Capacity Development packages for Myanmar to support the MAHFSA program

Peatland Assessment and Mapping

October, 2022

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What is Peat ?

- A soil which is composed of 65% or more organic matter (mostly semi-decomposed plant matter: trees, sedges, grasses, mosses)

- Normally black in color and spongy (Peat can contain c 90% water)

- Contrast: Mineral soils are made up of inorganic matter (e.g. sand, silt, clay)

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Distribution of Peatlands in Southeast Asia

AMS	Peatland area (ha)
Indonesia	20,200,000
Malaysia	2,560,341
Brunei Darussalam	90,900
Thailand	64,555
Viet Nam	24,000
Philippines	20,188
Myanmar	11,233
Cambodia	9,850
Lao PDR	1,000
TOTAL	**22,982,067**

Herbaceous Vegetation On Peat

Main type of vegetation on peat in mainland Southeast Asia

Forest has been replaced by herbaceous vegetation

Tasek Merimbun, Brunei

Inle Lake, Myanmar

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Peat belongs to a group of soils called **<u>HISTOSOLS</u>**

<u>HISTOSOLS</u> are organic soils which develop in waterlogged areas

There are three major groups of HISTOSOLS:

- Organic clay (20-35% organic matter)
- Muck (35-65% organic matter)
- <u>Peat (> 65% organic matter)</u>

Containing Materials in Peat

Peat: **<u>in terms of organic matter content and proportion of organic matter in soil profile</u>**

- ‘organic soil where the loss on ignition is greater than 65%. The minimum depth of the organic soil must be 50cm and the organic soil material must make up more than half the total cumulative thickness of the upper 100cm of the soil profile’

- Peat land: An organic soil, which contains at least 65% organic matter (less than 35% mineral material), and is at least 0.5m in depth and 1.0 ha in areal extent.

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Conditions for Peat Development

- Areas which are waterlogged for most of the year
- Where there is high production of organic matter
- Where water flow is low so that organic matter can accumulate
- Waterlogged soils are low in, or devoid of oxygen, so that decomposition of the organic matter is reduced:
- Partially decomposed organic matter accumulates as PEAT

PEAT formed under forest: normally acidic, infertile

PEAT formed from trees: many semi-decomposed trunks and branches are found in the peat profile

PEAT formed from herbaceous vegetation

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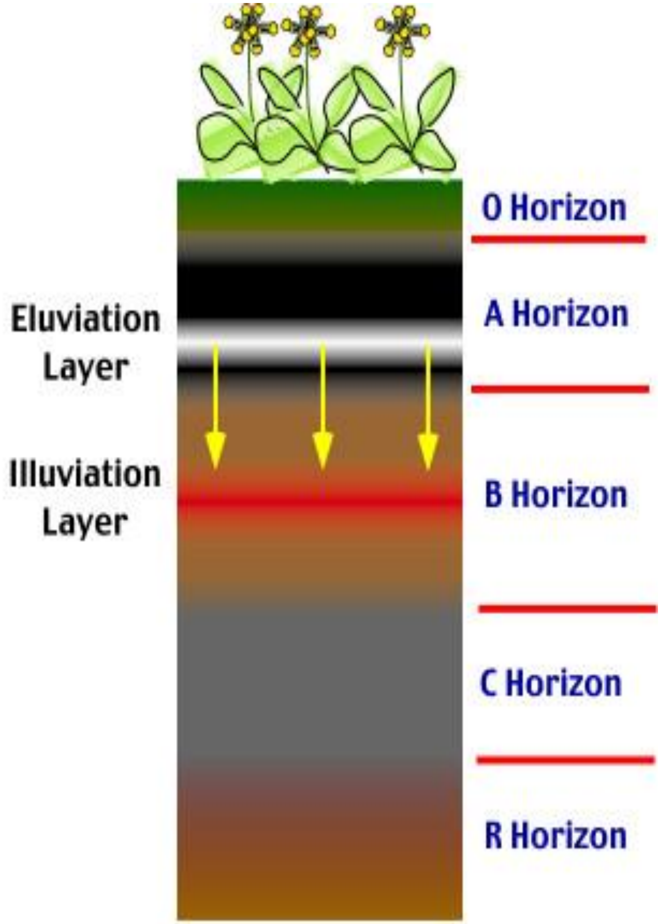
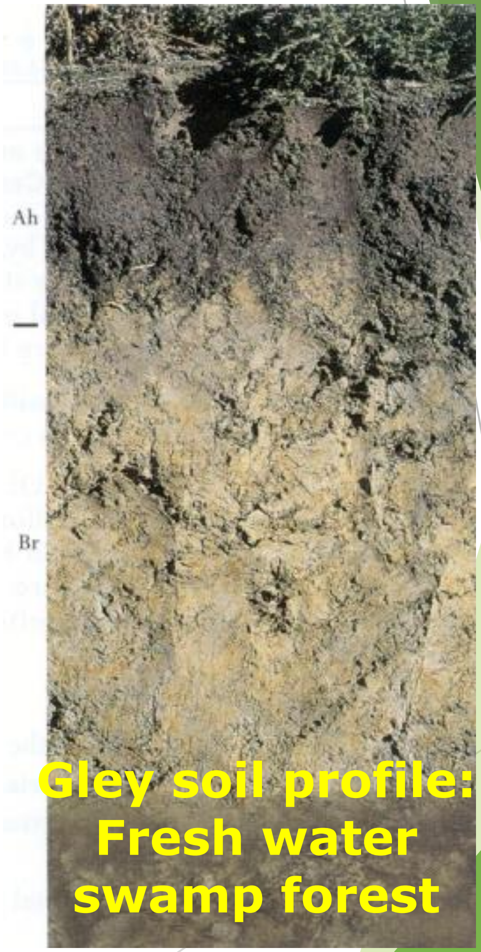
Contrast: Mineral Soil





Peat Water

In saturated state, peatlands may contain up to 90% water
Therefore, can be thought of as an aquatic rather than terrestrial system

Therefore, can be thought of as an aquatic rather than terrestrial system

Water which flows through peat areas becomes brown/black due to substances washed out from the peat:

"BLACKWATER" can be used as an indicator of the presence of peat areas – when viewed from above, the water appears black. When viewed from side, it appears brown, like plain tea

"BLACKWATER" – looks black from above; like tea from side

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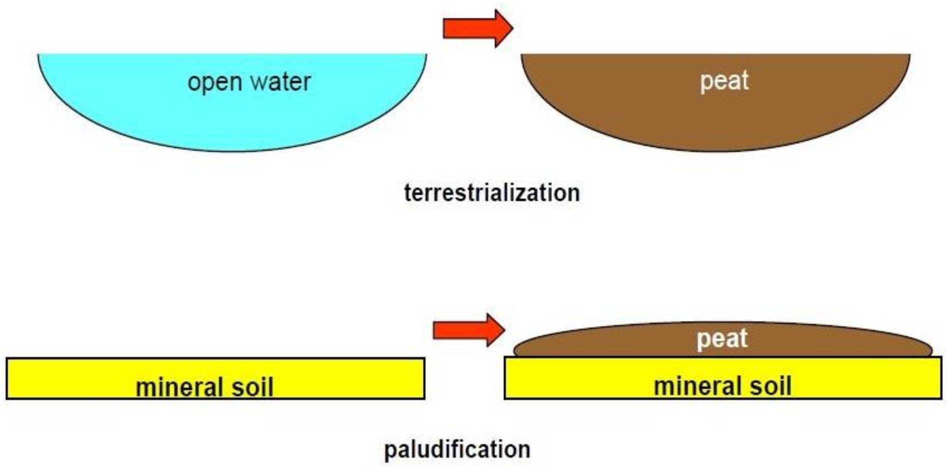
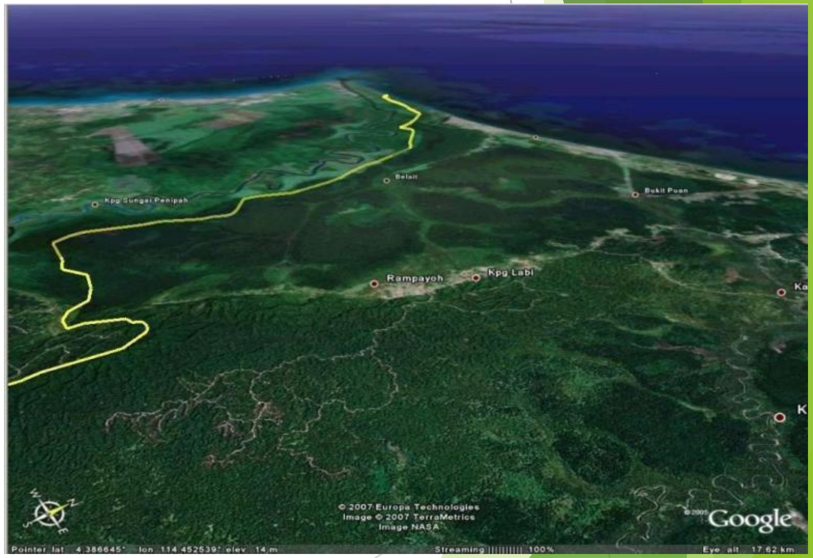
Topographical Settings for Peat Formation

