Attachment 24
Report on the Gully Analysis

Assessment Report on Existing Gullies in Inle Lake Watershed

1 Background and Objective

The flow of soil and sand into Inle Lake is a serious situation, which is said to be caused by gully erosion in the upstream area of Inle Lake. However, the extent of gully erosion is uncertain, and quantitative evaluation has not been carried out yet. Therefore, the aim of this study is to determine the distribution of gully erosion in the upstream areas of Inle Lake (Kalaw, Negya, Namlet, and Upper Balu basins) by interpreting gullies on satellite images and map them.

2 What Is Gully Erosion?

Gully erosion is a form of erosion by rainwater and refers to ravines formed by the action of water. The scale varies from large to small.

Source: http://muses.muses.tottori-u.ac.jp/dept/F/dept/F/erosion/water%20erosion.htm

Gully erosion in the Inle Lake Basin (Kalaw)

3 Target of the Gully Mapping

The target area of gullies mapping is Kalaw, Negya, Namlet and Upper Balu basins, with total surface area about 2,900km^2.

Map of basins in Inle Lake area.

4 Gully Interpretation and Mapping Method

4.1 Interpretation Method

Gully mapping was carried out according to the specifications and instructions descried below.

4.1.1 Minimum mapping unit and satellite data used

The minimum mapping unit was 5mm in length (about 25m in actual size on the ground) with a scale of 1/5000 on a computer display. Images used for the mapping is ArcGIS Online images (copyright-free, commercially available).

4.1.2 Mapping Procedure

i. Interpretation was carried out for each sub-basin.
ii. Enlarged target sub-basin to about 1/15,000, and checked the presence or absence of gully erosion.
iii. Enlarged the site of gully erosion to 1/5000 and drawn a line at the center of gully erosion (with reference to the Shape File of river system map and the gully chart provided by Dr. Furuchi).
iv. Enter satellite image information to the attributes of GIS data for each sub-basin (satellite name (Description, source_info), date of shooting (Date), and resolution (Resolution))

4.1.3 General mapping instruction

- Make sure to snap the line when gullies are connected.
- If gully is present across sub-basins, a line should be drawn across the sub-basins.
- For areas that could not be seen due to clouds, create polygons of the clouds.

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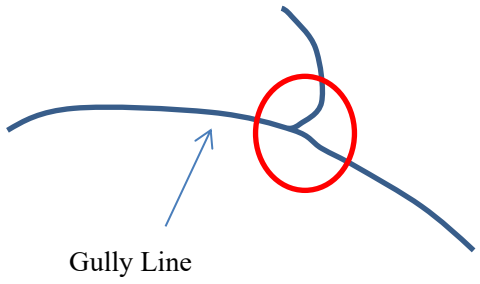
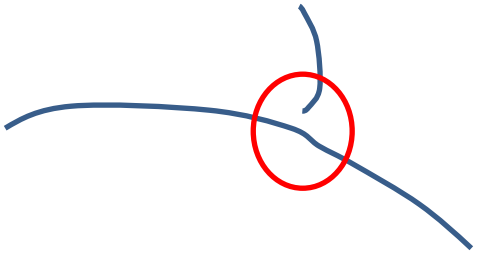
	

4.2 Order of interpretation

(1) Kalaw 3 blocks (to finish the work first, being a priority area)

(2) Namlet 4 blocks, Negya1 block, and Upper Balu 3 blocks (worked in parallel)

4.3 Quality control

Second check of all interpreted gullies was performed.

4.4 Outputs

(1) A set of shape file (.shp) of gully map (all the gullies in the target area are compiled in one shape file)

(2) Set of cloud area polygons (.shp)

(3) Small basin polygon (.shp) (satellite image information entered as attribute information)

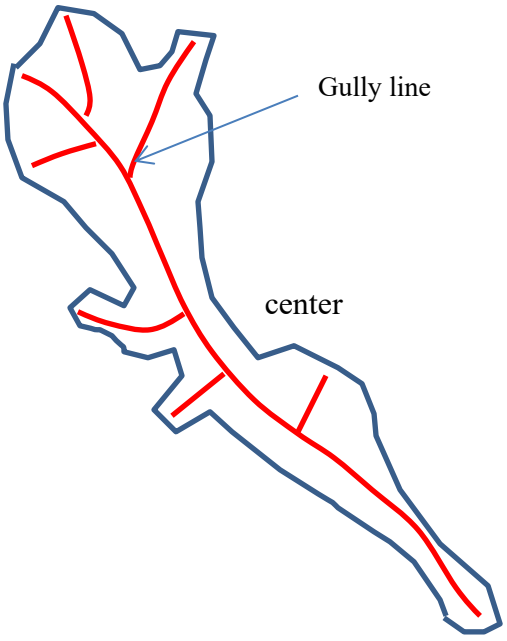
4.5 Interpretation key

Test interpretation and field ground truth survey were carried out, and interpretation keys were prepared as follows.

(1) Large-scale gully

Characteristics

- Branched, wide
- With or without vegetation



Mapping instruction

- Draw a line from the head of gully toward the center

(2) Waterway with vegetation

Characteristics

- Water channel on a flat land or with little slope
- Vegetation is grown along the channel

Mapping instruction

- Draw a line in the center of the channel
- Do not acquire lines for satellite images that show water

(3) Waterway without vegetation

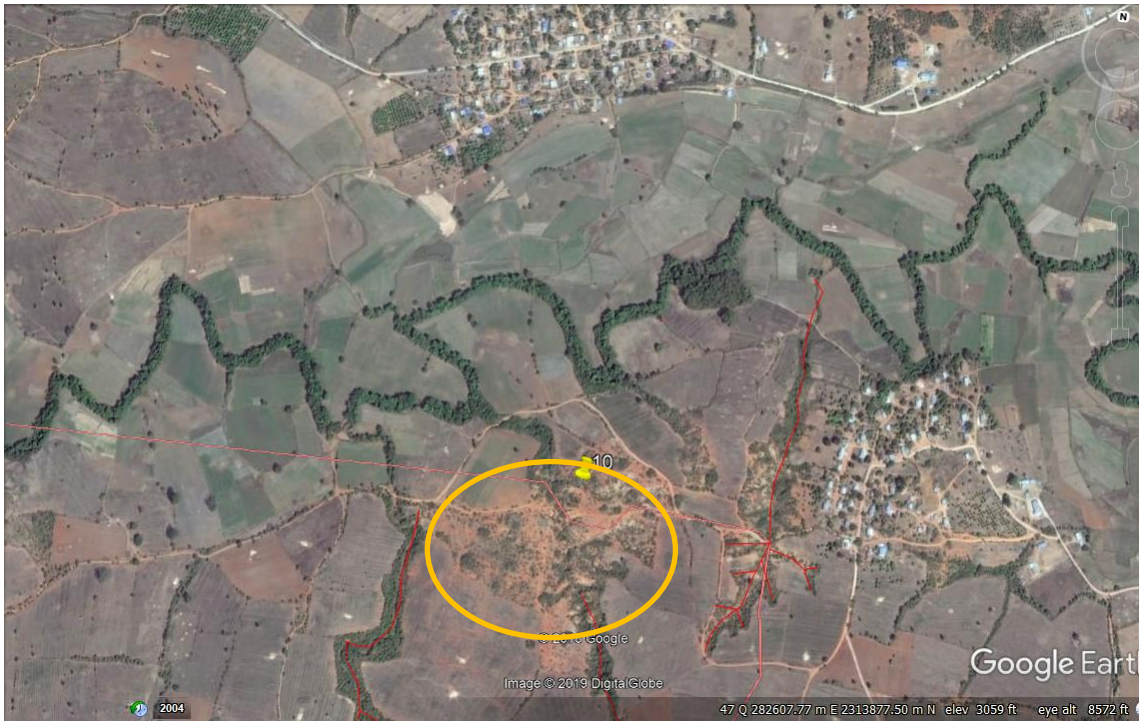
Characteristics

- Lie on a relatively flat area
- Grayish in color
- No vegetation is seen, but grooves (shadow) are visible

Mapping instruction

- Draw a line in the center of the channel
- If water is visible on satellite image, line shall not be drawn

(4) Surface erosion



Characteristics

- It is found in hilly areas with a slight slope.
- The color of the soil can be clearly visible.
- Difficult to see the groove.

Mapping instruction

- Determine the groove (with shadow) that has been confirmed.

It is not necessary to overtake.

The following two features are susceptible to be wrongly interpreted as gully, so pay utmost attention to them not to draw them as gully line:

- Road

After reaching the fields and villages, its width is still constant (i.e. a road does not taper but a gully does taper).

・ Vegetation planted along the field

Vegetation planted around the field is often not a gully.

4.6 Results

The gully interpretation chart, the gully density division chart, and the distribution of the acquisition date of the images used for gully interpretation are given below.

Table 1 Overall results of gulley interpretation1

River basin	Total land area (ha)	Gross extension of gully (m)	Gully density (m/ha)
Namlet	119,509.98	650,786	5.45
Negya	25,594.19	235,897	9.22
Kalaw	76,385.14	566,122	7.41
Upper Balu	72,007.20	242,480	3.37

Looking at the overall averages, the Negya basin had the highest gully densities, followed by the Kalaw, the Namlet, and the Upper Balu. Looking at the density profile for each small basin, it was in the southeastern part of Kalaw that the small basin with a gully density of 20m/ha or more was the most gully concentrated area. In the northwestern part of the Namlet upstream region, there is also a concentration of gullies. Satellite images were compared in southeastern Kalaw and northwestern Namlet (Fig. 4). In the southeastern part of Kalaw, gully is located in a gently sloping hills, which is wide, and branched. It can also be seen from the satellite image that it is deep. Gullies in northwestern Namlet are mainly located in mountains, with dense vegetation and slightly narrower widths. It was confirmed that the southeastern part of Kalaw has large gullies and the severity of gully is also high.

