Basin-wide Climate Change Impact and Vulnerability Assessment for Wetlands of the LMB for Adaptation Planning

2nd Regional Expert Advisory Workshop, Vientiane | 11-12 July 2011

Mekong Wetland Assets

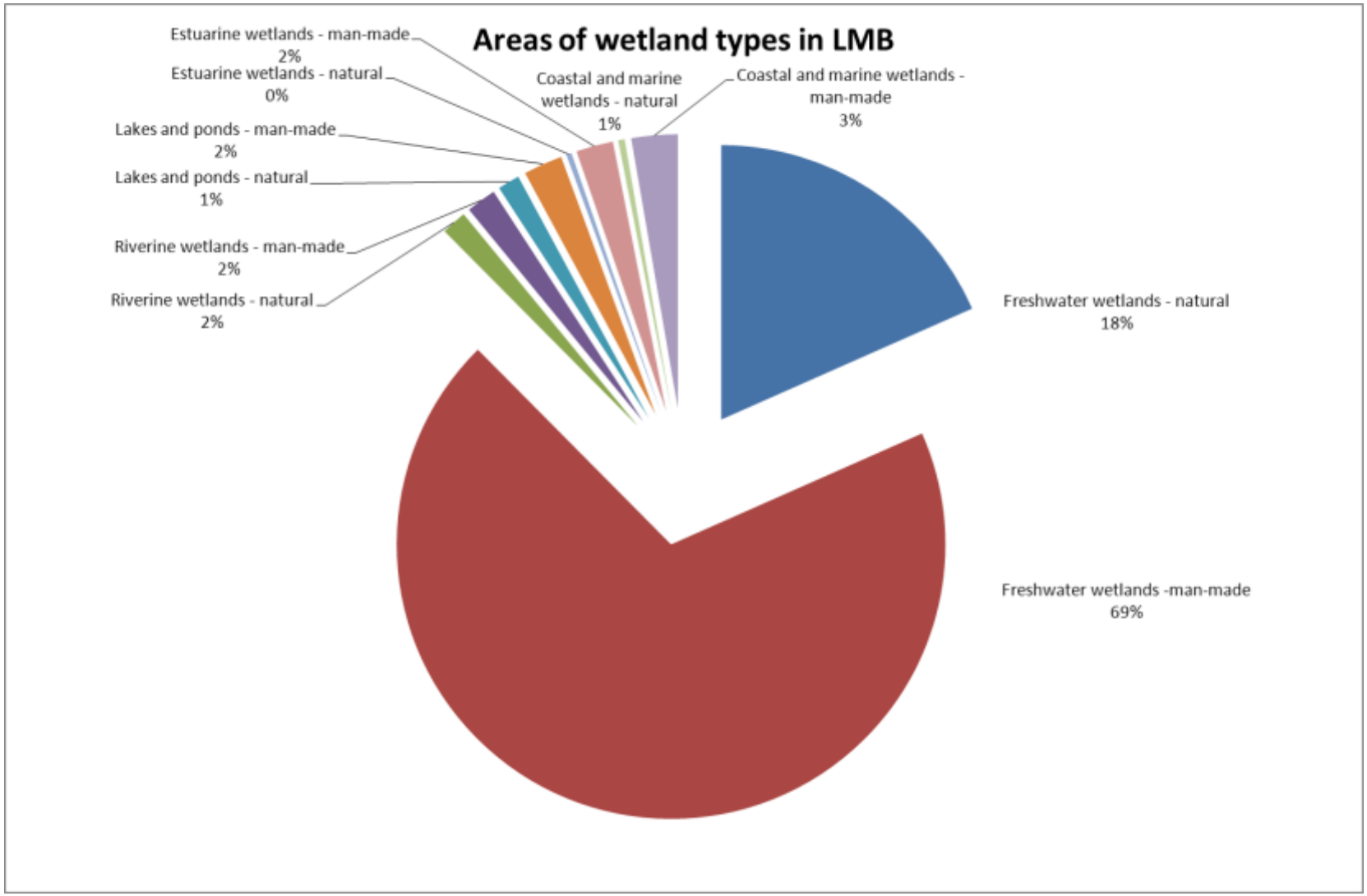
Prepared for the Mekong River Commission
By ICEM • WorldFish • IUCN • SEA START

Please note that this presentation presents initial finding and work that is in progress. It was developed for workshop discussion only.

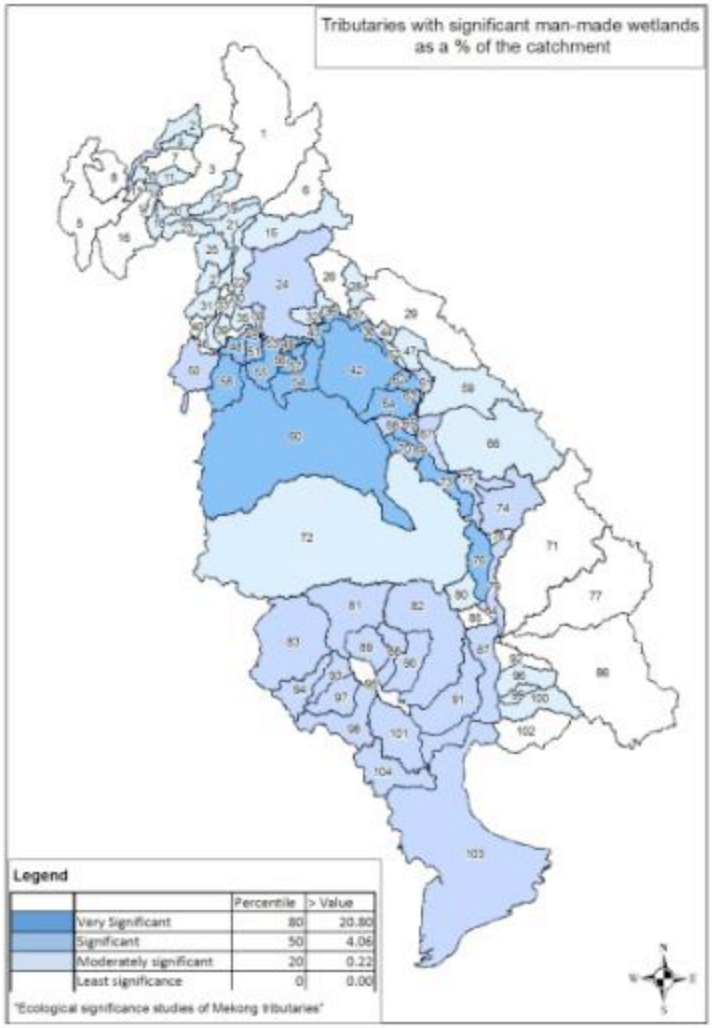
Overview of presentation

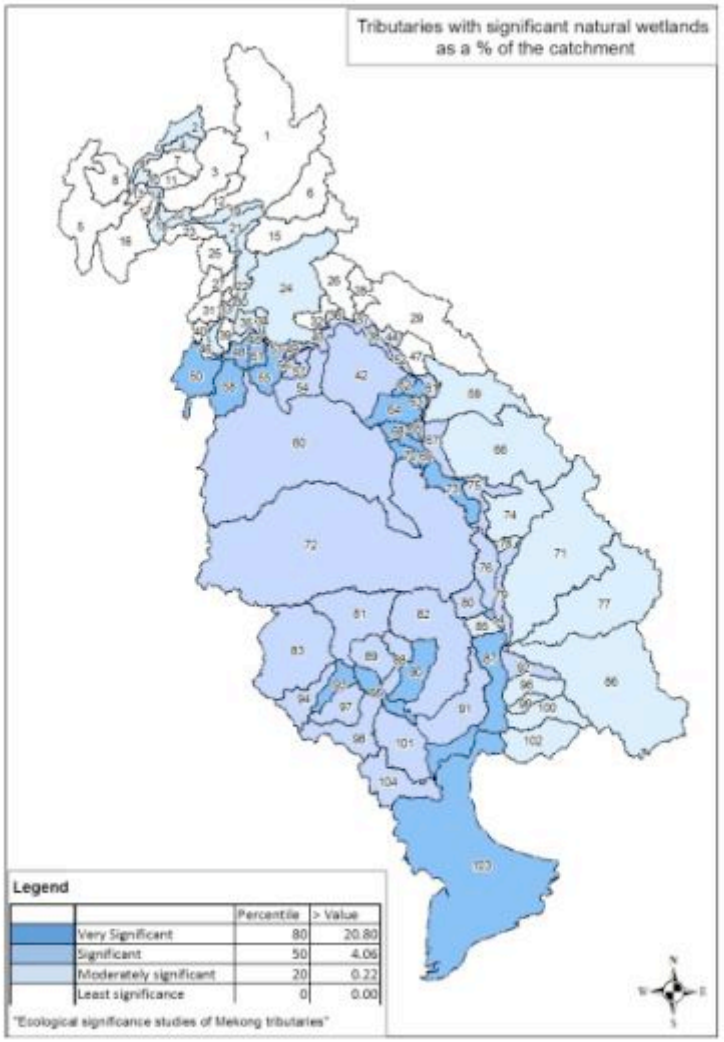
1. Wetlands in the LMB – man-made and natural
2. Natural wetlands described in different ways
3. Natural wetlands by current climate
4. Natural wetlands by predicted climate change
5. Fitting the case studies