A distinction can be made between terrestrialization, when peat develops in open water; and paludification, when peat accumulates directly over a paludifying mineral soil

MAINLY RIVER VALLEY / BASIN



MAINLY COASTAL / DELTAIC



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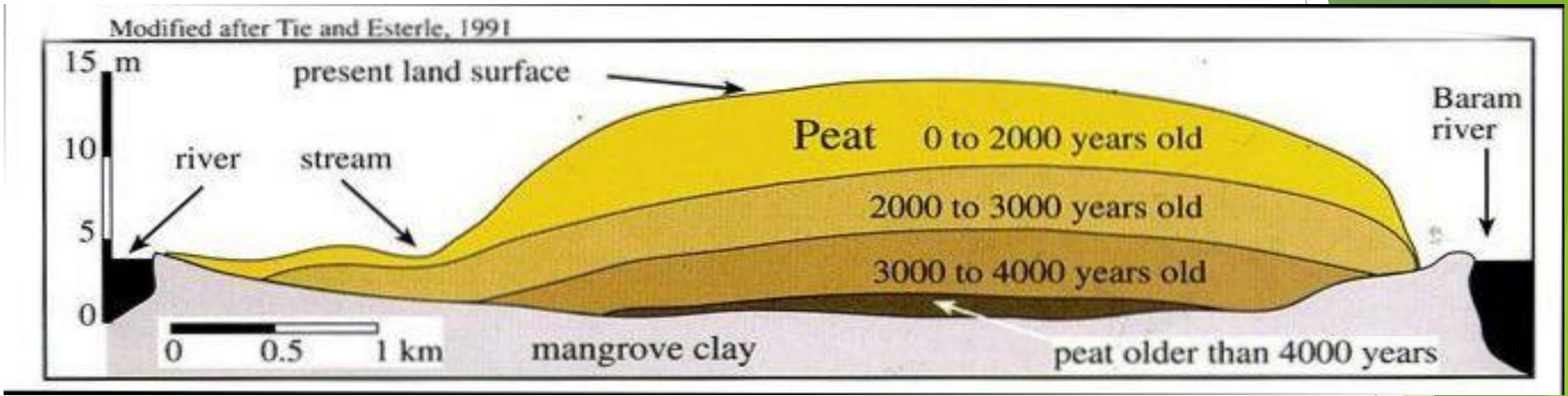
Most Coast/ Deltaic Peatlands Develop as PEAT DOMES

"PEAT DOME" in the Baram Basin, Sarawak



DEVELOPED BETWEEN RIVERS

Age of Peat

Coastal peatlands in Southeast Asia:

Peat started to accumulate **4,000 - 5,500** years ago, following stabilization of rising sea levels

From work on Borneo:
More inland peatlands probably older – may be up to **30,000** years old (Source: Rieley & Page, 2008)

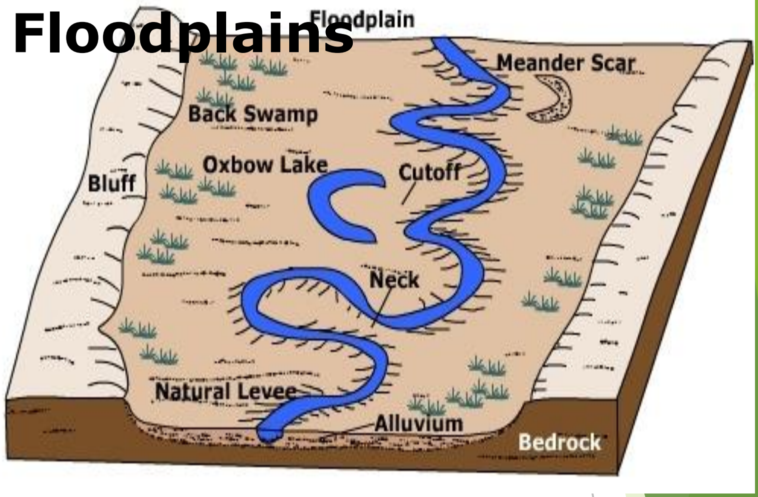
Changing sea levels
Holocene: post-glacial sea level max. c 6-5,000 BP, then fell slightly:
Large flat areas on exposed land in Southeast Asia:

PEAT ACCUMULATION

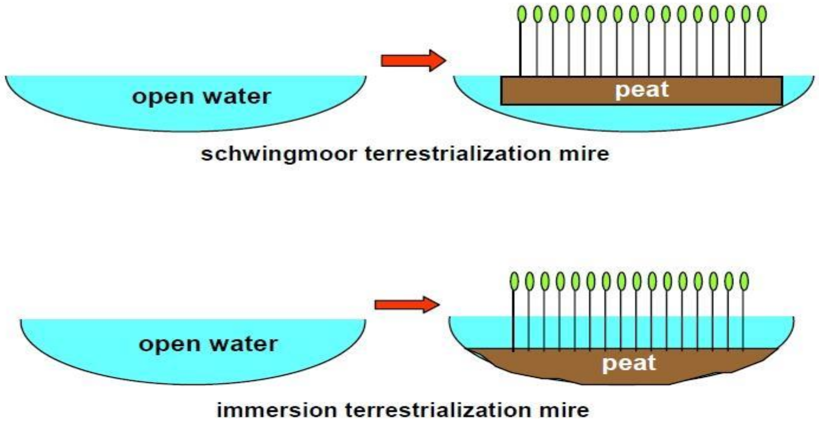
Occurrence of pollen types in different depths of peat reflects succession in time

River Valley/ Basin Peatlands

Conditions for Peat Development Suitable in Floodplains



Two Major Types of Peat Formation from Open Water (Terrestrialization)



Possible Peat Development from Floating Mats

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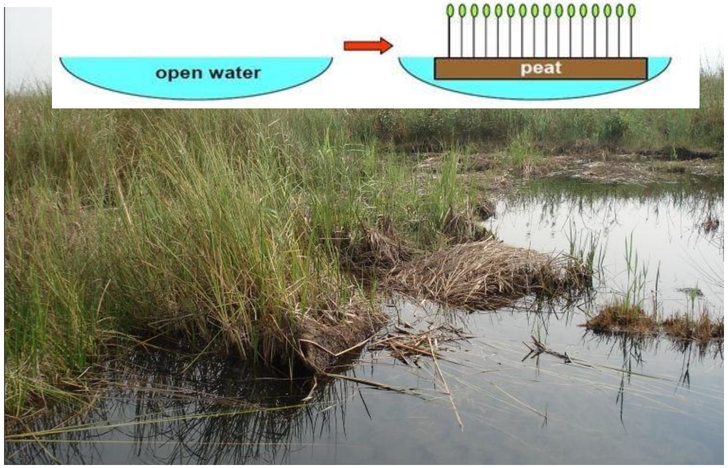
Inle Lake Floating Mats



Old Lake Basin, c. 1,000m above sea level

Shan Plateau, Myanmar

Peat normally formed over mangrove clay or sand

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Inlay lake peat land (shan state Myanmar)

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Floating island agriculture at inlay peatland

