Ecosystem based Disaster Risk Reduction in Rohingya Refugee camps of Cox's Bazar, Bangladesh

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Ethiopia

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Massive influx of Rohingyas refugees and the consequences on natural resources

Context

- The largest refugee movement in the world
- About 1.1 million people in 34 camps
- More than 2,500 hectares allocated for the camps.
- 7,220 ha land degraded in one year: inside (1,380 ha) and outside (5,840 ha) camps
- Wood is the only source of energy available
- And 857 tons of wood are extracted daily from neighboring lands





Land degradation in Cox's Bazar South Division

Present status

	2016	**2018**
Number of refugees	200,000 (approx.)	1,000,000 (approx.) **x5**
Number of camps	8	34 **x4**
Total area covered by the camps	669	2,639 ha **x4**
Camp area under BFD	349	1991 ha **x6**
Wood fuel demand	54,452 ton/year	**312,807** ton/year*

Land	**Area (ha)**	**Population (HHs)**
Inside the camp	2,639 (**4%**)	211,058 (**60%**)
Outside (BFD land)	40,695 (**60%**) (17% PF and 83% RF)	--
Outside (non BFD land)	24,358 (**36%**)	--
Total outside	65,053	144,844 (**40%**)
Grand Total	67,692	355,902

Degradation type	**2017 - 2018**	
	Inside camps	Outside camps
Highly degraded land	494	633
Medium degraded land	836	2,632
Low degraded land	50	2,575
Total	1,380	5,840 (**1744 non BFD**)

* Projected based on the FAO-IOM report

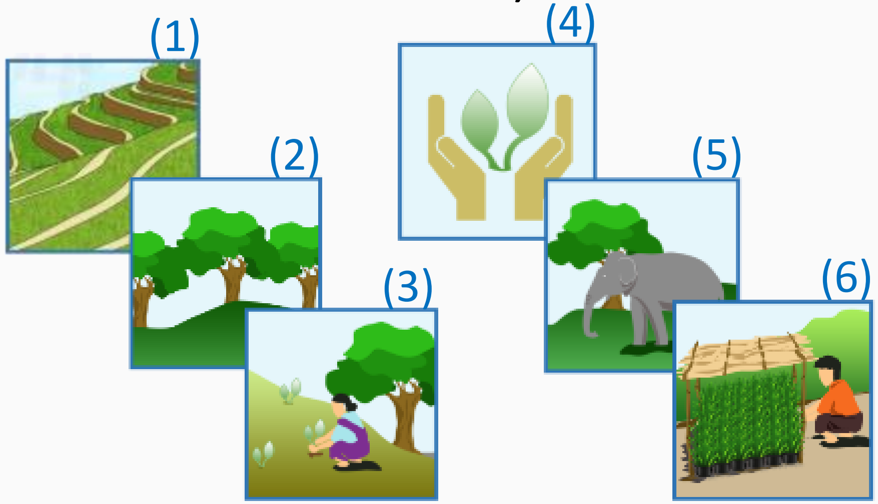
An unprecedented land degradation

SLM interventions to reduce the risk of disaster

Goal: Improving living and environmental conditions in displacement settings of Cox's Bazar south division through land stabilization and greening the camps

SLM interventions to reduce the risk of disaster in camps of Cox’s Bazar

- Development of one regional site specific plan for inside and outside the camps
- Identification of SLM technologies to introduce for ecosystem based disaster risk reduction
- Documentation of identified SLM practices through WOCAT
- Identification of available and suitable land (BFD and non-BFD land) inside and outside the camps for
  - (1) land stabilization / restoration,
  - (2) forest restoration,
  - (3) afforestation / reforestation,
  - (4) seedling distribution,
  - (5) habitat restoration,
  - (6) nursery development.

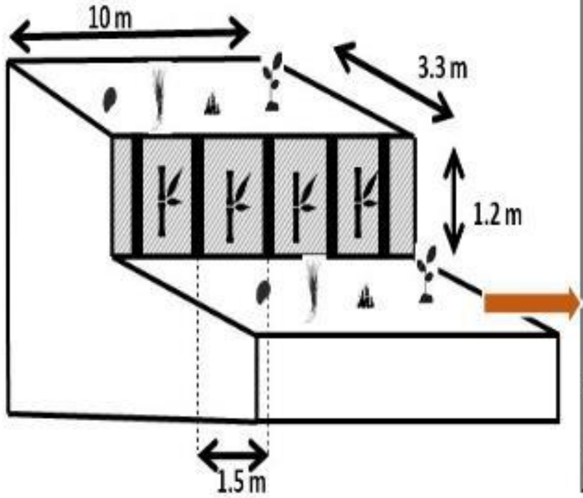


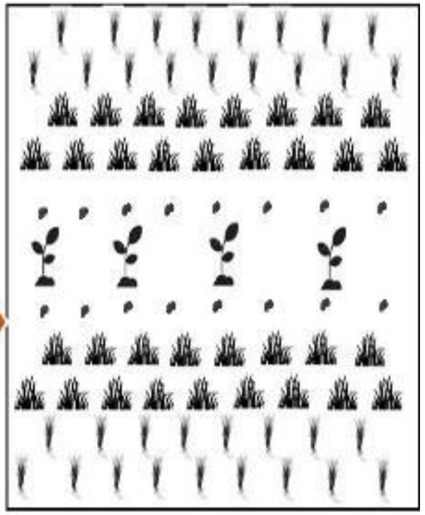
- Capacity development of refugees (inside the camps) and host communities (outside the camps)

SLM Interventions

Stabilization / land restoration

The land is restored through the planting of trees and legumes without disrupting the existing vegetation cover. If necessary, the terraces built by the refugees will be stabilized by planting a combination of grasses, trees and leguminous shrubs and biological reinforcement against the slope (inside the camps).



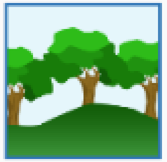


Materials	Cover grass	Tree seedling	Vetiver	Leguminous plant	Bamboo seedlings	Bamboo mat	Dry Bamboo
Distance (m)	0.3	2	0.3	1	1.5	3	1.5
Density/ha	40606	1516	40606	76 kg	2122	425 m2	36

Plant Species:

- Vetiver (*Chrysopogon zizanioides)*
- Pigeon pea (*Cajanus cajan)*
- Tephrosia (*Tephrosia candida)*
- Gamar *(Gmelina arborea)*
- Charcoal Tree *(Trema orientalis)*
- Kadam (*Neolamarckia cadamba*)
- Broom grass/Tiger grass (*Thysanolaena maxima*)
- Bermuda grass *(Cynodon dactylon)*
- Sesbania (*Sesbania bispinosa*)
- Acacia *(Acacia auriculiformis)*
- Bokful *(Sesbania grandiflora)*
- Amoloki (*Phylluntus emblica*)
- Bamboo (*Melocanna baccifera*, *Bambusa nutans*)

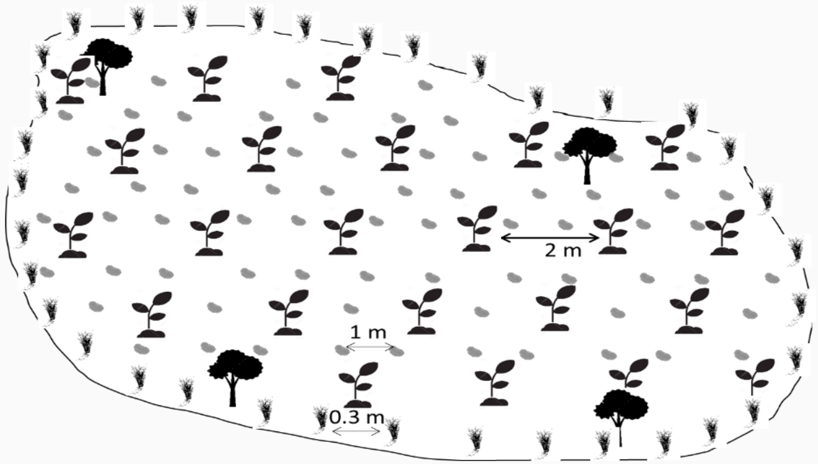
SLM Interventions



Forest restoration

To restore degraded forests (inside and outside camps), fast-growing trees are planted. Legumes are planted to increase soil fertility (by fixing nitrogen in the atmosphere).

