

**THA 2015 International Conference on  
“Climate Change and Water & Environment  
Management in Monsoon Asia**

# **Climate Change in Myanmar and Central Dry Zone**

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# Presentation Outlines

- Introduction
- Myanmar's Climate
- Climate Change and Natural Disasters
- Climate Change Drivers
- Pilot Project in Drought in Central Dry Zone
- Impacts
- Constraints
- Recommendations
- Conclusion

# Introduction

- Myanmar is generally regarded as a country endowed with rich natural resources: **minerals, forests, fertile agricultural lands** with plentiful of Monsoon **rains**, and opulent **marine resources**.
- Located between the east Himalayan syntaxis and the Andaman Sea to the south, washed by the Bay of Bengal on the west, Myanmar links *Alpine- Himalayan orogenic* belt to the west with its extension in the rest of Southeast Asia.
- Myanmar is natural *hazard or disaster prone country*, being located in the tectonically active Alpide Seismic Belt.
- Because of *rapid growth in population, industries and urban areas*, like elsewhere in the developing world, environmental degradation and other man-made hazards or disasters are also on the rise.

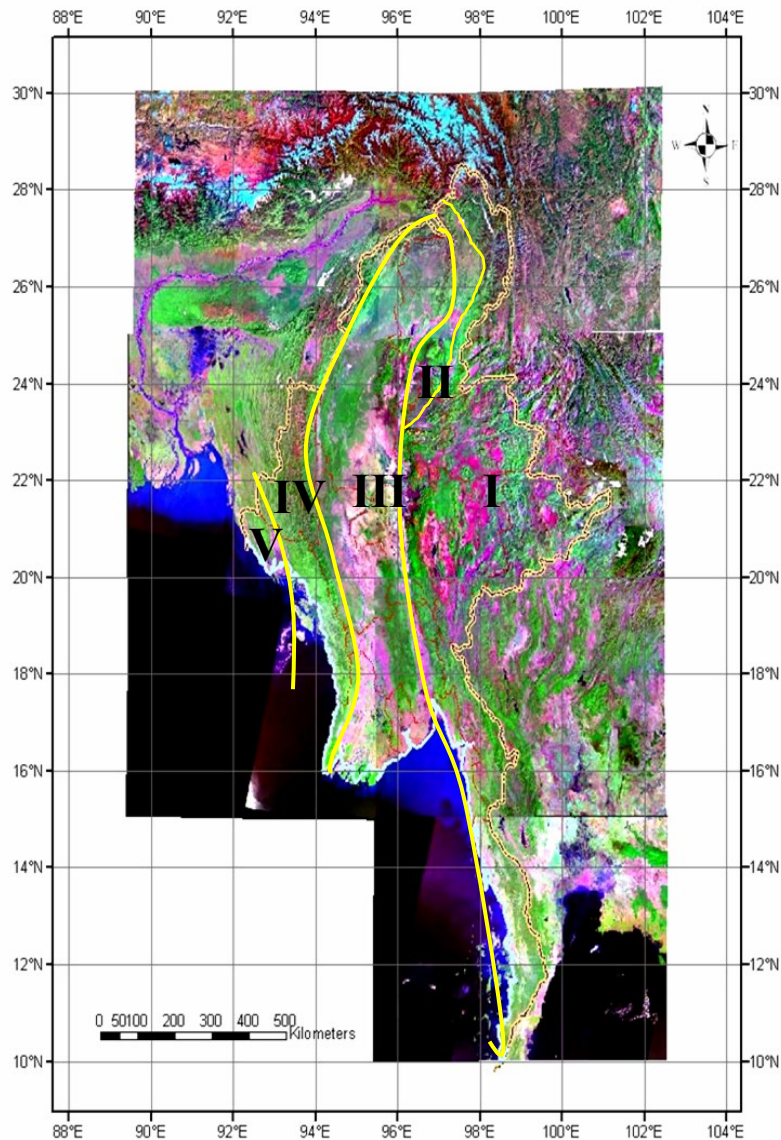
# Myanmar at a Glance

## The Republic of the Union of Myanmar



<b>Latitude:</b>	9° 32' – 28° 31' N
<b>Longitude:</b>	92° 10' – 101° 11' E
<b>North to South:</b>	2060 Km
<b>East to West:</b>	945 Km
<b>Area:</b>	67.65 million-hectares (676,577 sq. km)
<b>Population:</b>	52.00 million (2014)
<b>Growth rate:</b>	1.52%
<b>Rural Population:</b>	70%
<b>Life expectancy:</b>	57 years (men), 63 years (women)
<b>Climate:</b>	Tropical monsoon
<b>1. Monsoon</b>	May – October
<b>2. Winter</b>	November - January
<b>3. Summer</b>	February - April
<b>The coastline</b>	<b>2228 km</b>
<b>Bangladesh</b>	271 km (west)
<b>China</b>	2204 km (north)
<b>Thailand</b>	2107 km (east & south)
<b>India</b>	1338 km (west)
<b>Laos</b>	238 km (east)

# Morpho- tectonic Belts of Myanmar



## From East to West

- I. The Eastern Highlands
- II. Upper Ayeyarwaddy Province  
(Tagaung- Myitkyina Belt)
- III. The Central lowlands
- IV. The Western Ranges
- V. The Rakhine Coastal Belt