Peat land agriculture heho plain

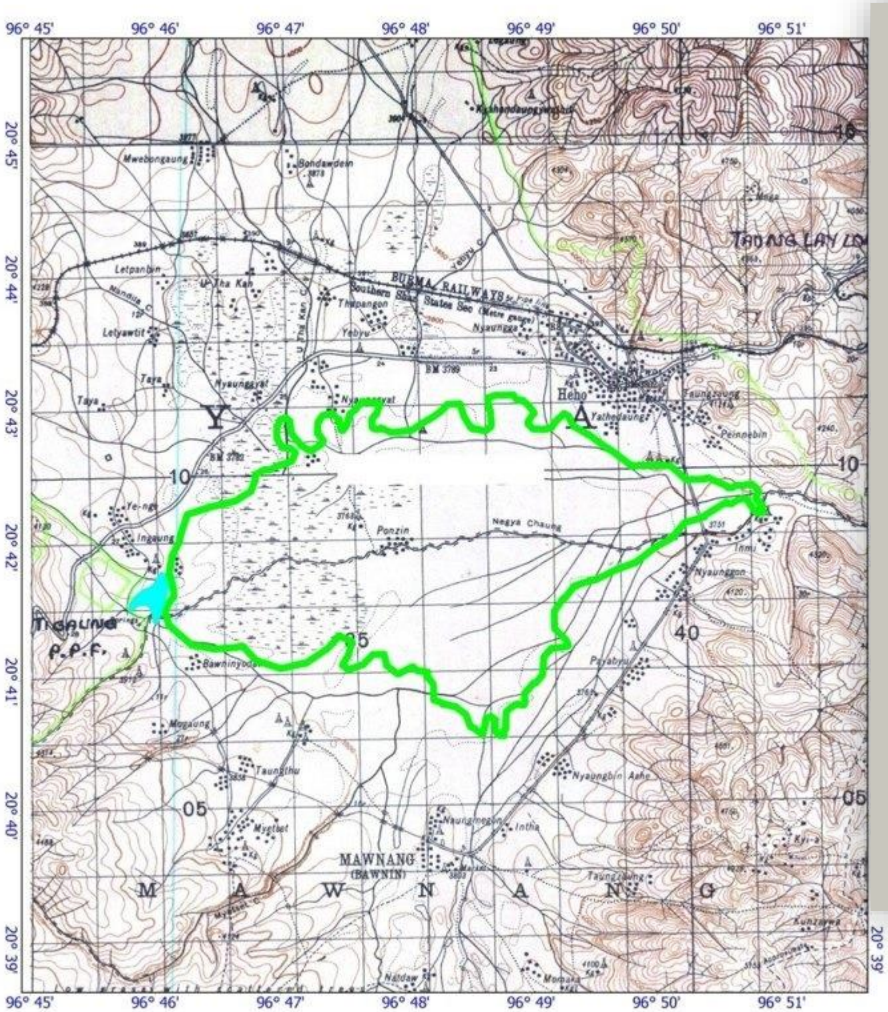
Peatland assessment Boatpyin township

Peat land Taungbokyi village Inlay

6.5 meters deep A rare type of peat hill

Peat assessement Heho plain

Location Map of Heho Valley Peatland



Scale : 1 inch = 1 mile

1625.7 ha

Peat land agriculture heho

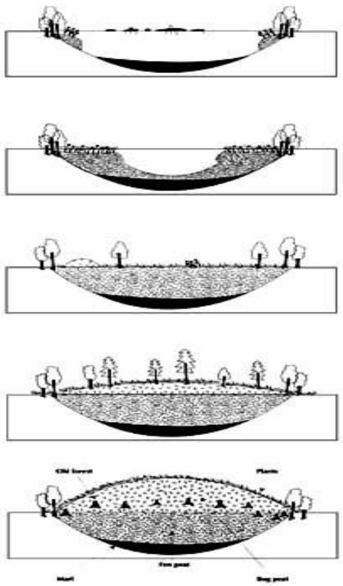
Htoinn peat land fish pond

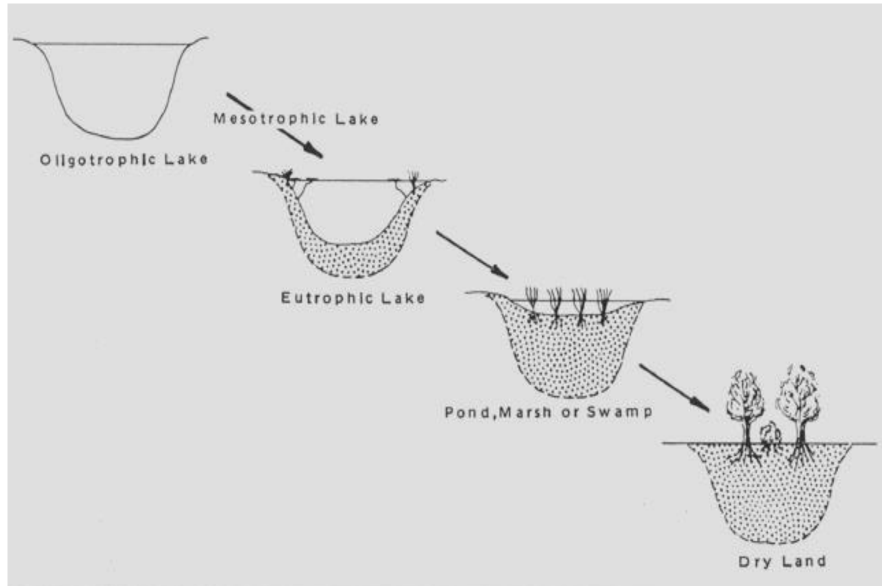
Flower planting

Peatland assessment Htoinn Myanaung township

2014 Jan

Peat can form through the infilling of lake basins (e.g. Shan Plateau, Myanmar)

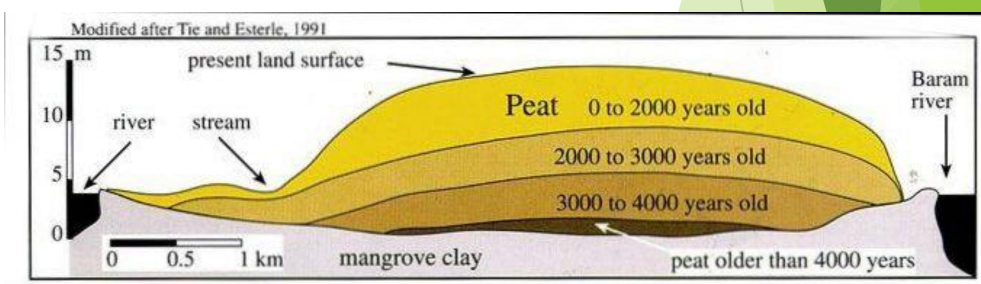




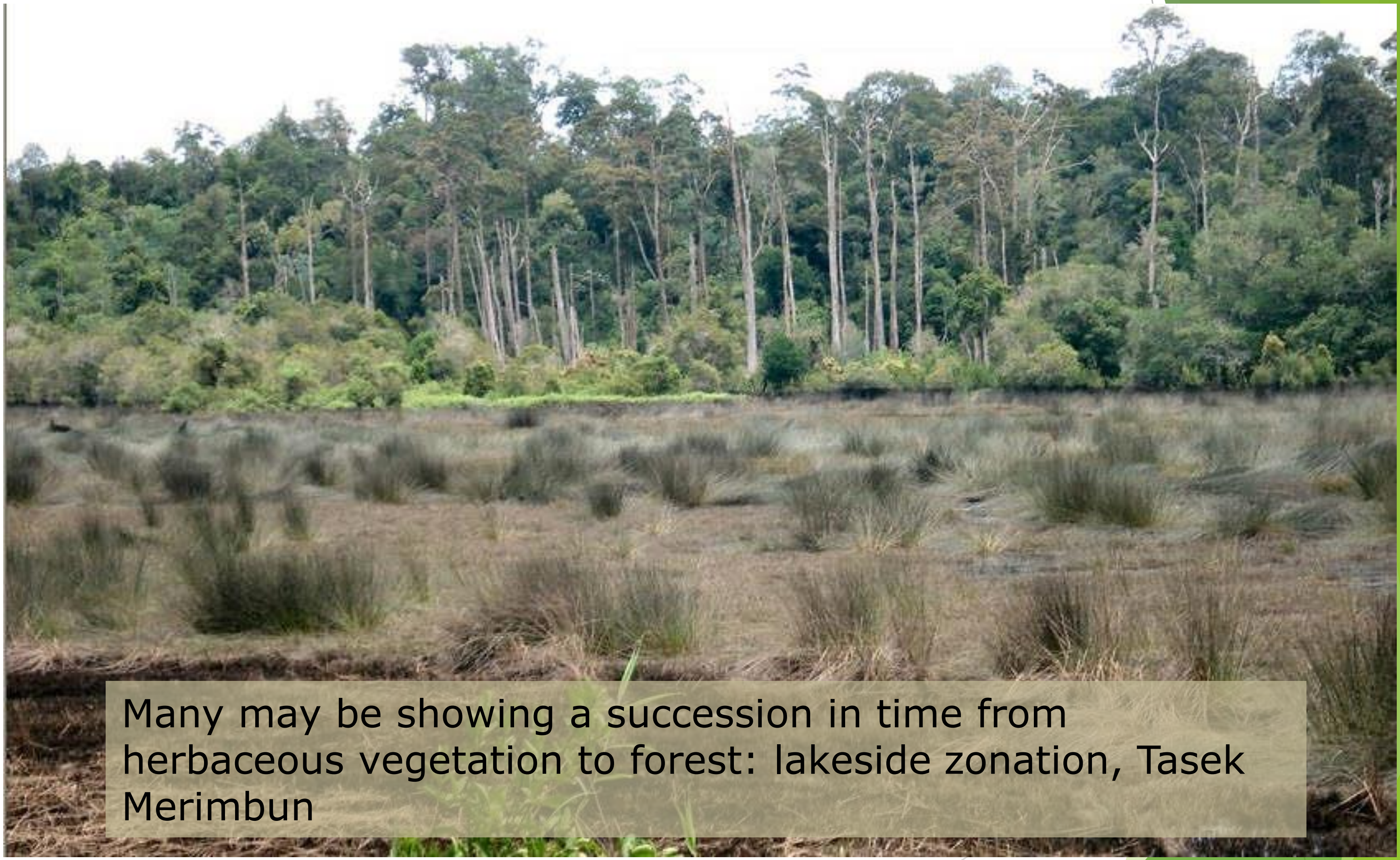
Concept in limnology: Ageing of lakes

Radiocarbon dating: long-term median peat accumulation rate of ~ 1.3 mm/yr (i.e. 67g C/m²/yr assuming a peat bulk density of 0.09 and 56% C content), which is about 2-10 times the rate for boreal and subarctic peatlands (0.2-0.8 mm a-1)
(Source: Page et.al., 2010)

Rate of Peat Accummulation



Remember that these are dynamic systems: many intact peatlands are still actively accumulating peat



Many may be showing a succession in time from herbaceous vegetation to forest: lakeside zonation, Tasek Merimbun

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Methods for Peatland Degradation Assessment

Assessing degradation based on physicochemical components of the peatland

Decomposition of peat materials

- The field method developed by Von Post can be used to determine the degree of humification (decomposition) in peatland.
- This field test is based on a visual examination of the colour of the water expelled and the peat material remaining in the hand after a saturated sample is squeezed.

