Basin-Wide Assessment on Impacts of Climate Change on Ecosystem Services in the Lower Mekong Basin

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2016 ACES A Community on Ecosystem Services
Implementation Advances and Challenges

In partnership with
ECOSYSTEM MARKETS
Making Them Work
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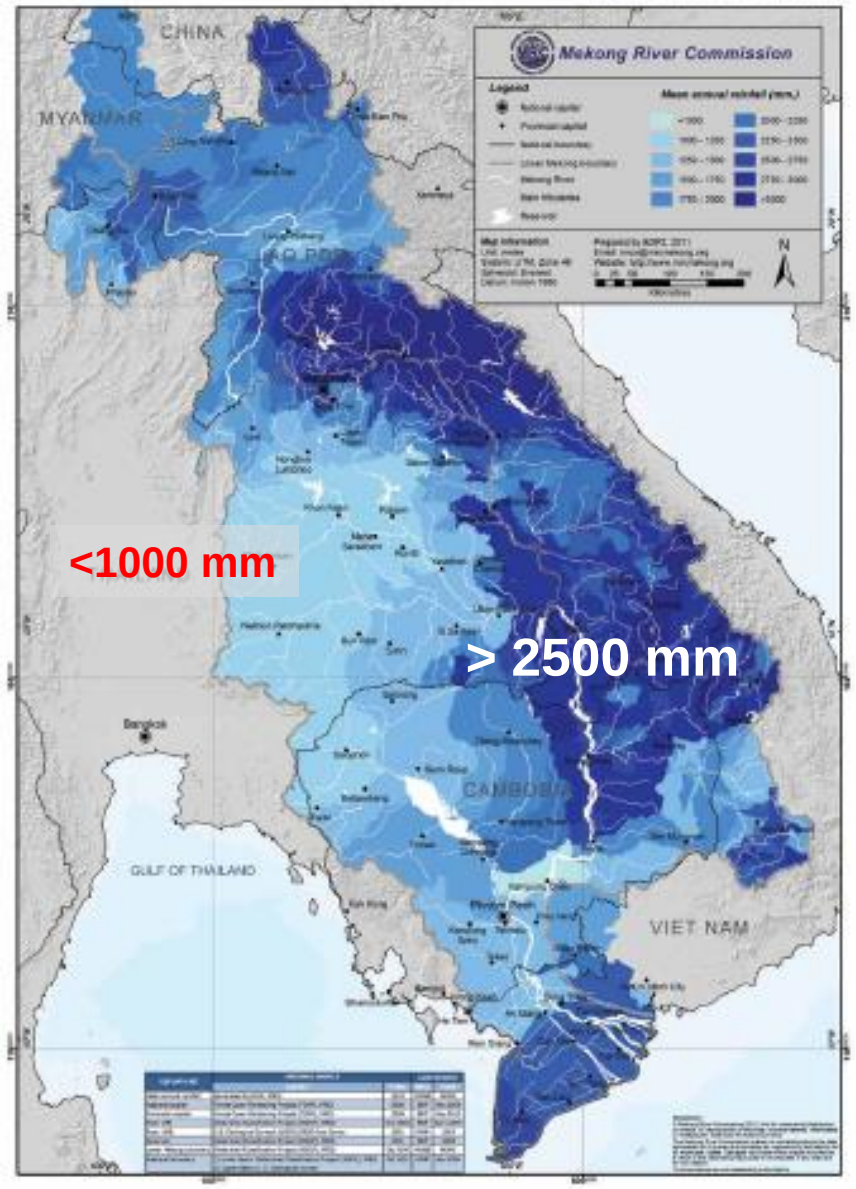
Transboundary River Basin

- 21st largest river basin
- Area: 795,000 km^2:
  Upper (24%), LMB (76%).
- Population 60.6 mill (’10),
  67.5 (‘30)
- **Water** - contribute 80% of people’s livelihood