Areas of wetlands in the LMB Natural and Man-made



Distribution of man-made and natural wetlands in the Mekong catchments

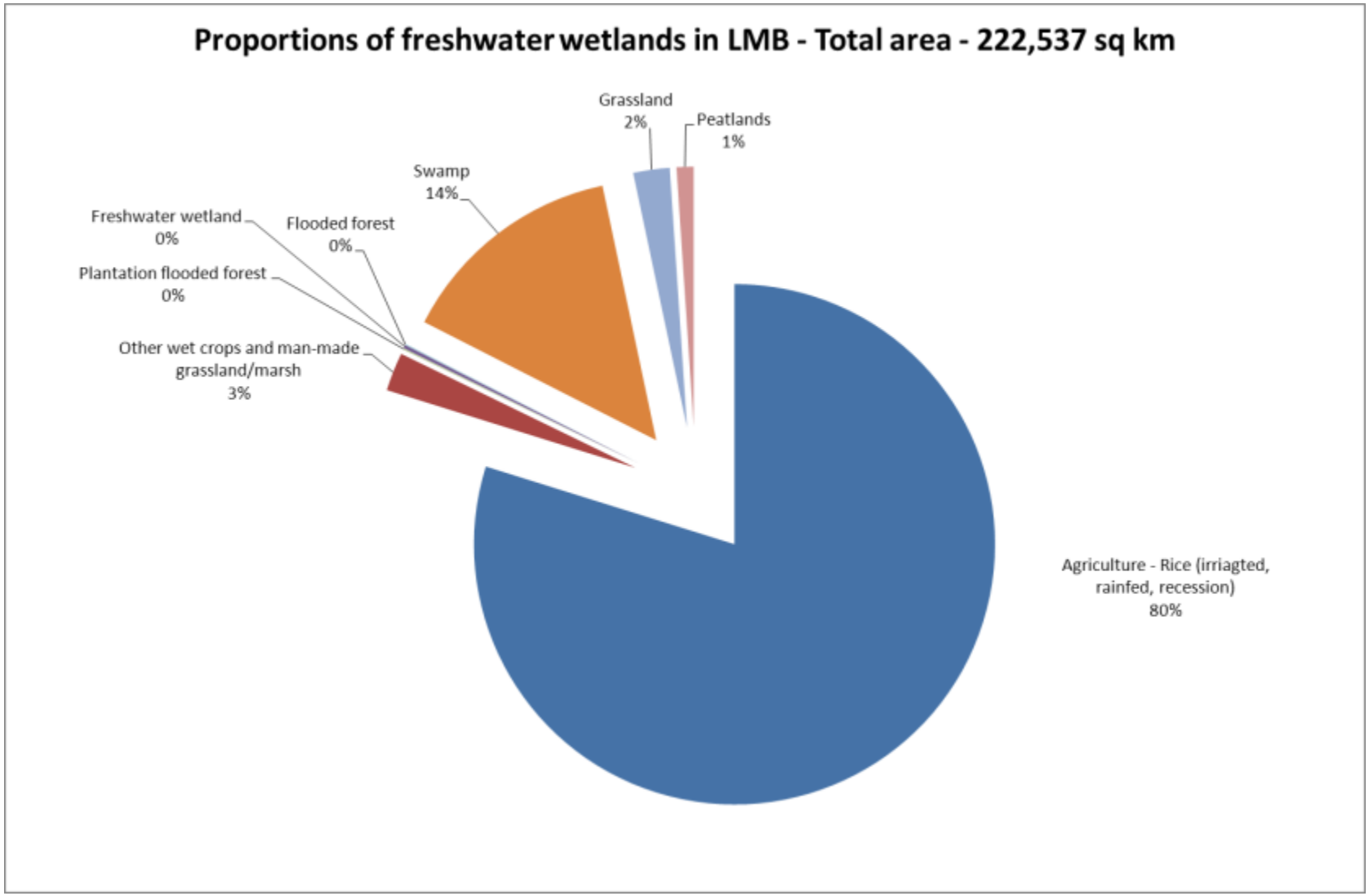




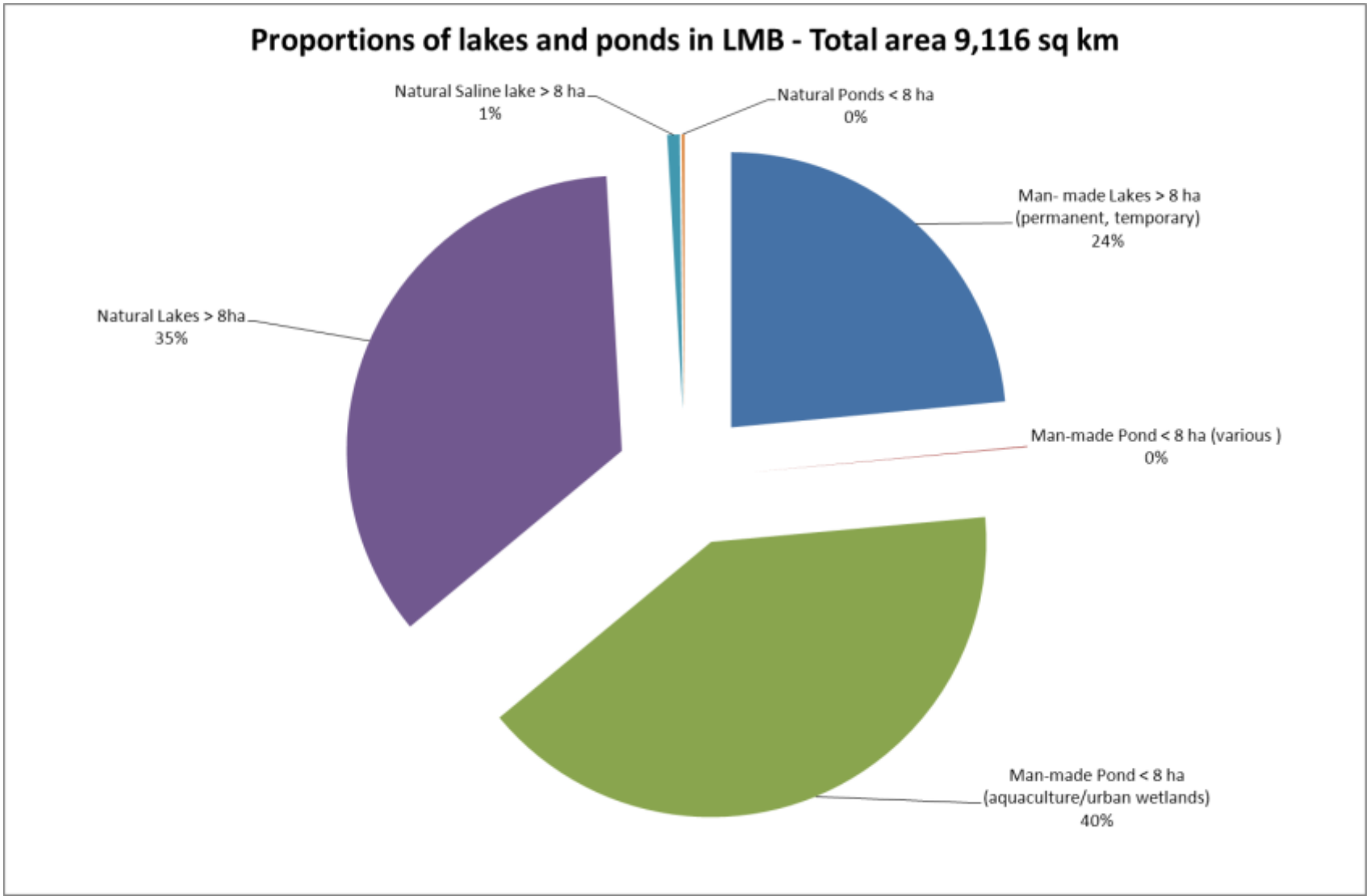
- Wetlands make up about 42% of the total land cover of the LMB
- Man-made wetlands make up about 33% and natural wetlands about 9%

Area of wetlands in the LMB (sq km)				
	Natural	% of LMB	Man made	% of LMB
Freshwater wetlands	46,696	7.7	175,841	29.0
Riverine wetlands	3,776	0.6	4,495	0.7
Lakes and ponds	3,284	0.5	5,832	1.0
Estuarine	788	0.1	5,550	0.9
Coastal and marine	954	0.2	6,928	1.1
TOTAL	**55,498**	**9.2**	**198,646**	**32.8**
Total area of Mekong			**606,000**	

