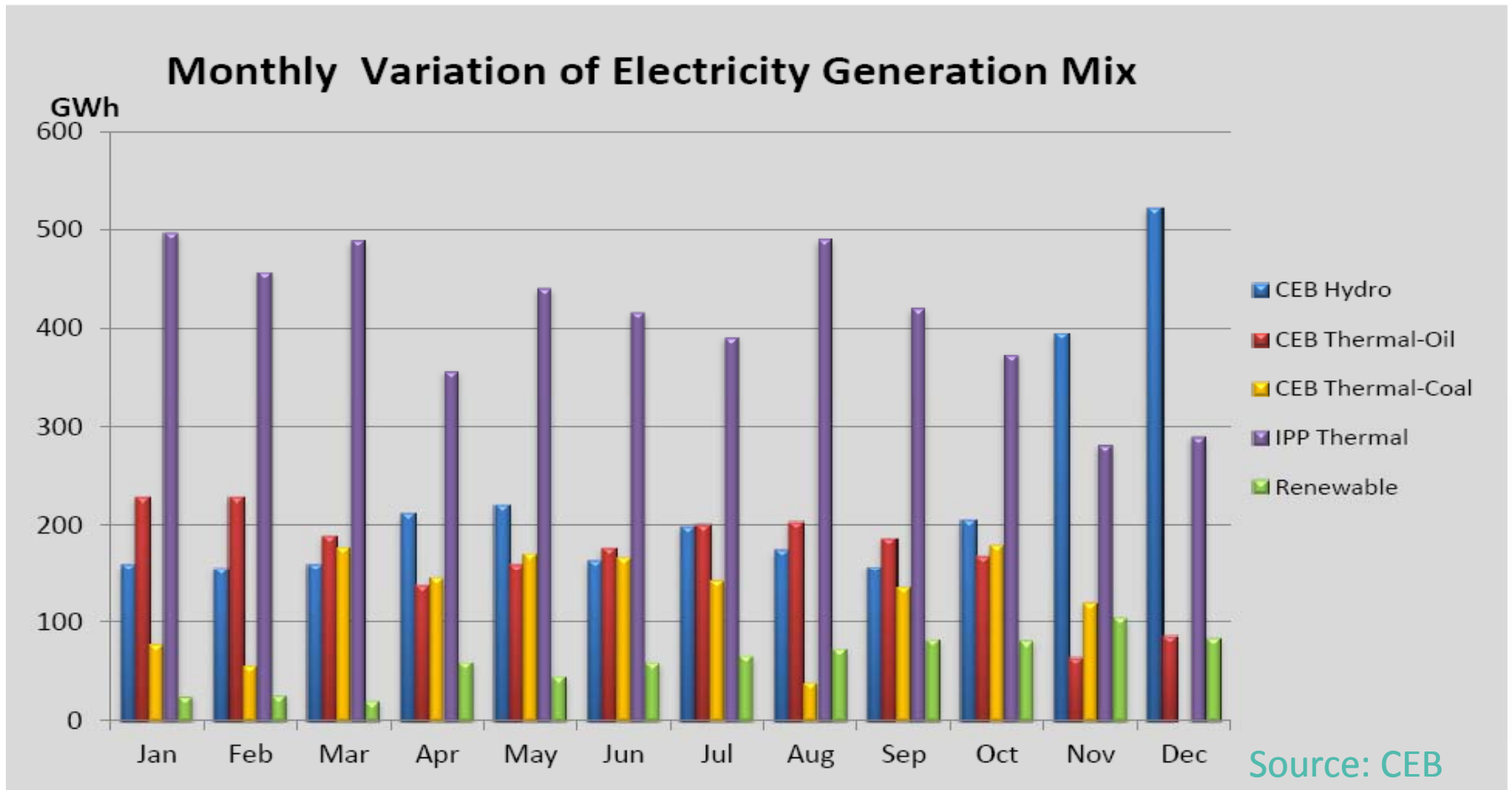


Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Cap. (MW)	8.6	11.1	23.6	31.2	39	73	88	112	119	161	181	212	227	320	351

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Energy (Gwh)	43.3	64.8	103	120	206	280	346	344	433	546	724	722	730

Source: CEB

The chart below shows the monthly variation of generation mix in Sri Lanka during the year 2012.



Run-of-river MHP/SHP provides lowest contribution during dry period and the country energy generation plan has to adjust accordingly