Photo: John Kelley, NRCS

Fibric: Slightly decomposed. When a saturated sample is squeezed the liquid expelled ranges from clear to brown and no organic solids ooze out from between the fingers.

Hemic: Partially decomposed. When a saturated sample is squeezed, the liquid expelled ranges from dark brown to nearly black (turbid) and up to a third of the sample oozes out between the fingers.

Sapric: Highly decomposed. When a saturated sample is squeezed, the liquid expelled is very dark to black (turbid) and greater than a third of the sample oozes out between the fingers.

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Methods for Peatland Degradation Assessment

Assessing degradation based on physicochemical components of the peatland

Four factors to assess using the **Von Post Scale** including:

- quantity of water expressed,
- nature of water expressed,
- the portion of sample extruded, and
- nature of residues

Degree of Decomposition	USDA SCS Classification	Nature of water expressed on squeezing	Proportion of peat extruded between fingers	Nature of peat residues	Decomposition description
H1	Fibric	Clear, colourless	None, elastic	Unaltered, fibrous	Undecomposed
H2	Fibric	Almost clear, yellow brown	None	Almost unaltered	Almost undecomposed
H3	Fibric	Slight turbid, brown	None	Most remains easily identifiable	Very slightly decomposed
H4	Hemic	Turbid, brown	None 1%	Most remains identifiable	Slightly decomposed
H5	Hemic	Strongly turbid, contains a little peat in suspension	Very little 2-25%	Bulk of remains difficult to identify	Moderately well decomposed
H6	Hemic	Muddy, much peat in suspension	One third 26-45%	Bulk of remains not identifiable	Well decomposed
H7	Sapric	Strongly muddy remains	One half	Relatively few identifiable	Strongly decomposed
H8	Sapric	Thick mud, little free water	Two thirds	Only resistant roots, fibers, and bark, etc., identifiable	Very strongly decomposed
H9	Sapric	No free water	Almost all	Practically no identifiable remains	Almost completely decomposed
H10	Sapric	No free water	All	Completely amorphous	Completely decomposed

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Methods for Peatland Degradation Assessment

Assessing degradation based on physicochemical components of the peatland

c. The bulk density value of peatlands

Dig around the ring (cylinder) and underneath it with a trowel and carefully lift it out to avoid losing contents.

Carefully cut off excess soil at either end of the ring with a flat-bladed knife. The bottom of the sample should be flat and even with the edges of the ring (cylinder).

Place the core in a labelled container and close the lid.

Bring all samples back to the lab, weigh each canister plus moist soil.

Determine the weight of dry soil in the sample.

Measure the volume of the metal cylinders.

Use this information to calculate bulk density, porosity, and water-filled pore volume.

The formula for calculating soil bulk density:

Bulk density (g/cm^3) = Dry soil weight (g) / Soil volume (cm^3)

Alternatively, a PVC tube with a diameter of 50 cm can be used to drive vertically into the soil from the top for sampling. After sampling up, cut each segment to include in the sample rings.

The method of sampling and analysing the peat bulk density follows the following procedure

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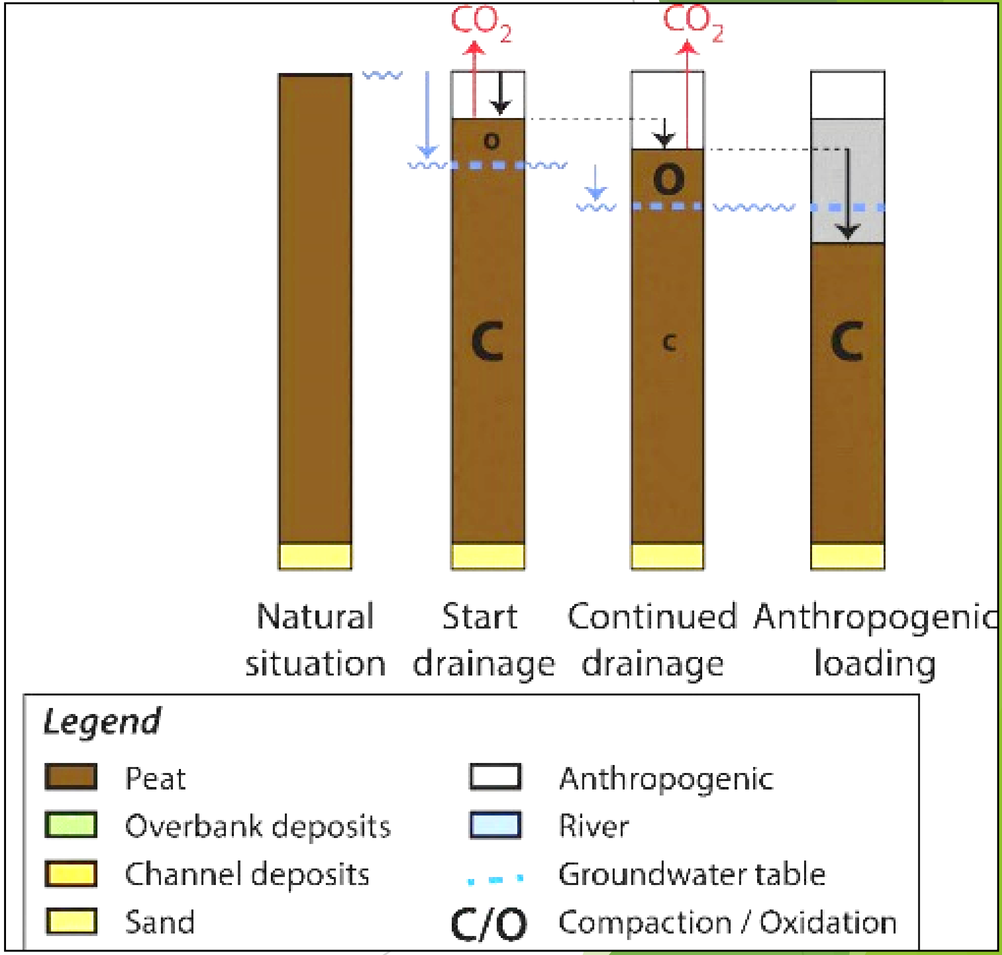
Methods for Peatland Degradation Assessment

Assessing degradation based on physicochemical components of the peatland

- Relative contribution of peat compaction and oxidation to subsidence resulted in the loss of carbon content through the release of carbon dioxide into the air.
- Amount and rate of subsidence due to peat compaction and oxidation is variable in time and space, depending on the peat type, organic-matter content, and water table