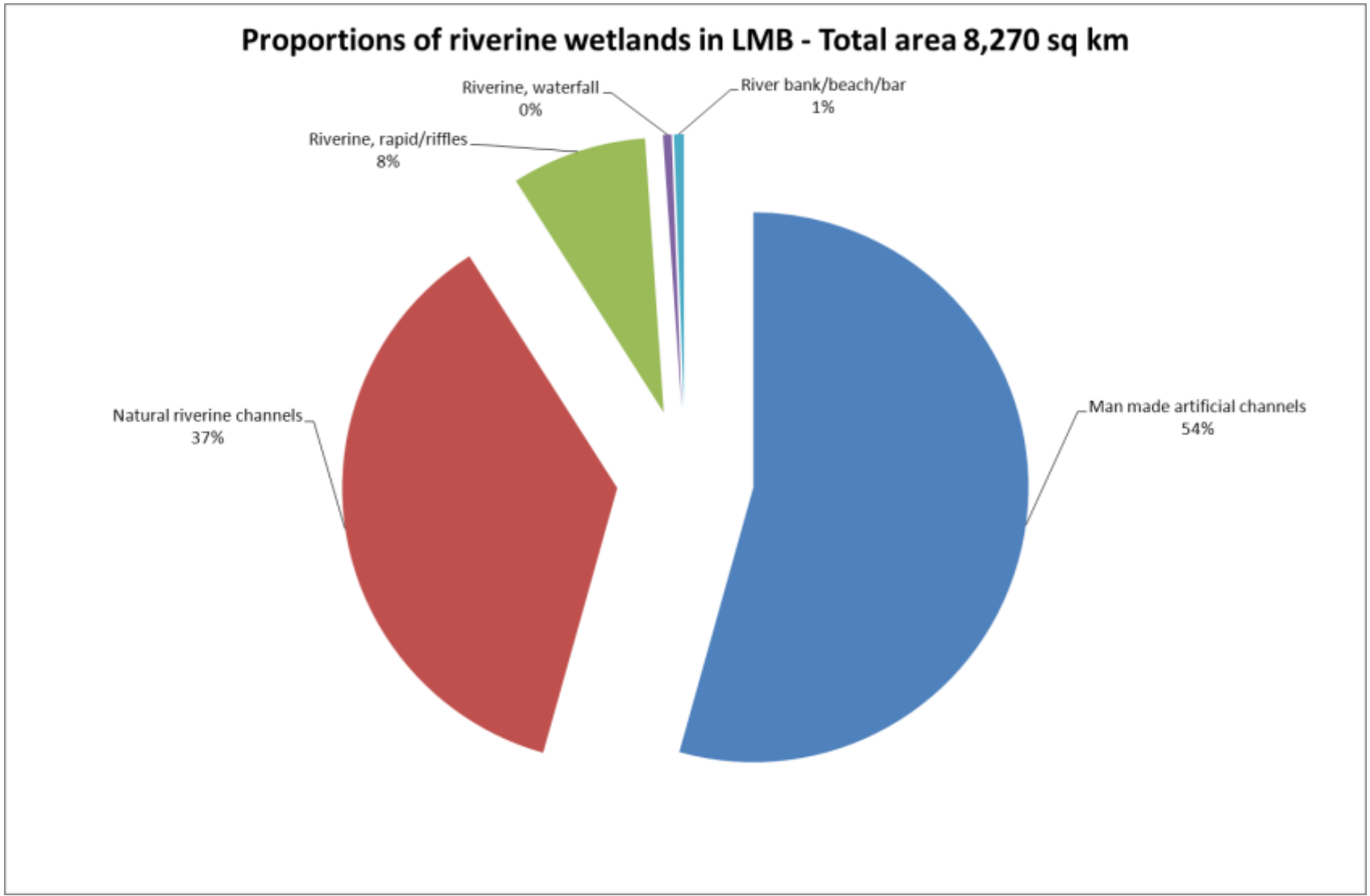
Freshwater wetlands



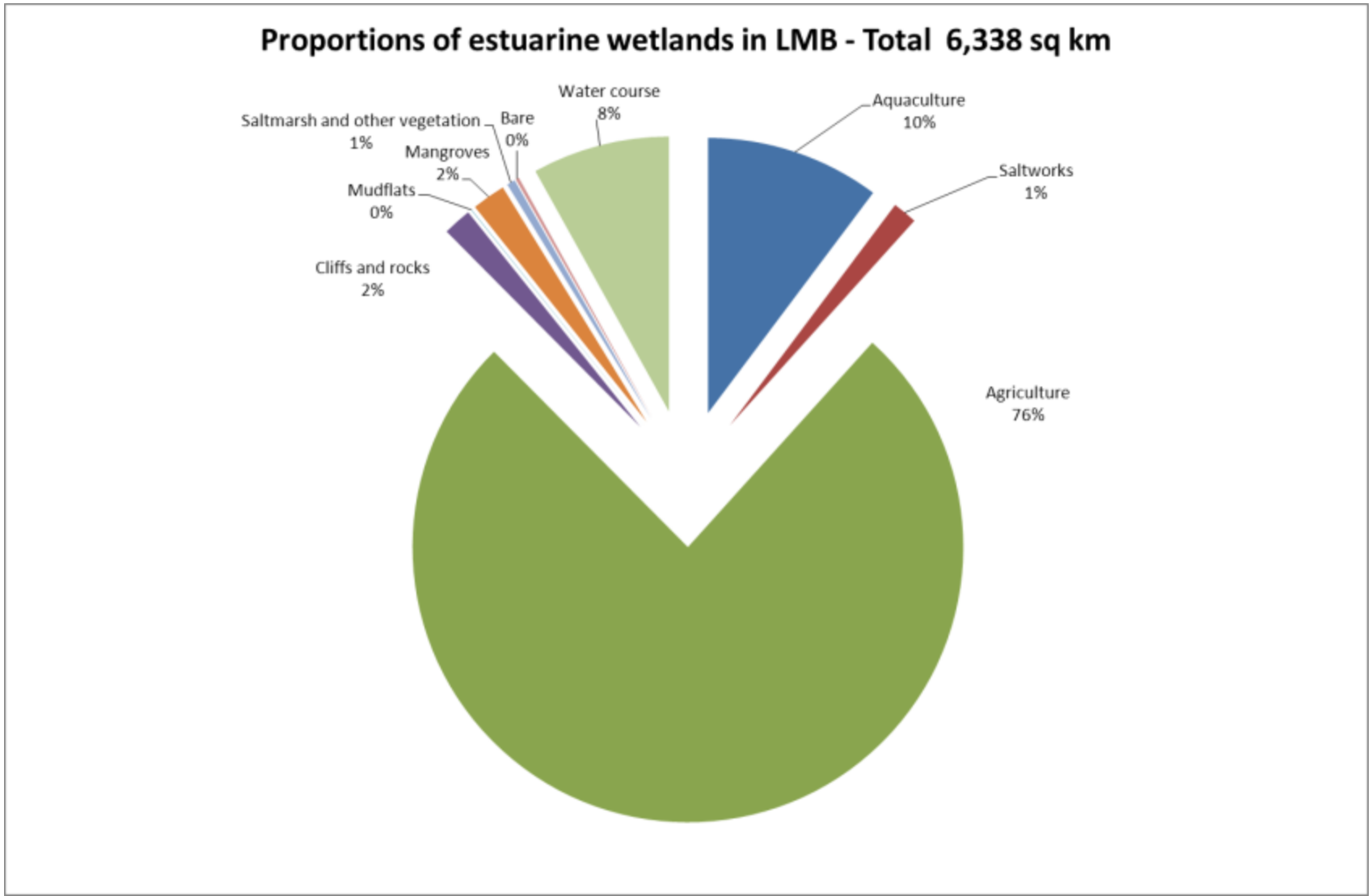
Lakes and Ponds in LMB



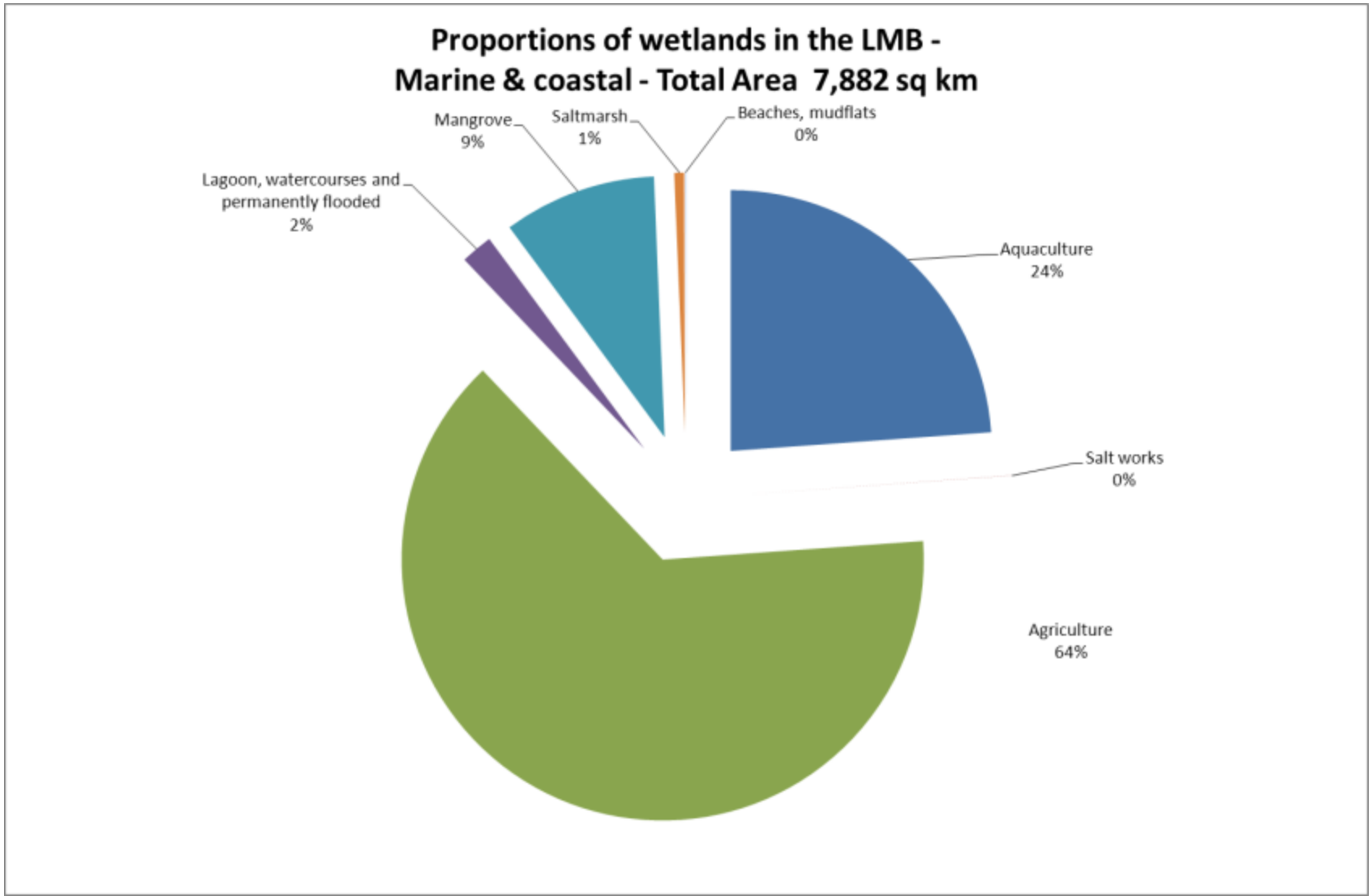
Riverine wetlands



Estuarine


Proportions of estuarine wetlands in LMB - Total 6,338 sq km
Water course 8%
Aquaculture 10%
Saltmarsh and other vegetation 1%
Bare 0%
Mangroves 2%
Saltworks 1%
Mudflats 0%
Cliffs and rocks 2%
Agriculture 76%

Marine and coastal wetlands



What are these man made wetlands?

Man Made wetlands	Area (ha)	%
Agriculture - Rice	18,049,371	90.86
Agriculture - Other wet crops	504,353	2.54
Aquaculture	253,268	1.27
Grasslands	5,552	0.03
Flooded forest plantations	10,578	0.05
Saltworks	9,218	0.05
Lakes and ponds - irrigation, hydropower, drinking water	214,359	1.08
Urban lake/ponds and wetlands	368,451	1.85
Man made artificial channels	449,451	2.26
Total	**19,864,602**	

For this study, we will focus on the **natural wetlands**

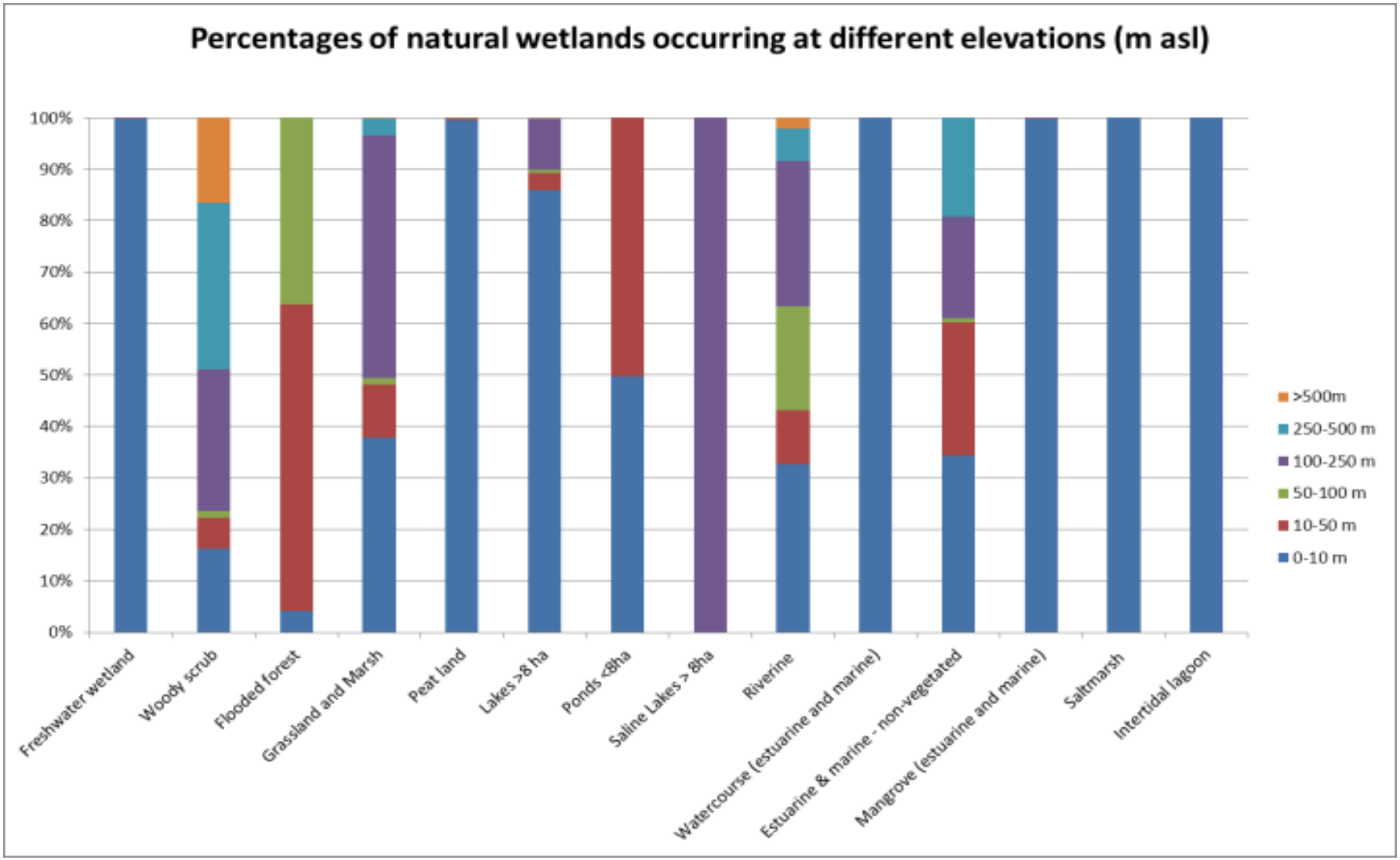
What are the natural wetlands?

Natural Wetland Type	Area in LMB (ha)	%
Freshwater wetland	43,201	0.78
Woody scrub	3,910,220	70.46
Flooded forest	7,549	0.14
Grassland and Marsh	482,597	8.70
Peat land	226,069	4.07
Lakes >8 ha	320,276	5.77
Ponds <8ha	1,519	0.03
Saline Lakes > 8ha	6,625	0.12
Riverine - natural channels, rapids, riffles, sand bars, waterfalls	377,582	6.80
Watercourse (estuarine and marine)	63,856	1.15
Estuarine & marine - non-vegetated, bare, cliffs and rocks and sand	14,900	0.27
Mangrove (estuarine and marine)	87,170	1.57
Saltmarsh	7,899	0.14
Intertidal lagoon	342	0.01
TOTAL	**5,549,806**	

Describing Natural wetlands

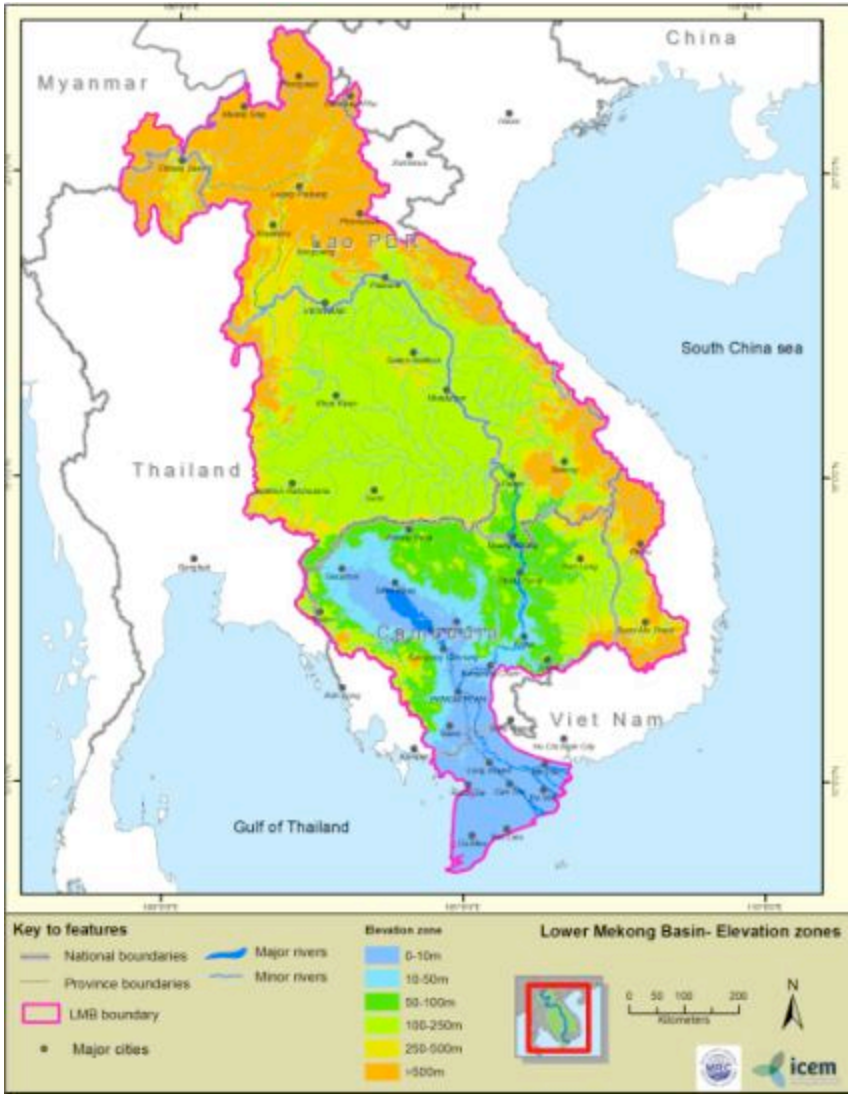
By Elevation
By Latitude
By Eco-Region
By Ecological Zone