# Major Forest Type in Myanmar



Hill and Temperate Evergreen Forest



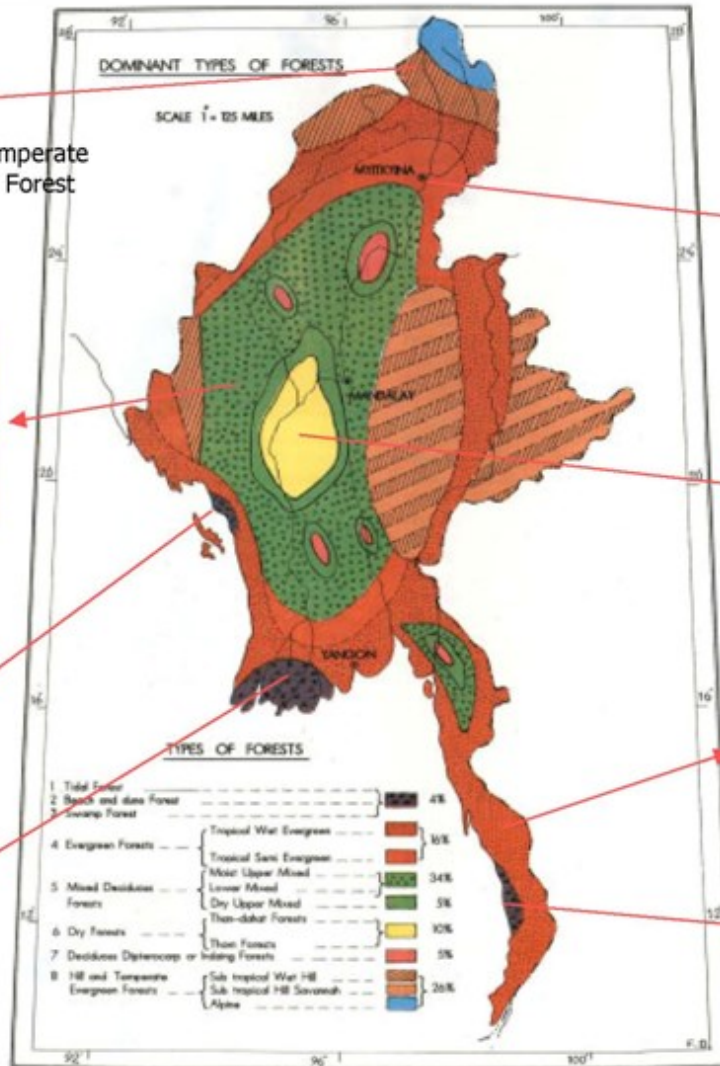
Mixed Deciduous Forest



Beach & Dune Forest



Swamp Forest



Indaing Forest



Dry Forest

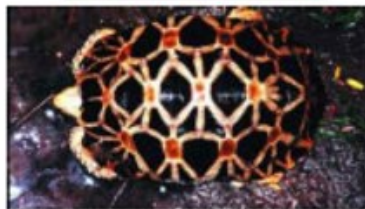


Tropical Evergreen Forest



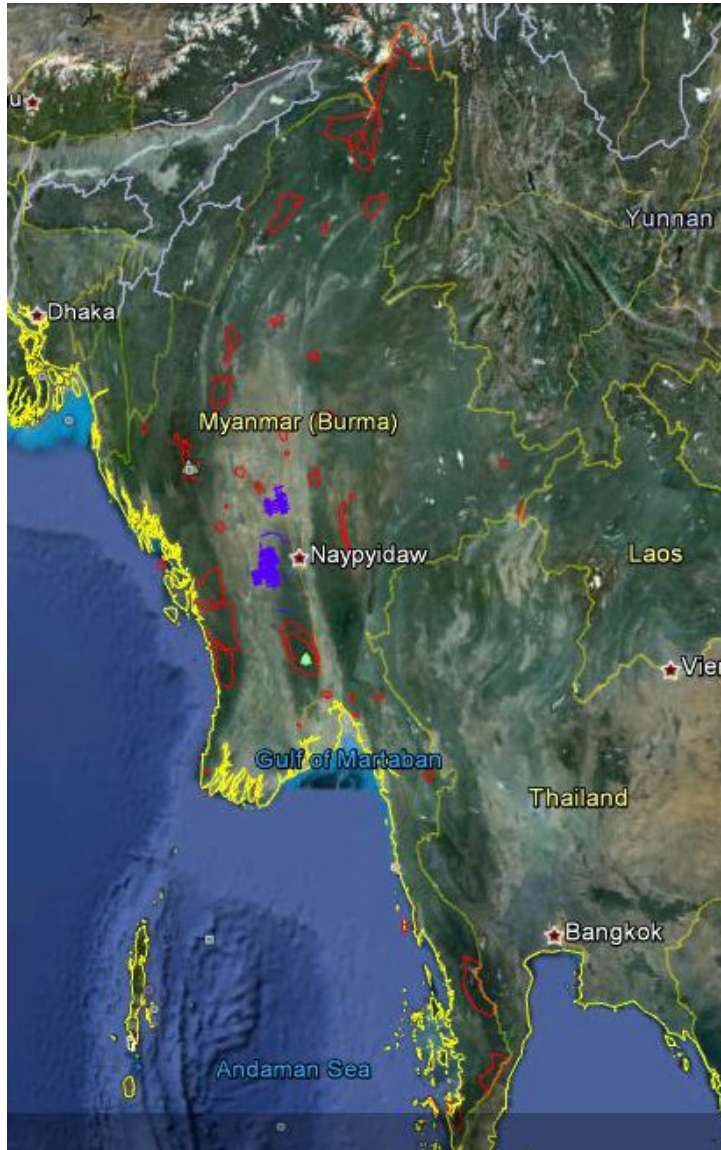
Tidal Forest

# Wildlife Resources in Myanmar



Mammal	300
Reptile	360
Bird	1,000
Butterfly	1,200

# Protected Area List



- |   |   |
|---|---|
| 1. Kyauk-Pan-Taung Wildlife Sanctuary     | 30. Nam Lang                            |
| 2. Shwese ttaw                            | 31. Tanlwe-ma-e-chaung                  |
| 3. Shwe-U-Daung (Shan)                    | 32. Taungup pass/ Thandwe Chaung        |
| 4. Minwuntaung                            | 33. Bago Yomas                          |
| 5. Kelatha                                | 34. Loimwe                              |
| 6. Pidaung                                | 35. Parsar                              |
| 7. Chatthin                               | 36. Kyaikhtiyoe                         |
| 8. Maymyo                                 | 37. Lawkananda                          |
| 9. Wethtikan                              | 38. Rakhine Yoma Elephant Range         |
| 10. Taunggyi                              | 39. Indawgyi Lake                       |
| 11. Kahilu                                | 40. Panlaung-Pyadalain Caves            |
| 12. Mulayit                               | 41. Minsontaung                         |
| 13. Cosmos Islands                        | 42. Hukaung Valley                      |
| 14. Thamihlakyun (Diamond Island)         | 43. Hponkanrazi                         |
| 15. Hlawga                                | 44. Maha Myaing                         |
| 16. Moyingyi Wetland                      | 45. Lenya National Park                 |
| 17. Nat Ma Taung                          | 46. Taninthari National Park            |
| <b>18. Popa Mountain Park</b>             | 47. Bumhpabum                           |
| 19. Pegu Yomas                            | 48. Pyin-O-Lwin                         |
| 20. Mainmahla Kyun                        | 49. Htamanthi                           |
| 21. Kadonlay Kyun                         | 50. Shwe-U-Daung (Mandalay)             |
| 22. Pakchan                               | 51. National Botanical Garden           |
| 23. Wunbaik                               | 52. Sein-Ye-Forest Camp                 |
| 24. Alaungdaw Kathapa                     | 53. Yangon Zoological Garden            |
| 25. Inlay Lake (Inlay Wetland)            | 54. Natma Taung National Park           |
| 26. Letkokkon                             | 55. Moyungyi Wetland Wildlife Sanctuary |
| 27. Dipayon                               | 56. Alaungdaw Kathapa National Park     |
| 28. Myaing Hay Wun Elephant Research Camp | 57. Meinmahla Kyun Wildlife Sanctuary   |
| 29. Khakaborazi                           | 58. Indawgyi Lake Wildlife Sanctuary    |
|   | 59. Inlay Lake Wildlife Sanctuary       |
|   | 60. Khakaborazi National Park           |
|   | 61. Lanpi Marine National Park          |

**4.2% of Myanmar's Land is protected.**



# Myanmar's Climate

## Climate, Average Weather of Myanmar

### Land area,

- 13.6% has a tropical rainforest climate (Af),
- 11.4% has a tropical monsoon climate (Am),
- 15% has a tropical wet and dry/ savanna climate (Aw),
- 35.8% has a temperate/ mesothermal climate with dry winters (Cw),
- 24.2% has a alpine/ highland climate (H)

