



**Training-Workshop on Climate Change Adaptation in Watersheds
for Water, Food, and Environmental Security in Southeast Asia**

15-18 October 2013

SEARCA, College, Los Baños, Laguna, Philippines

Challenges and Practices in Watershed Management in Myanmar

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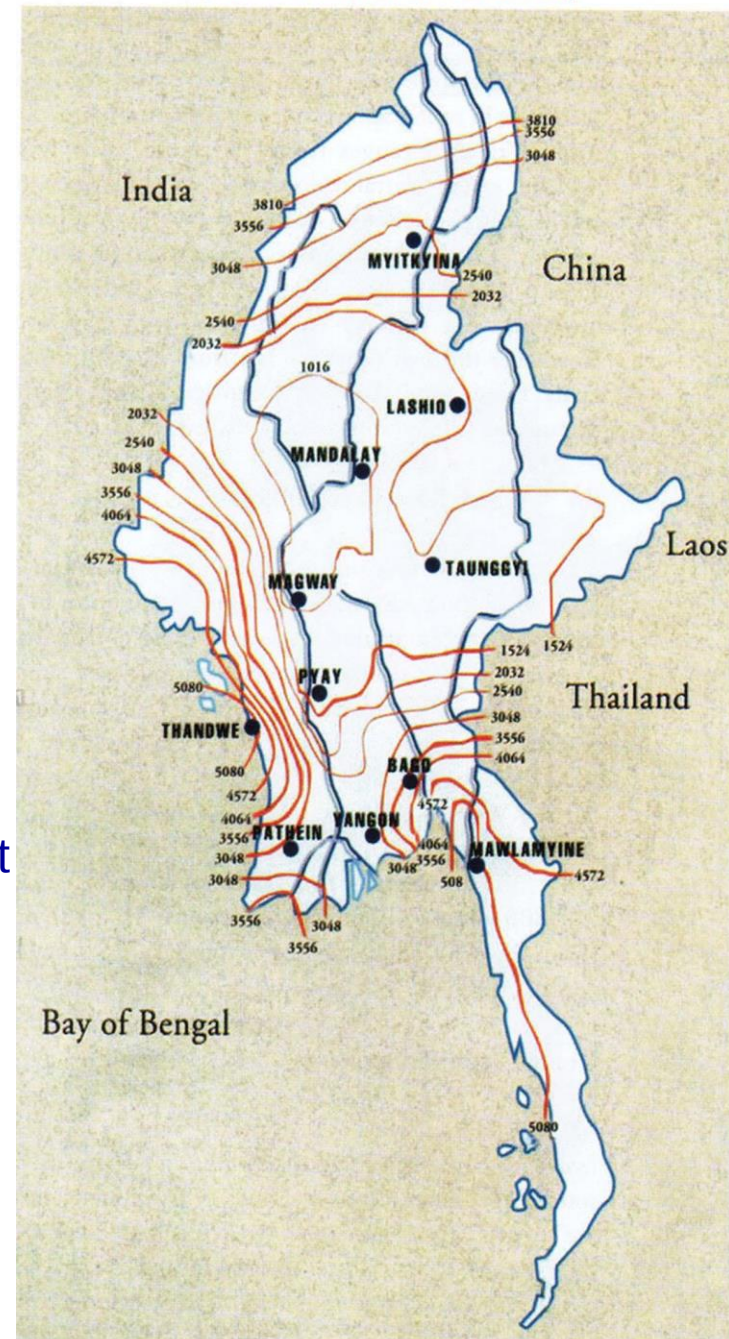
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General Information

Climatic Condition

- **Dry season (March to May)**
(Summer) - Temperature 40°C - 43°C
- **Wet season (June to October)**
 - Southwest monsoon rains
 - **2030 mm to 3050 mm** in Deltaic area
 - **1520 mm** in the East (Shan State)
 - **2030 mm to 3810 mm** in the North (Kachin State)
 - **5080 mm** in the South, Southeast and in the West
 - **750 mm** in the Central Dry zone
- **Cold season - November to February**
(Winter) - Temperature : 16°C - 10°C