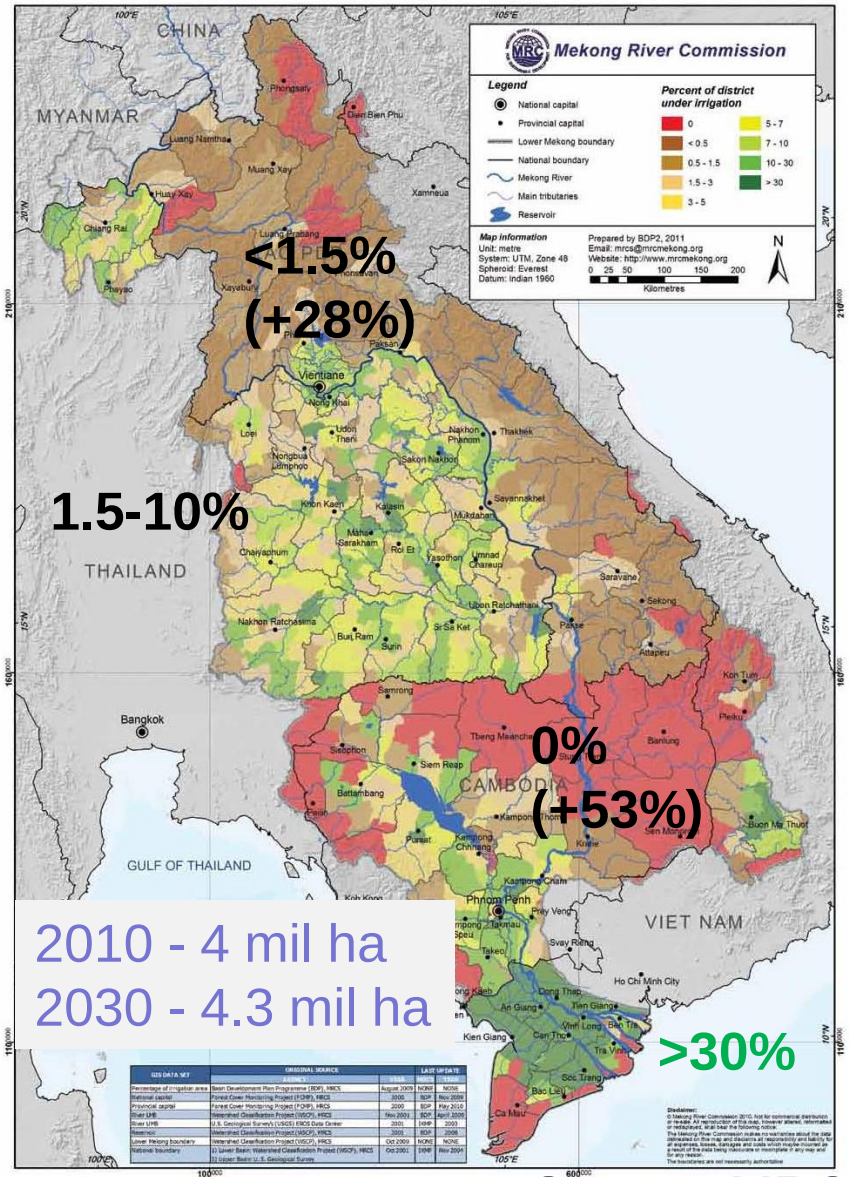
MRC (2011)

Rainfall & Irrigation

Mean annual rainfall



Percentage of district area under irrigation



Source: MRC (2011)

Climate

Baseline: 1986-2005 (1,675 mm; 25.2 °C)

Future: GCMs/SimClim+ emission scenarios

		Emission scenario		
		Low emissions (RCP2.6)	**M**edium emissions (RCP4.5)	**H**igh emissions (RCP8.5)
GCM climate	Drier Overall (GS)	**1,680**	**1,587**	**1,454**
		25.6	26.7	28.3
	Increased seasonality **(IS)**	**1,742** 25.5	**1,794** 26.5	**1,882** 28.0
	Wetter overall (GF)	**1,742** 25.5	**1,835** 26.7	**1,968** 28.2

