



Study on Potential Forests and Land Related to Climate Change and Forests (Progress)

2010.08.13. JICA

Implementing by JOFCA,JAFTA



Objectives of the Study

- ❖ To contribute to facilitation of international efforts for mitigation of global climate change under LULUCF through identifying the potential areas for A/R CDM projects, REDD, and examining possibilities of other non-UNFCCC approaches in Viet Nam.

Study duration

- ❖ The Study is implemented from September 2009 to May 2011 for one year and nine months.

Project components

Main activities of the Study are summarized in the following four components.

- 1. Development of digital maps**
- 2. Model land survey**
- 3. Setting a reference level for REDD and estimating cost and beneficial effects associated with projects for climate change mitigation**
- 4. Provision of information to potential investors**

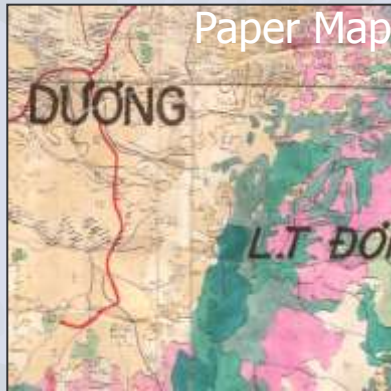
Contents and Progress of “1. Development of digital maps”

The Contents

- ❖ a. Preparation of a GIS map for the total nation area on which AR/CDM potential areas are shown.
- ❖ b. Preparation of a GIS map for total nation forest land on which Forest situation change based on the deforested and forest degraded areas for REDD is shown.
- ❖ These maps are developed through process of classifying the land on the basis of satellite data analysis in the points of three times (year 1990, 2000, 2010) and data on volumes and other forest resources.
- ❖ The carbon volume change for REDD will be estimated based on the map and forest volume data (FIPI National Forest Inventory Data and additional field survey data).

Way of Development of Forest Base Map

1990



LANDSAT



FIPI's paper maps are digitized, and to be modified by using LANDSAT imagery (resolution:30m).

2000



Forest maps are made by interpretation of LANDSAT imagery (resolution: 30m).

2010



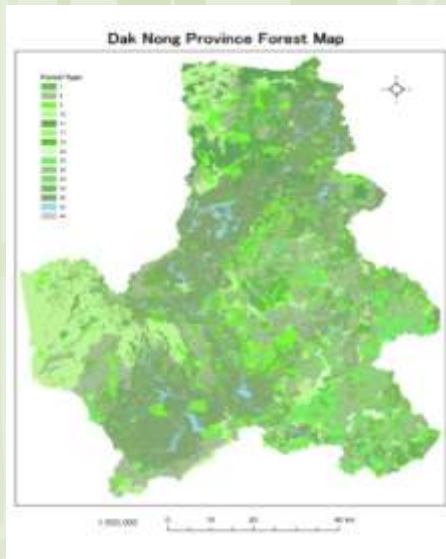
ALOS



Forest maps are made by interpretation of SPOT and ALOS imagery (resolution:2.5m).

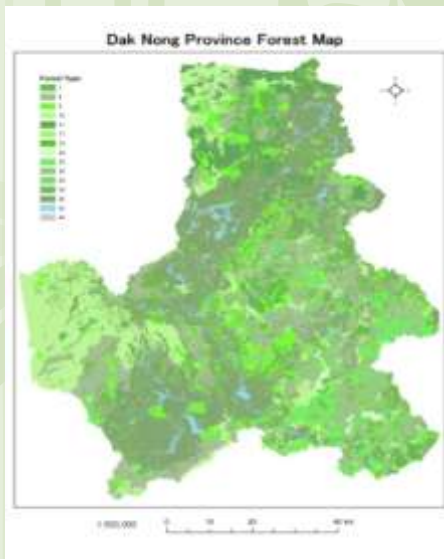
Way of Preparation for AR/CDM Potential Map

