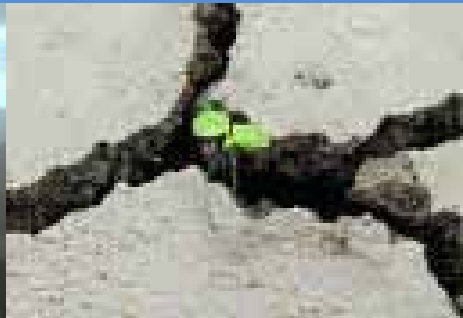


Union of Myanmar
Ministry of Agriculture and Irrigation
Irrigation Department

Climate Change Impacts to the
Water Environment and Adaptation
Options

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March ,2010



Outline of Presentation

- General
- Status of water resources
- Potential Impacts in Myanmar
- Water resources development works
- Potential climate change impacts to the water environment
- Adaptation
- Conclusion



General



Total area – 67.65 million hectares
(656500 sq-km)

There are three seasons
(Dry, Rainy, Cold)

Annual Rainfall :

Southern part - 2500mm -5000 mm

Delta region - 2200 mm – 3750 mm

And Zone - 1000 mm

Rainy Days

Northern Part - 75~100 days

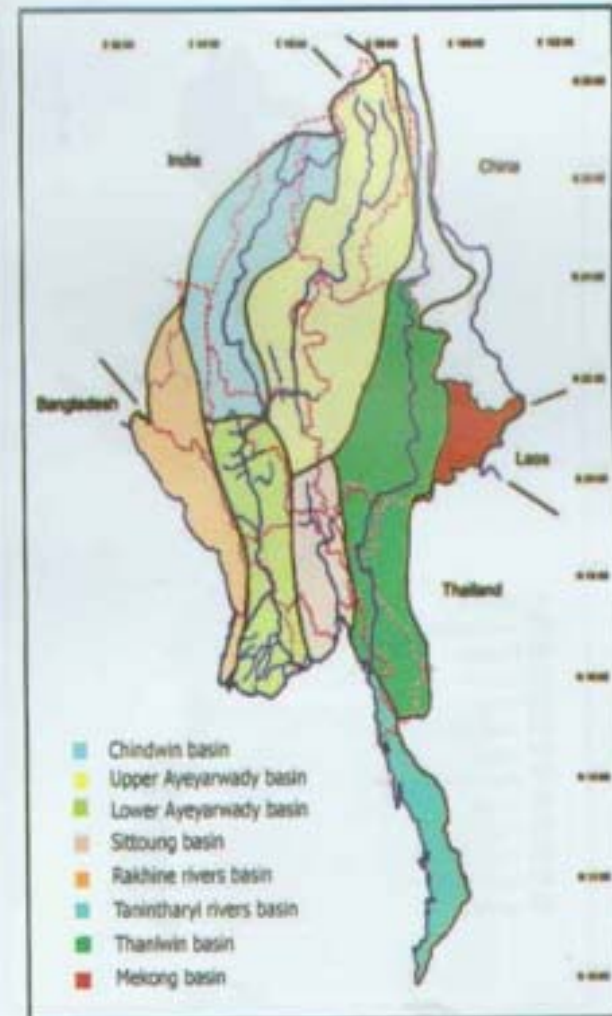
Arid Zone - 30 ~40 days

Water Resources

Annual Surface and Groundwater Potential in Myanmar

Sr	River Basin Number	Name of Principal River Basin	Catchment area for each stretch (thousand sq.km)	Average estimated annual surface water (km ³)	Estimated groundwater potential (km ³)
1.	I	Chindwin River	115.30	141.293	57.578
2.	II	Upper Ayeyarwaddy River (up to its confluence with Chindwin River)	193.30	227.920	92.599
3	III	Lower Ayeyarwaddy River (From confluence with Chindwin to its mouth)	95.60	85.80	153.249
4.	IV	Sittoung River	48.10	81.148	28.402
5.	V	Rivers in Rakhine State	58.30	139.245	41.774
6.	VI	Rivers in Taninthari Division	40.60	130.927	39.278
7	VII	Thanlwin River (From Myanmar boundary to its mouth)	158.00	257.918	74.779
8.	VIII	Mekong River (Within Myanmar territory)	28.60	17.634	7.054
		TOTAL	737.80	1081.885	494.713

