



Annual Deforestation Mapping in Sumatera 1990 -2014 using multi temporal digital classification

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OUTLINE



1. Background
2. Objective
3. Data
4. Classification methodology
5. Result
6. Conclusion

Background

1. Needs: Annual deforestation Information from 1990-2012 for FREL Submission
2. Available deforestation Information in Indonesia 1990, 1996, 2000 ... 2013

#	Ministry of Environment and Forestry (Official)	LAPAN (INCAS)	MARGONO (SDSU)
Classes	23 Class	Forest/Non Forest	Deforestation
Periode	1990, 1996, 2000, 2003, 2006, 2009, 2011, 2012, 2013	2000-2012 (annual)	2000-2012 (annual)
Metode	Visual interpretation	Digital Classification (semi automatic)	Digital Classification
Forest Definition	Natural and secondary forest	Tree cover (>5 meter height, < 30% cover)	Natural Forest

Table: Available deforestation Information in Indonesia

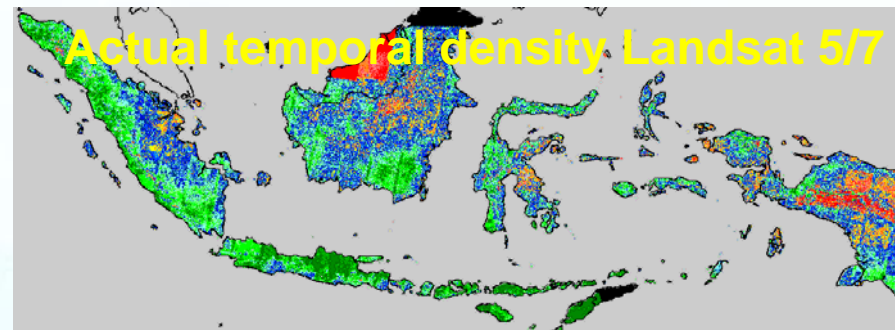
Background

3. Landsat data availability of Indonesia

- Processed data for INCAS (2000-2010)

Number of Scene

Sum	1399
Kal	1045
Sul	1062
Papua	1069
other	1614
Total	6189



Number of cloud free image (years : 2000 -2012)



- Raw Landsat data (1990-1999)

Tahun	LS-5		
	Total	TIFF_1T	TIFF_1G
1990	430	32	398
1991	408	59	349
1992	382	21	361
1993	438	12	426
1994	428	3	425
1995	612	62	550
1996	440	25	415
1997	319	68	251
1998	537	0	537
1999	480	0	480
Total	4474	282	4192

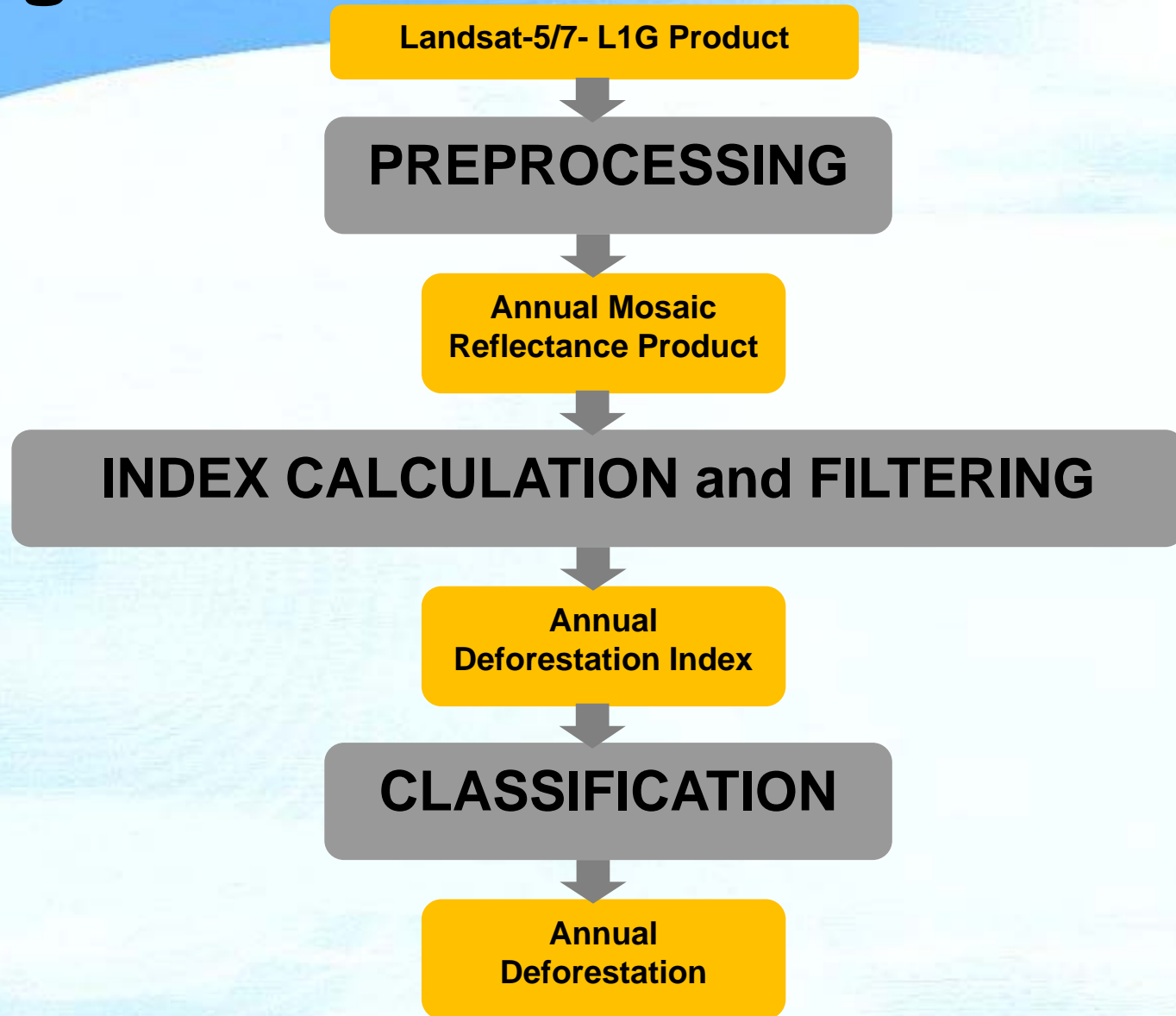
Objectives:

- Finding the algorithm for producing the annual deforestation information over Sumatera island using automatic processing