Materials	Tree seedlings	Vetiver	Leguminous seeds	Existing tree
Distance*	2 m	0.3 m	1 m	NA
Density/ha	2500	712/ha	40000/ha	NA



Tree Species:
- Acacia (*Acacia auriculiformis*),
- Gamar (*Gmelina arborea*),
- Bokful (*Sesbania grandiflora*),
- Charcoal Tree (*Trema orientalis*),
- Amoloki (*Phylluntus emblica*),
- Kadam (*Neolamarckia cadamba*)

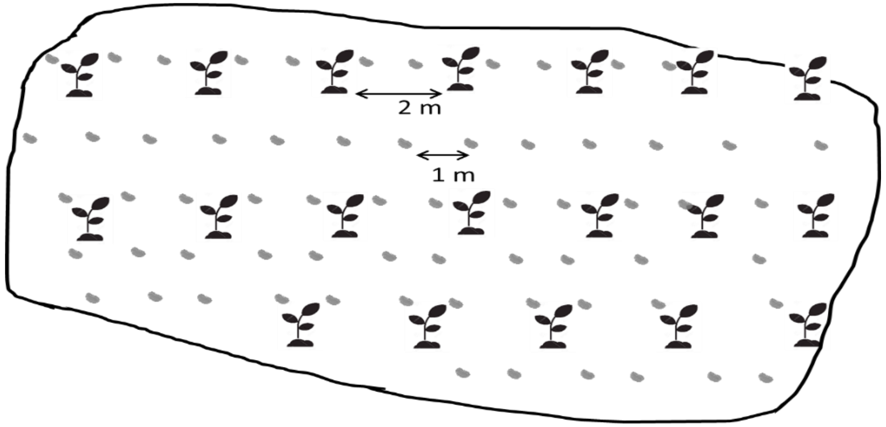
Leguminous shrub species
- Pigeon pea (*Cajanus cajan*),
- Sesbania (*Sesbania bispinosa*),
- Tephrosia (*Tephrosia candida*)

SLM Interventions

Afforestation/reforestation

Areas formerly covered with plantations (in social management mode) were cut for firewood. Refugees participate in reforestation activities.

Materials	Tree seedlings	Leguminous seeds
Distance*	2 m	1 m
Density/ha	2500	40000



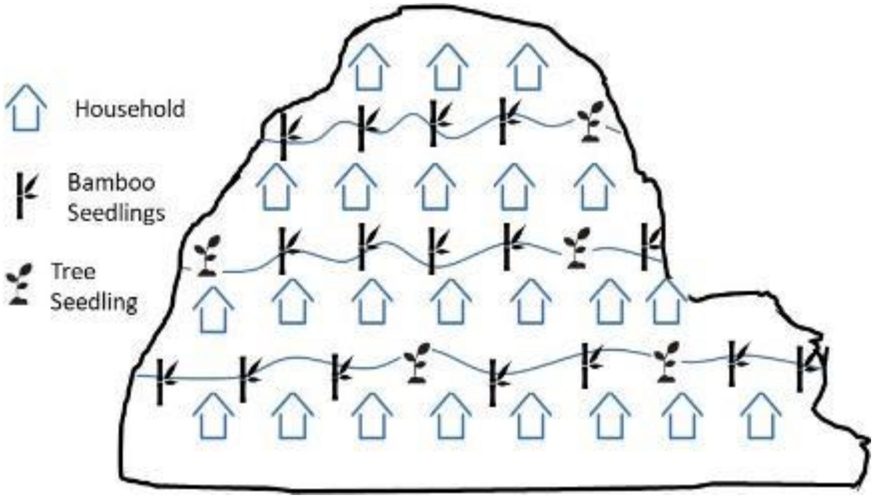
<u>Tree Species</u>:
- Acacia (*Acacia auriculiformis*),
- Gamar *(Gmelina arborea*),
- Bokful (*Sesbania grandiflora*),
- Charcoal Tree (*Trema orientalis*),
- Amoloki (*Phylluntus emblica*),
- Kadam (*Neolamarckia cadamba*)

<u>Leguminous shrub species</u>
- Pigeon pea (*Cajanus cajan*),
- Sesbania (*Sesbania bispinosa*),
- Tephrosia (*Tephrosia candida*)

SLM Interventions

Distribution of seedlings

Houses built on the slope are very vulnerable to landslides. To protect the house from landslides, tree seedlings and bamboo cuttings are distributed to refugees and host communities.



Species:

- Acacia *(Acacia auriculiformis)*
- Gamar *(Gmelina arborea)*
- Bokful *(Sesbania grandiflora)*
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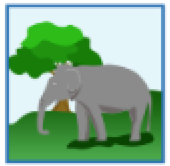
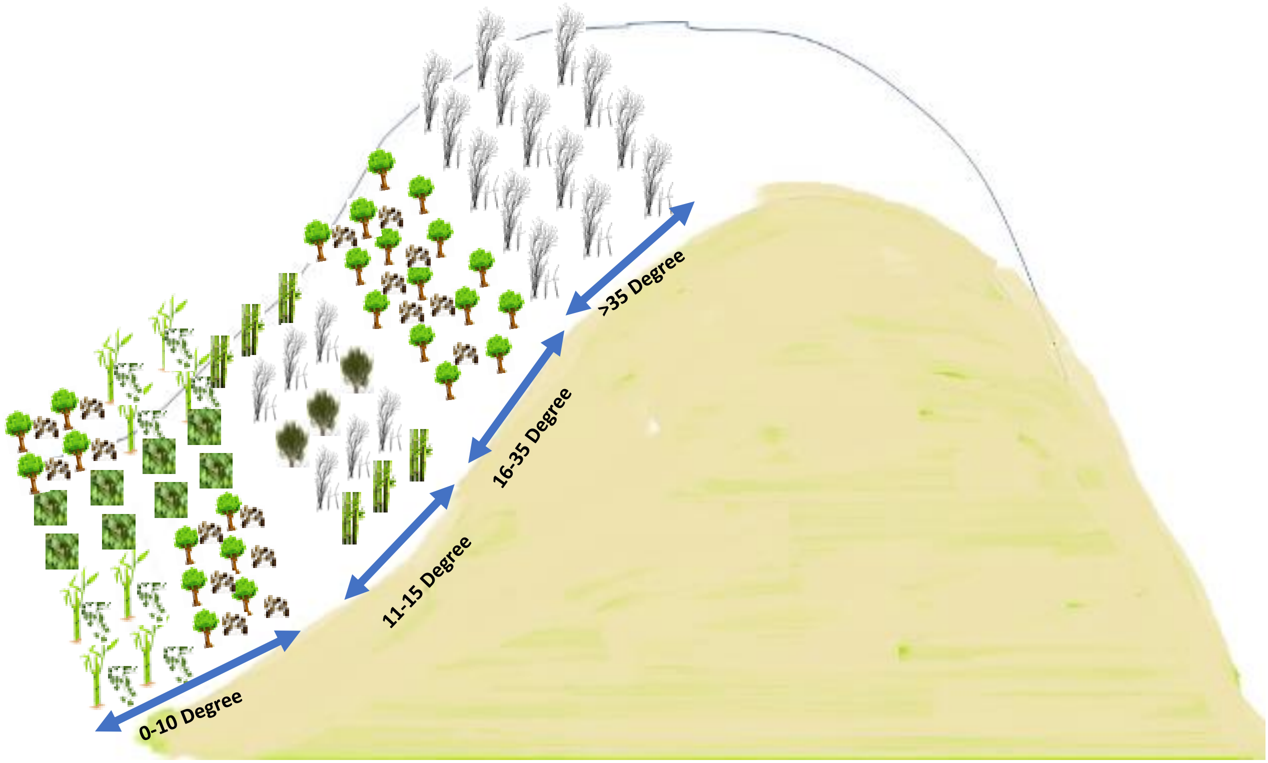
- Bamboo (*Melocanna baccifera, Bambusa nutans*)