Isohyetal Map of Myanmar
(Annual Rainfall in millimeter)



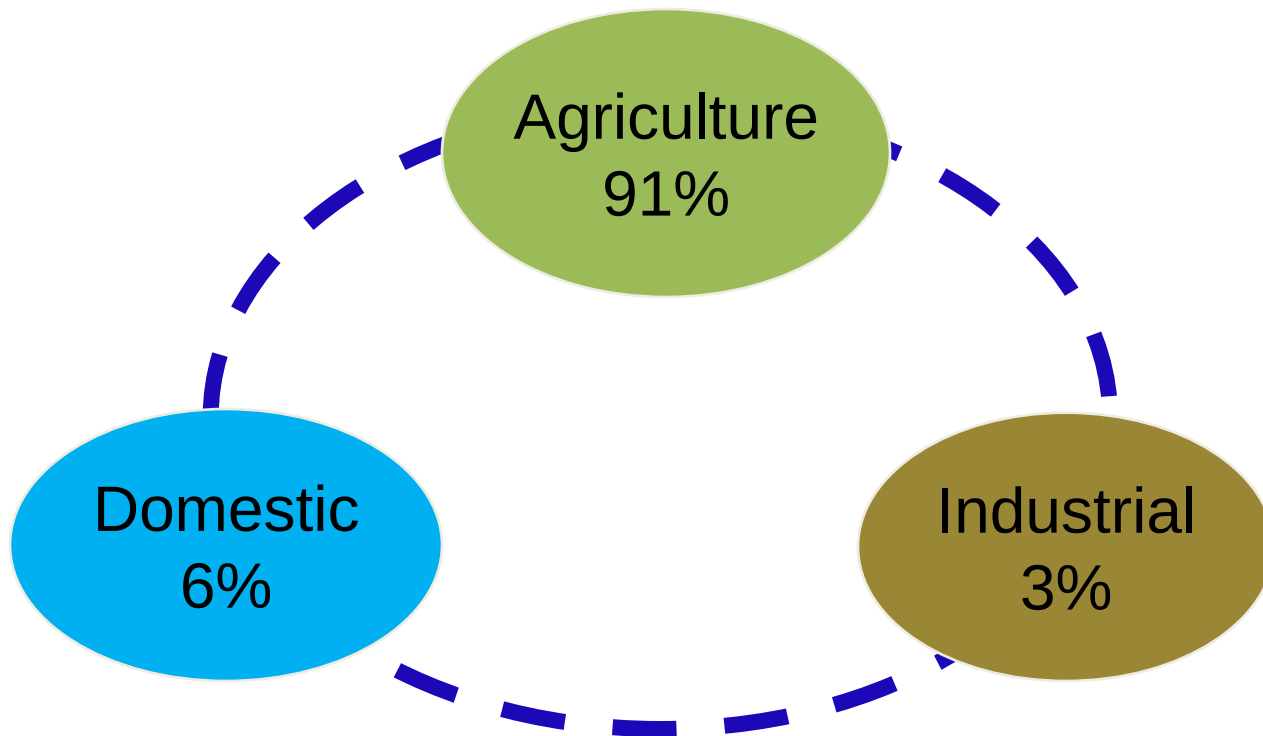
Water Resources Potential in Myanmar

(Annual Surface and Groundwater)

Sr No	Name of Principal River Basin	Catchment Area (000'sq-km)	Annual Surface Water (km³)	Estimated Groundwater Potential (km³)
1	Chindwin River	115.30	141.293	57.578
2	Upper Ayeyarwady River	193.30	227.920	92.599
3	Lower Ayeyarwady River	95.60	85.800	153.249
4	Sittaung River	48.10	81.148	28.402
5	Rivers in Rakhine State	58.30	139.245	41.774
6	Rivers in Tanintharyi Division	40.60	130.927	39.278
7	Thanlwin River (from Myanmar boundary to its mouth)	158.00	257.918	74.779
8	Mekong River (within Myanmar territory)	28.60	17.634	7.054
	Total	737.80	1081.885	494.713