Forest Map 2010



Extracting non-forest area and suitable area for plantation such as bare land

Forest Map 1990



Extracting non-forest area

Other GIS data for showing feasibility of plantation

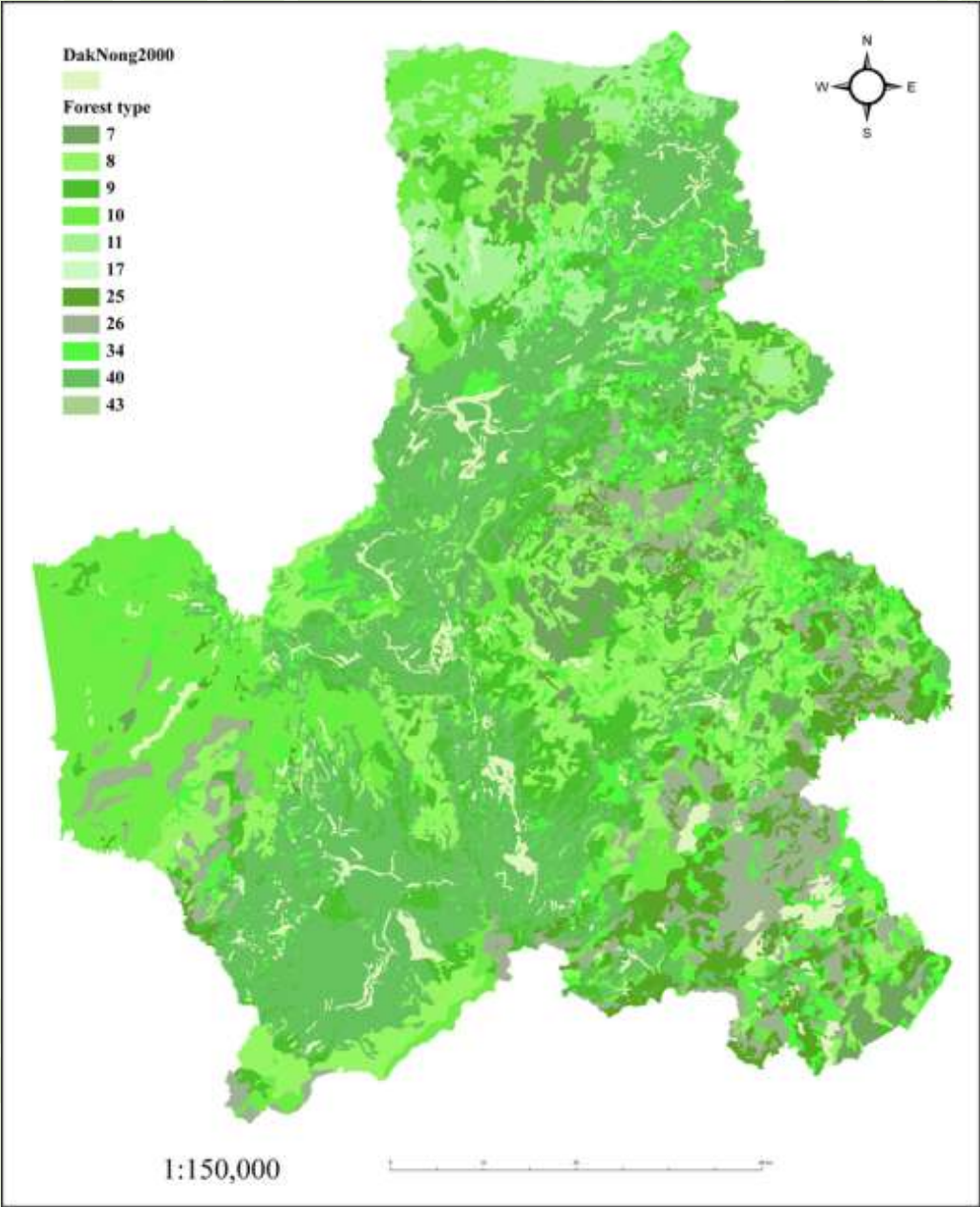
- Elevation Data
- Road Data
- Soil Data
- etc.

**AR/CDM
Potential Map**

The Progress(Developing of Digital Map)

Activities	Progress	Current issues
Map of 1990	Draft results finished at all provinces	Revising interpretation results
Map of 2000	Draft results finished at all provinces	Revising interpretation results
Map of 2010	Draft results finished at 16 provinces	It will be finished by end of August
Purchase SPOT Data	DakNong, ThanhHoa, QuanBinh, QuanNinh still	It will be finished by end of October
Purchase ALOS Data	Already purchased Mekong and Red River basin	Capacity of resolution for interpretation

Examination of model area(DakNong, KonTum, NgheAn, BinhPhuc)