Natural wetlands at different elevations



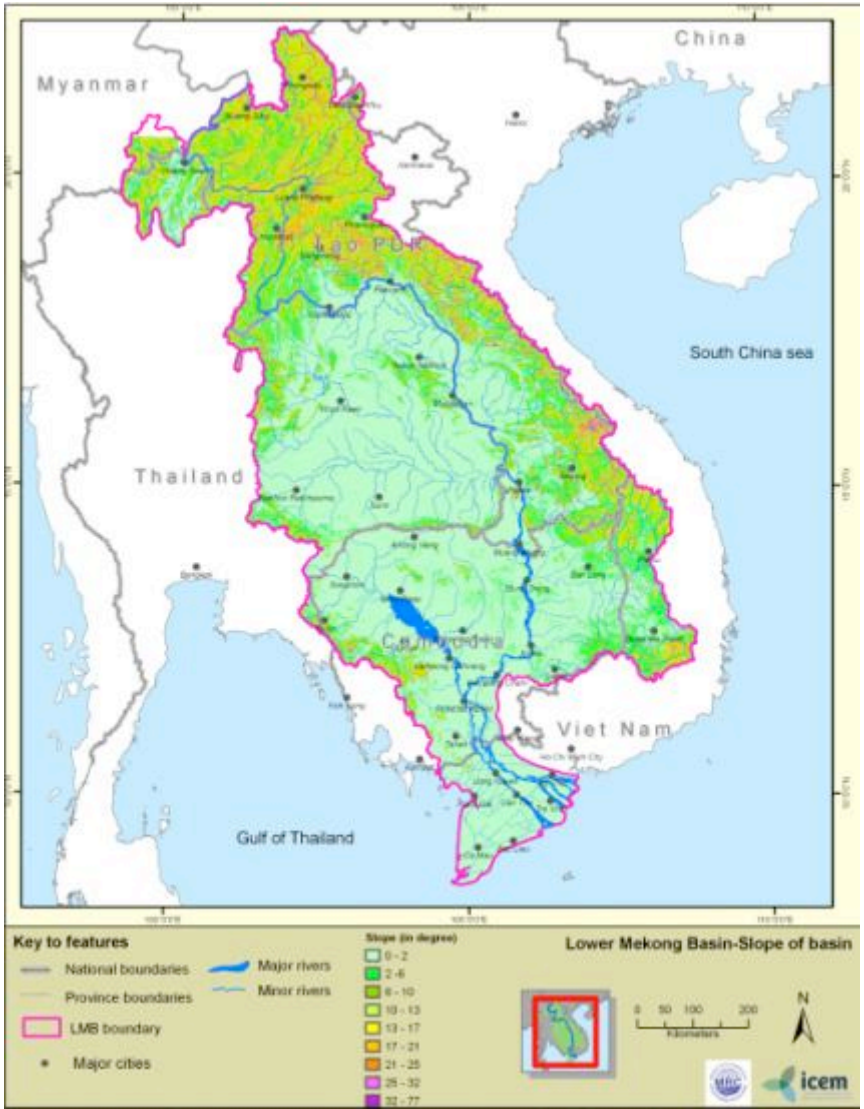
Wetlands by elevation

- Expected mangroves, salt marsh, intertidal lagoons etc at low elevation
- Non-vegetated estuarine wetlands are curiously spread out – cliffs and rocks – a data error?
- Riverine wetlands good spread – waterfalls mostly 100 – 250 m, rapids and riffles at 0 – 10m?
- Saline lakes – all at 100 – 250 m
- Ponds all at 0 – 50 m
- Lakes mostly 0 – 10 m, but also up to 250 m

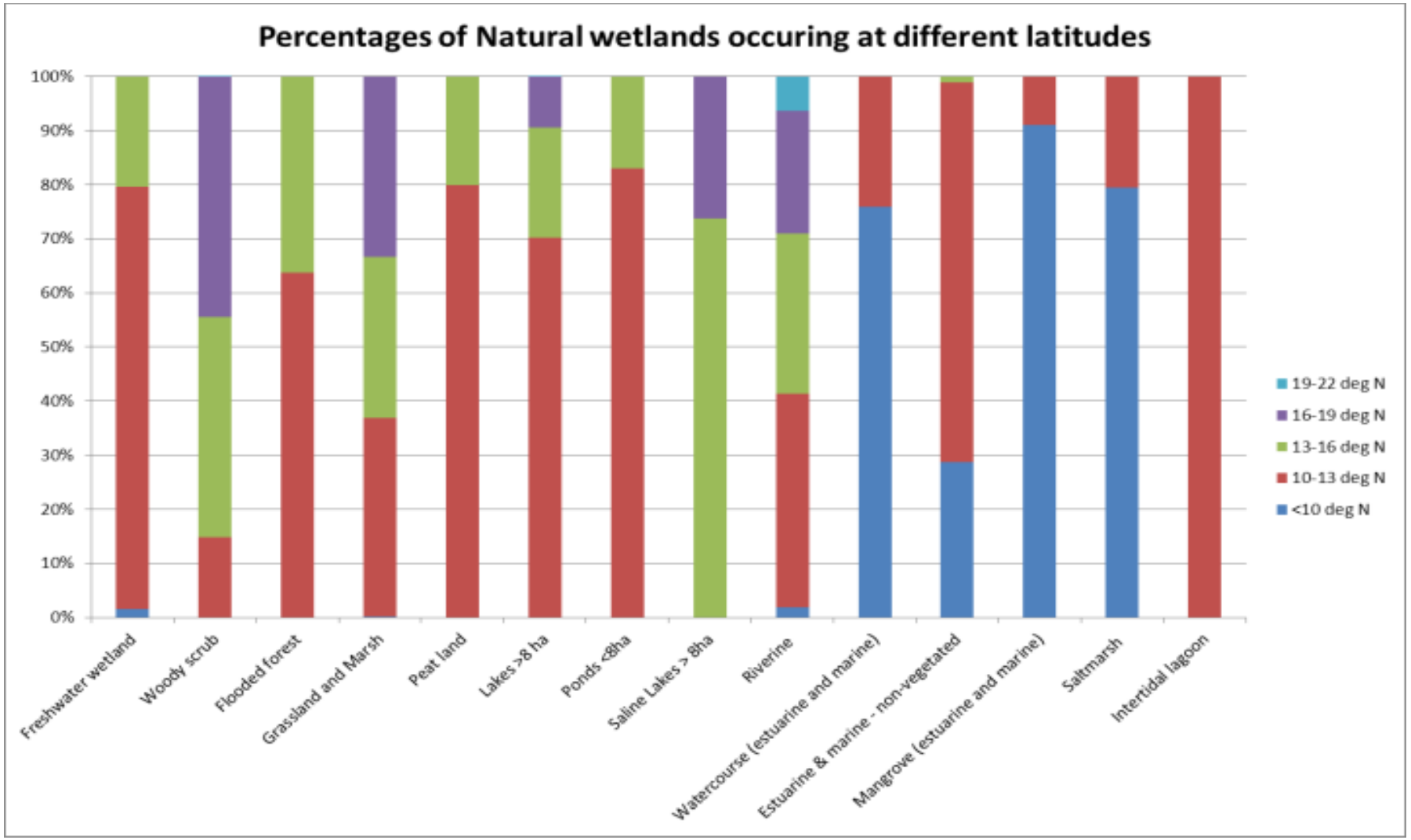


Slopes of catchments

- Peatland – all at 0 – 10 m
- Flooded forest – mostly 10 – 50 m but also up to 100 m
- Grassland – good spread but bulk are 0 – 10 m and 100 – 250 m
- Woody scrub – good spread at all elevations
- Freshwater wetland – all at 0 – 10 m

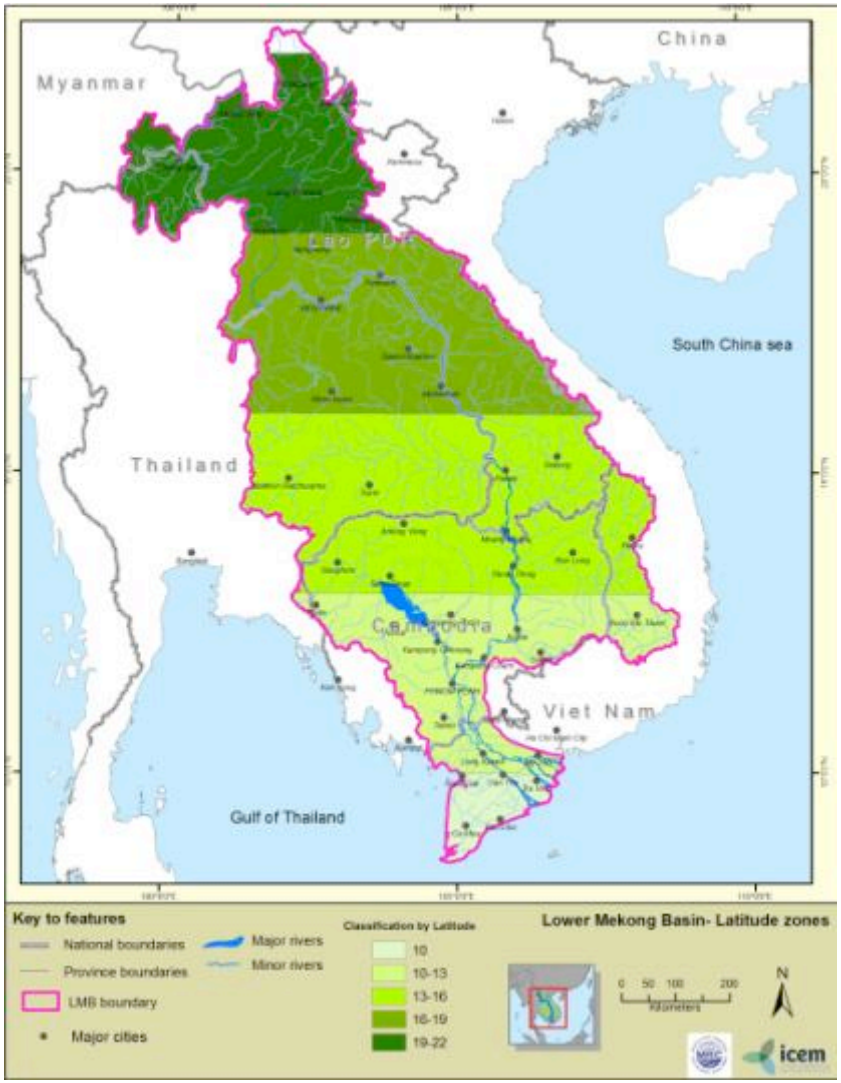


Natural wetlands at different latitudes

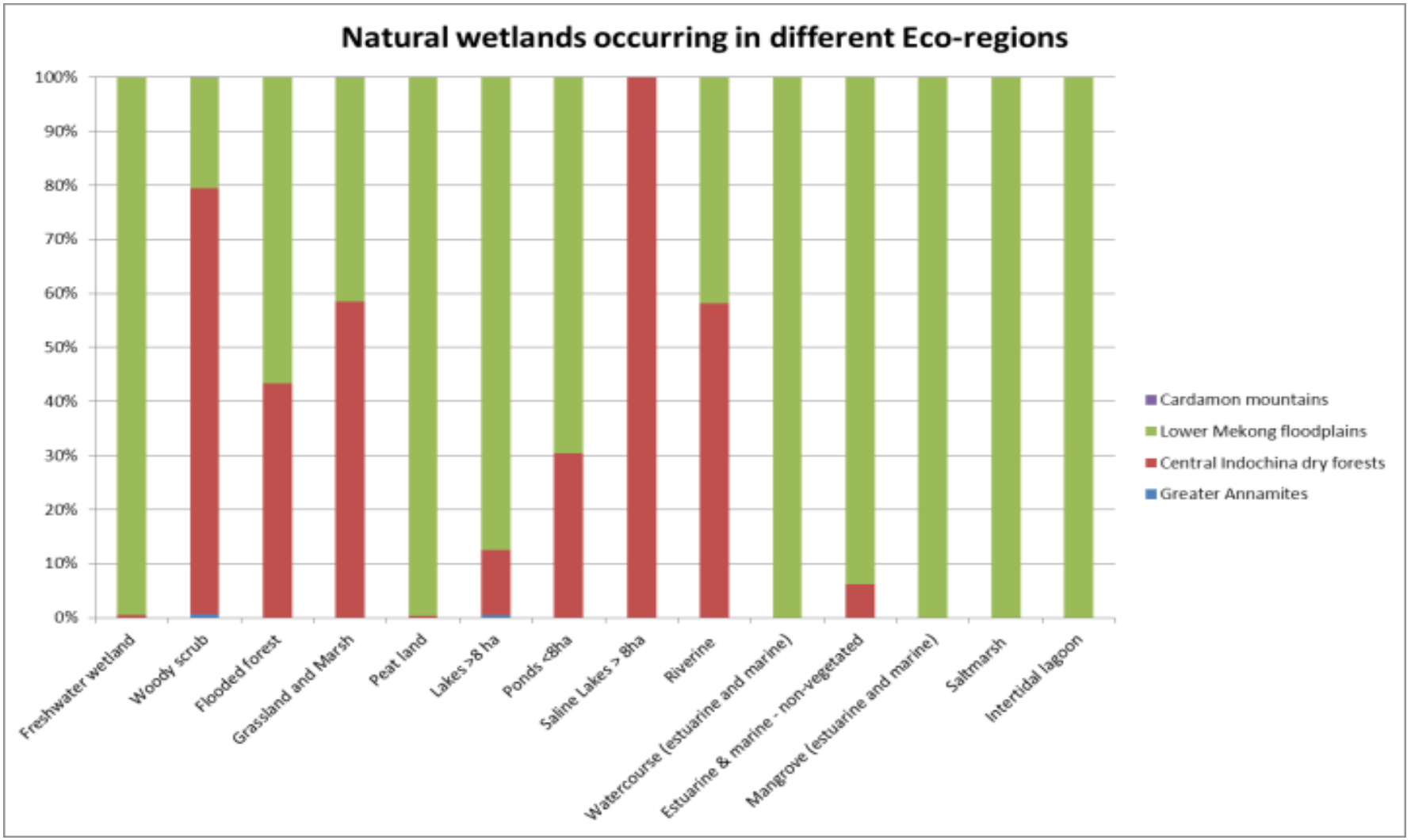


Wetlands at different latitudes

- Intertidal lagoons – 10-13 N
- Salt marsh – from <10-13 N
- Mangroves – mainly <10 N
- Non Vegetated marine – from <10 – 13 N
- Marine & estuarine watercourse - <10 – 13 N
- Riverine – good spread with waterfalls 16 – 19 N and rapids and riffles 10 -13 N
- Saline Lakes – 13 – 19 N
- Ponds – mainly at 10 – 13 N
- Lakes – mainly 10 -13 N
- Peatland – 10 – 13 N and 13 – 16N
- Grassland – even spread 10 – 19 N
- Flooded forest – 10 – 13 N
- Woody scrub – good spread 10 – 19 N
- Freshwater wetlands – mainly 10 – 13 N



