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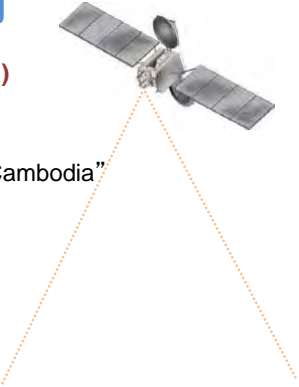
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## Cambodia Preparing Land Cover Map 2014 for REDD+ and Future Monitoring


(Update Progress Information)

6th Taskforce Meeting  
"National Forest Monitoring Systems in Cambodia"  
Rock Royal Hotel, Kep. 30<sup>th</sup> Dec 2014

Presented by: Chivin LENG and MRV/REL Team  
*Deputy Director of Forestry and Community Forestry*




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## Presentation Outline

- I. Historical Information**
- II. Generate Land Cover Map 2014 for REDD+ Program**
- III. Cambodia Land Monitoring Proposal**
- IV. Current Progress**
- VI. Noted**

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## I. Historical Information

The GIS and Remote Sensing lab of The Forestry Administration (former called Department of Forestry and Wildlife) was set up by GTZ in 1995.

Since February 2004 This Unit was upgraded to Watershed and Forestland Management Office. This office have been being run by our own resources. Currently was known as Watershed Management and Forest Cover Assessment Office (WFA/DFC/FA).

- ☐ **Forest cover assessment 1992/93, 96/97(MRC/GTZ)**
- ☐ **Forest cover assessment 2002 (FCMCP) Verified by FRM/ SGS, 2006(DANIDA/Dfid) Verified by GRAS Copenhagen.**
- ☐ **Forest cover assessment 2010(ITTO/DANIDA) Verified by GRAS Copenhagen.**

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### ❖ Main Purposes:

- Evaluation result with Cambodian Millennium Development Goal (CMDG) indicator.
- To monitor forest cover change as the measure assessment of current forest resource trend for preparing proper SFM plan
- As basic information for preparing forest management plan and strategic plan to support NFP 2010-2029

#### 1.Forest Cover Assessment:

Done by GIS & RS Staff of FA.

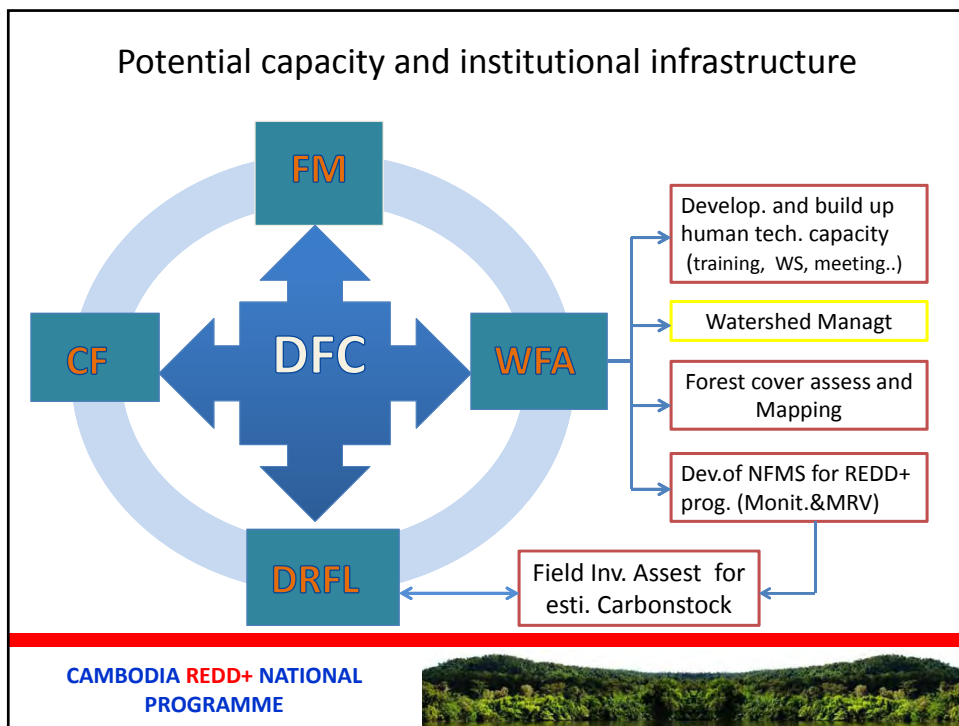
#### 2.Quality verification Forest Cover Data by GRAS (Geographic Resource Analysis & Science, University of Copenhagen)

#### -Satellite Image :

- . Landsat ETM(Michigan University) & Landsat 5 (GISTDA-Thailand)
- . Acquired:January-March
- . Total Scene Coverage 15 Scenes