SLM Interventions



Habitat restoration

The elephant is the flagship species of the Cox Bazaar region. Due to overexploitation of forest resources, elephants and other wildlife living in this region are extremely vulnerable. Habitat restoration takes into account the considerations of food-friendly species for elephants and other animals.



Plant Species

For 0-10 degree slope-
Kadam (*Neolamarckia cadamba*)
Jarul (*Lagerstroemia speciosa*)
Chalta (*Dillenia indica*)
Banana (*Musa spp*)
Dolu Bansh (Bambusa nutans)
Dendrocalamus spp (lathi Bansh)
Coccinia grandis (Tela Kucha)
Tinospora cordifolia (Guloncha)
Pigeon pea (*Cajanus cajan*),
Sesbania *(Sesbania bispinosa*),
Tephrosia (*Tephrosia candida)*

For 11-15 degree slope-
Dendrocalamus spp (Lathi Bansh)
Thysanolaena maxima (Broom Grass)
Ziziphus mauritiana (Bonkul)
Tinospora cordifolia (Guloncha)

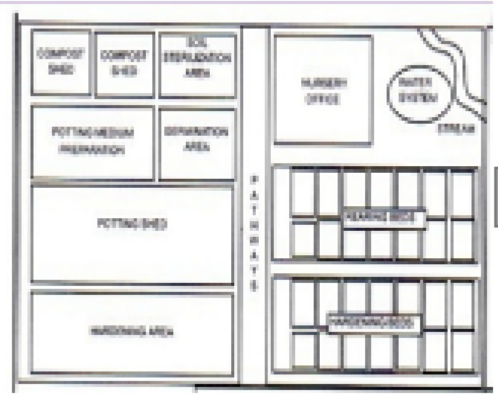
For 16-35 degree slope-
Grajan (Dipterocarpus turbinatus),
Chapalish (Artocarphus chaplasha),
Champa (Michelia champaca),
Moos (Pterospermum acerifolium),
Arsol (Vitex pendicularis),
Dhaki Jam (Syzygium firmum),
Simul (Bombax ceiva),
Kumbhi (Careya arborea),
Bot (Ficus spp),
Vadi (Garuga pinnata)
Kamalaguli (Mallotus philippensis)
Kadam (Neolamarckia cadamba)
Pigeon pea (Cajanus cajan),
Sesbania (Sesbania bispinosa),
Tephrosia (Tephrosia candida)

For 16-35 degree slope-
Thysanolaena maxima
(Broom Grass)

SLM Interventions

Nursery development

- Choose an appropriate location with sufficient light, sufficient air circulation, a source of water and a low risk of flooding.
- Collect quality planting material (seeds, cuttings) and prepare the soil.
- Increase the skills of stakeholders for nursery management.



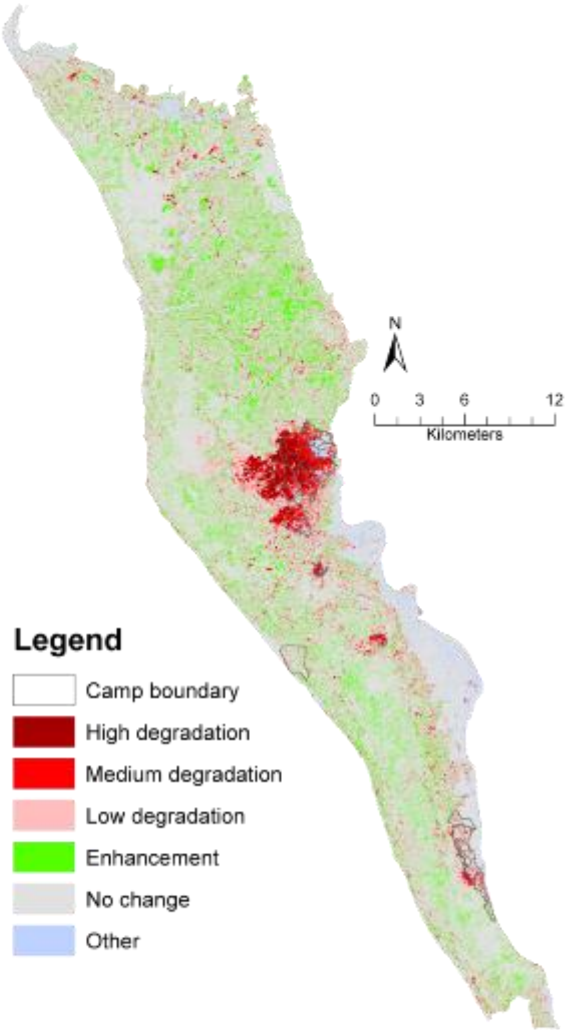
Scaling up of SLM interventions

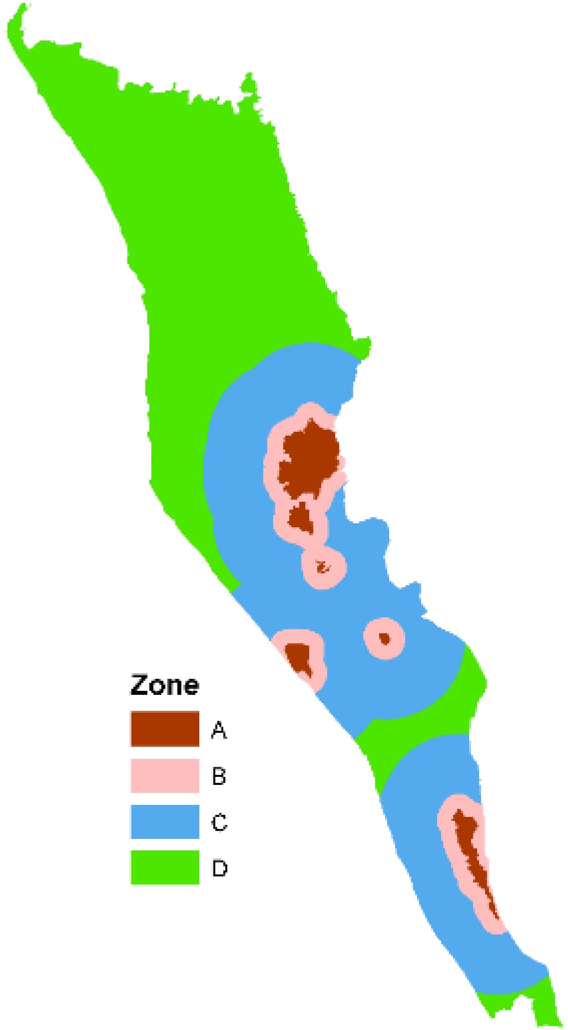
Identification of land degradation type

Land cover 2017	Land cover 2018	Degradation type
Dense vegetation	Bare land	High degradation
	Settlement	
	Water	
	Sparse vegetation	Low degradation
Sparse vegetation	Bare land	Medium degradation
	Settlement	
	Water	
	Dense vegetation	Enhancement

