

GLS Analysis

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GLS data acquisition overview

	2005	2000	1990
TOTAL SCENES	9390	8928	7446
TOTAL TROPICS	2323	1920	1866
MISSING SCENES IN TROPICS	10	0	49

GLS Acquisition Stability for corresponding path row combinations

Difference acquisition month

GLS data set	0	1	2	3	4	5	6
2005 and 2000	416	587	324	220	166	190	155
2005 and 1990	426	570	381	325	198	207	210
2000 and 1990	347	488	339	255	181	168	140

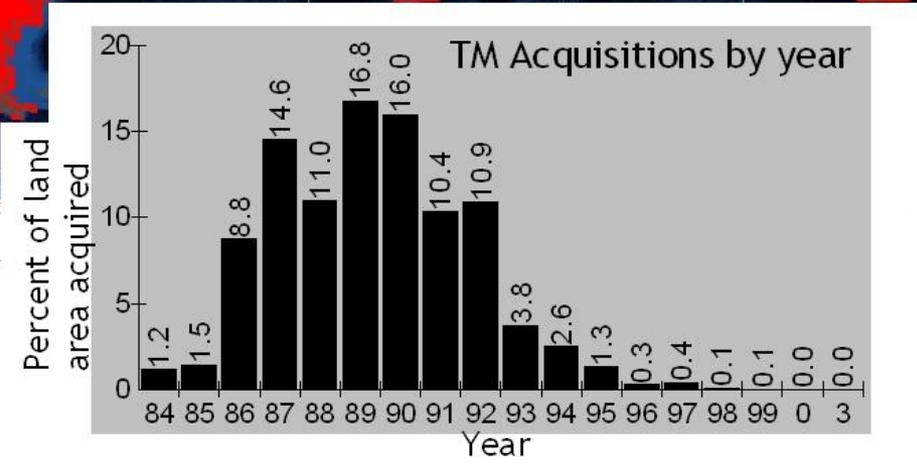
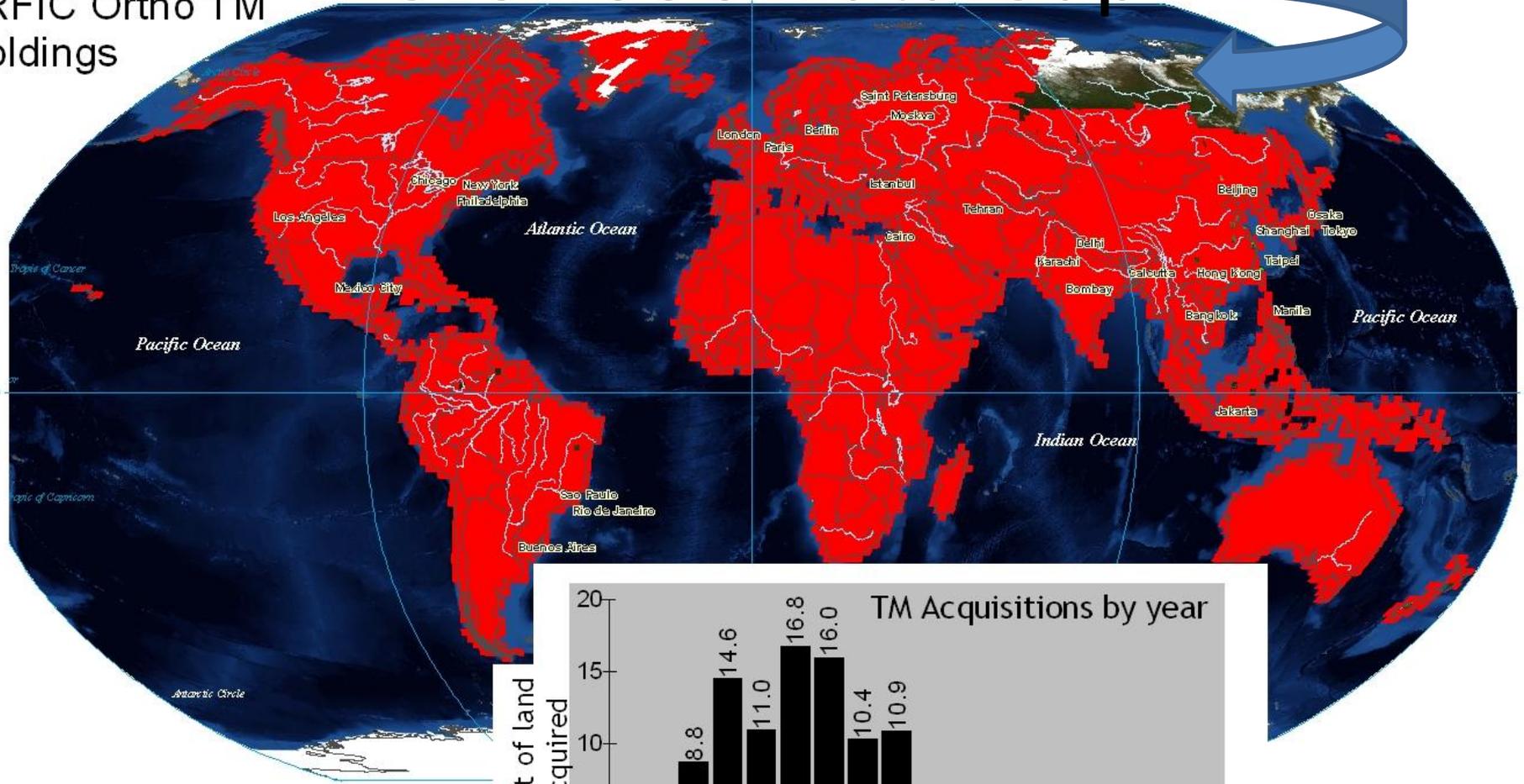
Number of scenes acquired