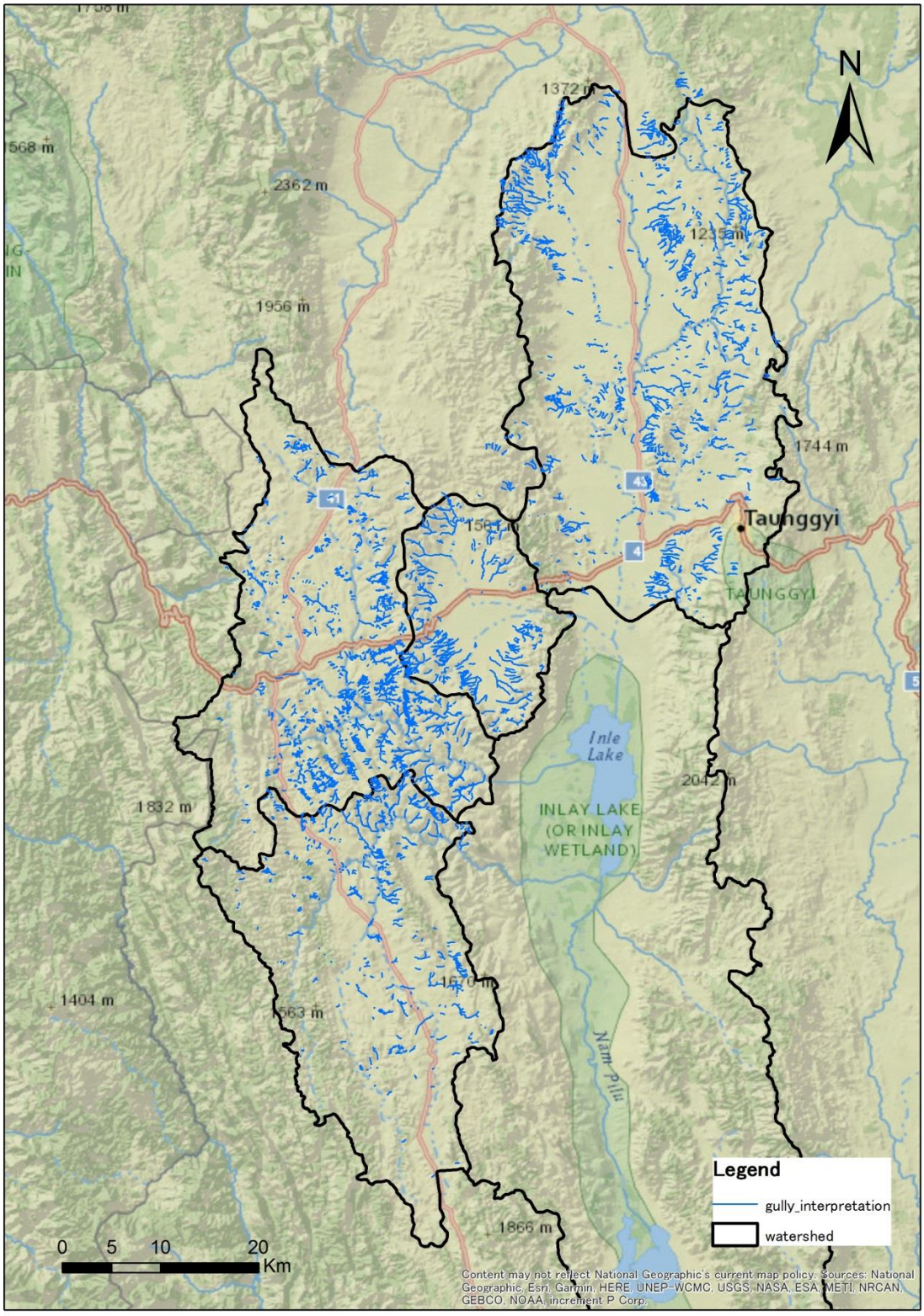


Figure 1 Gully Map1

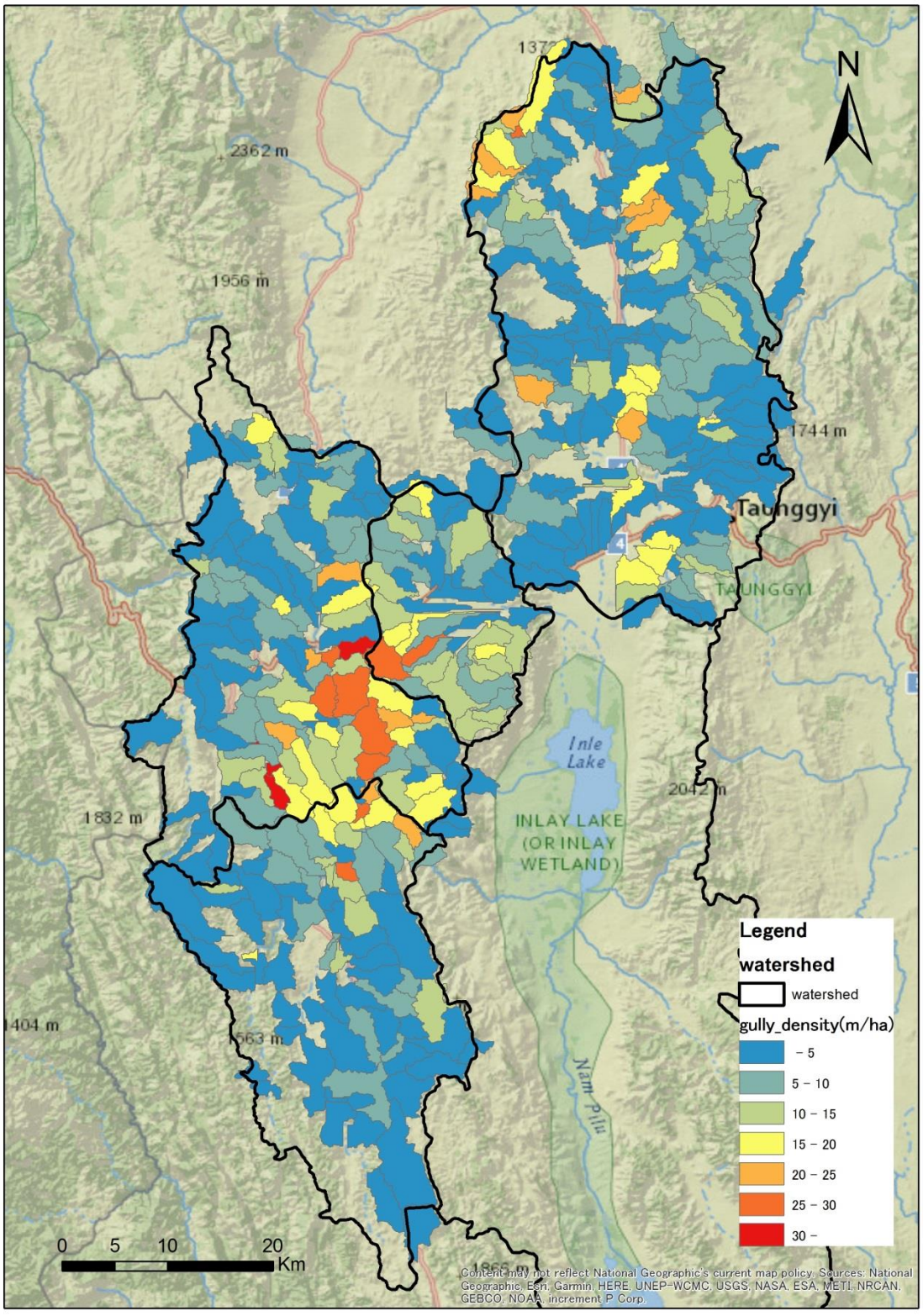


Figure 2. Gully Density Map (m/ha)2

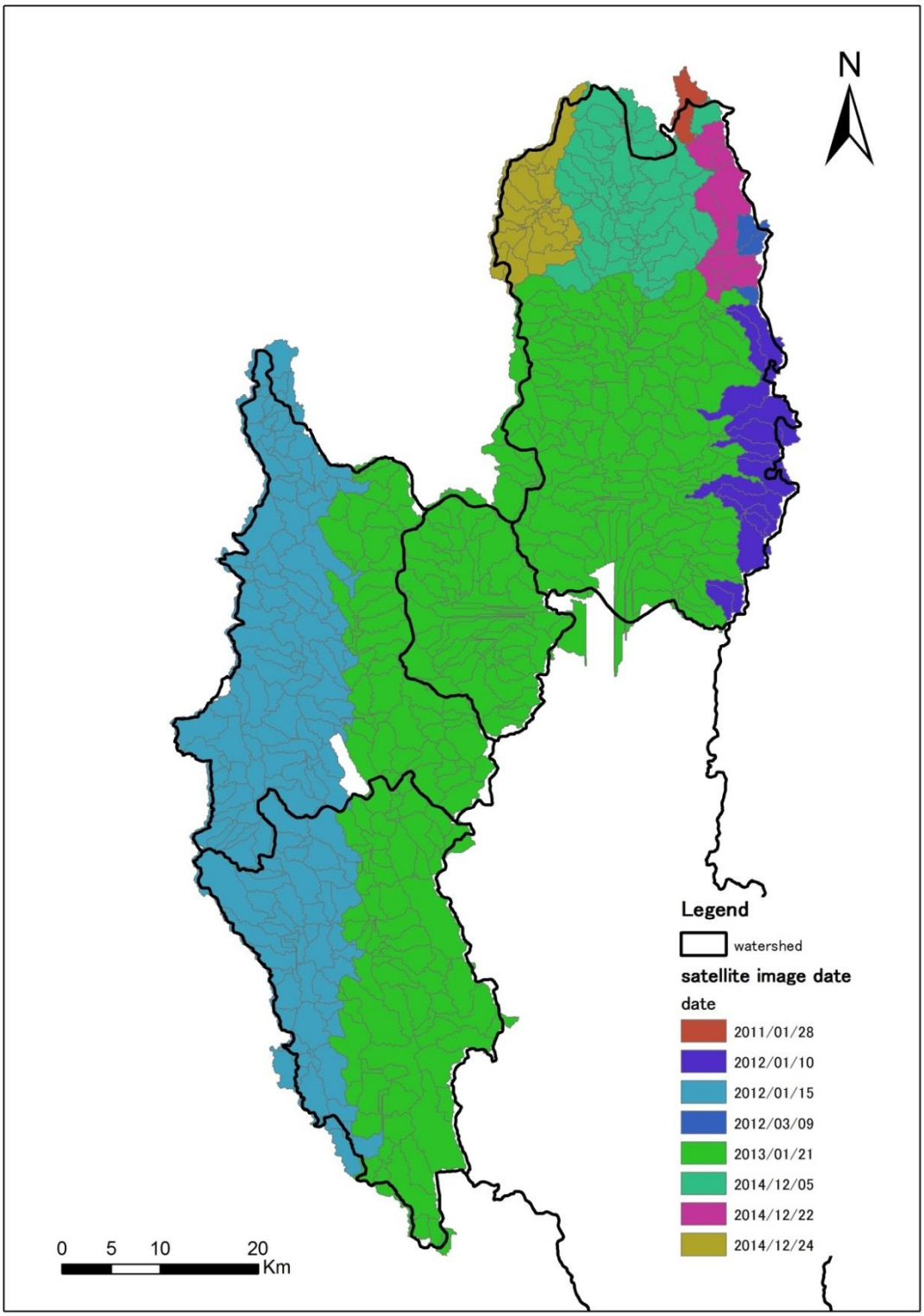
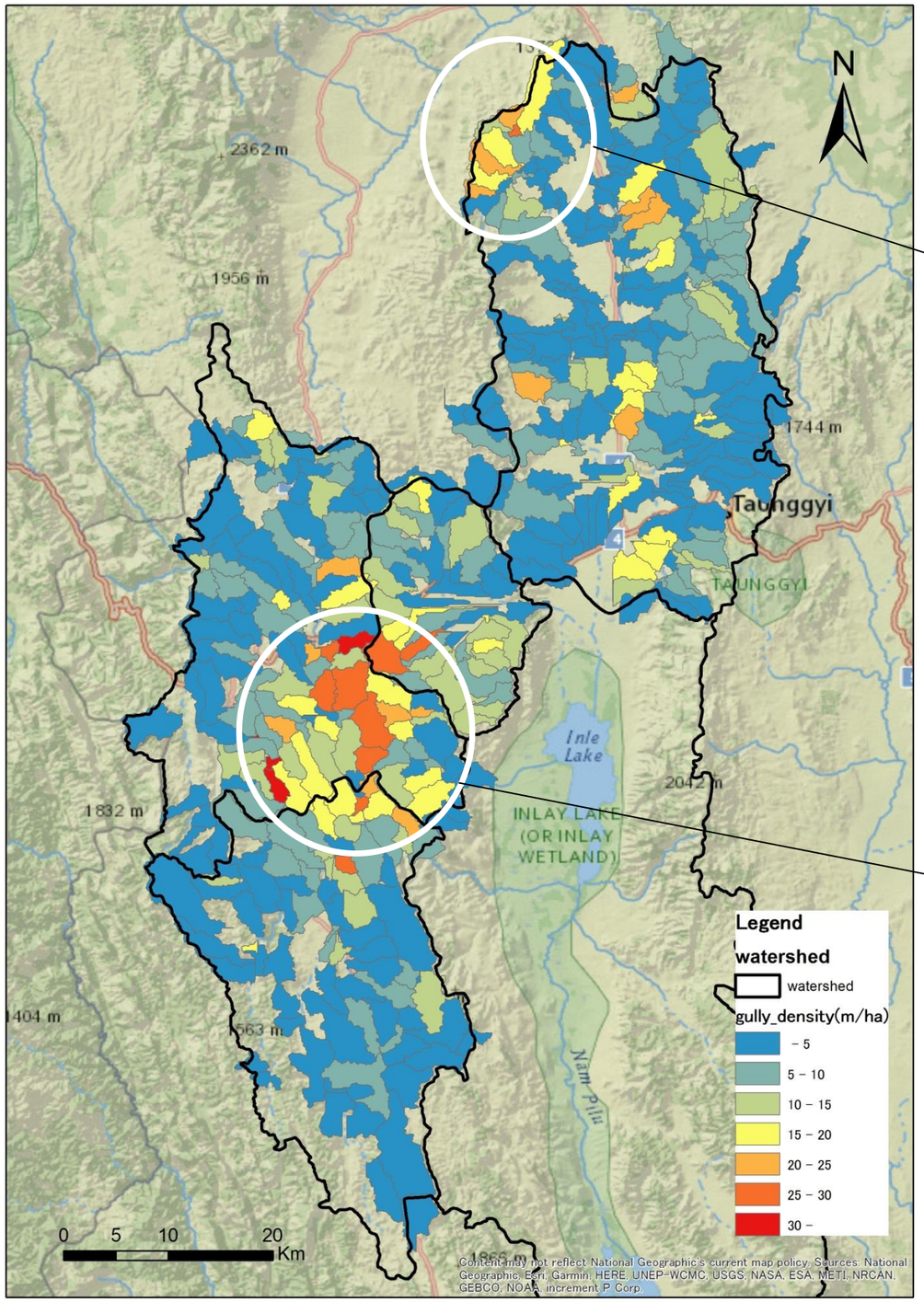
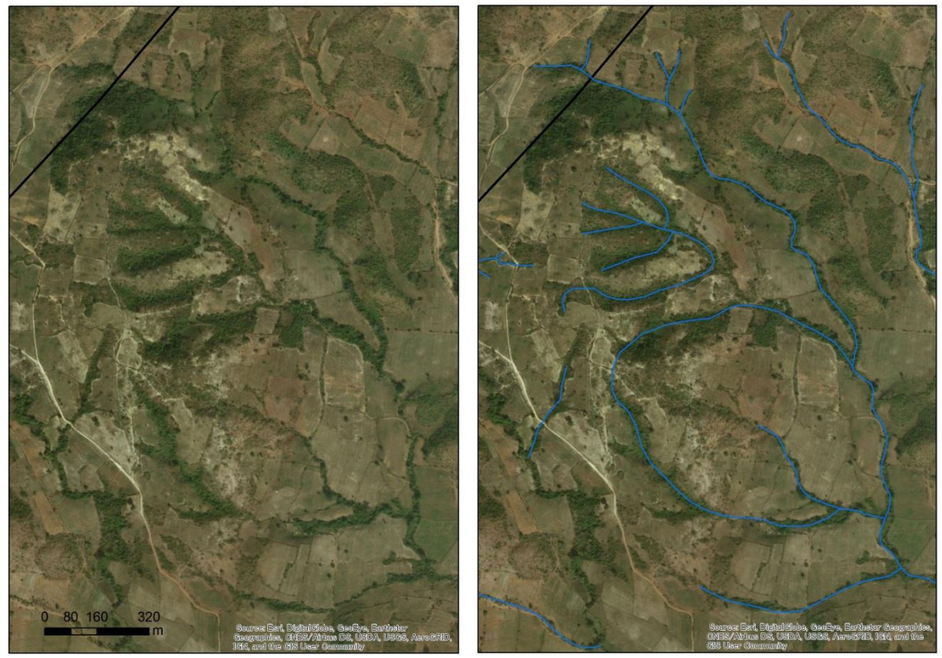
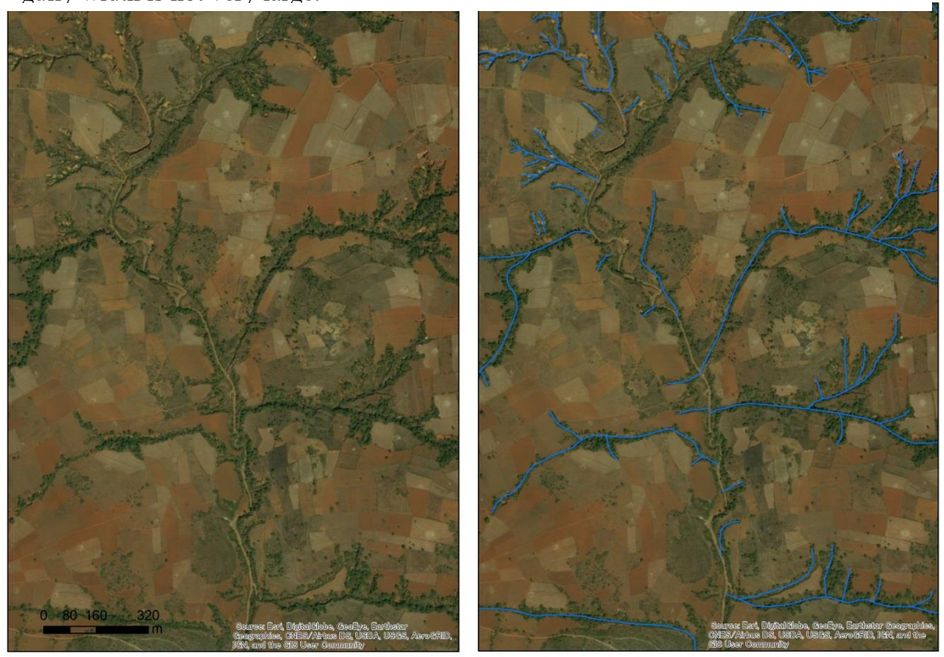


Figure 3. Satellite Image Date (ESRI, Satellite Image on ArcGIS Online, spatial resolution 0.3-0.5 m)3





Gully in the upper part of the Namlet: It is seen in a steep part of the mountain. The gully width is not very large.



Gully in the lower part of the Kalaw: it is seen on relatively loose slopes of hills. The gully is wide, and the soil color can be seen from place to place.

Figure 4. Comparisons of gullies in northwestern 4 Namlet and southeastern Kalaw4

5 Gully Type Category

5.1 Gully Type Legend Definition

In order to analyze the results of the gully interpretation in more detail, the gully type classification was performed as follows. An example of the Gully Type Legend Table and by Type is shown below.

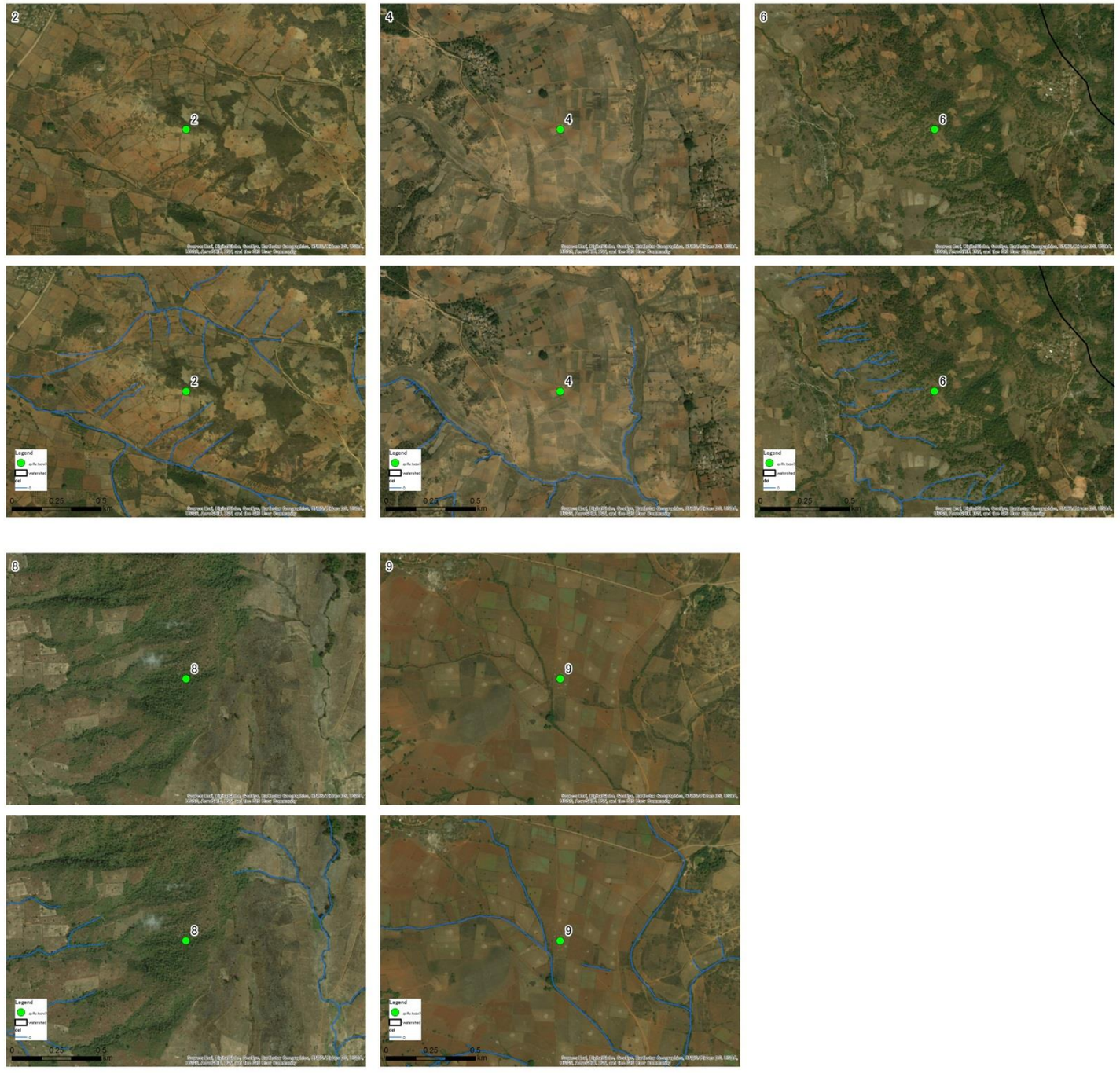
Table 2: Legend Table of Gully Types2

No	Gully type	Place of occurrence	Scale	Vegetation conditions	Remarks
1	Natural waterway type	Flat	About 2m of width	Grass, shrub, and bare land	
2	Mountain type	Mountains	—		Including those with severe surface erosion
3	Medium-sized vegetation mold	Hilly area	5~15m	Grass, shrub, and tall trees	Those whose depth can be confirmed comparing with 1 and 2
4	Medium-sized vegetation-free type	Hilly area	5~15m	Bare land	
5	Large-scale vegetation mold	Hilly area	15 m or more	Grass, shrub, and tall trees	
6	Large-scale vegetation-free	Hilly area	15 m or more		

(Source: gully_digitized_wrev. shp/field: g_type_12)

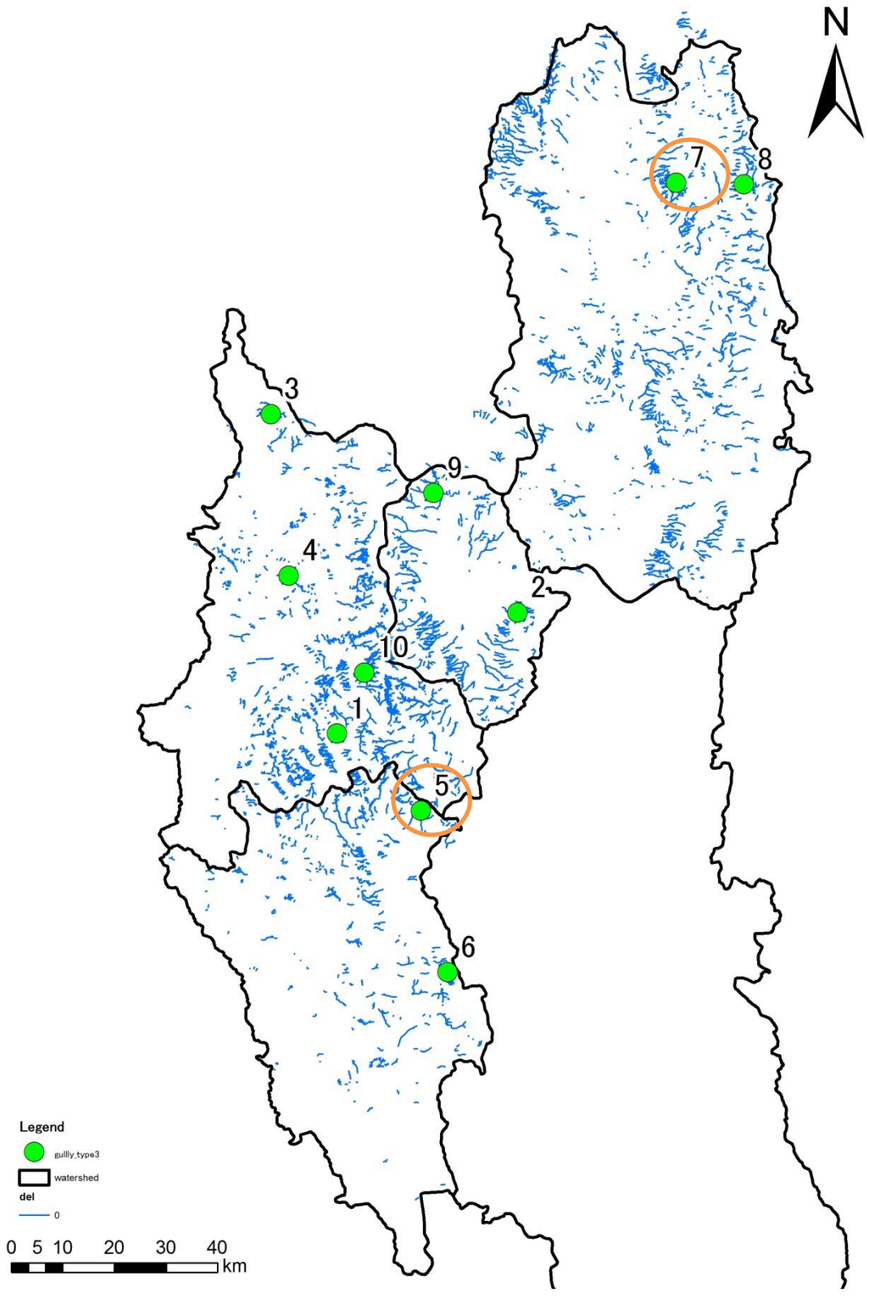
○ Gully Type No. 1: Natural waterway type

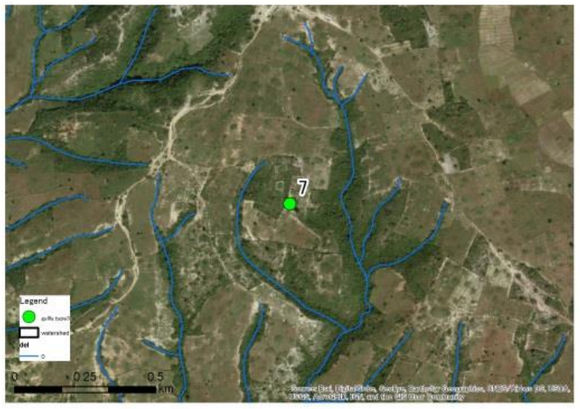
Flat areas, mainly surrounding areas of agricultural land, are shallow and thin (All satellite images are on the same scale).



○ Gully type number 2: mountain type

It is located in a steep mountain area and is shallow and thin. Also included in this type is a pattern around which surface erosion can be clearly seen (see 7).

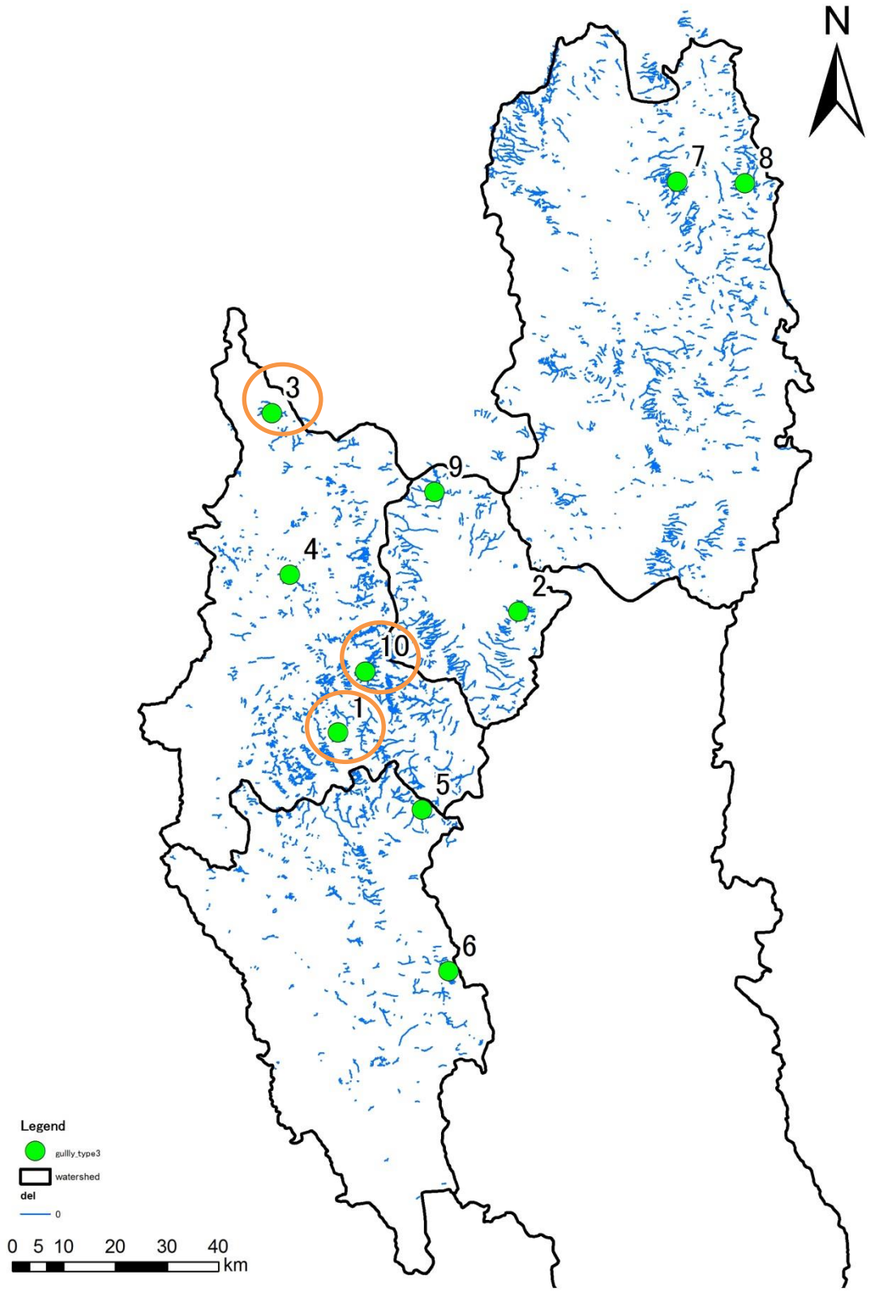


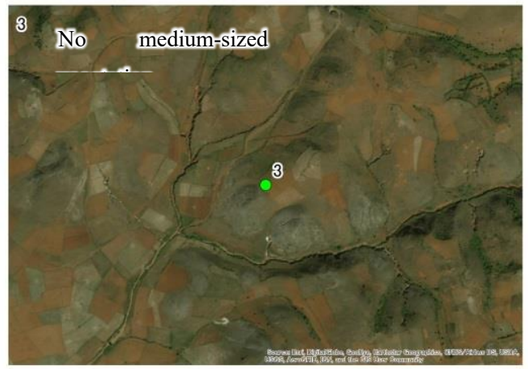


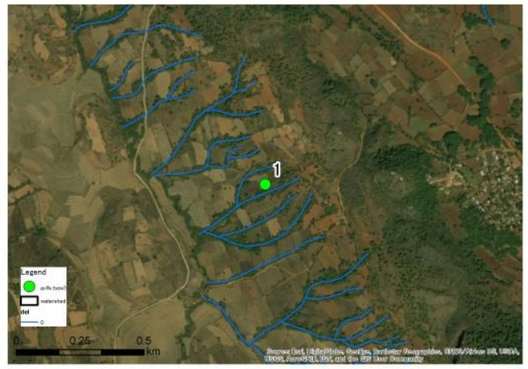
○ Gully Type Numbers 3, 4, 5, and 6: Medium to Large-Scale

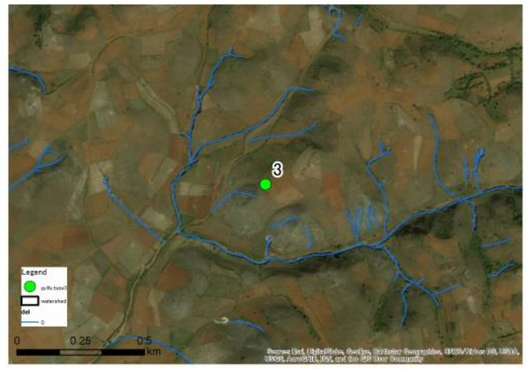
It is found in hilly areas and deeper than natural waterway type and mountain area type. (Shadows can be clearly seen on satellite images).