Zones of intervention

Zone	Location
A	Inside camp
B	Within 1 Km from camp boundary
C	Within 1-5 Km from camp boundary
D	Rest of the area





Scaling up of SLM interventions

Methodology (Geospatial suitability analysis)

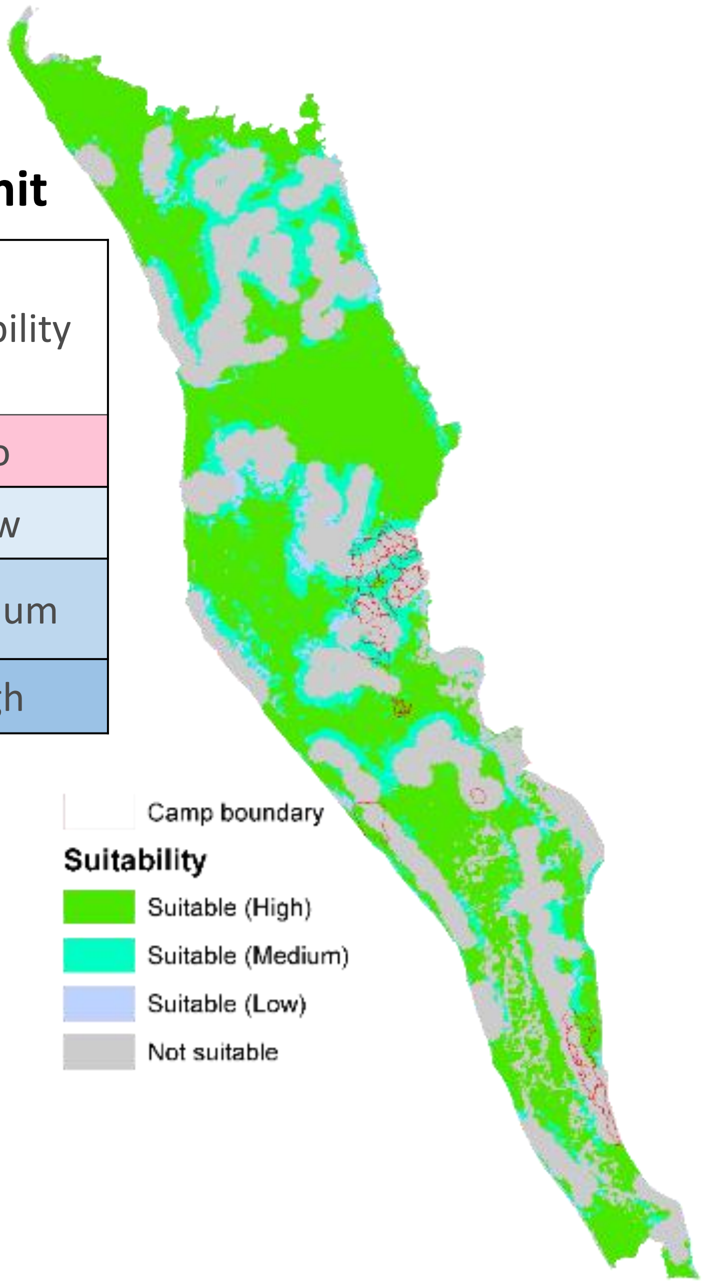
Compute score for each relevant variable, assign a suitability score to each land unit

Score	Slope (degree)	Elevation Texture	Road (m)	Distance from human-elephant conflict areas (m)	River (m)	Flood	PA	Suitability
0	>8	> 50	> 5000	< 500	> 25000	1		No
1	> 6	> 10	< 5000	> 500	< 25000	< 1	0	Low
2	> 4	> 5	< 2500	> 1000	< 1500	< 0.5	< 1	Medium
3	>= 0	>= 0	< 1000	> 1500	< 500	0	1	High

Multiply scores to obtain suitability score

Include
- Shrub with scattered trees
- Mud Flats or Intertidal Area
- Herb dominated area
- Sand
- Degraded forest

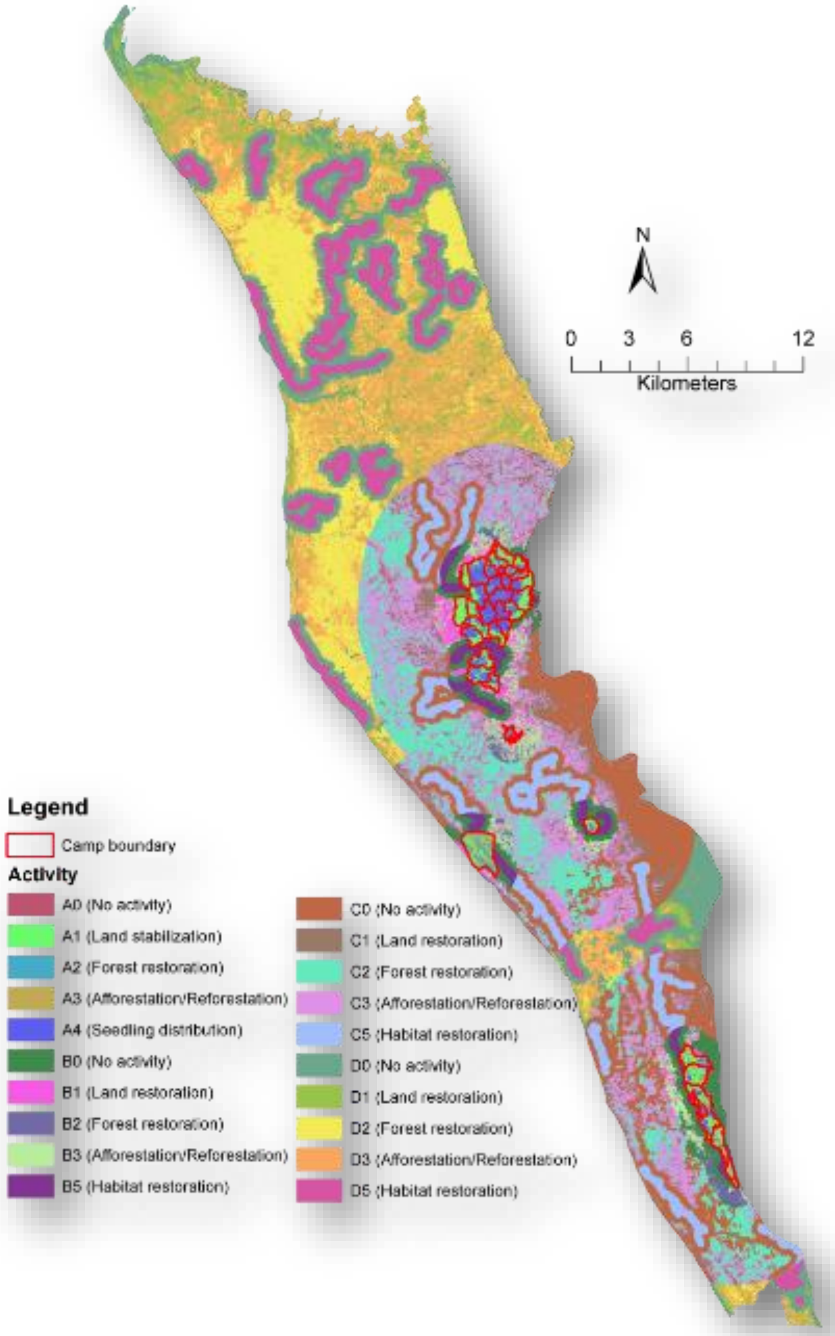
Exclude
- Crop
- Rural Settlement
- Urban
- Water