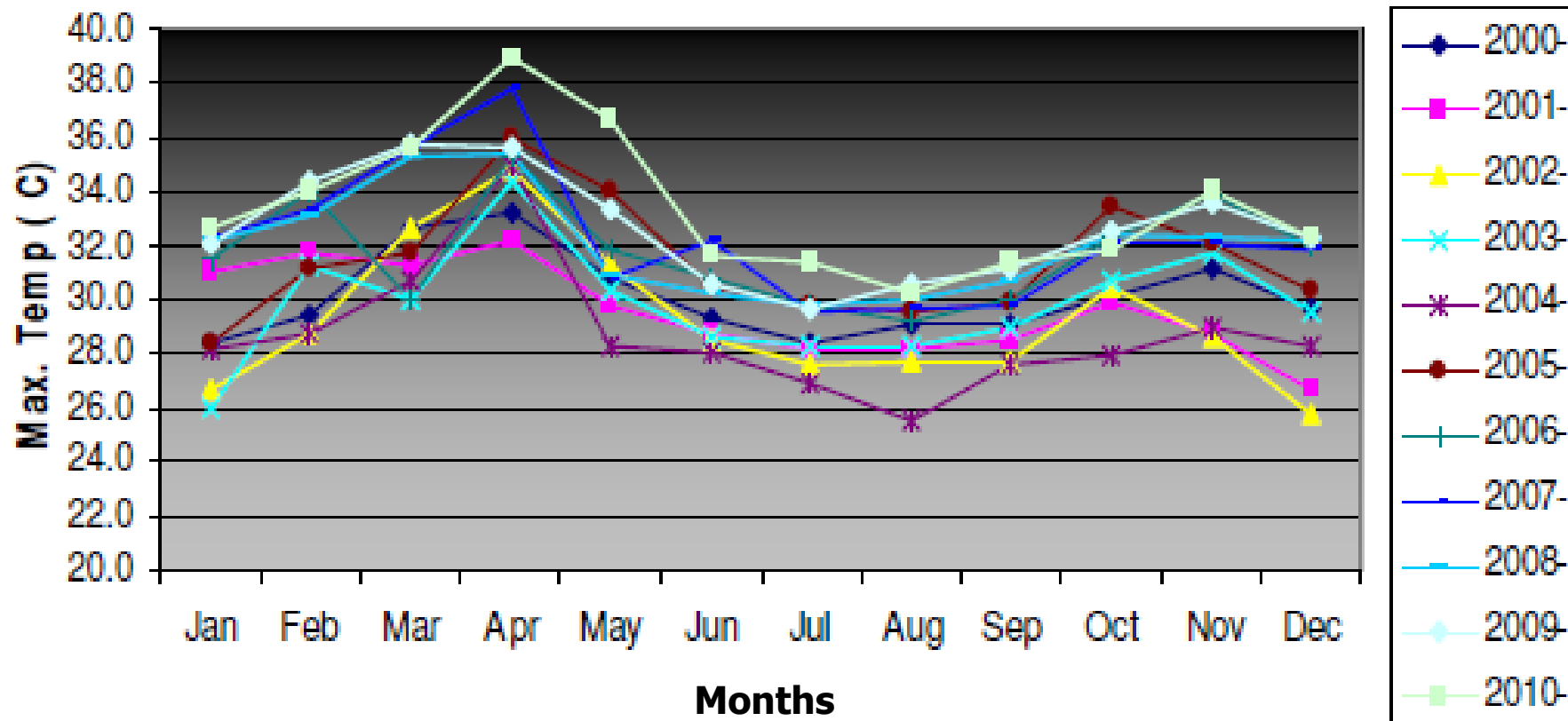
Water Utilization in Myanmar

- Estimated annual surface water ~ 1082 km³
- Estimated ground water potential ~ 495 km³
- At present less than 10% of the total fresh water resources are being utilized