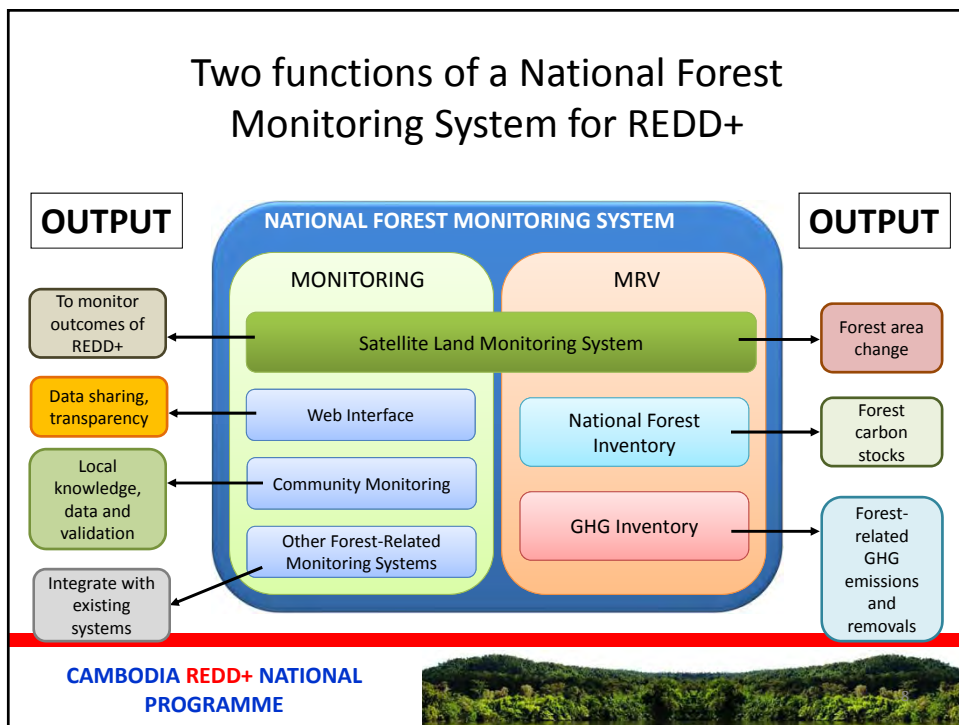
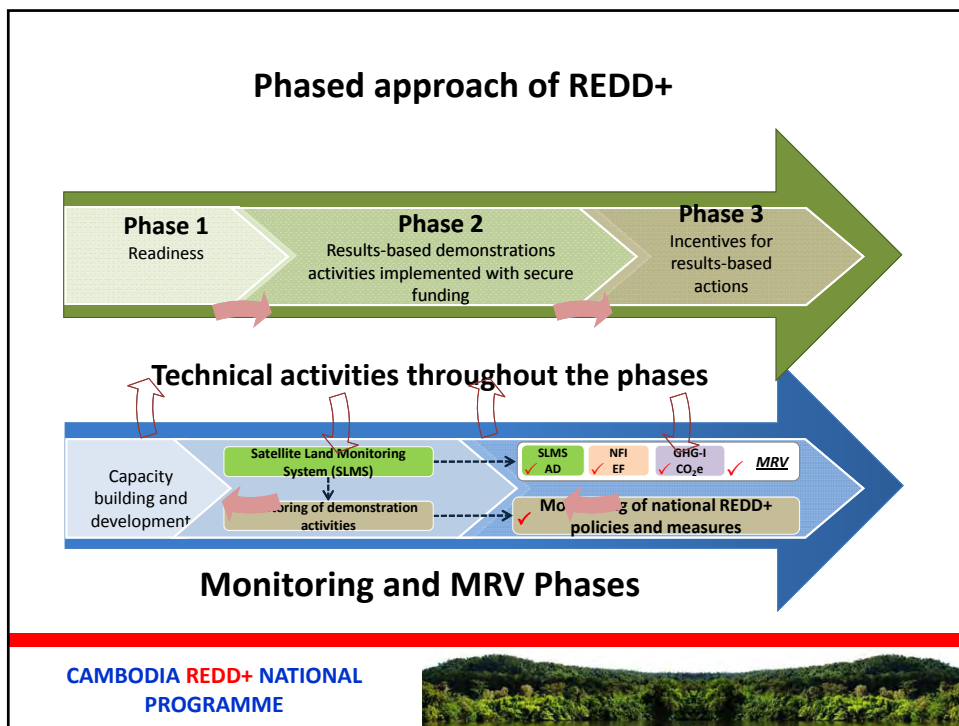
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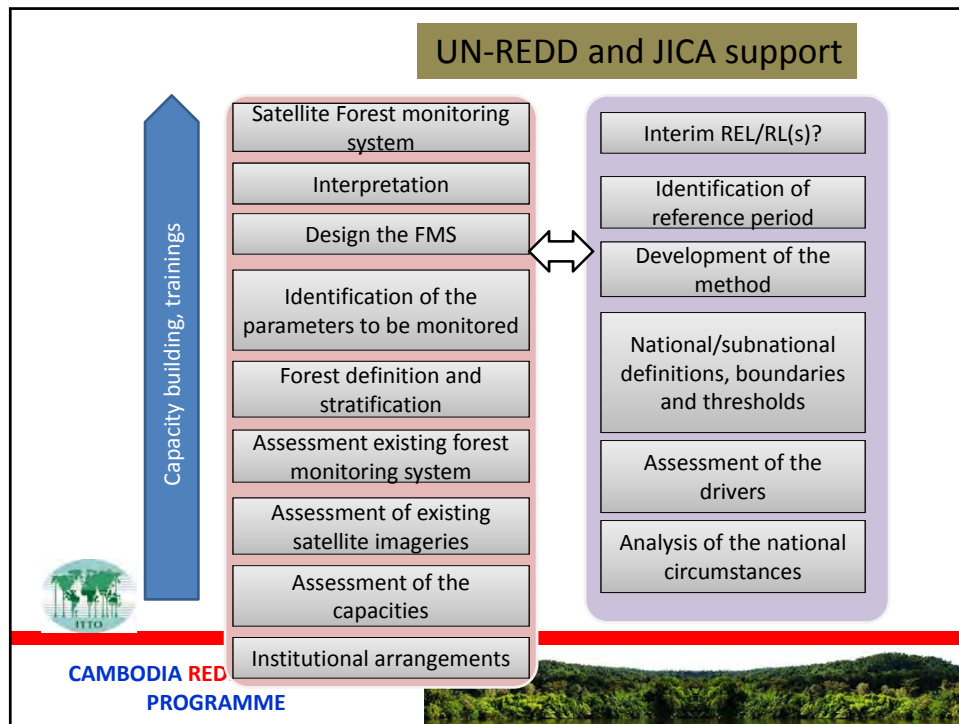




## II. Generate Land Cover Map 2014 for REDD+ Program

Choice of methodology development for current and future plan of Cambodia's forest monitoring systems





## A. Improve technical capacity and build up system

### ❖ Conduct training and software practices

Output: more training in professional REDD+

Out come: To assist country to set up protocol of NFM System



- Evaluated and assessment for set for enhancing technology/ equipments
  - Manpower resources capacity: Senior 4, Junior 4, Admin 2
  - Set up and functioning equipments

- Capacity assessment
- Discussion on identified the level of training
- 1<sup>st</sup> step of training capacity has been started

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## Attendant of various technical training and WS

### Capacity building on SLM :

- Training on GHG inventory reporting (2 steps)
- Delegation of Cambodia technical specialist has been to INPE, Brazil on SLC base system for National REDD+ (2 weeks)
- A series of training by JICA-CAMREDD expert on RS/GIS support tools in CAM and JAPAN
- Training and exchange technical transferred between FA-FFPRI through both countries
- LCCS3 training WS on land classification legend by FAO-UNREDD

### Capa.Build on designing sample plot for FI asst( Proj asst. for carbon stock) :

- Attend training on NFI testing method in different landscape of vegetation covers
- Training on methodology design for field invent. Assessment(FIA) and data collection for Prey Long proposed REDD+ project site (2times)
- Training review on FIA and data collection for Seing Pang LC project support by APFNet
- Training conducted to 6FAC for implementing at sub-national REDD+ project.
- Plus number of WS and meeting

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- On job training on tech. gaps identification
- Meeting discussion with int.experts on very tech. points



**Training on set up plot and  
practise use of support  
field equipment**

### III .Cambodia Land Monitoring Proposal



- (i) As the baseline map, “2014 map” will be produced by using 2013 & 2014 satellite image data (LANDSAT 8). This map will cover the full country surface (Forest/Non-Forest) and will function as a basis for future monitoring future land use and land use changes;
- (ii) Two Historical maps will be used to derive historical land use and carbon stock change development
  - (i) By upgrading of existing 2010 FA map of 2010 . Verification of the map will be done by using ALOS AVNIR2 data for inaccessible areas. (Size of forest and non-forest area may change as the result of upgrading or modification). And consideration of other data sources for non-forest areas.
  - (ii) By translating the 2005/2006 FA map in a comparable legend. Verification of this map has already been carried out by GRAS. And consideration of other data sources for non-forest areas
  - (iii) Additional maps/data points will be considered

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### A. Determine methodology and step forwards

1. Establishment of forest land cover definition and
2. Land cover classes represented by experts
3. Semi-auto classification method
4. Field check for image verification points and correction result
5. Set up RS database system for future monitoring of forest
6. Produce FLCover information map 2014 and report submitted to international communities (COP21)

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## B.Scope of Work of Map Production

- Following elements need to be determined:
- Scale and minimum mapping unit
- Legend (land cover class)
- Source data (which satellite data?)
- Production method (semi-automatic classification, manual editing...etc)
- Accuracy
- By when is the deadline could be achieve ?