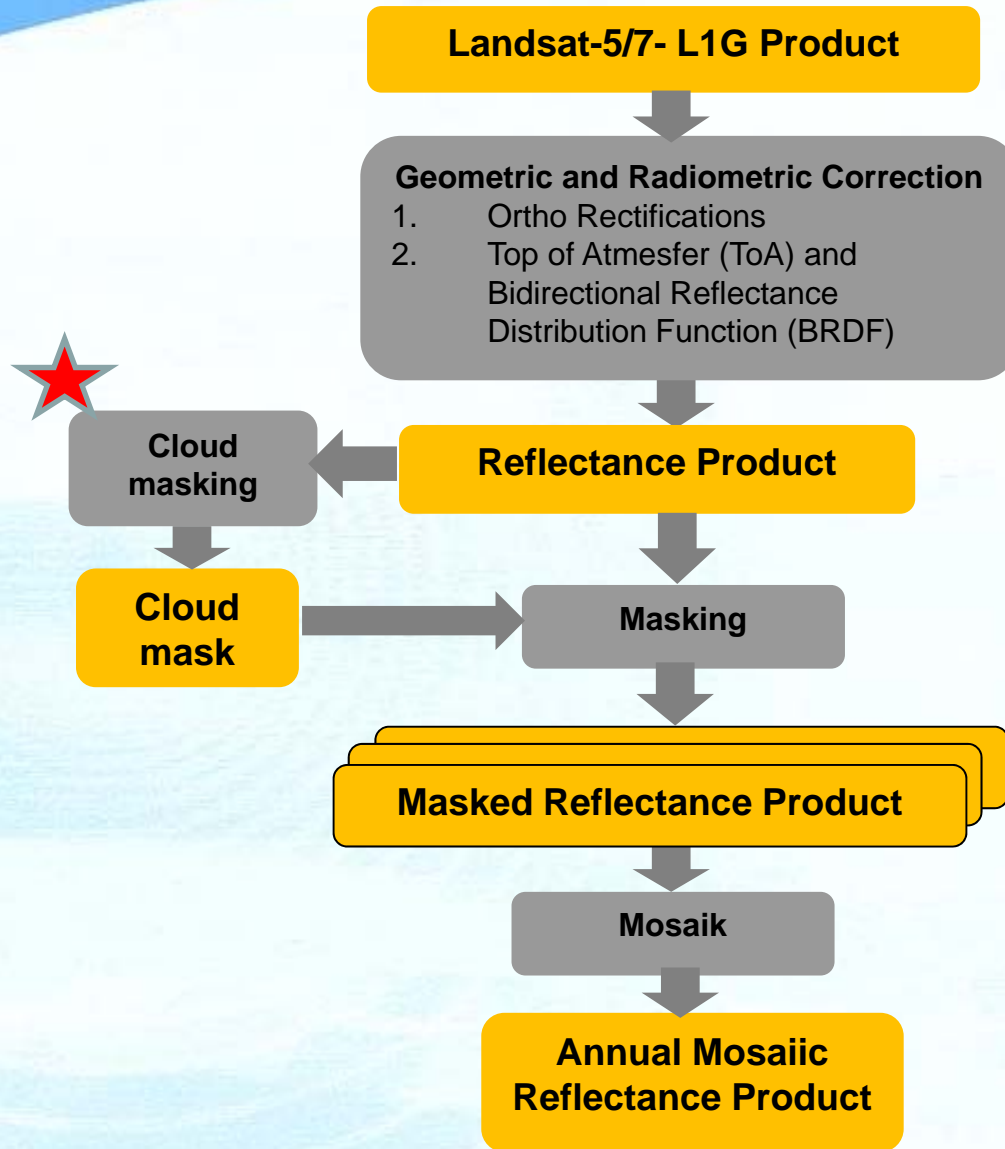
Data:

- Annual Landsat-5/7 data 1990 to 2012 (main data)
- Forest map 1990 (forest base map)

Processing Flow

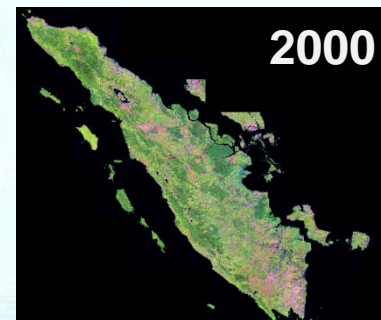
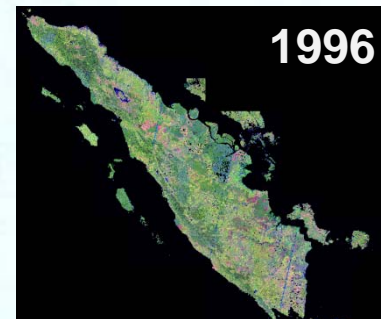


Processing Flow (Preprocessing)



Preprocessing results

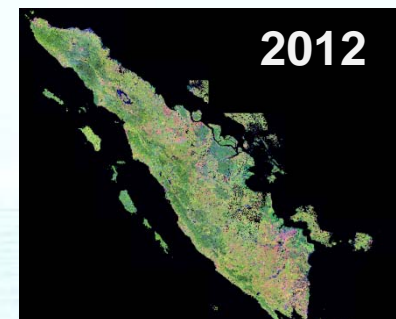
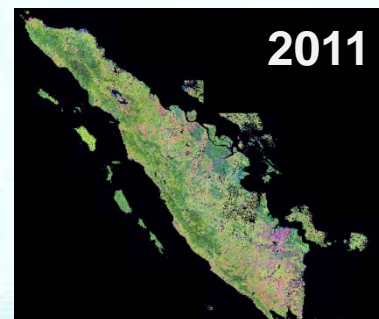
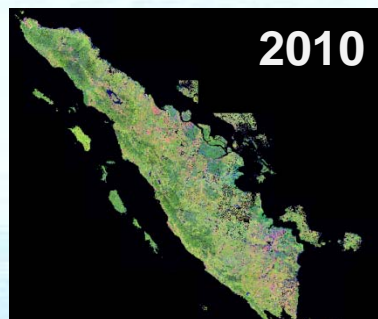
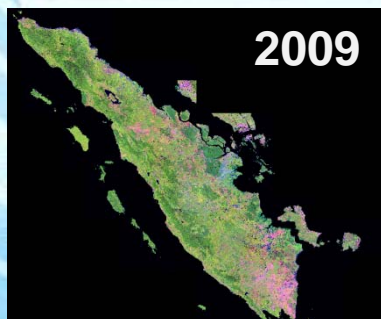
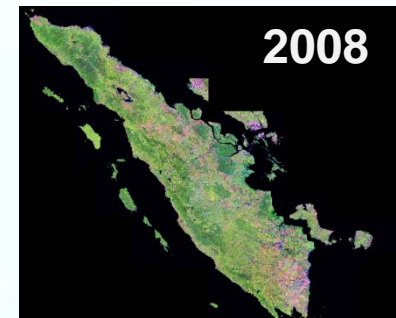
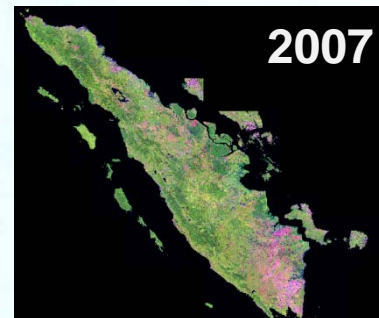
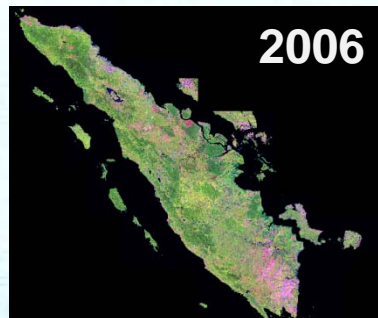
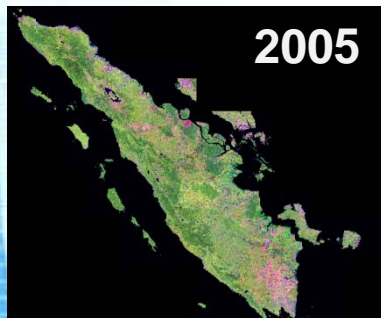
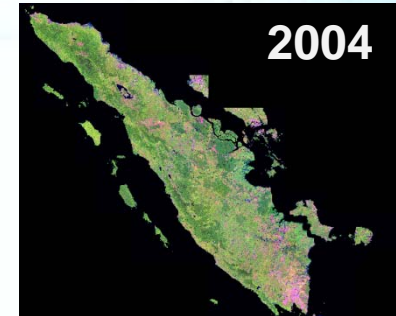
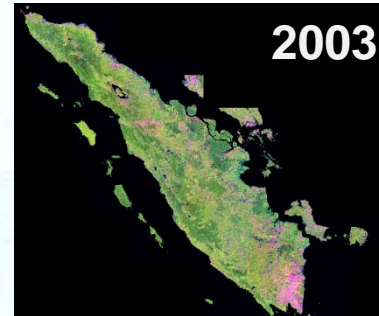
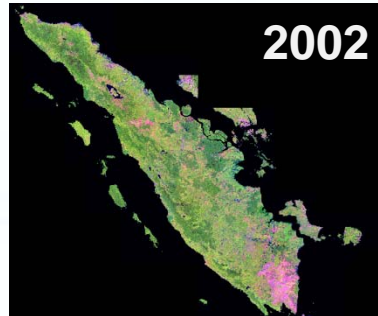
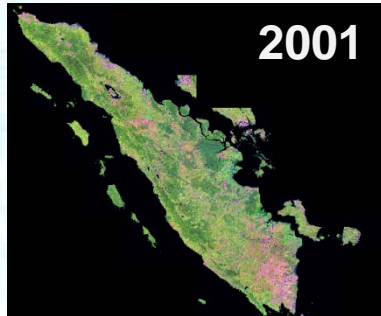
(Mosaic of Landsat data 1990-2012)(1/2)