Short-term 2030 → **Long-term 2060**

MRC (2011)

Basin-wide assessments on Ecosystems (2013-2015)

Main objective:

To determine **potential climate change impacts on ecosystems** of the LMB and **identify effective adaptation options** to address these impacts using a **consistent basin**-wide approach, datasets, methods, tools and knowledge

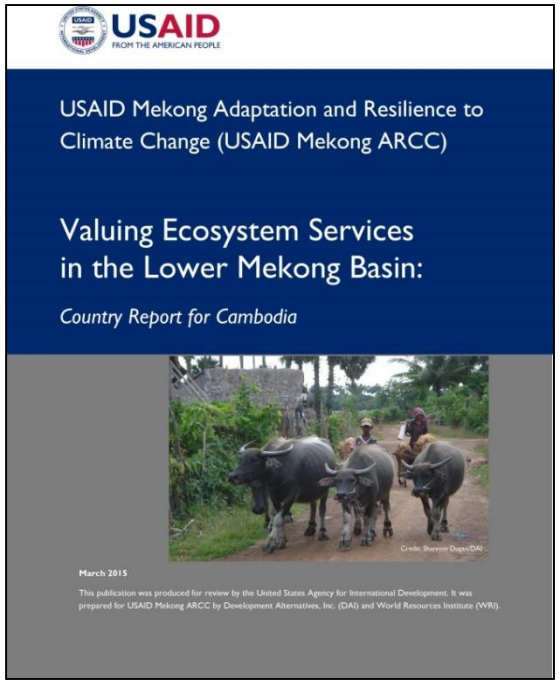
- **Water yield**
- Sediment
- Nutrient retention

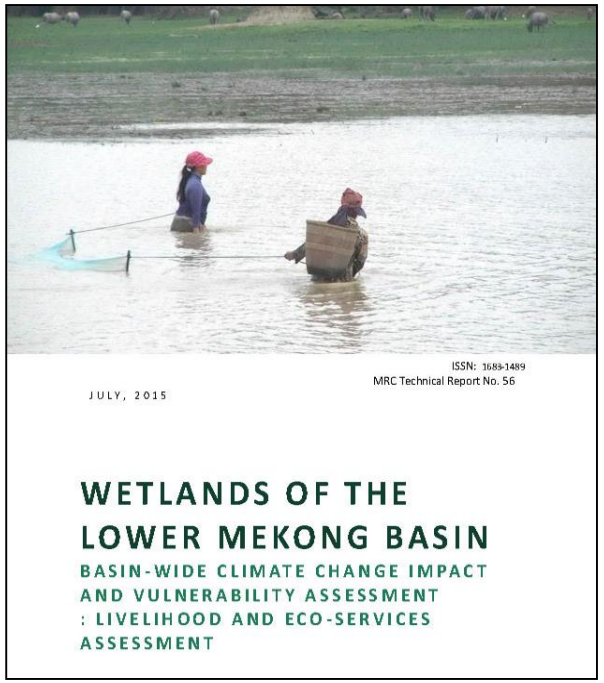
Model results will be used for preparation of Mekong Adaptation Strategy and Action Plan (MASAP)

Objectives

- To quantify and compare water yield between baseline and future CC scenarios
- To determine potential impacts on agriculture (paddy)

Build-on existing projects and Knowledge: regional & national levels…





Tools

1. Standalone platform
2. Simple, easy to learn
3. Robustness
4. Fit to available data
5. Well documented

(Bagstad *et al*., 2013)

Spatially explicit modeling tool to **quantify and predict changes** in ecosystem services

Model Inputs

Climate (MRC)

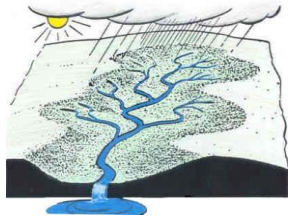
Precipitation, PET

Soils (ISRIC/EU)