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## IV. Current Updated Information



Which Methodology should be consider as  
current and future forest resource assessment?





## For Base map2014 Development

### Technical aspects developed:

- Analysis of Land Cover produced in Cambodia (MRC, MoE, FA, JICA, FAO-GLCN Vegetation map Blasco and others )
- Two National Workshops Land Cover Classification System (organized by UN-REDD)
- Selection Forest Definition (MRV/REL technical team)
- Development Legend (MRV/REL technical team)
- Selection MMU (MRV/REL technical team)
- Collection and selection Satellite (Landsat8 with negligible cloud cover)
- Atmospheric correction of Landsat 8 images (by FFPRI)
- Mosaic production (UN-REDD)
- Segmentation (UN-REDD in collaboration with FFPRI)
- Collection of ancillary data (plantation, ground truth and consulting of national experts)

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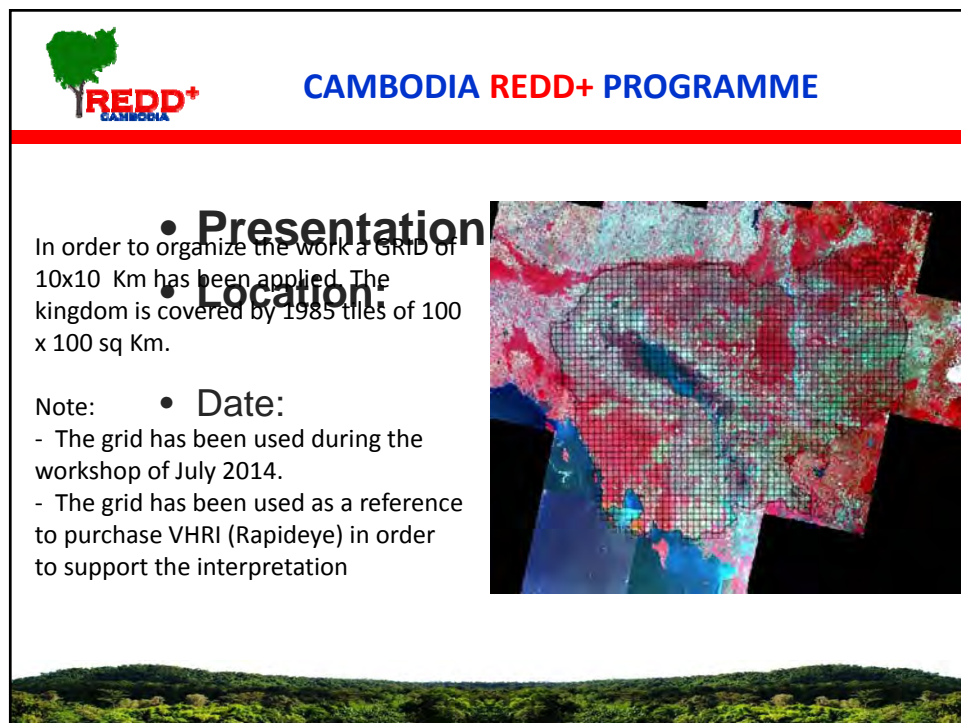
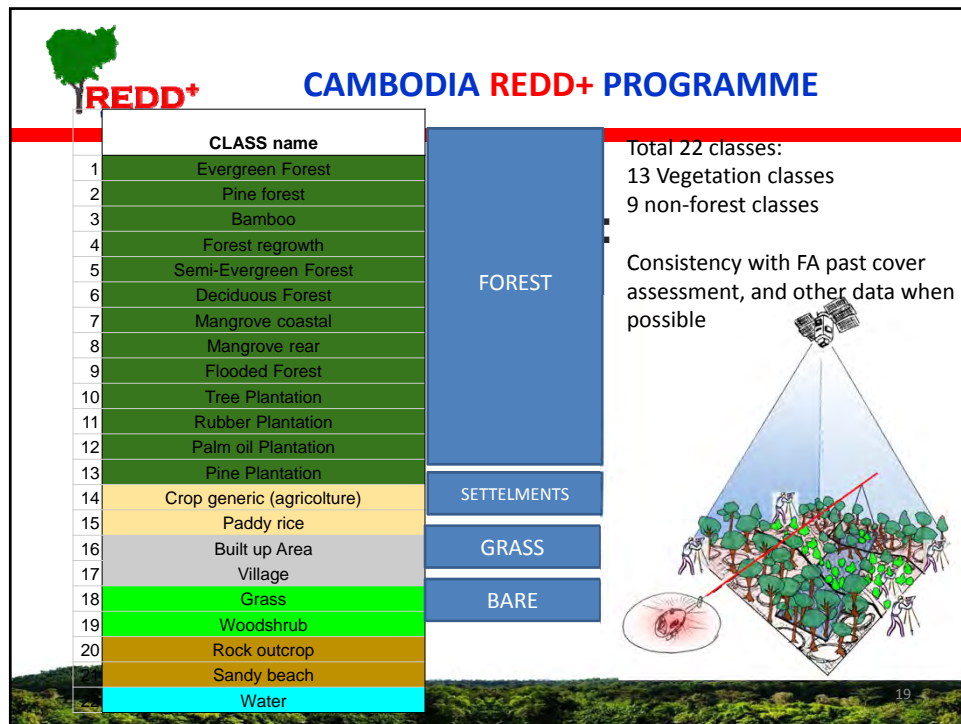


### Technical aspects under development:

- Visual interpretation by FAO and FA
- Collection of visual information from Google Earth
- Collection of very high resolution images for verification and accuracy assessment

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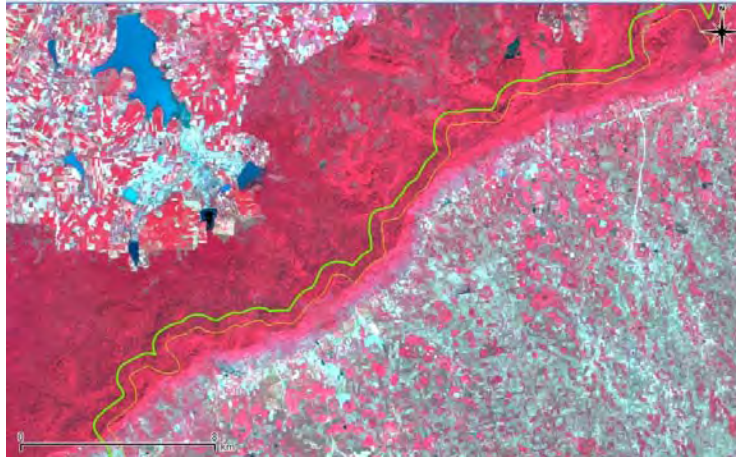






