Establishment of Forest Reference Level in Vietnam
Dinh Hung Nguyen (Forest Inventory and Planning Institute (FIPI), Vietnam)
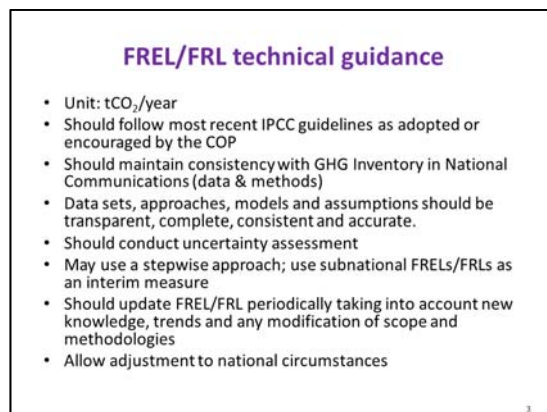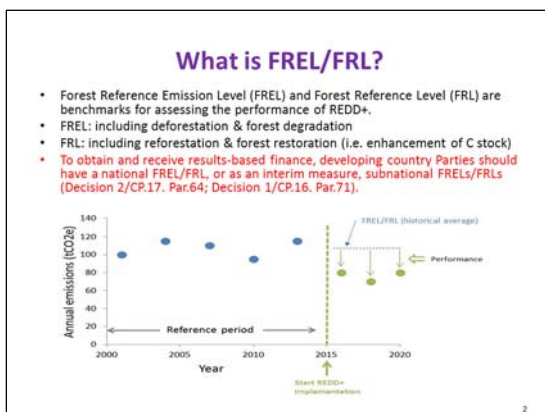
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Establishment of Forest Reference Level in Vietnam

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Today, I would like to tell you about our experience in the establishment of the forest reference level in Vietnam.

Explanation of FREL/Forest Reference Levels (FRL)

First of all, I would like to explain a little bit about the terms forest reference emission level and forest reference level. Basically, they are benchmarks for assessing the performance of REDD+. The forest reference emission level includes emissions from deforestation and forest degradation, while the forest reference level includes removals from REDD+ activities such as enhancement of carbon stock, and sustainable management of forests.

It is also important to note that, according to the COP decision, in order to obtain and receive result-based finance, developing country parties like Vietnam should submit a national forest reference emission level or forest reference level as an interim measure, sub-national FREL/FRL.
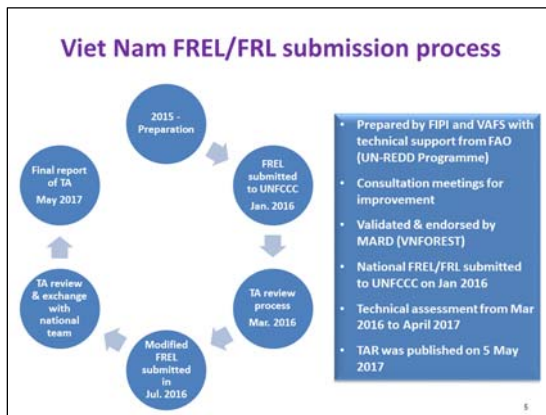
This is the technical guidance from the UNFCCC about FREL/FRL establishment. First, the reporting unit should be in tons of CO_2 per year, and the party should follow the most recent IPCC guidelines as adopted and encouraged by the COP. A party should also maintain consistency with the LULUCF sector of greenhouse gas (GHG) inventory in national communication. The dataset, approach, model, and assumption should be transparent, complete, consistent, and accurate. A party should conduct uncertainty assessment for FREL/FRL. The party might use as a stepwise approach. For example, they might use sub-national FREL/FRL as an interim measure. A party should update the FREL/FRL periodically taking into account new knowledge, trends, and any modification of scope and methodologies. A party might be allowed to make adjustment based on their national circumstances.