Climate Change in Myanmar

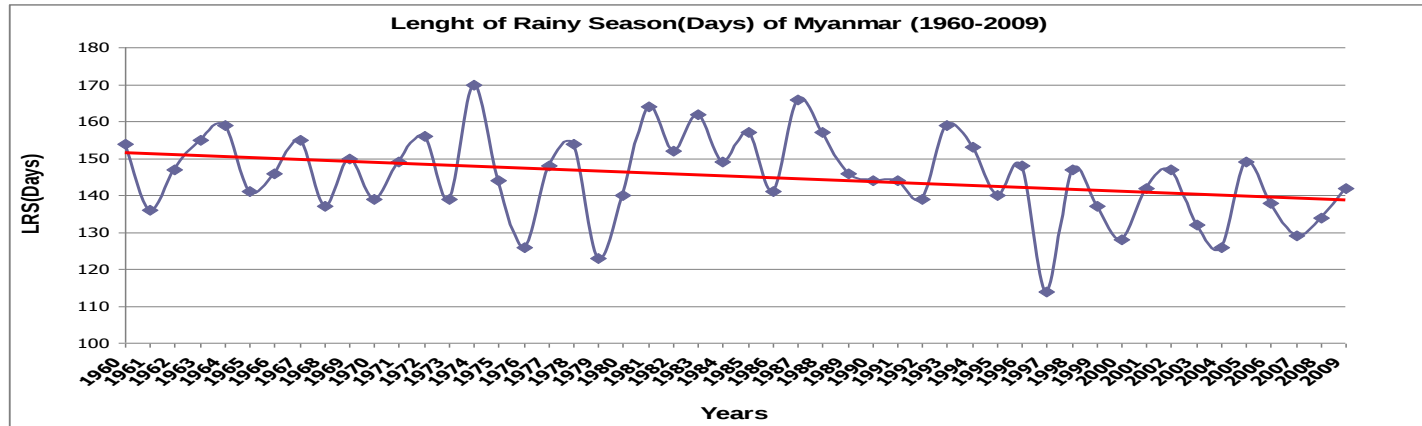
- Rising in Maximum Temperatures (2000 – 2010)



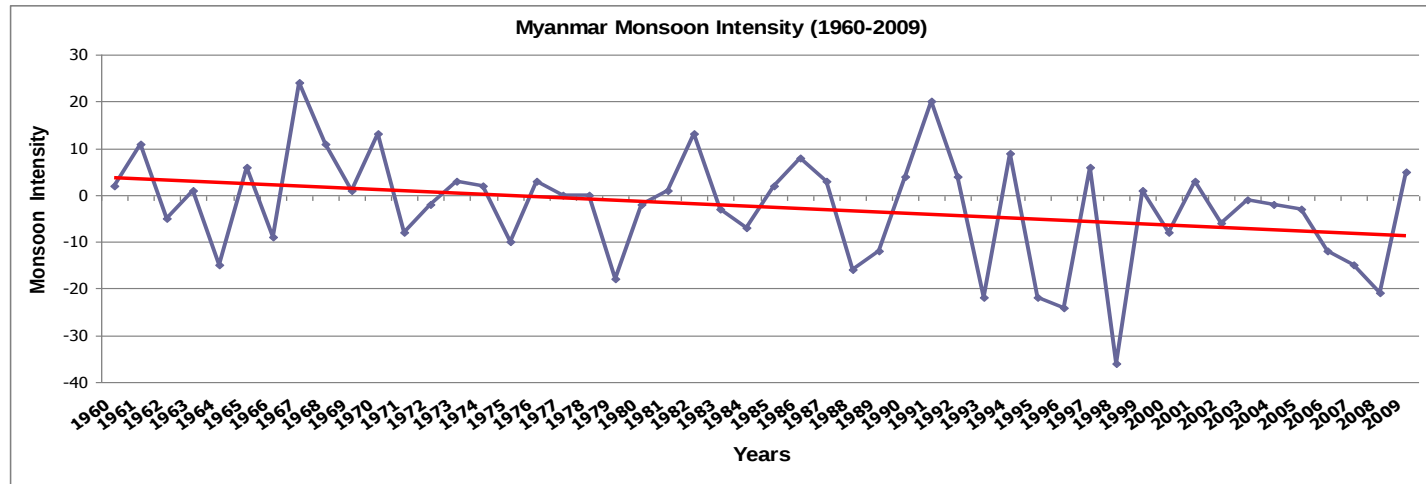
Source: Department of Meteorology and Hydrology (DMH)