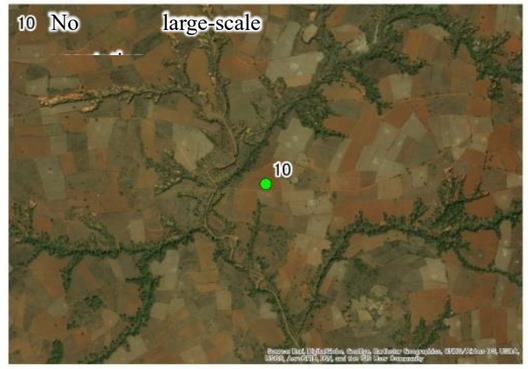
The scale was discriminated by the range, and the existence of vegetation was classified as the existence of vegetation is over 80% of the whole small basin.

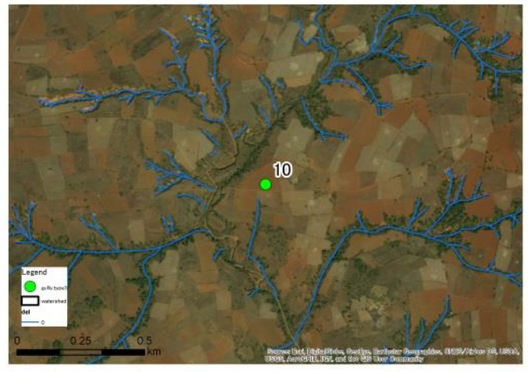












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5.2 Gully type classification results

The tabulation results for each type category and for each basin, and the Gully Type Category Chart are shown below. The most common of the gulley types were 1: native waterway type, followed by 5: large-scale vegetation type. Looking at each basin, the Namlet basin is mostly of the 1: natural waterway type, and mountainous types are distributed in mountains in northern and southern parts of the basin, and the medium to large-scale type was scarcely observed. The Negya basin is 1: natural waterway type, 2: mountainous type on the east side, and medium to large-scale type on the west side. In particular, many large-scale vegetation types are distributed. In the Kalaw basin, large-scale gullies are concentrated in the southeastern region, and some large-scale vegetation-free types are concentrated in some areas. In the Upper Balu basin, medium to large-scale types were concentrated in the northeastern part of the basin, and many other types of waterway type and mountainous type were observed.

Table 3. Gully length for each gully type category and for each basin3

No.	Gully type	Namlet	Negya	Kalaw	Upper Balu	Total
1	Natural waterway type	494,896	28,054	32,162	53,928	610,071
2	Mountain type	142,074	69	11,347	4,998	158,754
3	Medium-sized vegetation mold	13,815	74,417	83,872	64,658	236,762
4	Medium-sized vegetation-free type	0	16,637	21,633	9,989	48,259
5	Large-scale vegetation mold	0	80,316	262,922	87,144	430,382
6	Large-scale vegetation-free type	0	36,404	154,186	21,762	214,763
Total		650,786	235,897	566,122	242,480	1,698,992

The results of typing superimposed on geological and forest cover maps are shown in Figures 6 and 7. Looking at geological maps, large-scale gullies are predominantly located on the limestone plateau (Plateau Limestone Group) of the Triassic period. Among the limestone plateaus that extend from Kalaw to Upper Balu, large gullies are found in the southeastern part of the Kalaw basin, with few forests found in the vicinity and covered by agricultural land. On the other hand, in the eastern part of the Upper Balu basin, which has similar geological characteristics, there are relatively fewer gullies, but the surrounding forest cover status shows that there are more forests than in the Kalaw.

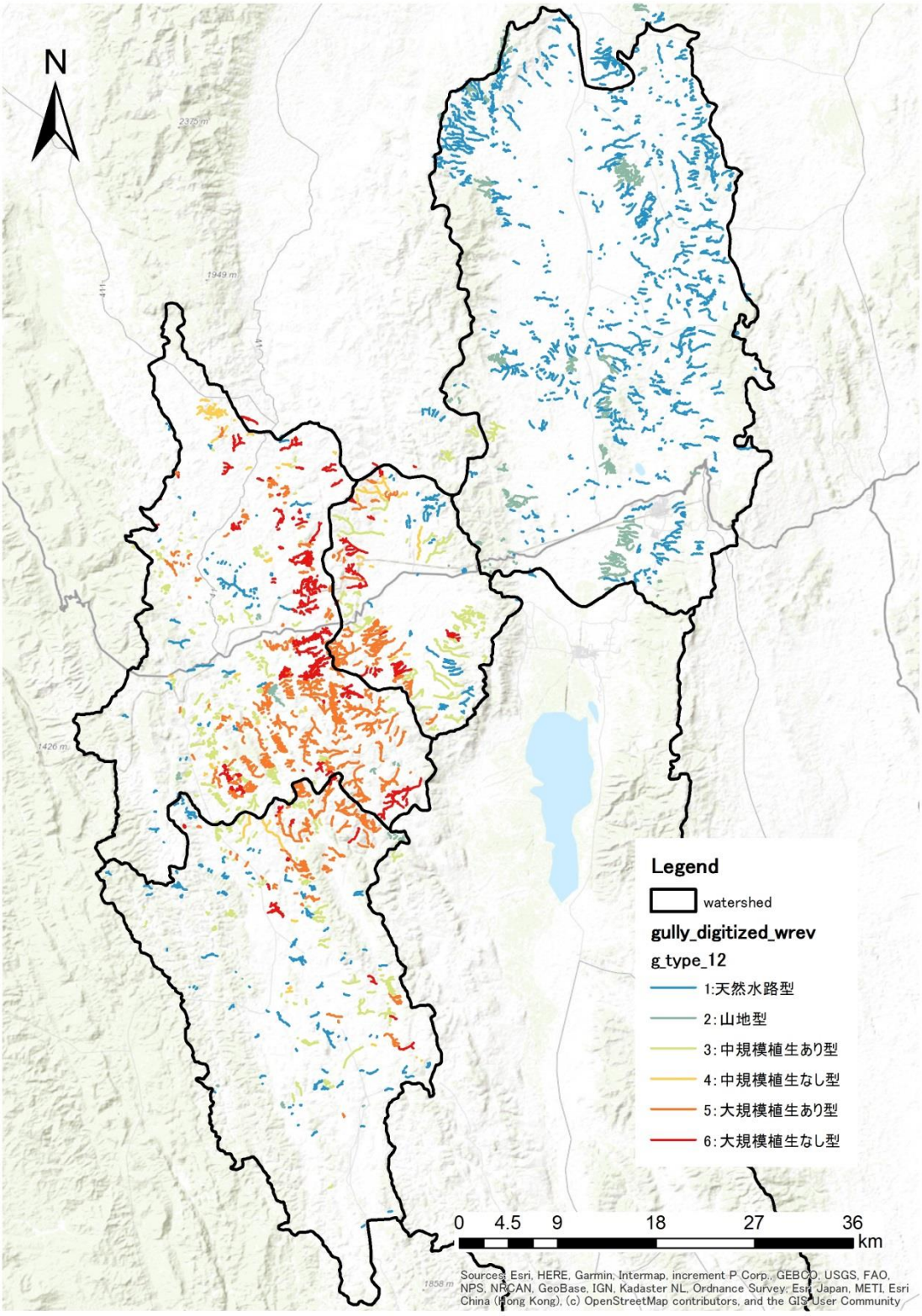


Figure 5. Gully Type Segment Diagram

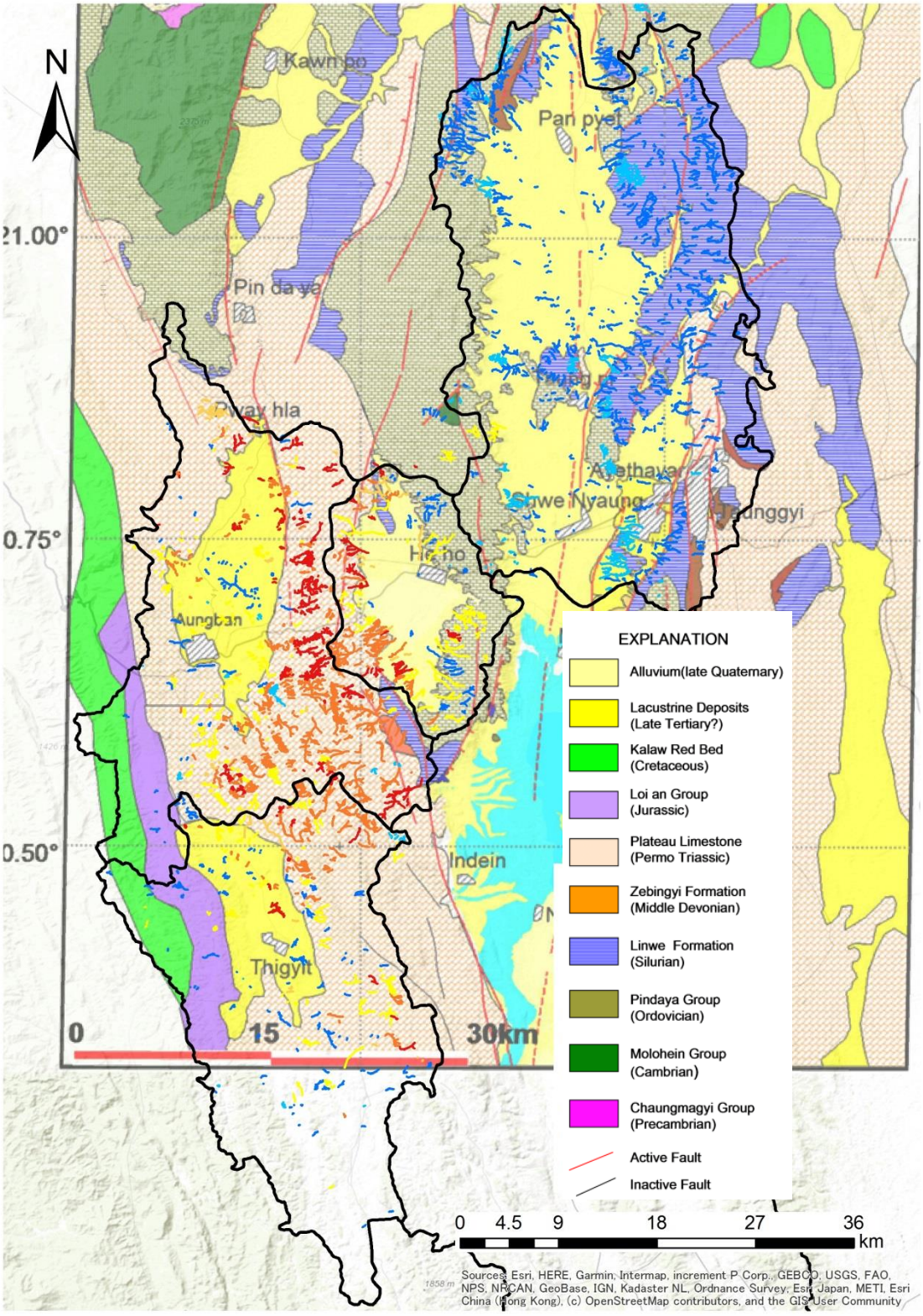


Figure 6. Gully Type Classification and Geological Map Superimposition5

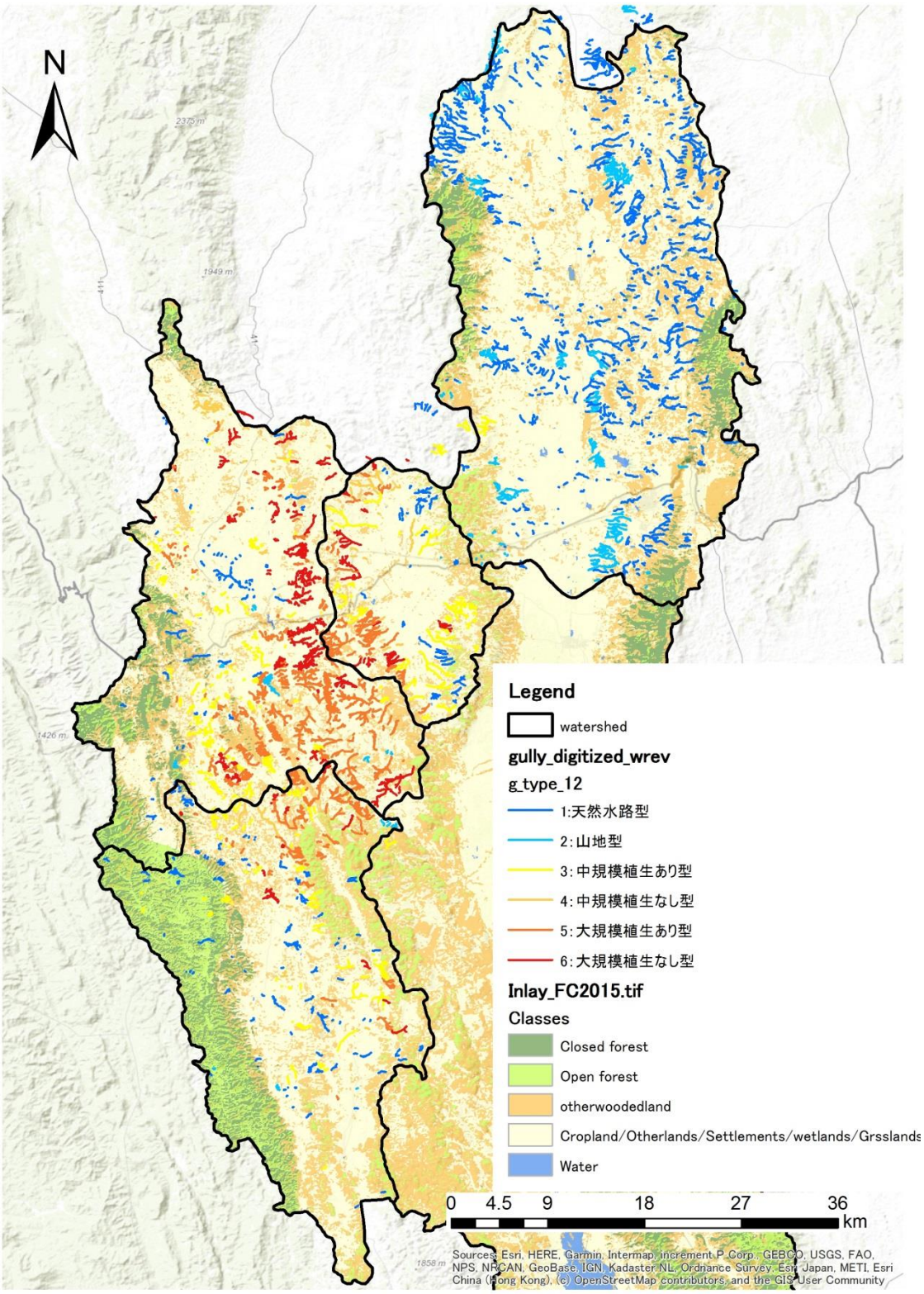


Figure 7. Superimposition of Gully Type Category and Forest Covering Diagram6

Attachment 25
Community Forestry Promotion Plan

Community Forestry (CF) Promotion Plan

1. Current Condition

1.1. Overall view of CF

In Myanmar, Community Forestry (CF) is a legal instrument to involve communities in forest management by granting formal endorsement and rights to communities on the control, use and management of forest resources in their respective localities. The basic logic of CF is as follows:

1). Forests have been degraded by human activities as they are freely accessible to local communities residing in the surrounding villages;

2). The first step of CF is to form a village-level institution with regulating rules on forest management so that local communities could play an important role in protection, regeneration, and management of the degraded forests on their own initiative. The institutional set-ups at village level is often led by donor-funded projects, CSOs or other outside institutions.

3). The conditions of degraded forests can be gradually improved by forest protection and management activities done by the village-level institution; therefore forest products and ecosystem services provided by forests in CF area can also be enhanced in the long run; and

4). In the initial stage, local communities may face difficulties in accessing forests, which may further cause the limitation of livelihood opportunities especially for those most dependent on forests, but they can have substantial benefits from forests once they are restored and rehabilitated over the course of CF implementation.

Sustainable forest management means the sustainable management of the entire forest ecosystem which encompasses forest depended communities. Hence, due consideration should be given to the involvement of local communities in the planning and implementation of forest management activities, to address local needs along with forest management and, more importantly, to enhance a sense of ownership among local communities.

1.2. Objective of CF

According to the latest version of Community Forestry Instruction (2019), the objectives of the Community Forestry are as follows:

- ✓ To provide forest and tree related basic needs such as wood and non-wood forest products for local communities;
- ✓ To enhance employment and income opportunities for local community and reduce poverty;
- ✓ To increase forest covered area in a sustainable manner and to ensure sustainable utilization;
- ✓ To promote participatory forest management system; and
- ✓ To enhance environmental services that can support climate change mitigation and adaption through preventing deforestation and forest degradation.

1.3. Main Activity in CF

The main CF activities which Forest Department (FD), NGOs and development partners have

conducted in the watershed so far are afforestation with provision of seedlings, patrolling to control forest fires and illegal hunting, and planting of cash crops for income generating. On the other hand, the benefits that local communities or members of CF Users Groups (CFUGs) expect from CF are: protection of water sources, soil conservation, collection of firewood, collection of branches for building of a house, planting of cash crops, and protection of traditional sacred tree and natural resources in the localities.

1.4. Number of Existing CF Sites and Areas

The following table shows the number of existing CF in Taunggyi District as of 2018. As the table indicates, **Nyanshwe Township (NS)** has the largest number and area of CF, followed by **Kalaw Township (KL)**. These two townships can be regarded as the significant areas in the district in terms of CF support. In NS, the majority of CF areas are in reserved/protected forests, while KL has CF areas in non-reserved/protected areas in addition to those in reserved/protected forests.

Table 1.1 Number and Areas of CF in Taunggyi District in 2018

No.	Township	Type of CF	Reserved/ Protected			Unclassified Forest			Grand Total	User Groups	Members
			Plantation	Natural Forest	Total	Plantation	Natural Forest	Total			
			Acre	Acre	Acre	Acre	Acre	Acre	Acre		
1	Taunggyi	Normal CF	-	-	-	-	164.86	164.86	164.86	2	364
		Encroachment	434.60	-	434.60	-	-	-	434.60	1	155
		Total	**434.60**	**-**	**434.60**		**164.86**	**164.86**	**599.46**	**3**	**519**
2	Kalaw	Normal CF	430.28	1,641.07	2,071.35	-	7,266.60	7,266.60	9,337.95	88	3310
		Encroachment	1,666.23	-	1,666.23	-	-	-	1,666.23	16	832
		Total	**2,096.51**	**1,641.07**	**3,737.58**	**-**	**7,266.60**	**7,266.60**	**11,004.18**	**104**	**4142**
3	Pinlaung	Normal CF	402.00	3,063.00	**3,465.00**	-	6,764.00	**6,764.00**	**10,229.00**	40	1170
		Encroachment	2,749.15	-	**2,749.15**	-	-	-	**2,749.15**	16	1303
		Total	**3,151.15**	**3,063.00**	**6,214.15**	**-**	**6,764.00**	**6,764.00**	**12,978.15**	**56**	**2473**
4	Pindaya	Normal CF	11.00	-	11.00	-	6,230.03	6,230.03	6,241.03	26	3133
		Encroachment	-	-	-	-	-	-	-	0	0
		Total	**11.00**	**-**	**11.00**	**-**	**6,230.03**	**6,230.03**	**6,241.03**	**26**	**3133**
5	Nyaung Shwe	Normal CF	4,037.10	26,462.60	30,499.70	-	22.50	22.50	30,522.20	76	5421
		Encroachment	5,909.46	-	5,909.46	-	-	-	5,909.46	37	2199
		Total	**9,946.56**	**26,462.60**	**36,409.16**	**-**	**22.50**	**22.50**	**36,431.66**	**113**	**7620**
6	Ywar Ngan	Normal CF	-	-	-	-	10,709.98	10,709.98	10,709.98	40	2912
		Encroachment	-	-	-	-	-	-	-	0	0
		Total	**-**	**-**	**-**	**-**	**10,709.98**	**10,709.98**	**10,709.98**	**40**	**2912**
7	Hsihseng	Normal CF	-	-	-	-	2,156.15	2,156.15	2,156.15	6	467
		Encroachment	8,205.10	-	8,205.10	-	-	-	8,205.10	18	1564
		Total	**8,205.10**	**-**	**8,205.10**	**-**	**2,156.15**	**2,156.15**	**10,361.25**	**24**	**2031**
8	Lawksawk	Normal CF	-	-	-	-	-	-	-	0	0
		Encroachment	4,820.64	-	4,820.64	-	-	-	4,820.64	14	946
		Total	**4,820.64**	**-**	**4,820.64**	**-**	**-**	**-**	**4,820.64**	**14**	**946**
9	Pekon	Normal CF	-	-	-	-	-	-	-	0	0
		Encroachment	670.00	-	670.00	-	-	-	670.00	12	161
		Total	**670.00**	**-**	**670.00**	**-**	**-**	**-**	**670.00**	**12**	**161**
	Grand Total		**29,335.56**	**31,166.67**	**60,502.23**	**-**	**33,314.12**	**33,314.12**	**93,816.35**	**392**	**23,937**

Source: Taunggyi District FD, MONREC

1.5. Institutional Framework for Implementation of CF

CF is implemented under the responsibility of FD at national, state/region, district and township levels. The institutional framework for implementation of CF is shown in Figure 1.1 below. The

roles and responsibilities of the respective actors in the framework are described below.