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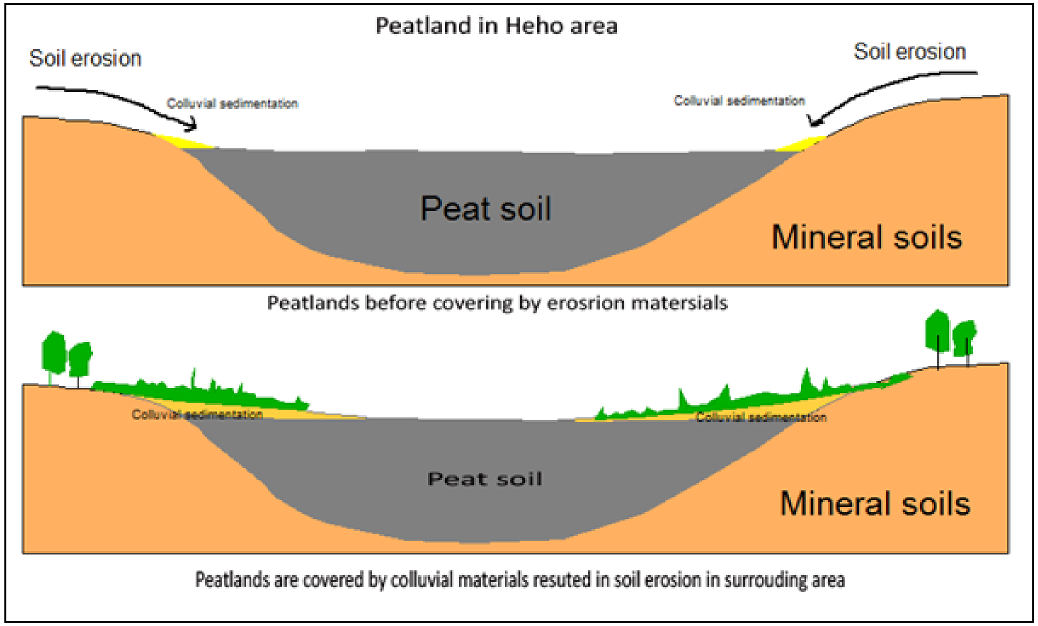
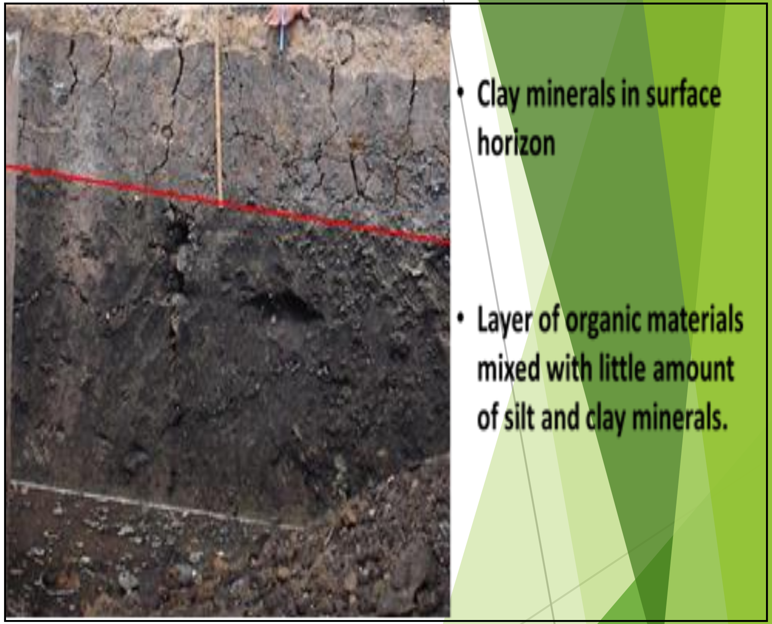
Causes and consequences of peatland degradation

Causes of peatland degradation:

Sedimentation of peatlands



Process of formation of colluvial layer above the Heho peatland, Myanmar (Source: SEApeat, 2015. Peatland Assessment in Shan State, Myanmar)



Section through buried peatland in Heho, Myanmar (SEApeat project, 2015. Peatland Assessment in Shan State, Myanmar)

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Causes and consequences of peatland degradation

Consequences of peatland degradation

Summary of development activities and their consequences:

Development activities	Impact/consequences
Changes to the hydrological regime	• Drainage of peatlands and lead to: ✓ Oxidation of organic materials ✓ Subsidence ✓ Reduced water holding capacity ✓ Increase the potential risk of forest fires • Flooding or inundation of peatland areas • Diversion of surface or subsurface flow
Clearance of natural vegetation	• Direct loss of natural habitats and biodiversity • Inability to continue to form peat • Increased oxidation and decomposition of peat layer • Release of carbon to the atmosphere as carbon dioxide (CO2)
Peatland fires (from land clearing, hunting, fishing access)	• Loss of habitat and biodiversity • Disruption of the formation or recovery of peat swamp forests • loss of peat layer • Loss of accumulated carbon and contribution to climate change
Sedimentation and pollution	• Cover the peat layer with layer of sediment, burying the peat • Increase the nutrient availability in peatland leading to decomposition and loss of the peat • Change the natural nutrient and mineral composition • Kill aquatic life and degrade the peatland
Peatland excavation	• Loss of peatland habitat and biodiversity • Loss of peat and stored carbon • GHG emission

Peatland Mapping

- Mapping peatland is to know their location, extent and greenhouse gas emissions potential, can help countries to plan and better manage their land, water and biodiversity, mitigating climate change and adapting to it more effectively.
- Accurate mapping of peatlands is a prerequisite to effectively monitoring changes in peatland condition.
- For countries to reduce greenhouse gas emissions and fire risk, monitoring peatlands' condition, especially their water level becomes key.

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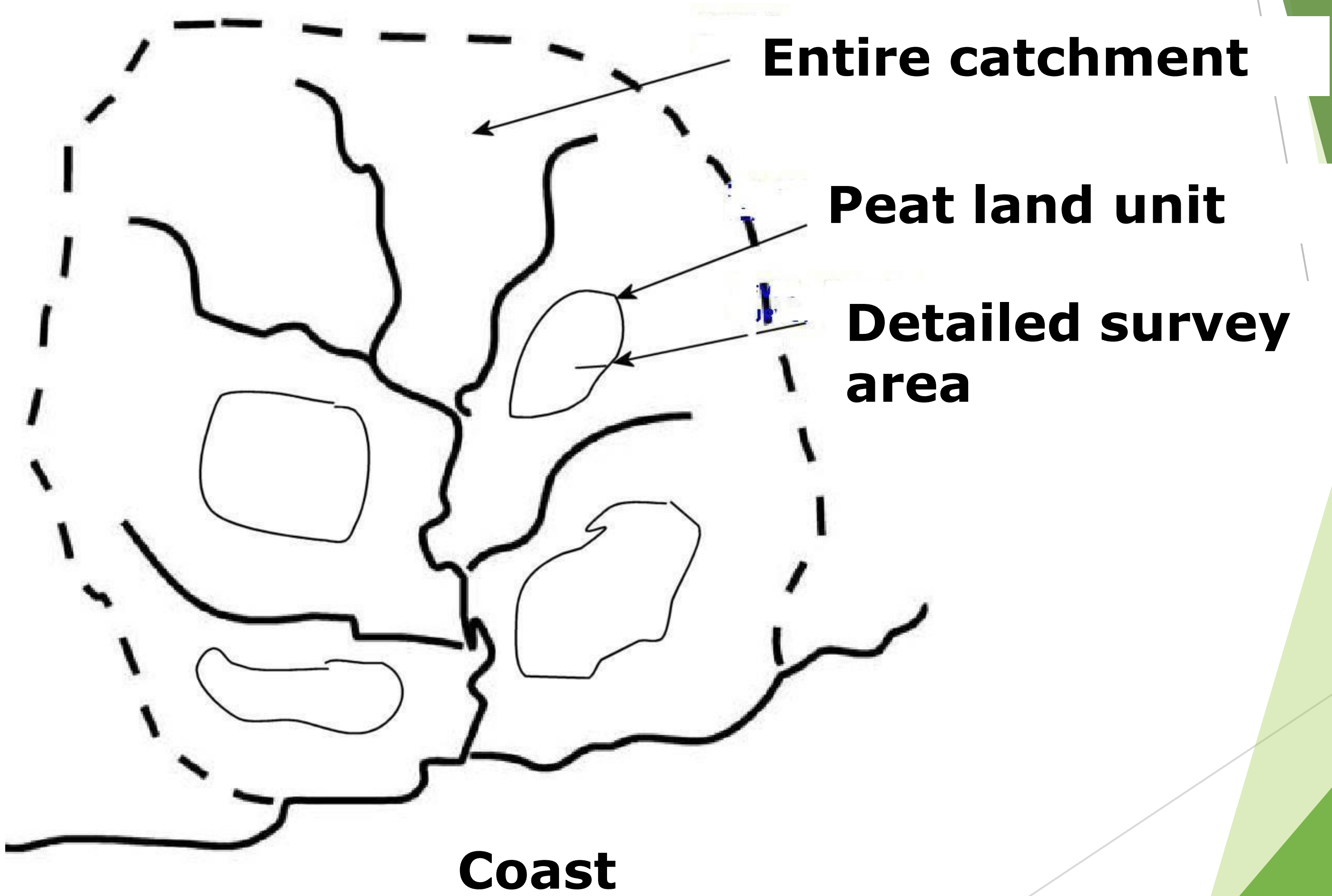
Gather Information



Description of Catchment within which site is located

NAME OF CATCHMENT:

STATE(S) / PROVINCE(S) COVERING CATCHMENT:

AREA (ha) OF CATCHMENT:

GEOMORPHOLOGY / TOPOGRAPHY OF CATCHMENT:

Brief description:

RANGE OF ELEVATION:

CLIMATE:

LAND USE / LAND COVER

Brief description:

SETTLEMENTS (MAJOR AREAS OF HUMAN POPULATION):

PROTECTED AREAS PRESENT IN CATCHMENT:

NAMES & AREAS (ha) OF PEATLAND AREAS WITHIN THE CATCHMENT:

(List peatland areas together with their area in hectares)

MAJOR MODIFICATIONS / DEVELOPMENT PLANS w.r.t MAIN RIVER:

(Dams, irrigation, flood control schemes etc.)