Natural wetlands occurring in different Eco-regions



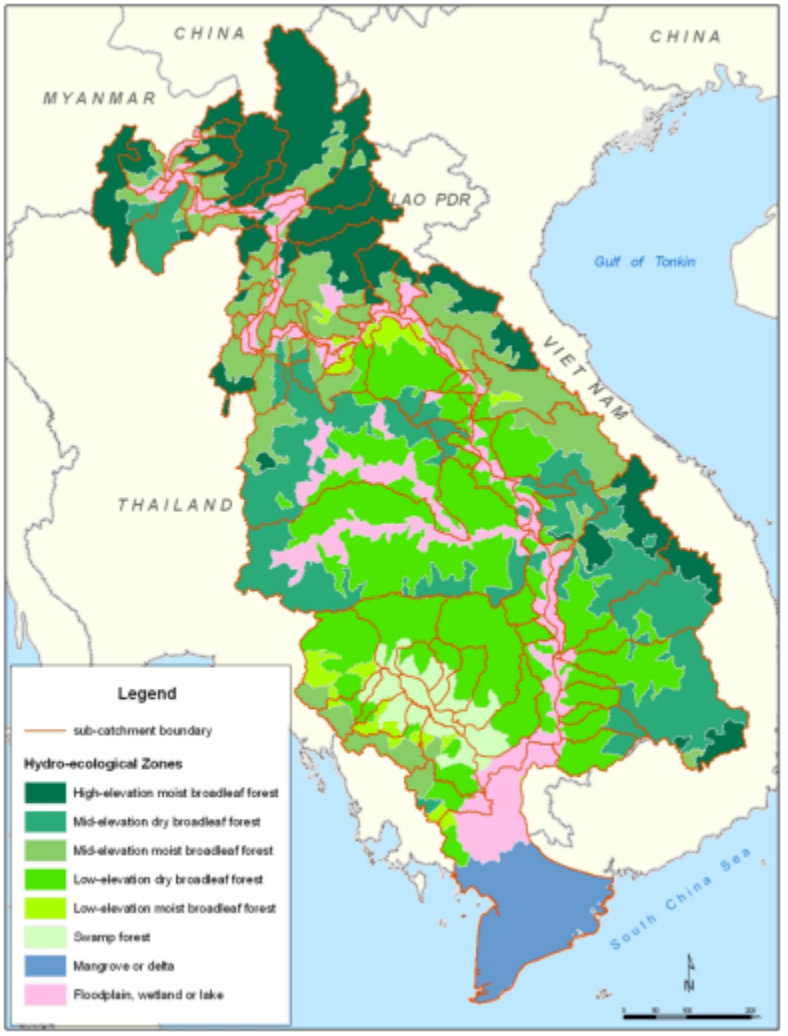
Wetlands in Lower Mekong floodplain and Indochina dry forests

- All the marine and estuarine wetlands fall into Lower Mekong Floodplain EZ
- Freshwater wetlands mostly in Lower Mekong Floodplain EZ
- Small areas of freshwater wetlands in Greater Annamites and Cardamon mountains EZs
- Riverine – mostly Dry forests EZ
- Saline Lakes all in Dry forests EZ
- Woody scrub, flooded forests and grasslands spread between LM Floodplains and I Dry Forests EZs

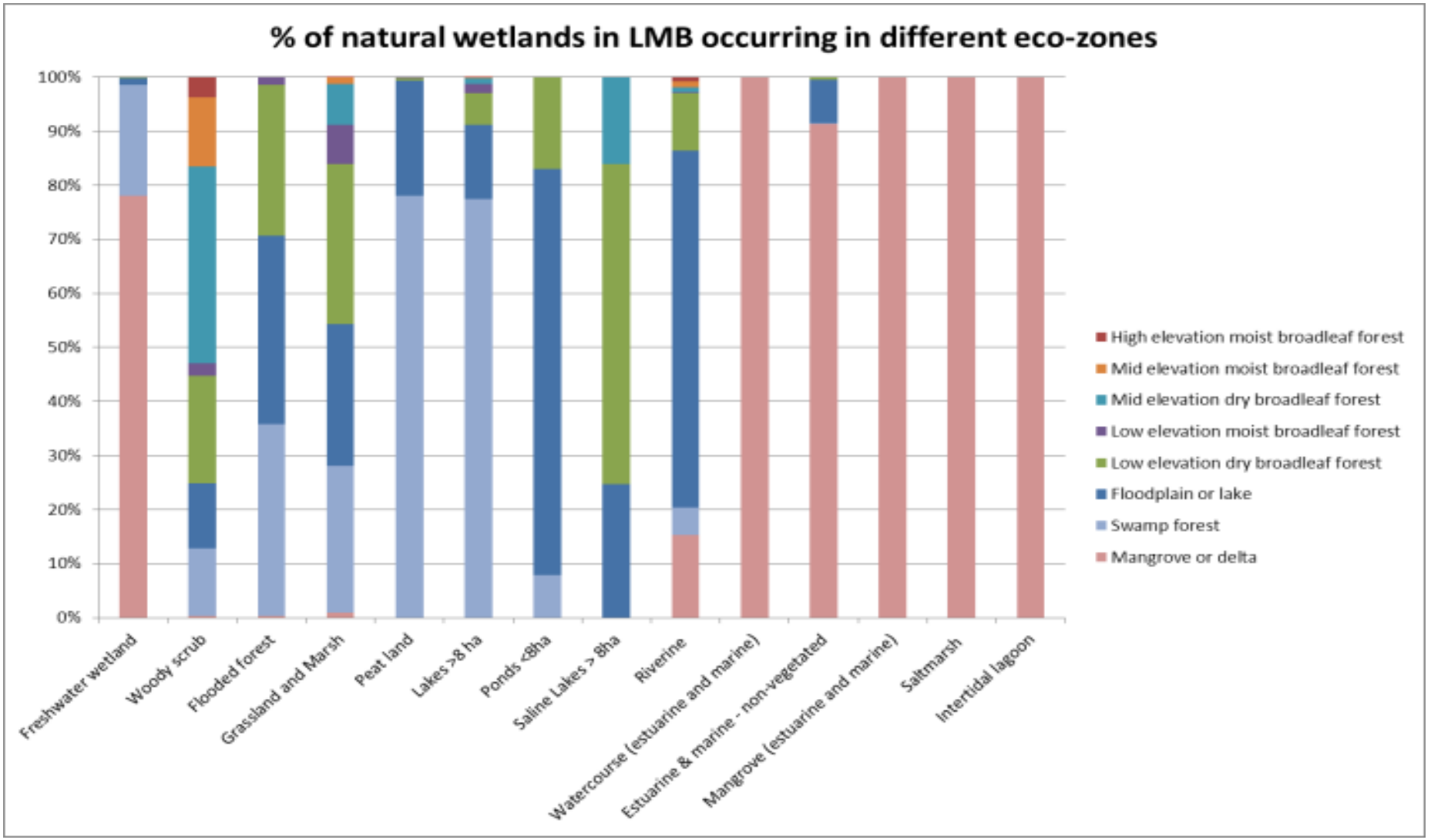
Ecological Zones

Developed by WWF in 2006 based on vegetation that would naturally grow there depending upon the latitude, elevation, soils and wetness:

- High elevation moist broadleaf forest (HEMB)
- Mid-elevation moist broadleaf forest (MEMB)
- Mid-elevation dry broadleaf forest (MEDB)
- Low elevation moist broadleaf forest (LEMB)
- Low elevation dry broadleaf forest (LEDB)
- Floodplain, wetland or lake (FWL)
- Swamp forest (SF)
- Mangrove or delta (MD)



Natural wetlands in LMB by ecological zone



Ecological zones

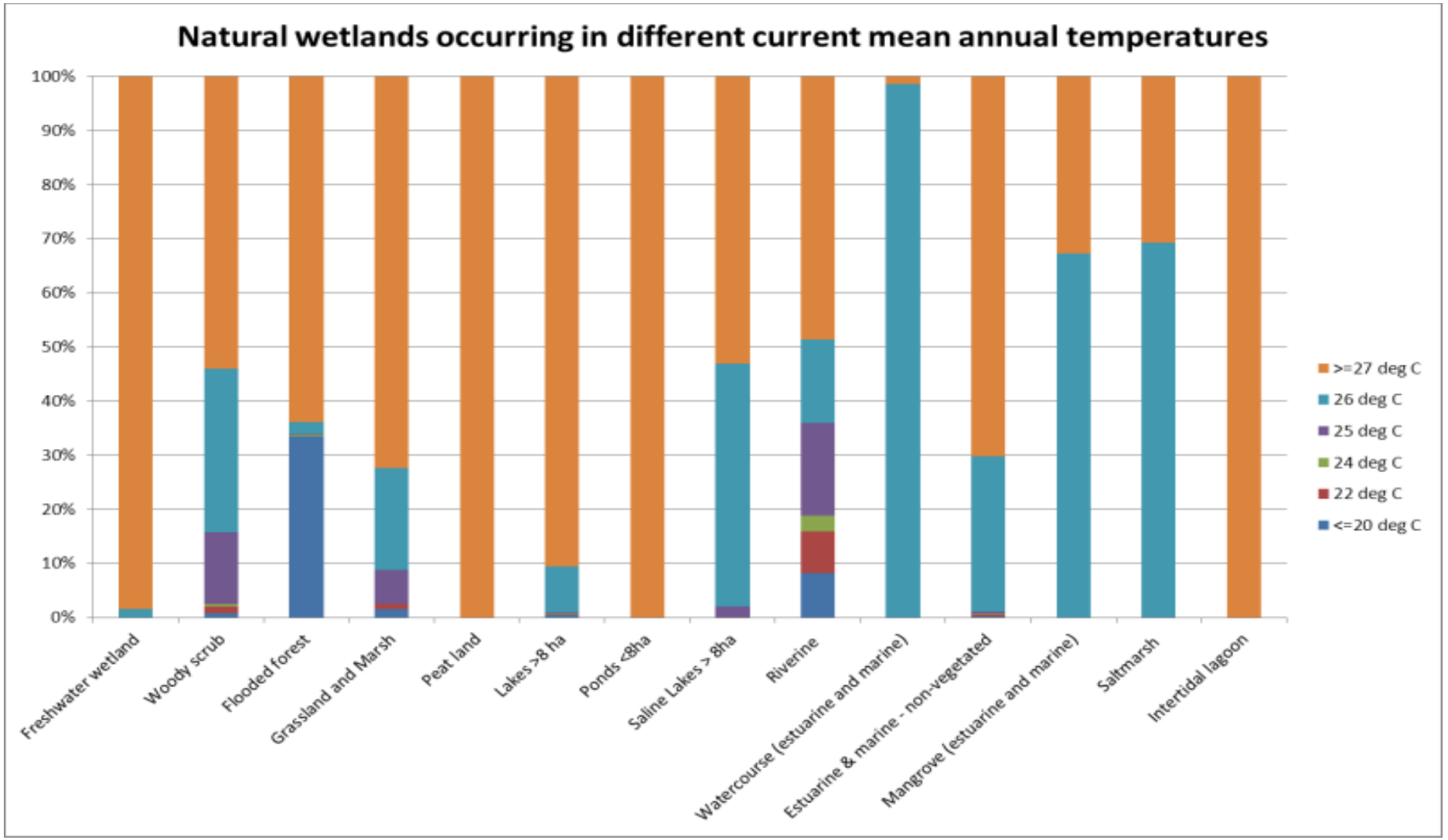
- All marine and estuarine wetlands fall into Mangrove and Delta
- Riverine – good spread across all ecozones but mostly in LEMB
- Saline lakes – floodplain (FWL) and LEDB
- Ponds – Mostly floodplain (FWL), some Swamp forest and LEDB
- Lakes – Mostly Swamp forest, and FWL
- Peat land – Mostly Swamp forest and floodplain
- Grassland – Good spread from Swamp forest to MEMB
- Flooded forest – Spread between Swamp, floodplain and LEDB
- Woody scrub – Good spread with all zones except for mangrove and delta
- Freshwater wetlands – Delta and Swamp Forests