- **Community Forestry National Working Group (CFNWG)** is a semi-government national coordinating platform established for promotion of CF throughout the country. CFNWG, chaired by Dy DG of FD and vice chaired by a former DG of FD who is a leader of an NGO in Myanmar, is composed of directors of FD and representatives of national and international NGOs in Myanmar.
- **Head Office CF unit** is responsible for supervising, monitoring and evaluation and reporting of CF implementation in the country.
- **CF Working Groups** at the district level (CFDWG) is the main body for CF implementation in the district. Assistant Director of District FD who is the chairperson of CFDWG, is devolved to award the CF Certificates to CF User Groups on behalf of DG of FD.
- **Towinship FD** is responsible for CF promotion and management activities at field level in collaboration with local communities.

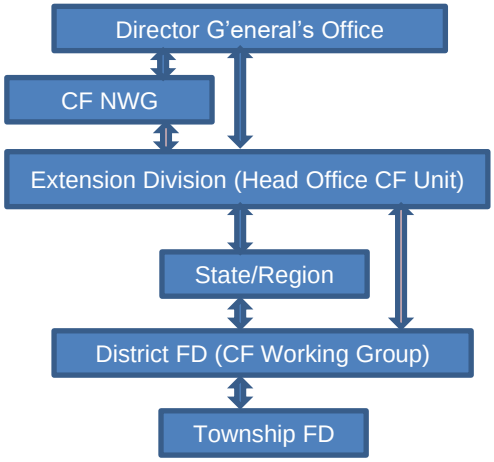


Figure 1.1 Institutional Arrangement of CF at FD, MONREC

As described above, the institutional structure for implementation of CF has been already in place; however, the implementation of CF has been affected by the allocation of human and financial resources for CF implementation. The FD officials at district and staff levels often have several tasks at a time.

1.6. Budget of CF Promotion

No datum on budget allocation specifically for CF promotion was collected from the relevant offices. In principle, there is a tendency that FD at township level has faced difficulties in securing sufficient budget specifically for CF promotion, and often used the budget allocated for afforestation, such as distribution of seedlings and plantation establishment, for CF promotion.

2. Challenges in CF Promotion

Through a series of field visits, household interview survey, PRA and pilot activities conducted by JET in collaboration with FD, some challenges are recognized. Key issues to be overcome are outlined below.

(1). Budget Limitation at FD

Although field officers in FD are motivated to work for CF promotion, it is likely that they face limitations of time and budget to cover the entire responsible area. While the cost for distribution of seedling is likely to be covered by FD budget, other expenditures for CF field activities, such as transportation to visit CF villages, workshops/ meetings with local communities in CF villages, and conducts of field survey, seem to be limited in the budget. It has often led to the improper or insufficient application of CFI at field level.

(2). Limited Sustainability of CF Users Groups (CFUGs)

In many cases, the sustainability of CFUGs is a crucial issue to be addressed. CFUGs are supposed to be responsible for continuation of CF activities after obtaining CF certificates with or without FD's assistance. However, there are CFUGs which seem not to function mainly due to the following reasons:

i) Limited understanding of the purpose of CF;
ii) Limited support from FD and other external organizations; and
iii) Limited financial resources of CFUGs for CF activities.

In general, projects supported by NGOs/ development partners can support local communities and FD in the establishment and management of CF during the project period; however, the support ends when the projects are finished and the responsibility for CF activities is handed over to CFUGs and FD. FD has the essential task in terms of CF support, but the township level FD also struggles with the limited human and financial resources as mentioned above.

(3). Lack of Awareness of CF

It has been often said that the carelessness of local villagers about environmental issues leads to the mismanagement and overexploitation of natural resources. However, the surveys of JET, i.e., the household interview survey and PRA, revealed that local villagers in the Inle Lake watershed seemed to recognize and understand well the importance of soil and water conservation. What is needed for them would be the opportunity to get to know how to use CF for improvement of local environment and livelihoods. For instance, there were cases that the majority of local villagers did not know 'CF' itself, even though the village has had the CF certificate before. The shortening of the process of CF introduction/ establishment is considered as one of the reasons behind the less understanding of CF among local communities in CF villages.

(4). Lack of Collaboration among Stakeholders

The stakeholder analysis conducted by JET reveals that many organizations working in the Inle Lake watershed have been involved in some way to environmental protection. At present, more than 50 organizations, namely CSOs/NGOs, public institutions, development partners, and private companies at national and international levels, are working for conservation of Inle Lake environment. The same analysis also reveals that there are some overlapped in activities among those working in the watershed; therefore, the NGOs participating in the stakeholder workshop realized the necessity of coordinating their activities and cooperate with each other in terms of the target area as well as activities. The same can be said to CF promotion. The more active collaboration stakeholders could make, the more effective and efficient the approach to CF promotion could be. CFUGs could have widespread support which would strengthen its capacity for sustainable operations of CF if they could well coordinate and collaborate with one another.

(5). Limitation of Establishment of CF

As presented in Table 1.1 in Chapter 1.4, a majority of CFs are established in Reserved/Protected Forest. CF can be introduced or established in Reserve Forest categorized as the local working circle or protection working circle, while CF is not allowed to be established in the commercial working circle in principle as such a type of Reserve Forest is part of the important state asset. Hence, Reserved Forest categorized as the commercial working circle is supposed to be protected by FD, particularly those at township level. In reality, it is not necessarily easy for the

township offices, particularly their field officers, to protect such a type of Reserved Forest as the control area of one officer is too large to protect and each officer has many tasks to do.

Th pilot activity conducted by JET in Pha Yar Phyu village in Kalaw township has assisted villagers in the introduction of CF in the part of the existing reserved forest, namely Aungban Reserved Forest, near the village, since villagers of Pha Yar Phyu village have a strong intention to protect the area as they recognize the values of forests in the area, such as protection of water sources, reduction of potential risks of climate-related events (e.g., landslide and drought), and maintenance of the scenery of the village. FD officers and JET also confirm in the field that existing forests in the proposed area for CF have been damaged by human activities caused by local communities from the surrounding villages.

Although the necessity of introduction of CF in the proposed area is the common understanding of FD and JET to effectively protect the same, it is currently difficult to empower villagers of Pha Yar Phyu village to protect and conserve the proposed area as Aungban Reserved Forest is registered as the commercial reserved forest in 1986. There is no legal justification to allocate the proposed area for management of local communities, particularly under the framework of CF.

3. Pilot Activity of CF Introduction conducted by JET

JET has implemented the CF introduction in Pha Yar Phyu village as one of the pilot activities of sustainable land and forest management under the design phase of Component 2. The outline of the pilot activity is summarized below.

<table>
<tr><th>Items</th><th>Descriptions</th></tr>
<tr><td>Location</td><td>Aungbang Reserve Forest near Pha Yar Phy village</td></tr>
<tr><td>Timeframe</td><td>August 2019 – January 2020</td></tr>
<tr><td>Purpose</td><td>Introduction of CF in the part of reserve forest in accordance with the latest CFI with full participation of local communities</td></tr>
<tr><td>Major activities</td><td>The following meetings and activities have been conducted with local communities.
<table>
<tr><th>Steps</th><th>Outline of the Work</th><th>Timeframe</th></tr>
<tr><td>1. Consultation with local communities</td><td>■ Explain the purpose, activities, and expected benefits of the pilot activities to local communities.
■ Confirm their preference and acceptance of the pilot activities.</td><td>1 day</td></tr>
<tr><td>2. Identification and selection of households who participate in the activities</td><td>■ Identify households / community members who will participate in CFUG.
■ Introduce major activities to be carried out by members of CFUG.</td><td>1 day</td></tr>
<tr><td>3. Organization of CFUG</td><td>■ Discuss vision, missions, objectives, and functions of CFUG.
■ Discuss roles and responsibilities of the members and management group of CFUG.
■ Selection of members of the management group, i.e., Leader, Secretary, Casher, and 2 core members.
■ Finalize the bylaw of CFUG.</td><td>2 days</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Items</th><th colspan="3">Descriptions</th></tr>
<tr><td></td><td colspan="3"><table>
<tr><td>4. Identification of target areas for CF</td><td>■ Assess the present land use using google earth images or aerial photos of village.
■ Identify the target area for CF in the google earth image or aerial photos of village.
■ Conduct the field survey of the identified areas and demarcate the boundaries of the identified areas on the ground.
■ Develop a location map of the identified area using google earth images or aerial photo of village.</td><td>2 days</td></tr>
<tr><td>5. Preparation and submission of the application for establishment of CF</td><td>■ Develop and submission an application form for establishment of CF together with members of CFUG.
■ Conduct the filed visit to the identified area for validation of the application form.</td><td>3 days</td></tr>
<tr><td>6. Development of a forest management plan</td><td>■ Introduce and explain the purpose and contents of a forest management and activities required for preparation of the plan.
■ Assess the current situation of the CF area together with members of CFUG.
■ Discuss rules on management of forests, lands, and other resources in the CF area.
■ Identify necessary activities to be undertaken for improvement and protection of existing forests in the CF area.
■ Develop a forest management plan together with members of CFUG. (Arrange and hold a series of meetings with members of CFUG.)
■ Submit the forest management plan to FD.</td><td>3 days</td></tr>
<tr><td>7. Issuance of CF certificate</td><td>■ Approval of the forest management plan.
■ Introduce the forest management plan, particularly the rules on management of the CF area to members of CFUG and other households in the village.</td><td>1 day</td></tr>
<tr><td>8. Development of an annual work plan</td><td>■ Preparation of an annual work plan based on the forest management plan together with members of CFUG.</td><td>2 days</td></tr>
</table>Source: JICA Expert Team (2019)</td></tr>
<tr><td>Major Outputs</td><td colspan="3">The following outputs have been developed through a series of discussions and meetings with local communities in Pha Yar Phyu village.
- By-laws of CFUG with vision, missions, and function of the group and roles of the respective members of the group
- Forest management plan of the proposed area for CF</td></tr>
<tr><td>Total cost</td><td colspan="3">MKY 3,080,000</td></tr>
</table>

Source: JICA Expert Team (2020)

Owing to the participatory process taken in the pilot activity, local communities, particularly local leaders of Pha Yar Phyu, seem to deepen their understanding of the objectives of CF as well as the roles and responsibilities of CFUG for protection of forests in the proposed area. JET also plans to conduct interviews to local leaders of Pha Yar Pyu village to confirm the effectiveness of the process in February 2020.

4. CF Promotion Plan

4.1. Ten Years CF Establishment Plan (Master Plan of District)

As Nyaung Shwe and Kalaw townships covers the majority of the Inle Lake watershed, the CF promotion plan hereafter targets the two township in principle. As the first step of the formation of the promotion plan, JET has reviewed the existing 10-year CF Establishment Plan of the district, which is described in Chapter 1.4 of this report. The following table presents the number and area to be CF in the two townships. According to the plan, both the townships plans to establish CF at 10-12 places (or 808-1,320 acres) annually on average in Reserved Forest.

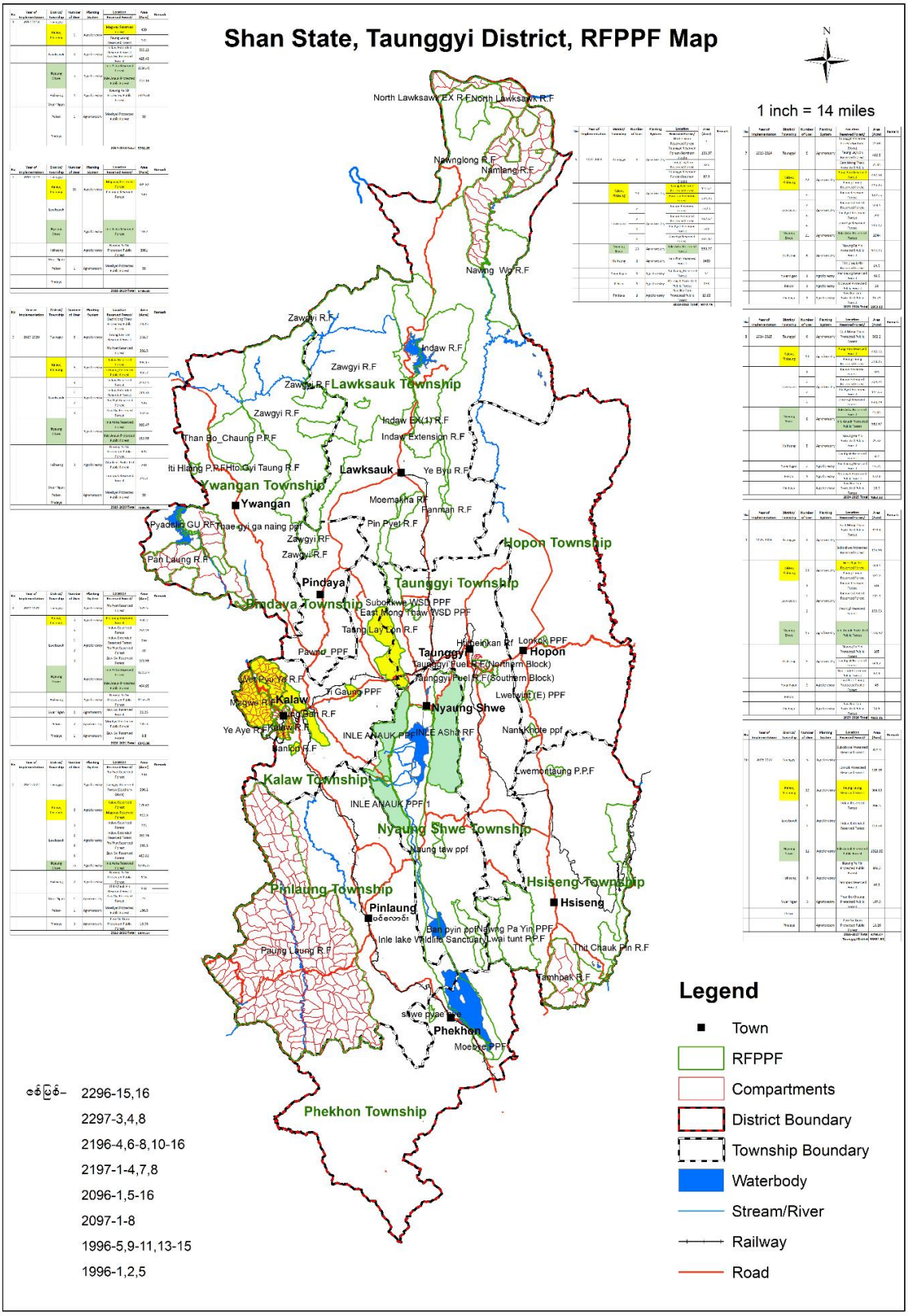
Table 4.1 Ten years CF Establishment Plan at Kalaw/Pinlaung and Nyanshwe Township

Year Township	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	Avg.
Number of CF											
Kalaw, Pinlaung	1	10	6	3	6	10	22	19	13	12	10
Nyaung Shwe	5	N/A	N/A	N/A	22	13	11	8	15	11	12
Area of CF (acre)											
Kalaw, Pinlaung	592.00	578.82	964.87	594.20	791.13	1,441.65	853.83	765.40	595.70	904.83	808.24
Nyaung Shwe	1,821.59	1,077	1,205.05	2,088.39	1239.73	550.77	2,044	627.82	1,226.97	1,321.92	1,320.32

Source: Ten years plan on CF establishment (2017-2027) at Taunggyi District FD, MONREC

Each township office has made efforts to achieve the targets set by the 10-year plan. According to FD offices of NS and KL townships, they have worked for establishment of CF in their areas in accordance with the plan. However, there might be a tendency that the process of CF introduction is often short-cut or skipped or the involvement of local communities in the process is limited or minimal.

For the reference, the following map (See Figure 4.1) highlights the establishment plan of CF with number, location, areas at Nyaung Shwe and Kalaw townships. All locations are situated in Reserved Forest.



Source: Taunggyi District FD, MONREC

Figure 4.1 CF Establishment at Nyanshwe and Kalaw Township

4.2. Scale-up Plan of CF for the Next Three Years

(1) Basic Concepts

Having referred to the existing plan, actual accomplishments in CF establishment in NS and KL townships, and key challenges stated in Chapter 2, JET proposes a three-year CF scale-up plan in consideration of the following points:

i) Contribution to the achievement of the district master plan;

ii) Ensuring of the sustainability of CFUGs (or Sufficient capacity enhancement of village leaders and members of CFUGs) though application of the process/ procedures demonstrated in the pilot activity during the design phase of Component 2;

iii) Contribution to sustainable land and forest management along with livelihood improvement in the watershed;

iv) Establishment of CF not only in Reserved Forest but also outside Reserved Forest;

v) Enhancement of the capacity of technical and field officers of FD townships; and

vi) Development of a/ model/s of a new instrument for collaborative protected area management or Joint Forest Management.

(2) Target Areas

Although the 10-year plan targets only Reserved Forest for CF promotion, it is important to include existing forests outside Reserved Forest as they are also considered as important forest resources remaining in the watershed. In addition to unclassified forests (forests outside Reserved Forest), Reserved Forest classified as the commercial working circle, may also be considered for a trial case of the collaborative forest management/ joint forest management. In fact, Pha Yar Phyu village should be one of the target areas for implementation of the forest management plan of the collaborative forest management.

(3) Five Years Targets

The following table shows the proposed number of CF promotion in NS and KL townships for the next five years. Part of the targets might be implemented by the FD offices with technical and financial support from Component 2 of FDSNR in the initial three years.

Table 4.2 Planned and Potential Number of CF Promotion

Year / Township	2020-21	2021-22	2022-23	2023-24	2024-25	Total.
10-year plan	*Acre (No.)*	*Acre (No.)*	*Acre (No.)*	*Acre (No.)*	*Acre (No.)*	*Acre (No.)*
Kalaw, Pinlaung	594 (3)	791 (6)	1,442 (10)	854 (22)	765 (19)	4,446 (60)
Nyaung Shwe	2,088 (N/A)	1,240 (22)	551 (13)	2,044 (11)	628 (8)	6,551 (> 54)
Target with support of Component 2	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
Kalaw <1	2	4	4	-	-	10
Nyaung Shwe	2	4	4	-	-	10

Note: The numbers include the implementation of the FMP in Pha Yar Phyu village.
Source: Ten years plan on CF establishment (2017-2027) at Taunggyi District FD, MONREC and JICA Expert Team (2020)

The targets given above should be further reviewed and discussed with the NS and KL township offices to check its validity in terms of financial and human resources of the offices. Due consideration should also be given to quality of the works so as to make CFUGs operational and sustainable even with less support from FD.

(4) Major Activities to be conducted in CF Promotion

The activities listed below should be carried out in target CF villages selected for CF promotion.

- Introduction of CF
- Implementation of CF FMP for 1~2 years
- Coordination with other stakeholders who may work in CF villages
- Review and revision of CF FMP (if necessary)

(5) Organizations involved in CF Promotion

FD township offices at NS and KL will be the main implementing bodies for CF promotion. CFDWG and FD Taunggyi District will provide necessary policy and administrative support to the township offices so that they could expand CF in their jurisdictional areas smoothly in a proper manner. General Administration Department (GAD) and Department of Agricultural Land Management and Statistics (DALMS) will be involved in the process when non-classified forests are targeted for CF. Department of Agriculture (DoA) is expected to play a role in supporting local communities in CF village for improvement of land management and crop production. CSOs and other external organizations, e.g., development partners' projects, are also important players for CF promotion. Among others, Component 2 of FDSNR will directly assist the FD offices in the implementation of the plan and the enhancement of capacity of their field officers to scale up CF in a proper manner.

5. Key Elements for Way Forward

Discussed in chapters above, some key elements to be addressed are summarized as follows.

(1). Raising of Awareness among Local Communities in the Process of CF Establishment

Awareness raising among local communities, particularly local leaders of CF village, is essential to the sustainability of CFUGs. Hence it is crucially important to involve local communities in the process of CF establishment so that they could enhance their understanding of CF, their roles and responsibilities for CF management along with the expected benefit, and forest management activities to be conducted with assistance from FD. More importantly, they can enhance a sense of ownership of CF area which encourages them to participate in forest management activities. The more villagers understand the essence of CF, the more CF would be managed effectively and sustainably by local community.

(2). Allocation of Sufficient Financial and Human Resources

As both the townships might not have sufficient human and financial resources to promote CF in several villages in a year in accordance with the process of the CFI, as it would take considerable time and expenditures as demonstrated in the pilot activity. It is, however, meaningless to just increase the number of CFUGs without their sustainability. Hence, due consideration should be given to the establishment of the implementation mechanism with budget allocation sufficient for CF promotion. In the implementation phase of Component 2 of FDSNR, JET will further communicate and collaborate with CFDWG so that it could develop a work and budget plan for implementation of the CF promotion plan.