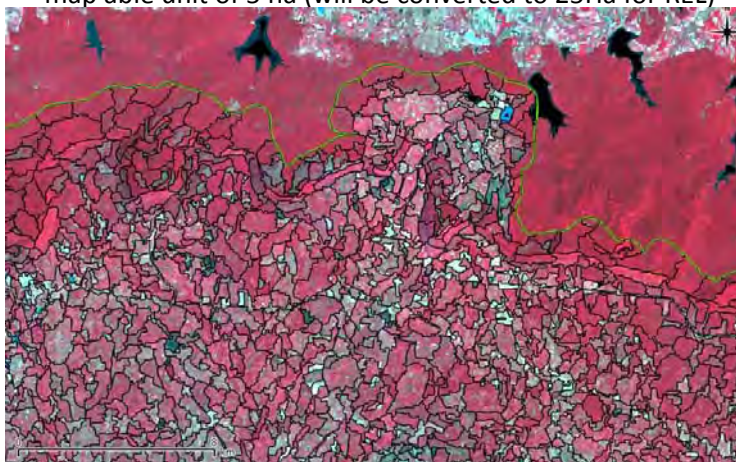
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A buffer of 500 m has been applied to the official Border



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A segmentation of the entire country was made using a minimum map able unit of 5 ha (will be converted to 25Ha for REL)



The country has been organized in 118 interpretation zones. The zones are created in order to group tiles which are as homogeneous as possible.



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The work of interpretation has been assigned to FAO and FA experts

Currently has been calculated an average time of 2 day of work to complete one zone (working only on the interpretation!)

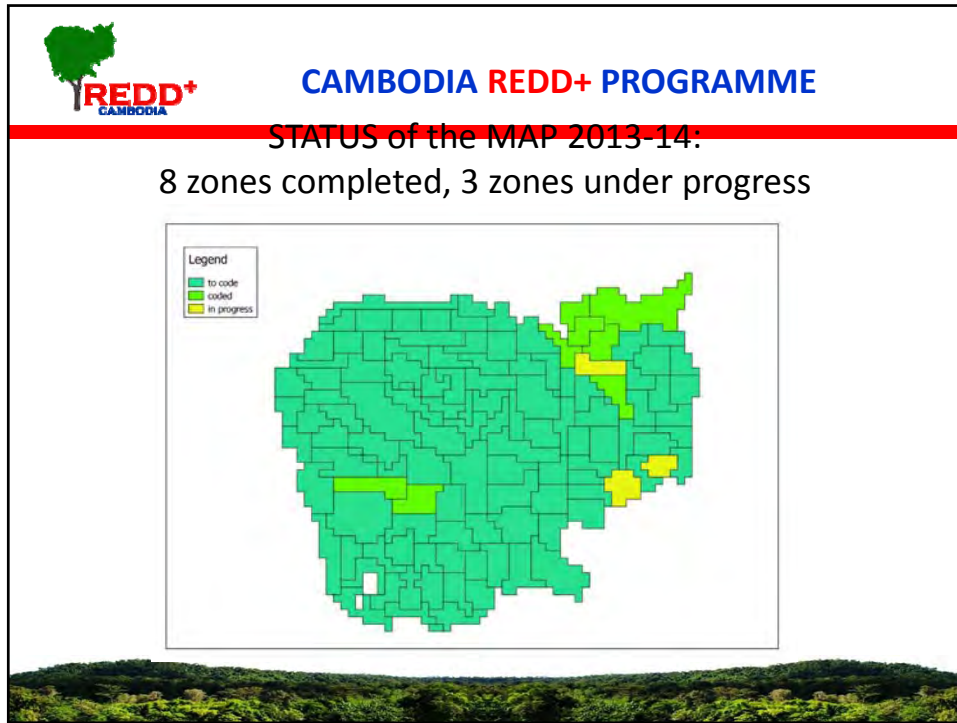
Usually the work of satellite images interpretation gradually speeds up as it proceeds

Additional expert will be sought to assist in the interpretation

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The final goal is the production of a Land Cover/Use Map for REDD+ for the year 2013-14 with the following characteristics:

- Adequate
- Consistent
- Complete
- Transparent

The MAP will be the basis for REL calculation and REDD+ reporting and monitoring

- 5- Establishment of RS ground truth database system for current and future forest monitoring
- 6- Field check for image verification of classification points

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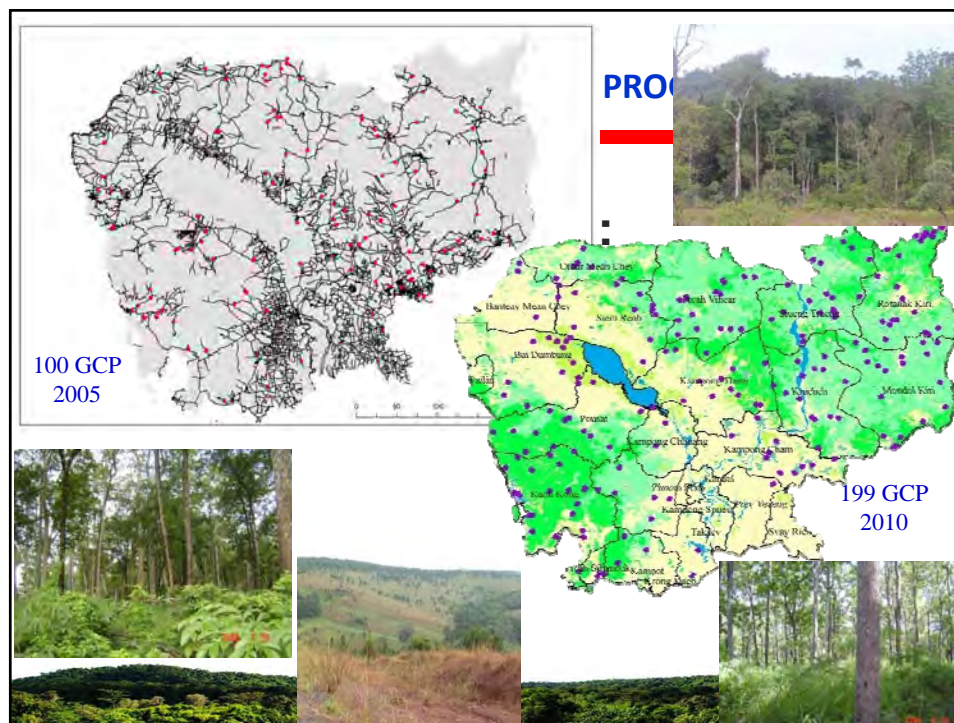
### **Stratification System**