Scaling up of SLM interventions

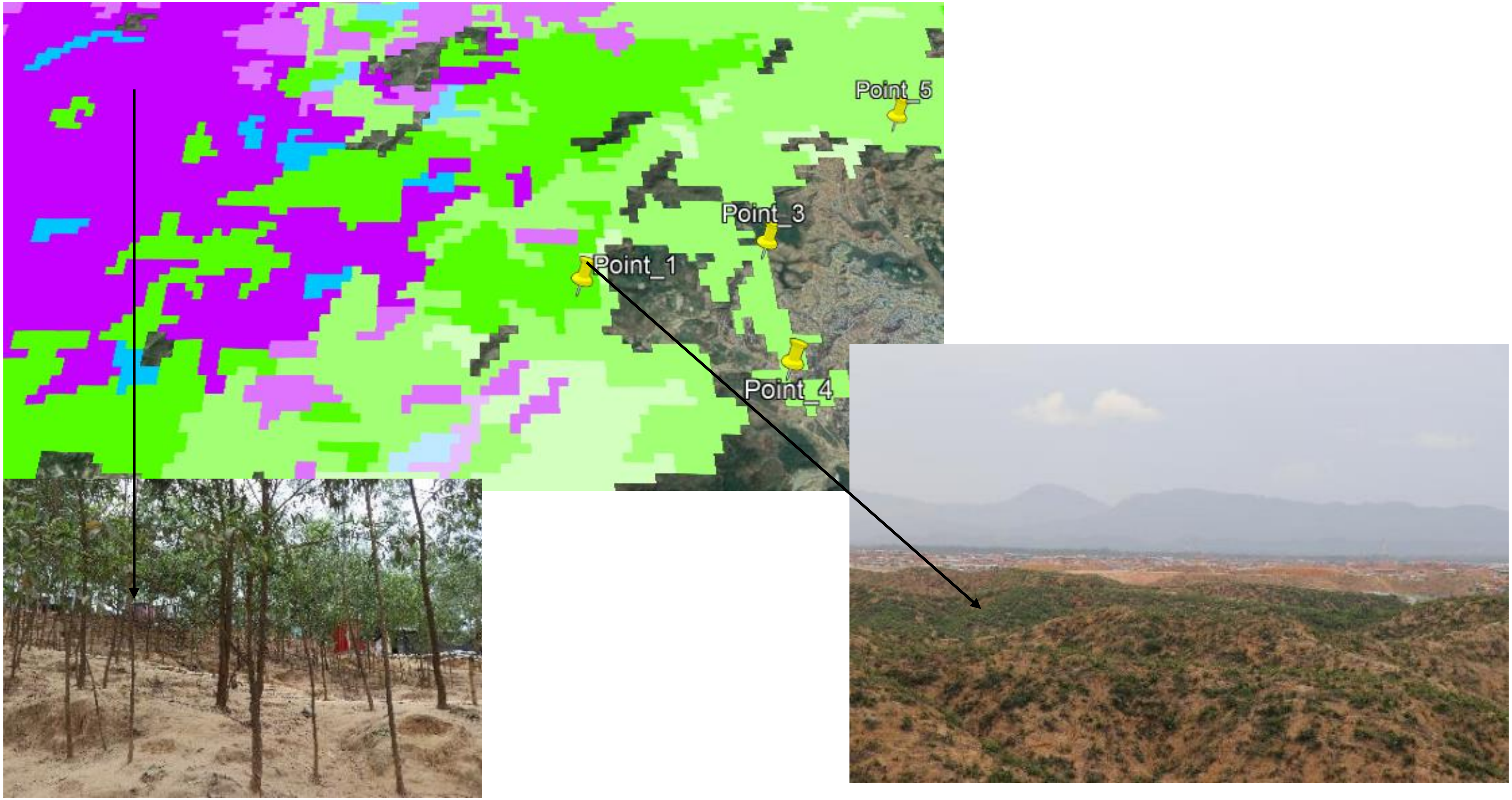
Results (Available land)

Land cover 2018	**Activity**
Bare land	Land stabilization / restoration
Dense vegetation	Forest restoration
Sparse vegetation	Afforestation/Reforestation
Settlement (inside camp)	Seedling distribution
Settlement (outside camp)	No activity
Water	No activity



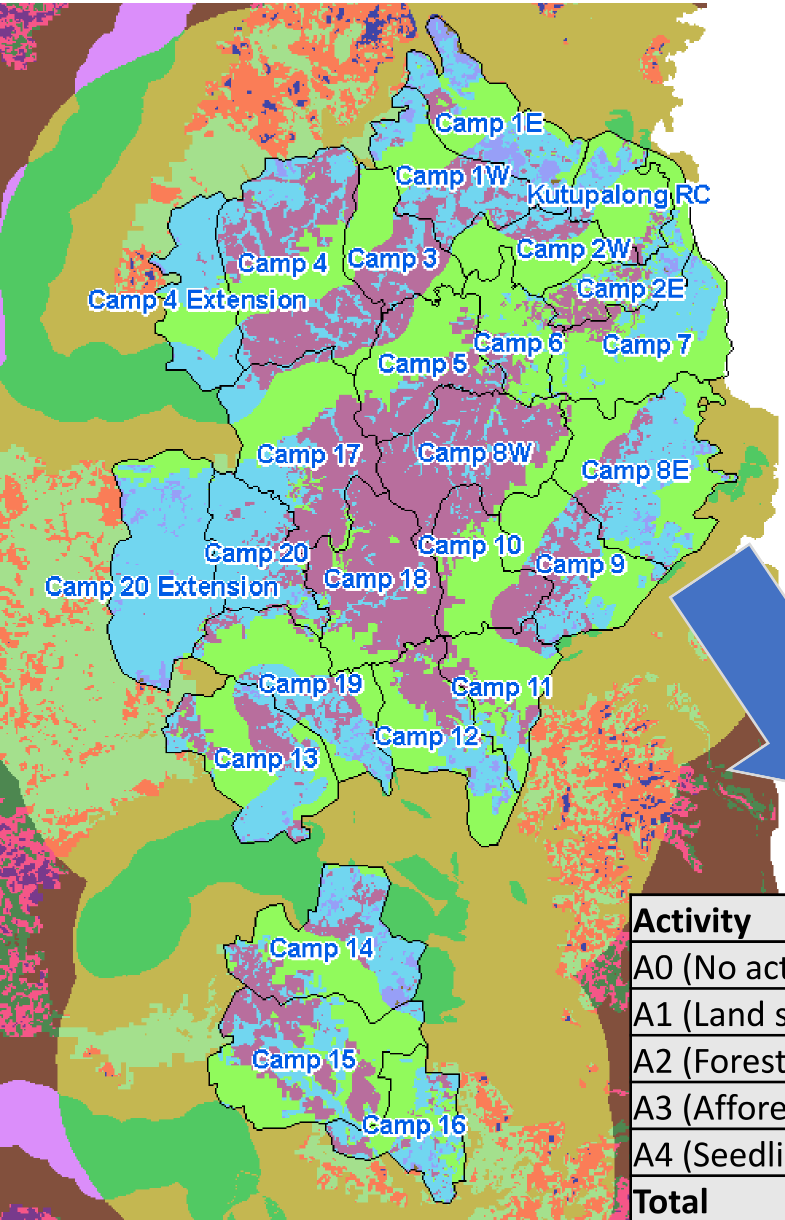
Scaling up of SLM interventions

Results (Field validation of suitable land)