(3). Technical Transfer in CF Promotion

Another key element for successful CF promotion is to enhance the capacity of FD officers at township and district levels, so that they could further scale up CF areas without assistance of component 2 of FDSNR. Hence, the next three years should be used as opportunities for FD technical and field officers to learn the way of introduction of CF and implementation of a CF forest management plan. They could learn the process of CF introduction and implementation through hands-on experience in the field with technical guidance of JET.

At the same time, due attention should be paid to the enhancement of capacity of local communities, particularly members of CFUG management committee (CFUGMC), for management, operations, and monitoring of CF. They would be the field managers of forest resources on the ground; hence their capacities as well as sense of ownership should be enhanced over the course of CF introduction and implementation in the initial stage.

(4). Collaboration among Stakeholders

It is difficult for FD or a single organization to satisfy all the needs of local communities or cover a wide range of areas in the watershed. Hence, meaningful collaboration with/among relevant stakeholders working in the Inle Lake watershed should be facilitated. They could complement each other, and what is more, generate synergy effect, which may bring the bigger impact on a large scale. In particular, local CSOs are keen to work together with other stakeholders. As they are willing to work for local communities on a long-term basis and well understand the local context in the respective localities, they should be treated as important partners for sustainable development of CF villages in the Inle Lake watershed.

(5). Collaborative Forest Management in Reserved Forest

As pointed out in Chapter 2, there may be a need to develop a new community-based forest management instrument applicable to production forest or protected area with a new legal document. The experience of Pha Yar Phyu village would be a model case of the collaborative protected area management or joint forest management, which is a community-based forest management focusing more on protection and conservation of forest resources rather than utilization.

It is, therefore, important to continuously support Pha Yar Phyu village in the implementation of its forest management plan, namely reforestation in open areas, protection of existing forests, and development of agroforestry models in encroachment areas, to assess the effectiveness of the approach and extract lessons learned through the trial case.

Attachment 26
Reports on
the Project Seminars

Report
on
Kick-off Meeting of Component 2 of FDSNR

1. Project Name — Component 2 of the Project for Capacity Building for Sustainable Natural Resource Management (MONREC-JICA FDSNR Project)

2. Date — 2nd August 2019

3. Venue — Hupin Hotel, Khaung Daing

4. Attendees — (Attached)

5. Agenda — (Attached)

6. Main discussion points

(1) Open remarks and self-introduction

Opening Remarks by H.E. Minister of Ministry of Natural Resources and Environmental Conservation

The meeting was opened with the opening remarks made by Dr. Nyi Nyi Aung, the member of the government of Shan State and the Minister for Ministry of Natural Resources and Environmental Conservation. In his remarks, he welcomed the participants and reiterated the Shan State Government's commitment to conserve the environment of Inle Lake as well as sustainable management of natural resources in Inle Lake Basin. He also guaranteed the full support from the Shan State Government for successful implementation of the project. His Excellency suggested that lessons from the past projects implemented by various organizations in Inle Lake watershed be fully taken into account for implementation of Component 2 of FDSNR. Finally, he expressed his appreciation to the organizer of the meeting as well as his wishes that the participants in the meeting could have active discussions and productive exchange of ideas for fruitful results.

Opening Remarks by H.E. Minister for Inthar Ethnic Affairs

Dr. Htun Hlaing, the member of Shan State Government and the Minister for Inthar Ethnic Affairs, stressed the importance of six pillars of Integrated Lake Basin Management (ILBM) in his opening remarks, namely, i) Institutions, ii) Policies, iii) Participation, iv) Technologies, v) Information, and vi) Finance. He also encouraged the relevant stakeholders to make full use of the knowledge and experiences gained through the implementation of the JICA project so that they could become self-reliant in sustainable management of Inle Lake watershed in the post project period. His Excellency concluded his opening remarks with his appreciation to the Japanese Government and JICA for provision of supports for conservation and management of Inle Lake.

Self-introduction

All the participants in the meeting introduced themselves.

(2) Presentations by the Project Team

Session 1: Overall Framework of Component 2

Mr. Yoji Mizuguchi, Team Leader of Design Phase of Component 2 of FDSNR, introduced the overall project framework and major project activities of Component 2, particularly design phase from March 2019 to February 2020. In the presentation, he also stressed the necessity of formation of the proposed organization set-ups, namely Sub-Project Management Unit (Sub-PMU) for operations and management of Component 2 and field working groups for collaboration between the JICA Project Team and relevant government organizations, namely FD, IWUMD, and DoA, for successful implementation of the component 2 of the FDSNR.

Session 2: Assessment of soil erosion potentials in Inle Lake watershed through Gully mapping and USLE

In the second session, Dr. Toru Inada of the Project Expert Team of Design Phase of Component 2 of FDSNR made a presentation on "Assessment of soil erosion potentials in Inle Lake watershed through Gully mapping and USLE." He introduced the objectives and process of the assessment including mapping of soil erosion potentials and distribution of existing gullies. His presentation indicated that the intensity and severity of gully erosion was very high in the southeastern part of Kalaw watershed area based on the assessment. He also explained the results of Universal Soil Loss Equation (USLE) assessment, which was based on the mathematical modeling to describe soil erosion processes. The total soil erosion potential in Inle Lake Watershed is estimated at about 1,818,000 ton per year accordingly. He concluded that the Kalaw sub-watershed should be selected as a target watershed for the Component 2, where proposed countermeasures should be demonstrated in the course of project implementation, as the gully density and the severity of erosion conditions were high in Kalaw catchment area.

Session 3: Possible Mechanism of Gully Erosion in Kalaw sub-watershed

Dr. Hirotaka Ochiai of the Project Expert Team explained the soil protection function of forest lands in comparison with those of grass and bare lands. He clarified the mechanism of the occurrence of gully erosion. He concluded in his presentation that the permeability and soil strength of saturated and unsaturated soils were crucial factors relevant to gully erosion in Kalaw sub-watershed.

Session 4: Ideas on Potential Measures Effective in Reducing the Progress of Gully Erosion

Mr. Hideki Imai of the Project Expert Team clarified that the objectives of the pilot project for gully erosion control was to "to identify effective measures reducing the progress of gully erosion". He also recommended several actions to be taken for reduction of the progress of gully erosion in Inle Lake watershed, such as i) development of a roadmap for gully erosion control, ii) identification of target gullies, iii) development of a plan for effective countermeasures, and iv) allocation of sufficient resources, such as budget, human resources, and technologies, necessary for effective countermeasures.

He also explained the concept, basic plan and design of countermeasures proposed as the pilot activity for gully erosion control with i) criteria for selection of gully type as well as target area and ii) sample cases of erosion control techniques used in Japan. He stressed in his presentation that **combination/ series of**

structures were more effective than single structure; and simple structure might **not necessarily be effective** in reducing the progress of gully erosion.

Session 5: Proposed plan of monitoring of river discharge and suspended sediment of the major rivers

Dr. Hirotaka Ochiai again made a presentation on "Proposed plan of monitoring of river discharge and suspended sediment of the major rivers" in Session 5. He introduced work plans and methodologies of monitoring of i) river discharge, ii) suspended sediment in river flow, iii) gully process, and iv) deposition of suspended sediment in Inle Lake. He also briefly introduced the equipment and devices to be used for monitoring and proposed locations where such equipment and devices should be put in place in his presentation.

Session 6: Current socio-economic conditions and forest management support in Kalaw sub-watershed

U Saw Eh Doh, the member of the Project Expert Team, briefly explained the results of the socio-economic survey, which was designed by the Project Expert Team and implemented by the national NGO named FREDA with technical assistance from the Project Expert Team. In particular, his presentation put its focus on the introduction of: i) agricultural practices and household economy, ii) major issues on forest and natural resource management as well as those on livelihood improvement, iii) potential measures to improve such issues, and iv) options (two options) to be implemented as the pilot activities in the design phase of Component 2. He also briefly introduced the following two options with the target village and tentative schedule of the proposed activities.

1. **Introduction of an/ agroforestry model/s of valuable tree/s ;** to help local communities develop an agroforestry farm to increase vegetation covers balancing with income generation;
2. **Introduction of Community Forestry (CF)**; to demonstrate the process and procedures for introduction of community forestry in line with the latest CFI.

Session 7: Major Activities in the Next 6 Months

Finally, Mr. Mizuguchi briefly introduced the overall work plan and major activities to be carried out in the next six (6) months by the Project Expert Team.

Question and Clarification Section

The question and clarification section was conducted after the presentation ended.

(1) The staff officer of Forest department of Kalaw Township requested further explanation/ clarification of the sentence of "weak or improper management of forests" in the presentation of Session 6. The member of the Project Expert Team explained that this was not necessarily the general characteristics in the watershed, but the indication based on the local people's understanding of CF and forest management, which was confirmed in PRA conducted in one of the surveyed villages.

(2) The staff officer also questioned whether a series of masonry check dams were efficient and effective for controlling gully erosion. The expert of the Project Expert Team replied that i) the durability of masonry check dam could be about 15 years while the same of sandbag/ stone check dam with wooden frame might last only four (4) to five (5) years, and ii) the consecutive structures, such as check dams with stone pavement waterways, could be more effective for stabilization of existing gullies.

(3) He also suggested to the Project Expert Team that the Team should use the term of "stream" instead of "river" as the major water channels flowing into Inle Lake were rather small in size.

(4) U Myat Min Soe, the representative of CSOs in Inle Lake Area requested the JICA expert Team to clarify the name of the 14 organizations who would participate in the project activities. He also suggested that the project should work together with CSOs rather than government organizations because the political situations could be changed though the local CSOs could keep working in the Inle Lake area.

Deputy Director General of FD replied that, in recognition of the importance of CSOs in the Inle Lake area, FD and the project invited local CSOs, NGOs and INGOs to the Kick-off Meeting. He then clarified that 14 organizations, which were the members of Sub-Project Management Unit (Sub-PMU) for Component 2, as mentioned in the presentation of the Team, but not necessarily from 14 organizations as some of the members were from the same department. He also stressed the importance of CSOs and NGOs for conservation and sustainable management of the watershed area of Inle Lake not only in the project period but also after the end of the project.

(5) He also suggested that the project should also target the eastern part of Inle Lake in addition to the four (4) major river basins to solve the issue of sedimentation in Inle Lake. The Team Leader of the Project Expert Team replied that the catchments of the four (4) major rivers occupied the large part of the watershed of Inle Lake; hence they should be more relevant to watershed management, particularly in terms of sediment control.

(6) U Sithu Aung, the staff officer of Watershed Management Division of FD, inquired whether the Project Expert Team had a plan to give training on gully erosion control to FD officers at the central office. Mr. Imai, the expert of the Project Expert Team, replied that the Team planned to arrange and organize a one-day seminar or training course on erosion control named "Construction Cycle of Gully Erosion Control Measures" sometime in September 2019.

(7) U Soe Naing Aye from MIID raised the question on the difference in effectiveness and efficiency of the erosion control measures between "soft-type" measures, i.e., vegetative measures using trees and grasses, and simple ones using sand bags and wooden wattles, and "hard-type" measures, i.e., masonry check dams made of cements and stones. The expert of the Project Expert Team replied that masonry works with stone and cement should be more effective, efficient and sustainable in the long run, particularly in the areas where construction materials could be transported, but simple stone works and vegetative works could be used in a small scale erosion or not severe eroded area (such as a small erosion area where No.5 and No.6 check dams were constructed in the pilot area).

(8) H.E. Minister of Inthar Affiars first expressed his sincere gratitude to JICA for its technical and financial support for Inle Lake, and then, he questioned whether the project involved socio-economic development activities such as infrastructure development. The Team Leader of the Project Expert Team clarified that the project would not include infrastructure development since its main counterpart was Forest Department and the project mainly focused on erosion control and sustainable land and forest management in the watershed. Nevertheless, he stated that the project aimed to contribute to the socio-economic development through improvement of local livelihoods by project activities, such as introduction of valuable tree crops and diversification of cash crops in farmlands.

Closing section

Deputy Director General of Forest Department delivered the closing remarks of the meeting. He expressed his high expectation of the project and guaranteed continuous support from FD for the successful implementation of the project. He also encouraged the participants, particularly those from related organizations, to provide their full support to the project and participate in its activities. In conclusion he showed his appreciation to all the participants for their attendance and sharing of their insights and knowledge with the Project Expert Team in the meeting.

Agenda of the Kick-off Meeting of Component 2 of FDSNR

Ser.	Subject	Time frame	Resource person
Registration (12:30-13:00)			
Opening Section			
1.	Opening Remarks (1)	13:00-13:10	H.E. Minister for Ministry of Natural Resources and Environment, Shan State
2.	Opening remarks (2)	13:10-13:20	H.E. Minister for Inthar Affairs, Shan State
Coffee Break (Photo Session: 13:20-13:30)			
3.	Introduction of the participants	13:30-13:40	MC : Ms.Khin Hnin Thet, Range Officer, FD Taunggyi
4.	Session 1: Overall Framework of Component 2, particularly its Design Phase	13:40-14:00	Mr. Yoji Mizuguchi, JICA Project Expert Team
5.	Session 2: Assessment of soil erosion potentials in Inle Lake watershed through Gully mapping and USLE	14:00-14:20	Mr. Toru Inada, JICA Project Expert Team
6.	Session 3: Possible mechanism of gully erosion in Kalaw sub-watershed	14:20-14:40	Mr. Hirotaka Ochiai, JICA Project Expert Team
7.	Session 4: Ideas on potential measures effective in reducing the progress of gully erosion	14:40-15:00	Mr. Hideki Imai, JICA Project Expert Team
Coffee Break (15:00-15:15)			
8.	Session 5: Proposed plan of monitoring of river discharge and suspended sediment of the major rivers	15:15-15:35	Mr. Hirotaka Ochiai, JICA Project Expert Team
9.	Session 6: Current socio-economic conditions and major issues on land and forest management in Kalaw sub-watershed	15:35-15:55	Mr. Aung Myo Khaing, Assistant Director, FD Taunggyi Mr. Saw Eh Doh, JICA Project Expert Team
10.	Major activities in the next 6 months	15:55-16:10	Mr. Yoji Mizuguchi
11.	Questions and Clarifications	16:10-16:50	MC and All Participants
12.	Closing Remarks	16:50-17:00	Deputy Director General of FD

Session 1 : Overall Framework of Component 2, particularly its Design Phase

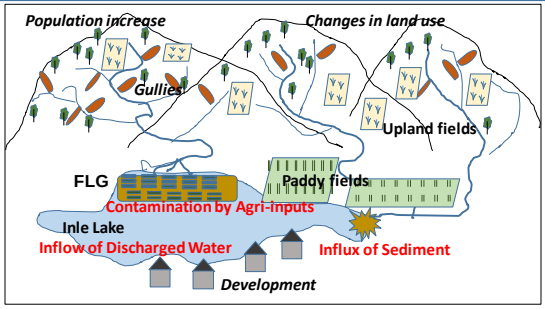
August 2019

JICA Project Expert Team

1. Background of the Project (Component 2)

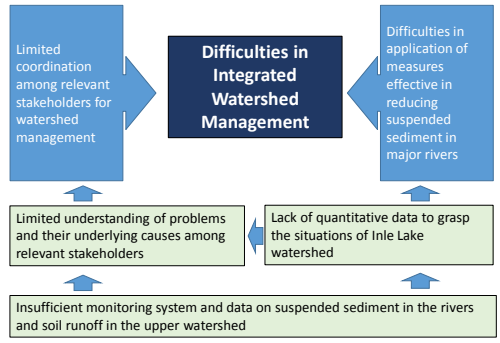
- Inle Lake Integrated Watershed Management is one of the component of the Project for Capacity Building of Sustainable Natural Resource Management (FDSNR), which comprises of three components, namely:
  1) forest management;
  2) integrated watershed management; and
  3) biodiversity conservation.
- Prior to the full implementation of the 2nd component, it was decided that collection and assessment of baseline on the watershed should be carried out to figure out the mechanism of sedimentation in Inle Lake and design effective measures for watershed management.
- The design phase of Component 2 started its works in the middle of March 2019.

1. Background of the Project (Component 2)



Sedimentation in the Inle Lake, apparently caused by the influx of suspended sediment in the major rivers, is one of the great concerns to be addressed. Soil erosion/ run-off in the upper watersheds is considered as the main source of sediment.

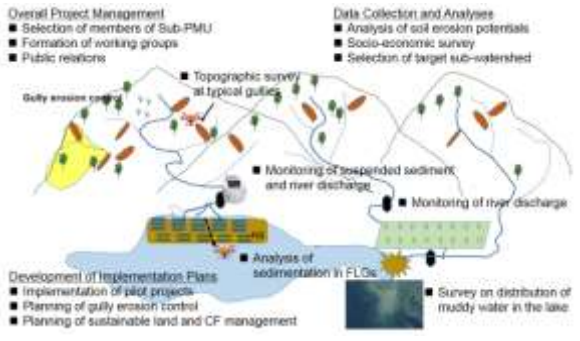
1. Background of the Work



2. Objectives of the Work

- The main objective of Component 2 is **to improve integrated watershed management in Inle Lake.**
- Specifically, the design phase of Component 2 aims **to lay the groundwork for smooth implementation of effective measures for watershed management in a coordinated manner**.
- The emphasis of the design phase is placed on:
  - Assessment of the mechanism of generation of sediment in the watershed;
  - Communication with a wide range of stakeholder to form a platform for effective information sharing;
  - Demonstration of some potential measures for soil erosion control and sustainable land management in collaboration with local communities;
  - Facilitation of stakeholders' understanding of the situations of the watershed; and
  - Development of a plan and procedures for scale-up of the measures in the watershed.

3. Plan of Operations



4. Major Activities (completed)

4.1 Assessment of Soil Erosion Potentials in the Watershed

- Analysis of surface soil erosion potentials using the universal soil loss equation (USLE) method.
- Analysis of existing gullies through visual interpretation using Google Earth Images

4.2 Collection of Socio-economic data

- Conduct of a socio-economic survey composed of household interviews and PRA
- Targets of household interviews: 540 HHs in 12 villages
- Targets of PRA: 4 villages

4. Major Activities (on-going)

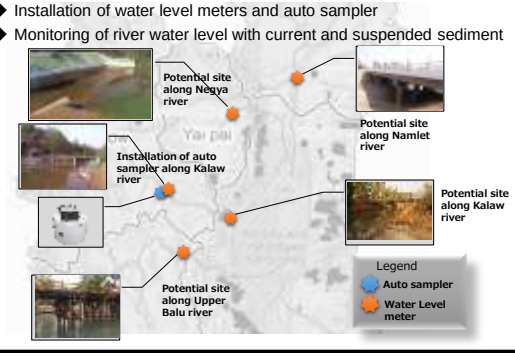
4.3 Determination of Potential Effective Measures for Watershed Management

- Topographic survey at selected typical gullies (for gully erosion control)
- Assessment of the results of the socio-economic survey (for sustainable land and forest management)
- Identification of possible measures for gully erosion control and sustainable land and forest management
- Planning and designing of potential effective measures with FD and other relevant organizations
- Implementation of one or two of potential effective measures as a pilot activity together with FD and other relevant organizations
- Review of the results of the pilot activity with FD and other relevant organizations

4. Major Activities (planned)

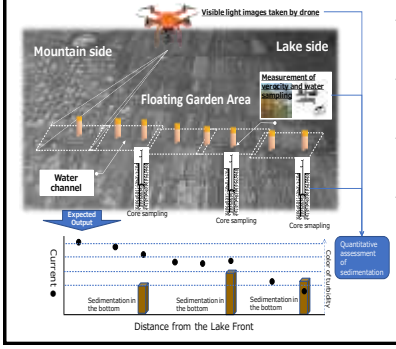
4.4 Collection of River Monitoring Data

- Installation of water level meters and auto sampler
- Monitoring of river water level with current and suspended sediment



4. Major Activities (planned)

4.5 Analysis of sedimentation in floating garden



- Measurement of the differences in turbidity in floating garden.
- Analysis of suspended sediment in the flow in gloating garden.
- Measurement of current velocity in floating garden.
- Analysis of soil particles and radiocarbon dating of bottom layer in floating garden.

4. Major Activities (Planned)

4.6 Development of an Implementation Plan of Effective Measures for Watershed Management

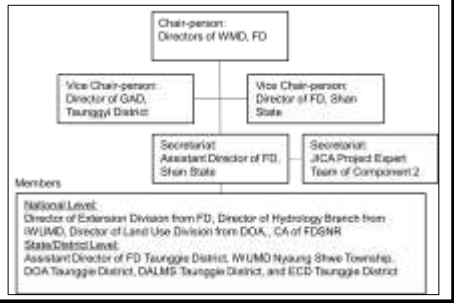
- Analysis of the results of the pilot activities
- Development of implementation plans of proposed measures effective in gully erosion control and sustainable land and forest management in the watershed
- Clarification of the organizational structure for implementation with expected roles and responsibilities of the relevant organizations

5. Proposed Organizational Set-ups

5.1 Sub-Project Management Unit (Sub-PMU)

Sun-Project Management Unit (Sub-PMU) for Component 2 will be formed for smooth and collaborative implementation of the project.

The proposed structure of Sub-PMU is shown right.