Tropical 40%

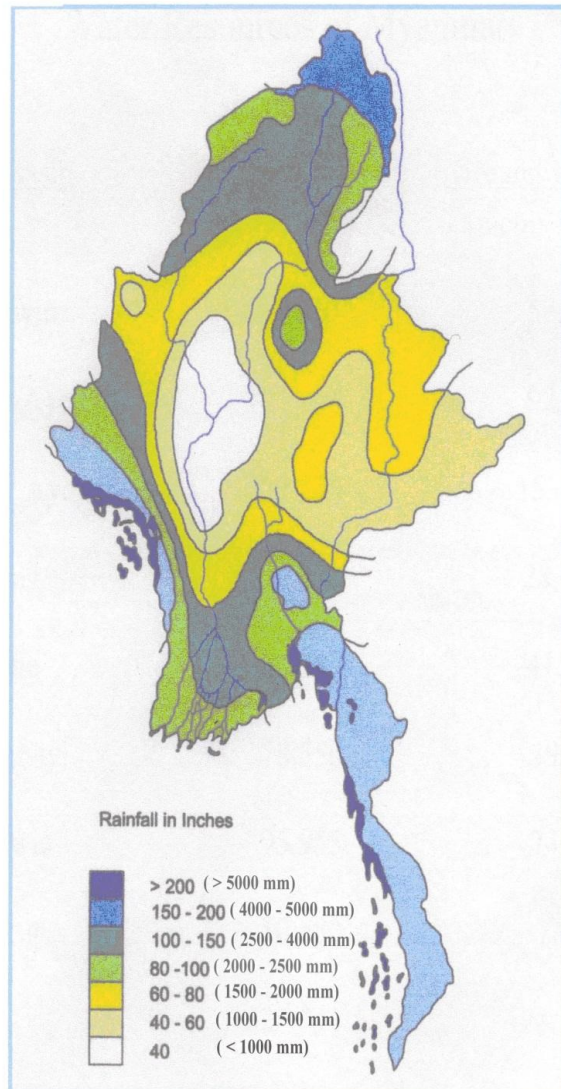
### Population,

- 21.9% live in a tropical rainforest climate (Af),
- 18.5% live in a tropical monsoon climate (Am),
- 21% live in a tropical wet and dry/ savanna climate (Aw),
- 33.7% live in a temperate/ mesothermal climate with dry winters (Cw),
- 4.9% live in a alpine/ highland climate (H)

Tropical 62%

Myanmar's Average Climate is Tropical Monsoon Climate

# Rainfall in Myanmar



## South & West

Coastal Strip - 5500 mm

Delta - 2000 - 3000 mm

## North & Eastern

Hilly Region - 1250 - 3000 mm

Central Myanmar - below 700 mm

**Scarcity of Water in dry season**

**all over the country**

# Historical Monthly Data on Precipitation and Tropical Storms

## Historical Monthly Data on Average Precipitation and Tropical Storms

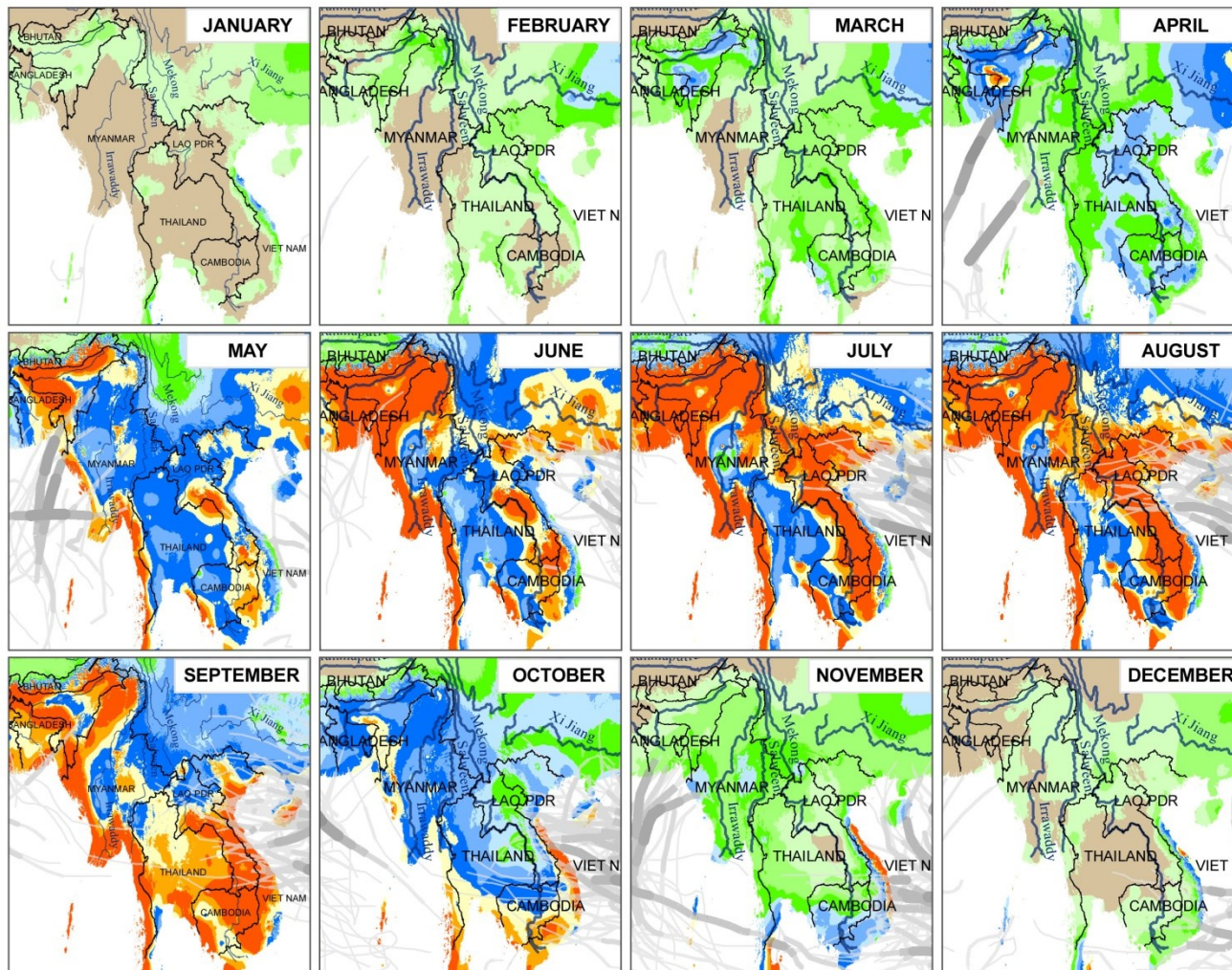
Average monthly precipitation and all tropical storms recorded for the month between 1956 and 2006

## MYANMAR



**OCHA**

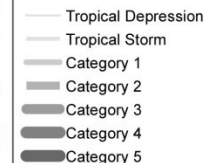
Regional Office for Asia-Pacific



### Historical Average Monthly Precipitation: mm (WORLDCLIM)



### All tropical storms recorded during month: 1956 to 2006 (UNISYS)



### Map Doc Name:

OCHA\_MYA\_Monthly\_Climate\_v1\_090710

### GLIDE Number:

n/a

### Creation Date:

10 July 2009

### Projection/Datum:

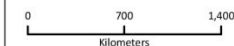
Behrmann

### Web Resources:

<http://ochaonline.un.org/roap>

### Nominal scale at A4

1:40,000,000



### Map data source(s):

WORLDCLIM, UNISYS, UN Cartographic Section, Global Discovery

### Disclaimers:

The designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.