Dr. Julian Fox has presented about the international process of FREL/FRL submission. Here, I only want to stress that FREL/FRL is the only REDD+ element need to be technically assessed by the UNFCCC, and the technical assessment is a facilitative process and can be considered as an opportunity for improvement of the FREL/FRL. Now 34 countries have already submitted FREL/FRL to the UNFCCC. Please note that my number 34 is slightly different from Dr. Fox's number of 38. This is because some countries like Brazil or Malaysia have submitted their FREL/FRL twice, so there is a little bit difference in the numbers. Among the 34 countries who have already submitted FREL/FRL, 17 countries have already completed a technical assessments, and have the technical assessment reports published on the UNFCCC website. Vietnam is among the countries that have made the technical assessment report published.

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FREL/FRL in Vietnam

This graph shows the process of FREL/FRL preparation and submission of Vietnam. Actually, Vietnam has started preparing the FREL/FRL since 2009 with the support from Finland and the Japanese governments, as well as the Ministry of Agriculture and Rural Development[1] of Vietnam. However, from 2015, with the approval of UN REDD phase II programme, my institution together with the Vietnamese Academy of Forest Sciences[2] have improved the FREL/FRL with the direct technical support from FAO. After completion of the first draft, we organized several consultation meetings to add comments for improvement. After that, the Ministry of Agriculture and Rural Development has validated and endorsed the FREL/FRL submission of Vietnam and submitted it to UNFCCC in January 2016. Our submission has received a concentrated review process in March 2016. Based on the feedback from the concentrated review, we modified our FREL/FRL submission and resubmited it in July 2016. After that, our national team on FREL/FRL have had intensive discussion and action with the technical assessment (TA) team to give them more information for clarification. Finally, the technical assessment report has been published in May 2017.
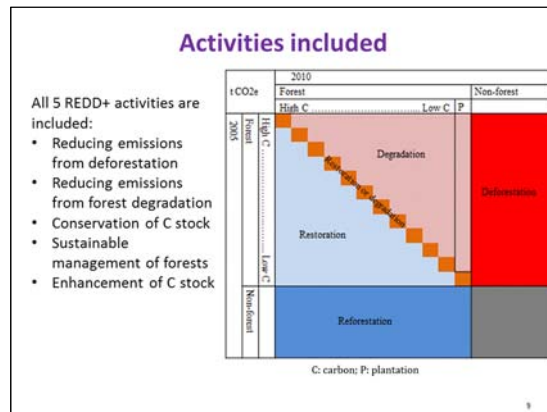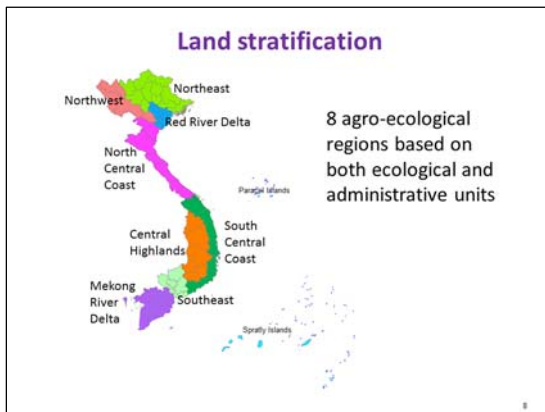