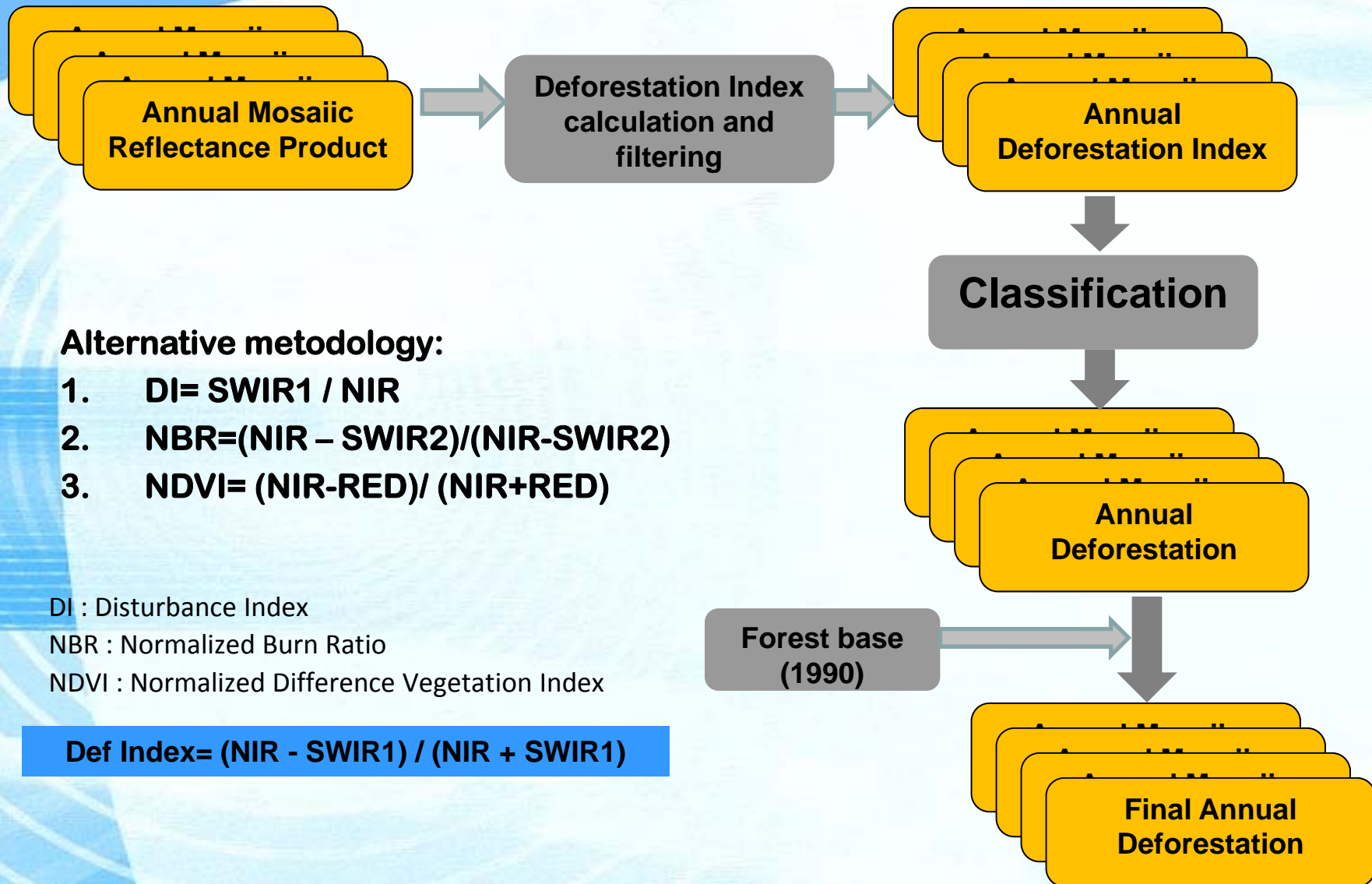
2012

Preprocessing results

(Mosaic of Landsat data 1990-2012)(2/2)



Processing Flow (Classification)



Deforestation Index

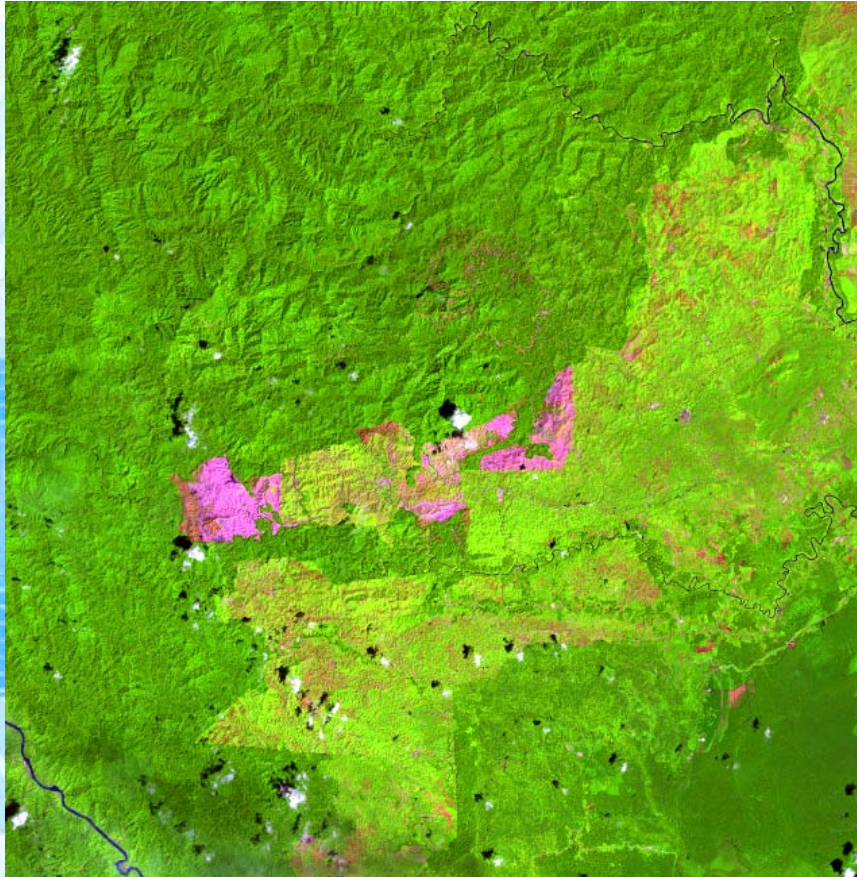
$$\text{Index} = (\text{NIR} - \text{SWIR1}) / (\text{NIR} + \text{SWIR1})$$

Characteristics :

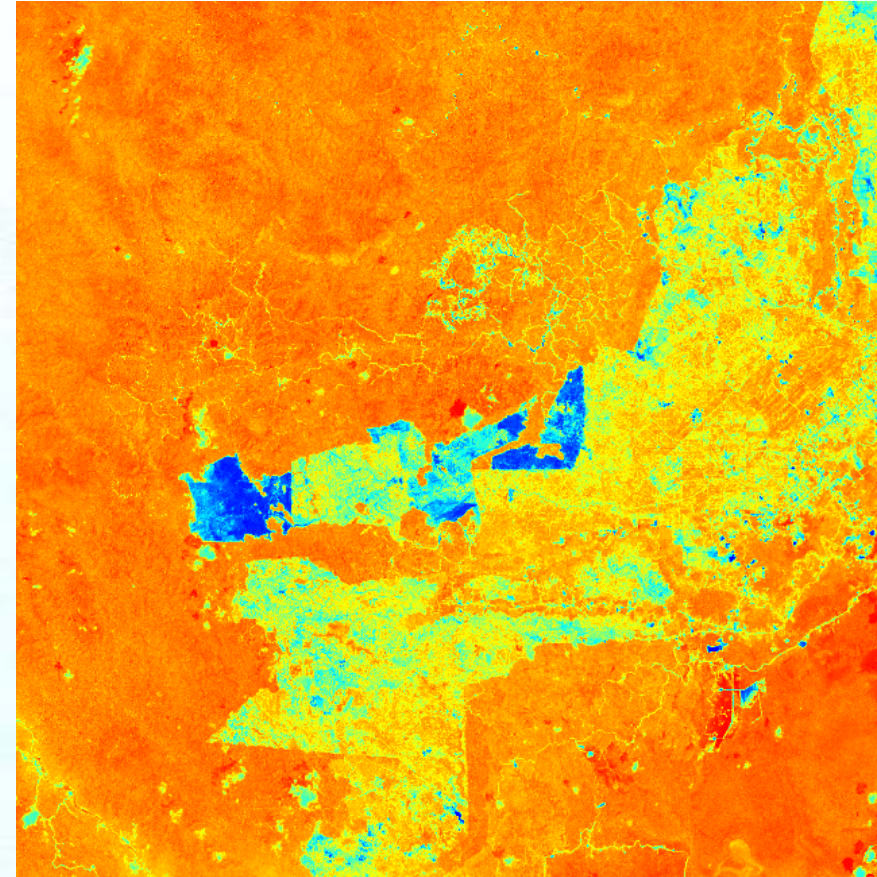
- Higher value for vegetation, less value for open area
- Less sensitive from Haze
- Sensitive with the logging
- Correct the terrain effect