	1988/1989	1992/3	1996/7	2002	2005/2006	2010	2014 (Base Map)
Satellite	LANDSAT	LANDSAT	LANDSAT	LANDSAT ETM+	LANDSAT ETM+	LANDSAT ETM+	Landsat 8
	Hardcopy	Hardcopy	Hardcopy	On-screen	On-screen	On-screen	on-screen
Method	Interpretation	Interpretation	Interpretation	Interpretation	Interpretation	Interpretation	Semi-Autoclassification
By	Mekong Secretariat	Mekong River Commission GTZ	Mekong River Commission GTZ	FA Supported by DANIDA	FA Supported by DANIDA	FA Supported by DANIDA	FA Supported by UN-REDD
Land cover class	20 (Forest 9)		30 (Forest 15)	8 (Forest 4)	5 (grouping of 2002 nomenclature))	5 (grouping of 2002 nomenclature))	13 class
Scale	1/250,000	1/250,000	1/250,000	1/50,000	1/50,000	1/50,000	1/50,000
Minimum unit	1km <sup>2</sup>	1km <sup>2</sup>	1km <sup>2</sup>	0.2km <sup>2</sup>	0.2km <sup>2</sup>	0.2km <sup>2</sup>	
Accuracy					74% (71% before grouping)		Will use high resolution image (spot, geo-eye)

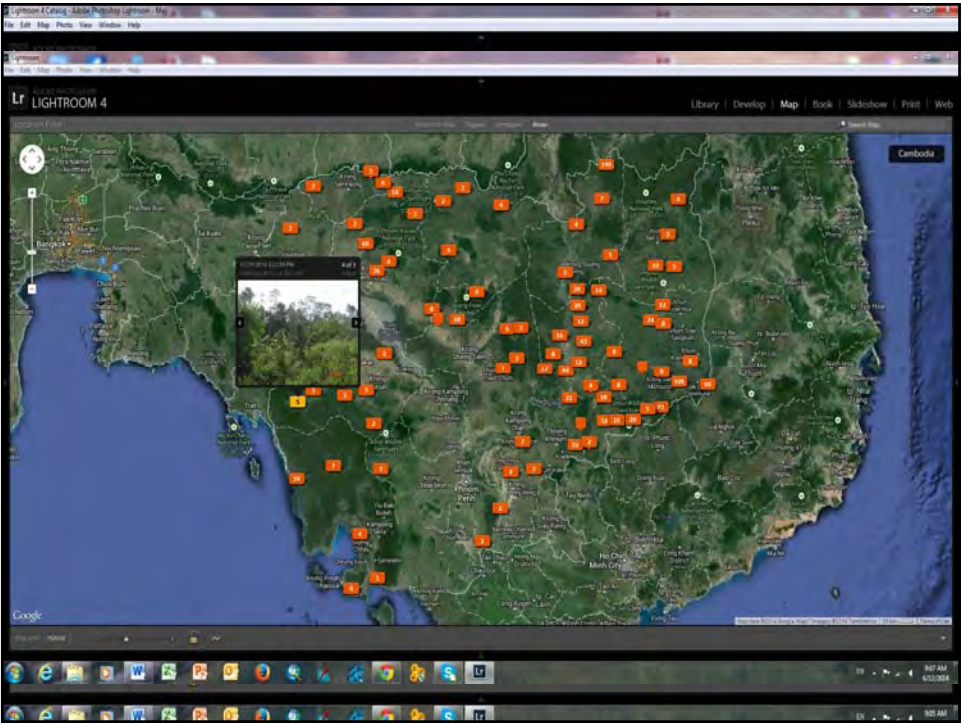
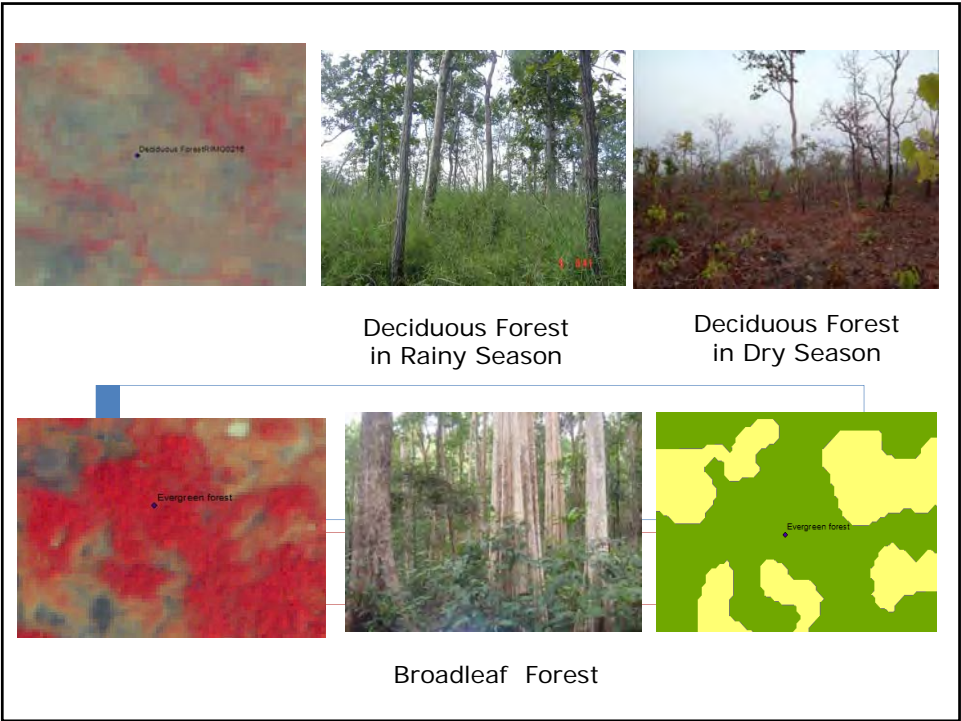
### Software and satellite image that FA received in year 2011/12