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[1] https://www.mard.gov.vn/en/Pages/default.aspx
[2] http://vafs.gov.vn/en/
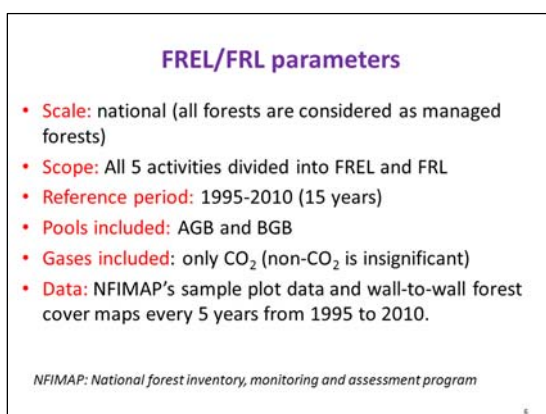
About the parameters of our country FREL/FRL, first was the scale. Since in Vietnam we have historical data at the national level, we have decided to develop the FREL/FRL at the national level. About the scope, because of recent reforestation, the forest cover in Vietnam has been increasing. That is why we decided to include all of the five REDD+ activities. However, in the report, we divided them into two different reference levels, FREL and FRL. The reference period is from 1995 to 2010. It is because of the availability of our historical data. About the pools included, we only included above-ground biomass and below-ground biomass. For other carbon pools like the deadwood, litter, and soil, we excluded them because we do not have country-specific data to calculate these carbon pools. About the gases, we excluded non-CO_2 because it is not significant based on some research. In order to develop FREL/FRL, we use the sample plot data and also the forest cover maps every five years from 1995 to 2010 generated from the National Forest Inventory, Monitoring and Assessment Programme (NFIMAP). This programme was implemented by our institute.

Forest definition and classification

Forest definition:
– Following Circular no. 34 (2009)
– Minimum area: 0.5 ha
– Minimum height: 5m
– Minimum canopy cover: 10%

Classification:
– 17 types in total
– 12 forest types (1 to 12)
– Types 1 to 3 are based on timber volume

| Code	Forest and land use type
1	EGBL - rich
2	EGBL - medium
3	EGBL - poor
4	EGBL - regrowth
5	Deciduous
6	Bamboo
7	Mixed woody - bamboo
8	Coniferous
9	Mixed broadleaf - coniferous
10	Mangroves
11	Limestone forest
12	Plantations
13	Limestone without forest
14	Bared land
15	Water bodies
16	Residence
17	Other land

We used our national forest definition in circular number 34 issued by the Ministry of Agriculture and Rural Development. This definition defined forest as a land expanding more than 0.5 hectare, having trees with minimum height of five meters, and having minimum canopy cover of 10%. About the classification, we classify the forest and land use into 17 types in total. There are 12 forest types numbered from one to 12, and five non-forest types. For the evergreen broadleaf forest, which accounts for about 70% of Vietnam, we further divide those into three subtypes based on the timber volume. Here you can see that the forest type number one is evergreen broadleaf with rich timber volume. Number two is medium timber volume, and number three is poor timber volume. By dividing the evergreen broad leaf forest into three subtypes, we can monitor the forest degradation and also forest enhancement.

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Vietnam is a long country and has many agro-ecological regions. One forest type may have different carbon density across agro-ecological regions. That is why we have to stratify our mainland into eight agro-ecological regions based on both the ecological and administrative division.

Before, I have mentioned that in Vietnam we have included all of the five REDD+ activities. Here I would like to explain a little bit more about this. Actually, I have mapped these five REDD+ activities into four categories here in the matrix. One is deforestation, which includes all of the conversions from a forest type to a non-forest type. The next one is forest degradation, which converts forest types with high carbon density to forest types with low carbon density. The third category is forest restoration, which converts a forest type from low carbon density to a forest type with high carbon density. The last one is reforestation including all of the conversions from a non-forest type to a forest type. Therefore, the conversion of carbon stock and sustainable management of forest can be mapped to restoration and enhancement of carbon stock can be mapped to restoration and also reforestation.

