



Forest (Emissions) Reference Level action plan for Myanmar



September 2015

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Acronyms

AAC	Annual Allowable Cut
APFnet	Asia-Pacific Network for Sustainable Forest Management and Rehabilitation

CSO	Civil Society Organization
DBH	Diameter at breast height
ESA	European Space Agency
FAO	Food and Agriculture Organization of the United Nations
FCPF	Forest Carbon Partnership Fund
FD	Forest Department
FRA	Forest Resource Assessment
FREL/FRL	Forest Reference Emission Level/ Forest Reference Level
GCF	Green Climate Fund
GHG	Greenhouse Gas
GMS+	Greater Mekong Subregion + Malaysia
IPCC	Intergovernmental Panel on Climate Change
LiDAR	Light Detection and Ranging
MODIS	Moderate resolution imaging spectroradiometer
MONREC	Ministry of Natural Resources and Environmental Conservation
MRV	Monitoring, Reporting, Verification
MtC	Millions of tons of Carbon
NFI	National Forest Inventory
NFM	National Forest Monitoring
NFMS	National Forest Monitoring System
NGO	Non-governmental organization
PFE	Permanent Forest Estate
REDD+TFO	REDD+ Taskforce Office
RS	Remote sensing
SBSTA	Subsidiary Body for Scientific and Technological Advice
SIS	Safeguard Information Systems
SLMS	Satellite based Land Monitoring System
SPOT	Satellite for observation of Earth
TA	Technical assessment
TCP	Technical Cooperation Project
UAVs	Unmanned Aerial Vehicles
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USD	US Dollar
WB	World Bank

Summary

The present Forest Reference (Emission) Level, FREL, action plan has been developed in the framework of the FAO component of the UNREDD targeted support for Myanmar. The action plan is based on existing guidance for the development of FREL/FRLs available through the

UNREDD programme and FAO and describes the major tasks and activities to be mastered during the respective planning process in Myanmar.

Taking into account the present and likely future data availability in the country and the results of discussions and proposals among stakeholder during the national workshop on FRELs in 2015 as well as several technical meetings before and after the workshop, a 4 year workplan with budget was developed.

The approach for planning is organized around major elements of guidance for FREL development namely: (1) Multi-stakeholder participation and consultation during FREL development, (2) Data review and methodology, (3) Identification of national circumstances and adjustment factors, (4) Development of subnational FRELs with national level consistency, and (5) Linkage of FRELs with the national forest monitoring system, the REDD+ strategy and the Cancun safeguards.

The budget is calculated with a total amount of 1 Million USD for 4 years.

1. Introduction

Myanmar is partner country of the UNREDD programme since December 2011 and has developed a comprehensive REDD+ readiness road map in 2013. The readiness road map is government approved and in the process of its implementation under the leadership of the Ministry of Natural Resources and Environmental Conservation (MONREC), together with other ministries as well as relevant national authorities, interministerial committees and civil society organisations. The road map implementation is carried out with technical and financial support by the UNREDD programme.

The road map consists of six major components: (1) management of REDD+ readiness, (2) stakeholder consultation and participation, (3) development of REDD+ strategies, (4) implementation framework and safeguards, (5) national forest reference (emission) levels (FREL, FRL) and, (6) national forest monitoring system. The implementation of components 5 and 6 are supported by FAO while UNDP and UNEP lend support to the other four components.

Work on developing FRELs for Myanmar began in early 2015 concentrating on capacity building among key stakeholders in government and CSOs about the importance of FRELs in the context of REDD+, their constituent elements, technical guidance from international bodies and programmes to support REDD+ readiness in countries (UN-REDD and FCPF) as well as discussions with stakeholders on design and arrangements for FRELs in the national context. Two technical working group sessions with the MRV group and one national multi-stakeholder workshop had been carried out during the first half of 2015 the results of which give the input for developing the present FREL action plan.

2. Summary of guidance for FREL development

The following four major decisions at the level of the UNFCCC are related to the development of FRELs:

1. Decision 4/ CP. 15 in Copenhagen recognizes that developing countries in establishing FRLs/FRELs should do so transparently taking into account historic data, and adjust for national circumstances;
2. Decision 1/CP.16, paragraph 71(b) of Cancun includes FRELs as one of the four key elements to be developed for REDD+
3. Decision 12/CP.17 Durban states about the modalities for FRL/FRELs:
 - be expressed in tonnes of carbon dioxide equivalent (CO₂ eq) per year and serve as benchmarks for assessing the country's performance in implementing the REDD+ activities
 - maintain consistency with anthropogenic forest-related greenhouse gas emissions by sources and removals by sinks as contained in the country's GHGs inventories
 - the usefulness of a step-wise approach to national FRL/FREL development enabling Parties to improve FRLs/FRELs by incorporating better data, improved methodologies and, where appropriate, additional pools,
 - subnational FRLs/FRELs may be elaborated as an interim measure, while transitioning to a national, and
 - update a FRL/FREL periodically as appropriate, taking into account new knowledge, new trends and any modification of scope and methodologies
4. Decision 13/CP.19 Warsaw on guidelines and procedures for the technical assessment (TA) of submissions on proposed FRLs/FRELs stating that:
 - each FRL/FREL submission shall be subject to a technical assessment
 - submission is on a voluntary basis
 - technical assessment is possible also in the context of results-based payments
 - a synthesis report on the TA process is prepared by the Secretariat, for consideration by SBSTA after the first year of technical assessments
 - countries are invited to nominate experts to the roster for TA as well as to support capacity-building in relation to the development and assessment of FRLs/FRELs

In an Annex to Decision 13/CP.19 guidelines and procedures for the TA of submissions from Parties on proposed FRLs/FRELs are lined out.

The UNFCCC decisions for guidance at the country level in Myanmar can then be summarized as follow:

- Apply a transparent process in developing the FREL, FRL
- Take into account historical data
- Adjust for national circumstances and consider expectations of future development, if appropriate
- Use metrics and land classifications consistent with those included in the GHG inventory, FRA reporting and the incipient national forest monitoring system

- Think of a stepwise approach in terms of scope of REDD+ activities, carbon pools to be included, tiers and approaches for measuring emission factors and activity data according to IPCC guidelines
- Consider sub-national reference levels as an interim measure if appropriate
- Define intervals of regular updating for the FREL, FRLs