# The Evidence for Climate Change

- ❖ Myanmar has been experiencing climate variability effects since decades. According to the Initial National Communication (INC) project report jointly implemented by National Commission for Environmental Affairs (NCEA) and UNEP, it is stated that **“Prior to 1977, the average number of rainy days per annum used to be around 144, but it reduced to 103 in 1997.”**
- ❖ In the period from 1988 to 2000, **the monsoon duration was shortened by about three weeks in the northern part and by one week in other parts of Myanmar** compared to the 1951 - 2000 average.
- ❖ The year 2009 was an El Nino year with decreased annual rainfall, with heavy rains in some areas and with droughts in others”. This is the evidence for climate change condition in Myanmar.

## The Long-Term Climate Risk Index (CRI): Results (annual averages) in specific indicators in the 10 countries most affected from 1994 to 2013.

<b>CRI 1994–2013 (1993–2012)</b>	<b>Country</b>	<b>CRI score</b>	<b>Death toll</b>	<b>Deaths per 100,000 inhabitants</b>	<b>Total losses in million US\$ PPP</b>	<b>Losses per unit GDP in %</b>	<b>Number of Events (total 1994–2013)</b>
1 (1)	Honduras	10.33	309.70	4.60	813.56	3.30	69
2 (2)	Myanmar	14.00	7137.40	14.80	1256.20	0.87	41
3 (3)	Haiti	16.17	307.80	3.41	261.41	1.86	61
4 (4)	Nicaragua	16.67	160.15	2.98	301.75	1.71	49
5 (7)	Philippines	19.50	933.85	1.13	2786.28	0.74	328
6 (5)	Bangladesh	20.83	749.10	0.54	3128.80	1.20	228
7 (6)	Vietnam	23.50	391.70	0.48	2918.12	1.01	216
8 (8)	Dominican Republic	31.00	210.45	2.38	274.06	0.37	54
9 (10)	Guatemala	31.17	83.20	0.68	477.79	0.62	80
10 (12)	Pakistan	31.50	456.95	0.31	3988.92	0.77	141

Source: Germanwatch



# Nargis Cyclone (2008)



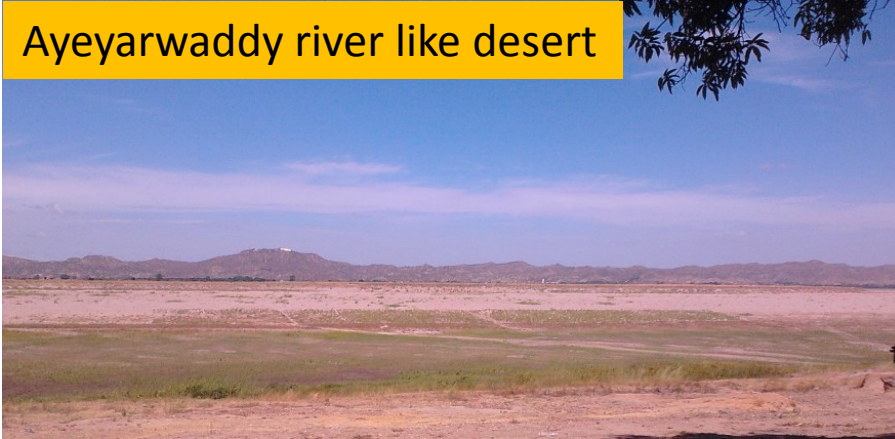
<b>Formed</b>	<b>April 27, 2008 (2008-04-27)</b>
<b>Dissipated</b>	<b>May 3, 2008 (2008-05-04)</b>
<b>Highest winds</b>	<b><i>3-minute sustained: 165 km/h (105 mph)</i></b> <b><i>1-minute sustained: 215 km/h (130 mph)</i></b>
<b>Lowest pressure</b>	<b>962 mbar (hPa); 28.41 inHg</b>
<b>Fatalities</b>	<b>138,366 total</b>
<b>Damage</b>	<b>\$10 billion (2008 USD)</b>
<b>Areas affected</b>	<b>Bangladesh, Myanmar, India, Sri Lanka</b>

What are lessons learned from Nargis?



# Climate is changing.....

Ayeyarwaddy river like desert



Extraordinary rain



Untimely snow fall in northern part



Coastal Erosion



# Climate Change Drivers of Myanmar

## Deforestation

Myanmar's total forest area in 2010 was 31.7 million hectares but was destroyed at a rate of 310,000 hectares per year between 2005 and 2010.



Commercial logging



Charcoal Baking

Firewood Extraction



# Access to modern energy services in ASEAN, 2011

	Population without access to electricity		Population relying on traditional use of biomass for cooking*	
	Million	Share (%)	Million	Share (%)
Brunei Darussalam	0	0%	0	0%
Cambodia	9	66%	13	88%
Indonesia	66	27%	103	42%
Lao PDR	1	22%	4	65%
Malaysia	0	1%	1	3%
Myanmar	25	51%	44	92%
Philippines	28	30%	47	50%
Singapore	0	0%	0	0%
Thailand	1	1%	18	26%
Vietnam	3	4%	49	56%
<b>Total ASEAN</b>	<b>134</b>	<b>22%</b>	<b>279</b>	<b>47%</b>

\* Preliminary estimates based on IEA and World Health Organization (WHO) databases. Final estimates for 2011 will be published online at [www.worldenergyoutlook.org](http://www.worldenergyoutlook.org).

Actual 70%

# Climate Change Drivers of Myanmar



Gold mining along the Ayeyarwady River



Brick baking

Mercury & Cyanide Problems

Uncontrolled Gold mining



# Energy requirement and Hydropower Dams



The Paunglaung Dam project under construction about 50 km from Naypyitaw, the capital of Myanmar  
Photo: KNGY

???