Disaster Risk Reduction for Sustainable Development

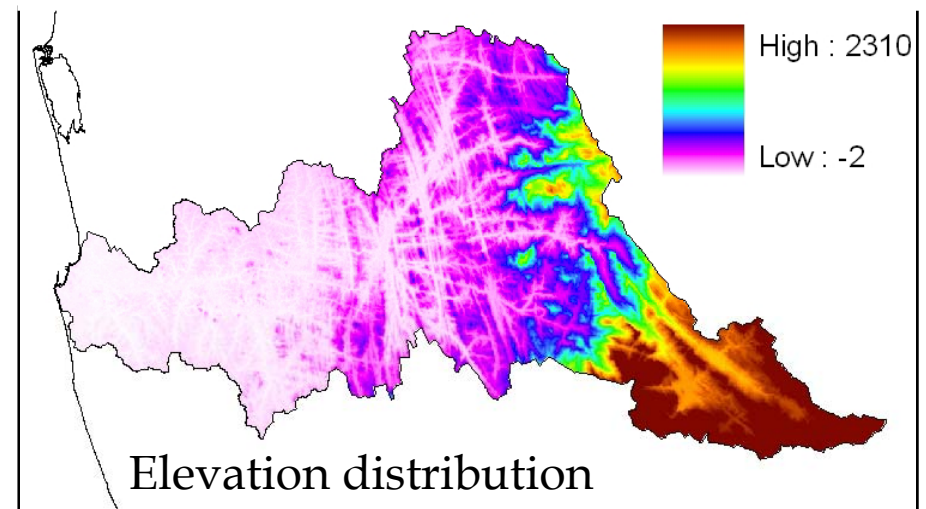
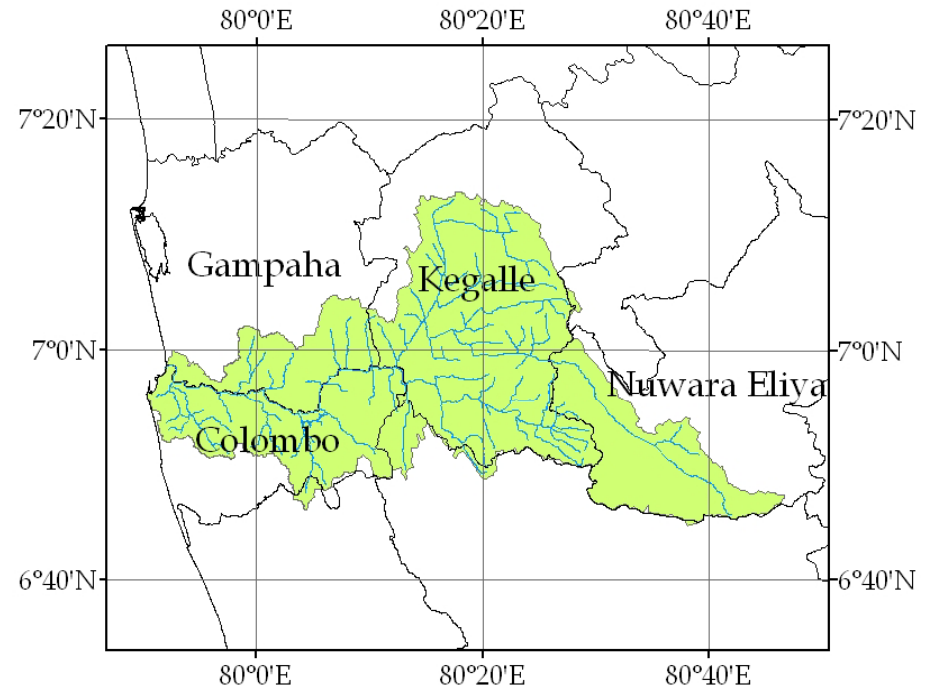
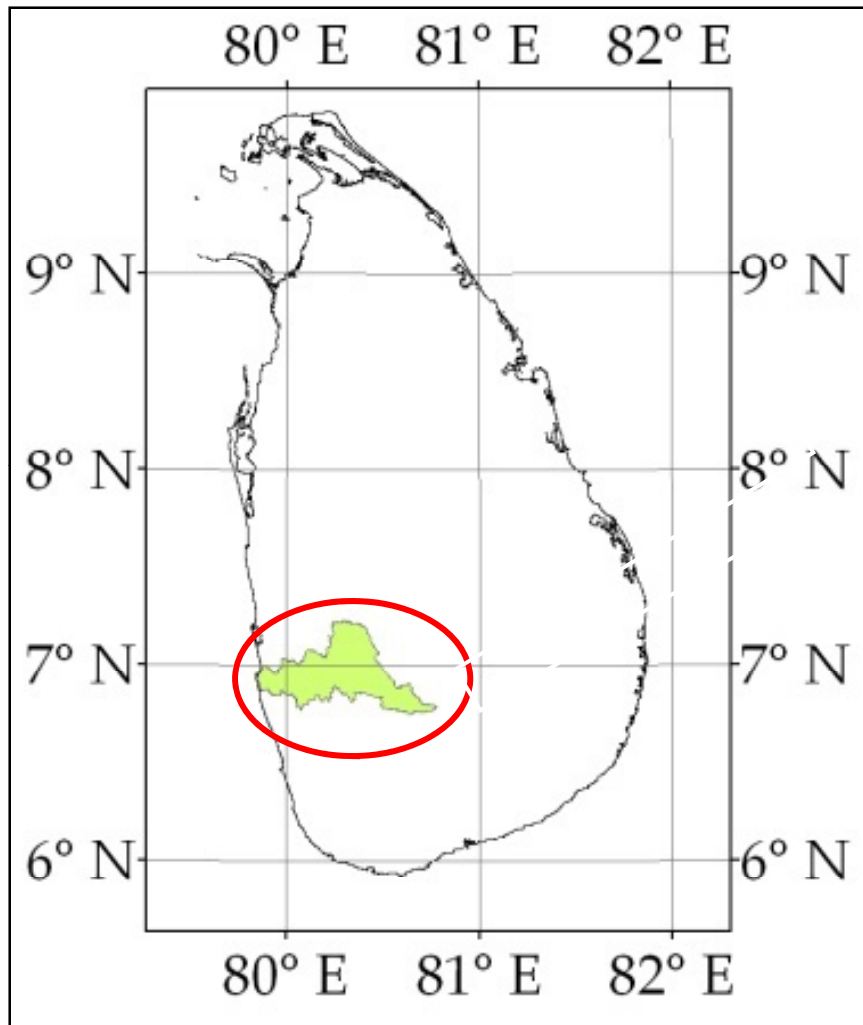
A Case study-
Flood Inundation along the Lower Reach
of Kelani River Basin under Changing Climate,
and Adaptation Strategies

S.B Weerakoon¹, Srikantha Herath², Gouri De Silva¹

*¹Department of Civil Engineering,
University of Peradeniya, Peradeniya, Sri Lanka*