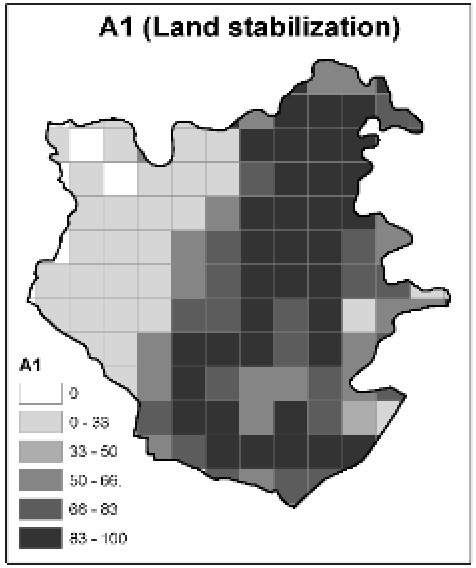


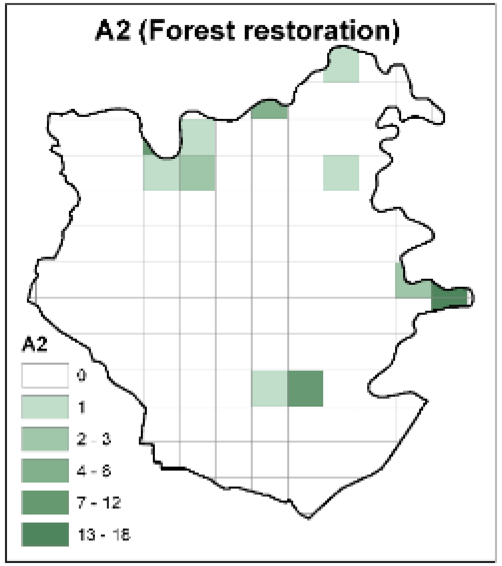
Scaling up of SLM interventions

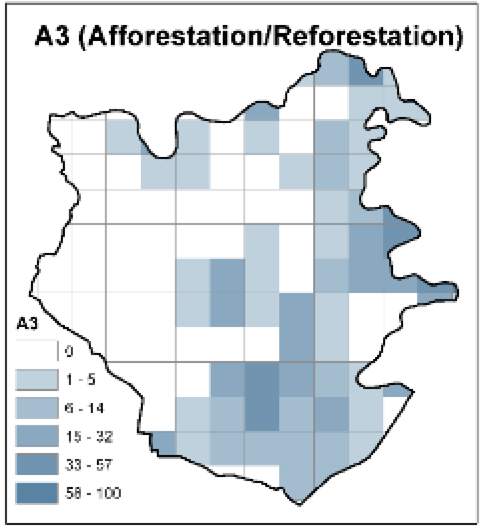
Activities inside the camps (geographic location and planning)

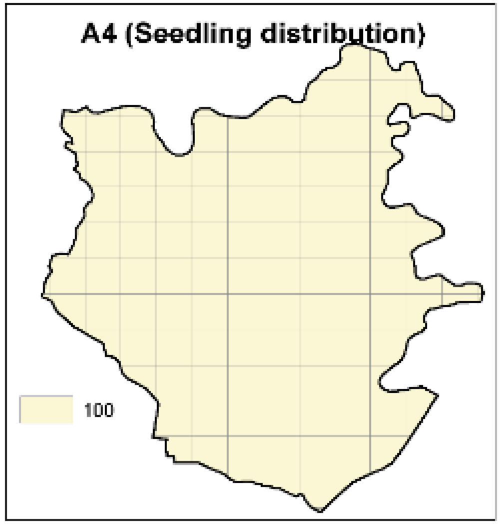


Area distribution of activity in Camp 8E







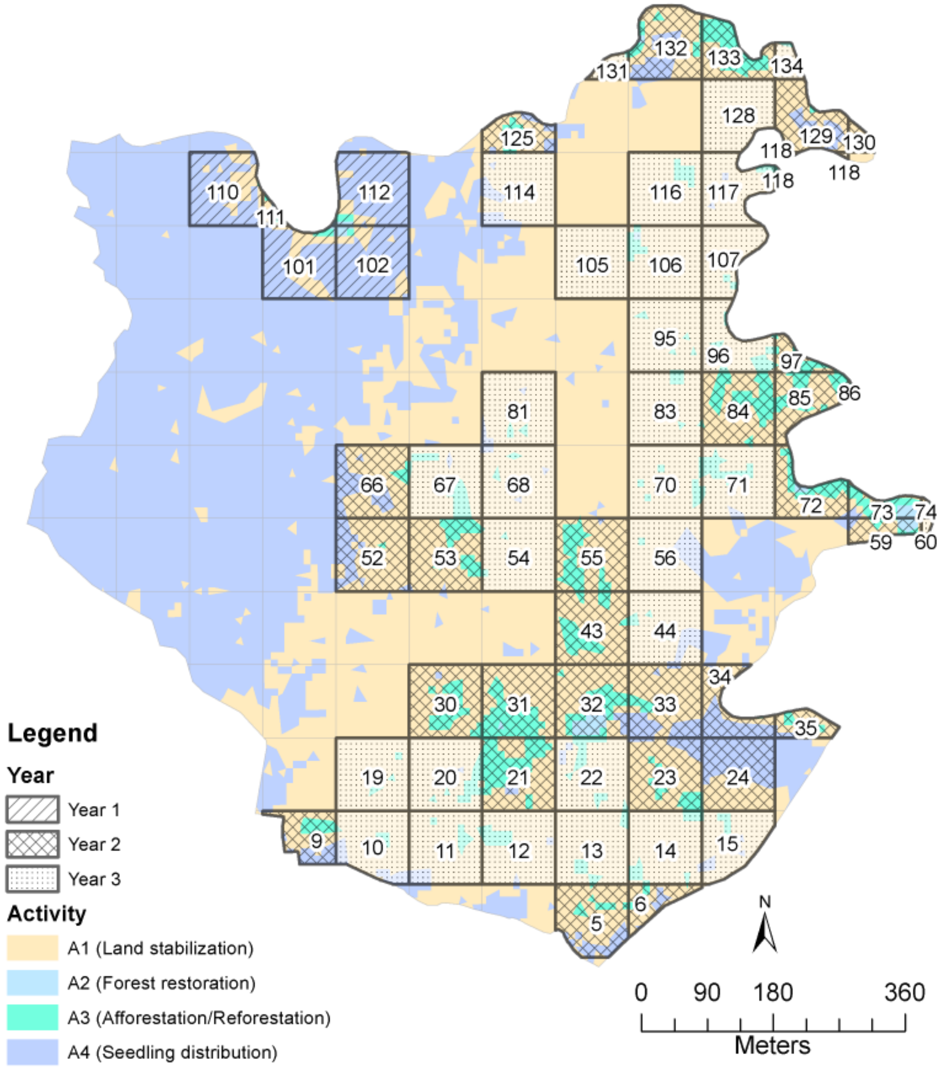


Activity	Area (ha)
A0 (No activity)	0
A1 (Land stabilization)	1217
A2 (Forest restoration)	108
A3 (Afforestation/Reforestation)	321
A4 (Seedling distribution)	994
Total	**2639**

Scaling up of SLM interventions

Planning, management and monitoring of activities

An example on mapping and planning activities
3 Afforestation/Reforestation



Implementation schedule

	Months				
Grid No	1	2	3	…	12
112		SA1	SA2	SA3	
101					
52		SA1	SA2	SA3	
53					
117					
106					
--					
--					

Responsible beat officer: ….