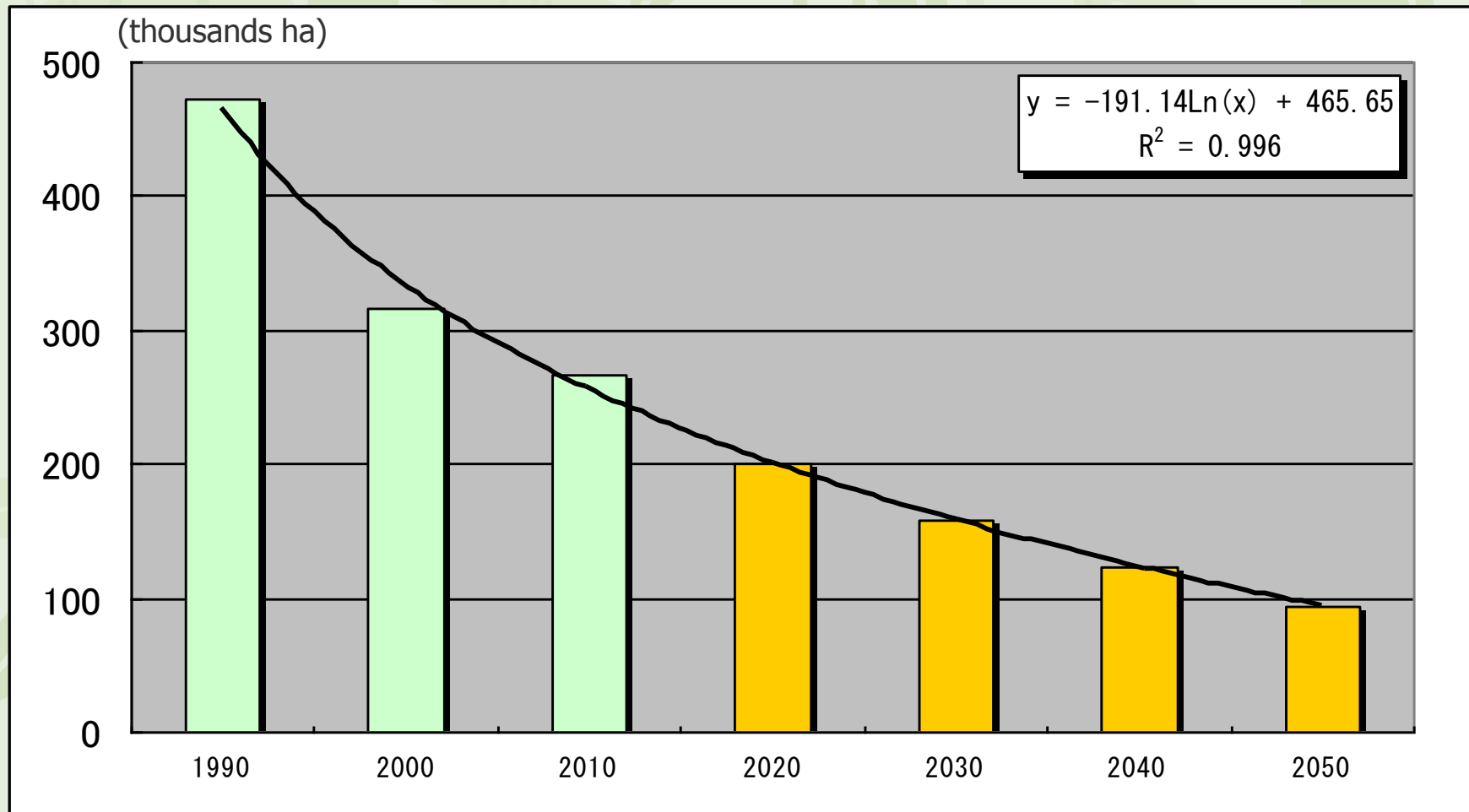


Rich Forest
Medium Forest
Poor Forest
Rehabilitated Forest
Dry open forest
Semi Deciduous Broad-Leaved Forest
Coniferous Forest
Broad-leaved and coniferous mixed Forest
Bamboo forest
Wood and Bamboo mixed Forest
Man-made forest
Non-Forest Land
Other Land
Settled Land
Wet Land

Examination of model area (DakNong)