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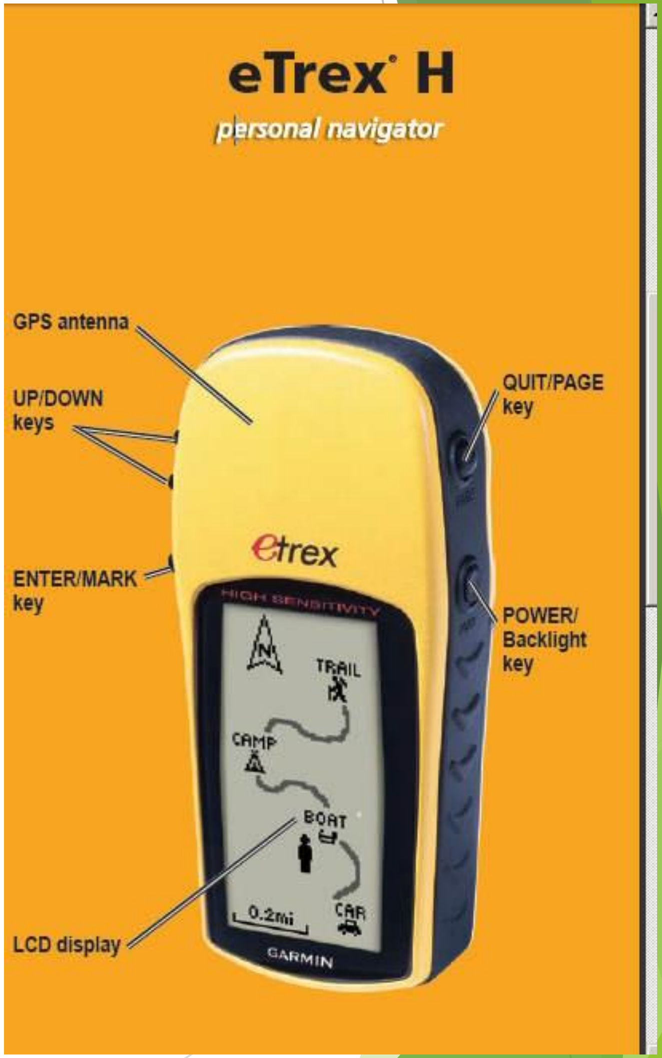
Preparation for Field Survey

<u>Aspects of GPS work</u>
(For non-GIS specialists)

Hand-held GPS units:
• most recent – high sensitivity e.g. Garmin Etrex

Can get signal even under forest canopy



USE OF GPS

- Mark waypoints (point marking location) at strategic points; e.g. changes in direction, changes in vegetation, interesting features

- Make note in field notebook

- Ensure track log is on and clear

- Use in conjunction with compass

Waypoints and routes can be uploaded for use in GPS software

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Software for Use With A GPS Unit

<u>GPS freeware:</u>

Google Earth
Easy GPS: www.easygps.com
Trackmaker: www.trackmaker.com

Uploading GPS data to a computer requires a connection cable – should be bought with GPS unit (not always a USB connection)

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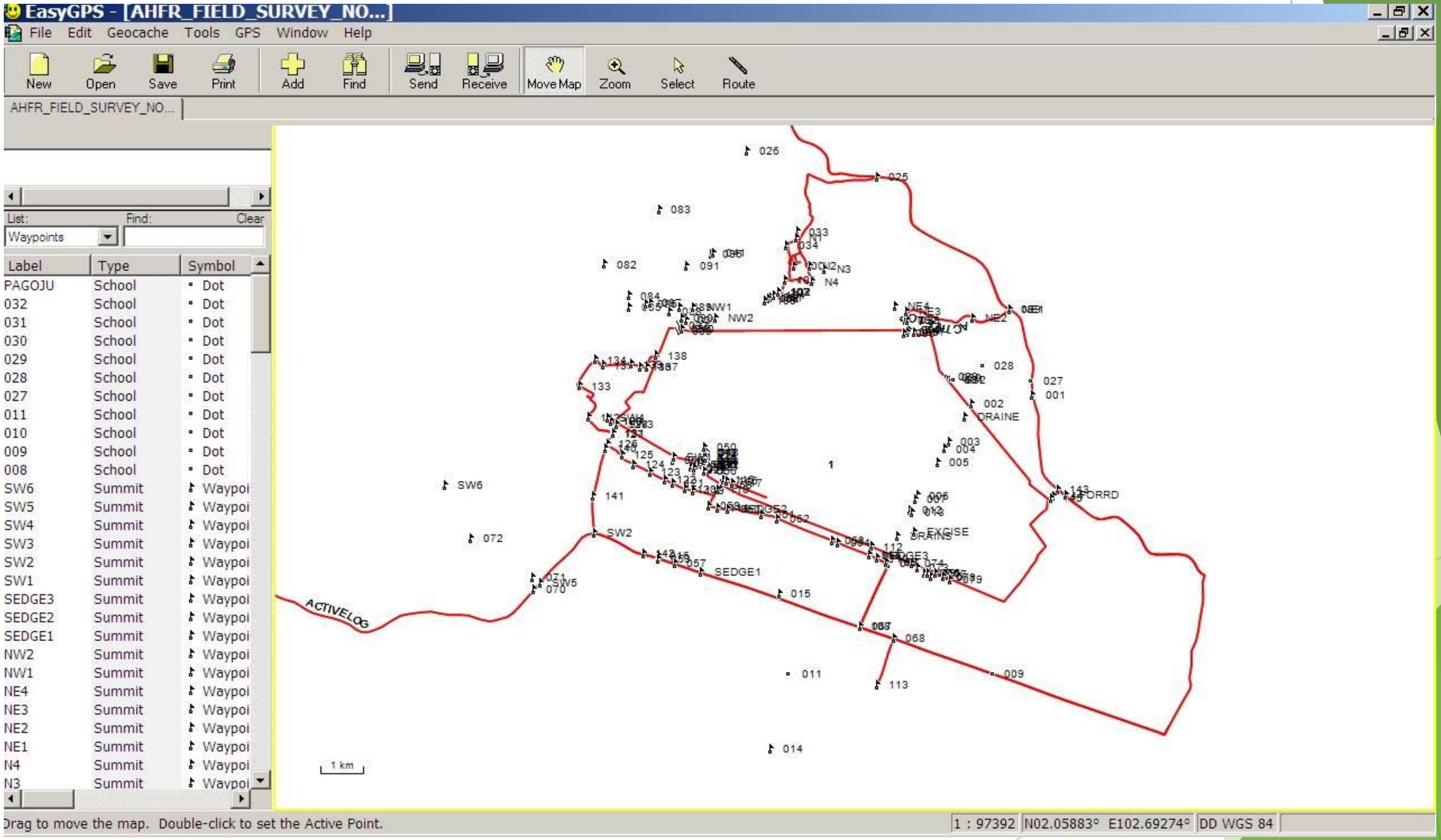
Google Earth

Can upload waypoints and tracks. Saved as kml files. Can measure distances (needs internet connection)

Easy GPS: Send & Receive From GPS Unit

Saved as GPS Exchange files (.gpx): Can be opened in several different programmes



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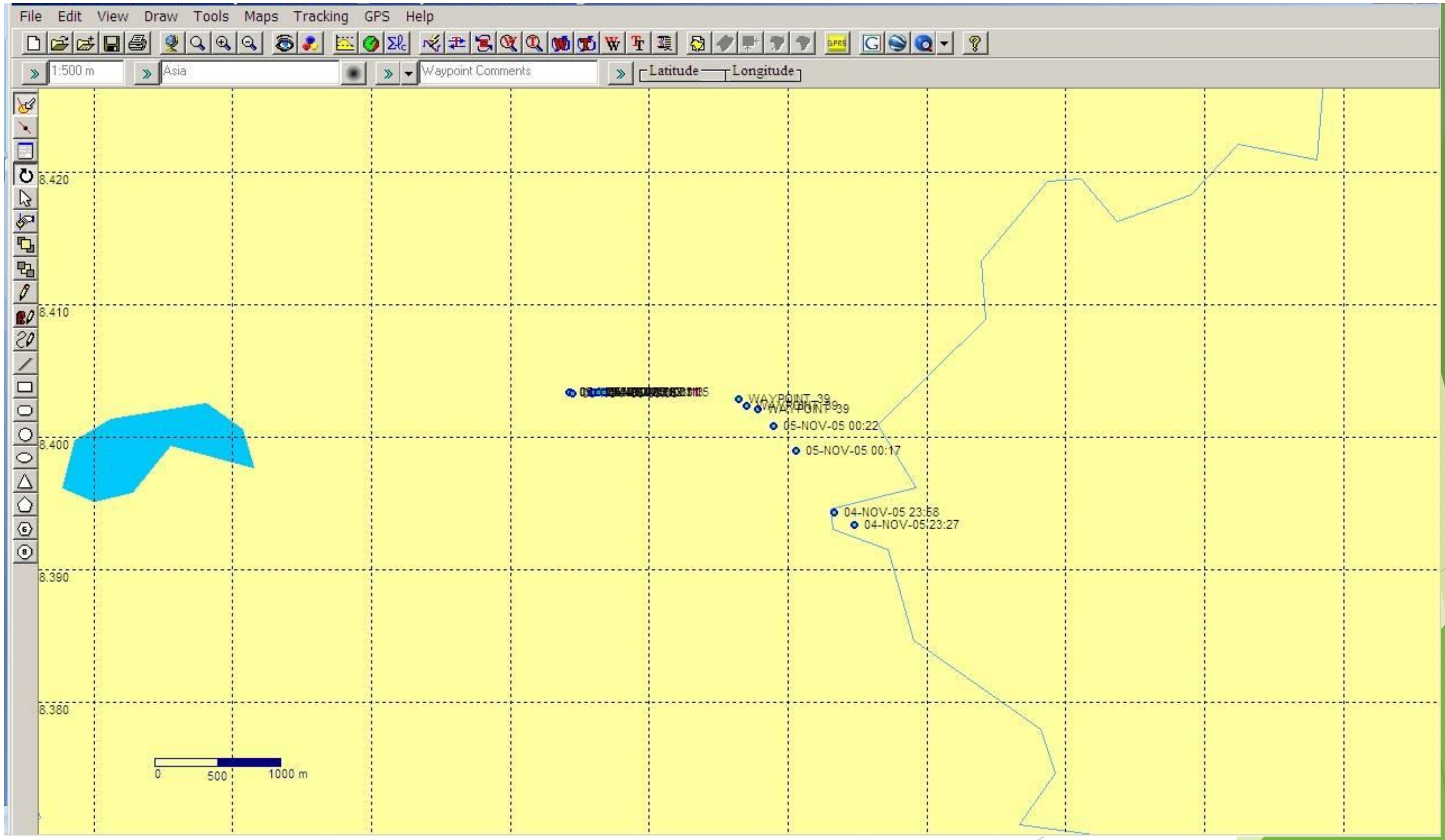
GPS Trackmaker