3. Data availability in Myanmar

3.1 Activity data

3.1.1 Historical data record from forest cover assessments

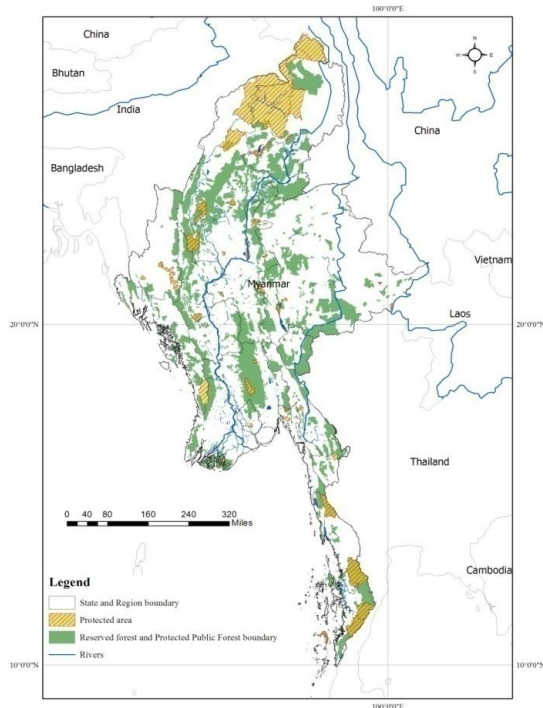
3.1.1.1 National data sources

National forest cover assessments had been carried out for the years of 1990, 2000, 2005 and 2010 based on Landsat (FRA 2005, 2010), and in 2015 based on projected data from 2010 IRS Liss3 images (FRA 2015, draft version). The forest cover map of 1990 is not available in digital form. The deforestation rates based on the land cover change assessments as part of FRA 2005, 2010 and 2015 are included in table 1.

The permanent forest estate, PFE, (forest areas under the authority of MONREC) is available as digital map for 2014 (figure 1). Mapping is also ongoing on the extent of actual forests still existing within the boundaries of PFE but is not yet concluded.

In the context of the GMS+ project carried out by APFnet, which covered 8 countries including Myanmar, forest cover maps for 2005 and 2010 as well as forest cover change maps for 2005-2010 were developed based on Landsat images. However, the resulting deforestation rates from the change assessment for Myanmar appear as too high to be convincing since the annual area of deforestation would then be higher than in Indonesia which is not very likely (see table 1).

Figure 1: Permanent Forest Estate (PFE) in Myanmar in 2010



Source: Forest Department of Myanmar

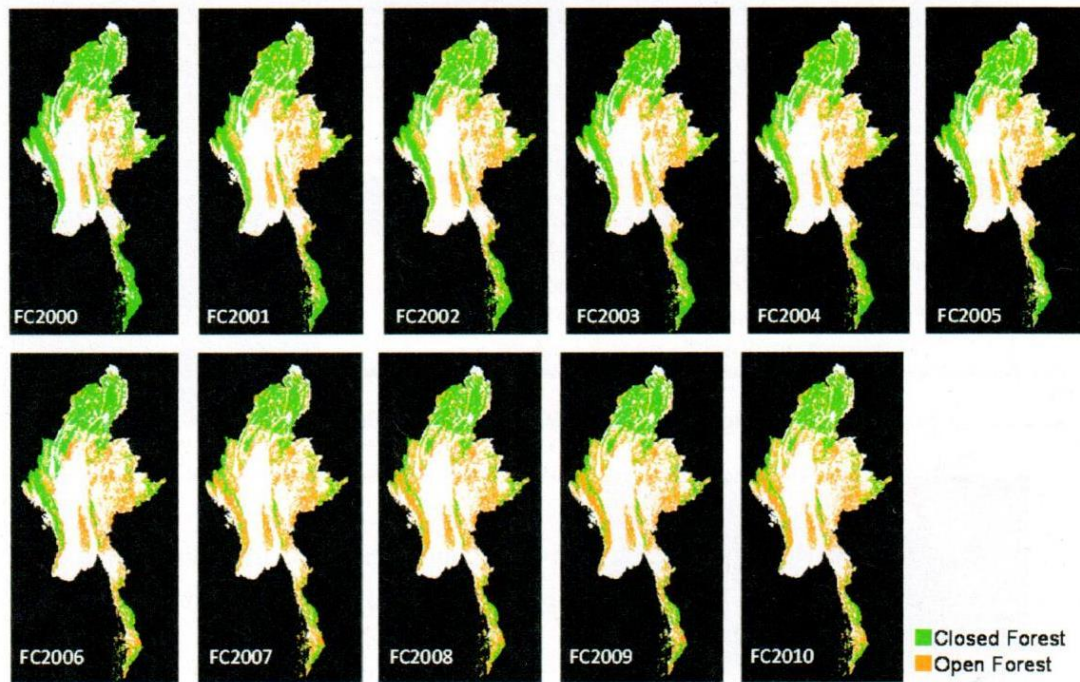
Asia Air Survey (2014) carried out different studies for the Forest Department in the area of land cover/change monitoring during the years of 2012 and 2013 including the following:

- Nationwide forest distribution maps for the years of 2000 – 2010 for each year based on three categories of land cover (closed forest, open forest, non-forest) according to forest definitions used in Myanmar. The data sources for this mapping were SPOT vegetation data with a spatial resolution of 1 km using the NDVI index and 10 day composite data (figure 2). Accuracy assessments for the mapping products for the years 2000 and 2005 based on standard confusion matrices were also conducted the results of which showed thematic accuracies of 64% for the 2000 map and 80% for the 2005 map¹.
- Based on this forest distribution maps change assessments were conducted for the periods of 2000 – 2005 and 2005 -2010. The change from closed forest to open forest was mapped as a proxy for forest degradation and the change from forest to non-forest as deforestation. However, no tabular values of the results seem to exist. Ground truthing for change detection was carried out on 23 selected locations. On these 23 locations the sources of change were determined such as, mining, fire, farmland and plantation development among others (figure 3).
- Forest cover simulations for the years 2015 and 2020 were conducted based on the trends developed from the forest distribution maps and aggregated in five major regions of the country (north, south, east, west and central).

¹ An 80% thematic accuracy is usually seen as a standard which should be achieved for land cover classifications based on medium resolution satellite images.

The data from these studies are available in the Japanese headquarters of Asia Air Survey and can be accessed on demand.

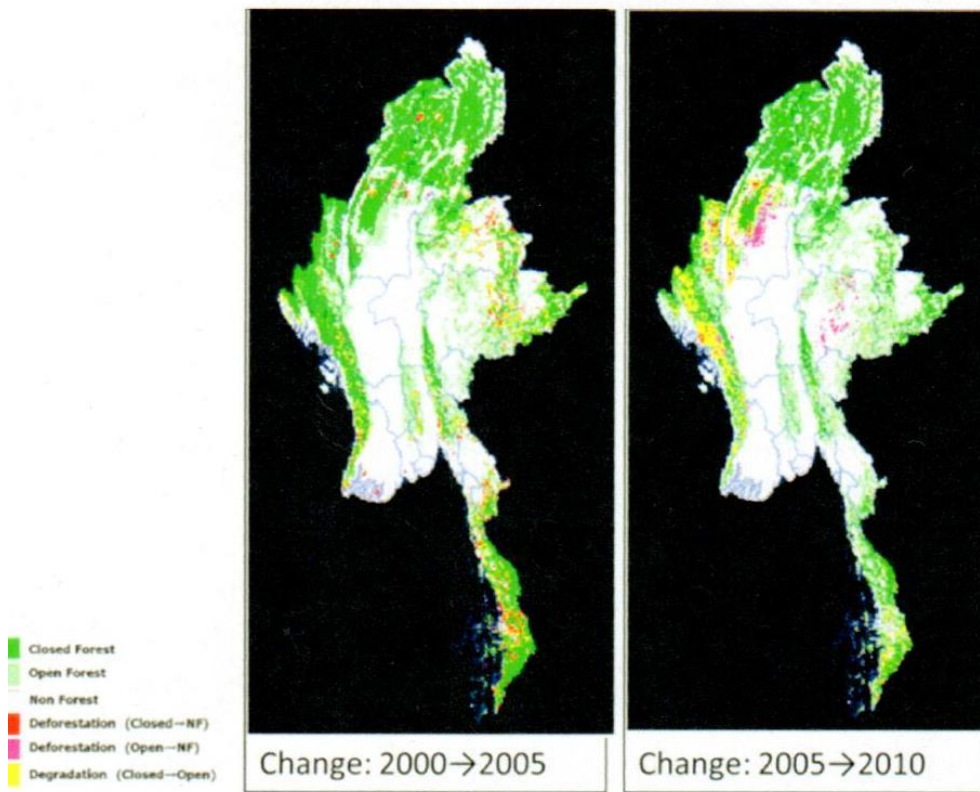
Figure 2: Forest cover development in Myanmar 2000 – 2010