Describing natural wetlands by current climate

By current mean annual temperature

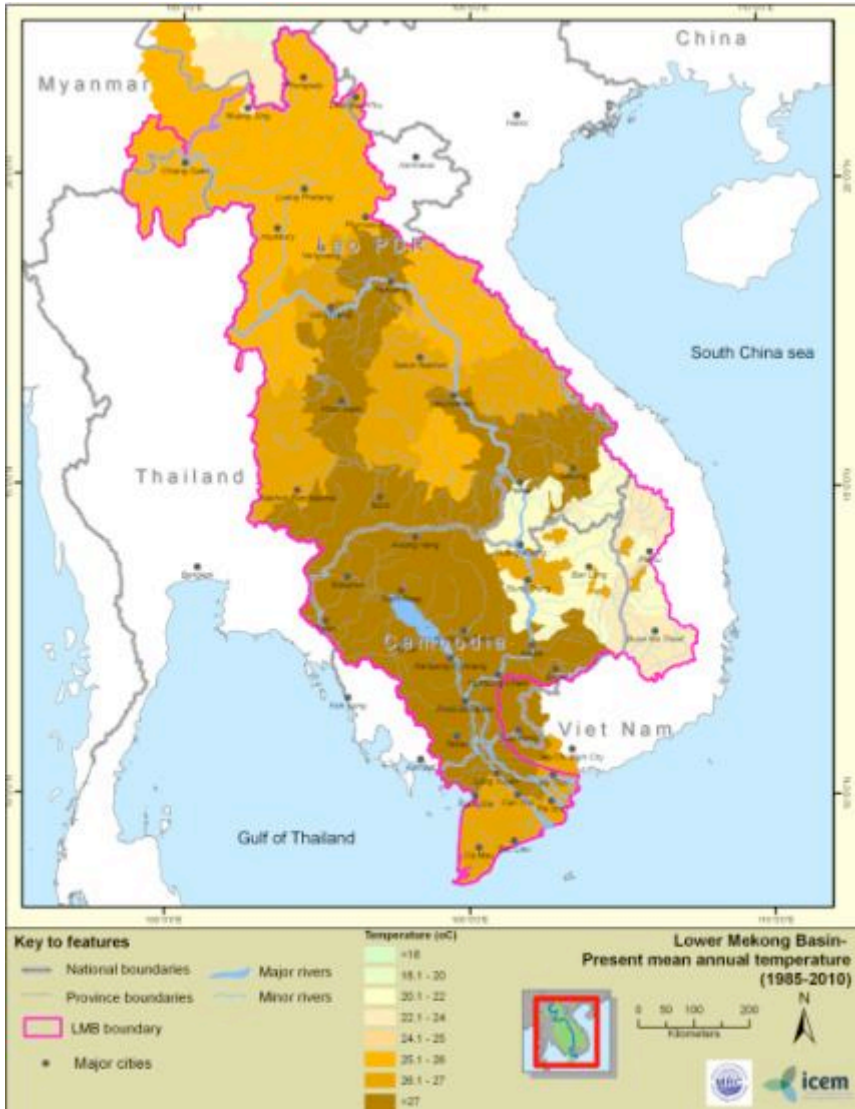
By current mean annual rainfall

Natural wetlands occurring in different mean annual **temperatures**

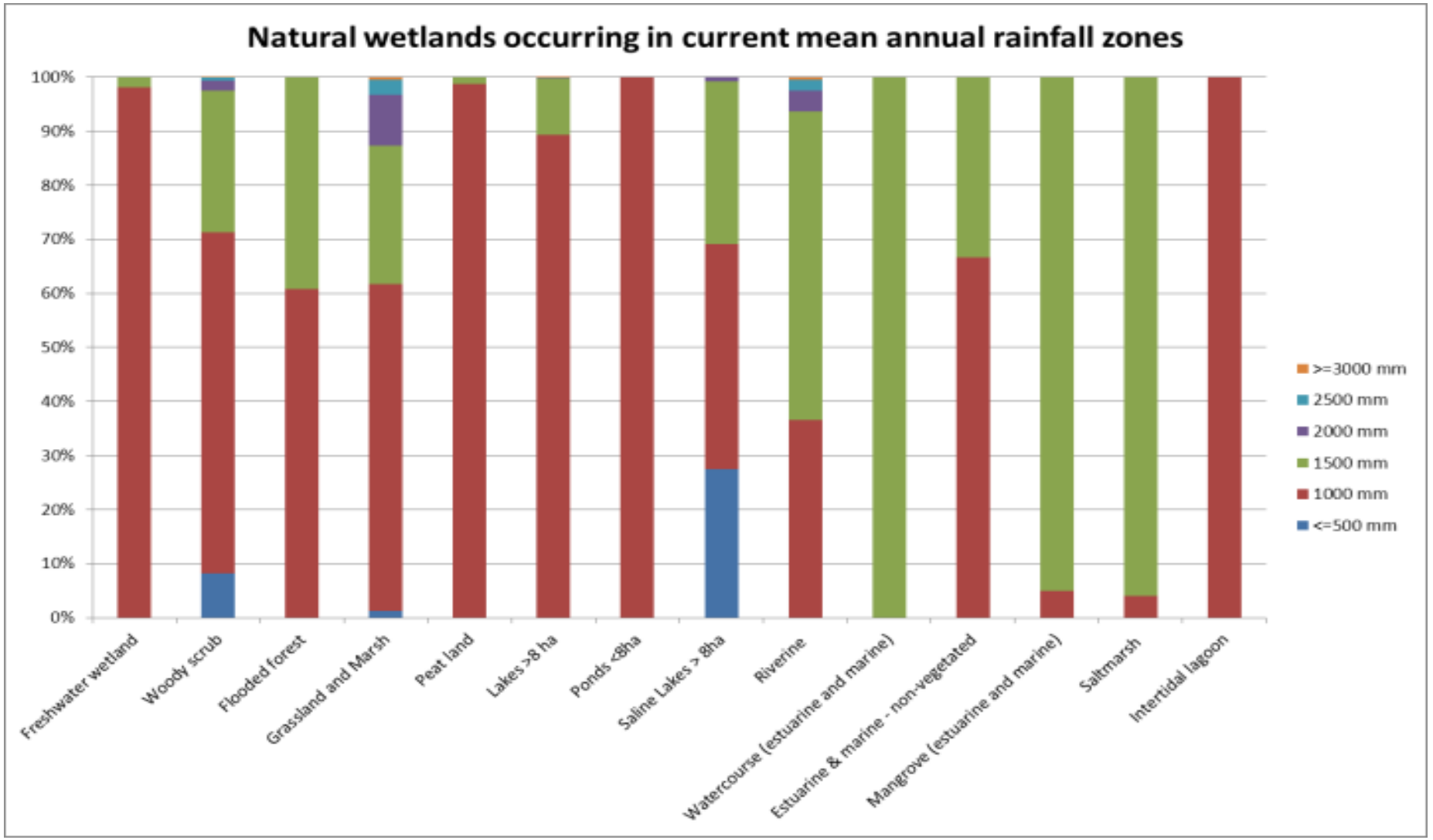


Wetlands and Current mean annual temperature

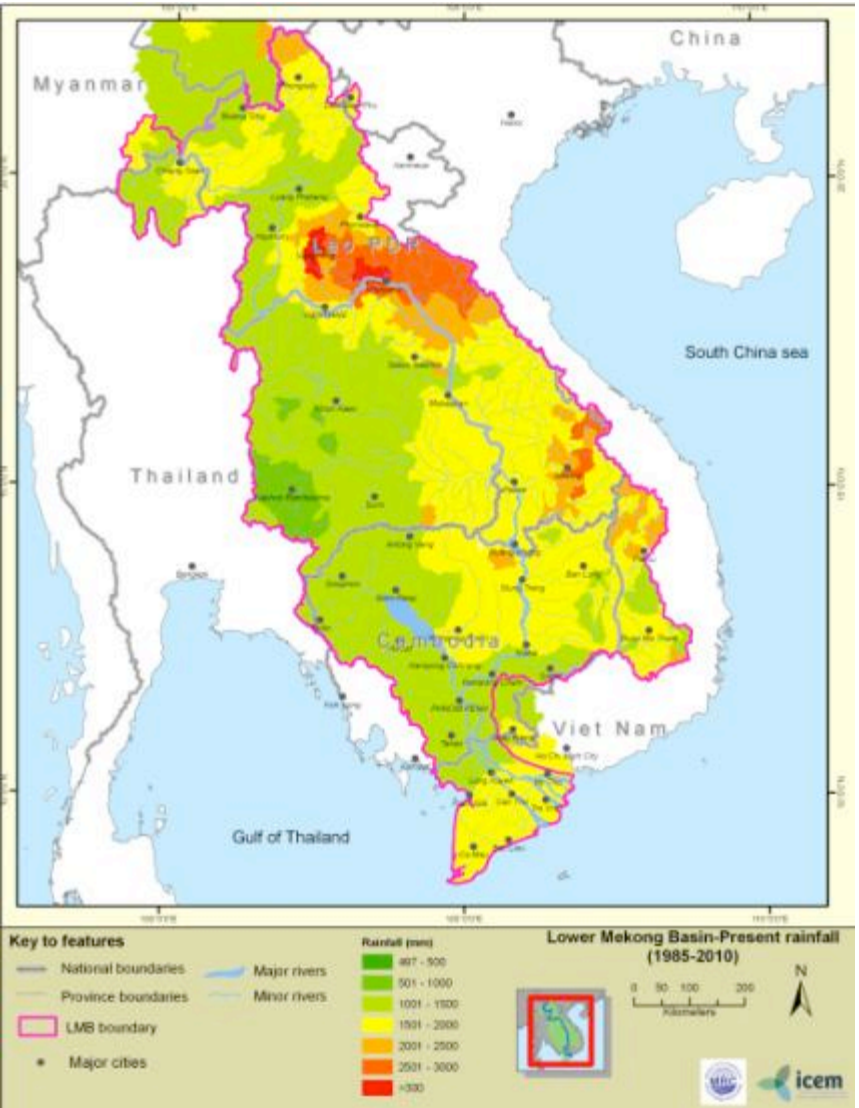
- Freshwater wetlands and Intertidal lagoons all >27 C
- Also Ponds, Peatland & most of Lakes > 27 C
- Estuarine watercourses 26 – 27 C
- Saltmarsh, mangroves, Est. & Mar non vegetated – all split between 26 – 27 and >27 C
- Saline lakes – v small area 25 – 26 C, half 26 – 27C and half >27 C
- Riverine – good spread over all temperature zones
- Woody scrub – mostly >27 C, some in 26 – 27 C and in other temp. zones
- Flooded forest – Mostly >27 C or 25 – 26 C, with small area in 26 – 27 C