Deforestation Index (Landsat8: PR-117057, Acq.Date-29012014)

RGB (SWIR1, NIR, RED)

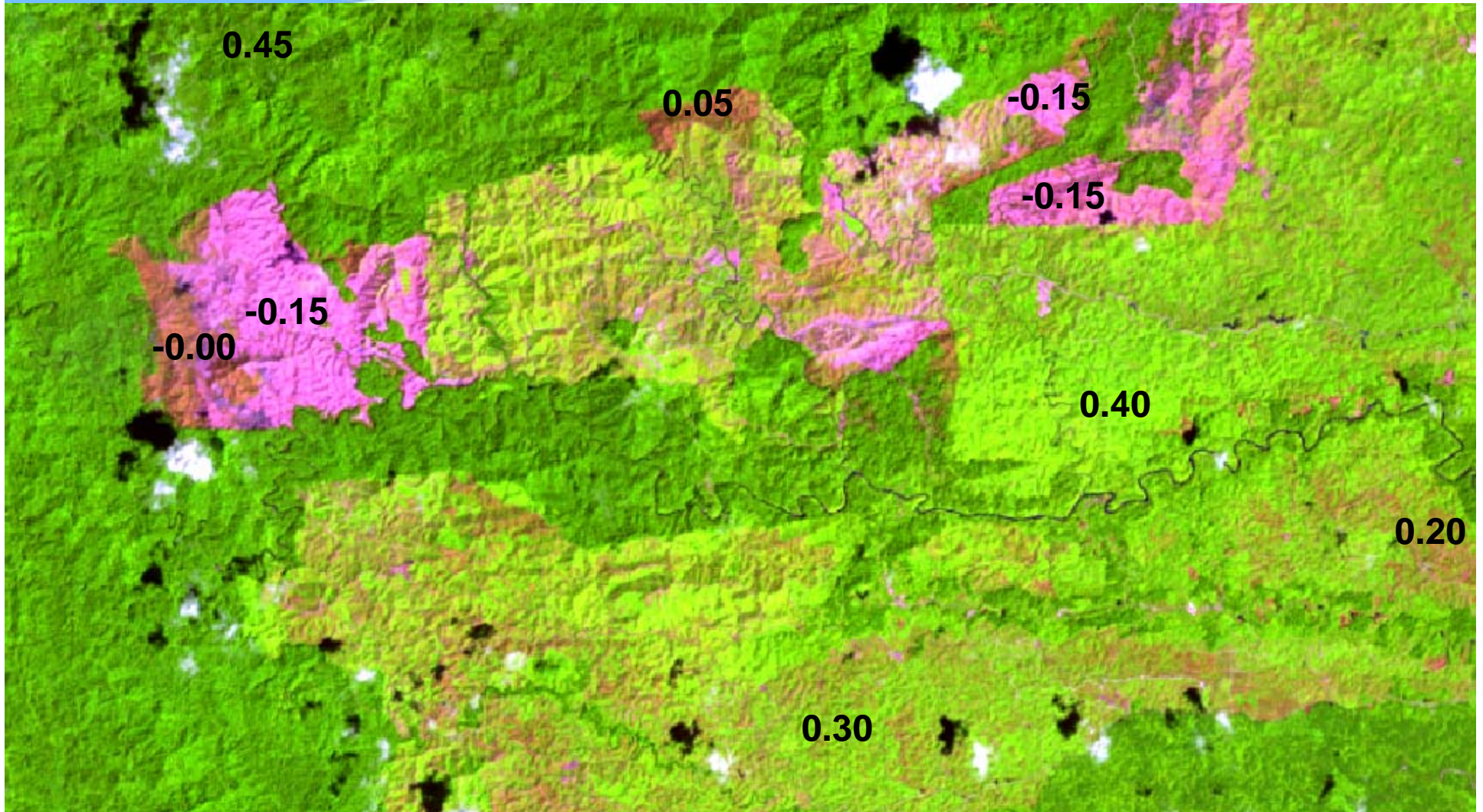


$\text{INDEX}(\text{NIR}-\text{SWIR1})/(\text{NIR}+\text{SWIR1})$



Higher value for vegetation, less value for open area

Deforestation Index (Landsat8: PR-117057, Acq.Date-29012014)



INDEX:

-0.2 -0.1 0.0 0.1 0.2 0.3 0.4 0.5 0.6

Open Area

bush

low-veg

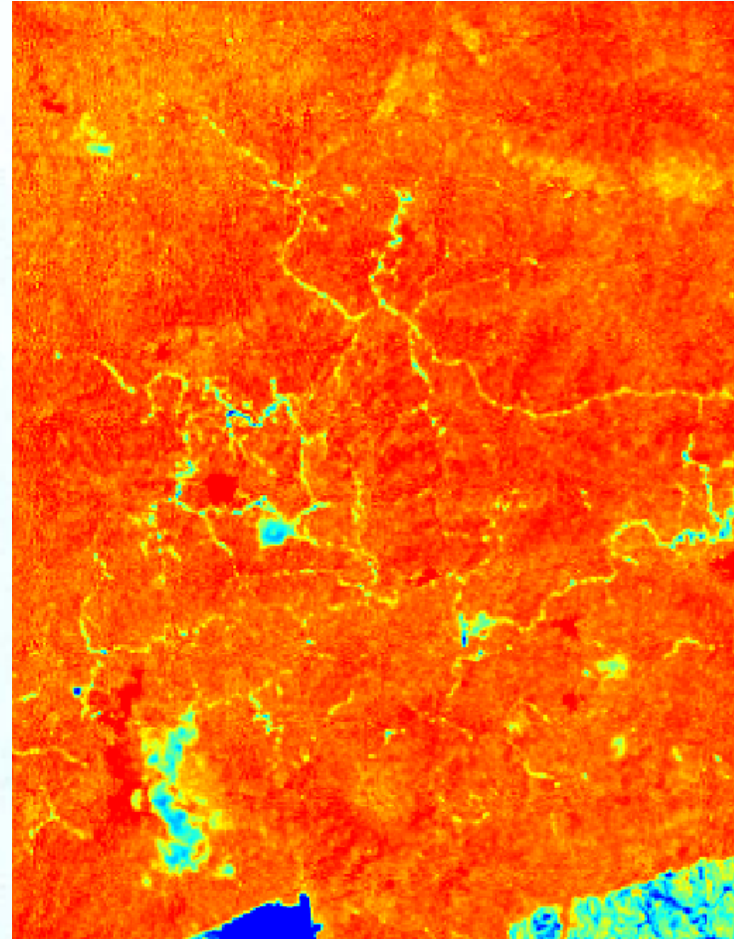
dence-veg

INDEX: Detect logging activities

RGB (SWIR1, NIR, RED)