Source: Asia Air Survey, 2014

Asia Air Survey also carried out a pilot study on the use of RapidEye images for forest degradation monitoring based on tree cover change monitoring and field inventory data in the Taunggyi district of Shan state. The tentative methodology and preliminary results of this study were presented during a workshop in January 2015 at the FRI in Yezin (Mitsozuka, 2015).

Figure 3: Forest cover change in Myanmar years 2000 – 2005 - 2010



Source: Asia Air Survey, 2014

In addition, Air Asia Survey developed a methodology for localized degradation monitoring of forests using UAVs with digital cameras and modeling from test sites which gives a 3D image of the forest area in question (Wada, 2015).

Table 1: Overview on deforestation rates according to different studies in Myanmar and pantropical studies including Myanmar

Period	Annual rate in %	Annual rate in ha	Source
1990 - 2000	1.17	435,000	FRA 2010
	0.27	120,000	Leimgruber et al, 2005
	0.21	83,000	Kim et al, 2015
2000 - 2010	0.84	278,100	FD, 2000; FRA, 2010
	0.47	179,000	Kim et al, 2015
2000 - 2012	0.23	100,000	Hansen et al, 2013
2004 - 2013		154,970	Hansen et al, 2014
2006 - 2013		167,000	Hansen et al, 2014
2005 – 2010	2.98	984,826	GMS+ project Myanmar
2010 - 2015	0.83	260,000	Draft FRA, 2015

The incipient One Map project for Myanmar has recently carried out an assessment of existing spatial data for three pilot areas of implementation (figure 4). At least one of them may be overlapping with identified subnational FREL areas (Bago region, see chapter 4.2.4) and potentially either generate or make available relevant data for FREL development including for eventual adjustment factors and safeguard information.

Figure 4: Availability of spatial data for three target thematic areas and national level in Myanmar
OM Workshop - 11August NPT Core data for Onemap by Government Partner / Participant Institutions.
Data status, availability a) for the three target thematic areas and at National level.

Responsible	Core Data	Mon		Bago				Thayarwaddy			MM	Format	Priority OM Phase 1
		Thaton	Mawlamyine	T.waddy	T.goo	Pyay	Bago	Dawei	Myeik	Kayahone			
1	SLRD	Boundaries of formal land tenure										Paper	High
		Location and Names of Commercial agricultural plantations										Paper	High
2	SD	All administrative boundaries (State, District, Township)										V	High
		UTM Topo sheets										R & V	High
		One Inch topo sheets										R	
		Digital Aerial Photography										R	
3	MOECA	2014-2015 Land Use / Land Cover										V	High
		Land Zonation (District, Township, Village Tract)										V	High
		Protected Areas, N.Parks, Reserves, FR, PPF										V	High
		Location and Names of Private Forest Concessions										V	High
		Rapideye Satellite Data 2015										R	
4	MOPI	Population by smallest unit (Ward / VT / enumeration area)									V	High	
5	Geo. SD	Location and Names of Mining Concessions (Large)										V	High
		Mining Concessions (Small)										Paper	Incomplete
		Location and Names of Mineral Exploration areas										V	High
		National Geological maps										V	High
6	HMD	Hydrological network											SD data
		Dams, Lakes											SD data
		Flood risk areas											Incomplete
7	DoHS& HD	Meteorological Data (Met Stations)											
		Urban and regional planning areas										V	
		Economic Development zones and corridors										V	
		Road Transport Network & Bridges										V	High
8	YCDC	Urban development Zones									V		
9	MCDC	Urban development Zones									V		

KEY		Data Available for use now - with checking
		Data Processing requested or in progress
		Data Available from NGO partner (FFI)
		Commercial Copyright restrictions
		Revision Very Likely

Source: Jewell, 2015

3.1.1.2 Data from pantropical or external studies relevant for Myanmar

Several pantropical studies include Myanmar and give estimates potentially useful for FREL definitions, two recent studies (Kim et al, 2015; Hansen et al, 2013,2014) and one older study for Myanmar (Leimgruber et al, 2005). All three studies are mainly based on land cover change assessments making use of Landsat images. How far they could/should be used for establishing historic baselines of deforestation is to be decided by local experts since the forest definition used for forest cover assessments in Myanmar is considerably different from those applied for the above mentioned studies (table 2).

Table 2: Minimum tree cover threshold used in forest definitions in Myanmar as opposed to some pantropical or external studies

Minimum tree cover threshold for forest definition	Source
10%	FRA-Myanmar, 2010,2015 based on FAO definition
25%	Hansen et al, 2013, 2014 ²
25%	Kim et al, 2015
50%	Leimgruber et al, 2005

The differences in minimum tree cover threshold account for at least part of the differences in deforestation rate estimations between the mentioned pantropical studies and the national forest cover assessments for FRA reporting in Myanmar (see table 1).

3.1.2 Data sources for future forest cover/ change assessment

The ongoing TCP project of FAO³ aims, as one of its main products, to develop a new national forest cover map with base year 2015. The data sources (satellite images) and the forest definition used for this forest cover assessment will be consistent with those used in Myanmar's FRA assessments and reports so far. The data from this assessment could then potentially be used for change assessments against the existing maps of 2005 and 2010 in the country. For historic average calculations for FREL definitions at least three points in time would then be available (2005, 2010, 2015).

As an alternative for Landsat, Sentinel 2 images from ESA could also be used. These images have spatial resolutions between 10, 20 and 60 m, depending on the spectral bands used for analysis⁴, and can be downloaded free of charge from the ESA website.

3.2 Emission factors

3.2.1 Information available from Historical NFI

The first national scale forest inventory with a probability sampling approach was initiated in 1980/81 and supported by a UNDP/FAO project during the first phase (BUR/79/011). With financial assistance of the project MYA/85/003 support was extended until 1992 (second phase).