Send and receive from GPS unit; View in Google Earth; Can open files in various formats and convert files between different formats



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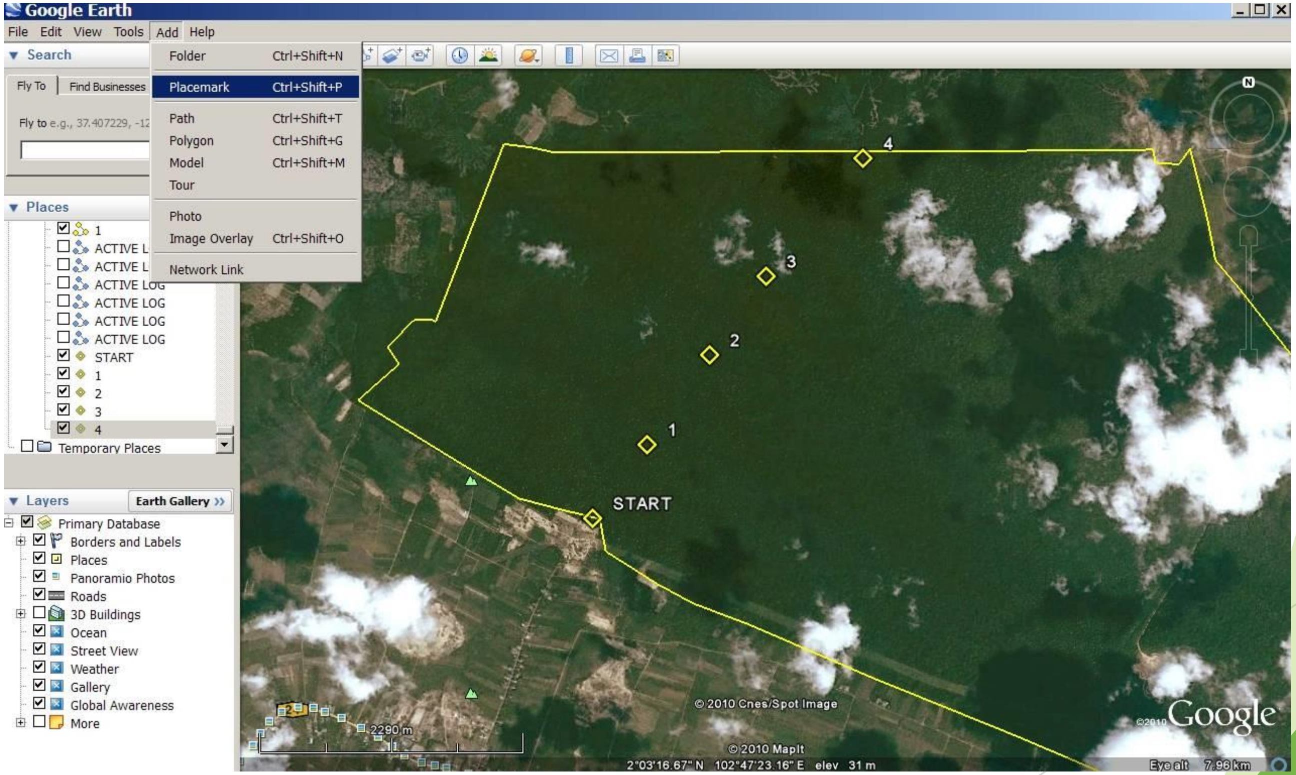
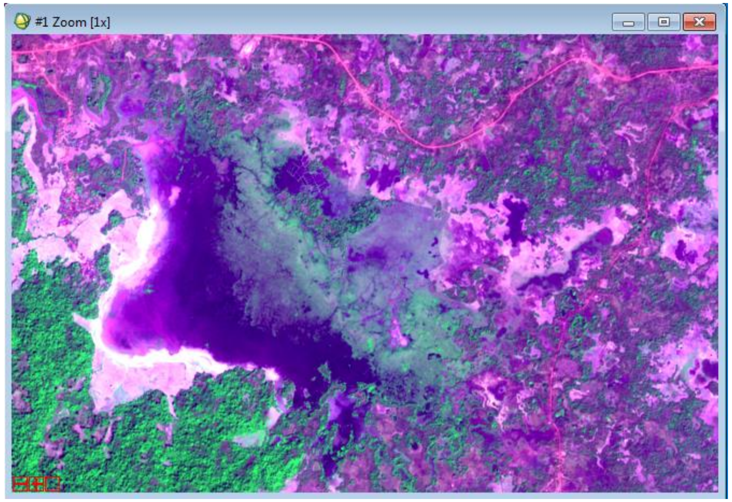
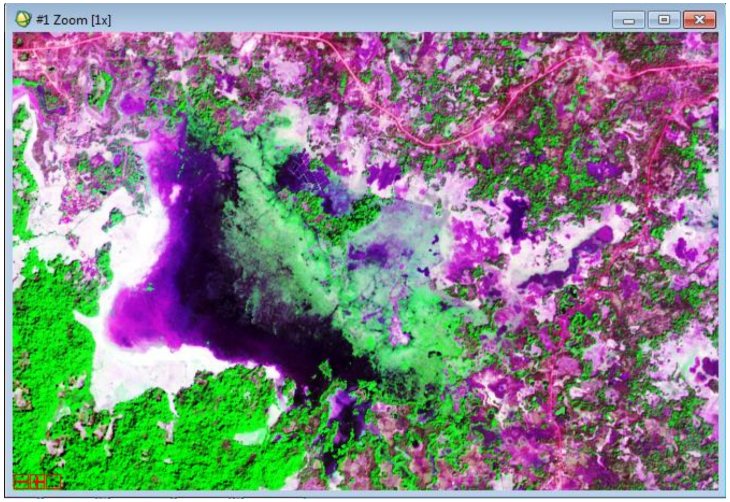
Preparing a Field Survey : Using Google Earth

Making waypoints to follow along a transect: Upload to GPS unit, then use "GO TO" function



Satellite Image Interpretation



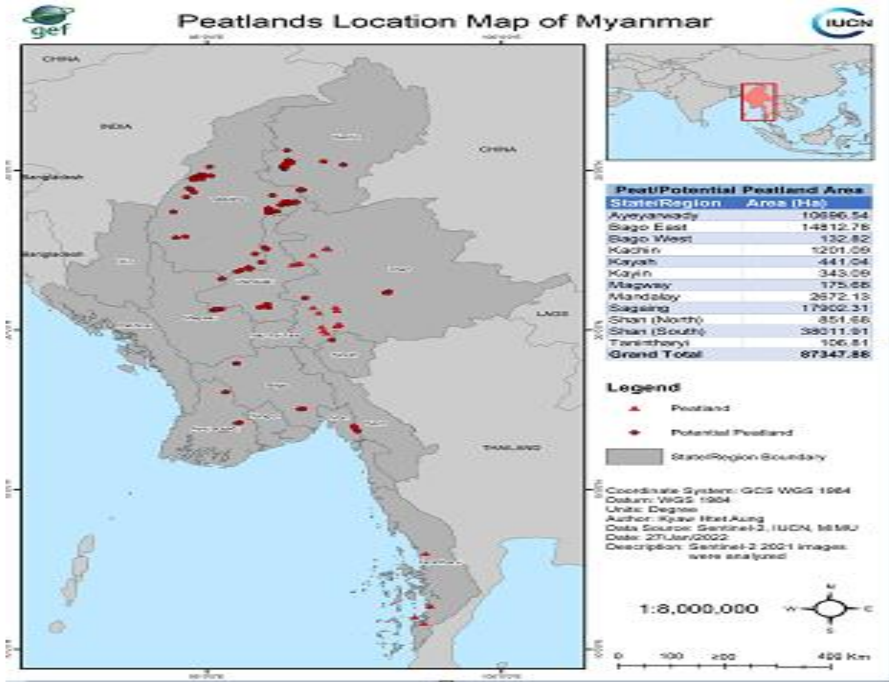


(a)To detect potential areas of the peatlands, satellite imagery interpretation should be done before the field trip.