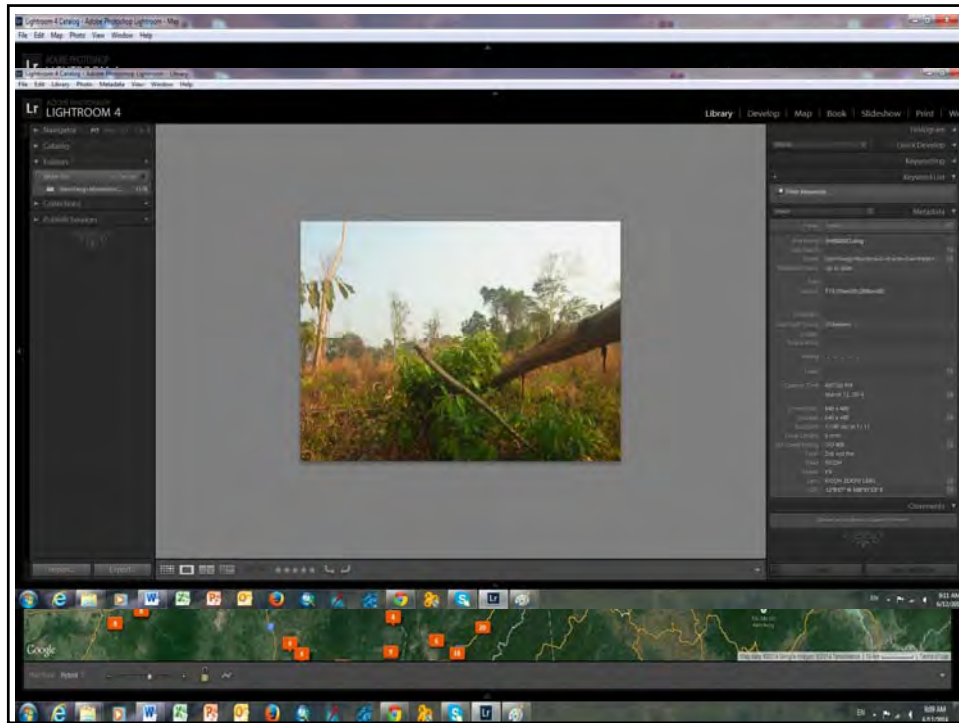
ID	Description	Supported by
<b>Software</b>		
1	ERDAS 2011	JIC
2	eCognition	JIC
3	ArcGIS 10.1	JIC
4	ArcInfo	JIC
<b>Satellite Image</b>		
1	Landsat 1989 ,1998	FFPRI, JIC
2	Spot 2004, 2005,2008,2009,2010	FFPRI
3	ALOS-AVNIR2	JIC
4	ALOS-PALSAR	JIC
5	ALOS-PRISM	JIC
<b>Equipment</b>		
1	Office and analyst	JIC and JICA-CAM-REDD
2	Field forest inventory equipment	JIC and JICA-CAM-REDD

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## Updated Map 2005/06 for REL Development

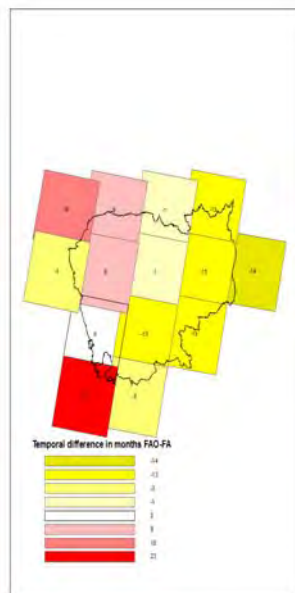
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Production of Cambodia land cover map 2005 is the result of the integration of 2 different land cover database :

- FORESTRY ADMINISTRATION forest cover assessment year 2005-2006
- FAO GLCN Cambodia LAND COVER year 2005
- The two data set have been implemented and harmonized using the new Base Legend of 22 classes.


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#### Consideration :

- FA and FAO land cover database have been produced from the interpretation of 2 different dataset of Landsat images the figure shows the temporal difference of the images used.
- The final map 2005 will be based on the FORESTRY ADMINISTRATION dataset




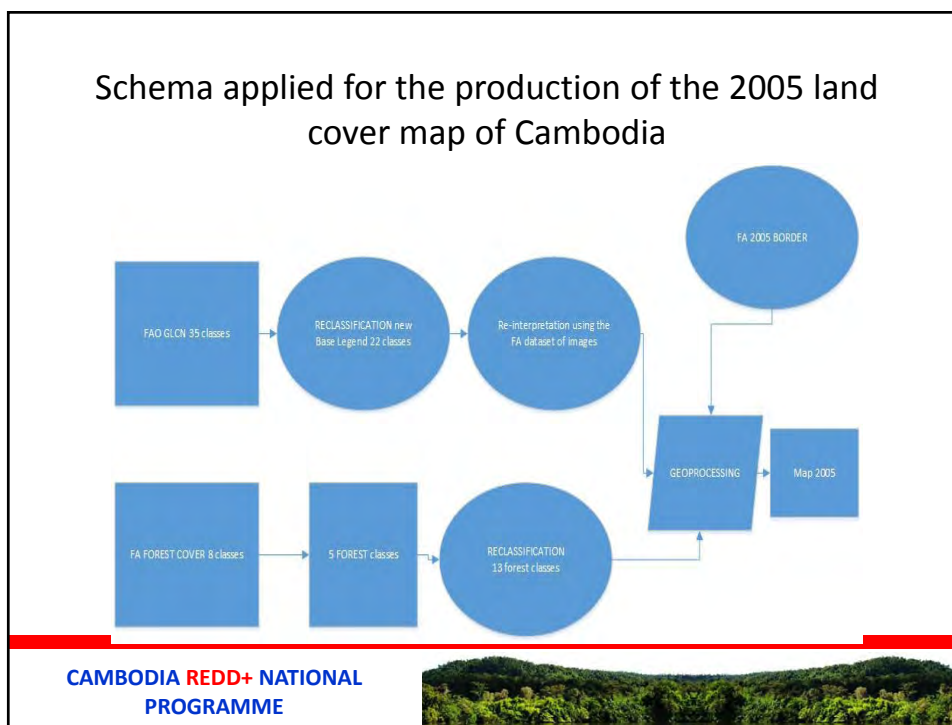


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12550_09032005	8/7/2014 3:42 PM	File folder
12551_08022006	8/7/2014 3:42 PM	File folder
12552_24022006	8/19/2014 9:10 AM	File folder
12650_11012005	8/19/2014 9:17 AM	File folder
12651_11012005	8/7/2014 3:43 PM	File folder
12652_16032005	8/7/2014 3:44 PM	File folder
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12750_23032005	8/19/2014 9:46 AM	File folder
12751_07032005	8/19/2014 9:54 AM	File folder
12752_07032005	8/19/2014 10:01 AM	File folder
12753_02012005	8/20/2014 9:49 AM	File folder
12850_12012006	8/7/2014 3:44 PM	File folder
12851_26022005	8/7/2014 3:44 PM	File folder
QB validation	8/7/2014 3:45 PM	File folder