² The threshold of forest cover for the Hansen data can actually be changed and calculations be carried out in 5% steps of difference between 10 – 30% tree cover (10, 15, 20, 25 and 30%). See annex 9.2

³ Strengthening Myanmar's National Forest Monitoring System - Land Use Assessment and Capacity Building: Project number: TCP/MYA/3501

⁴ http://www.esa.int/Our_Activities/Observing_the_Earth/Copernicus/Sentinel-2/Facts_and_figures

This NFI was never completely finished and abandoned in 1992 for unknown reasons.

However, as part of this project 70 tree bole volume equations were developed which predict the bole volume of many of the major tree species in natural forests of Myanmar aggregated in several species regression groups (Leech et al, 1990). The volume equations do not cover the whole country, only 8 out of 14 states⁵, and only the bole volume for trees with DBH (over bark) between 20 cm and 65 - 205 cm and an upper limit of 10 cm depending on the species group. Still those equations could be useful at least for first order assessments combining the estimations with expansion factors according to IPCC guidelines, ideally national level factors (IPCC, 2006⁶) and as a basis for expanding to other species and locations not included in the original study but with similar silvicultural or ecological conditions. The equations can be found in an xls spreadsheet table which is attached to this document. However, whether and how these equations could be used for national level biomass estimations in the context of REDD+ in Myanmar should be subject to discussions with biometry experts.

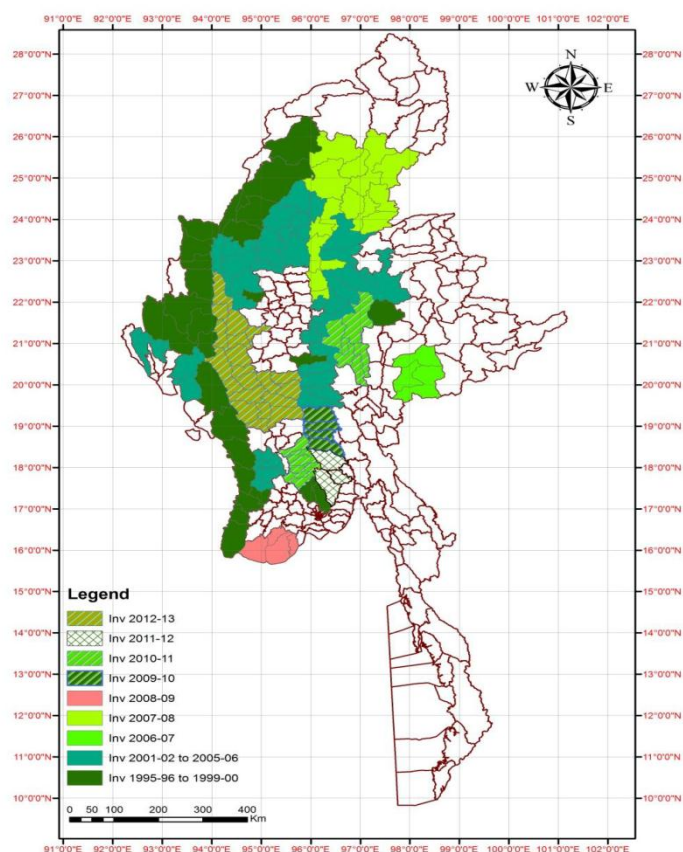
⁵ Ayeyarwady, Bago, Chin, Magwe, Mandalay, Rakhine, Sagaing, Yangon. Not included were the states of Thaninthayi, Mon, Kayin, Kayah, Shan and Kachin.

⁶ Chapter 4.5 pp. 4.46 – 4.71

3.2.2 Information available from district level inventories

Since the abandonment of the NFI in the early 1990s only district level forest inventories have been carried out, with management plan purposes (definition of AAC, stand and stock tables). Only part of the country's area and forest is covered by district level inventories (figure 5). The district level inventory design is based on a systematic distribution of plots within two basic strata: closed forests (> 40% tree cover) and open forests (10% - <40% tree cover). More details on this can be found in Myanmar's NFMS action plan document (chapter 2.3.3.2).

Figure 5: Coverage of districts with field inventory in Myanmar until the year 2013



Source: Forest Department of Myanmar

How far the results of the district level inventories in combination with expansion factors, either generic factors according to IPCC, 2006 or nationally determined factors will be useful for first order biomass estimations and forest carbon measurement is to be determined still.

3.2.3 Data from pantropical studies

Saatchi *et al.*, 2011, developed a benchmark map of forest carbon stocks in tropical regions across three continents which includes Myanmar. The estimations include above ground and below ground biomass with three ranges of estimations (low, mean and high) in terms of Mt of carbon. For above ground forest carbon stock in Myanmar the study estimates ranges between 5,130 Mt C and 6,135 MtC with a mean value of 5,631 MtC. If we take this mean value of total forest carbon divided by the forest area used in this study (49 MM ha) we have around 115 t C per ha forest in Myanmar for the early 2000s. The latter value, thus, is much higher than the FRA estimations for 2005 and 2010 (see table 3).

Table 3: Above ground forest carbon stock estimations in Myanmar

Category	Year 2005	Year 2010	Source
AGB forest carbon stock (Mt C)	1,445	1,378	(1)
Reference forest area (ha)	33,320,000	30,470,000	(1)
Average C stock/ ha forest, in t	43,4	45,2	(1)
AGB forest carbon stock (Mt C)	5,631		(2)
Reference forest area (ha)	49,000,000		(2)
Average C stock/ha forest, in t	114,9		(2)

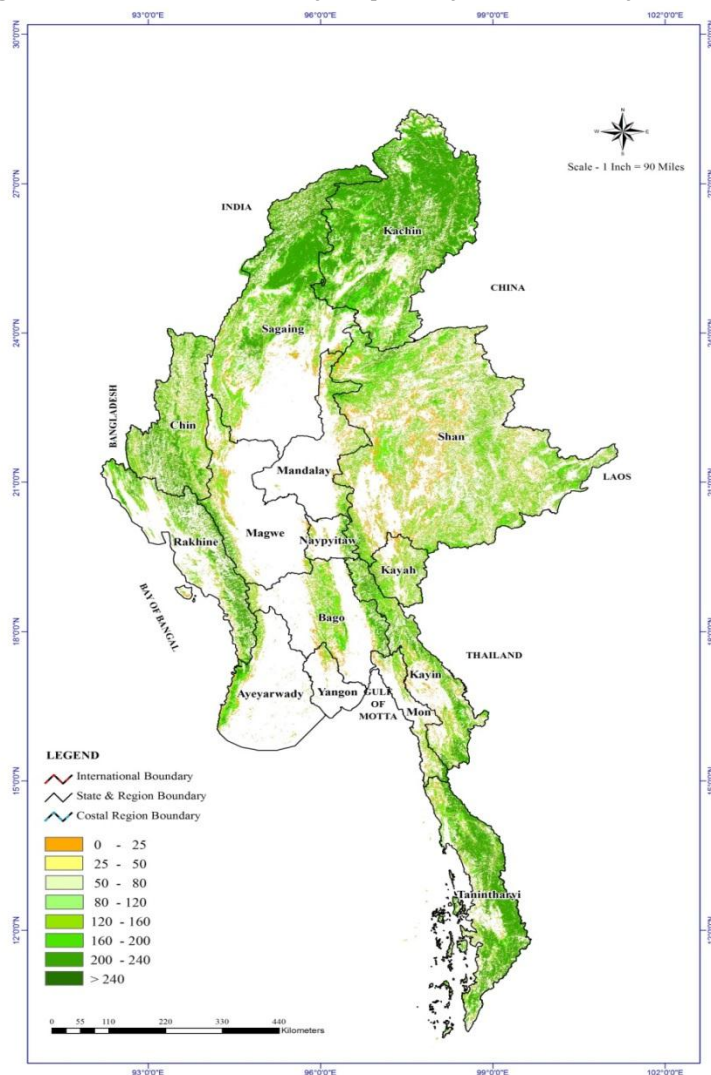
Sources: (1) FRA 2010; (2) Saatchi et al, 2011, data for early 2000s