Soil depth, PAWC

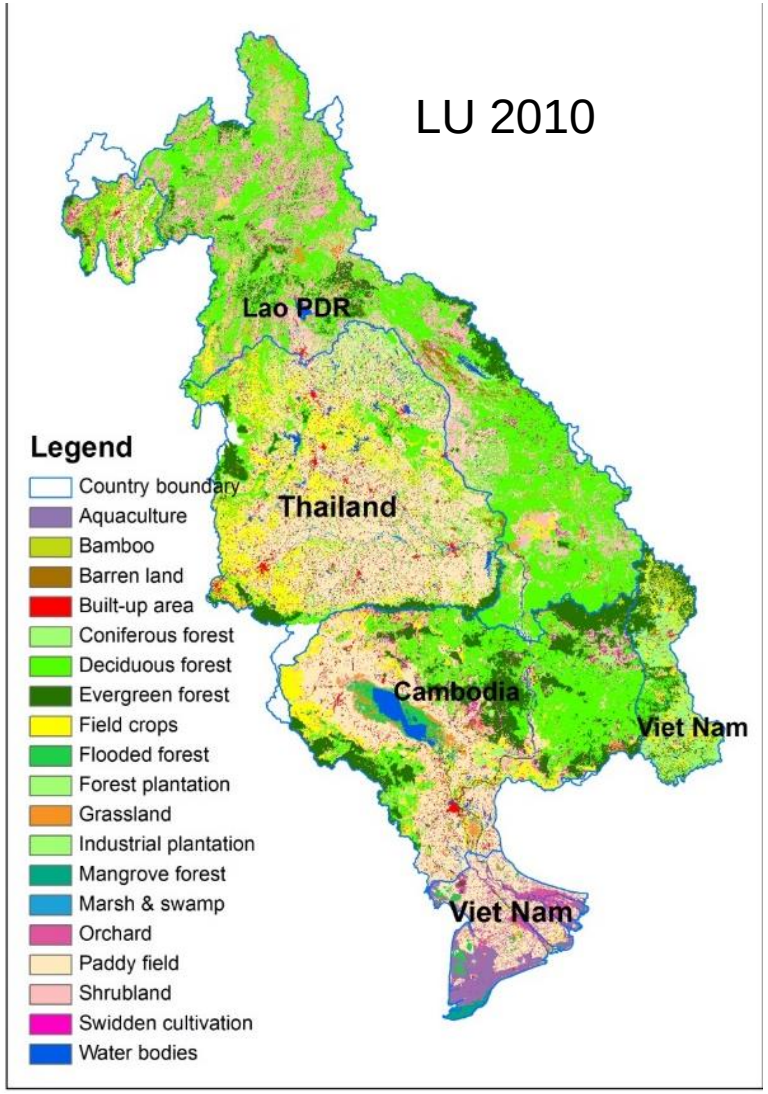
Land Use/Land Cover (MRC)

Root depth, evapotranspiration coefficient (Kc)



Watersheds

Main and sub-wsh



FAO Land suit. evaluation (matching approach)

Land Quality Rating

Land quality	Factor	S1	S2	S3	N
Temp.	Mean temp. (°C) in growing season	22-30	31-33 21-20	34-35 19-18	>35 <18
Moisture availability	Water requirement in growing season (mm)	700-800	550-700	400-500	<400
Oxygen availability	Soil drainage	Poor	moderate	well	excessive
Rooting condition	Effective root depth (cm)	>50	25-50	15-25	<15
Erosion hazard	Slope	0-2%	2-5%	5-12%	>12

LDD (1999)