**Climate Compatible Development?**

## Exploitable Hydropower Potential in Myanmar

State/Region	Number of Sites	MW
Kachin State	39	2,061
Kayah State	7	3,909
Kayin State	21	17,021
Chin State	22	1,312
Sagaing Region	21	2,399
Tanintharyi Region	14	692
Bago Region	11	387
Magwe Region	8	123
Mandalay Region	17	3,482
Mon State	10	292
Rakhine State	14	247
Shan State	83	7,699
Total: 12	<b>267</b>	<b>39,624</b>

Constructed Hydropower Dams = 40  
Planned Hydroelectric Dams = 88  
Irrigation Dams = 4

# Developing Countries Are Most At Risk

<i><b>Drought</b></i>	<i><b>Flood</b></i>	<i><b>Storm</b></i>	<i><b>Coastal 1m</b></i>	<i><b>Coastal 5m</b></i>	<i><b>Agriculture</b></i>
Malawi	Bangladesh	Philippines	All low-lying Island States	All low-lying Island States	Sudan
Ethiopia	China	Bangladesh	Vietnam	Netherlands	Senegal
Zimbabwe	India	Madagascar	Egypt	Japan	Zimbabwe
India	Cambodia	Vietnam	Tunisia	Bangladesh	Mali
Mozambique	Mozambique	Moldova	Indonesia	Philippines	Zambia
Niger	Laos	Mongolia	Mauritania	Egypt	Morocco
Mauritania	Pakistan	Haiti	China	Brazil	Niger
Eritrea	Sri Lanka	Samoa	Mexico	Venezuela	India
Sudan	Thailand	Tonga	Myanmar	Senegal	Malawi
Chad	Vietnam	China	Bangladesh	Fiji	Algeria
Kenya	Benin	Honduras	Senegal	Vietnam	Ethiopia
Iran	Rwanda	Fiji	Libya	Denmark	Pakistan

Low Income  
 Middle Income

Source: World Bank



# Drought causes water shortage in Myanmar (2005)



Inle Lake in Myanmar dried up due to sever drought  
(May, 2005)

- Myanmar is hit by a drought in 2005, which is the most severe in several decades.
- Temperature has been higher this year than previous years in Myanmar and rain fall is late, causing severe shortage of water in many parts of Myanmar.
- In April, temperature has risen as high as 40 degree Celsius, according to government meteorological department.
- In some parts of Myanmar, temperature is as high as 43 degree Celsius. As a result, many streams and water reservoirs were dried up all over Myanmar.

# Myanmar Faces Water Shortage (2009-2013)



A boy carries a plastic container filled with water on his shoulder as he walks across a dried creek in Thaunglay Village of the Irrawaddy Delta in 2010. Villages across central Burma are reporting water shortages this year as temperatures rise. (Photo: AP)



A woman receives a water ration for her family during a severe drought in Thone Gwa township in the Yangon region of Burma/Myanmar on July 9, 2012. Image: Kaung Htet/ICIMOD/UN



*A woman in Pakokku District striving for getting of drinking water (Photo/EMG)*



A boy carrying empty plastic containers follows his mother to help her fetch water, in Dala township, about 15 kilometers (9 miles) south of Yangon, Myanmar, Tuesday, May 7, 2013



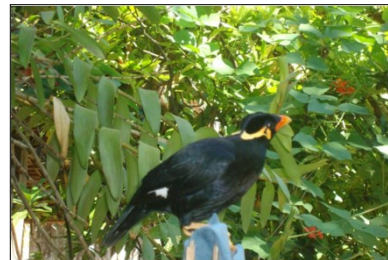
# Myanmar Environment Institute

## Private Research Institute

- Class rooms and laboratory
- standard teaching materials and instruments
- local and international professors and lecturers

## Research Team

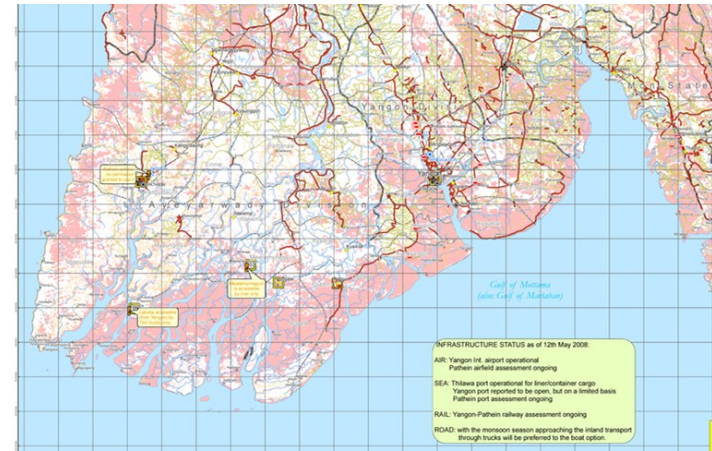
- Environmental Geology Research Group
- Ecological Science Research Group
- Environmental Biological Science Research Group
- Environmental Microbiological Science Research Group
- Socio-economic Study Group
- Environmental Engineering & Monitoring Group
- Natural Hazards Study Group