## Calculating Emissions/Removals and Data Generation for FREL/FRL
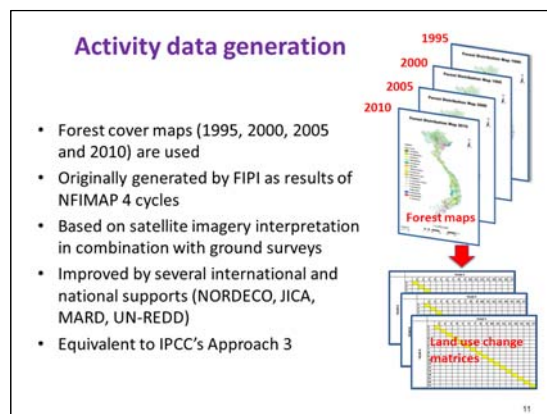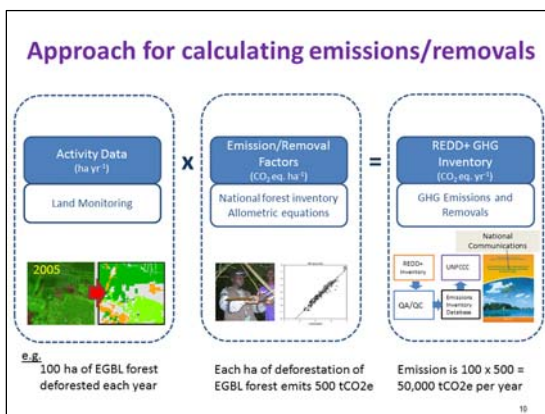
To calculate emissions and removals, we follow the approach from the IPCC. We multiply the activity data by the emissions and removal factor to get the total emissions and removal. For example, if there are

100 hectares of evergreen broadleaf forest deforested each year, and each hectare of deforestation of an evergreen broadleaf forest emits 500 tons of CO_2, then the total emission is 100 multiplied by 500 and equal to 50,000 tons of CO_2 per year.

To generate activity data, we use forest carbon maps at four time points in 1995, 2000, 2005, and 2010. These maps were originally generated by our institute as results for the four cycles of NFIMAP. The method for generating these maps is based on satellite imagery interpretation in combination with ground survey. These maps have been improved by many international and national supports from Nordic Agency for Development and Ecology[3] (NORDECO), JICA, the Ministry of Agriculture and Rural Development, and finally the UN-REDD[4] Programme. Using this approach, we can track the change. Especially our approach corresponds to IPCC's approach three.
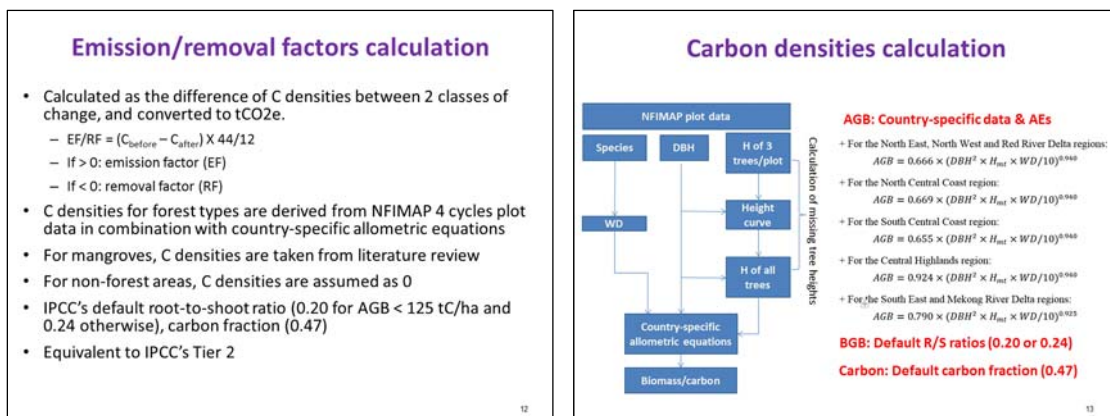

The emission/removal factor was calculated as the difference of carbon densities between two classes of change, and then converted to tons of CO_2. You can see from the formula here we take the carbon density before the conversion minus the carbon density after the conversion, and then convert to tons of CO_2. If the result is positive, it is the emission factor. Otherwise, it is the removal factor. Carbon densities for different forest types were derived from the plot data of NFIMAP in combination with country-specific allometric equations. For mangroves, because the number of sample plot is very few, we used result from the other research institute. For non-forest types, we assumed that carbon density is equal to zero. We also used IPCC's default root-to-shoot ratio, which is 0.2 when the above-ground biomass less than 125 tons of carbon per hectare, and 0.24 otherwise, and use the default carbon fraction of 0.47. Our method uses both country-specific data and the IPCC default values, so it is equivalent to IPCC's tier two.