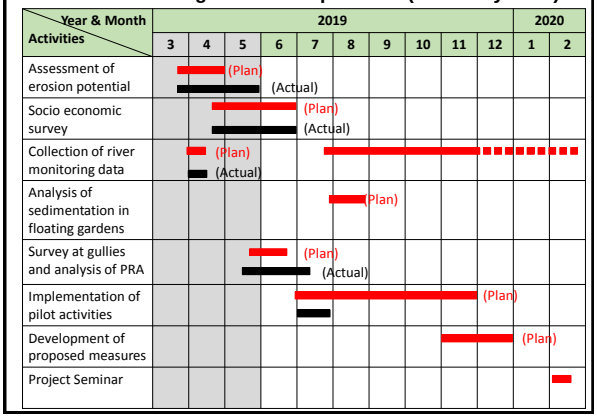


5. Proposed Organizational Set-ups

5.2 Field Working Groups

- The formation of two (2) working groups listed below is proposed.
  a. Working Group of water monitoring and erosion control (WG-WM&EC)
  b. Working Group of community forestry and sustainable land management (WG-CF&SLM)
- The proposed structures of the respective working groups are as follows:
  i) WG-WM&EC
    - Staff Officers from Kalaw and Nyaung Shwe FD
    - 2 Assistant Engineers from Nyaung Shwe IWUMD
    - 2 Range Officers from WMD of FD
  ii) WG-CF&SLM
    - Staff Officers from Kalaw and Nyaung Shwe FD
    - Staff Officers from Kalaw and Nyaung Shwe DoA

Work Plan and Progress of Component 2 (as of July 2019)



Design Phase of Component 2 (Integrated Watershed Management in the Inle Lake Watershed) of The Project for Capacity Building for Sustainable Natural Resource Management

Session 2 : Assessment of soil erosion potentials in Inle Lake watershed through Gully mapping and USLE

August 2019

JICA Project Expert Team

Objective of Gully Mapping

- To identify the distribution of gully erosion in the upstream areas of Inle Lake (Kalaw, Negya, Namlet, and Upper Balu sub-watersheds), which to be used for finding priority areas for countermeasures.

What Is Gully Erosion?

- Gully erosion is a form of erosion by rainwater and refers to ravines formed by the action of water. The scale varies from large to small!

2

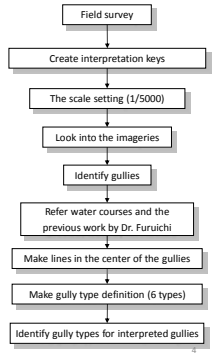
Target area

- The target area of gullies mapping is Kalaw, Negya, Namlet and Upper Balu sub-watersheds, with total surface area about 2,900km^2

3

Mapping Method

- **Data**: Satellite imageries from ArcGIS online
- **Technique**: Visual interpretation
- **Scale**: 1/5000
- **Field survey**: Before starting interpretation, several gullies were visited by the interpreter and interpretation keys were created
- **Gully types**: Gullies were grouped into 6 types based on topography, size and vegetation.



4

Interpretation key: e.g. Waterway without vegetation

Characteristics

- Lie on a relatively flat area
- Grayish in color
- No vegetation is seen, but grooves (shadow) are visible

Mapping instruction

- Draw a line in the center of the channel
- If water is visible on satellite image, line shall not be drawn

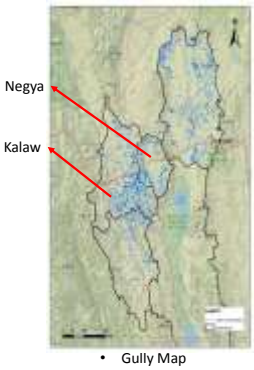
5

Overall results of gulley interpretation

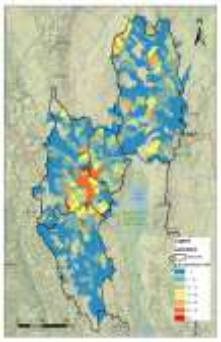
River sub-watershed	Total land area (ha)	Gross extension of gully (m)	Gully density (m/ha)
Namlet	119,509.98	650,786	5.45
Negya	25,594.19	235,897	9.22
Kalaw	76,385.14	566,122	7.41
Upper Balu	72,007.20	242,480	3.37

6

Gully Map



- Gully Map



- Gully Density Map (m/ha)

7

Gully type: Six

No	Gully type	Place of occurrence	Scale	Vegetation conditions	Remarks
1	Natural waterway type	Flat	About 2m of width	Grass, shrub, and bare land	
2	Mountain type	Mountains	—		Inc. those with severe surface erosion
3	Medium-sized vegetation mold	Hilly area	5~15m	Grass, shrub &tall trees	Those whose depth can be confirmed comparing with 1 and 2
4	Medium-sized vegetation-free type	Hilly area	5~15m	Bare land	
5	Large-scale vegetation mold	Hilly area	15 m or more	Grass, shrub, and tall trees	
6	Large-scale vegetation-free	Hilly area	15 m or more		

(Source: gully_digitized_wrev.shp/field: g_type_12)

8

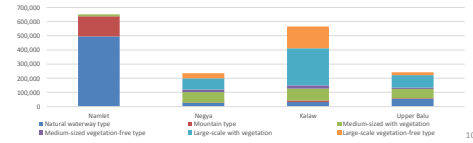
Natural waterway type, Flat area	Medium to Large-Scale, Hilly area
	
Mountain type	
	

9

Gully length for each gully type category

Unit: meter

	Gully type	Namlet	Negya	Kalaw	Upper Balu	Total
1	Natural waterway type	494,896	28,054	32,162	53,928	610,071
2	Mountain type	142,074	69	11,347	4,998	158,754
3	Medium-sized with vegetation	13,815	74,417	83,872	64,658	236,762
4	Medium-sized vegetation-free type	0	16,637	21,633	9,989	48,259
5	Large-scale with vegetation	0	80,316	262,922	87,144	430,382
6	Large-scale vegetation-free type	0	36,404	154,186	21,762	214,763



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Consideration for a priority area

- **In the northwestern part of the Namlet upstream region**, there is a concentration of gullies, with dense vegetation and slightly narrower width.
- **Negya sub-watershed** has the highest gully densities, followed by the Kalaw, the Namlet, and the Upper Balu.
- **In the southeastern part of Kalaw** has a gully density of 20m/ha or more which is the most gully concentrated area.

Summary for Gully mapping

- **In the southeastern part of Kalaw**, gully is located in a gently sloping hills, which is wide, branched and deep.
- The southeastern part of Kalaw has large gullies and the deepness is high.

Application of USLE

1) **Objective**: To grasp the surface erosion potential of the entire Inle Lake sub-watershed.
2) **Method**: USLE method
3) **What is USLE**: The Universal Soil Loss Equation (USLE) is a widely used mathematical model that describes soil erosion processes. It was developed in the 1930s by the U.S. Department of Agriculture (USDA) .

13

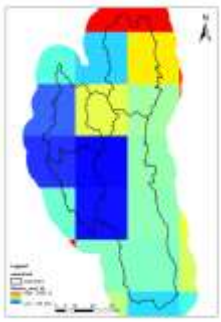
Average annual soil erosion (ton/year) =A was calculated by the following formula;

A=R*K*L*S*C*P

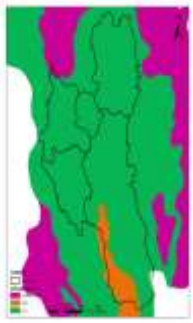
List of parameters in the USLE

	Average annual soil loss (ton per hector per year)	References
A		
R	Rainfall erosivity index (MJ*mm/(ha*hr))	$R = \sum_{i=1}^{12} 1.735 \times 10^{(1.5\log_{10}\frac{P_i^2}{P}-0.08188)}$
K	Soil erodibility factor (ton*ha*hr/(ha·Mj·mm))	Zaw (2014)
L	Slope length (m)	Aster GDEM
S	Slope	Aster GDEM
C	Cropping (soil management) factor	Thin Nwe Htwe (2015)
P	Conservation practice (maintenance) factor	No data. Not used

14



Rainfall erosivity factor (R)



Soil erodibility factor (K) map

15

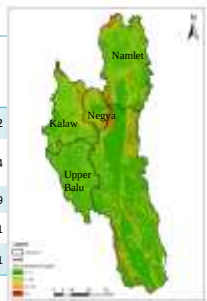
Topographic factor (LS) map

Soil management factor (C) map

16

Soil erosion estimation (t/ha/year) of Inle Lake area using USLE

River sub-watershed	Area (km^2)	Maximum (t/ha)	Mean (t/ha)	Total (t)	t/km^2
Namlet	1,170	671.33	9.36	1,069,634.25	914.22
Negya	261	677.19	15.23	388,405.26	1,488.14
Kalaw	754	1,516.97	9.06	667,129.59	884.79
Upper Balu	716	237.86	4.34	303,806.43	424.31
Delta range	2,508	1,116.73	7.42	1,818,335.70	725.01



17

Summary for USLE results

- Soil erosion estimation in Negya is high at 15.23 ton/ha because of the hilly slopes, while it is similar at Namlet and Kalaw at 9.36 and 9.06 respectively.
- Total erosion is the highest at Namlet because it has the most extensive area.

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Evaluation of the four sub-watersheds based on previous researchers and JICA expert team estimation

Items	Namlet	Negya	Kalaw	Upper Balu
Catchment area <1	1,149 km^2	250 km^2	742 km^2	813 km^2
Total sediment input <1 (input per unit)	103,600 ton/yr (90 ton/yr/km^2)	19,000 ton/yr (76 ton/yr/km^2)	56,500 ton/yr (76 ton/yr/km^2)	98,300 ton/yr (121 ton/yr/km^2)
Type of soil erosion <3	Surface: High Gully: Low	Surface: Medium Gully: High	Surface: Medium Gully: High	Surface: High Gully: Low
Sediment trap <4	Exist	Exist	None	None
Deposition in the lake <1	0.85 ton/yr	0.15 ton/yr	0.50 ton/yr	0.03 ton/yr
Outflow at outlet <2	0%	0%	13%	50%

Sources:

<1 Catchment Processes and Sedimentation in Lake Inle, Southern Shan State, Takahisa Furuichi, 2008
<2 Estimated by the JICA Project Expert Team based on the Dr. Furuichi's report
<3 Initial estimation by the JICA Project Expert Team based on the GIS assessment and interpretation of Google Earth Images
<4 IWUMD Nyaung Shwe

19

Consideration for a priority area

- In terms of gully density (m/ha) and its severity on erosive conditions, Kalaw and Negya are high, although the total gully length is the longest at Namlet.
- According to Dr. Furuichi's report, gully intensity is high at Kalaw and Namlet.
- In terms of surface soil erosion intensity (t/km) through USLE analysis, Negya is the highest followed by Namlet and Kalaw.
- The area of Negya is smaller than other areas and therefore total amount of soil erosion might be not so high.
- Based on above conditions when the application of countermeasures is considered, it may be effective at Kalaw than other sub-catchments.

20

JICA - FDSNR - Integrated Watershed Management for the Inle Lake, Myanmar

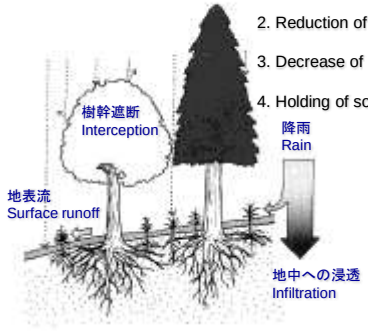
Session 3: Possible mechanism of gully erosion in Kalaw sub-watershed

August 2019
JICA Project Expert Team

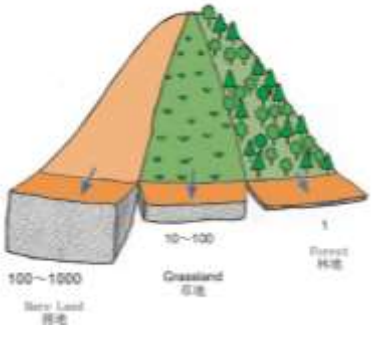
1

Function of Erosion Prevention

1. Suppression of rain drop splash energy
2. Reduction of surface runoff velocity
3. Decrease of runoff discharge
4. Holding of soil particles



Soil erosion volume from bare land, grass land and forest



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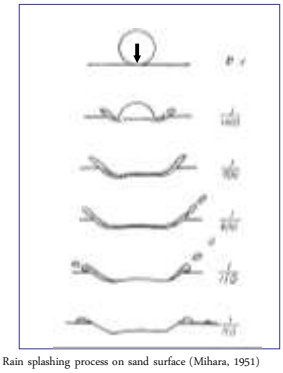
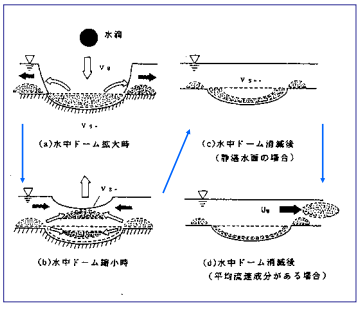
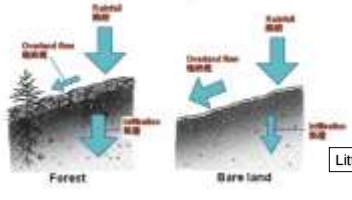


Rain splashing process on sand surface (Mihara, 1951)

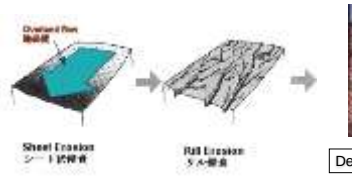


Soil particle movements when a rain drop hit on the shallow water.

(Fukada, 1993)



Litter layer and overlandflow



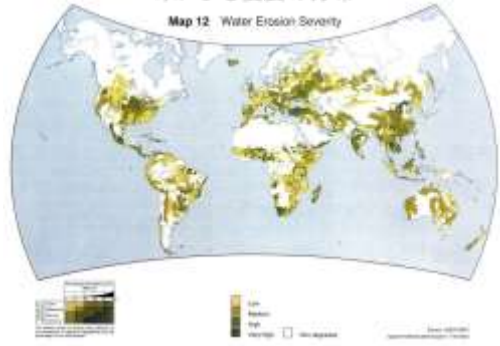
Development of erosion

乾燥地の分布

UNEP. 1992. World Atlas of Desertification. Edward Arnold, London (UK)

7

水による侵食の分布



UNEP. 1992. World Atlas of Desertification. Edward Arnold, London (UK)

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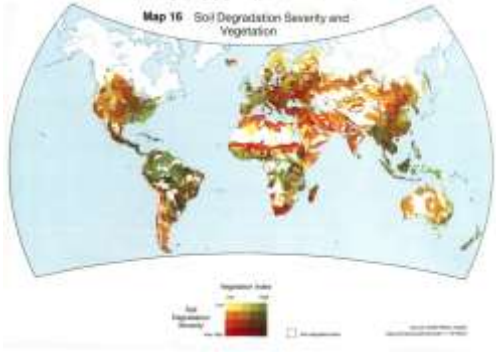
土壌荒廃と植生の分布



UNEP. 1992. World Atlas of Desertification. Edward Arnold, London (UK)

9

Gully Development
in Pasture Land
(Sao Paulo, Brazil)

JICA Forest and Environment Conservation Research Project (1993 – 1998)

10

Large scale Erosion in Loess Plateau, China

JICA Forest conservation technical training in Loess plateau in China
(1990 ～ 1995)

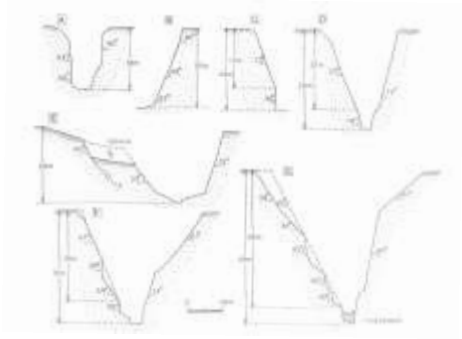
11

Evolution of Valley Side Slopes in Japan (Matsukura, Y, 1987)

Sakurajima-vocano, Kagoshima, Japan

12

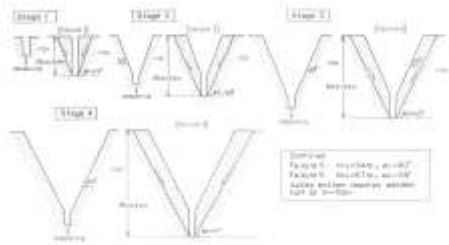
Side slopes of valleys in Pumice, Kagoshima, Japan



Evolution of Valley Side Slopes in Japan (Matsukura, Y, 1987)

13

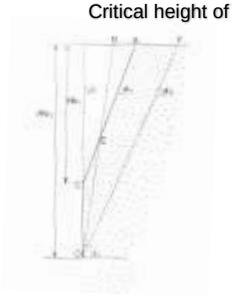
Model for valey-side slope evolution



Evolution of Valley Side Slopes in Japan (Matsukura, Y, 1987)

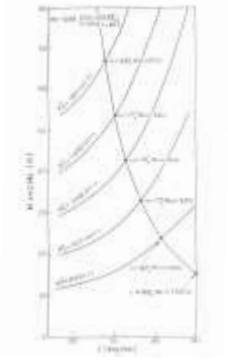
14

Critical height of valley side slopes



$$H_c = \frac{4c}{\gamma}\frac{\sin i \cos\phi}{1-\cos(i-\phi)}$$

Critical height of slopes (Culmann, K, 1866)



Evolution of Valley Side Slopes in Japan (Matsukura, Y, 1987)

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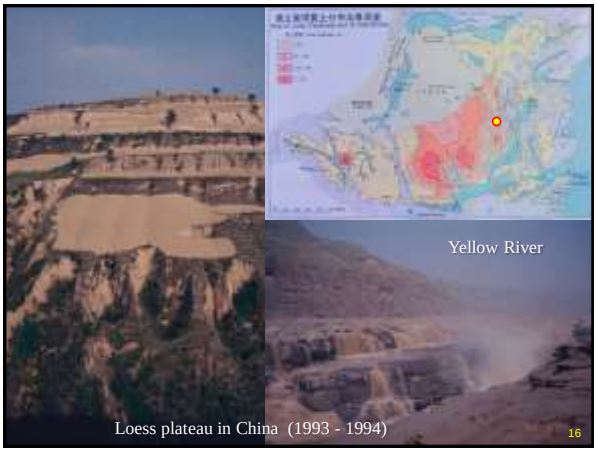


Loess plateau in China (1993 - 1994)

16

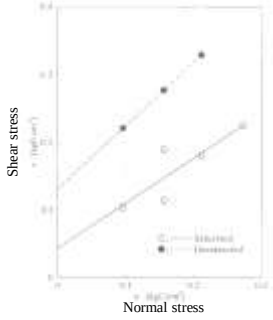
Landslide initiation of Loess plateau in China (Ochiai, H. 1994)

17

Landslide initiation of Loess plateau in China (Ochiai, H. 1994)

18

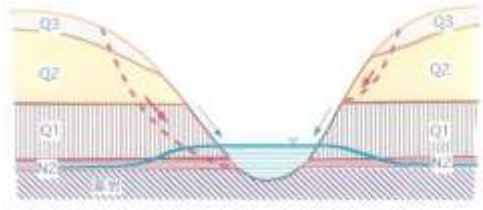
Shear strength differences
between dry and saturated condition of Loess soils



Landslide initiation of Loess plateau in China (Ochiai, H. 1994)

19

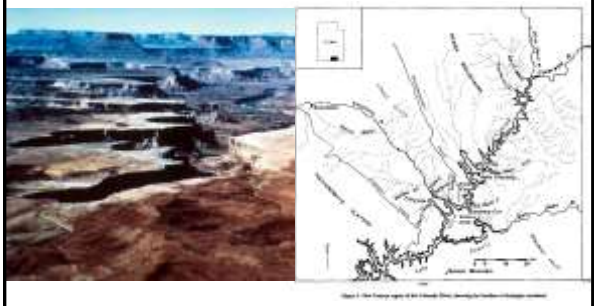
Landslide initiation caused by
the water level rise and decrease in strength of slopes



Landslide initiation of Loess plateau in China (Ochiai, H. 1994)

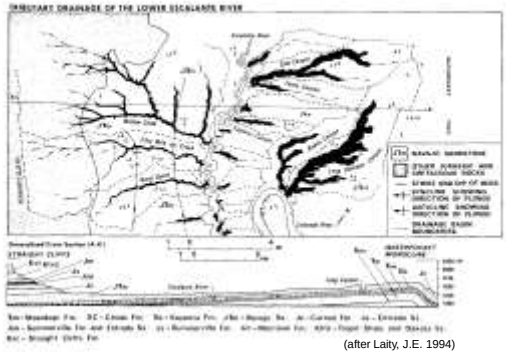
20

Sapping process and the development of
theater-headed valley networks on the Colorado Plateau
(after Laity, J.E. 1994)



21

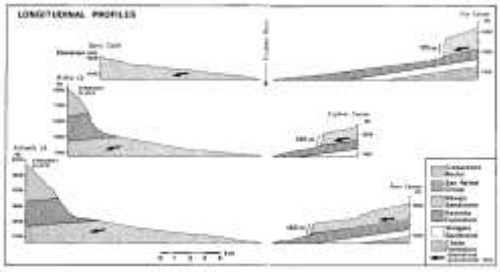
Tapered and theater-headed canyons developed in the Navajo Sandstone, attributed to the relative effectiveness of overland-flow or ground-water erosional processes



(after Laity, J.E. 1994)

22

Longitudinal profiles of tributaries to the Escalante River



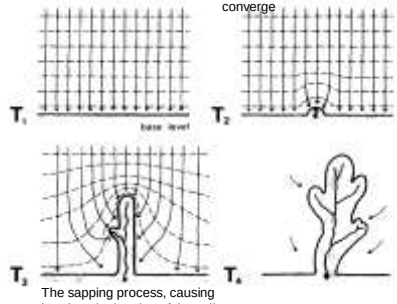
(after Laity, J.E. 1994)

23

A general model of drainage extension by sapping processes
(after Dunne, 1980).