# Storm Surge Mapping (2009)

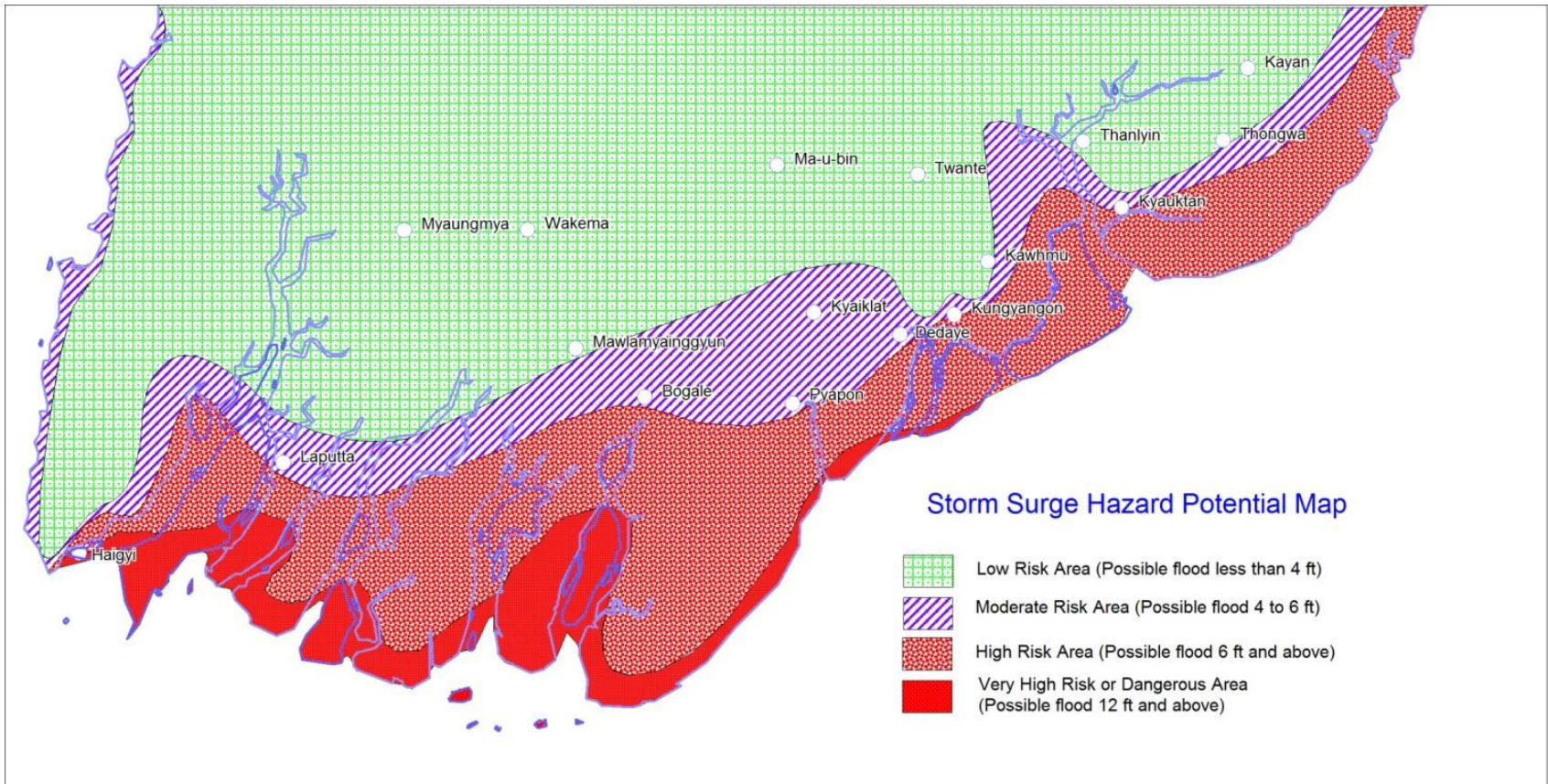
## Objective

- Saving lives for (possible) future natural disaster, mainly for storm and storm surge
- Reestablishment of infrastructure
- Building emergency shelter
- Ayeyarwaddy Delta Region, comprising Ayeyarwaddy and Yangon Divisions from Mawdin Cape to Sittoung River mouth



Win Naing Tun, Soe Thura Tun, San Hla Thaw, Saw Htwe Zaw, Than Myint, and Natural Disaster Mitigation and Preparedness Research Group, Myanmar Engineering Society

# Storm Surge Potential Map – MES Ver. 1.1 (2009)



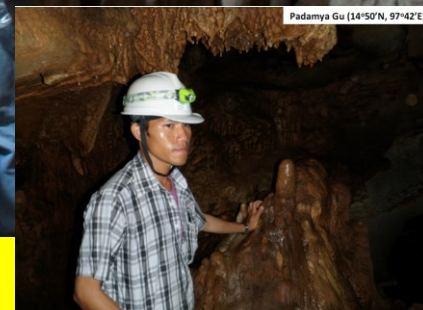
Myanmar Engineering Society

# Tracking Hydro-climate Changes in Myanmar

## Paleo-monsoon Study (2012-2013)



THE PAST IS THE KEY TO THE FUTURE.

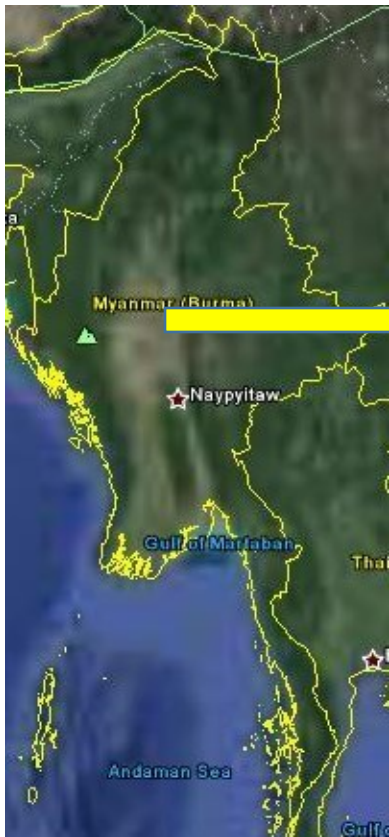


Xianfeng WANG<sup>1</sup>, Hong-Wei CHIANG<sup>1</sup>, Guangxin LIU<sup>1</sup>, Xiuyang JIANG<sup>2</sup>, Phyo Maung Maung<sup>3</sup>, Lin Thu Aung<sup>4</sup>, Win Naing Htun<sup>4</sup>, Soe Thura Tun<sup>4</sup>, Chuan-Chou SHEN<sup>5</sup> (<sup>1</sup>Earth Observatory of Singapore, Nanyang Technological University, Singapore <sup>2</sup>Fujian Normal University, China <sup>3</sup>Department of Meteorology and Hydrology, Myanmar <sup>4</sup>Myanmar Earthquake Committee, Myanmar <sup>5</sup>National Taiwan University, Taiwan) "Tracking Hydro-climate Changes in Myanmar", MEC, Yangon, Myanmar, May 2013

# Summary of Paleo-monsoon Study

1. Speleothem records from **two sites in Myanmar** can allow quantification of moisture transport and monsoonal rainfall pattern for past times.
2. Preliminary data supports the Held-Soden hypothesis that **the wet tropics would become much wetter in the future, if current warming continues.**
3. The large magnitude of  $^{18}\text{O}/^{16}\text{O}$  change recorded in South East Myanmar speleothems suggests **significant rainfall change in the region.**

# On going research for Paleo-climate in Myanmar



Crater lake Study in  
Central Myanmar



# Pilot Study location in Dry Zone (July 2014 – Jan 2015)

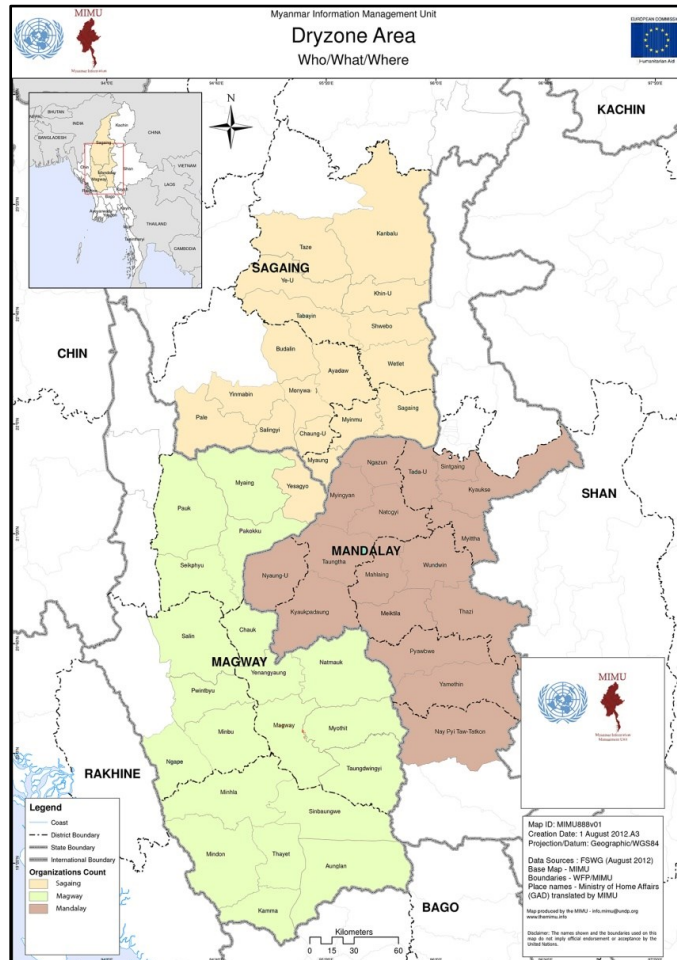


Township	6
Villages	10
Households	200
Sample points	24



# Central Dry of Myanmar

## Pilot Project in Central Dry Zone of Myanmar



- ✓ Meteorological drought
- ✓ Hydrological drought
- ✓ Agricultural drought
- ✓ Socio-economic drought