Row 1, 2005 and 2000 shows in column 1 the number of GLS2005 scenes acquired in the same month (0 months difference) as GLS 2000

Row 2 2005 and 1990 shows in column 1 the number of GLS2005 scenes acquired in the same month (0 months difference) as GLS 1990

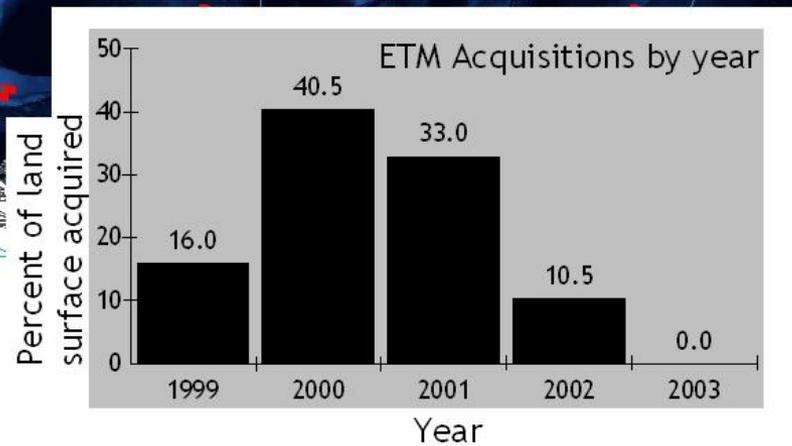
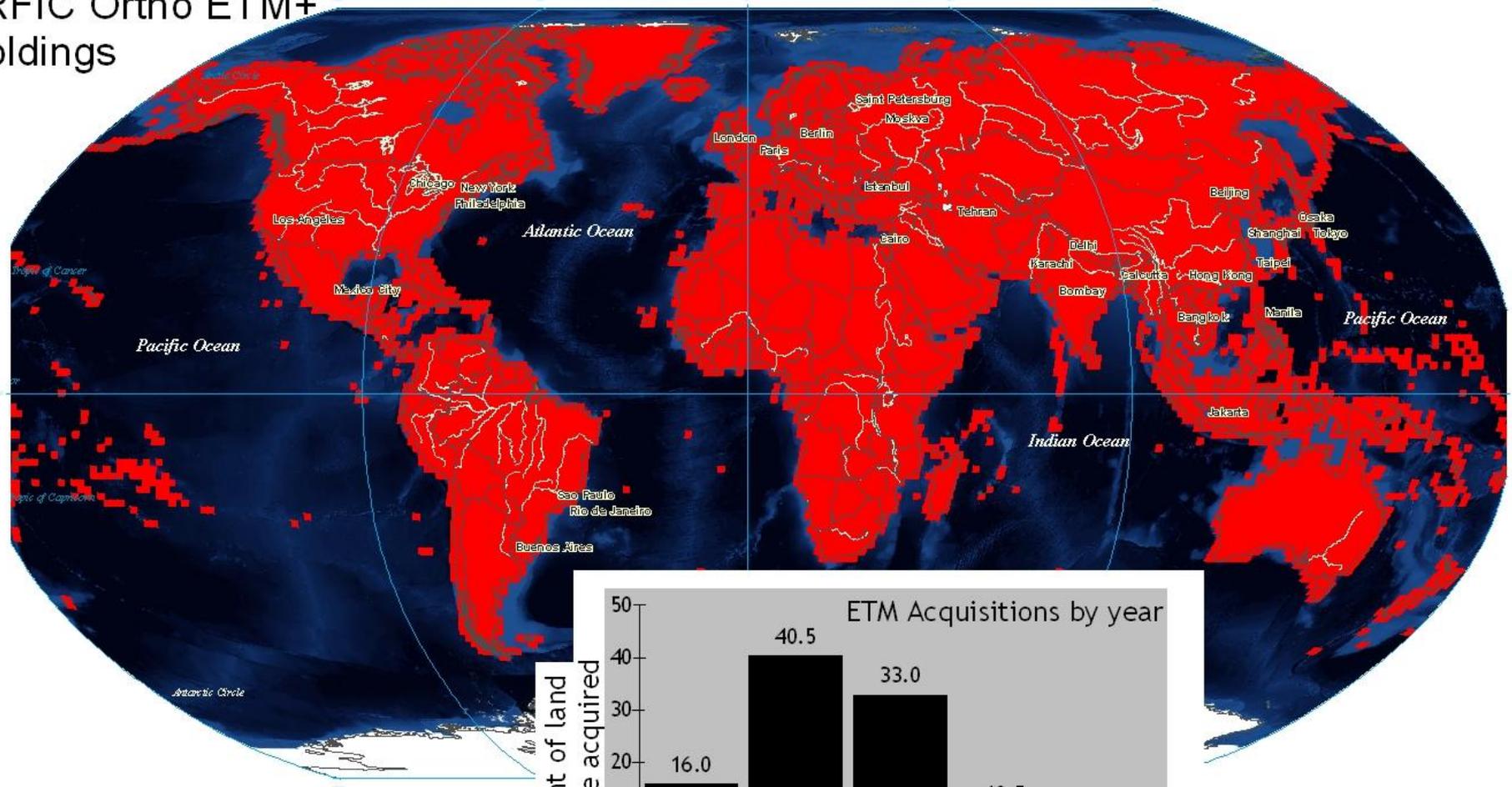
GLS 1990 Data Gap