Natural wetlands occurring in different mean annual **rainfall** zones



Wetlands and current mean annual rainfall



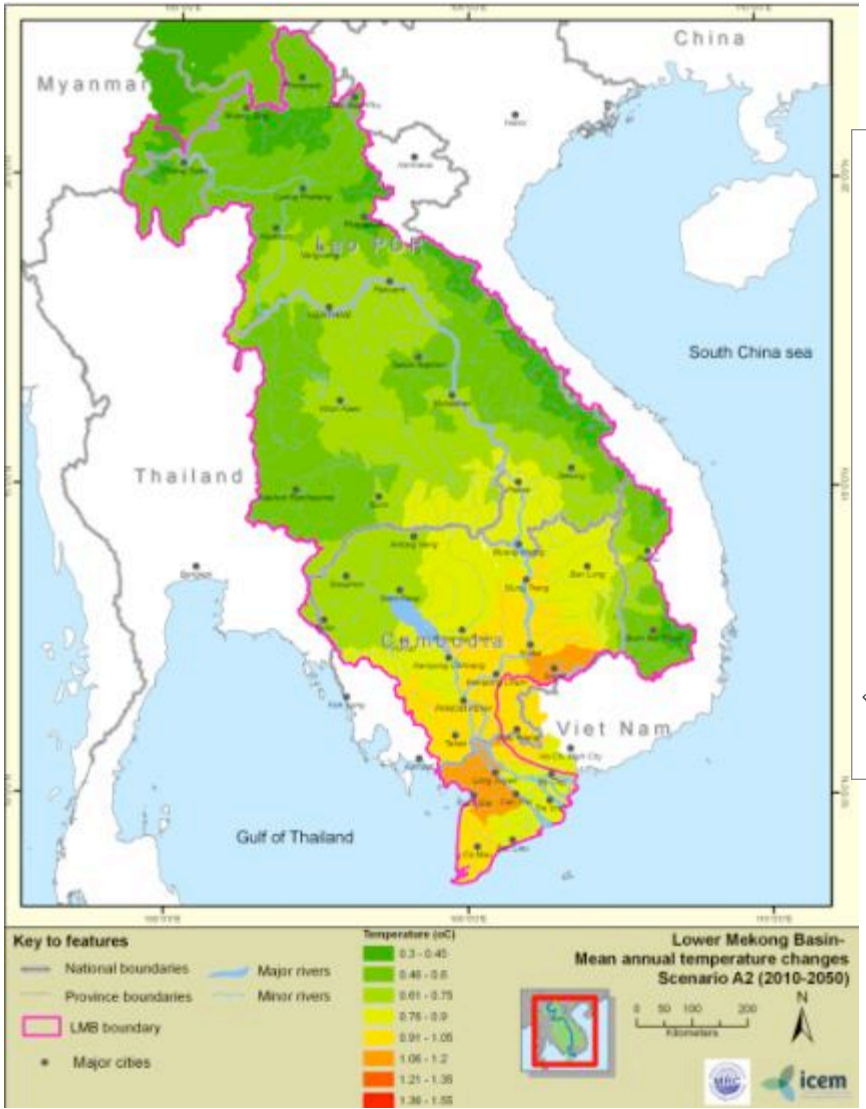
- Freshwater wetlands and intertidal lagoons all at 500 – 1000 mm
- Ponds, most of Lakes and Peatland at 500 – 1000 mm
- Saltmarsh, Marine & Est. watercourses, mangroves mostly all 1000 – 1500 mm
- Riverine – good spread, though mostly 500 – 1000 and 1000 – 1500 mm
- Saline lakes 1/3rd <500 mm, 500 – 1000 mm and 1000 – 1500 mm
- Grassland – spread but mostly 500 – 1000 mm
- Flooded forest – 2/3rd 500 – 1000 mm, 1/3rd 1000 – 1500 mm
- Woody scrub – small < 500 mm, 2/3rd 500 – 1000 mm and 1/3rd 1000 – 1500 mm

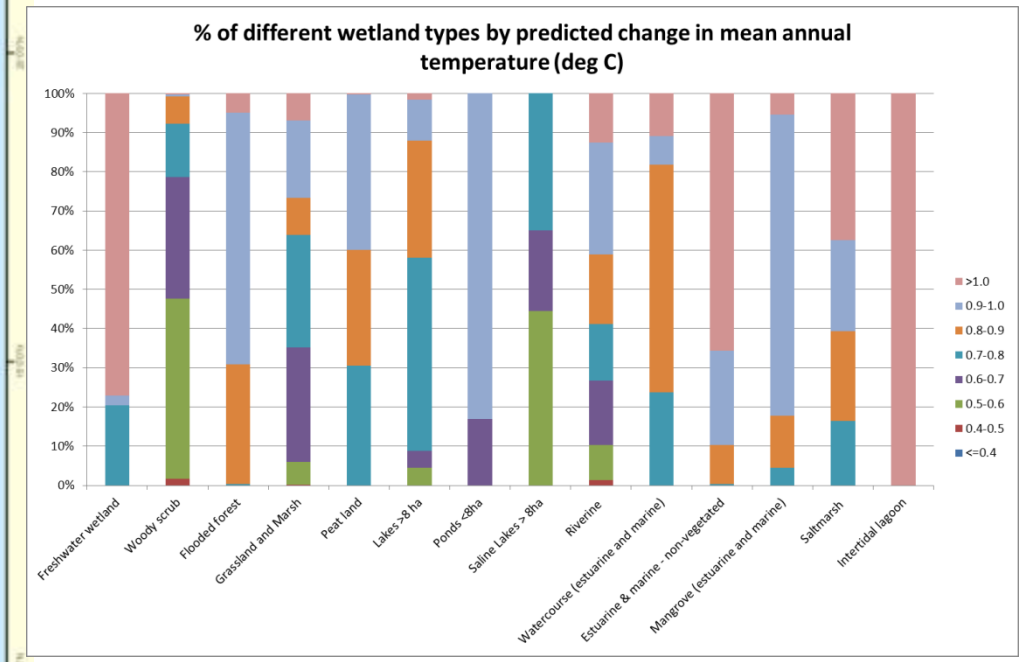
Analysing wetlands by the threats of climate change

By predicted changes in mean annual temperature

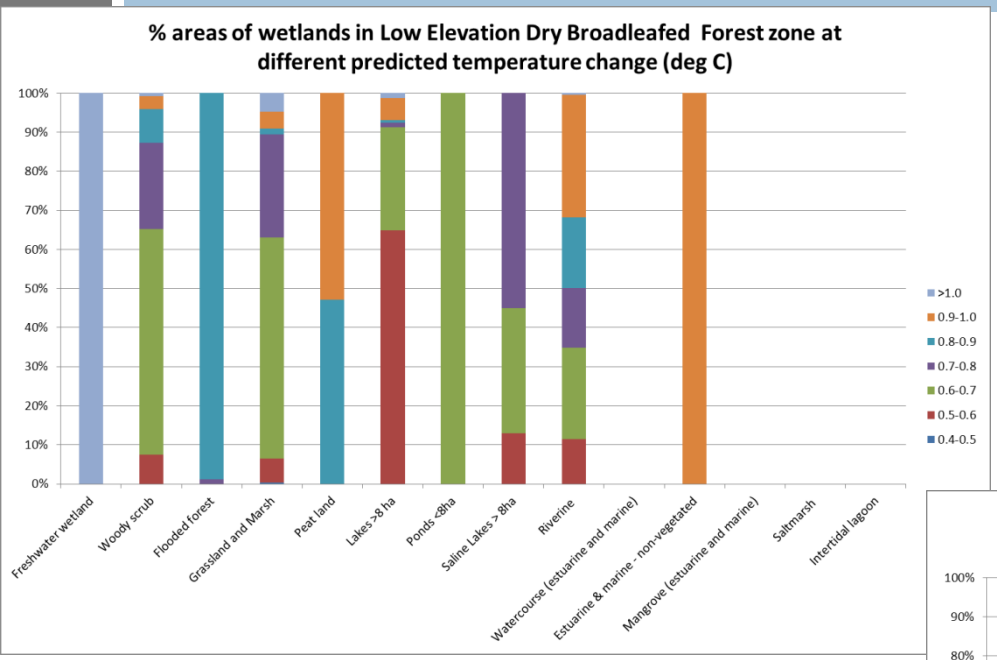
By predicted changes in mean annual rainfall