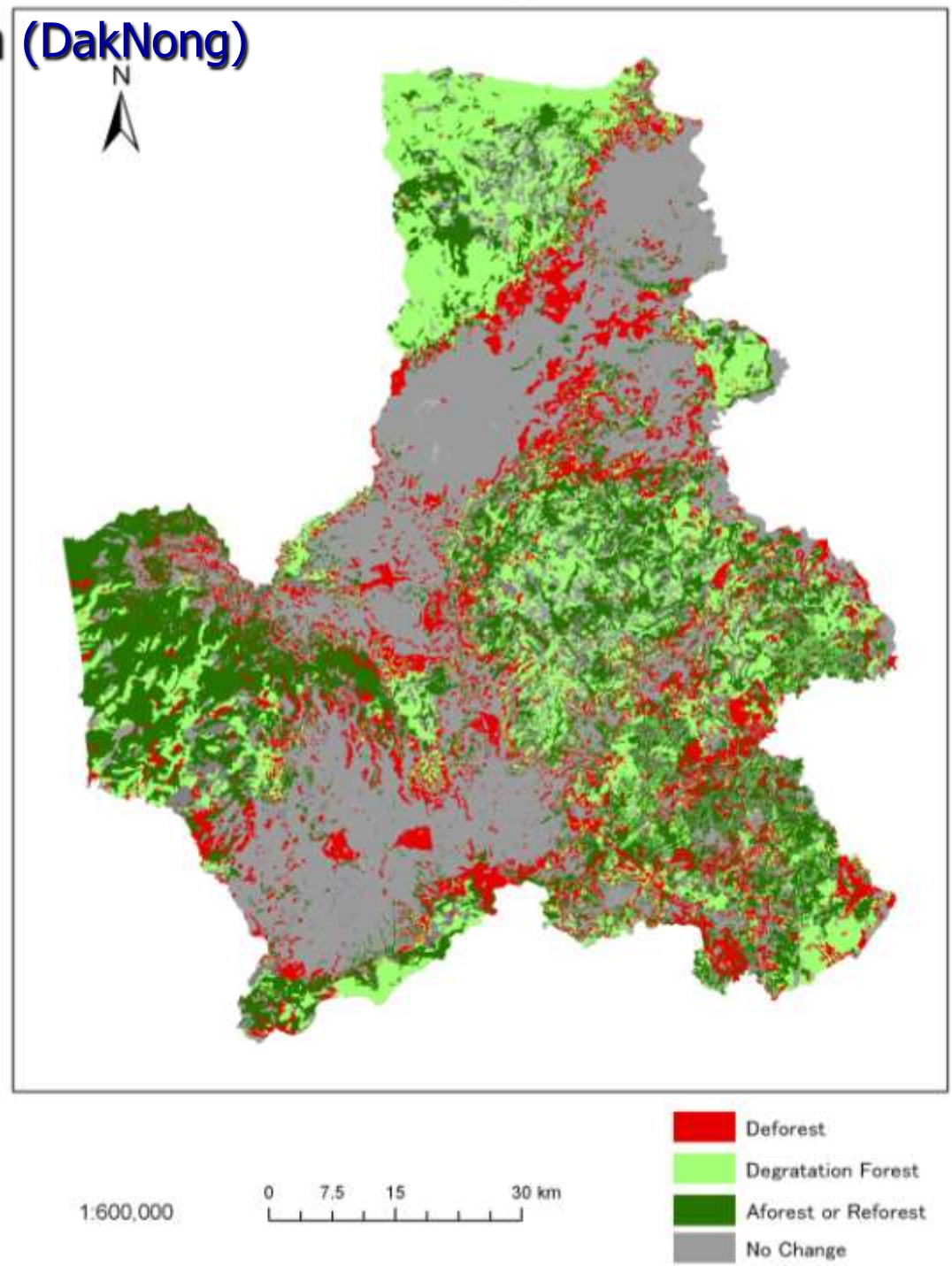
- Forest area in 1990 to 2010 by visual interpretation
- It decrease 472,000ha to 267,000ha
- Extrapolation by retrospective model, we can estimate forest area in 2050 (94,000ha)

Year	Forest area (thousands ha)	
1990	472	Interpreted
2000	317	Interpreted
2010	267	Interpreted
2020	200	Estimate
2030	158	Estimate
2040	123	Estimate
2050	94	Estimate



Examination of model area (DakNong)

- Forest change matrix using GIS software





Examination of model area (DakNong)