This flowchart shows the process of calculating the carbon density from the plot data of NFIMAP. From the species information, we can assign the wood density, and from the DBH and heights of three

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[3] https://www.nordeco.dk/
[4] http://www.un-redd.org/

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trees per plot, we can develop the height curve for each forest type and each eco region. Then we use the height curve and the DBH as the predictors to estimate the heights all other trees. Finally, we use three predictors: wood density, DBH, the height, and country-specific allometric equations to estimate the above-ground biomass, then use the default root-to-shoot ratio to estimate the below-ground biomass, and use the default carbon fraction to calculate the carbon density.
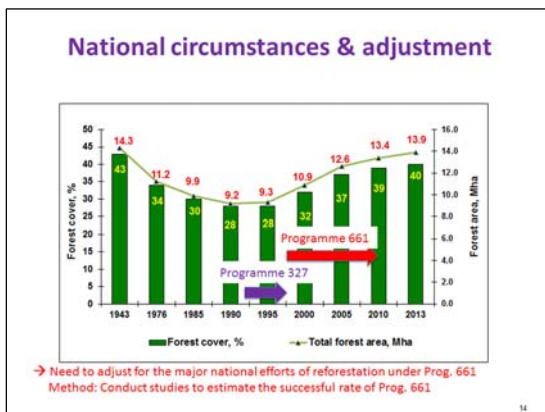

This graph shows the forest dynamics of Vietnam from 1943 to 2013. You can see that, from 1943 to 1995, the forest cover of Vietnam had steadily decreased from 14.3% to 9.2%. At that time, the government of Vietnam has recognized the environmental importance of forest, and then the government invested in several programs in order to reverse the trend. Among these programs were program number 327 and program number 661. Program number 661 is the largest reforestation program of Vietnam so far. It aimed to reforest about five million hectares over 12 years from 1998 to 2010. In the future, it is very difficult for Vietnam to invest in such a big reforestation program. That is why we propose to make the adjustment for the impact of the program 661 from our forest reference level. Our method for assessment is we conduct a study to estimate the successful rate of program 661, and then make the adjustment accordingly.
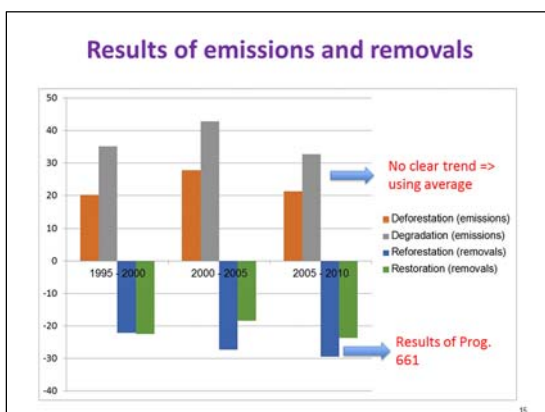
This graph shows our final result at the national level about the emissions and removals of the three time periods from 1995 to 2000, from 2000 to 2005, and from 2005 to 2010.   The orange bars here show the emission from deforestation.   The grey bars show the emission from forest degradation.   The blue bars show the removal from deforestation, and the green bars show the removal from forest restoration. You can observe that there is no clear trend here.   That is why we decided to use the average to make our FREL and FRL.   One more observation is that removal from reforestation for the period from 2000 to 2005 and from 2005 to 2010 is higher than the removal from reforestation in the period from 1995 to 2000. This clearly shows the impact of the program 661.
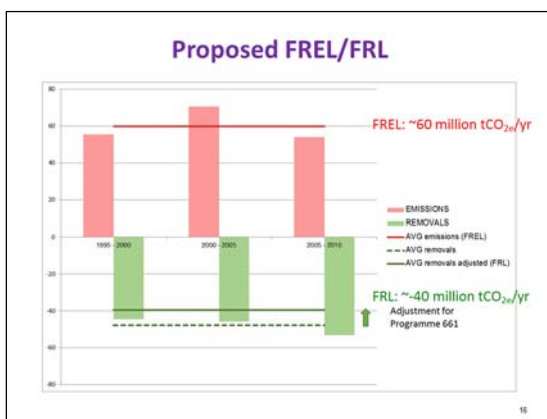
And this graph shows our proposed FREL and FRL.   The red bars here show the emissions from deforestation and forest degradation.   This red line shows the average of three time periods.   It is also our proposed FREL, which is about 60 million tons of CO_2 per year.   The green bars show the removals from reforestation and forest restoration.   The dotted green line shows the average over three time points. The solid green line shows the adjusted forest reference level, which is about minus 40 million tons of CO_2 per year.