²United Nations University, Shibuya-ku, Tokyo, Japan

Kelani River Basin



Flood inundation in
create heavy damages

(DEM)
Colombo and suburbs

Kelani River Basin

- Region – Wet Zone
- Total Basin Area – 2,230 km²
- Uppermost Elevation – 2,250 m
- Length of the River – 192 km
- Average Annual Rainfall – 2,400 mm
- Peak flow – 800-1500 m³/s
- Vegetation cover
 - Upper basin – Tea, rubber, grass and forest
 - Lower basin – heavily urbanized

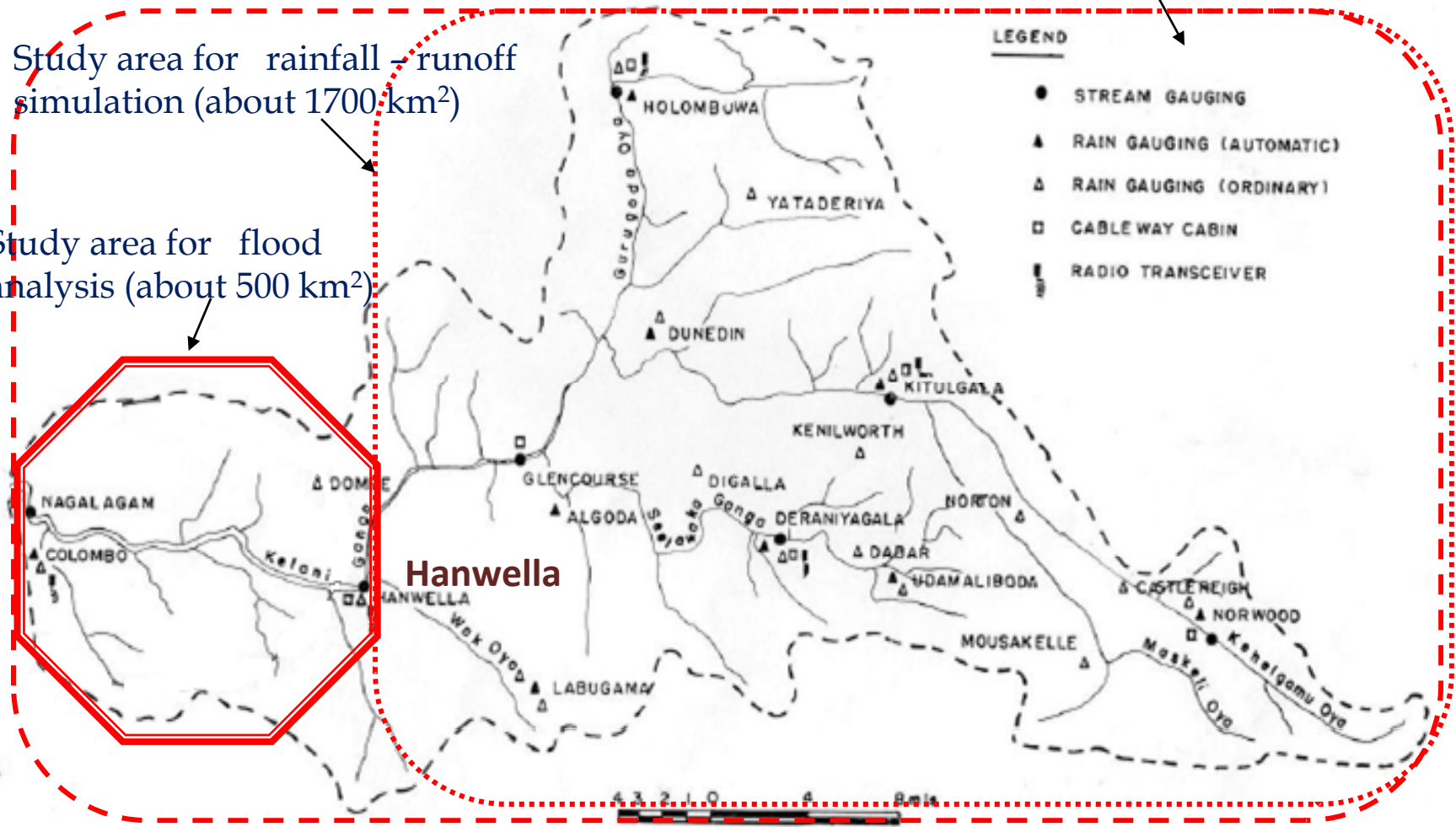
Kelani River Basin

MAP OF KELANI RIVER BASIN

Study area for rainfall analysis (about 2200 km²)

Study area for rainfall-runoff simulation (about 1700 km²)