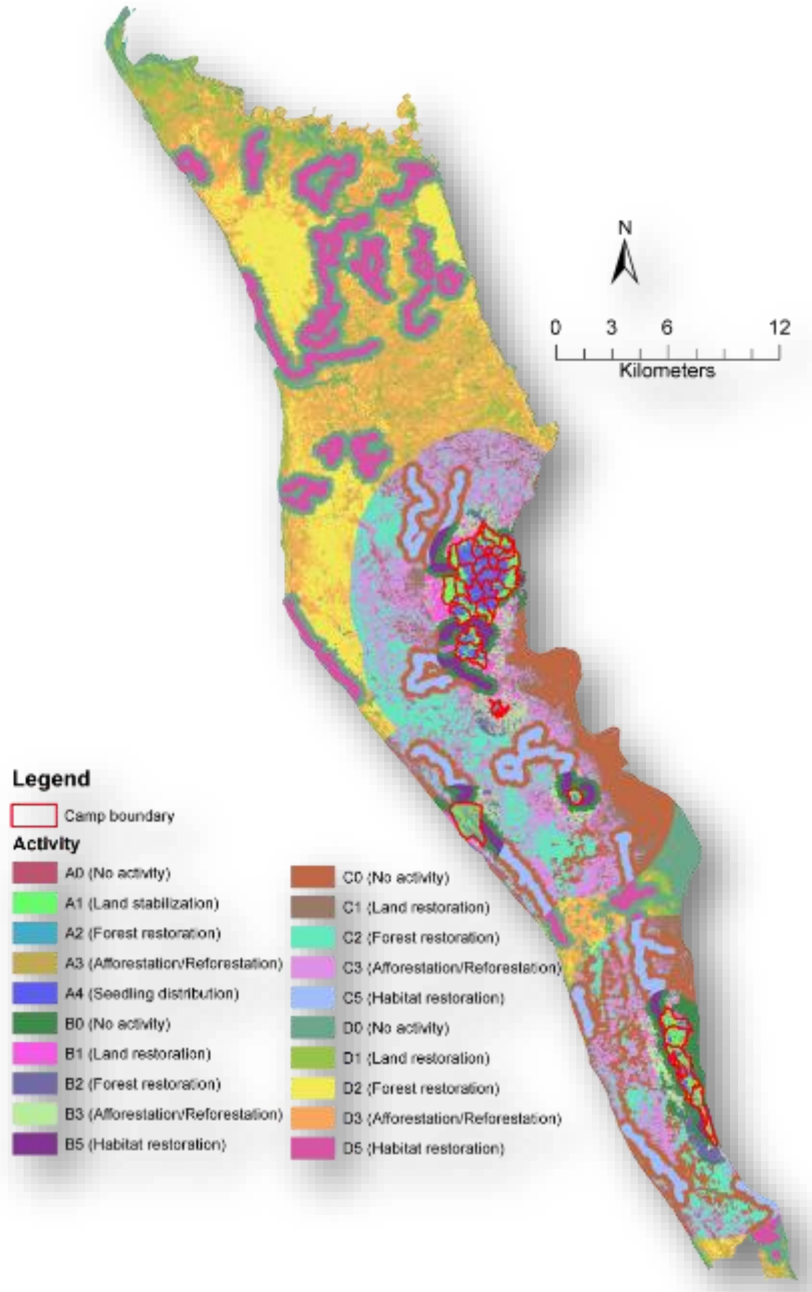
Responsible camp manager: ….

SA1 Prepare land for plantation by weeding, bush cutting pit digging and giving fertilizer in every pit.
SA2 Plant forest tree seedlings maintaining 2m X 2m interval from the existing tree and planted seedlings
SA3 Plant leguminous shrubs (1m X 1m) in both sides of tree seedling
SA4 Fill-up vacancies of dried-up seedlings (20%)
SA5 Ensure participation of all stakeholders.
SA6 Maintain plantation journal for keeping track of silvicultural intervention

Scaling up of SLM interventions

Results (Available land)

Activity	Land type (ha)			
	Non forest land	Protected forest	Reserved forest	Grand Total
A0 (No activity)	0		0	0
A1 (Land stabilization)	303	108	806	1217
A2 (Forest restoration)	85	2	21	108
A3 (Afforestation/Reforestation)	168	32	121	321
A4 (Seedling distribution)*	92	23	879	994
Zone A	**648**	**165**	**1826**	**2639**
B0 (No activity)	764	95	1056	1915
B1 (Land restoration)	282	47	614	943
B2 (Forest restoration)	108	9	447	564
B3 (Afforestation/Reforestation)	212	56	998	1266
B5 (Habitat restoration)	326	54	644	1024
Zone B	**1691**	**262**	**3760**	**5712**
C0 (No activity)	3634	439	3817	7891
C1 (Land restoration)	1582	164	1154	2900
C2 (Forest restoration)	539	75	4780	5394
C3 (Afforestation/Reforestation)	1432	332	4822	6586
C5 (Habitat restoration)	1138	227	1549	2914
Zone C	**8325**	**1237**	**16122**	**25685**
D0 (No activity)	3645	1014	3131	7789
D1 (Land restoration)	3329	715	472	4516
D2 (Forest restoration)	1377	642	5536	7556
D3 (Afforestation/Reforestation)	4281	1897	2837	9015
D5 (Habitat restoration)	1710	952	2118	4781
Zone D	**14342**	**5220**	**14094**	**33656**
Grand Total	**25006**	**6884**	**35801**	**67692**



* Seedling distribution will cover all the camp area

Scaling up of SLM interventions

Area Coverage by Implementing Organizations

Implementing Organizations	Area (sqm)
ACTED	6,196
ActionAid	1,148
AF/FAO	210,500
BRAC	348,969
CARE	5,381
FAO	34,154
IOM /FAO	337,903
IUCN	39,620
MSF	22
PUI	17,800
Samaritan’s Purse	10
SMEP	10,000
WFP/FAO	412,457
World Vision	4,620.00
Grand Total	1,428,781