Drainage Basins of Myanmar



Potential Impacts in Myanmar



- In coastal area and delta
 - Cyclone (Storm), flood
 - change of rainfall pattern and intensity
 - moving of shore line
 - sea water intrusion
- Middle part (Central Dry Zone)
 - drought (non-rainy days, 2-3 weeks)
 - annual rainfall is less than normal
 - lesser inflows into the reservoirs

Water Resources Development Works

- to boost mainly agricultural production
- to increase irrigated area
- Implemented 230 water resources projects after 1988
- Implemented polders and sluice in delta

Dry Zone Area

- to ensure getting sufficient for the cultivation of crops.
- to keep greening the environment
- to supply drinking water to local people

Delta and coastal Area

- to control the sea water intrusion
- to mitigate of flood impacts
in the flood prone region

Potential Climate Change Impacts

- Delta Area
 - Flooding
 - Farmland, towns and cities (protected by embankments)
 - Storms (cyclone)
 - Cyclone Mala(2005) and Nargis (2008)
- Dry Zone Area
 - decrease of annual rainfall
 - rising temperature
 - lesser inflows into reservoir
 - water scarcity



လေ့ထွားပြိုကွက်၊ လေဘေးသင့်ကျေရာ တစ်ရွာအားဖြင့်တွေ့ရမည်။

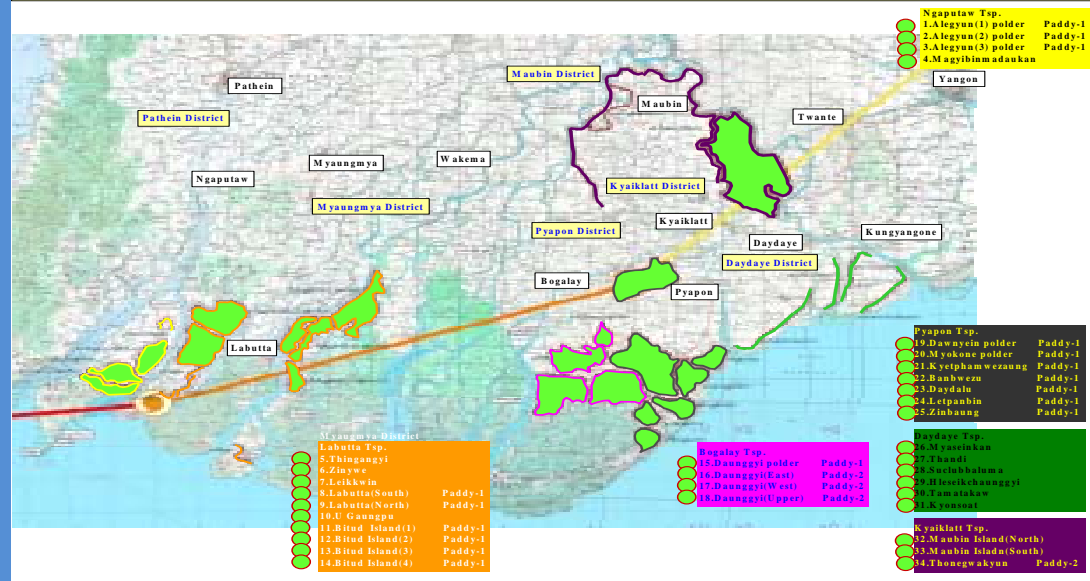
Damage of Embankments /Polders



- Total length 1079 km (11.562 million m³)
 - Damaged Embankments/Polders
- Ayeyarwaddy Division
20 polders
14 embankments (along the coastal line)
- Yangon Division
7 embankments