Ground water flowing toward base level encounters an irregularity

An outcropping joint or erosional notch that causes ground water to converge

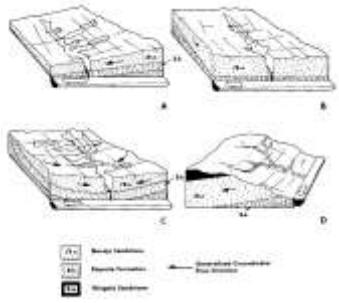


The sapping process, causing headward migration of the valley

(after Laity, J.E. 1994)

24

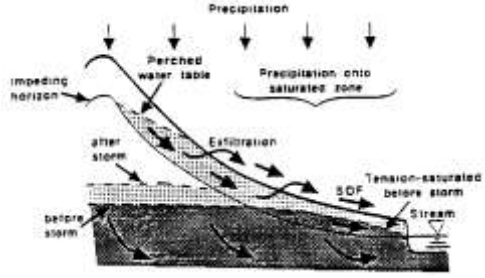
Interpretation of network pattern, valley morphology, and structural relationships



(after Laity, J.E. 1994)

25

Hydrology, mechanics, and geomorphic of erosion by subsurface flow (after Dunne, T., 1990)



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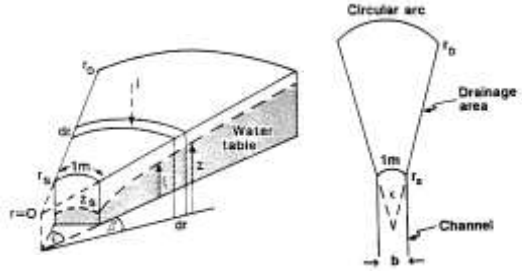
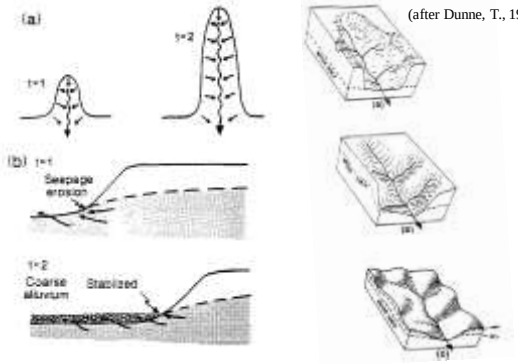


(after Dunne, T., 1990)

27

(after Dunne, T., 1990)

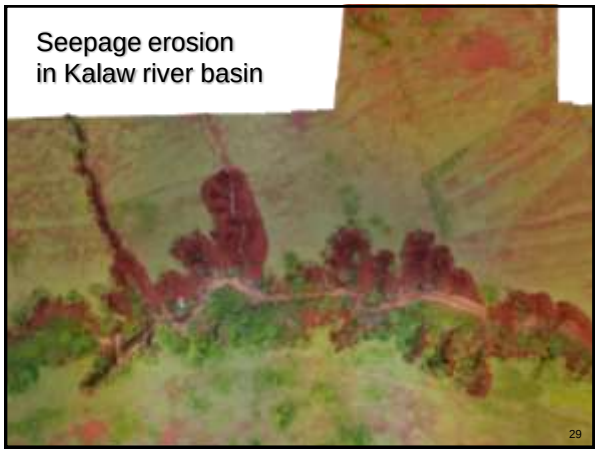


Two ways in which the extension of valley networks may be resisted by sediment influx

Forms of valley heads produced by seepage erosion

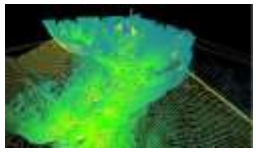
28

Seepage erosion in Kalaw river basin

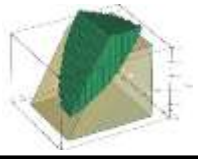


29

To clarify the mechanism of gully erosion in Kalaw sub-watershed



- Infiltration characteristics of saturated and unsaturated soil
- Soil strength of saturated and unsaturated condition
- 3D-seepage analysis
- 3D-slope stability analysis



30

Design Phase of Component 2 (Integrated Watershed Management in the Inle Lake Watershed) of The Project for Capacity Building for Sustainable Natural Resource Management

Session 4: Ideas on potential measures effective in reducing the progress of gully erosion

August 2019
JICA Project Expert Team

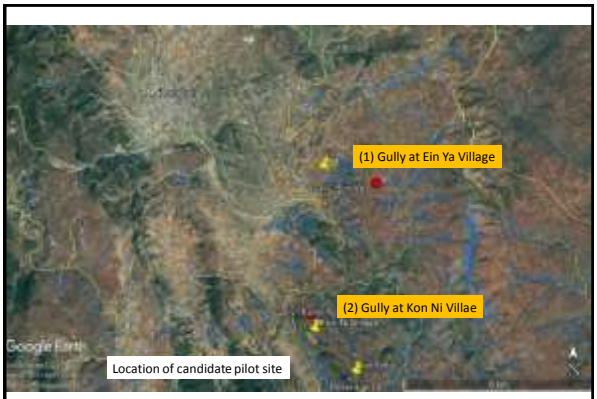
Outline of gully distribution and Major type types of gully

- There are 6 types of gully in Inle Lake Basin
  1. Natural water way type
  2. Mountain area gully type with steep slope
  3. Hill area gully with gentle slope in medium scale with vegetation
  4. Ditto in medium scale without vegetation
  5. Ditto in large scale with vegetation, and
  6. Ditto in large scale without vegetation
- The major gully types in the basin can be said as 1) natural water way type, 2) mountain area gully, and 3) hill area gully
- Number/ total length of gully of 3) is the biggest in the three types

⇒ Hill area gully type is the major in Inle Lake Basin

Candidates of Gully for the Pilot activity

- Target gully for the Pilot activity is selected from the major type 3) above
- The selection criteria are:
  - Good access to the site
  - Compact and easy to see whole area from 1 to 2 places
- A gully located in Kon Ni Village and another gully in Ein Ya Village are considered as the candidates for the pilot site



Selection of plot site

- Based on discussion and consideration with FD Kalaw and IWUMD Nyaunshwe about the points below, the gully at Kon Ni Village was selected as the target gully for pilot activity
  - Typical type gully
  - Good access to the site
  - Scale of countermeasure (it should not be much large.)
  - Inclusion of some new technologies (there should be some new technologies/ approaches in the pilot activity.)

Additionally, FD Kalaw has installed some sand bag check dams in the gully at Kon Ni village and they are necessary to be improved.

Concept of countermeasure against gully erosion

- The target gully is developing and has high risk to be expand.
- The complete measure to restore the gully is not realistic considering its cost and time required.

Therefore, the basic concepts of the countermeasures are determined as below based on discussions with Myanmar side.

- Minimum input to reduce the pace of expansion of erosion
- Stabilization of gully bed and slope foot to accelerate the regeneration of natural vegetation.

⇒ **Then**

The natural vegetation in the gully will be recovered in the near future.

Basic plan

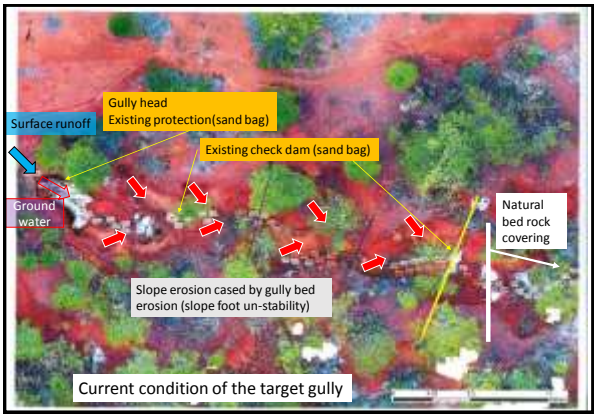
- The basic plan of countermeasures against the gully erosion is set as below.
  - Divert surface runoff to prevent water flow into the gully
  - Control the water flow in the gully to stop the erosion of the gully bed and slope foot
  - Stabilize the gully bed and slope foot and accelerate natural vegetation recovery

Design outline

- Target segment of gully
  - Approx. 100m the lower segment from the junction with the main gully is covered by natural rock.
  - The upper stream from the point where the FD installed sand bag check dam upto the head, approx. 60m is the target segment.
- Design outline
  - The erosion is caused by surface runoff and ground water flow.
  - Therefore, the structures shall function to control the water flows and prevent erosion.
  - The actual major structures are below

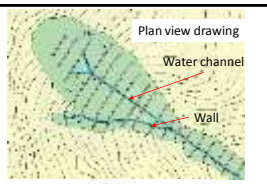
a. Water channel: control the water flow

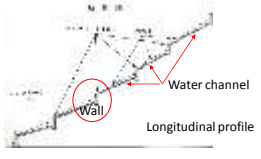
b. Check dam: support the water channel, stabilize the slope foot



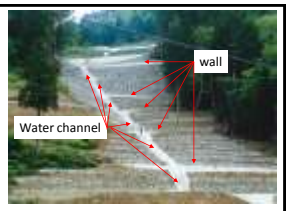
Current condition of the target gully

Introduced Japanese forest conservation technology





Outline of distribution of water channel and walls



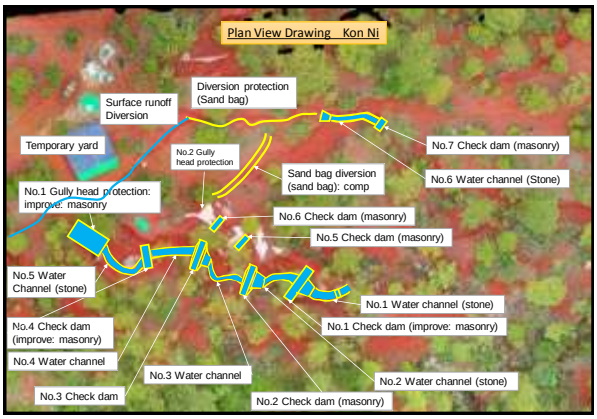
Refence of example of combination work in Japan
Quoted from:「治山技術写真図説」(Explanation with photos of forest conservation technology)

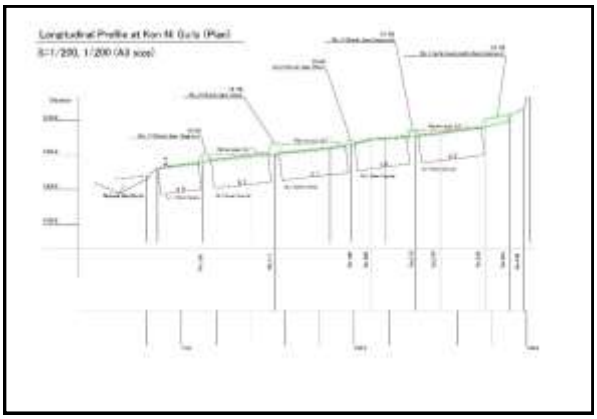

Masonry wall at slope failure in Japan

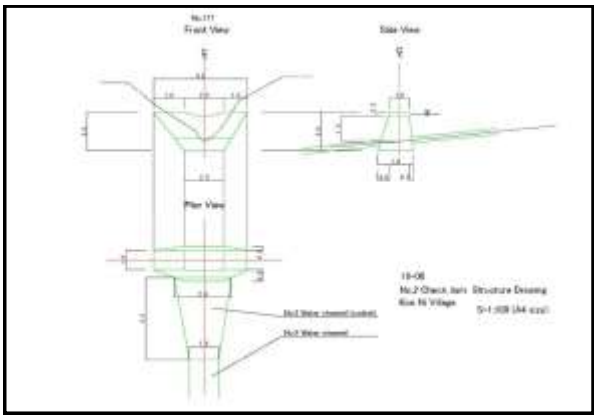
Refence of example of masonry work in Japan
Quoted from:「治山技術写真図説」(Explanation with photos of forest conservation technology)

Design of pilot activity for erosion control at Kon Ni Village

- The design was prepared by he JICA expert team and discussed with Myanmar side.
- Myanmar side (FD, IWUMD) gave some suggestions below.
  - 50cm Thickness (depth) of water channel is too much, 30cm is enough.
  - Ratio of masonry material (stone, sand, cement, and water) was given by the Norm.
  - Some vegetation work was suggested to accelerate the recovery but the planting in gully would be better when the bed and slope foot will be stabilized, some years later.
- The design was finalized including the suggestions.

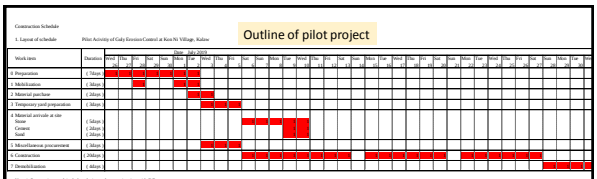






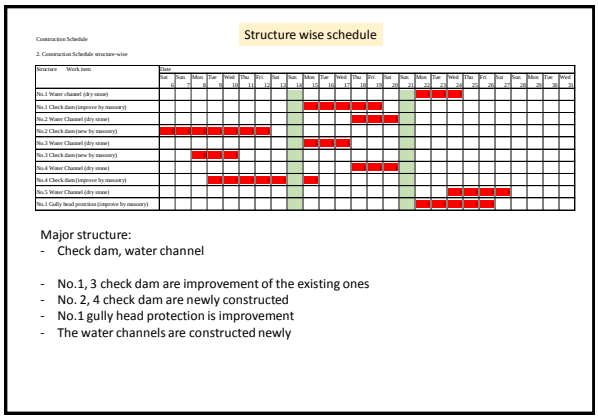
Schedule of pilot activity for erosion control

- The outline of the work schedule was discussed with the Myanmar side.
- The draft detailed schedule of the pilot activities and the construction were prepared by the JICA team.
- The schedule was finalized and the pilot activity started on the end of June, 2019.



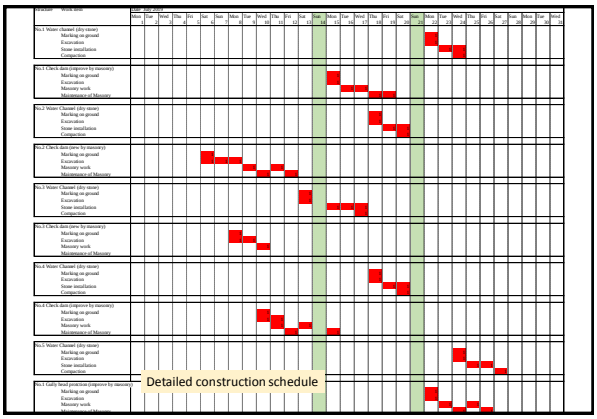
0 . Preparation: planning, design preparation, discussion, cost estimation, etc.

1. Mobilization: necessary members move and negotiation with Village such as, land use, duration of the construction, use of access road passing in the field, works and skilled owrkers provision, and some other cooperation.
2. Material purchase: major material for this construction are: stone, sand, cement.
3. The temporary yard to storage material is the first work at the site.
4. Miscellaneous material are: water tank, sand bag, blue sheet, and goods for safety control such as helmet/ grove for workers and all visitors at the site.
5. The major construction work are: ground breaking (marking pegs), excavation, masonry, and dry stone setting.
6. When the work will be completed, all the site shall be cleaned and material, equipment, machines shall be demobilized.



Major structure:
- Check dam, water channel

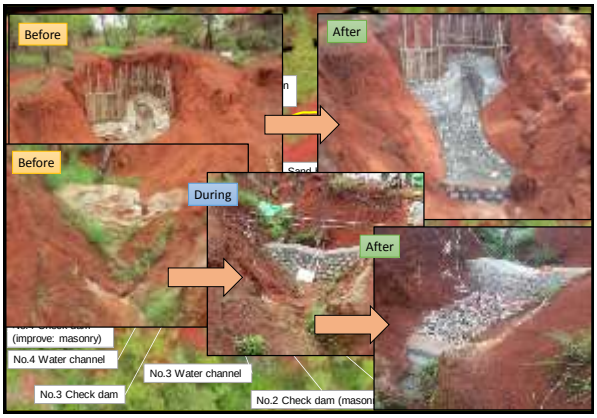
- No.1, 3 check dam are improvement of the existing ones
- No. 2, 4 check dam are newly constructed
- No.1 gully head protection is improvement
- The water channels are constructed newly

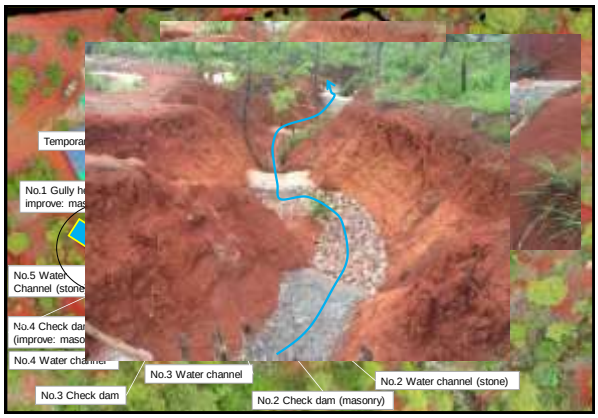


Progress of work (as of July 10)

- The following works have been finished by July 10
- Temporary yard (completed)
- Diversion of the surface water (:drainage) and end treatment (completed)
- No.2 check dam: excavation was completed and masonry work is on-going
- No.3 check dam: same as ditto

The additional works below have been completed.
- No. 2 gully head protection (additional work)
- No.5 check dam (additional work)
- No.6 check dan (additional work)





Findings through Pilot activity

- Combination/ series of structures are more effective than single structure (: discussion results with FD Kalaw)
- FD does little experience of such countermeasure
- Importance of cycle if erosion control activity (Planning/ design concept/ ground survey/ design/ cost estimate/ construction planning/ monitoring)

End of presentation

- Thank you very much for lisning

Session 5: Proposed plan of monitoring of river discharge and suspended sediment of the major rivers

2 August, 2019

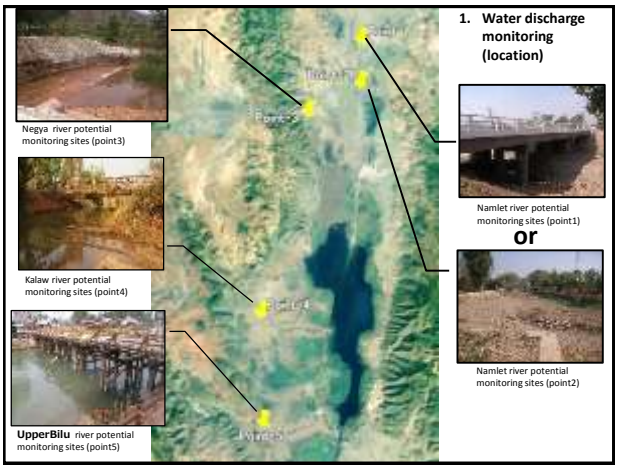
Hirotaka Ochiai, PhD.