### FA Landsat dataset (2005-2006)

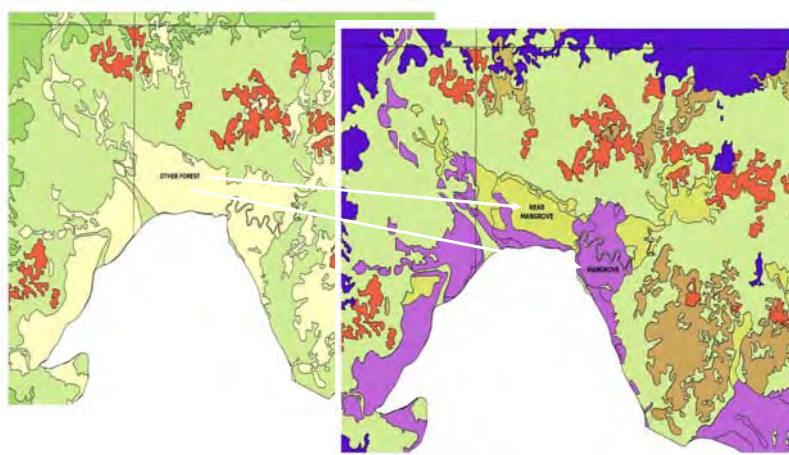
## Reclassification of 5 forest classes into 13 classes of the new Base Legend

FA 2010 classes		CODE
E-F	Evergreen Forest	E
D-F	Pine Forest	P
B-B	Bamboo	B
O-F	Forest Regrowth	Fr
S-E	Semi-Evergreen Forest	Se
D-F	Deciduous Forest	D
O-F	Mangrove	M
O-F	Rear Mangrove	Mr
O-F	Flooded Forest	Ff
O-F	Tree Plantation	Tp
O-F	Rubber Plantation	Rp
O-F	Oil Palm Plantation	Po
O-F	Pine Plantation	Pp

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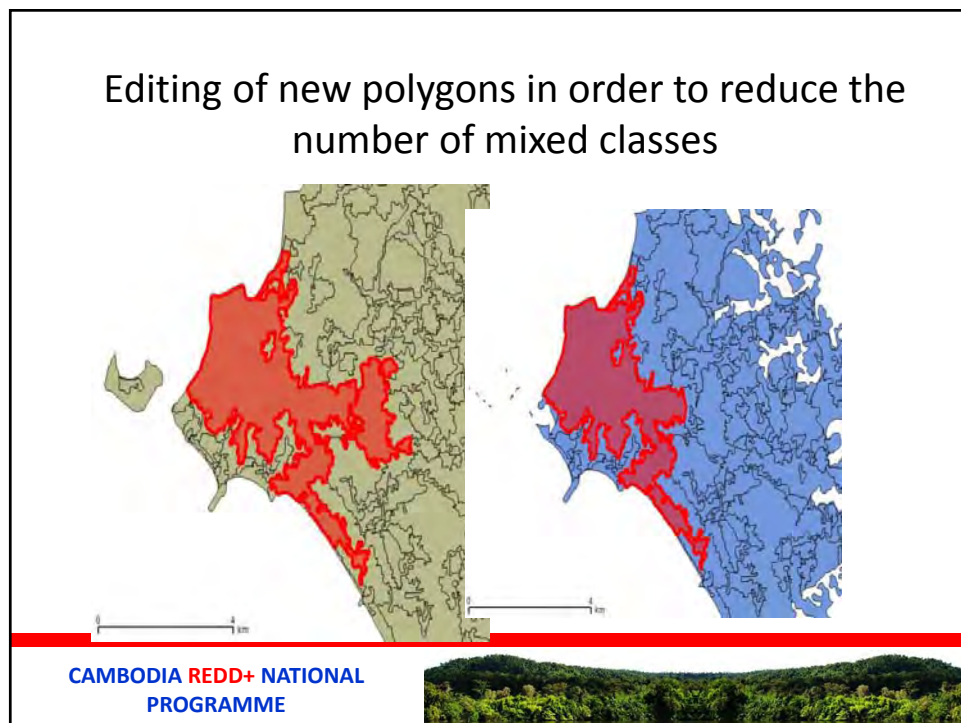
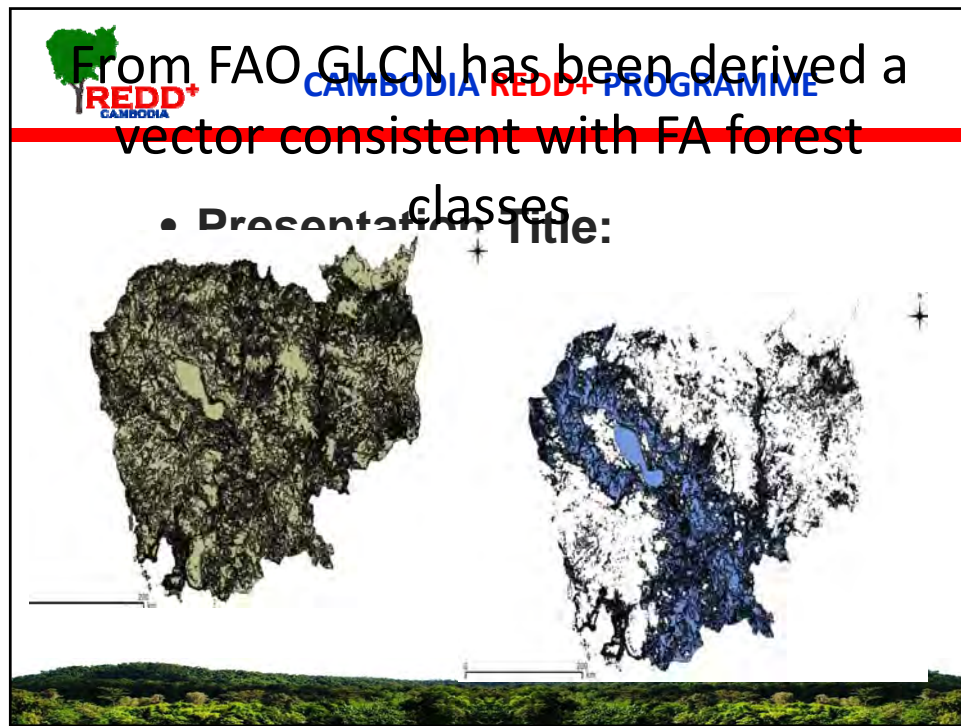
## Correction of past error and editing of new polygons (example: from other forest to mangrove and rear mangrove)