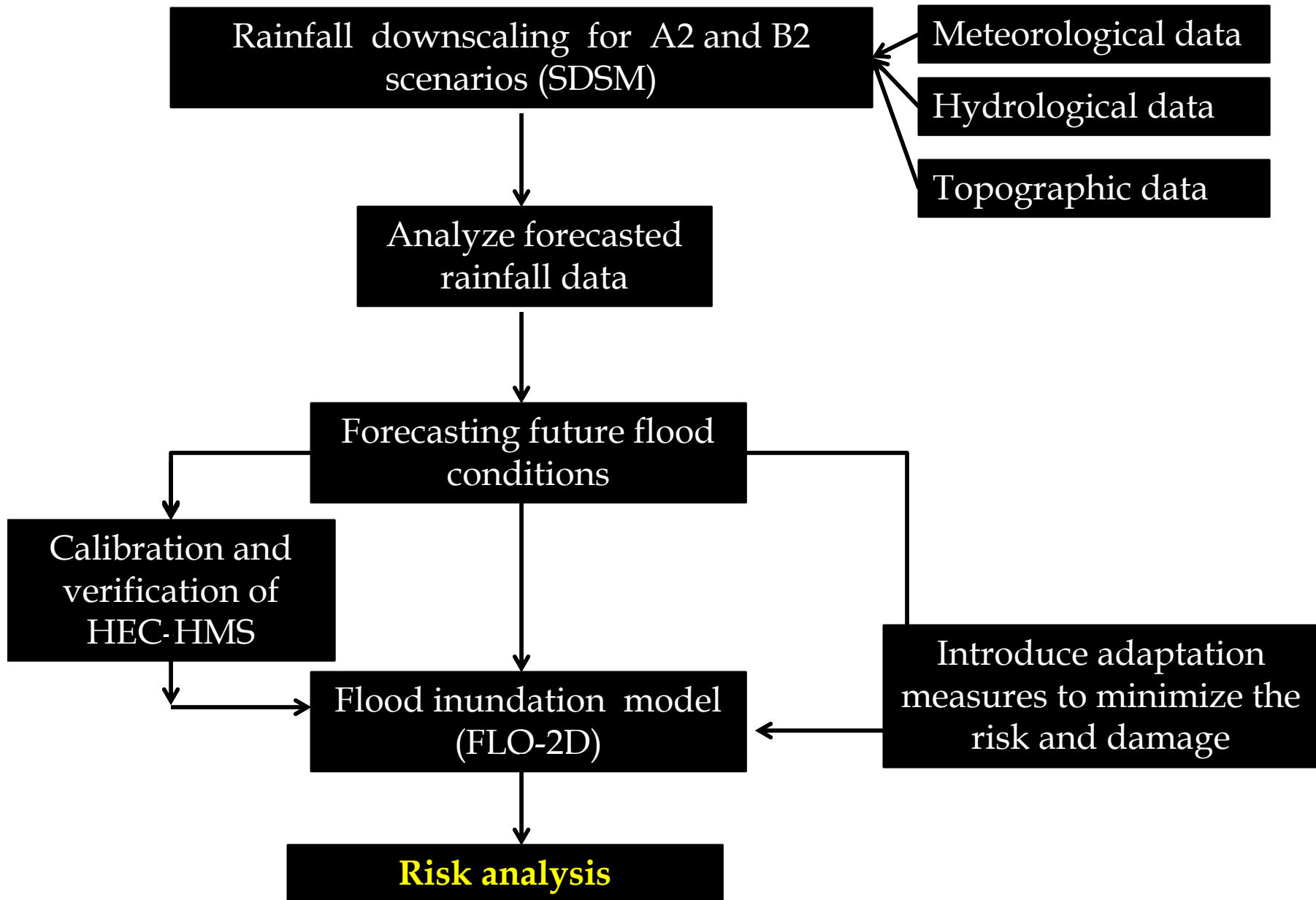
Study area for flood analysis (about 500 km²)



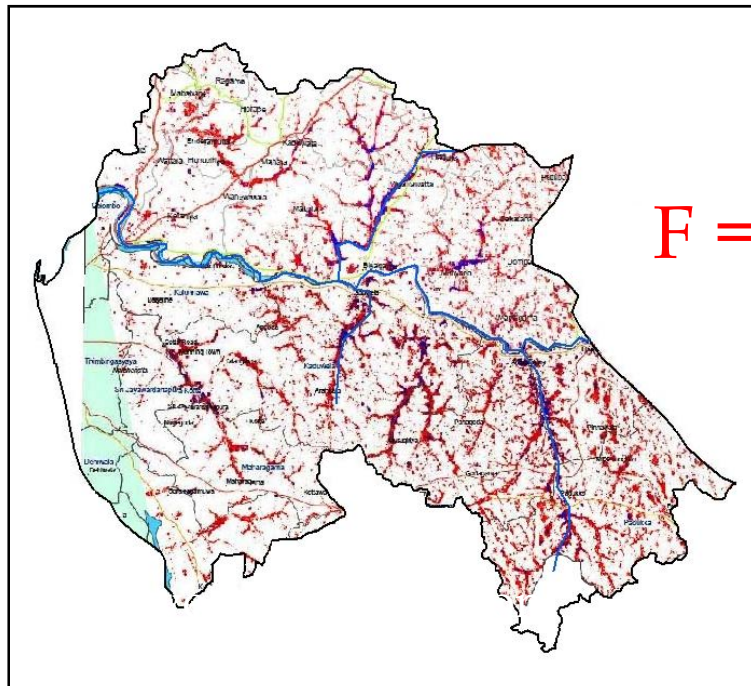
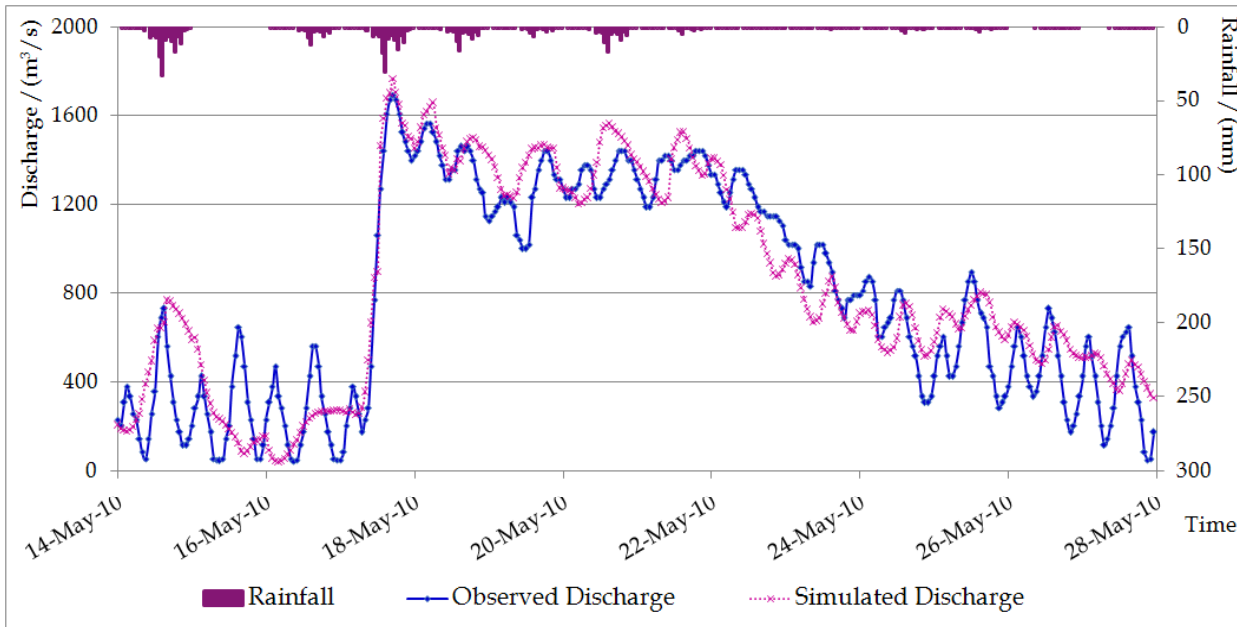
Objective