SLM interventions – monitoring results of interventions

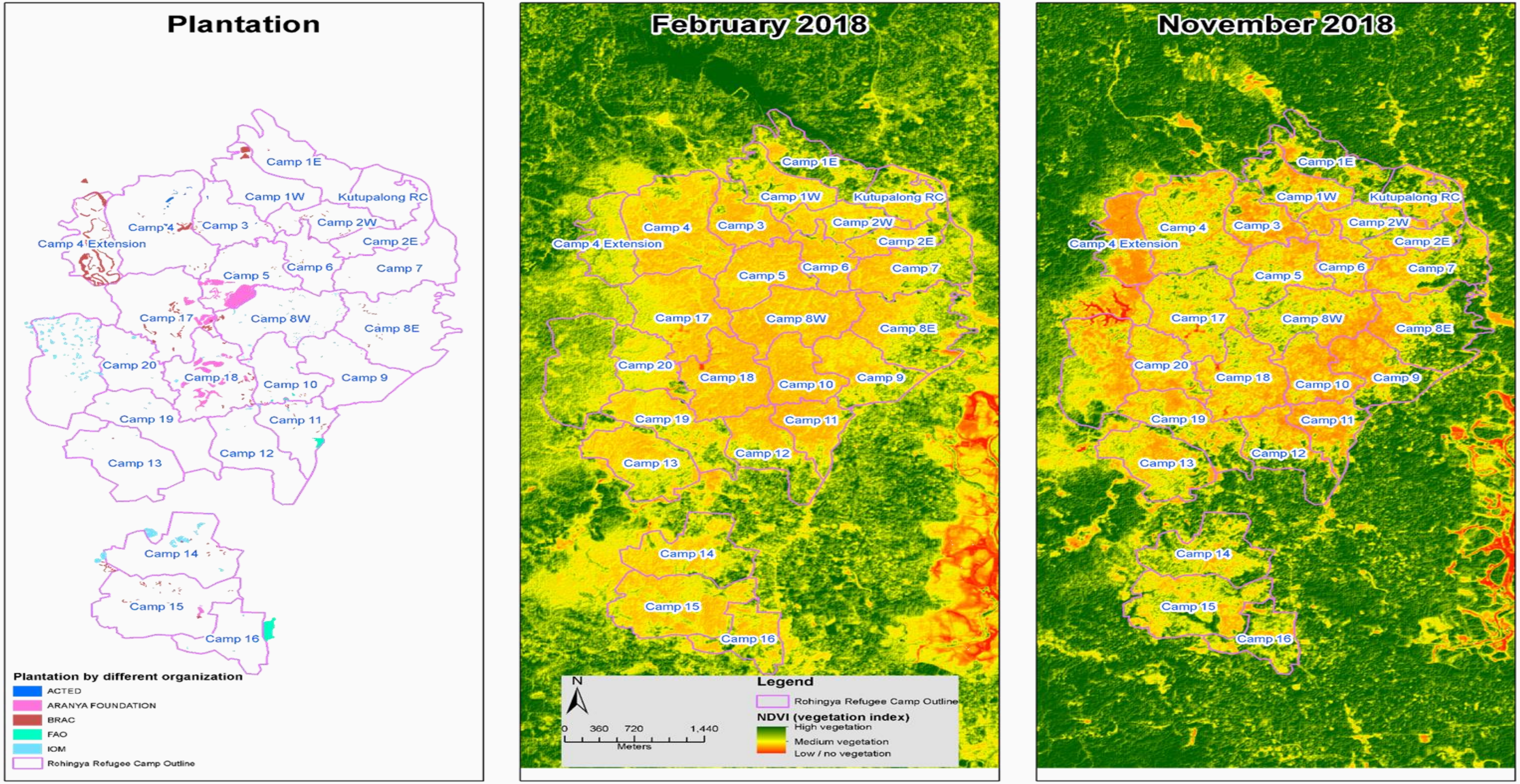
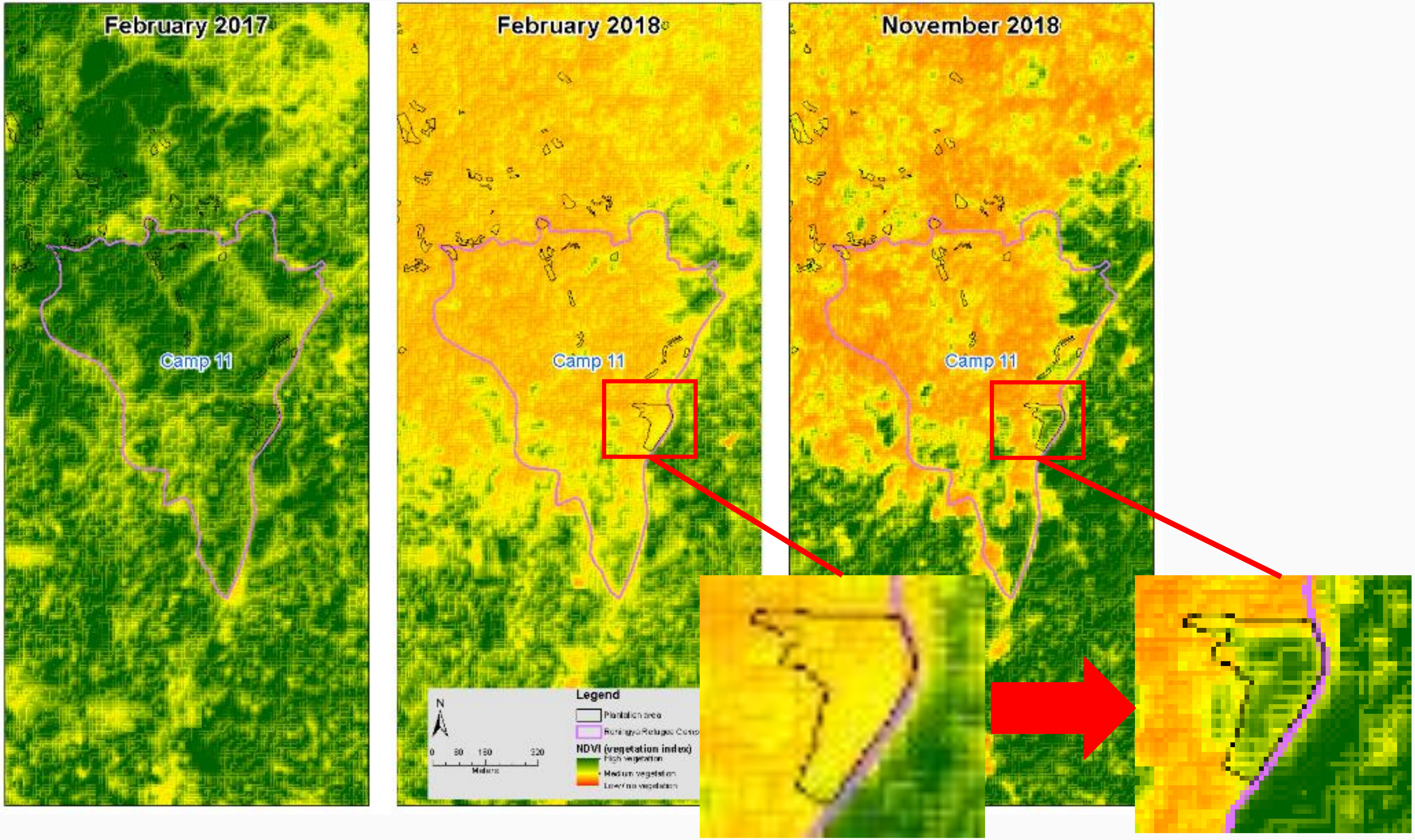


Figure 1: Remote sensing to analyze the difference of plantation intervention

SLM interventions – monitoring results of interventions



Thank You