Predicted changes in temperature



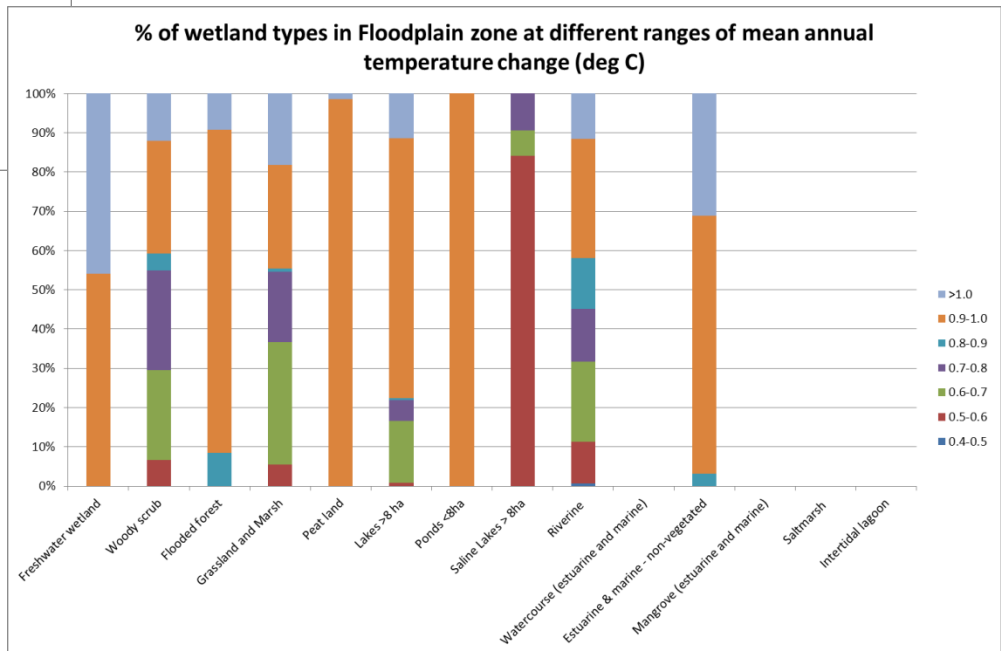


Areas of wetlands by ecozone and predicted temperature change

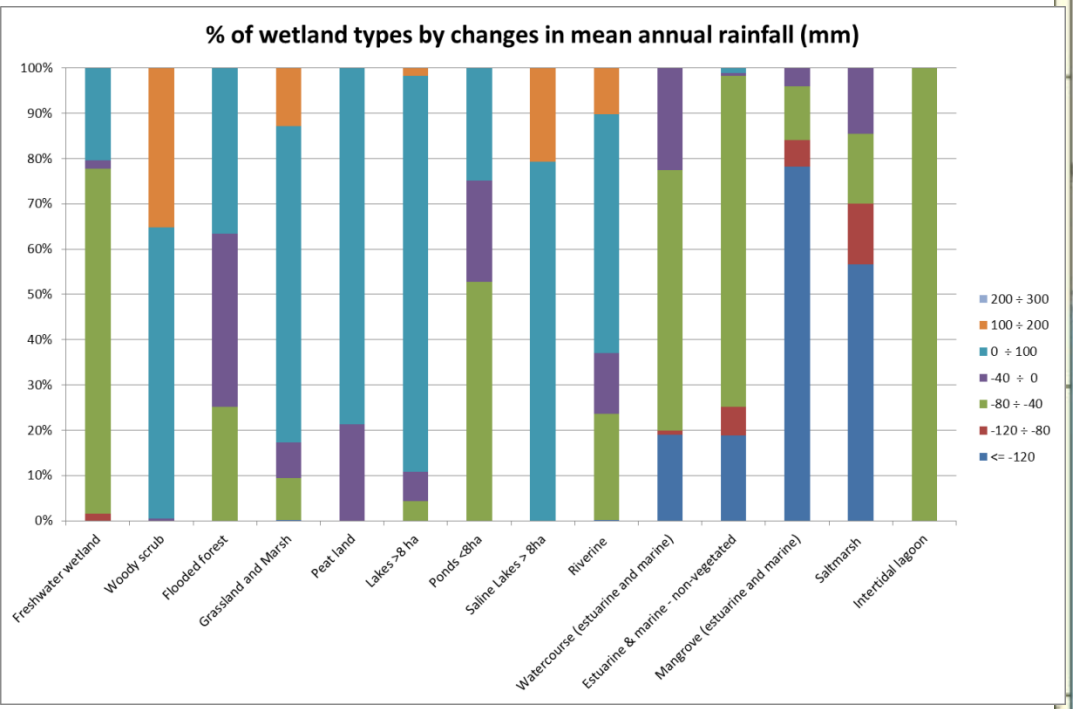


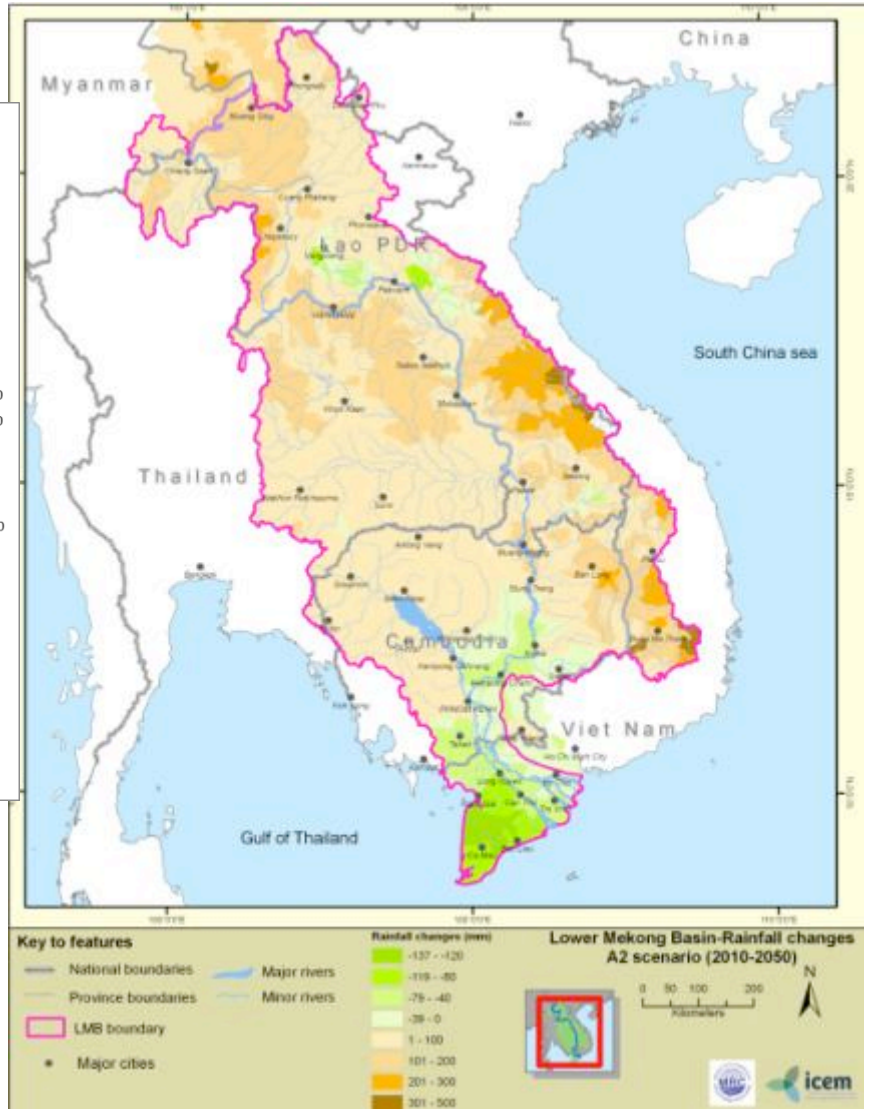
Low Elevation Dry Broadleafed Forest

Floodplain and Lake Zone

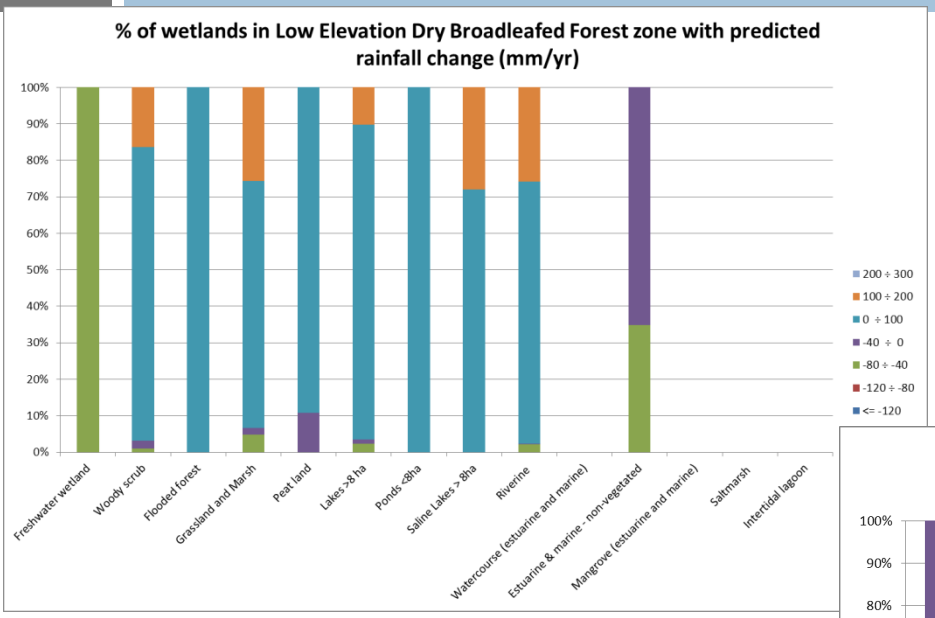


Predicted changes in rainfall



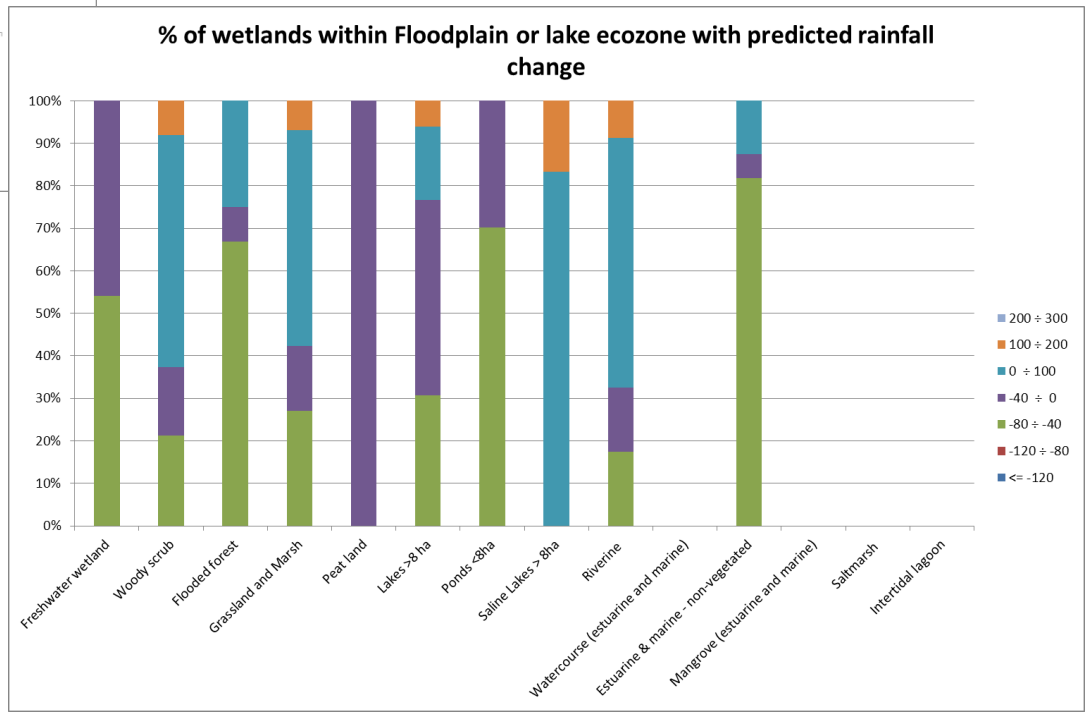


Area of wetlands by ecozone and predicted rainfall change



Low Elevation Dry Broadleafed Forest

Floodplain and Lake Zone



What do we do with this wetland analysis?

Case study Selection criteria

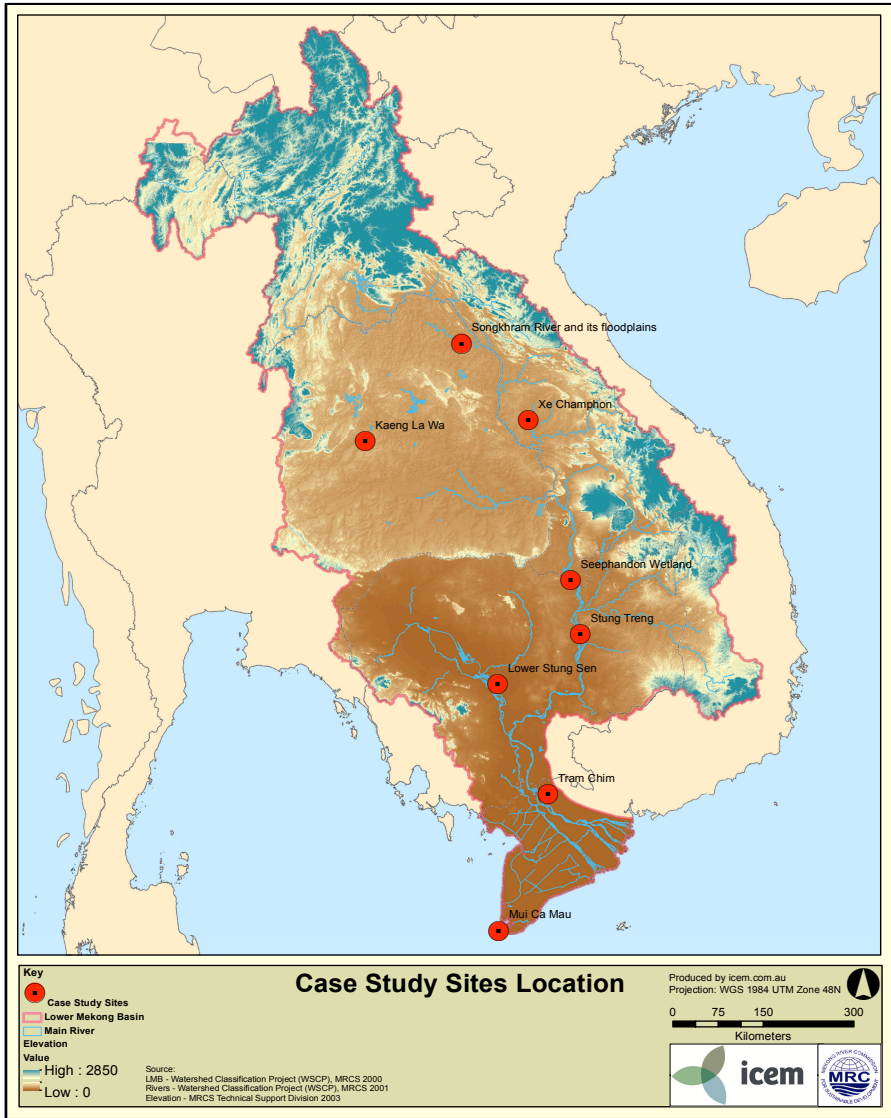
Representative of wetland types

Comparing wetlands by their hydrology

Upscaling of adaptation to similar wetland types

Wetland case study sites

- Case study sites chosen to be:
  - Representative of wetland types
  - Importance of the wetland for biodiversity and human use
  - With good information base
  - Reasonable access
  - History of previous work
- Case study sites selected during 1st Regional Workshop
- Thai case study sites still to be selected



Wetland Type	Cambodia	Lao PDR	Thailand	Vietnam
Seasonal flooding wetlands:				
▪ Flooded forest	**Stung Treng** **Lower Stung Sen**	**Siphandone - mainstream**	**XX1**	**Tram Chim**
▪ Floodplain marshes and swamps	**Lower Stung Sen**	**Xe Champhone**	**XX1** **XX2**	**Tram Chim**
▪ Floodplain grasslands	**Lower Stung Sen**	**Xe Champhone**		**Tram Chim**
▪ *Peat lands*		**Xe Champhone**		
Permanently flooded lakes and ponds:				
		Xe Champhone	**XX2**	
Man-made/regulated:				
▪ *Reservoirs*				
▪ Rice fields		**Xe Champhone**	**XX1**	**Tram Chim**
▪ *Fish ponds and aquaculture*				
▪ *Urban wetland*				
Rivers:				
▪ River/streams	**Lower Stung Sen**	**Xe Champhone** **Siphandone**	**XX2**	
▪ River /streams with pools and rapids	**Stung Treng**	**Siphandone - mainstream**	**XX1**	
Coastal and marine wetlands:				
▪ *Saline lakes/ pond marsh/ swamp*				
▪ Mangrove forest				**Ca Mau**

Comparing wetlands by hydrology

- Wetlands on Mekong mainstream
  - Siphandone
  - Stung Treng
- Wetlands affected by Mekong mainstream flows and floods
  - Lower Stung Sen
  - Tram Chim
- Wetlands on tributaries not affected by Mekong mainstream
  - Xe Champhone
- Coastal wetlands affected by Mekong after it has reached the sea
  - Mui Ca Mau
- Plus Thailand case study sites? Representing
  - Northern tributaries of Mekong and associated marshes
  - Dry west side of LMB
  - Saline lakes
  - Upland lakes

Upscaling of adaptation measures

- Each of these layers of analysis may not be very useful by themselves
- Taken together they will help us to compare similar types of wetland in different situations e.g.
  - Riverine at different eco-zones
  - Flooded forest at different altitudes
- Identify rare and unique types of wetland – peat swamps and saline lakes
- Identify wetlands that occur in small patches in special ecoregions – freshwater wetlands in Cardamon mountains or Greater Annamites
- Identify wetland types and locations that are at higher risk of climate changes than others