1. Basic Approaches to the Work

1. **Collection and analysis of data in a scientific manner using high-tech devices and equipment and development of monitoring methods for continuous data collection**
2. Use of scientific data for determination of effective measures for soil erosion potential and sustainable land use management with due consideration of ethnic minorities, gender, stakeholders' capacity, and development needs
3. Facilitation of mutual understanding between/among stakeholders with clarification of stakeholders' roles in watershed management

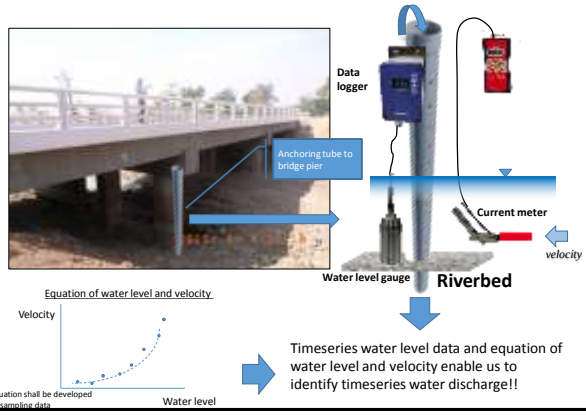
2. Series of monitoring and data collection

Types		Objectives	Equipment
Monitoring	1.Water discharge monitoring	Measuring water level	Auto data logger
	2.TSS discharge monitoring	Collect water sample	Auto water sampler
	3.Precipitation monitoring	Identify pattern of rainfall	Rain Gauge
	4.Gully process monitoring	Understanding process of gully development	Trail Camera
Data collection	5.Soil sample collection	To understand sedimentation history, collet soil sample from surface to 2~3m below.	Soil sampler
	6.Gully surface measurement	In order to evaluate check-dam effect, current status of gully surface shall be identified.	Laser measurement (OWL)



1. Water discharge monitoring

(Equipment and methodology; Auto data logger for monitoring water level)



2. TSS discharge monitoring

3. Precipitation monitoring (location TBD)
4. Gully process monitoring (Aya village)
5. Soil sample collection (Kalaw river exit from cave)
6. Gully surface measurement (Aya and KhoNi village)


Rain gauge

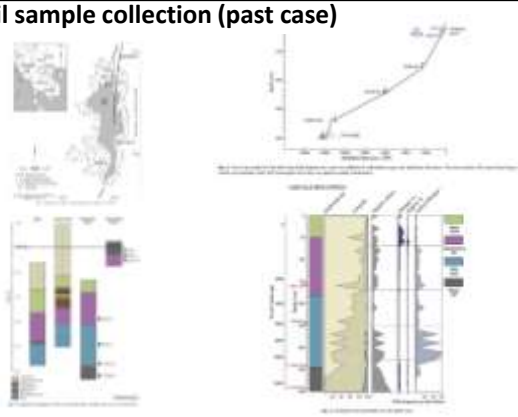

Trail Camera


Soil sampler


Laser measurement

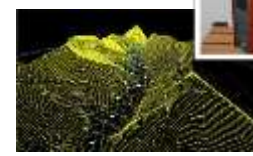
4. Gully process monitoring (Aya village)

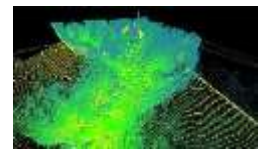
5. Soil sample collection (past case)



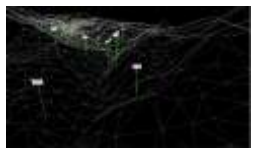
Geoffrey, H. et. al (2019) Holocene environmental change at Inle Lake, Shan State, Myanmar, and its implications for the regional development of agriculture

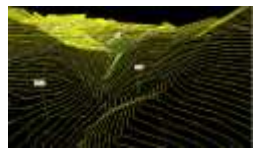
6. Gully surface measurement (Aya village)





6. Gully surface measurement (Khon Ni village)





Session 6: Current socio-economic conditions and forest management support in Kalaw sub-watershed

August 2019

JICA Project Expert Team

1. Socio-Economic Survey

(1) Objective

To identify the socio-economic situations, utilization and management practices of natural resources of Kalaw watershed in Taunggyi district

(2) Methodology

a. Secondary data collection
b. Household interview survey
c. Participatory rural appraisal (PRA)

(3) Period: May-June 2019

(4) Survey design: JICA Expert Team

Implementor: FREDA

1.1 Household Interview Survey

1) **Target**: 540 households in 12 villages in Kalaw sub-watershed

2) **Selection of target villages**: The following points/criteria were considered in the evaluation
   - ✓Accessibility
   - ✓Allocation of Community Forest (CF) or possibility of allocation of CF
   - ✓Existence of gullies / Slope conditions
   - ✓Ethnicity
   - ✓Location of village (distance from the stream/river of the selected target watershed and even distribution of the villages in the watershed)

3) **Data collected**

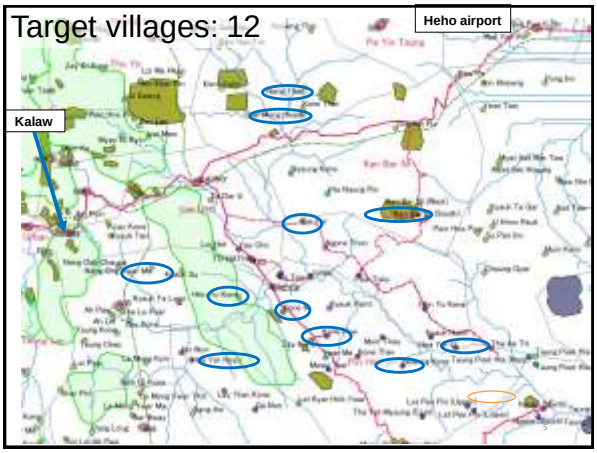
Item	Contents
Basic information	Population, Number of households, Average income, Poor/Socially vulnerable, Infrastructure, Ethnic groups, History, Location (GPS)
Household	Family member, History, Academic background, House type, Access to Water /Electricity, Main source of fuel for cooking
Agriculture	Land ownership/tenure (Land holding size, Own farming area, Renting/Borrowing area), Cropped area, Type of crops grown/harvested in farms, Agri. Products and Inputs, Crop calendar, Production, Sales/Income
Financial information	Main income sources, Cash income, Monetary value, Main expenditures, Average monthly expenditure of major cost items
Natural resources	Firewood consumption, NTFPs, others

4) Target villages

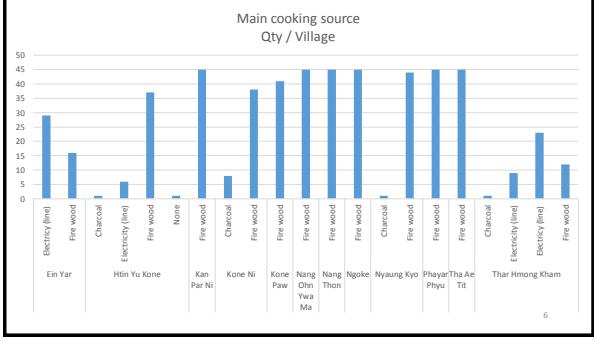
S. N.	Village for HH survey	Ethnicity	CF	PRA
1	Kone Ni	Danu	Established	Conducted
2	Kone Paw	Paoh	Submitted	
3	Nyaung Kyoe	Paoh	Not established	
4	Hpa Yar Hpyu	Taung Yo	Not established	Conducted
5	Thit Ae Tit	Hta Naw	Not established	
6	Ein Yar	Danu	Not established	Conducted
7	Kan Bar Ni (South)	Danu	Established	
8	Ngoke (North)	Paoh	Established	
9	Htin Yu Kone	Paoh	Not established	
10	Thar Mong Hkam	Danu	Established	
11	Nan Thon	Danu, Taung Yo	Established	Conducted
12	Nang Ong Ywar Ma	Taung Yo	Established	

4

Target villages: 12

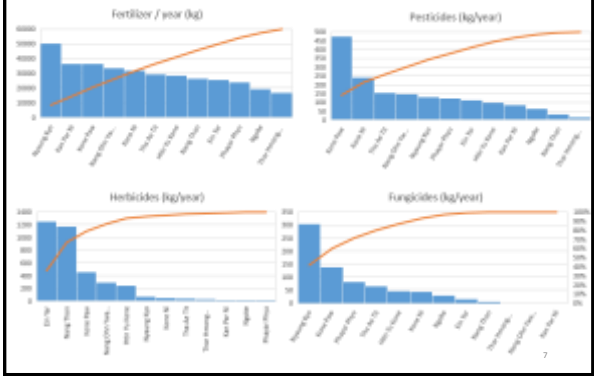


5) Preliminary results



6

Agricultural input

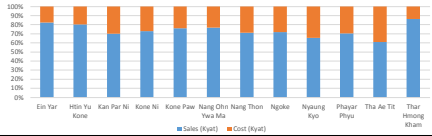


7

Agriculture: Sales, Cost and Net income

Village	Sales (Kyat)	Cost (Kyat)	Net income
Ein Yar	7,292,014	1,553,323	5,738,691
Htin Yu Kone	4,094,200	995,748	3,098,452
Kan Par Ni	3,278,116	1,407,889	1,870,226
Kone Ni	3,107,327	1,157,272	1,947,023
Kone Paw	4,488,137	1,413,370	3,074,767
Nang Ohn Ywa Ma	4,067,929	1,242,458	2,825,472
Nang Thon	2,363,354	959,501	1,403,853
Ngoke	1,446,891	563,652	883,238
Nyaung Kyo	2,505,378	1,313,388	1,147,892
Phayar Phyu	1,845,754	772,990	1,072,764
Tha Ae Tit	1,222,232	780,635	441,597
Thar Hmong Kham	4,737,185	759,557	3,977,628
Average	3,370,710	1,076,649	2,290,134

Crop production: Sales and Cost ratio



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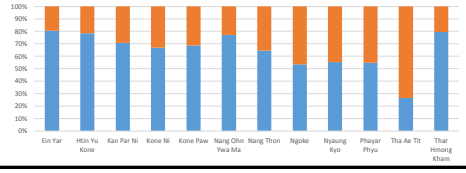
Total income and expense

Village	Total income	Total expense	Total net income
Ein Yar	6,461,158	1,570,764	4,890,394
Htin Yu Kone	4,506,071	1,242,258	3,263,813
Kan Par Ni	2,516,895	1,046,653	1,470,242
Kone Ni	3,077,216	1,517,254	1,559,962
Kone Paw	3,426,089	1,568,098	1,857,991
Nang Ohn Ywa Ma	4,141,063	1,224,173	2,916,889
Nang Thon	2,077,186	1,136,307	940,879
Ngoke	1,470,105	1,280,689	189,416
Nyaung Kyo	1,367,061	1,102,764	264,298
Phayar Phyu	1,241,931	1,026,879	215,052
Tha Ae Tit	444,230	1,231,089	-786,859
Thar Hmong Kham	7,661,539	1,968,542	5,692,997

Total income and expense ratio



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1.2 Participatory Rural Appraisal (PRA)

1) **Target villages**: 4 villages selected from the 12 villages of household interview survey

2) **Selection of target villages**:
   - ✓ accessible by car even during the rainy season
   - ✓ the major ethnic groups to be covered
   - ✓ existence of CF and non-CF villages
   - ✓ rather evenly distributed in the sub-watershed.

Target Villages selected for PRA

Village	Village Tract	Accessibility	Ethnicity	Existence of CF
Kone Ni	Pin Han	Good	Paoh, Taung Yo	Registered
Pha Yar Phyu	Lei Kyar	Ditto	Taung Yo	Planned
Ein Yar	Kan Par Ni	Ditto	Daun	None
Nan Thon	Thar Mong Hkam	Ditto	Daun	Registered

Source: JICA Project Expert Team (2018)

3) Sessions/Discussions organized in PRA

Sessions/discussions	Participants	Remarks
1. Resource mapping/Hazard mapping	20 ~30 Participants, of which 40% are female	Present land use, natural resources, soil erosion etc
2. Trend analysis		Historical changes in natural resource uses and status
3. Seasonal calendar		Seasonal major activities in farming, livelihood, and traditional events etc
4. Group discussions on community forest and forest resource management	10 ~ 20 female and male participants to separately organized into a group	
5. Group discussions on farming practices and agricultural resources		
6. Group discussions on Natural Resource Management		

4) Major Results on Forest/ Natural Resource Management

Topics	Issues	Consequences
Land Management	- Overexploitation of forests or extensive deforestation to expand farmlands	- Lowering of forest ecosystem services, such as water harvesting, prevention of erosion, and provision of forest products
	- Progress of gully erosion particularly in Kone Ni and Ein Yar villages	- Encroachment in farmlands and reduction of farmland
CF management	- Frequent forest fires in existing forests except Nhan Thon village	- Difficulty of effective of reforestation activities in CF areas
	- Less protection community forests	- Conversion of community forests into farmlands
		- Improper management of existing forests
	- Less understanding of CF among communities in Nhan Thon village	- Less interest in community forest and protection of forests
	- Less involvement of women in forest management	
Local Livelihoods	- Overdose of farm inputs, particularly agrochemicals, for production of vegetables	- High investment costs required for crop production
	- High dependency on F1 hybrid crops for crop production	
	- Limited sources of fuel wood in the village	- Longer time for collection of fuel wood
	- Limited sources of water in the dry season	- Longer time for collection/ fetching of water for domestic purpose in the dry season
		- Shortage or fluctuation of crop production due to rainfall patterns

2. Pilot Project on Natural Resource management and Livelihood Improvement

(1). Overall Objectives:

- Test and demonstrate the potential measures effective in sustainable management of lands and forests and improvement of local livelihoods.
- Raise awareness and ownership of community to appropriate and effective natural resource management (NRM) for sustainable land and forest management.
- Make model case to be replicable to the other areas at Taunggyi District in terms of NRM and implementation arrangement.
- Obtain lessons learnt and monitoring result to be reflected to further activities for the next phase of project (after 2020 onward).

(2). Key Elements:

Respect **'social aspects'** such as culture, gender and ethnicity , and **'partnerships'** with stakeholders for making forest and natural resource management effective and sustainable!

(3). Current Situation on natural resource management and community forest

(4). Type of Activities Proposed

Referring to the series of surveys conducted by Project and FD Policy, the following two types of activity were proposed as pilot activities for sustainable land and forest management.

1) **Introduction of an/ agroforestry model/s of valuable tree/s** ; to help local communities develop an agroforestry farm to increase vegetation covers balancing with income generation; and
2) **Introduction of Community Forestry (CF)** ; to demonstrate the process and procedures for introduction of community forestry in line with the latest CFI.

(5). Selection of Target Village for Pilot Project

The target villages are selected among those where the PRA survey was conducted. The four target villages are evaluated as shown below.

Evaluation for Selection of Target Villages

Pilot Activities	Villages	Existence of CF	Potential positive impact	Potential negative impact	People's interest	Time Frame (-Dec 2019)
Introduction of valuable tree crops in the private farms	Kone Ni	See below	Medium	None	Low	Possible
	Ein Yar		Medium	None	Medium	Possible
	Nang Thon		High	None	High	Possible
	Pha Yar Phu		**High**	**None**	**High**	**Possible**
Introduction of CF	Kone Ni	Registered	-	-	-	Already set up
	Ein Yar	None	Medium	None	High	Diffucult
	Nang Thon	Registered	-	-	Low	Already set
	Pha Yar Phu	**Planned**	**High**	**None**	**High**	**Possible**

(6). Future schedule (tentative)

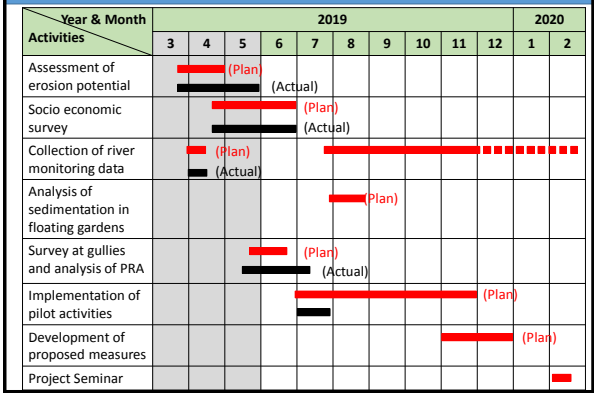
	Steps	Time-frame	Parties to be involved (proposed)
Preparatory activities			
1	Consultation with local communities	Jul-19	FD and DoA officers/ JICA Expert Team (JET)
2	Identification and selection of households who participate in the activities	Aug-19	FD and DoA officers/ JET
Introduction of an/ agroforestry model/s			
1	Selection of tree crops and design of an/ agroforestry model/s	Aug-19	FD and DoA officers/ JET
2	Procurement of planting materials and others		DoA officers/ JET
3	Provision of training in planting of trees (Hole digging, Fertilizer application, and Planting)	Sep-19	FD and DoA officers/ JET
4	Provision of planting materials and other inputs		DoA officers/ JET
Introduction of CF			
1	Discussion on vision, missions, objectives, and functions of CFUG	Aug-19	FD officers/ JET
2	Identification of target areas for CF	Sep-19	FD officers/ JET
3	Submission of an application for establishment of CF		FD officers/ JET
4	Development of a forest management plan	Oct-19	FD officers/ JET
5	Issuance of CF certificate	Nov-19	FD officers/ JET
6	Development of an annual work plan	Dec-19	FD officers/ JET

Session 7: Major Activities in the Next 6 Months

August 2019

JICA Project Expert Team

1. Work Plan and Progress of Component 2



2. Major Activities planned in Next 6 Months

1. Collection of River Monitoring Data

- Installation of water level meters on the 4 major rivers (Aug. 2019)
- Installation of an auto sampler on Kalaw river (Sep. /Oct. 2019)
- Monitoring of water level and suspended sediment (Sep. – Dec. 2019)
- Monitoring of river current/velocity of the 4 major river (Sep. / Oct. 2019)

2. Analysis on Sedimentation in Floating Gardens

- Analysis of distribution of muddy water using UAV (Aug. 2019)
- Analysis of TSS and flow velocity in floating gardens (Aug. 2019)
- Analysis of soil particles and radiocarbon dating of bottom layer in floating garden (Aug. and Sep. 2019)

2. Major Activities planned in Next 6 Months

3. Implementation of Pilot Activities

- Completion of construction works of gully erosion control (Aug. 2019)
- Implementation of pilot activities for sustainable land and forest management, e.g., i) introduction of an agroforestry model in backyard farms and ii) introduction of community forestry (Aug. – Dec. 2019)
- Review and evaluation of pilot measures and activities (Sep. – Dec. 2019)

4. Development of proposed measures

- Review and analysis of the results of the pilot activities (Nov. / Dec. 2019)
- Development of implementation plans of erosion control and sustainable land and forest management in the watershed for the implementation phase of Component 2 (Nov. / Dec. 2019)
- Development of an monitoring plan of monitoring of river discharge and suspended sediment in the major rivers (Nov. / Dec. 2019)

Meeting Memo

1. Topic/Purpose	Introducing the accomplishments made by Component 2 and over all plan of watershed management in Inle Lake watershed including draft ideas on implementation plan of Phase 2.
2. Participants	Government side -2 Minister and Officers from Relevant Department - JICA HQ, JICA Myanmar Office, Team members of FDSNR -Member of parliament and representative from CSO/CBO
3. Place	Royal Taunggyi Hotel, Taunggyi.
4. Date & Time	10:30 – 16:30, Feb. 20, 2020

5. Points of Discussion

1) Opening Remark by Minister of Natural Resources and Environmental Conservation, Shan State.
2) Opening Remark by Minister of Inthar Affairs
3) Presentation: Following presentations were made by the relevant experts.
   - Outline of the works of Design Phase of Component 2 by Team Leader, Mr. Yoji Mizuguchi
   - Soil erosion potential and proposed measures for soil erosion control in Inle Lake watershed by the Expert for Soil Erosion/Planning for Sediment Control (1), Mr. Hideki Imai
   - Analysis of sedimentation mechanism in Inle Lake and proposed monitoring plan of the sedimentation process by the Expert for Procurement/Laser Survey, Mr. Kei Suzuki
   - Analysis of socio-economic condition in the watershed in relation to sustainable land and forest management by the Expert for Socio-economic Survey, Mr. Toru Inada
   - Potential measures for sustainable land management based on the pilot activity (introduction of agroforestry model) by Project Coordinator/Monitoring of Pilot Activities, Ms. Yayoi Yoshioka
   - Proposed measures for sustainable forest management based on the pilot activity (introduction of CF) by Co-Team Leader, Ms. Junko Kikuchi
   - Overall picture of the second phase of Component 2 by Mr. Mizuguchi.
4) After the presentation, the participants made some clarifications to the Project Expert Team and exchanged their opinions. Some highlights of the discussions are summarized below.
   - U Zaw Win, FREDA, the retired FD Officer shared his experience in gully erosion control in watershed area of 3 lake including Zaw Gyi Lake and Kin Tar Lake. He explained that the check dam construction work including dry stone check dams, tree planting and diversion channel which he implemented was not systematic comparing with those installed by the Project Expert Team. He pointed out that the local community needs to understand the importance of the erosion control works to follow the techniques. He also encouraged CSO to participate in the seminar as today.
   - DDG of IWUMD asked Mr. Imai the indicators of prioritization of gully types, followed the clarification by Mr. Imai.
   - DDG of IWUMD also showed his interest in Carbon 14 Analysis made by the Project Expert Team because it is very new for him. Accordingly, there is no laboratory to analysis C 14 in Myanmar. Mr. Suzuki pointed out that the water near flooding garden is clean and water in the stream in land area is turbid.
   - Minister for Inthar Affair inquired about i) the source of water pollution in the lake, 2) most suitable species for reforestation and 3) status of depositing the sediments from the lake. Regarding 1), Mr. Suzuki answered that source of pollution might be chemical pollution and sedimentation, clarifying that chemical pollution is difficult to be covered by the Project since the main counterpart of the Project is FD to deal with the sedimentation issues. About 2), Mr. Suzuki expressed his opinion that the indigenous species such as pine could be suitable for reforestation. M. Mizuguchi added that the species for the reforestation would be decided through the discussion with the FD. With regards to 3), Mr. Suzuki proposed to recycle sedimentation

deposited for e.g., agricultural use such as compost.

- Minister for Environmental Conservation suggested the Project Expert Team to make survey on chemical utilization in the implementation phase because all household around Inle Lake use detergent every day.
- Ko Sai Tun Aye, Administration Officer, Terra People Association (TPA) said that the water of Inle Lake is quite clean in comparation with the water at river mouth. The Project Expert Team responded that it could be assumed that aquatic grasses might keep water clean.
- The lecturer from Taunggyi University said that November and December are winter season in Myanmar, not dry season in relation to the slide no. 24 of Mr. Suzuki about results of water discharge monitoring. He clarified that March, April and May are dry seasons in Myanmar. Also, he shared his opinion that the human intervention activities such as pumping up the river water for agriculture purposes could affect the data.
- Minister for Innthar Affair asked whether small scale waste management treatment technique at household level could be provided in Inle area. Mr. Suzuki replied that he is not in the position to answer this.
- Staff of GIZ stressed the importance of the role of CSO and asked whether the Project Expert Team has conducted the capacity building to CSO/CBO in this project period or not. Also, he mentioned that it might be difficult to go through the process from cropping to marketing of the crops such as avocado since it takes time. Mr. Inada replied to his question that the Project Expert Team contracted out the socioeconomic survey to the local NGO, FREDA. In addition, Ms. Yoshioka agreed on the difficulty to cover the process up to the marketing by the project and shared the possibility of the implementation phase to cover the marketing process through e.g., introduction of Good Agricultural Practices.
- DDG of IWUMD asked whether the Improvement of Land Management proposed under the project is is the same as Slopping Agriculture Land Technique (SALT). Ms.Yoshioka agree on it.
- Minister for Environmental Conservation invited the project team to come and observe the pine plantation in Taung Lay Lone reserve forest which could be the reference for SALT practice in the implementation phase.
- U Tin Aung from InnThar literature and culture Association said that he understand the effectiveness of the sustainable land management and soil conservation activities of the project, mainly in the upstream of the watershed. However, as representative of Innthar he would like to know whether the project team will assist the communities in the downstream in the implementation phase, such as improvement of tomato plantation.
- In response to the above comment, Minister for Environmental Conservation clarified that the assistant of international donor is limited in a sense and we need to contribute by our own for development, clarifying that the government has responsible to improve the basic infrastructure such as road, electric and health care service while the farmers need to try and find the way by their own for marketing. Also, he asked the parliament members who attend this seminar to share the knowledge and information with the community.