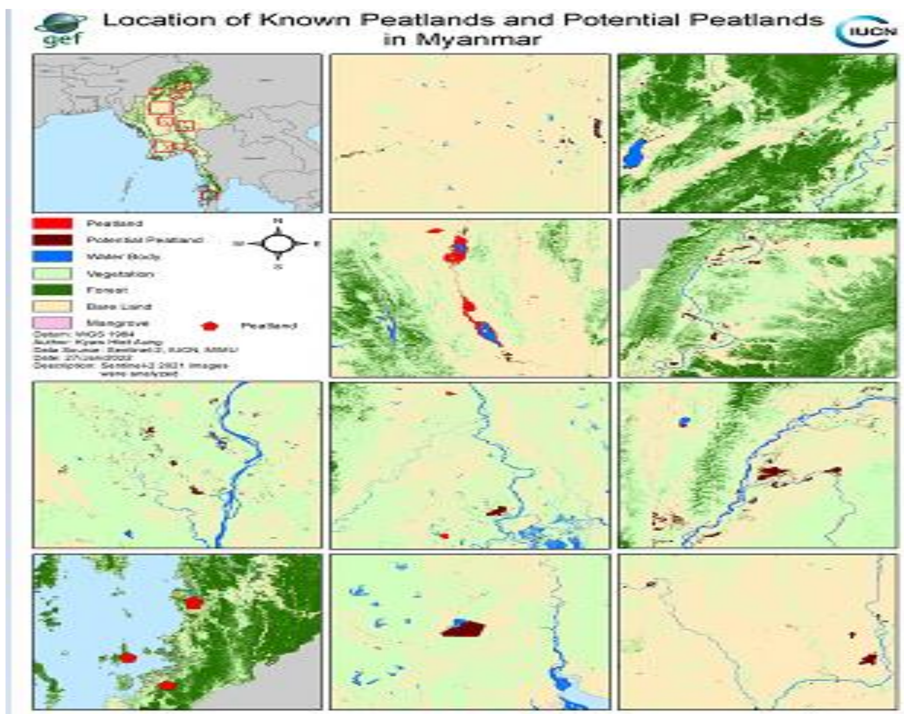
(b)Some types of satellite imageries can be used for interpretation include : Landsat TM7, SPOT5, etc.

(c) From satellite image interpretation, representation of distinct polygons of different peatlands types (depth of peats layers, characters, land covers) being initially delineated through satellite images will be considered as check polygons in a given peat land areas.

- Different identified areas (different polygons) will be used for determining field check sites
- Mapping of survey areas, in which sub-areas should be identified for ground truthing.



Peat/Potential Peatland Area	
State/Region	Area (Ha)
Ayeyarwady	10696.54
Bago East	14812.76
Bago West	132.82
Kachin	1201.09
Kayah	441.04
Kayin	343.09
Magway	175.66
Mandalay	2672.13
Sagaing	17902.31
Shan (North)	851.66
Shan (South)	38011.91
Tanintharyi	106.81
Grand Total	**87347.88**



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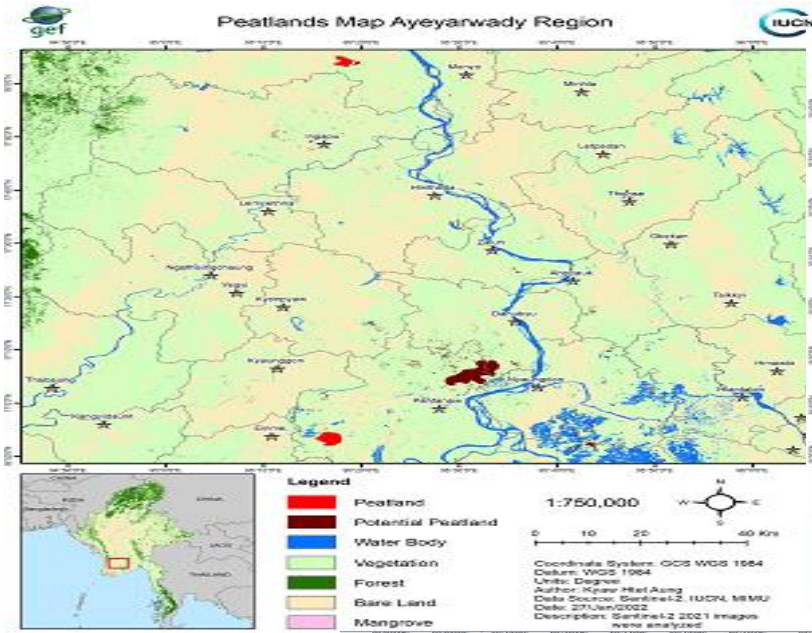

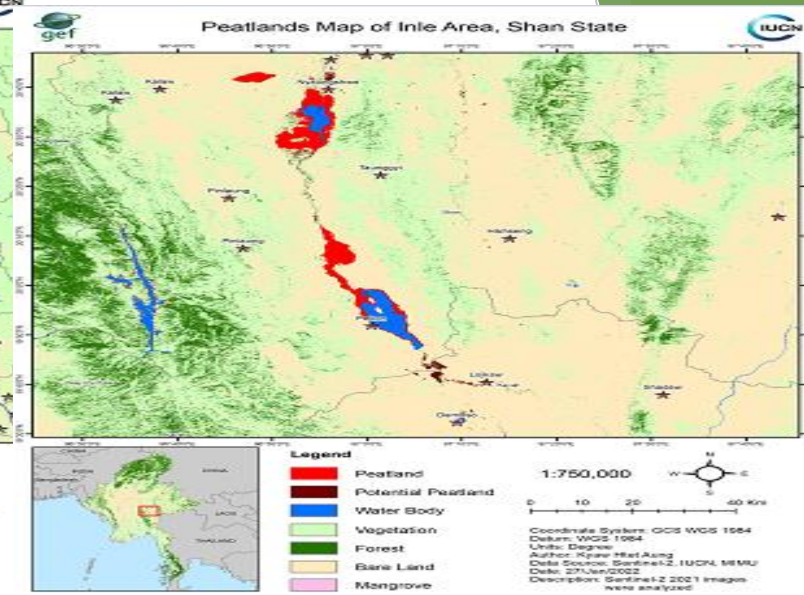

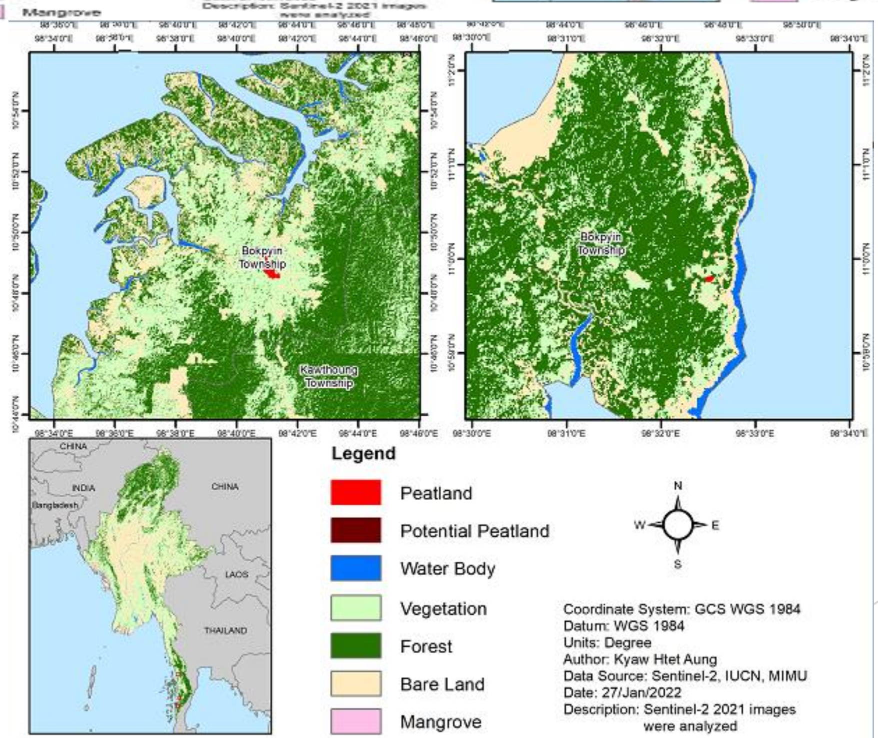

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Thank You for Your Attention

Acknowledgement

This training material development is supported by MAHFSA Programme, with reference to multiple sources including the training modules developed by Mekong Peatlands Project