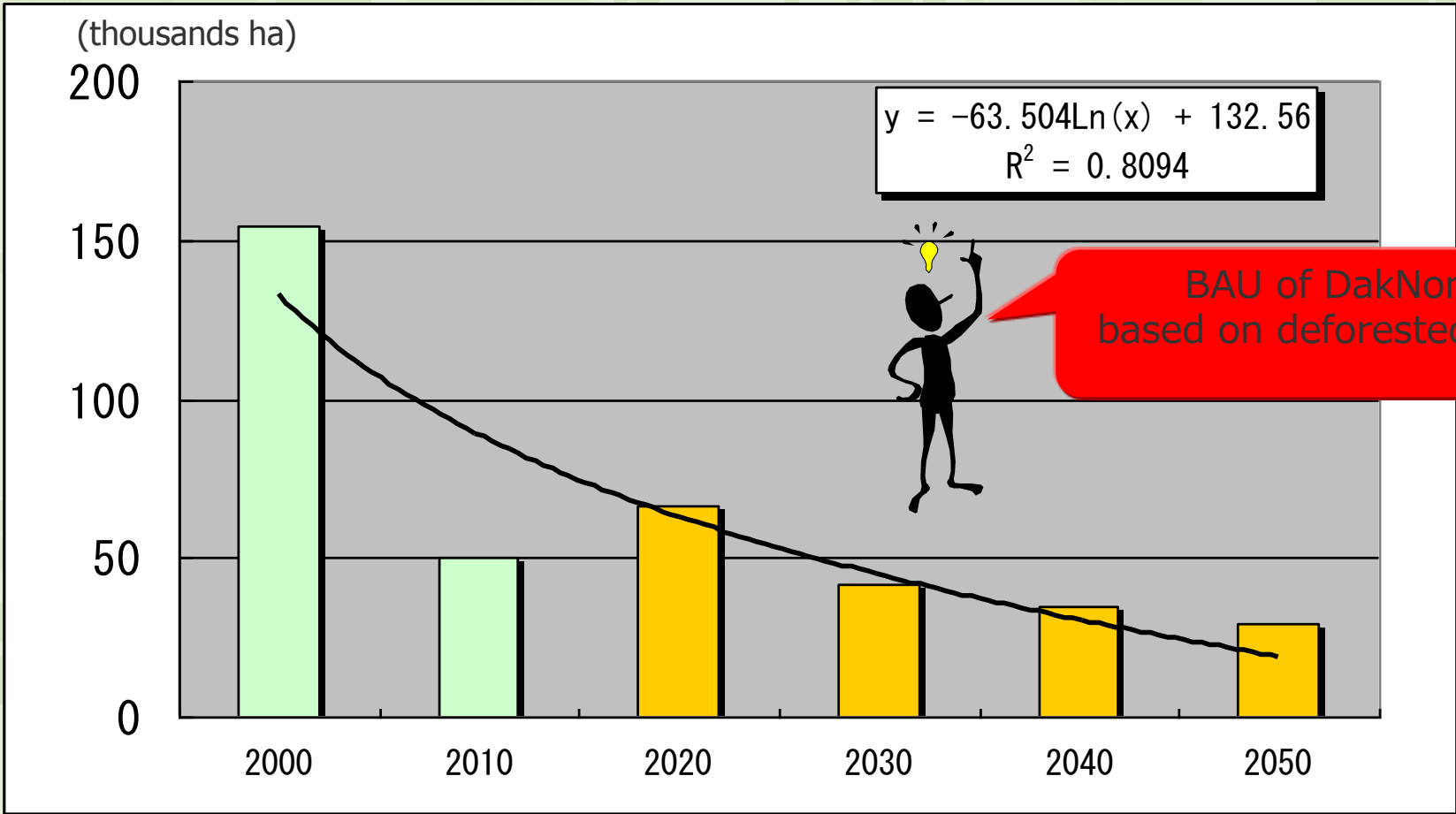
- Forest change matrix using GIS software

Sum of AREA		1990年											
		Rich Forest	Medium Forest	Poor Forest	Rehabilitated Forest	Dry open forest	Semi Deciduous Broad-Leaved Forest	Bamboo forest	Wood and Bamboo mixed Forest	Non-Forest Land	Other Land	Wet Land	Grand Total
2000年	Rich Forest	8.988	11.705	1.369	238	1.370	304	148	443	102	2	3	24.672
	Medium Forest	33.818	22.525	8.930	5.155	5.567	1.738	226	10.086	998	1.150	7	90.199
	Poor Forest	13.529	15.178	12.014	3.036	7.901	1.502	1.249	4.520	1.148	2.222	4	62.302
	Rehabilitated Forest	20.466	15.986	26.970	9.723	5.049	4.508	1.051	7.664	3.155	2.046	12	96.629
	Dry open forest	236	7.009	376	0	19.429	2.671	2	564	110	59	3	30.459
	Semi Deciduous Broad-Leaved Forest	1	600	45	0	300	147	0	15	3	1	0	1.112
	Coniferous Forest	0	0	34	0	43	0	0	0	0	0	0	76
	Broad-leaved and coniferous mixed Forest	360	271	1	229	0	0	0	1.668	25	0	0	2.554
	Bamboo forest	3.635	3.028	3.724	2.917	153	31	1.530	13.874	1.927	787	12	31.618
	Wood and Bamboo mixed Forest	5.141	4.711	5.779	7.650	681	0	3.234	19.992	2.007	783	9	49.986
	Man-made forest	1.632	1.428	1.475	953	39	0	126	1.207	658	1.447	2	8.967
	Non-Forest Land	6.251	9.616	7.346	4.687	10.147	387	1.339	7.189	5.890	5.864	23	58.740
	Other Land	25.122	27.947	29.795	5.758	27.662	770	1.518	8.992	9.872	41.213	247	178.896
	Settled Land	338	1.190	538	270	993	55	21	75	701	7.262	75	11.520
	Wet Land	127	48	63	3	131	8	33	88	18	472	2.331	3.321
	Grand Total	119.644	121.241	98.461	40.621	79.462	12.121	10.476	76.376	26.614	63.308	2.728	651.052