Again, how far these data could be used for constructing emission factors in Myanmar, at least for first order assessments, is still to be discussed.

3.2.3 Recent and future initiatives of biomass/ forest carbon studies

There exists also a forest carbon storage map for the whole country with 300 m resolution with 8 strata derived from MODIS data (figure 6). This study was carried out as part of the Myanmar component of the GMS+ project of APFnet and reflects data from the year 2013/2014.

Figure 6: Forest carbon density map for Myanmar for the year 2013/2014



Source: Forest Department of Myanmar

For the second phase of the regional GMS+ project AGB and forest carbon maps with 500 m resolution based on space borne LiDAR data, ground measurements and other RS data sources are planned.

4. The planning process

4.1 Approach to FREL development in Myanmar

The process for developing actions for the definitions of FRELs in Myanmar will be organized around the main guidance elements for this topic (see chapter 2) summarized in table 4 with indications on what the meaning of this guidance is in the national context.

Table 4: Summary of guidelines for FREL development and their expressions in Myanmar

Summarized guideline indications	Expression in Myanmar
Apply a transparent process in developing the FREL, FRL	FREL development is inserted in REDD+ stakeholder engagement structures in the country according to the REDD+ road map. The MRV working group is tasked with developing proposals for the FREL action plan to be implemented

	through the REDD+ Task Force once they are agreed among relevant stakeholders and authorities.
Take into account historical data	<p>Historical data about forest cover and forest cover change are available but suffer from inconsistencies according to different methods, definitions and data sources used for generating the estimations.</p> <p>The existing data are to be revised and checked for their utility in the context of FREL development and the kind and quality of additional data requirements be established.</p>
Adjust for national circumstances and consider expectations of future development, if appropriate	<p>Social and economic development in Myanmar will almost certainly require a certain amount of “desired” deforestation (e.g., agricultural development and infrastructure) or “desired” forest degradation (e.g., timber extraction), although the sustainability criteria should be applied in this context.</p> <p>However, how far the development circumstances of Myanmar will be reflected in the FRELs is still an open question (see below under chapter 4.2.5 about methodology).</p>
Use metrics and land classifications consistent with those included in the GHG inventory, FRA reporting and the incipient national forest monitoring system	This aspect is not to be seen as a major problem since standard metrics and classifications are in use in Myanmar and will be further developed consistently across the different reporting schemes and requirements the country will use or be part of.
Think of a stepwise approach in terms of scope of REDD+ activities, carbon pools to be included, tiers and approaches for measuring emission factors and activity data according to IPCC guidelines	The multi-stakeholder FREL workshop during 21, 22 July in Naypyitaw concluded that a step wise and incremental approach for developing scope and scale as well as for the methods and approaches for measurements will be applied. The latter is also dependent on the advances made by establishing the NFMS for Myanmar and design choices to be made for both the satellite land monitoring component and the incipient National Forest Inventory
Consider sub-national reference levels as an interim measure if appropriate	Subnational FRELs is an option in Myanmar. However, this still requires some more discussion since consistency with REDD+ strategy and eventual priority areas for REDD+ implementation should be guaranteed.
Define intervals of regular updating for the FREL, FRLs	Intervals of updating have to be decided taking into account the land use dynamics in the country as well as the measurement capacities and methodologies. Decisions about updating intervals of the NFM/NFI will also influence the definition of intervals for FREL updating.

4.2 Summary of results of the national FREL workshop and follow up MRV group meetings in 2015

4.2.1 Purposes of the FREL

The workshop conclusions indicate that FREL(s) in Myanmar should be established both for domestic and globally relevant purposes.

Among the domestic purposes the following was identified: baselines for measuring

- good forest governance,
- sustainable forest management and
- land use policy and practice

Among globally relevant purposes

- the contribution to climate change mitigation
- access to results based payments

As a possible source for the latter the Green Climate Fund, GCF, was mentioned.

4.2. 2 Forest Definition

Myanmar is using the FAO definition of forest which consists of:

- a tree cover threshold of 10%
- minimum area of 0.5 ha or above
- minimum height of 5 meters at maturity of tree species
- young natural stands and plantations established for forestry purposes which do not yet fulfil all the above criteria are considered forests anyway⁷

For forest areas within the context of “shifting cultivation” basically three principal situations have to be distinguished:

- areas with short term fallow periods (less than 10 years) which could or should be included into the cropland category;
- areas with longer term fallow periods (more than 10 years) could/should somehow be categorized as forests under a forest degradation regime, and
- areas with regulated agroforestry systems (e.g. Taung Ya).

More discussion on this is needed in terms of categorization and also the data requirements in order to be able to monitor meaningfully the phenomenon of shifting cultivation (higher spatial and temporal resolution of images and better multi-temporal image analysis).

4.2.3 Scope

Because deforestation is significant in Myanmar, it should be included in any FREL, per guidance provided by the UNFCCC. For forest degradation, although some workshop participants suggested its inclusion in FREL right from the beginning, more discussions are necessary on this. The inclusion of forest degradation will depend on an agreeable definition and proper techniques to actual measure it. If forest degradation is simply defined as a transition from closed forest to open forests (transition from more than 40% tree cover to less than 40% tree cover) then this would be comparatively easy to measure but probably not capture the complexity of the phenomenon of forest degradation. The biomass dynamics in forests must somehow be captured as well as the time frames over which the changes occur and whether or not the changes are desirable (forest management) or undesirable (forest fire, illegal activities). Thresholds of resilience may also play a role in this context. Thus, more thinking has to be put into this topic.

The workshop concluded also to include afforestation and reforestation in the FREL. For this purpose maps and registries in the government have to be checked in order to know more about availability and quality of data about forestry planting activities.

Concluding it can be said, that:

- deforestation to be included

⁷ Rubbertree or oilpalm plantations are considered tree crops but within the category of agriculture not forestry.