State/ Division	= 3
District	= 12
Township	= 54
Area	= 67,700 sq. km
Land area of Myanmar	= 15%
Average Annual Precipitations in Dry Zone	= 725 mm
Population	= 30 %

# Annual Precipitation in Central Dry Zone

Division	Station	Average Annual Precipitation in mm
Magway	Seikphyu	612.90
	Myaing	509.02
	Chauk	635
	Sale	553.72
	Aunglan	980.44
Average Magway Division		658.22
Mandalay	Nyaung U	624.84
	Mandalay	830.58
	Meiktila	845.82
	Myingyan	655.32
	Hlaingtet	914.4
Average Mandalay Division		774.19
Sagaing	Sagaing	904.24
	Monywa	862.33
Average Sagaing Division		740.56

# Number of interviewed Households, Air Quality and Water Quality Points

Township	Village	Socio-Economic Survey (Households)	Air Quality	Water Quality	Noise Survey
Myingyan	Sa Ka	20	1	1	1
	Hnan Ywa	20	1	1	1
	Phettaw	40	1	1	1
	Gyok Bin	10	1	1	1
Kaukpadaung	Taung Nauk	20	1	1	1
Chauk	Bin Gwa	20	1	1	1
Nyaug U	Su Ti	20	1	1	1
	The Byin Daw	20	1	1	1
Yinmabin	Kywe Kya	10	-	-	-
Pale	Min Daing Bin	20	-	-	-
Total		200	8	8	8



# Problems in Water Sources



Poor drinking water quality



Dry Sand Streams cannot hold water



Rain harvested lakes are dried up early

# Meteorology Drought?



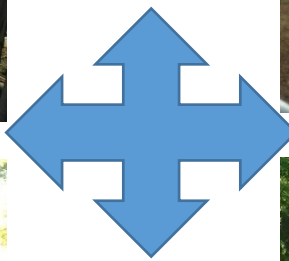
“Mya Kan”  
Near Bagan  
ancient  
heritage zone.

This reservoir was built by the King Uzana of Bagan in 12 century A.D.  
The reservoir lake was dried up in 2014.

# Drought causes Water Shortage in Dry Zone (2014 – 2015)



Nyaung U



Kyaukpadaung



# Drought Impacts on Agricultural Sector



Drought affected Crops yields and causes degradation or soil quality. That drove farmers to use more chemical fertilizer which is one of sources of Methane Gas emission.

# Drought Impacts on Socio-economic sector



- Economic Loss
- Mental Problems
- Family problems
- Malnutrition
- Resource Drain



# Ambient Noise Study



Time	The Byin Daw	Su Ti	Taung Nauk	Bin Gwa
6:00-7:00	72.11	47.80	52.76	53.33
7:00-8:00	61.87	53.21	57.36	52.92
8:00-9:00	62.93	59.07	55.26	63.24
9:00-10:00	61.05	61.22	58.53	58.93
10:00-11:00	64.63	55.67	51.24	52.87
11:00-12:00	73.77	57.27	43.90	44.86
12:00-13:00	61.64	56.16	45.50	62.17
13:00-14:00	72.66	55.71	45.59	43.41
14:00-15:00	64.91	54.91	46.96	51.12
15:00-16:00	68.81	54.22	53.61	51.08
16:00-17:00	58.21	59.66	58.82	51.91
17:00-18:00	72.66	52.49	62.31	56.82
18:00-19:00	63.83	43.65	46.20	47.53
19:00-20:00	64.05	40.69	48.55	45.72
20:00-21:00	63.88	42.71	42.70	57.02
21:00-22:00	60.41	43.19	45.44	47.26
Day $L_{Aeq}$	65.46	52.35	50.92	52.51
22:00-23:00	60.16	39.83	41.08	50.40
23:00-24:00	44.56	40.31	41.00	55.43
24:00-1:00	44.39	41.76	41.90	42.97
1:00-2:00	58.33	41.71	40.42	35.74
2:00-3:00	44.38	42.89	40.46	49.76
3:00-4:00	45.90	40.79	34.43	42.07
4:00-5:00	73.96	49.47	40.25	45.08
5:00-6:00	77.15	48.09	52.68	43.22
Night $L_{Aeq}$	56.10	43.11	41.53	45.58

# Ambient Air Quality Study



	Date	Time	CO	NO2	NO	PM2.5A	PM10B	RH	SO2
	D.M.Y	hours	mg/m3	mg/m3	mg/m3	mg/m3	mg/m3	%	mg/m3
1	10-11 August,2014	24	0.22	0.07	< 0.01	0.146	0.01	67.1	< 0.01
2	11-12 August,2014	24	0.19	0.07	0.03	0.017	0.01	62.8	< 0.01
3	12-13 August,2014	24	0.18	0.07	0.02	0.019	0.01	59.0	< 0.01
4	13-14 August,2014	24	0.20	0.07	0.02	0.013	0.01	59.3	< 0.01
5	14-15 August,2014	24	0.21	0.07	0.02	0.022	0.02	72.8	< 0.01
6	15-16 August,2014	24	0.17	0.07	0.02	0.025	0.01	71.9	< 0.01
7	16-17 August,2014	24	0.22	0.07	0.02	0.027	0.01	66.0	< 0.01
Maximum		24	0.22	0.07	0.03	0.146	0.02	72.8	< 0.01
Average		24	0.20	0.07	0.02	0.039	0.01	65.6	< 0.01
Minimum		24	0.17	0.07	< 0.01	0.013	0.01	59.0	< 0.01
Target Value		24	10	< 0.06		< 0.05	< 0.12		< 0.04
			Japan	Japan		Thailand	Thailand		Japan

# In-Situ Measurement and laboratory analysis of Water Quality (GW and SW)



No .	Sample No./ Physical Parameter	MWQ 1		Test Method	Detection Limit
1	Location	-			
2	Date/Time (Sample Collection)	12-7-2014 (10:00 AM)	24-7-2014 (9:30 AM)		
3	Weather	Partly Cloudy	Partly Cloudy		
4	Water Depth (Channel) m	9.3	9.9		
	Depth of Sample Collection (m)	1.75	2.0		
5	Flow Rate/Velocity (m/s)			Digital Water Velocity Meter	0.1m/s
6	Temperature _Water (°C)	27.12	26.65		
7	Temperature _Atm (°C)	34	31		
8	pH	7.71	8.62	HI7609829-1 pH Sensor	-
9	DO (mg/l)	7.26	5.19	HI7609829-2 Galvanic dissolved oxygen sensor	0.2mg/l
10	BOD5 (mg/l)	2.4	4.5	Direct inoculation method	2mg/l
11	COD (mg/l)	6.7	12.0	Dichromate method	0.5mg/l
12	Total Nitrogen (mg/l)	ND	ND	APHA 4500-MB	0.6 mg/l
13	Total Phosphorus (mg/l)	ND	0.05	Photometric (ascorbic) method	0.05 mg/l
14	Oil and grease (mg/l)	ND	2.2	APHA 5520-B	0.2 mg/l
15	Total Suspended Solid (mg/l)	162	246	APHA 2540 D-B	2 mg/l
16	Total Coliform (MPN/100ml)	1,100	110	APHA, AWWA, WEF	-