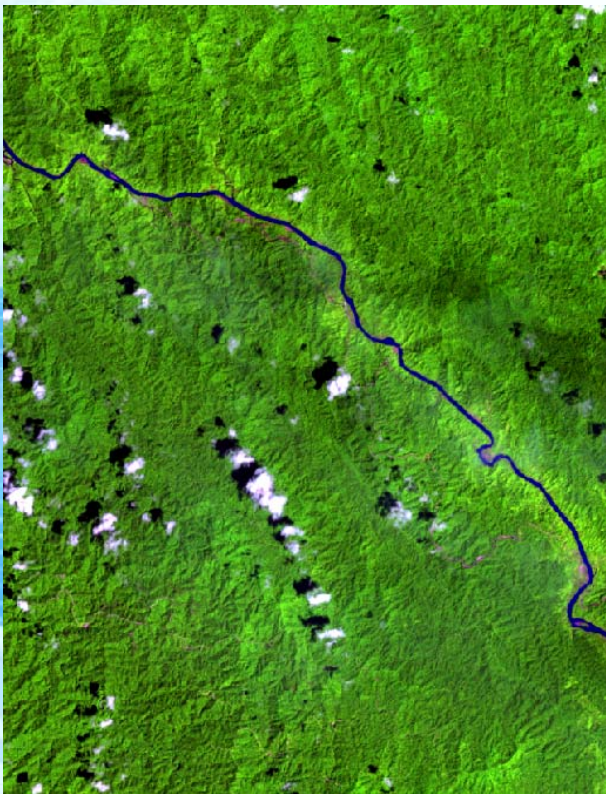
INDEX(NIR-SWIR1)/(NIR+SWIR1)



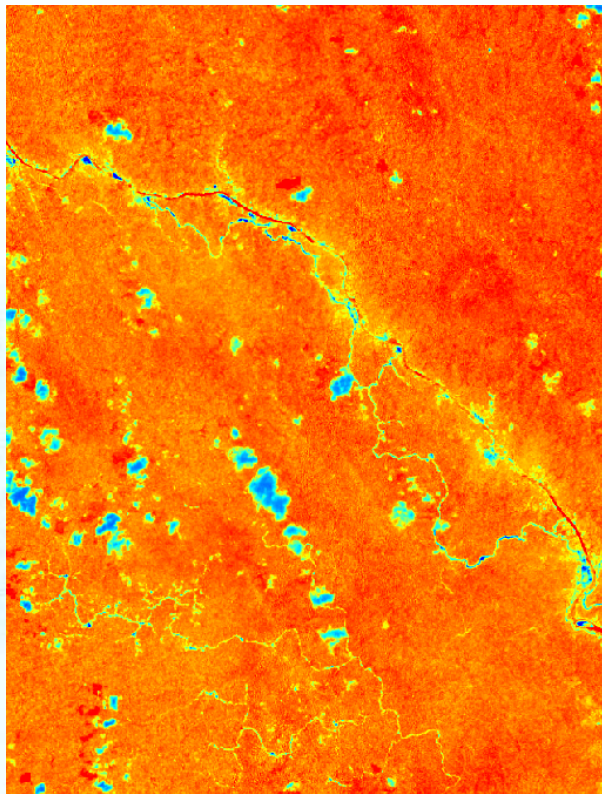
-0.2 0.6

INDEX: Less effected by haze

RGB (SWIR1, NIR, RED)



INDEX(NIR-SWIR1)/(NIR+SWIR1)

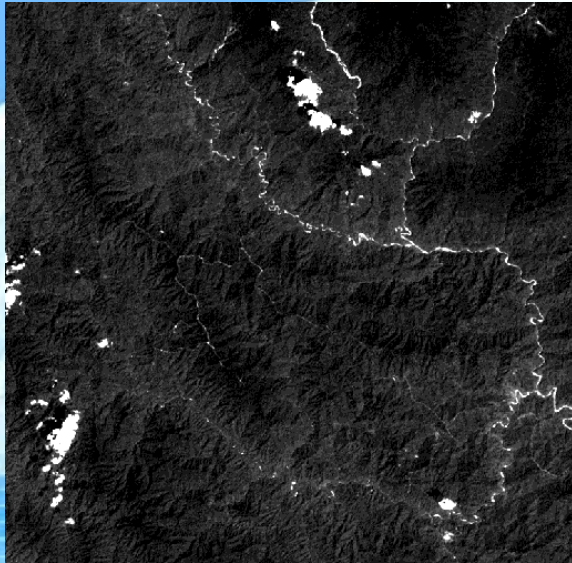


RGB (RED, GREEN, BLUE)

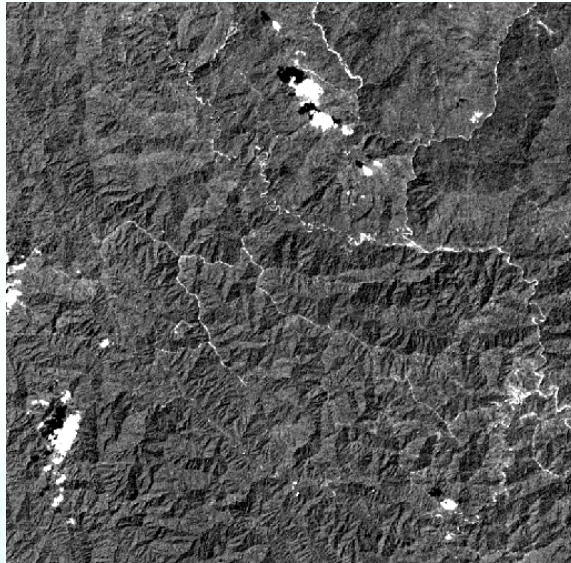


INDEX: Less impacted by terrain effect

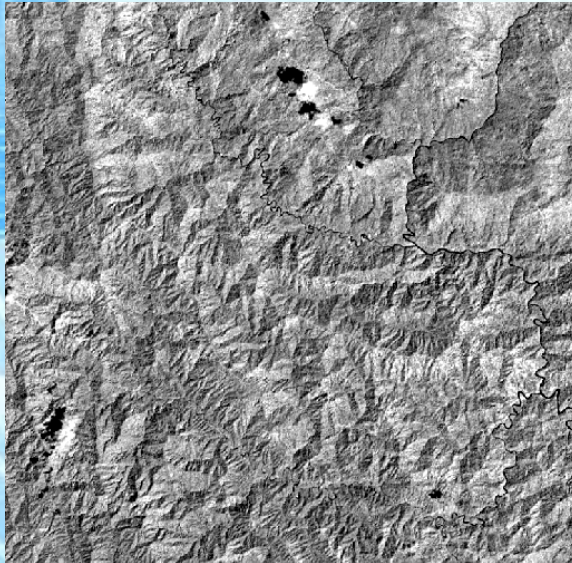
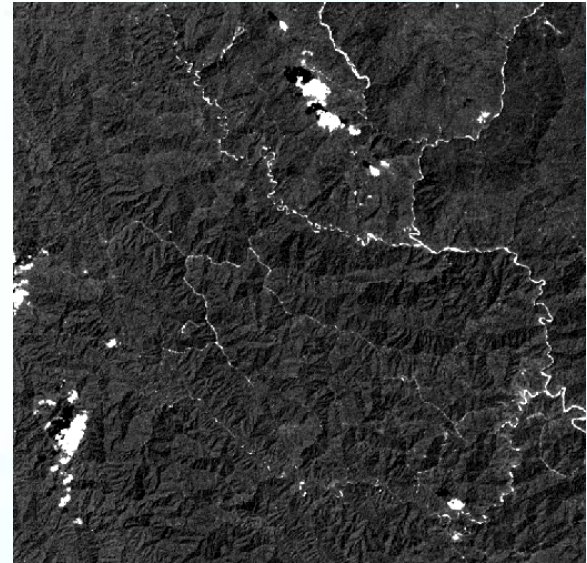
Band Blue