Overall Suitability Class

Suit = Crop reg. x Cons. x Mgt

Land quality rating score

S1 = 1.0
S2 = 0.8;
S3 = 0.5
N = 0.0

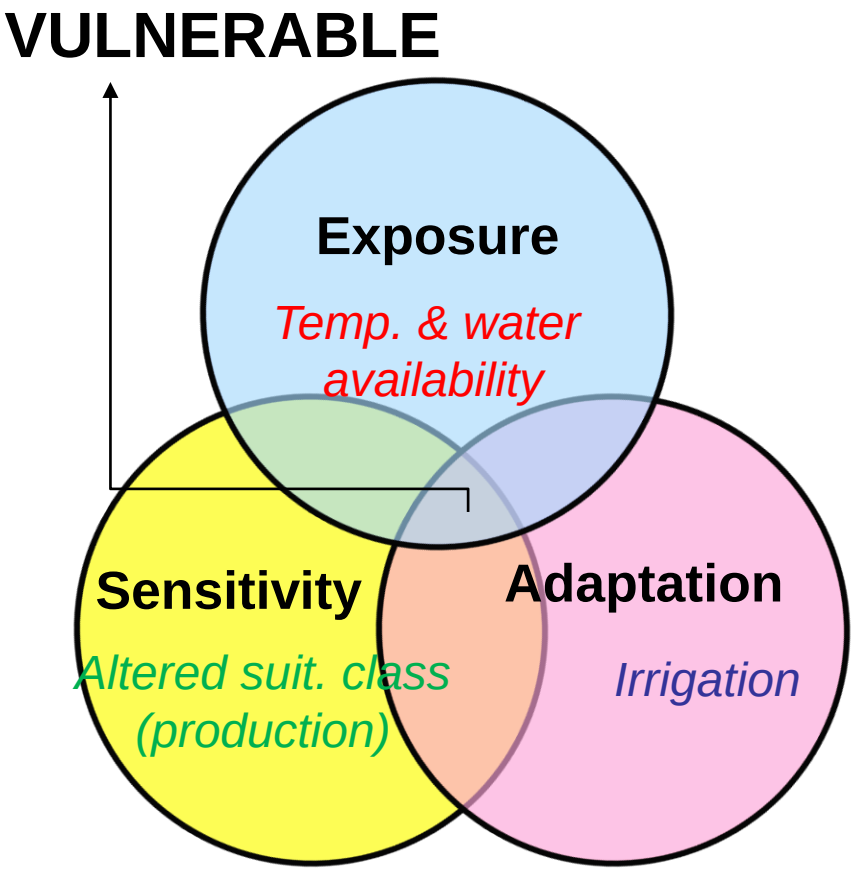
Suitability class range

S1 = 0.8-1
S2 = 0.4-0.8;
S3 = 0.2-0.4
N = 0.0-0.2

Modified from LDD (1999); FAO (1989); RID (2011); Yamauch (2014)

		N	S3	S2	S1
		Conservation (slope)			
		N	**S3**	**S2**	**S1**
Crop requirement (Jul-Nov)	**N**	**N**	**N**	**N**	**N**
	S3	**N**	**S3**	**S3 (0.4)**	**S2 (0.5)**
	S2	**N**	**S3**	**S2**	**S1**
	S1	**N**	**S2**	**S1**	**S1**

Agriculture Vulnerability (Food Security)



Sensitivity class	Irrigation (%) <3	3-10	10-30	>30
N	N	N	N	L
S3	L	L	L	M
S2	M	M	H	H
S1	H	H	H	H

Predicted annual water yield (km^3)