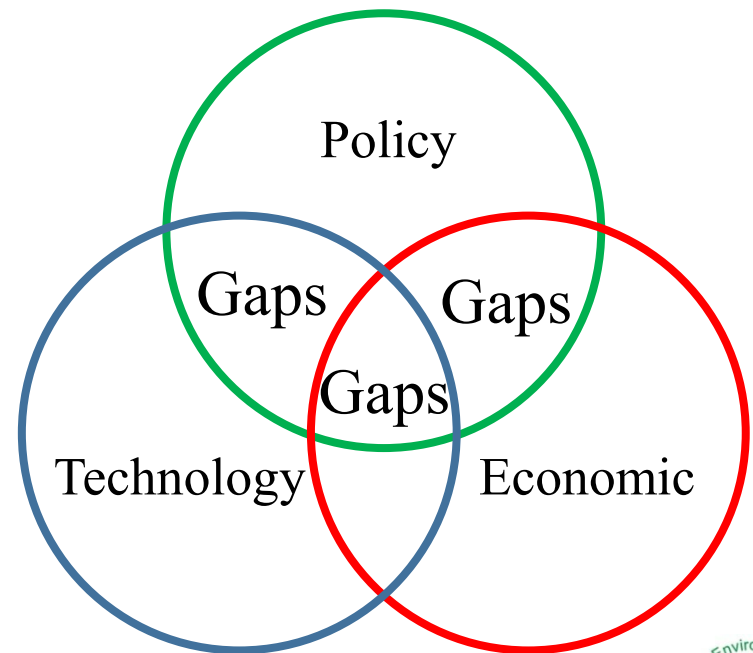
# Socio-economic Assessment



1. Demographic data
2. Household Sizes
3. Ethnicity & Religions
4. Occupation
5. Electricity
6. Cooking energy
7. Transportation
8. Health
9. Education
10. Water & Sanitation
11. Cultural Landmarks
12. Historical Sites
13. Historic disasters experience
14. Extreme weather experience
15. Drought experience
16. Crops patterns
17. Migration
18. Livelihood pattern
19. Other..

# Constraints

- Non-availability of previous Physical Environmental Study and Social, Cultural Information
- There is no National Data Sharing Policy in Myanmar and difficult to fetch information from respective department since Bureaucracy is too much
- Limited Budget
- Public and private partnership is weak
- Long term project



# Finding

- Questionnaires are satisfactorily responded by communities
- Drought affected on agriculture absent of rainfall and extreme heat
- 50% of the villages the can not cultivate due to absent of rain
- 50% of households rely on agriculture and 30% have odd jobs whilst the rest 20% have no jobs
- Due to damage by drought most of people move to other part of the country to find another job for their livelihood, so families are separated
- Students can not continue their education in new places
- Social-conflicts occur in some areas
- Some people change their carrier and went to aboard for jobs
- People also concerned for coming year whether drought will be affected or not
- Water Scarcity, Malnutrition and food shortage for livestock breeding

- Particulate matters ( $PM_{2.5-10}$ ) in Ambient air measured exceed than permitted level due to drier climatic condition in some points
- Water quality drop due to extreme temperature and nutrient of soil degraded
- Winds are generally light, occur spasmodically and are less than 16 kilometers per hour
- Central Dry Zone has the lowest rainfall and the highest potential evaporation and temperature within the country.
- These climatological factors result in a considerable soil moisture deficiency and a lack of significant surface water availability.

# What is the intervention of Government?

**Issue do and don't in hot seasons**

**Issue Curfew in some area within 10:00 am – 4:00 pm**

**Water supply to some area**

# Legal and Institutional Framework



**The Myanmar National Adaptation Programme of Action (NAPA) Report is prepared in the framework of the LCDF funded project “Preparation of National Adaptation Programmes of Action” implemented by United Nations Environment Programme (UNEP) and Executed by the Department of Meteorology and Hydrology, Ministry of Transport of Union of the Republic of Myanmar**

# Myanmar Climate Change Alliance



Myanmar Government announces formation of High Level Committee on Climate Change in December 2013.

This is a significant milestone in establishing the Myanmar Climate Change Alliance and highlights the political will of the government to address the climate change.

- Chairmanship - Union Minister (MOECAF)
- Vice Chair - 2 Deputy Ministers (MOECAF)
- Secretary - Director General (Planning & Statistics, MOECAF)
- Members - 28 Directors General of related government line ministries



# Legal and Institutional Framework

## Myanmar Disaster Management Law 31<sup>st</sup> July 2013

- 9 Chapters
- 43 Articles

15. (c) enhancement of the capacity of the public for emergence of a disaster resilient community in compatible with climate change for reduction of damage and losses due to unforeseen disaster risk caused by climate change;

The Law lacks sufficient needs of more vulnerable people such as women, children, aged persons and people with disability.

# Recommendations for NEXT.....

- Reforestation, Alternative Energy and reducing of Hydropower Dams construction
- Climate compatible business require for country's developement
- Comprehensive research on Droughts and Impacts required for Central Dry Zone of Myanmar
- ASEAN or regional level collaboration work on Climate Change (CC) and Knowledge Transfer required since Climate Change is global phenomenon and no demarcated boundary
- Required scientific study and practical approach on CC
- Authorities and experts of Administration, Relief, Water resources, Agriculture, Forestry, DMH, other concerned depts. , NGOs, INGOs & CBOs should cooperate, coordinate and collaborate on Climate Change Deduction and Adaptation
- To promote education and public awareness for CC
- Building capacity for resilience and adaptation on climate change to Stakeholders
- To develop CC policy and strategies for CC management in Myanmar

# Conclusion

- Myanmar's Climate changing significantly since 50 years ago.
- Late onset and early withdrawal of monsoon are recorded
- Environmental and Socio- economic sectors affected by climate change impacts
- Drought Risk Management required in Myanmar
- Central Dry Zone of Myanmar also experienced severe drought in 2005 and frequency of drought closer and closer
- Research of Drought on Central Dry Zone of Myanmar will continue in order to cover the whole area
- Finally, according to the law of impermanent, “Nothing is permanent” , but we are try to maintain sustainable environment

A tropical landscape featuring a field of dry, yellowed grass in the foreground. In the middle ground, there are several tall palm trees with green fronds. The background shows a line of trees and a small building under a clear blue sky. The text "Thank You" is overlaid in yellow at the bottom.

**Thank You**