- forest degradation to be included once a proper definition and measurement techniques exist in the country
- inclusion of afforestation and reforestation within the incremental approach during a later stage or when and where data are available (see below chapter 4.2.4)

For the carbon pools for inclusion in FREL the workshop concluded to include, of course, above ground biomass (AGB) as the most important and most reliably measurable carbon pool. However, higher precision data about AGB at national level can only be produced once a new National Forest Inventory is established or more sophisticated remote sensing techniques being applied at national scale (e.g. LiDAR image based monitoring approach). In the meantime conservative estimates for carbon stocks could be used together with the simple version of the gain-loss method according to IPCC as mentioned in chapter 4.1.2 of Myanmar's NFMS action plan document.

Other carbon pools could be included with their default values according to IPCC guidance (see footnote 5 in chapter 3.2.1 of this document).

4.2.4 Scale

The workshop concluded to start with subnational FRELs and defined three possible subnational areas, namely: (1) Bago region, (2) Ayeyarwaddy region and (3) Shan state. The reasons for the selection were based on criteria of data availability, logging and timber extraction activities, shifting cultivation and the accessibility.

However, during follow up discussions during a MRV group meeting some cautioning on this was expressed stating that the definition of subnational areas for FREL should be harmonized with the incipient REDD+ strategy and its potential priority areas.

It is also to be noted that, although subnational FRELs could be used as a starting point for FREL development or pilot areas of national level FRELs, the monitoring has still to be done at national scale for various reasons, the capturing of leakage and displacement of emissions being the most important.

4.2.5 Methodology

No clear decisions about the methodology (historical average, projection, definition of national circumstances) to be used for FREL came out of the workshop. Participants sensed the need for more information on the advantages/ disadvantages or consequences of one or another approach. For calculating historical averages the existing data at national level are not complete or do not reach back far enough and pantropical data are seen with some skepticism. With completion of a new 2015 forest cover assessment map in line with methods and definitions used in Myanmar in the past the country would have at least 3 points in time (2005, 2010, 2015) with reliable data for calculations and change assessment. The data from the Asia Air Survey project (figures 2 and 3) should be checked in terms of accessibility and usefulness for FREL development since they seems to provide the only source of annual forest cover assessment between the years of 2000 and 2010 in Myanmar.

Whether projections make sense is a matter of whether reliable models can be developed which reflect the likely development of carbon emission in the future and also whether

potential investors in REDD+ payment would accept this method. Other countries have used historical averages which they adapt periodically upon availability of new data and a defined periodicity to smooth out annual differences.

National circumstances expressed at the level of adjustment factors could be developed too and either be fed into projections and models if decisions go for that or be applied as a margin on FREL levels. The latter could be justifiable for post-conflict areas in Myanmar similar to what has been done in other countries (e.g. Columbia).

4.3 Actions to be undertaken

As pointed out in chapter 4.1 the actions of the FREL plan will be developed around the main elements of guidance from UNFCCC and organized in five major outcome areas, namely:

- (1) Multi-stakeholder participation and consultation during FREL development
- (2) Data review and methodology
- (3) Identification of national circumstances and adjustment factors
- (4) Development of subnational FRELS with national level consistency
- (5) Linkage of FRELS with NFMS and the REDD+ strategy

4.3.1 Multi-stakeholder participation and consultation during FREL development

The development of the FRELS will be inserted in the existing stakeholder engagement mechanisms for REDD+ in Myanmar. Specifically the MRV group and the REDD+ Taskforce office (UNREDD programme management unit) will have to make sure that all relevant stakeholder are adequately involved in all major decisions which lead to the definitions of FRELS.

As present thinking on FREL development includes to start with subnational FRELS in three regions of the country the formation of subnational working groups on FRELS in these three regions (Bago, Ayeyarwaddy, Shan state) should be evaluated. Otherwise subnational actors could be included in MRV sessions and decisions when FREL discussions relevant for their area are on the agenda. In any case capacity building of relevant subnational actors in these regions is essential. A capacity building programme or plan should be developed for that purpose. For the execution of capacity building national NGOs or specific consultants could be contracted with the support from UNREDD programme and the REDD+ Taskforce office.

4.3.2 Data review and methodology

The historic data record on forest cover has to be completed in a way that at least a full period of 15 years back with at least three points in time of forest cover assessment is available in order to establish reasonable historic baselines for change assessments. For the change assessment a specific consultant could be contracted once the new 2015 forest cover assessment is completed (TCP project of FD/FAO). At the same time the data produced by Asia Air Survey (see chapter 3.1.1.1) should be retrieved and reviewed for their usefulness for FREL development.

It is very likely that by the time when the new forest cover change assessment is available, the results of the new NFI are not yet ready. In addition, historical emission factors which could be related to the area changes for the historic periods are not available either. It is therefore

probably reasonable and justified under a stepwise and incremental approach to develop conservative estimates for emission factors for forest cover classes or types and apply the simpler version of the gain-loss method for forest carbon stock calculations as mentioned earlier (chapter 4.2.3). In this context the usefulness of the results of district level inventories should be evaluated in those districts which fall into one of the three subnational FREL areas, at least for Bago and the Ayeyarwaddy region. This work could be done by a qualified consultant specifically contracted for this purpose.

For decision support about the methodology (see chapter 4.2.5) a study could be undertaken which develops options for Myanmar on the basis of a revision of experiences in other countries and the national conditions. This study should include the construction of historic averages and the feasibility of projections and modelling.

4.3.3 Identification of national circumstances and adjustment factors

The FREL workshop in Naypyitaw in 2015 touched only briefly on the matter of national circumstances and adjustment factors. The best way forward on this is probably to conduct a study in order to identify relevant circumstances of development at the national level and in those three subnational FREL areas with proposals for resulting adjustment factors the FREL construction should consider. Either a qualified consultant or an NGO could be contracted for this purpose.

4.3.4 Development of subnational FRELs with national level consistency

In order to assure national level consistency for subnational FRELs it is probably useful to develop a guiding framework or manual to follow which indicates scope, definitions, land cover classifications, methods and data sources, etc. so that the resulting subnational FRELs are compatible when stitched together at national level and no major contradictions and interpretation needs arise. This manual or guidance framework could be developed by the REDD+ TFO with support from UNREDD and/or by contracting an external consultant.

Once the manual is available or parallel to developing the manual subnational planning processes should be established. The operational development of the planning process could be entrusted to consultants or NGOs, preferably people familiar with the environment and actors in the respective region. Subnational offices of the Forest Department could support this process. Feedback mechanisms should be established between the subnational planning process and the overall stakeholder participation mechanism of REDD+ in Myanmar (see chapter 4.3.1). A subnational workplan on FRELs should be developed and approved by the REDD+ TFO.

4.3.5 Linkage of FRELs with NFMS, REDD+ strategy

The development of FRELs is intrinsically linked to the development of a national forest monitoring system and the incipient REDD+ strategy of the country.