Location map of Polders and Embankments damaged by Cyclone Nargis in Ayeyarwaddy Division



Potential Climate Change Impacts to the Water Environment Storm History in Delta and Coastal Area

No	Name	Date	Peak Surge(m)	Land fall point	Death toll	Losses estimated (kyats)
1	Sittwe Cyclone	7.5.1968	4.25	Near Sittwe	1037	800million
2	Pathein Cyclone	7.5.1975	3.00	Near Pathein	304	776 million
3	Gwa Cyclone	4.5.1982	3.70	Near Gwa	31	38 million
4	Maungdaw Cyclone	2.5.1994	3.66	Near Maungdaw	10	78 million
5	Mala Cyclone	29.4.2006	4.57	Near Gwa/Yangon	37	1264 million
6	Akash Cyclone	14.5.2007	-	Rakhine State	14	589 million
7	Nargis Cyclone	2.5.2008 to 3.5.2008	7.02	Ayeyarwady/ Mon Yangon	138000	11 Trillion

Location of Project Sites



Kyetmauktaung Dam

Nankathu Dam

Nankathu Dam Project

- Location - Ayeyarwady Division
- Project Term - 1995-1996 to 2000-2001
- Provided Spillway
 - Service Spillway - 150 ft (45.72 m)
 - Emergency Spillway - 120 ft (36.57 m)
- After biggest flood (2006)
 - Head over spillway crest - 10.6 ft (3.23 m)



New Emergency Spillway (Nankathu Dam)



Kyetmauktaung Dam

Location

-

Mandalay Division

Year	Rainy day	Rainfall	
		(inch)	(mm)
1988	78	43.93	1115.8
1989	71	37.25	946.5
1990	72	31.26	794.0
1991	83	36.28	921.5
1992	72	33.82	860.0
1993	67	28.21	716.0
1994	69	33.64	855.0
1995	84	40.92	1040.0
1996	74	35.68	906.0
1997	51	29.99	761.0

Year	Rainy day	Rainfall	
		(inch)	(mm)
1998	31	26.65	676.0
1999	70	38.23	971.0
2000	56	34.88	885.0
2001	52	33.51	851.0
2002	68	40.92	1039.0
2003	39	26.10	662.0
2004	39	26.36	669.0
2005	56	31.77	806.0
2006	48	42.43	1077.0
2007	46	29.13	739.0

Adaptation

- Delta and Coastal Region
 - To reserve wet land and mangrove forest
 - To restore the watershed
 - To introduce emergency spillway
- Dry Zone Region
 - To launch greening project (JICA, NGOs, helping)
 - Afforestation in watershed
 - Introducing modulating dams upstream
 - Natural disaster warning system
 - Worked out emergency preparedness plan



Conclusion

- Concerning with the climate change impacts on water environment, while insufficient or aging infrastructure is a challenge for both, financing, strengthening capacity and improving legal frame works are core concerns particularly in developing countries as Myanmar.
- Participation in Seminar, Workshop and cooperation programs of climate change has to be done to share information and learn from other countries, with a view to enhance present ways of responding to climate change and efficient formulation of strategies.
- Since Meteorological Stations play a curtail role in observing and predicting climate changes, more stations need to be installed in strategic locations of river basins.

continuous

- Assessment of past and present climate change needs to be made using the measured data covering the atmosphere, soil surface, water, sea , snow and ice. Impacts of climate change on water environment should be assessed, options to respond should be developed and realistic response strategies should be formulated.



A scenic sunset over a body of water. The sky is filled with soft, golden light from the setting sun, with some light clouds. In the distance, a range of mountains is visible under the twilight sky. A small boat is on the water in the middle ground, and its wake is visible. On the right side of the image, there is a structure made of thin, dark poles or sticks, possibly a fishing trap or a marker, which is reflected in the calm water. The overall mood is peaceful and serene.

**THANK YOU
FOR YOUR KIND ATTENTION !**