To estimate flood inundation and accompanied risk factors, in the lower Kelani River basin due to climate change impacts under A2 and B2 scenarios of AR4 and to propose adaptations

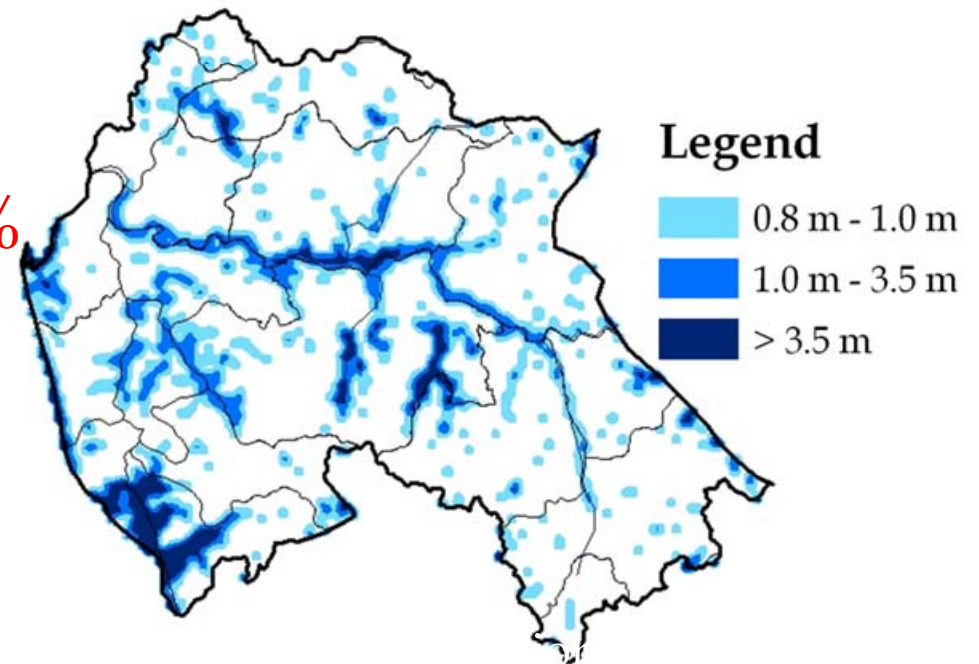
Methodology



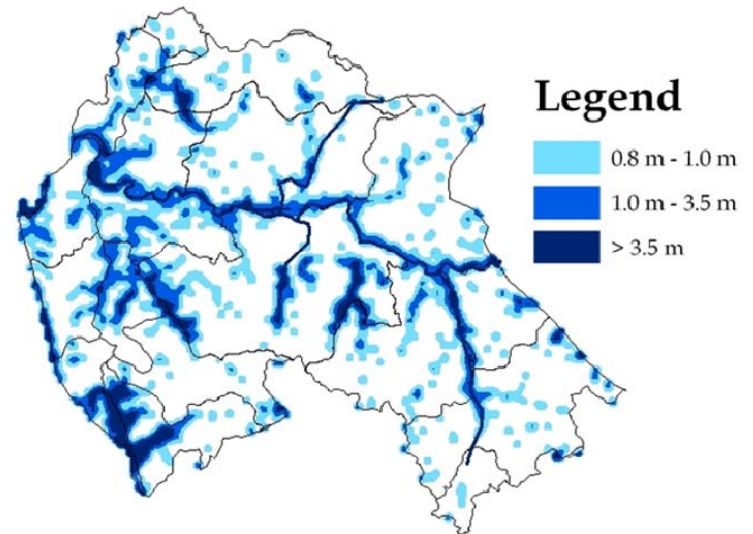