Technical decisions, design choices, data collection approaches, and choices for analysis and reporting formats for the two constituent elements of the NFMS, the Satellite based Land Monitoring System (SLMS) and the National Forest Inventory (NFI), will determine the availability and quality of input data for FRELs, the levels of accuracy and precision of outputs of FRELs including the levels of tiers and approaches applicable for the calculation of forest

carbon stocks, land use activity data and the resulting forest related emissions or sinks of CO₂. As the availability and quality of data from the NFMS improve over time the quality and usefulness of data for FRELs increase too.

The national REDD+ strategy, on the other hand, influences scope and scales of FRELs, which REDD+ activities should be included, where territorially subnational FRELs could or should be established among others. For instance, if the REDD+ strategy decides to include SFM and afforestation activities the FRELs ideally would include these into their scopes and if the REDD+ strategy develops subnational priority areas for REDD+ measures these areas should be included in subnational FRELs.

In practice the processes of developing FRELs, the NFMS and a REDD+ strategy in Myanmar will be parallel ongoing processes and a constant coordination and feedback between these processes is essential in order to assure consistency among these elements of REDD+. The latter will be the task of the REDD+ Taskforce Office in its daily overview of operational development of REDD+ in the country and ultimately of the REDD+ Taskforce itself.

5. Logical frame work

Objectives	Outcomes	Indicators/milestones	Activities
The FRELs in Myanmar are developed in a way useful for domestic and global purposes and fulfill the requirements for potential REDD+ payments according to UNFCCC and potential funding mechanisms (GCF, WB-forest carbon fund)	Multi-stakeholder participation and consultation during FREL development assured	Capacity development plan for national and subnational actors for areas selected for subnational FRELs after 6 months; Capacity development implemented in subnational FREL areas during second and third year; Draft FRELs (national/subnational) presented and consulted during second and third year; Final version of FRELs for Myanmar ready to be submitted to UNFCCC by end of fourth year;	<ul style="list-style-type: none"> - 3 MRV group sessions/ year; - At least one national workshop on progress of FREL development/ year; - One national and three subnational capacity building workshops/ year for each subnational FREL area; - At least one NECC session on FREL development/ year - Contract local NGO or consultants for implementing the capacity development plan - Expert consultation of draft version of FRELs (meetings, workshop, electronically)
	Data reviewed and methodology defined	New forest cover map for Myanmar base year 2015 by the end of first year (TCP project); Historical data record complemented with forest cover change assessment 2010 – 2015 and available end of second year; FREL methodology developed by end of third year; Framework for emission factors based on existing information developed by the end of second year; Depending on development of NFMS new NFI derived emission factors developed by the end of the fourth year.	<ul style="list-style-type: none"> - Project TCP/MYA/3501 (FAO - Forest Department) - Contract consultant(s) for conducting area change assessment (national and for selected subnational areas) - Retrieve and review data from Asia Air Survey project (SPOT vegetation data) - Check the possibility of producing annual forest change data for the period of 2010 – 2015 with methodology of Asia Air Survey project (SPOT vegetation data) - Contract consultant for emission factor development based on existing information (proposal for national level and selected subnational areas/subnational FRELs) - Contract consultant for FREL

Objectives			
	Outcomes	Indicators/milestones	Activities
			<ul style="list-style-type: none"> methodology including historic baselines - If first NFI results available within the timeframe of this action plan develop baseline of emission factors for future FRELS - When data or results are available from the second phase of the GMS+ project (LiDAR based forest carbon mapping) check possibility of use for emission factor development
	National circumstances and adjustment factors identified	National circumstances analyzed and draft proposal for adjustment factors developed at national level and for selected subnational FREL areas by the end of third year; Final proposal of adjustment factors developed ready to be included in FREL approach for submission to UNFCCC during fourth year;	<ul style="list-style-type: none"> - Study/ consultancy on national circumstances and framework for developing adjustment factors - National Workshop on development circumstances and adjustment factors/ results of study as input - Subnational workshops in areas selected for subnational FRELS/ priority areas of REDD+ strategy - Developing TORs and concept papers - Select and contract consultants/ local or national NGO
	Subnational FRELS developed with national level consistency	Manual or framework for developing consistent subnational FRELS by end of first year/ beginning of second year; Proposals for subnational FRELS in three areas developed by the end of third year; Final versions of subnational FRELS with a proposal to extension to national level at the end of fourth year;	<ul style="list-style-type: none"> - Consultancy/study for developing the FREL manual/guiding framework - Technical meetings with MRV group - Establishment of subnational FREL working groups in selected areas - Study/consultancy on extent and dimensions of shifting cultivation in selected areas with proposal on how to capture shifting cultivation adequately in FRELS - Consultancy/study on developing proposals for three subnational FRELS - Three subnational workshops on FREL proposals - Proposal for upscaling of subnational FRELS to the national level - National workshop on proposals for upscaling of subnational FRELS to national FRELS
	Linkage of FRELS with NFMS, REDD+ strategy and incipient SIS secured	Consistency of subnational FRELS with REDD+ priority areas, three areas selected by end of first year; Harmonization of land use/cover classification for subnational FRELS with national level classifications (GHG, land inventory, FRA) by the end of second year; Proposal for consideration of Indicators of SIS or summary information on safeguards in subnational/ national FRELS by the end of third year;	<ul style="list-style-type: none"> - Meetings/ sessions between MRV group and TWGs about REDD+ strategy and safeguards - Study on land use/cover classification/ stratification in the selected subnational areas for FRELS (in coordination with data review above) - Proposal from safeguard TWG on kind and quality of information/ indicators for compliance with Cancun safeguards - Proposal from MRV group for inclusion of baselines for safeguards in FRELS (subnational and national) - Technical meetings on consistency among FRELS, approach for NFM and safeguard

6. Workplan and timeline

Expected outcomes	Activities	Targets	Year1				Year 2				Year 3				Year 4			
			1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q
Multistakeholder participation and consultation during FREL development	NECC meetings with FREL topics	1 meeting per year	█				█					█					█	
	REDD+ taskforce meetings on FREL	2-3 meetings per year		█		█		█			█		█				█	
	REDD+ stakeholder network meetings	3 MRV group meetings per year		█		█		█			█		█				█	
	3 subnational workshops	1 Bago region, 1 Ayeyarwady region, 1 Shan state										█	█					
	1 national workshop	After conclusion of subnational WS													█			
	Formation of subnational working groups	one group in each subnational FREL				█												
	contract local NGO or consultant to develop and implement capacity building plan	second year workshop, technical meetings and/or electronic consultation					█	█	█									
	Expert consultation on draft versions of FRELs													█			█	
Data reviewed and methodology defined	Forest cover assessment from TCP project	available by end of first year				█												
	Contract consultant/firm for area change assessment	beginning of second year					█											
	Conduct/complement area change assessment 2005, 2010, 2015 (Landsat)	during the second year					█	█	█	█								
	Retrieve and review data from Asia Air Survey (SPOT)	during the first year		█														
	Check possibility of producing annual forest change data with Asia Air Survey methodology for years 2011 - 2015	during first year			█													
	Contract consultant for emission factor development	beginning of second year					█											
	Develop FREL methodology (consultancy or project personnel)	methodology available by the end of third year											█	█				
	Check usability of eventual NFI and GMS+ project data	end of fourth year															█	█