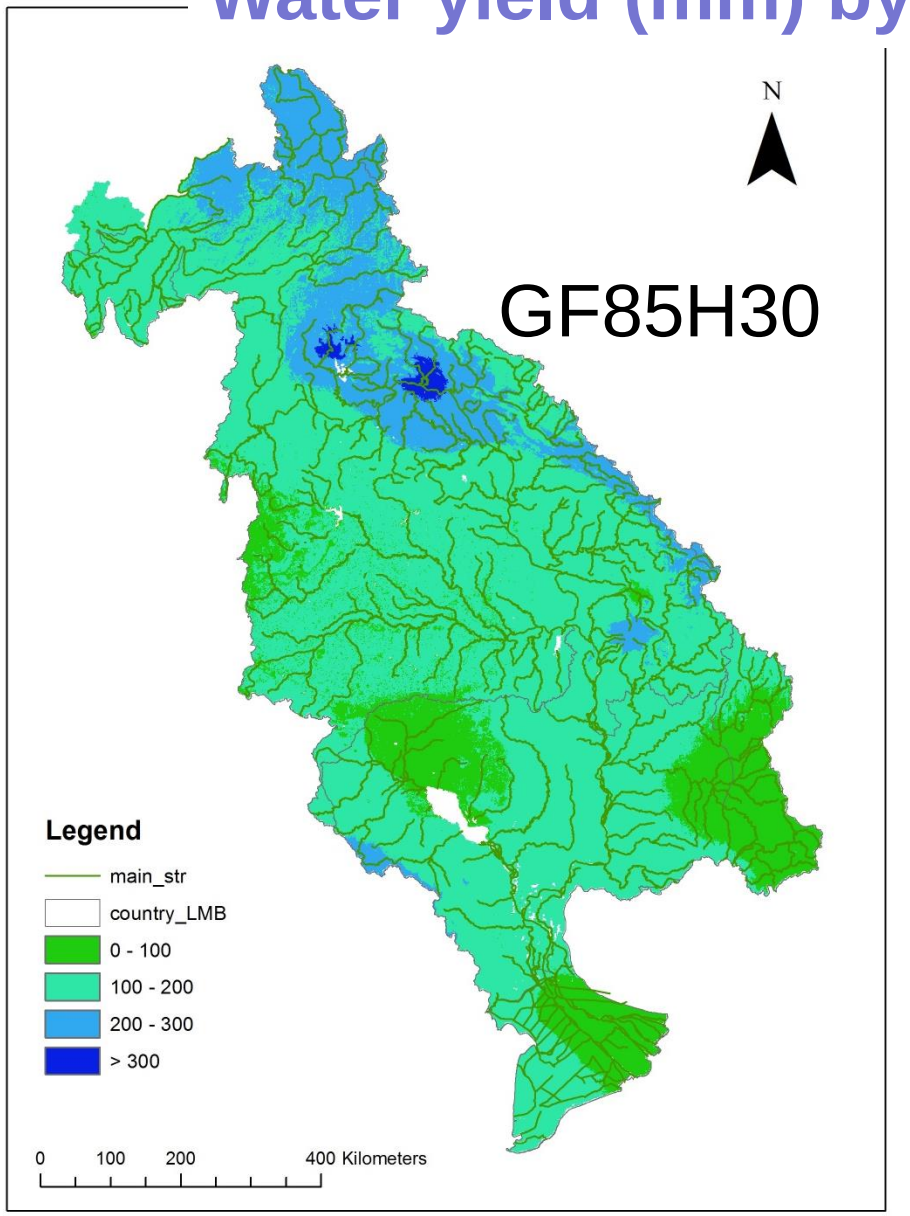
InVEST Output

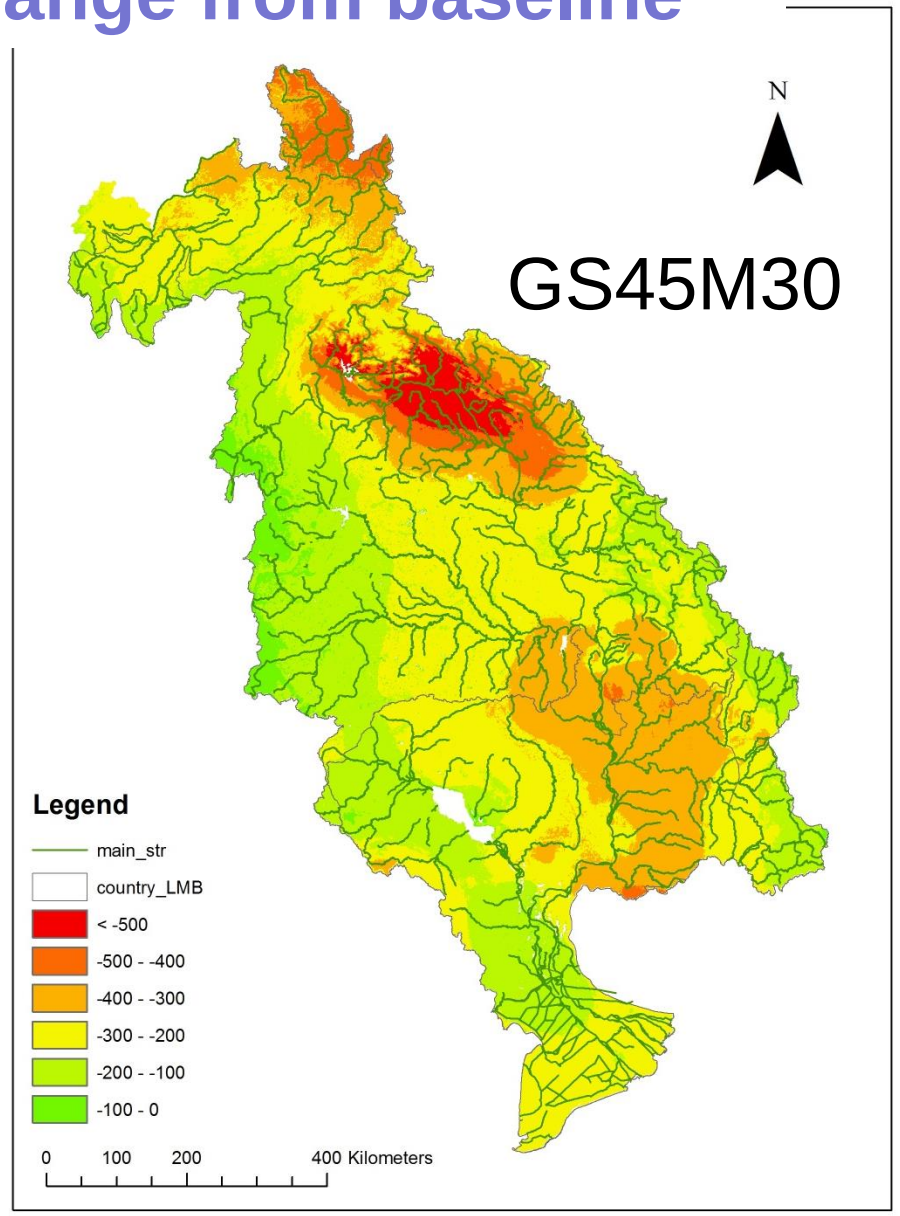
Scenario	Cambodia	Laos	Thailand	Vietnam	Total
Baseline	152	251	154	78	**639**
2030					
~~GS26L30~~	~~149~~	~~249~~	~~152~~	~~79~~	~~633~~
GS45M30	113	190	113	64	**484** *
~~GS85H30~~	~~134~~	~~233~~	~~136~~	~~78~~	~~583~~
IS26L30	157	266	165	79	671
IS45M30	158	271	167	80	680
IS85H30	158	281	171	80	696
GF26L30	161	269	167	81	683
GF45M30	165	277	171	82	700
GF85H30	170	290	179	84	**727**
2060					
GS26L60	151	151	154	79	639
GS45M60	132	230	134	77	576
GS85H60	107	200	107	66	**482**
IP26L60	160	267	166	81	678
IP45M60	158	282	172	80	697
IP85H60	142	185	169	68	669
GF26L60	160	267	166	81	678
GF45M60	170	291	179	85	730
GF85H60	185	33	199	90	**805**