Technical Assessment Summary/Recommendations

This slide shows the summary of the technical assessment.   The technical assessment team assesses

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that Vietnam's FREL/FRL is overall in accordance with the guidelines for submission of information on FREL/FRL. They also acknowledged Vietnam's efforts to improve the transparency of the data used in the construction of its FREL/FRL. They also commend Vietnam for showing a strong commitment to the continued improvement of this FREL/FRL estimates in line with stepwise approach. You can access the technical assessment report on the UNFCCC website.
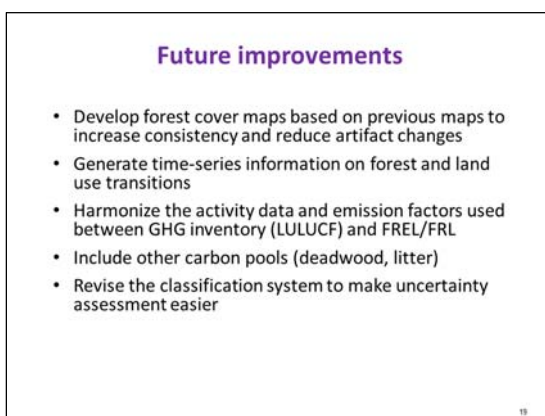
The TA team also made several recommendations for Vietnam to improve our FREL/FRL. First, we should use consistent an approach for image interpretation across the time series. We should harmonize the activity data and emission data used between the LULUCF GHG inventory and the FREL/FRL submission. We should provide time-series information on forest and land use transitions. We should use time-series consistent data in the estimation of carbon density. We should improve the definition of forest degradation to include thresholds like canopy cover or carbon stock decline to exclude short-term loss of carbon stocks. We should include non-biomass pools: soil, deadwood, and litter and non-CO_2 gases. We should also assess the effect of forest fires on the resulting non-CO_2 emissions from deforestation and forest degradation.

Future Improvements

Based on the recommendations of the TA team, we have made a plan for near future improvement of our FREL/FRL. First, we will develop forest cover map based on previous maps to increase the consistency and reduce artifact changes. We will generate time-series information on forest and land use transition. We will harmonize the activity data and emission factor used between the LULUCF sector of the GHG inventory and FREL/FRL submission. We will include other carbon pools of soil, deadwood, and litter. We will revise the classification system to make the uncertainty assessment easier.

I would like to take this opportunity to thank all the donors that are supporting us in the establishment of the FREL/FRL, in particular the UN-REDD Vietnam programme, the Norway, Finland, and Japan governments, FAO, and other organizations. Finally, thank you for your attention.