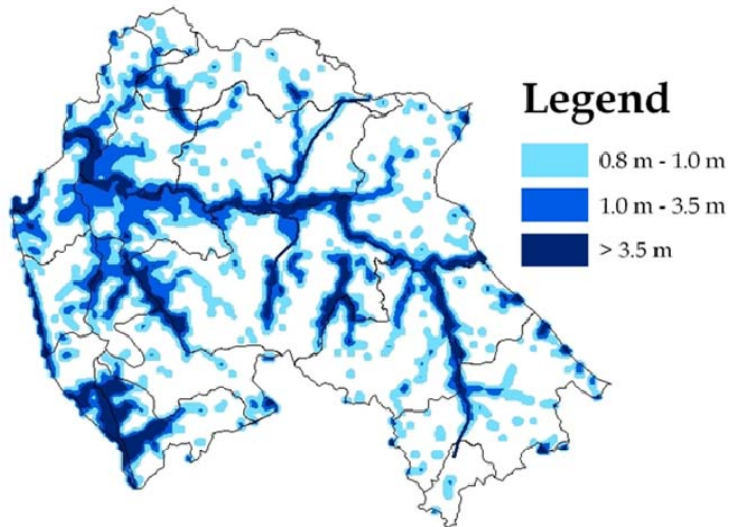
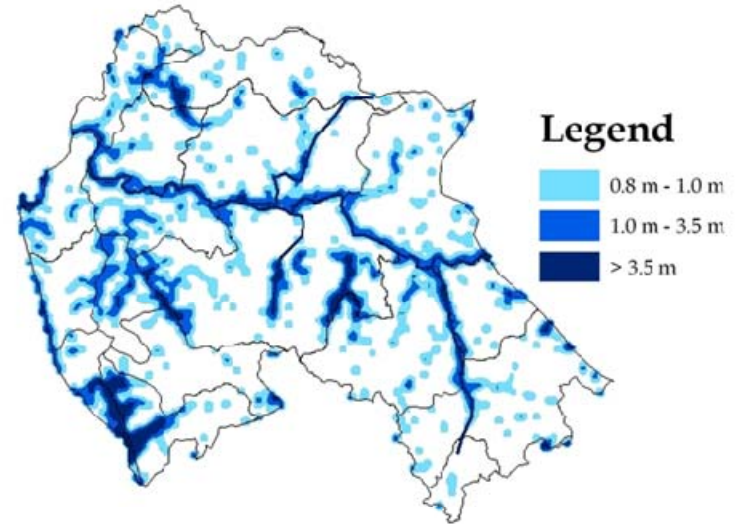
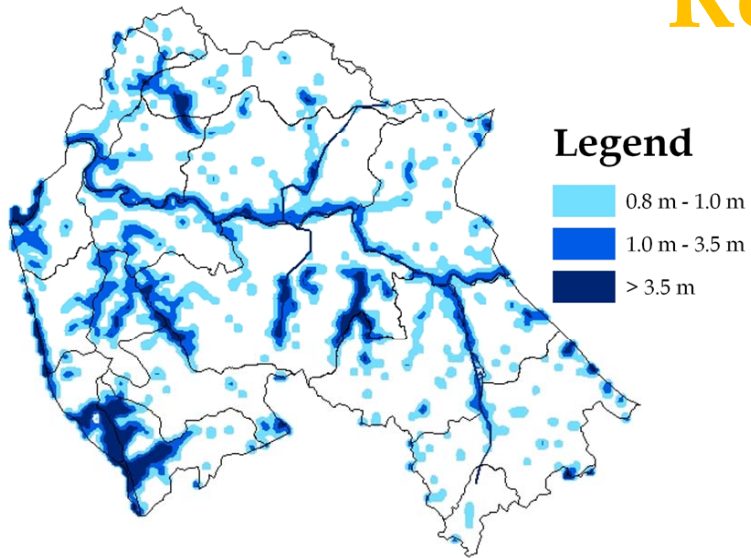
Validation



F = 73%



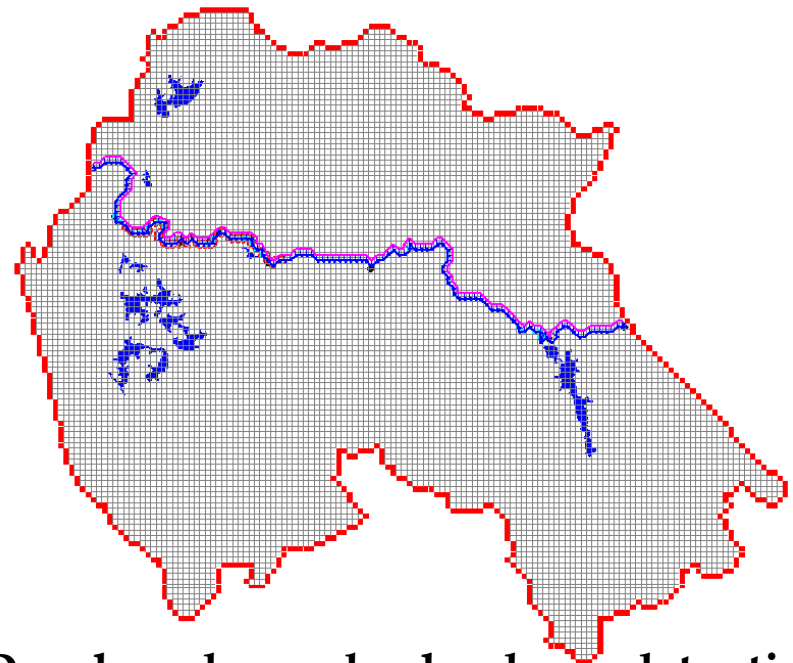
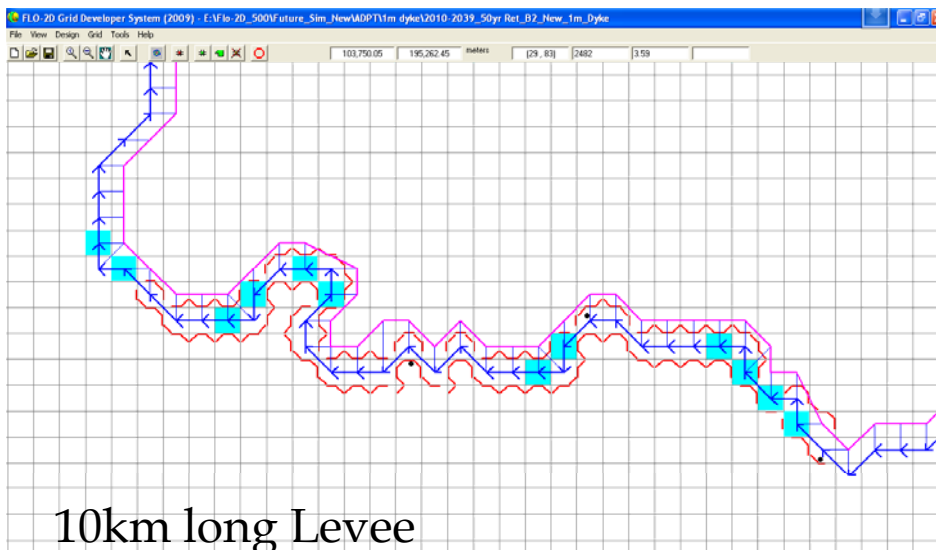
Results