Climate Change in Myanmar

- Shorter length of rainy season (Late onset and early withdrawal of monsoon)
- Weakening of monsoon rains intensity during 1960 -2009



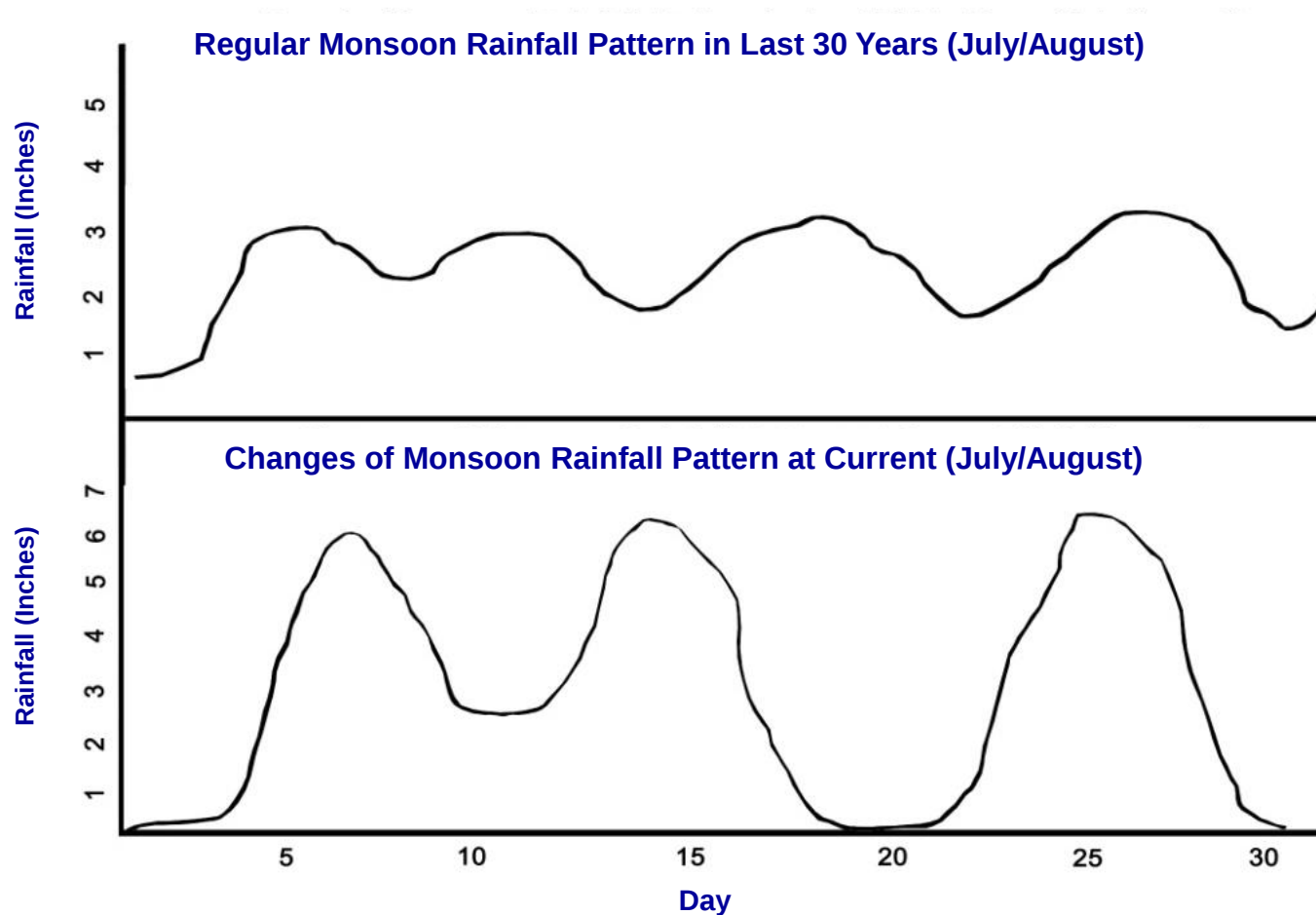
Length of Rainy Season (Days) in Myanmar (1960 - 2009)