Band Green



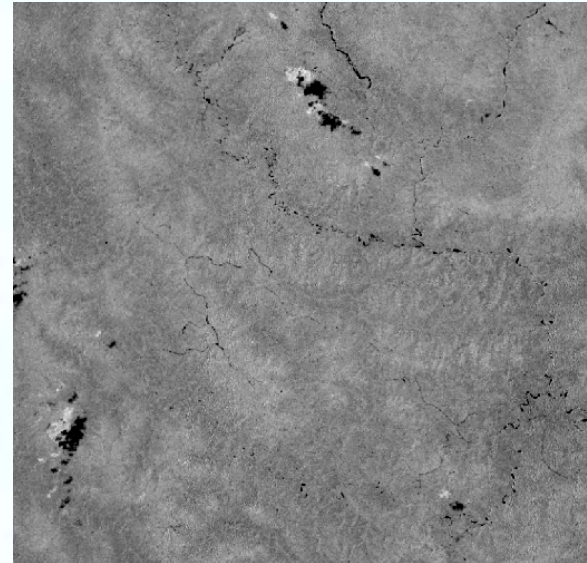
Band Red



Band NIR

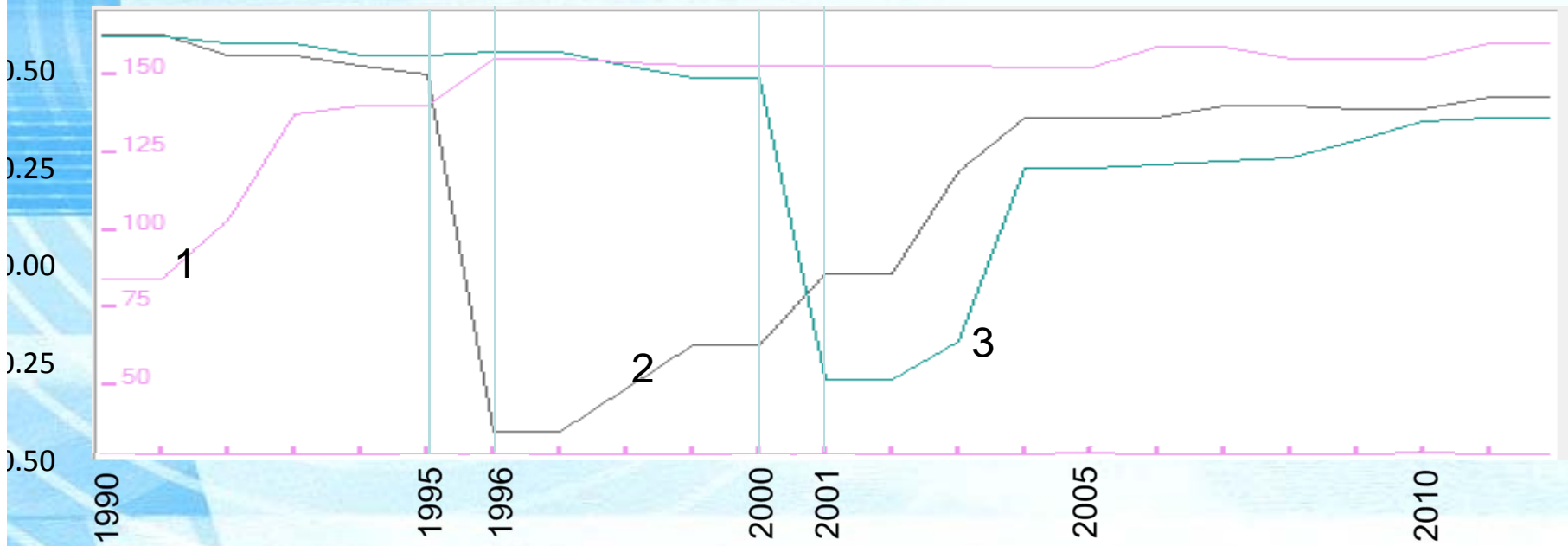
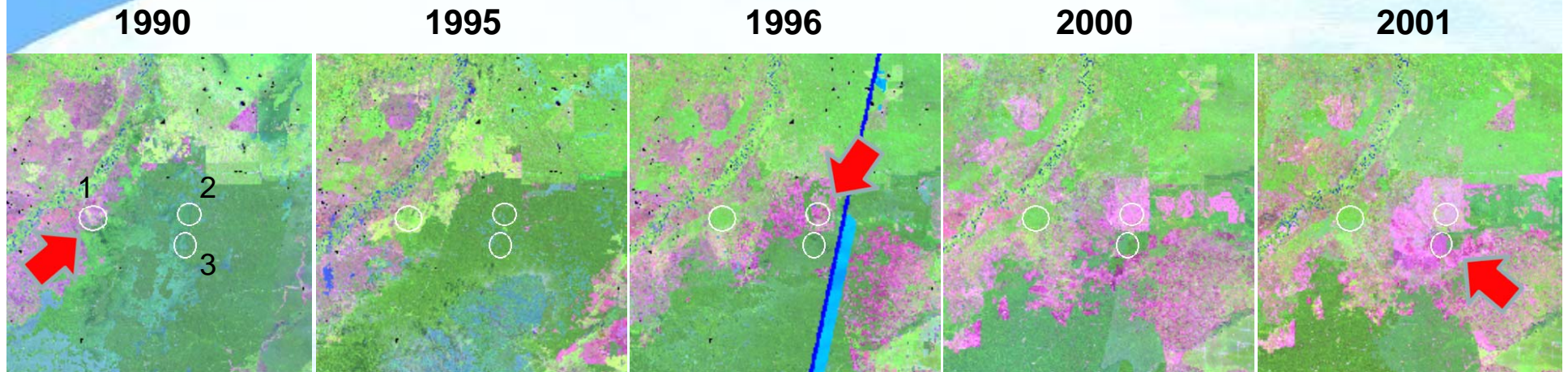


Band SWIR-1



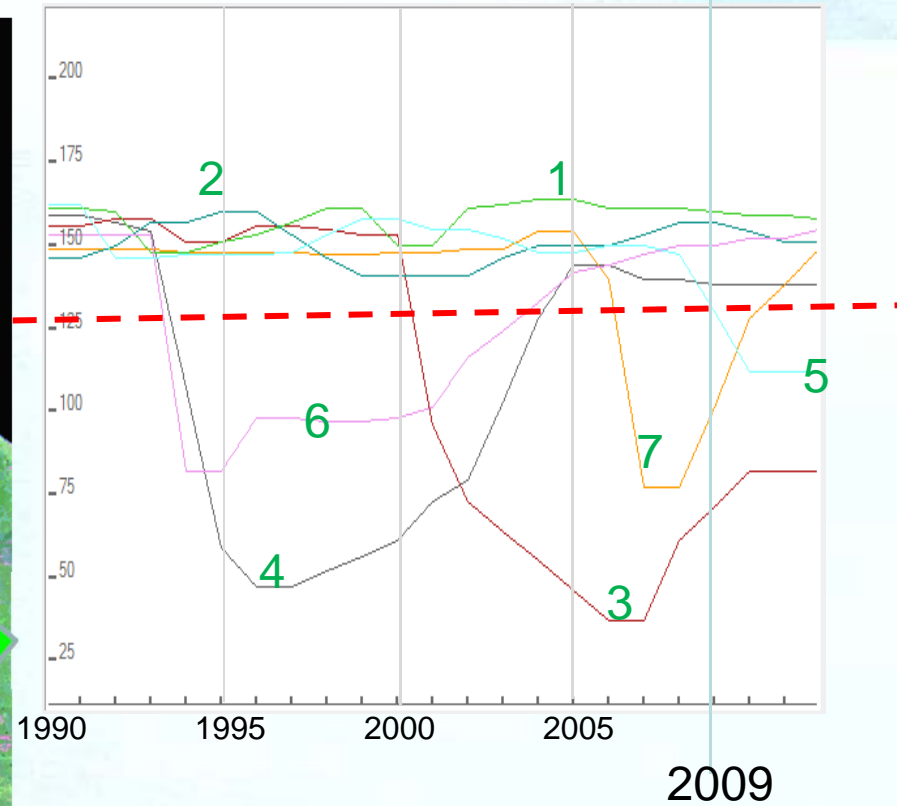
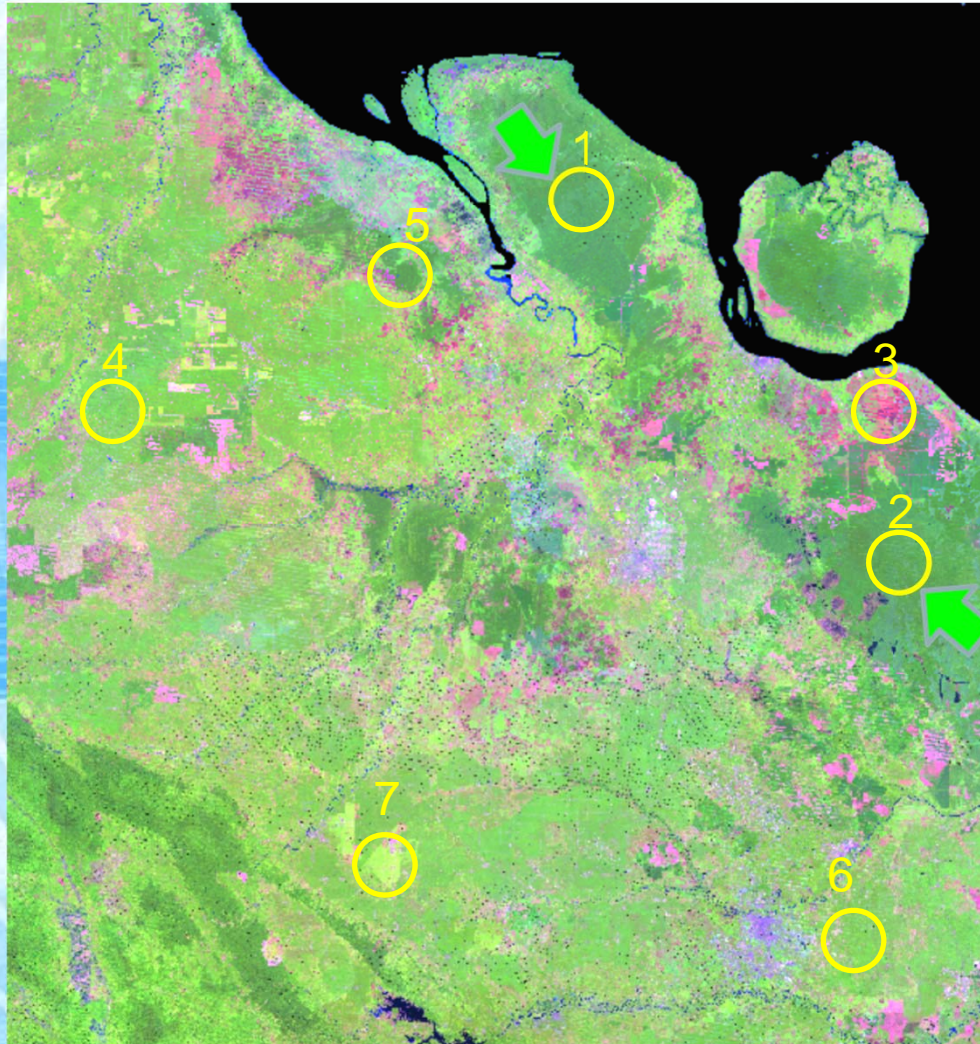
INDEX