Examination of model area (DakNong)

- Deforestation area between 1990 to 2000(155,000)
- Deforestation area between 2000 to 2010(55,000)
- Extrapolation by retrospective model, we can estimate deforestation area in 2050 (29,000ha)

Year	Deforestation area (thousands ha)	
2000	155	Calculated
2010	50	Calculated
2020	67	Estimate
2030	42	Estimate
2040	35	Estimate
2050	29	Estimate



The Progress (Data collection of NFI)

Activities	Progress	Curren issue
1 st Cycle 1991 to 1995	It w ill complete by the end of August	<ul style="list-style-type: none">▪ Consistency of classification▪ Needs verification process▪ Stratification boundary (Ecological zone)
2 nd Cycle 1996 to 2000	Data input completed	
3 rd Cycle 2001 to 2005	Data input completed	
4 th Cycle 2006 to 2010	It w ill complete by the end of August	

Forest types	Northwest	Northeast	Northeast	North middle centre	South middle centre	Highland	Southeast	Mekong river delta
Rich Evergreen broad-leaved forest	343.44			306.15	239.44	219.40	295.45	
Medium Evergreen broad-leaved forest	85.15	89.79		136.33	149.99	149.50	180.96	
Poor Evergreen broad-leaved forest	37.25	34.24		81.92	74.18	85.72	75.95	79.34
Restored forest	33.51	20.81		32.85	70.35	86.67	83.04	67.43
Coniferous forest		30.60		65.50	94.04	95.74	180.90	
Broad-leaved and coniferous mixed forest						106.73	179.86	
Rich Dry open forest of Dipterocarps						149.07	226.64	
Medium Dry open forest of Dipterocarps						134.97	175.62	
Poor Dry open forest of Dipterocarps						70.47	77.83	
Restored Poor Dry open forest of Dipterocarps						70.60	39.62	
Bamboo forest	35.97	30.36		83.41	52.60	60.14	63.03	

Mean volume of each Forest types in 19
Cycle 2

Primary forest and natural forest						
Mangrove						
Forest on rocky mountain						
Man-made forest	20.79	20.66		11.15	10.46	19.33

Mean volume of each Forest types in 2000
Cycle 3

Forest types	Northwest	Northeast n	Northeast n Red river	North middle centre	South middle centre	Highland	Southeast	Mekong river delta
Rich Evergreen broad-leaved forest	275.0	268.1	286.1	255.6	271.5	247.2	195.0	195.0
Medium Evergreen broad-leaved forest	110.8	90.6	123.4	137.3	184.8	164.1	142.4	179.2
Poor Evergreen broad-leaved forest	45.9	43.7	46.0	84.3	76.4	86.6	99.0	115.0
Restored forest	43.9	33.6	30.3	50.9	76.1	88.7	102.3	105.0
Coniferous forest					21.0	141.5		
Broad-leaved and coniferous mixed forest						138.0	108.5	
Rich Dry open forest of Dipterocarps						139.8		
Medium Dry open forest of Dipterocarps						113.6	147.4	
Poor Dry open forest of Dipterocarps						73.3	96.5	
Restored Poor Dry open forest of Dipterocarps						80.9	82.3	
Bamboo forest	5.1	4.5	3.3	6.5	3.5	9.5	6.2	
Primary forest and natural forest	47.4	19.2	44.0	60.8	79.9	87.7	107.6	50.0
Mangrove		40.0	40.0	40.0	40.0		40.2	21.0
Forest on rocky mountain	48.0	34.0	46.3	80.2			66.0	
Man-made forest	16.9	19.2	25.0	18.7	54.4	20.1	14.2	18.7