Expected outcomes	Activites	Targets	Year1				Year 2				Year 3				Year 4			
			1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q
National circumstances and adjustment factors identified	Study/ consultancy on national circumstances and framework for developing adjustment factors	draft version available for workshop/ endorsed version available end of third year																
	National workshop on development circumstances and adjustment factors	during first half of third year																
	Subnational workshops in areas selected for subnational FRELS	during second half of third year																
	Contract and select consultants	end of second year																
Subnational FRELS developed with national level consistency	Development of a manual or guiding framework (consultancy)	available by end of first year/ beginning of second year																
	Establishment of subnational WGs in selected areas	beginning of second year																
	Technical meetings of MRV group with subnational WGs	during second and third year																
	Study/ consultancy on extent and dimensions of shifting cultivation in selected areas and how to include in FRELS	draft available end of second year, final version first half third year																
	Study/ consultancy on proposals for three subnational FRELS	proposals available middle of third year/ final version end of third year																
	Three subnational workshops on FRELS	during second half of third year																
	Proposal for upscaling of subnational FRELS to the national level	first half of fourth year																
	National workshop on upscaling subnational FRELS to national level	first half of fourth year																
	Select and contract consultants	during first and second year																

Expected outcomes	Activites	Targets	Year1				Year 2				Year 3				Year 4			
			1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q
Linkage of FRELs with NFMS, REDD+ strategy and incipient SIS secured	Meetings/ sessions between MRV group and TWGs about REDD+ strategy and safeguards	twice a year		■		■		■		■		■		■		■		■
	Study on harmonisation of land use/cover classification/ stratification in selected subnational areas	results available by end of second year						■										
	Proposal from safeguard TWG for inclusion of safeguards in FREL baselines	available during first half of third year								■								

7. Budget in USD

Expected outcomes	Activites	Budget				Total
		Year 1	Year 2	Year 3	Year 4	
Multistakeholder participation and consultation during FREL development	NECC meetings with FREL topics	5.000	5.000	5.000	5.000	20.000
	REDD+ taskforce meetings on FREL	6.000	6.000	6.000	6.000	24.000
	REDD+ stakeholder network meetings	6.000	6.000	6.000	6.000	24.000
	3 subnational workshops			75.000		75.000
	1 national workshop				45.000	45.000
	Formation of subnational working groups		15.000	15.000	15.000	45.000
	contract local NGO or consultants to develop and implement capacity building plan		45.000			45.000
	Expert consultation on draft versions of FRELS				10.000	10.000
Subtotal		17.000	77.000	107.000	87.000	288.000
Data reviewed and methodology defined	Forest cover assessment from TCP project	50.000	100.000			150.000
	Select and contract consultant/firm for area change assessment		2.000			2.000
	Conduct/complement area change assessment 2005, 2010, 2015 (Landsat)		50.000			50.000
	Retrieve and review data from Asia Air Survey (SPOT)	5.000				5.000
	Check possibility of producing annual forest change data with Asia Air Survey methodology for years 2011 - 2015	5.000	50.000			55.000
	Contract consultant for emission factor development		15.000			15.000
	Develop FREL methodology (consultancy or project personnel)			45.000		45.000
	Check usability of eventual NFI and GMS+ project data				5.000	5.000
Subtotal		60.000	217.000	45.000	5.000	327.000
National circumstances and adjustment factors identified	Study/ consultancy on national circumstances and framework for developing adjustment factors			25.000		25.000
	National workshop on development circumstances and adjustment factors			45.000		45.000
	Subnational workshops in areas selected for subnational FRELS					
Subtotal		0	0	70.000	0	70.000
Subnational FRELS developed with national level consistency	Development of a manual or guiding framework (consultancy)	30.000				30.000
	Establishment of subnational WGs in selected areas		15.000			15.000

Expected outcomes	Activites	Budget				Total
		Year 1	Year 2	Year 3	Year 4	
	Technical meetings of MRV group with subnational WGs		20.000	20.000		40.000
	Study/ consultancy on extent and dimensions of shifting cultivation in selected areas and how to include in FRELS		25.000	25.000		50.000
	Study/ consultancy on proposals for three subnational FRELS			50.000		50.000
	Three subnational workshops on FRELS					
	Proposal for upscaling of subnational FRELS to the national level				25.000	25.000
	National workshop on upscaling subnational FRELS to national level				45.000	45.000
	Subtotal	30.000	60.000	95.000	70.000	255.000
Linkage of FRELS with NFMS, REDD+ strategy and incipient SIS secured	Meetings/ sessions between MRV group and TWGs about REDD+ strategy and safeguards	5.000	5.000	5.000	5.000	20.000
	Study on harmonisation of land use/cover classification/ stratification in selected subnational areas		35.000			35.000
	Proposal from safeguard TWG for inclusion of safeguards in FREL baselines			10.000		10.000
	Subtotal	5.000	40.000	15.000	5.000	65.000
Total		112.000	394.000	332.000	167.000	1.005.000

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9. Annexes

9.1 [Tree bole volume equations for Myanmar according to Leech et al, 1990](#)

(separate spread sheet table)

9.3 Deforestation rates in Myanmar according to Hansen et al, 2013, 2014 with different thresholds of forest cover

All areas are in hectares	TREE COVER LOSS (>10% CANOPY COVER)													TOTAL 2001-2013	AVE
Country	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	TOTAL 2001-2013	AVE
Myanmar	45884	67748	78869	104500	93536	130920	149630	121872	220288	172717	138790	204357	213128	1742241	134018,5
	TREE COVER LOSS (>15% CANOPY COVER)														
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	TOTAL 2001-2013	AVE
	45540	67218	78342	103796	93013	129816	148656	121000	218957	171802	137766	202342	210211	1728459	132958,4
	TREE COVER LOSS (>20% CANOPY COVER)														
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	TOTAL 2001-2013	AVE
	45348	66915	78036	103380	92716	129164	148110	120545	218256	171285	100333	201379	208682	1684150	129550
	TREE COVER LOSS (>25% CANOPY COVER)														
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	TOTAL 2001-2013	AVE
	45047	66497	77628	102753	92255	128290	147334	119876	217277	170636	136523	200086	206826	1711028	131617,5
	TREE COVER LOSS (>30% CANOPY COVER)														
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	TOTAL 2001-2013	AVE
	44797	66115	77222	102185	91844	127459	146593	119206	216296	169906	135701	198436	203989	1699750	130750
	TREE COVER LOSS (>50% CANOPY COVER)														
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	TOTAL 2001-2013	AVE
	42337	62061	72734	95855	87213	117613	137938	111831	204571	161499	128099	183853	187138	1592741	122518,5
	TREE COVER LOSS (>75% CANOPY COVER)														
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	TOTAL 2001-2013	AVE
	30838	43379	50902	67562	65638	76246	96027	76905	143226	116868	91192	121722	111857	1092362	84027,83