Adaptation strategies

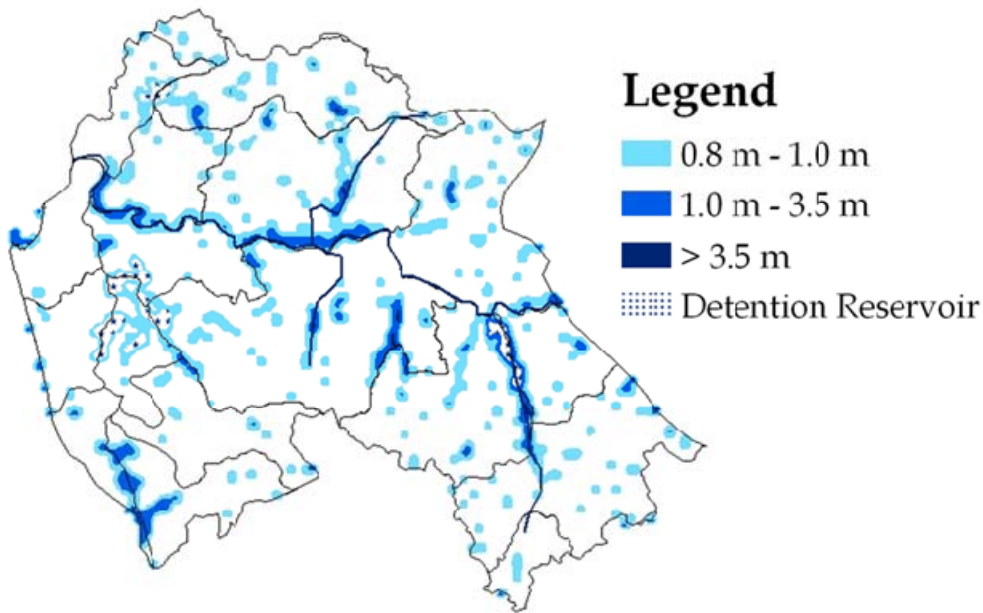
Levee and detention basin

- A levee of 1.0 m height and 10 km long from the downstream
- Detention reservoirs; several marshy lands were identified from land use maps and converted in to detention reservoirs.



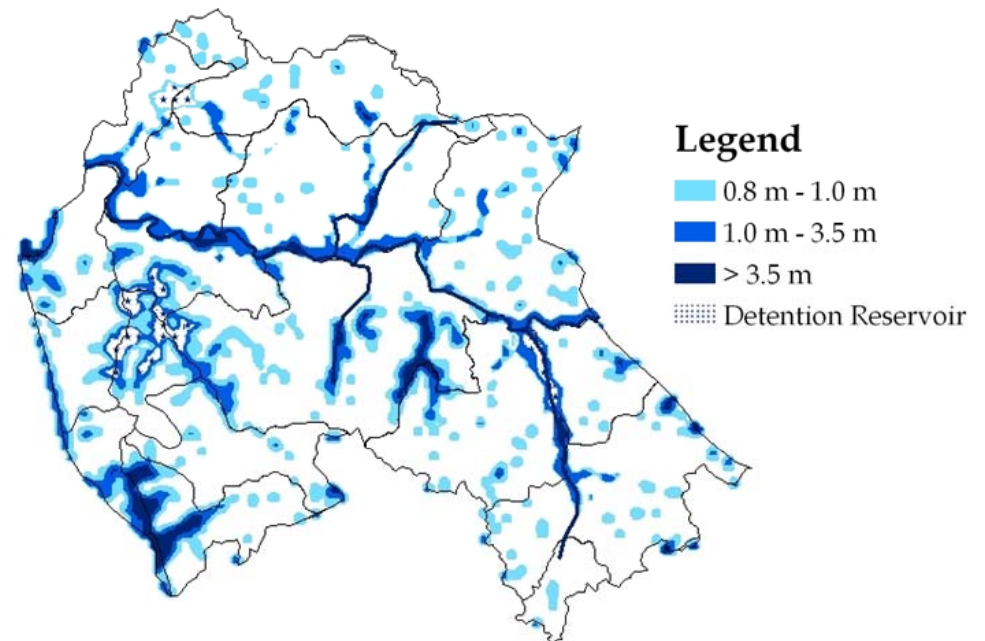
Developed marshy lands as detention reservoirs

Results - Inundation extents under (c)