Monsoon Intensity (1960 - 2009)

Change in Rainfall Patterns

- Abnormal rainfall patterns and intensities are visual consequent effect of climate change
- Unusual drought and flood events



Change of Inflows in Reservoirs

Reduction of inflow ~ Due to the effect of abnormal drought in central dry zone

~ Cause significant shortage of irrigation and drinking water

Excessive inflow ~ Due to unusual rainfall pattern and high intensity in dry zone area,

~ Resulting in excessive or severe flooding events

~ The amount of water stored in existing dam has fluctuated immensely

~ Cause excessive water spillage

~ Cause damage to spillway facilities and downstream infrastructures

Over Spilling at the Spillway of Salin Dam in Dry Zone during the O2B Storm (20 October 2011)



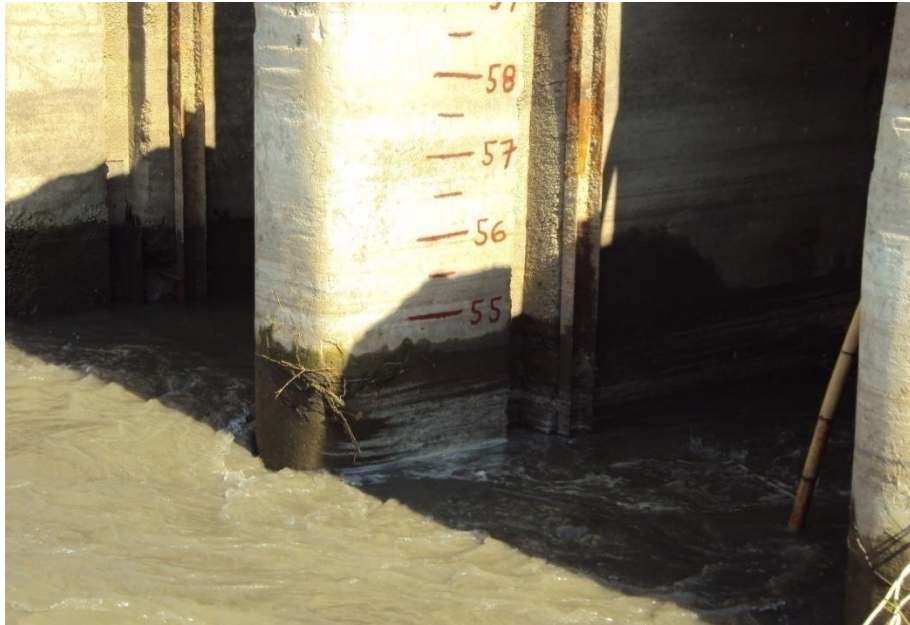
Upstream



Downstream

Impacts on Pumping Irrigation

- Changes of Water Course and Dropping of Water Level in the rivers
- Change of Water Way in the river
- For Pumping Irrigation, water levels are insufficient for pump mechanism's requirements