Deforestation Index (trend 1990 – 2012)

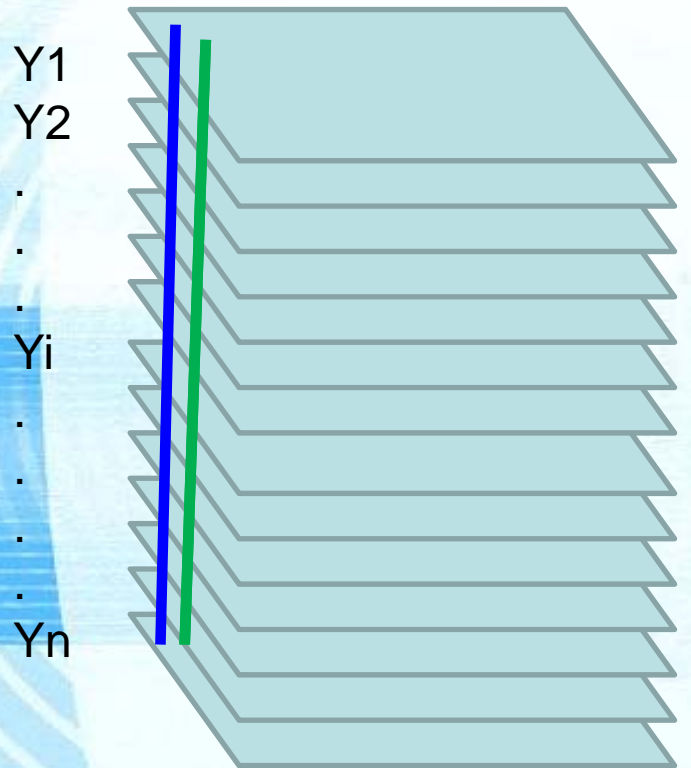


Deforestation Index (trend1990 – 2012)

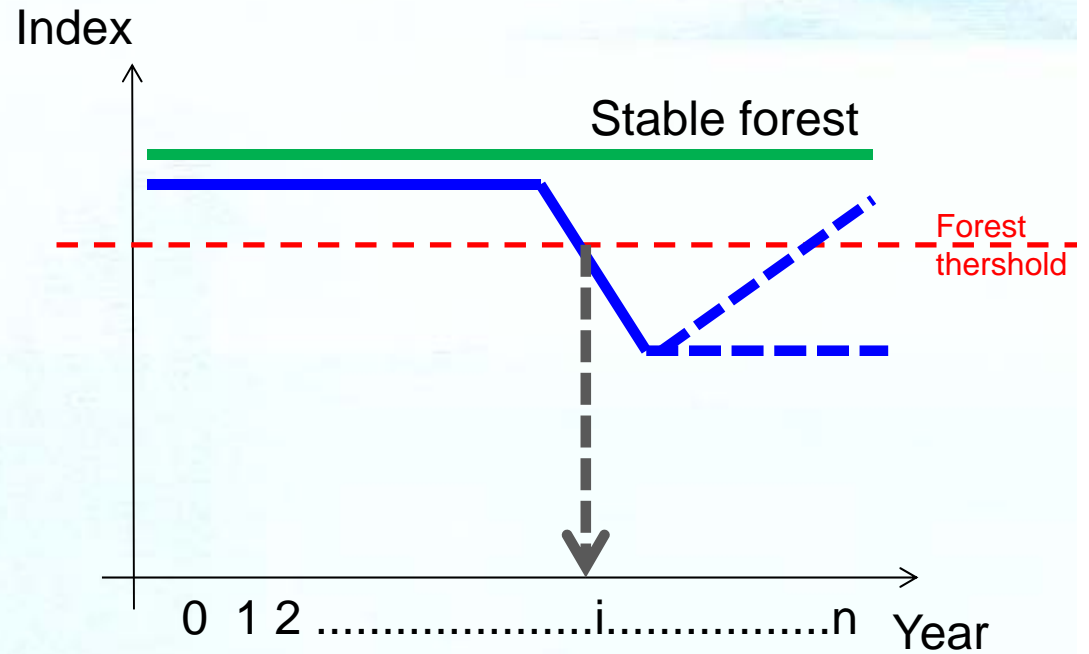
Landsat 2009



Deforestation Classification methodology



Index Deforestation Images



Deforestation on year-i

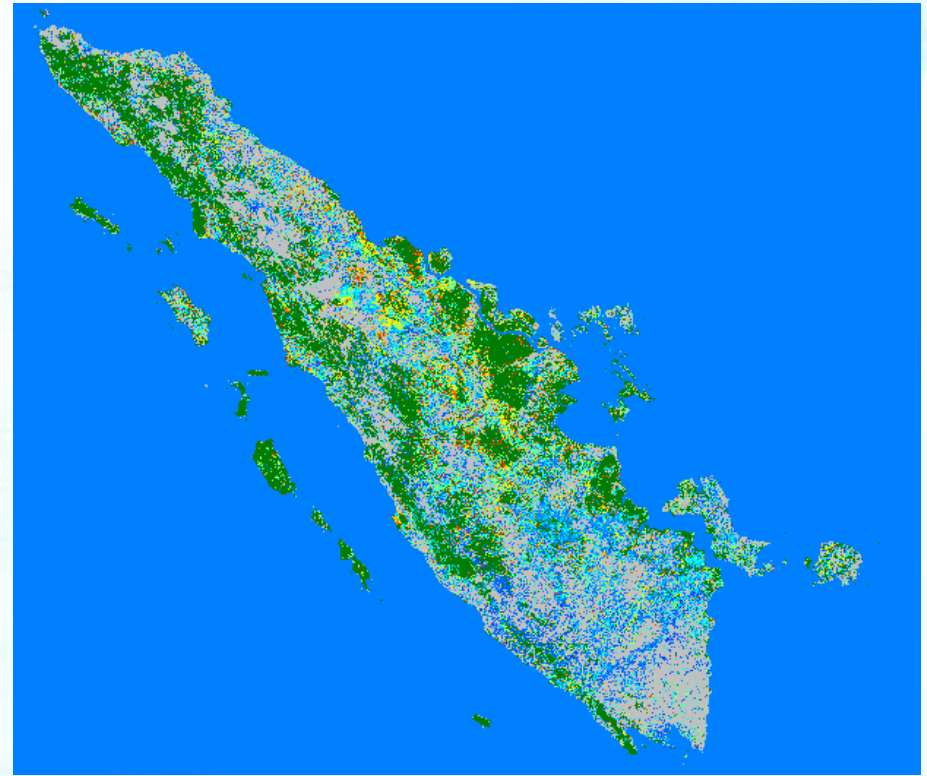
Result

Forest map in 1990 from MoEF



Forest in 1990

Result of annual deforestation (1990 - 2012)