The Progress (Data collection of NFI)

Mean Volume Change Matrix in DakNong from 1995 to 2000

	1995年 平均蓄積→	219.4	149.5	85.7	86.7	95.7	106.7	149.1	135.0	70.5	70.6	60.1	19.3
2000年平均蓄積 ↓	Forest types	Rich Evergreen broad-leaved forest	Medium Evergreen broad-leaved forest	Poor Evergreen broad-leaved forest	Restored forest	Coniferous forest	Broad-leaved and coniferous mixed forest	Rich Dry open forest of Dipterocarps	Medium Dry open forest of Dipterocarps	Poor Dry open forest of Dipterocarps	Restored Poor Dry open forest of Dipterocarps	Bamboo forest	Man-made forest
247.2	Rich Evergreen broad-leaved forest	27.8	97.7	161.5	160.5	151.5	140.5	98.1	112.2	176.7	176.6	187.1	227.9
164.1	Medium Evergreen broad-leaved forest	-55.3	14.6	78.4	77.4	68.4	57.4	15.0	29.1	93.6	93.5	104.0	144.8
86.6	Poor Evergreen broad-leaved forest	-132.8	-62.9	0.9	-0.1	-9.1	-20.1	-62.5	-48.4	16.1	16.0	26.5	67.3
88.7	Restored forest	-130.7	-60.8	3.0	2.0	-7.0	-18.0	-60.4	-46.3	18.2	18.1	28.6	69.4
141.5	Coniferous forest	-77.9	-8.0	55.8	54.8	45.8	34.8	-7.6	6.5	71.0	70.9	81.4	122.2
138.0	Broad-leaved and coniferous mixed forest	-81.4	-11.5	52.3	51.3	42.3	31.3	-11.1	3.0	67.5	67.4	77.9	118.7
139.8	Rich Dry open forest of Dipterocarps	-79.6	-9.7	54.1	53.1	44.1	33.1	-9.3	4.8	69.3	69.2	79.7	120.5
113.6	Medium Dry open forest of Dipterocarps	-105.8	-35.9	27.9	26.9	17.9	6.9	-35.5	-21.4	43.1	43.0	53.5	94.3
73.3	Poor Dry open forest of Dipterocarps	-146.1	-76.2	-12.4	-13.4	-22.4	-33.4	-75.8	-61.7	2.8	2.7	13.2	54.0
80.9	Restored Poor Dry open forest of Dipterocarps	-138.5	-68.6	-4.8	-5.8	-14.8	-25.8	-68.2	-54.1	10.4	10.3	20.8	61.6
9.5	Bamboo forest	-209.9	-140.0	-76.3	-77.2	-86.3	-97.3	-139.6	-125.5	-61.0	-61.1	-50.7	-9.9
87.7	Primary forest and natural forest	-131.7	-61.8	2.0	1.0	-8.0	-19.0	-61.4	-47.3	17.2	17.1	27.6	68.4
20.1	Man-made forest	-199.3	-129.4	-65.6	-66.6	-75.6	-86.6	-129.0	-114.9	-50.4	-50.5	-40.0	0.8

Forest Area Change in DakNong from 1990 to 2000

(ha)

Forest Area Change (ha)		1990年						
		Rich Evergreen broad-leaved forest	Medium Evergreen broad-leaved forest	Poor Evergreen broad-leaved forest	Restored forest	Dry Open forest	Broad-leaved and coniferous mixed forest	Non-Forest
2000年	Rich Forest	8,988	11,705	1,369	238	1,370	304	550
	Medium Forest	33,818	22,525	8,930	5,155	5,567	1,738	12,240
	Poor Forest	13,529	15,178	12,014	3,036	7,901	1,502	7,894
	Rehabilitated Forest	20,466	15,986	26,970	9,723	5,049	4,508	12,876
	Dry open forest	236	7,009	376	0	19,429	2,671	737
	Semi Deciduous Broad-Leaved Forest	361	871	46	229	300	147	19
	Coniferous Forest	0	0	34	0	43	0	0
	Man-made forest	1,632	1,428	1,475	953	39	0	3,313
	Bamboo forest	3,635	3,028	3,724	2,917	153	31	16,600
	Non-Forest Land	36,979	43,510	43,522	18,368	39,614	1,220	113,103

Mean Volume Change in DakNong from 1995 to 2000

(m3/ha)