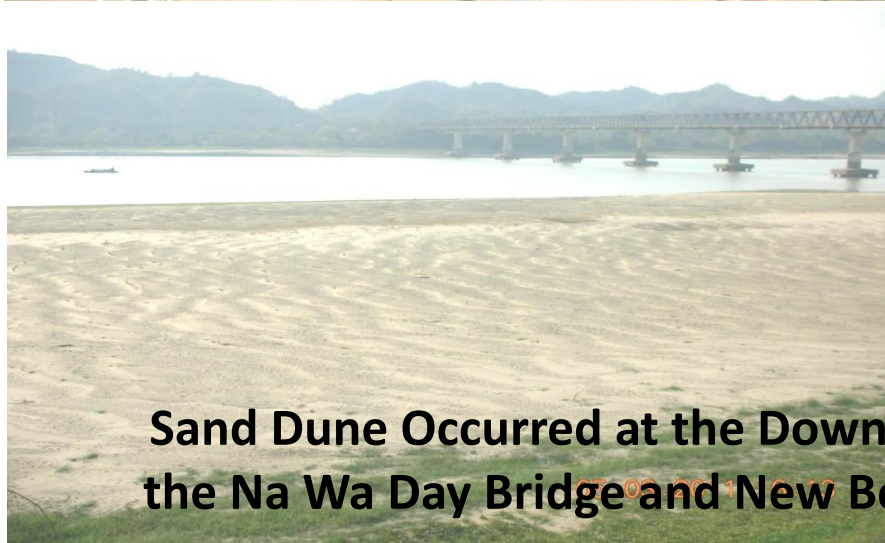
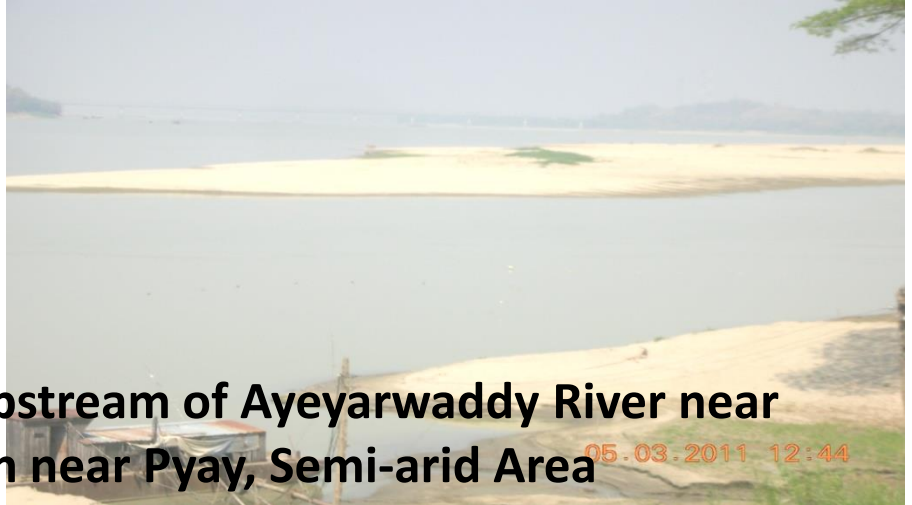
Decrease in Water Level in the Ayeyarwaddy River Effected Insufficient Water Head

Impacts on Pumping Irrigation

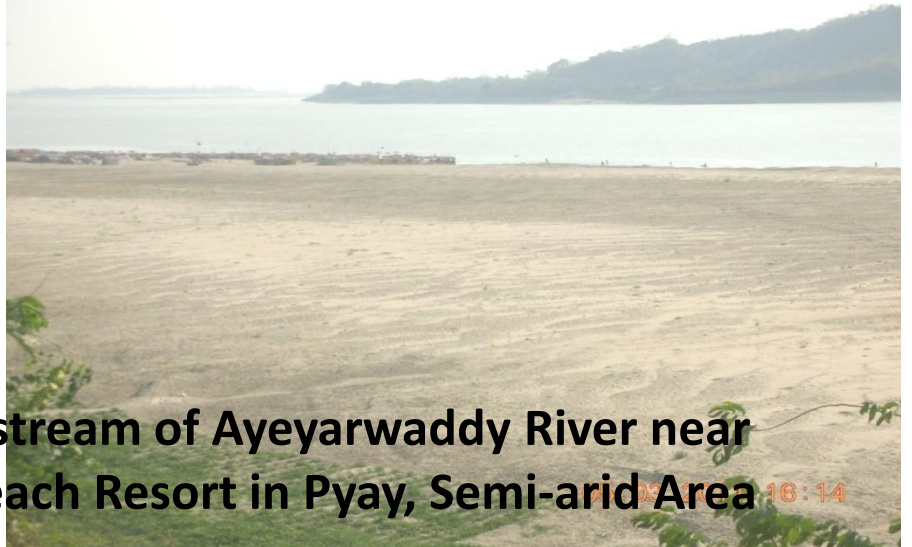
- High cost for moving of pump station to get water source for pumping irrigation