Forest in 2012



Result: Annual deforestation (1990 - 2012)



Note:
The result was mask
by forest in 1990
from MoEF

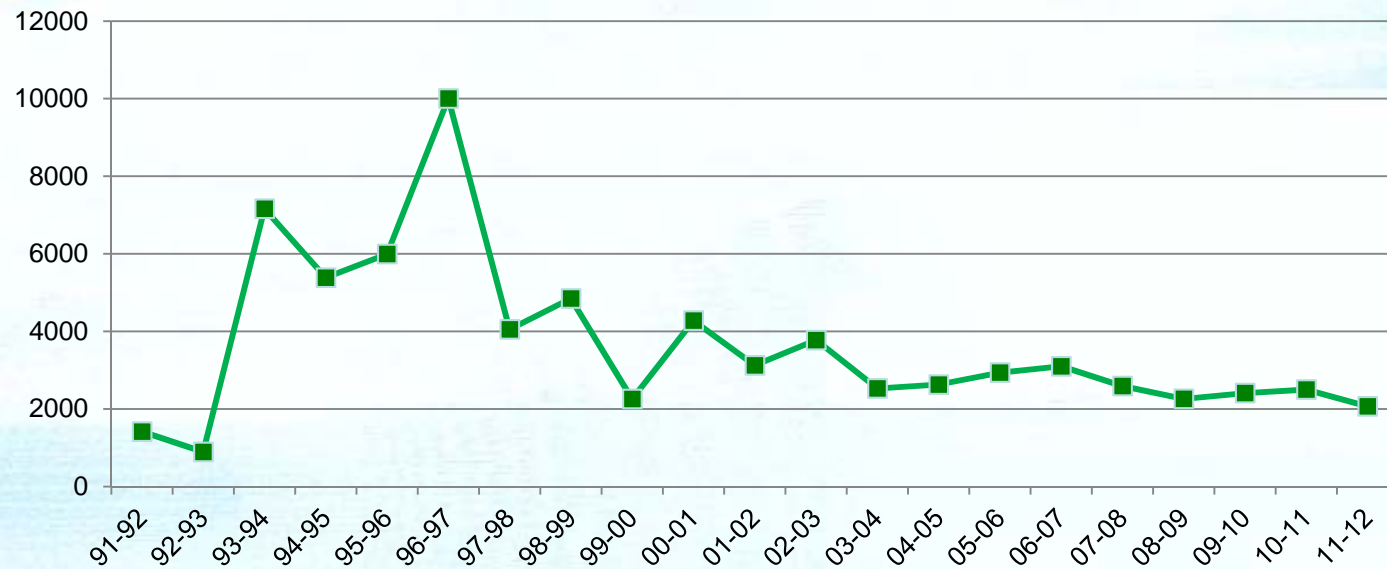
 Forest in 2012

Deforestation

1991

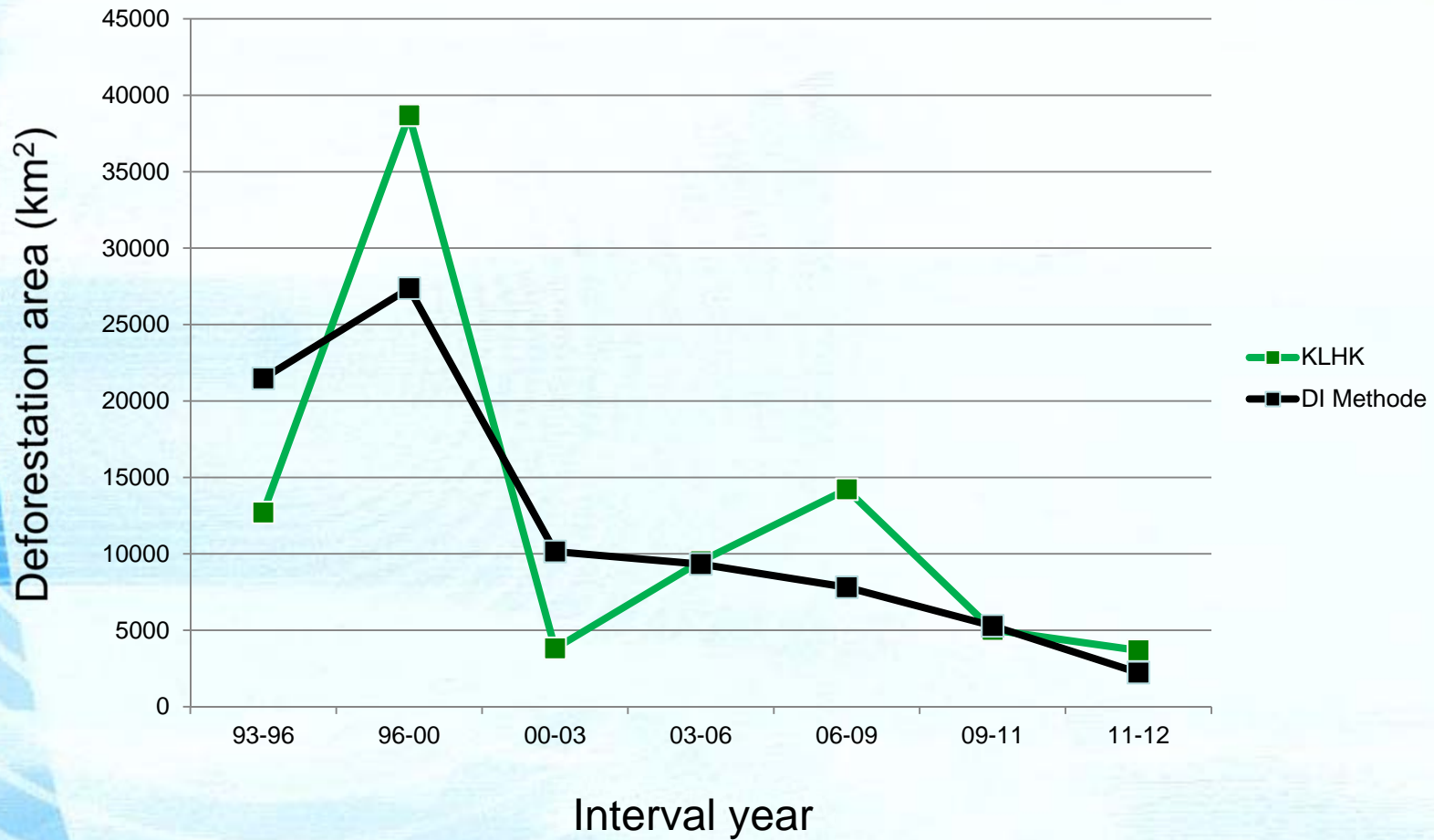
2012

Result: Annual deforestation in Sumatera (km²)



The biggest deforestation in Sumatera is 1996-1997,
It is related with strong El Niño 1997

Comparison of deforestation area in Sumatera between result and Ministry of Environment and Forestry



Conclusions

- 1. This method detected the biggest deforestation in Sumatera : 1996-1997**
- 2. In general, the result shows that deforestation trend is similar compare with deforestation from Ministry of environment and Forestry.**
- 3. Improving the result using other information (Elevation and Slope)**
- 4. Accuracy assesment is needed**



THANK YOU