NSE = 0.76

Implications: Wet & Dry

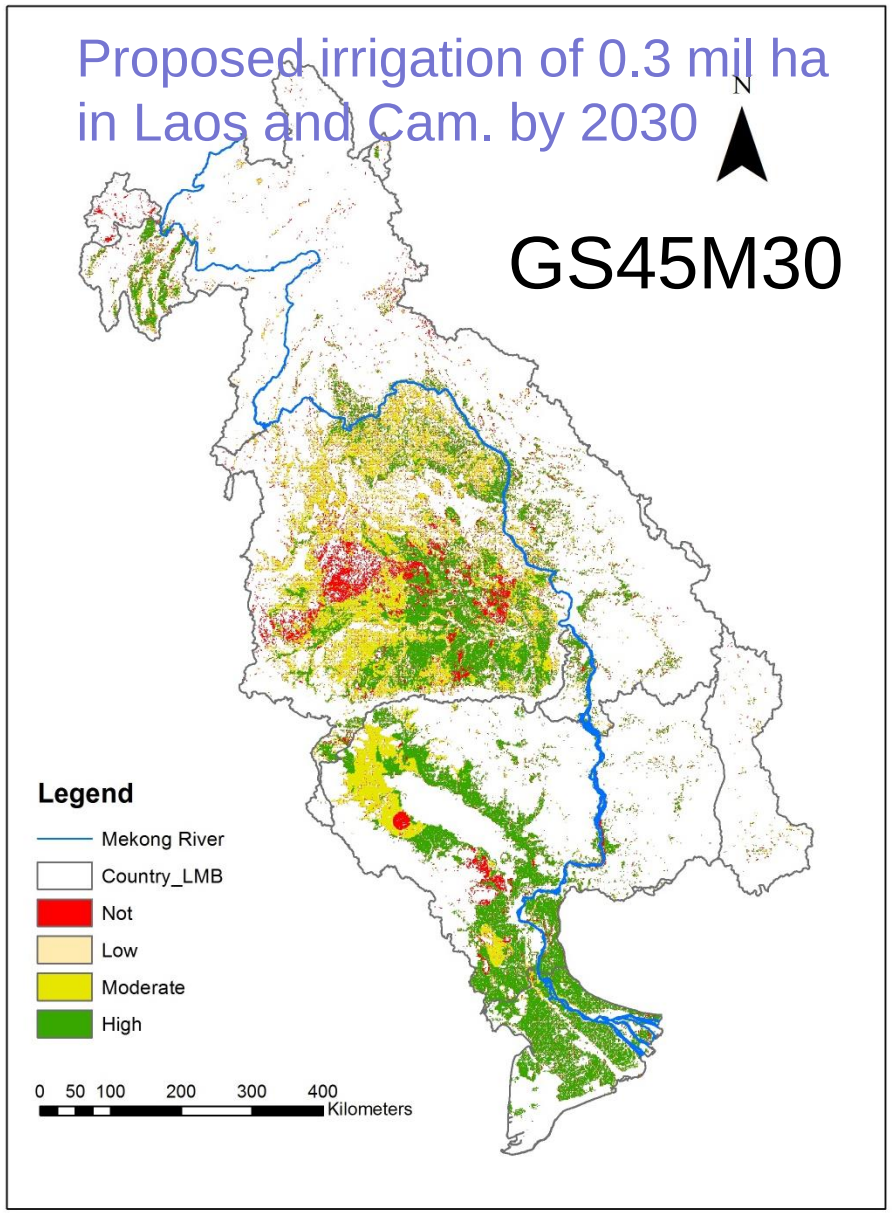
Water yield (mm) by pixel change from baseline





Implications: Food security

Suit. class	Baseline (%)	GS45M30 (%)
High (S1)	36.39	33.29
+irrigation	36.60	33.49
Mod (S2)	19.57	20.81
	19.41	20.66
Low (L3)	10.43	10.53
	10.44	10.54
N	33.61	35.38
	33.55	35.31



Conclusions

Water is an important factor contributing 80% of local livelihood and rice production.

Future climate change (short-term/long-term)

- Drier climate with mod. emission scenario (2030) would reduce 25% of current runoff;
  severe drought in northern & central Laos and western Cambodia

Consequences

- reduce high suit. class for paddy of 3%
  BUT population would increase **12%** (60-67 mill.)
- Escalate flooding and **dengue fever risks**

Acknowledgements?

MRC-CCAI Team
LMB country Coordinators
National Experts in the LMB

natural capital PROJECT

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