Large Sand Dune Occured at the Upstream of Ayeyarwaddy River near the Nattmaw Pump Station near Pyay, Semi-arid Area



Sand Dune Occurred at the Downstream of Ayeyarwaddy River near the Na Wa Day Bridge and New Beach Resort in Pyay, Semi-arid Area



Impacts on Agriculture

- In 2010, monsoon begun approximately two weeks later than usual.
- In some parts of the country, rainfalls were so far less than usual.
- In later part of the dry season, it was much hotter all over the country.
- Increasing in water demand requirements for summer paddy due to effect of high temperatures



Challenges in Watersheds Management

- Population growth and associated demands for food and fuel within and outside watershed areas are posing high pressure on watershed forests threatening their resilience and integrity.
- Forest fragmentation and decrease rapidly in watershed areas
- The development of infrastructure also contribute to the fragmentation and loss of forest cover lead to severe soil erosion
- Urbanization, frequent wildfire, development projects such as roads, dams and hydropower plants, tourism infrastructures
- land use change
- Climate change
- Poverty linked with unsustainable cultivation practices (e.g. shifting cultivation)
- Limited resources and knowledge
- Limited community participation/ no incentive mechanism for participation
- Practiced single approaches rather than integrated approach
- Weak Law enforcement

Adaptations for Water and Food Security

- Forest protection and restoration project in the watershed areas of dams, reservoirs, and lakes
- Establishing plantation to supply fuel wood and to control soil erosion and sediment flux
- Constructing more small ponds and water impoundments in the dry zone
- Implementing new irrigation systems
- To practice the effective water saving techniques and appropriate water harvesting
- Need to review and evaluate rainfall-runoff relationship in watersheds, capacity of dams and reservoirs in relation with climate change
- Necessary to modify the reservoir operations and water management practices and to set up appropriate cropping patterns with changing climates
- Need to coordinate and collaborate with international and regional organizations to share information and knowledge on integrated water resources management in watersheds and their downstream

Policies related to watershed management

- **National Environment Policy (1994)**
- **Forest Policy (1995)**

Legislations

- **Protection of Wildlife and Wild Plant and Conservation of Natural Areas Law (1994)**
- **Forest Law 1992 and Forest Rules (1994)**
- **Protection of Wildlife and Wild Plant and Conservation of Natural Areas Rules**
- **Community Forestry Instructions**
- **Environmental Law**

Formulating Strategic Plans

Strategies relating to watershed management

1. **Myanmar Agenda 21 (1997)**
2. **National Forest Master Plan (NFMP) (2001-2030)**
3. **National sustainable development strategy**
4. **National Biodiversity Strategy and Action Plans**

Source: Forest Department

Forest Protection and Restoration Project in the watershed areas of Dams, Reservoirs, Lakes

Bago Yoma Greening Project, Started in 2004

■ Activities:

- Natural forest protection
- Enrichment planting
- Natural regeneration, plantation establishment and
- Law enforcement, notification of wildlife sanctuaries

Action Plan for Environmental Conservation and Sustainable Management of Inlay Lake, Started in 2010

■ Activities

- Watershed conservation, maintaining streams flows and preserving area of open water body of Inlay Lake
- Preventing soil erosion and sedimentation
- Conducting activities for extension, capacity building and technical cooperation
- Biodiversity conservation
- Conducting activities to improve socio-economic status of local communities

Current Activities – Technical Cooperation for nomination processes to enlist Inlay Lake in the World Heritage Sites (Nordic World Heritage Foundation and UNESCO)