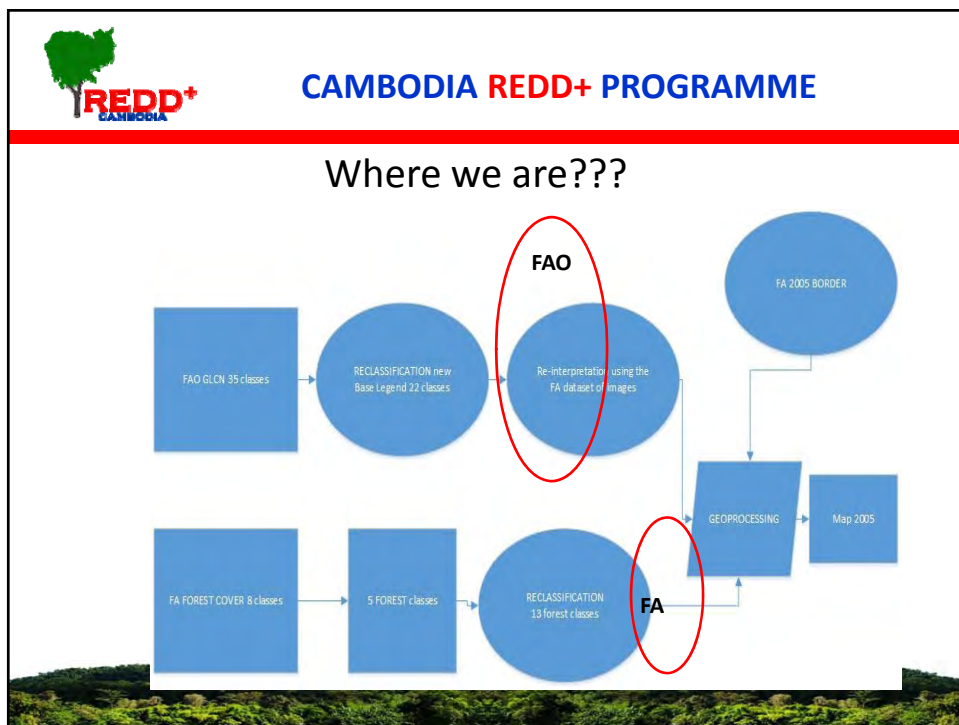
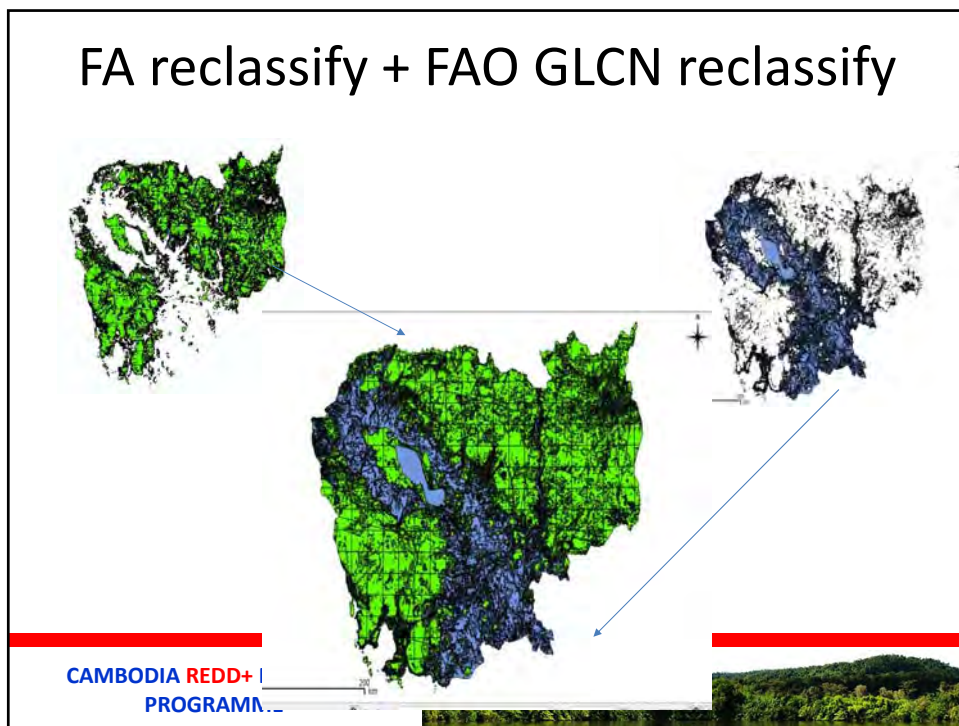


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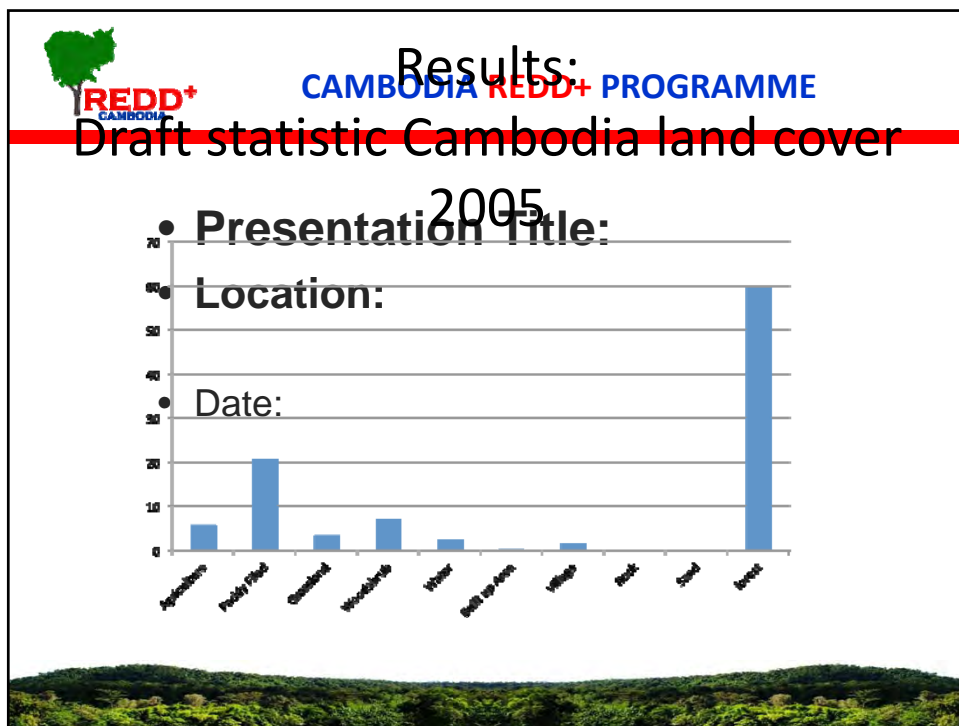












## RESULTS

- Implementation of the forest classes from 5 to 13
- Implementation of the no forest class from 1 to 9
- NEXT
- Checking of the no forest classes using the FA Landsat dataset ( the official statist of FA could be change)
- Application of the official Border ( the FAO GLCN vector is smaller)



## VI. Noted

### Needs of knowledge and experience

Regardless of the type of method used, solid knowledge of remote sensing technology and capacity of image interpretation is necessary.

This means, while classification by software looks like easy, the result is meaningless if not conducted by experienced persons.

### Time is needed

After land cover map is made, accuracy assessment needs to be done. And if the assessment result is not satisfactory, all the process needs to be reviewed and work needs to be done again.

Please do not forget that selection of appropriate satellite images before start of the mapping work takes time.

This means land cover mapping needs enough time if high quality map is required.

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**Thank You  
for Kinds Attention ! ! !**

**REL/MRV TT**

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