Forest Volume Change par hector (m3/ha)		1995年						
		Rich Evergreen broad-leaved forest	Medium Evergreen broad-leaved forest	Poor Evergreen broad-leaved forest	Restored forest	Dry Open forest	Broad-leaved and coniferous mixed forest	Non-Forest
2000年	Rich Evergreen broad-leaved forest	28	98	161	161	141	140	247
	Medium Evergreen broad-leaved forest	-55	15	78	77	58	57	164
	Poor Evergreen broad-leaved forest	-133	-63	1	-0	-20	-20	87
	Restored forest	-131	-61	3	2	-18	-18	89
	Dry Open	-117	-48	16	15	-4	-5	109
	Broad-leaved and coniferous mixed forest	-81	-11	52	51	35	31	138
	Coniferous forest	-78	-8	56	55	34	35	142
	Man-made forest	-199	-129	-66	-67	-86	-87	20
	Bamboo forest	-210	-140	-76	-77	-19	-97	9
	Non-Forest	-219	-149	-86	-87	-96	-107	0

Total volume loss between 1990 and 2000 in DakNong province

Forest Volume Change (thousands m3)		1990年							
		Rich Evergreen broad-leaved forest	Medium Evergreen broad-leaved forest	Poor Evergreen broad-leaved forest	Restored forest	Dry Open forest	Broad-leaved and coniferous mixed forest	Bamboo forest	Non-Forest
2000年	Rich Evergreen broad-leaved forest	250	1,144	221	38	193	43	28	136
	Medium Evergreen broad-leaved forest	▲ 1,870	329	700	399	322	100	24	2,009
	Poor Evergreen broad-leaved forest	▲ 1,797	▲ 955	11	▲ 0	▲ 155	▲ 30	33	684
	Restored forest	▲ 2,675	▲ 972	80	20	▲ 89	▲ 81	30	1,142
	Dry Open	▲ 28	▲ 334	6	0	▲ 78	▲ 13	0	80
	Broad-leaved and coniferous mixed forest	▲ 29	▲ 10	2	12	11	5	0	3
	Coniferous forest	0	0	2	0	1	0	0	0
	Man-made forest	▲ 325	▲ 185	▲ 97	▲ 63	▲ 3	0	▲ 5	67
	Bamboo forest	▲ 763	▲ 424	▲ 284	▲ 225	▲ 3	▲ 3	▲ 78	157
	Non-Forest	▲ 8,113	▲ 6,505	▲ 3,731	▲ 1,592	▲ 3,792	▲ 130	▲ 916	0

Deforestation

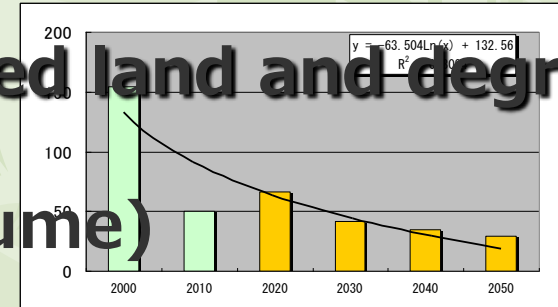
Volume loss due to Deforestation=26.5 million m3

Degradation

Volume loss due to Degradation = 9.3 million m3

Concept of generating REL (proposal)

- **Simple historical line BAU on deforested land and degraded forest land**
(Forest type maps, Mean standing volume)
- **Simple historical trend of gross stock change of total forest**
(NFI, exclude plantation and natural growth)
- **MODIS sequence curve (2000 to 2010) of forest carbon decreasing on deforested and degraded forest**
(MODIS, NFI, Ground truth,)



Discussion and future plan

【Developing of the digital maps】

- Verification to assess uncertainty of these maps
⇒ JICA study team will undertake the verification
- Some problem concerning projection conversion from UTM to VN2000
⇒ FIPI will try to find solution
- Consistency of land cover classification from 1990 up to now
⇒ FIPI is internally discussing and will revise classification code.

【Developing of emission factor by using NFI data】

- Stratification boundary (Agro-ecological vs. Terrestrial eco-regions)
- Verification to assess uncertainty of NFI data
⇒ Needs further consideration

【Generating REL】

- Detecting of forest degradation is highly uncertain due to limitation of interpretation capacity when evaluating forest status.



Thank you for listening !

The study will present a interim report on September 2010. If anybody wants to know the interim results, please contact to h.chiba@jofca.or.jp

Photo Taken in Tuong Dong District, Nghe An province