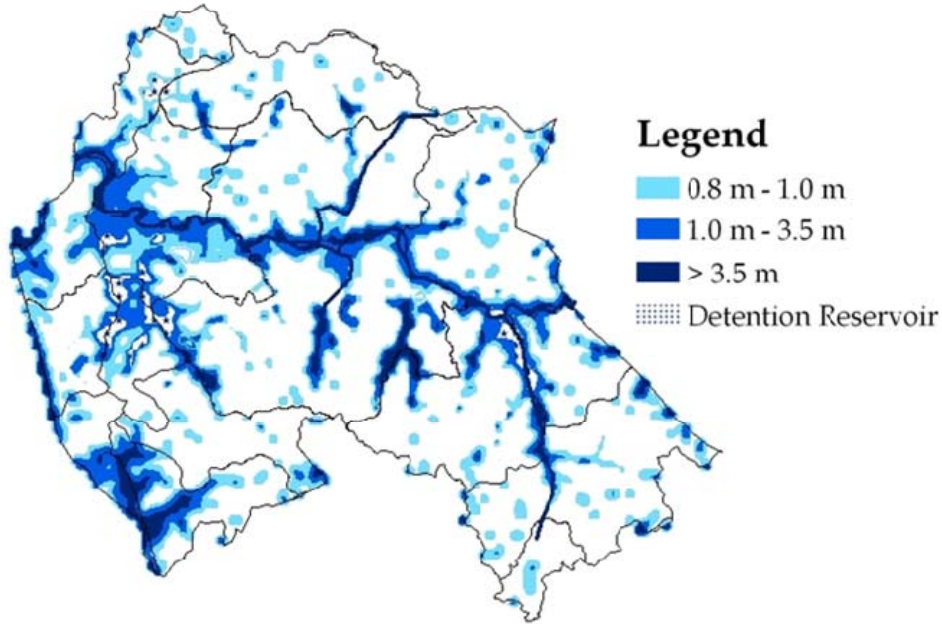


Reduces average risk about 65%

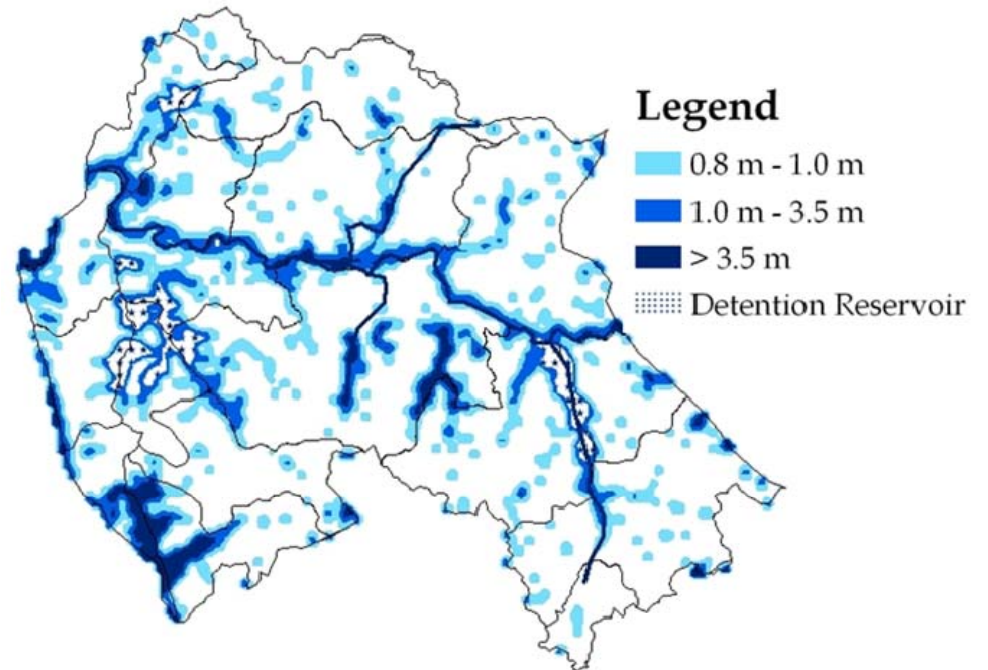
Reduces the average risk about 40%



Results - Inundation extents under (c)



Reduces the average risk about 32%




Reduces the average risk about 25%

Concluding Remarks

- Government has taken number of initiatives for low carbon, sustainable developments.
- Hydropower in SL has a significant contribution for her sustainable development.
- Small hydropower plants which are generally run-of-river type can provide many benefits to dispersed rural communities. NCRE projects are encouraged to achieve 10% share of electricity generation by 2016.
- Adaptation for disaster risk reduction under CC impacts for sustainable development is important

Case study - Inundation extents and high risk areas of inundation by rainfalls of 50, 100 year return periods under both A2 and B2 scenarios in Colombo were investigated



Devon waterfall
(Upper Kotmale Subbasin)

Thank You

7th July 2008, Weerakoon

Ownership & Source of Power Station	No.of Power Stations			Installed Capacity in MW.		
	2010	2011	% Change	2010	2011	% Change
C.E.B. - Total	23	24	4.3%	1758	2058	17.1%
- Hydro	16	16	0.0%	1207	1207	0.0%
- Thermal-Oil	6	6	0.0%	548	548	0.0%
- Thermal-Coal	-	1	-	-	300	-
- Wind	1	1	0.0%	3	3	0.0%
P.P.P. - Total	105	115	9.5%	1059	1082	2.2%
- Hydro-Small	85	90	5.9%	175	194	10.4%
- Thermal-Oil	11	11	0.0%	842	842	0.0%
- NCRE	9	14	55.6%	42	47	11.4%
Total	128	139	8.6%	2818	3141	11.5%

Ownership & Source	Gross Generation in GWh			Percentage of Total	
	2010	2011	% increase	2010	2011
C.E.B. - Total	6386	6552	2.6%	60%	57%
- Hydro	4988	4018	-19.5%	47%	35%
- Thermal-Oil	1394	1494	7.1%	13%	13%
- Thermal-Coal	-	1038	-	-	9%
- Wind	3	3	-11.1%	0%	0%
P.P.P. - Total	4329	4976	14.9%	40%	43%
- Hydro-Small	646	604	-6.5%	6%	5%
- Thermal-Oil	3600	4254	18.1%	34%	37%
- NCRE	83	118	43.0%	0.8%	1.0%
Total Generation	10714	11528	7.6%	100%	100%