TRFIC Ortho TM Holdings



Improved GLS 2000 coverage

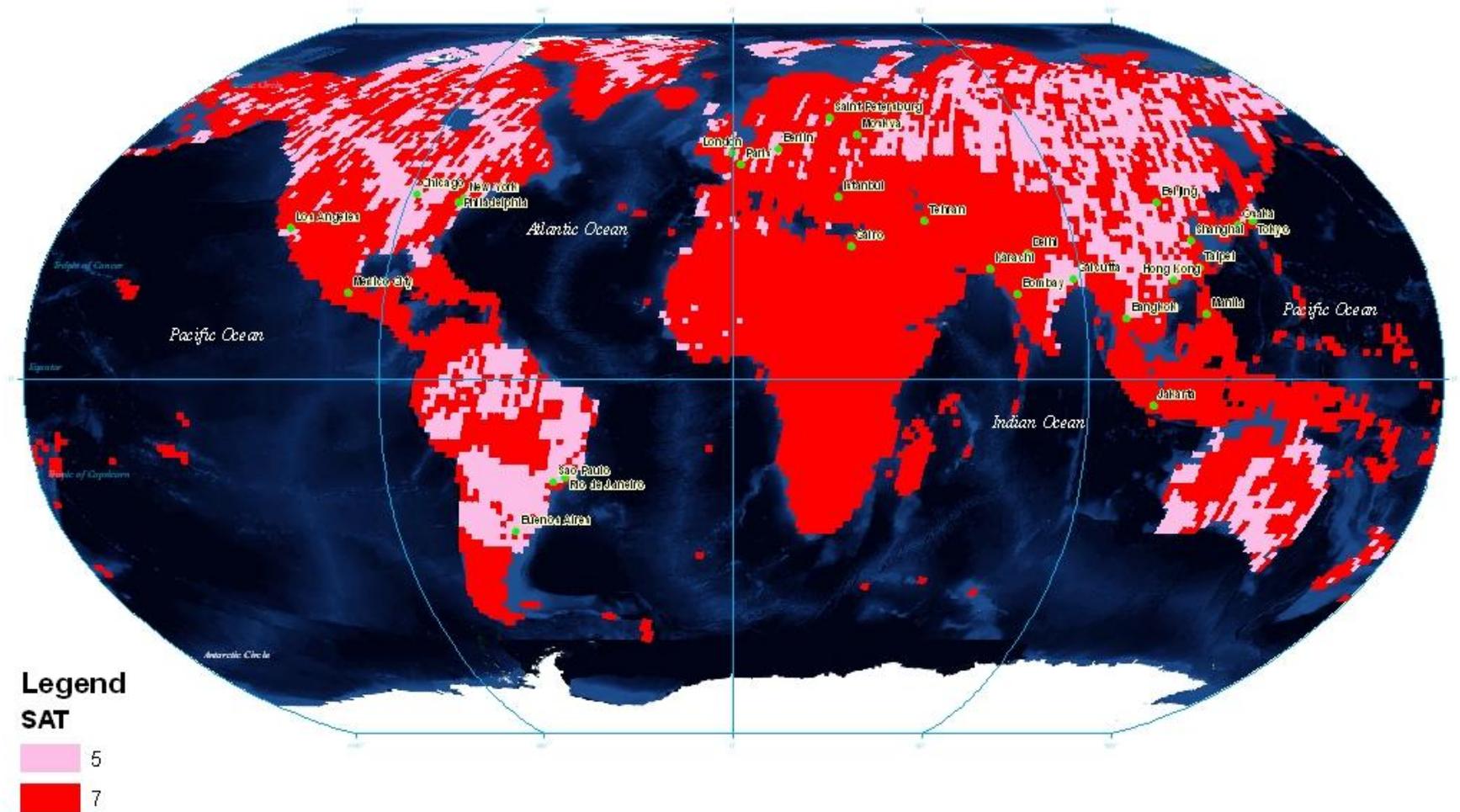
TRFIC Ortho ETM+
Holdings



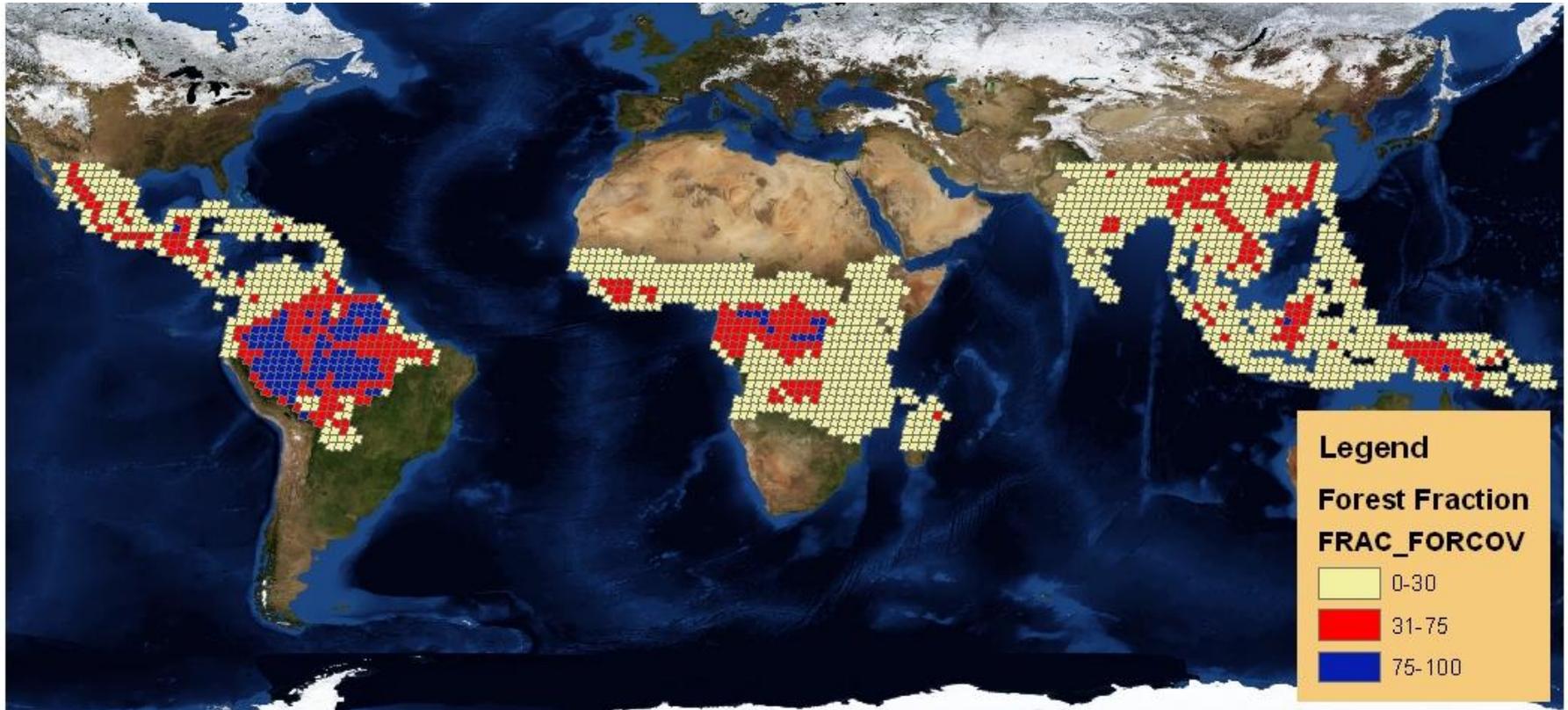
Legend

- Cities (pop. > 5 Mill.)
- Rivers
- Lakes
- Country Boundary
- ETM+

GLS2005 holdings by acquisition satellite



Our Study Area defined with WRS2



GLS Detailed Analysis 2000

Data sets Defined

The data sets described in this report are:

- Landsat 7 data set
- GLS 2000 data set
- TRFIC ETM data set

Census of 3 Archives

Archive	Granule total	Pan Tropic granule total	Individual path/row combinations
Landsat7	614073	124252	1729
GLS 2000	8749	1904	1729
TRFIC <small>(ORTHO EXCLUDED)</small>	3067	1420	713

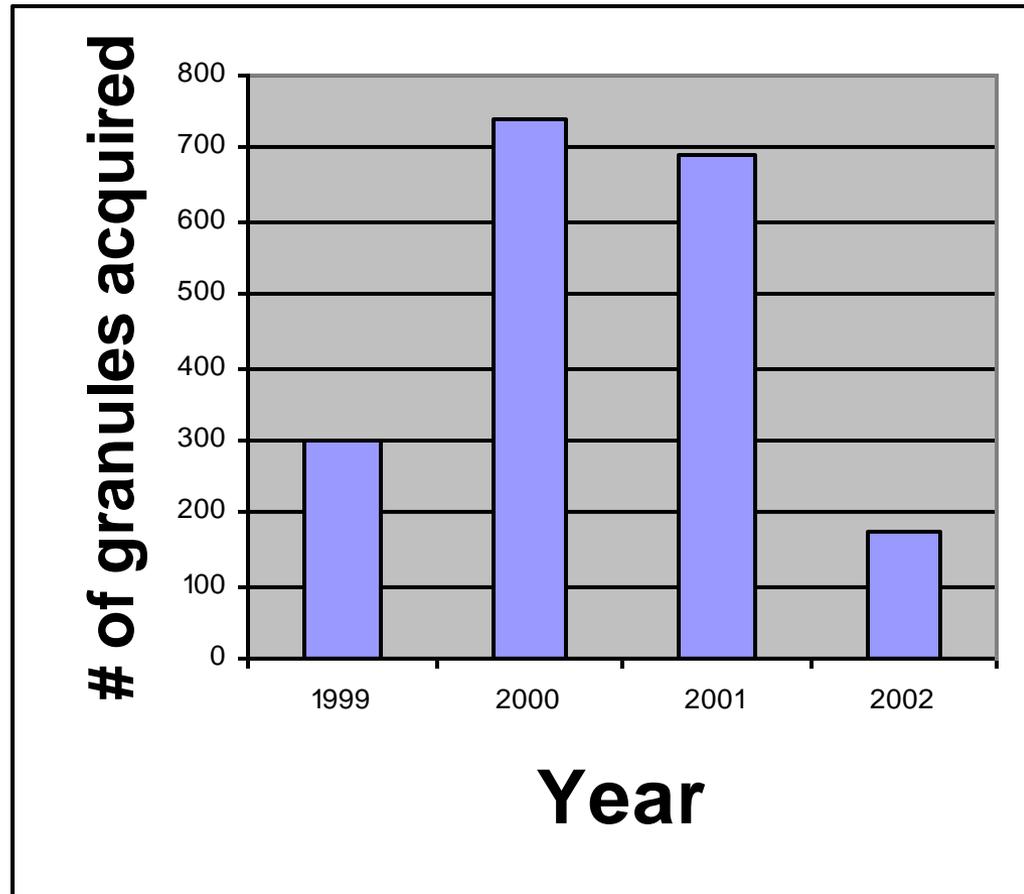
Archive Cloud Cover

Archive	Pan Tropic granule total	Total cloud free granules	Total cloud > 0 and <= 20%	
Landsat7	124252	33313	23385	
GLS 2000	1904	1650	217	
TRFIC (ORTHO EXCLUDED)	1420	1018	340	

In this report the three Landsat data archives will be compared to determine if and when cloud free or nearly cloud free granules can be acquired for the pan-tropics during specific time windows.

Tropical GLS 2000 data set summary

- **The GLS 2000 data set was acquired over a four year period ranging from 1999 to 2002.**
- **Most of the data (76%) was acquired from 2000 to 2001.**
- **Better than in 1990**



Ortho ETM Peak Acquisition month by region

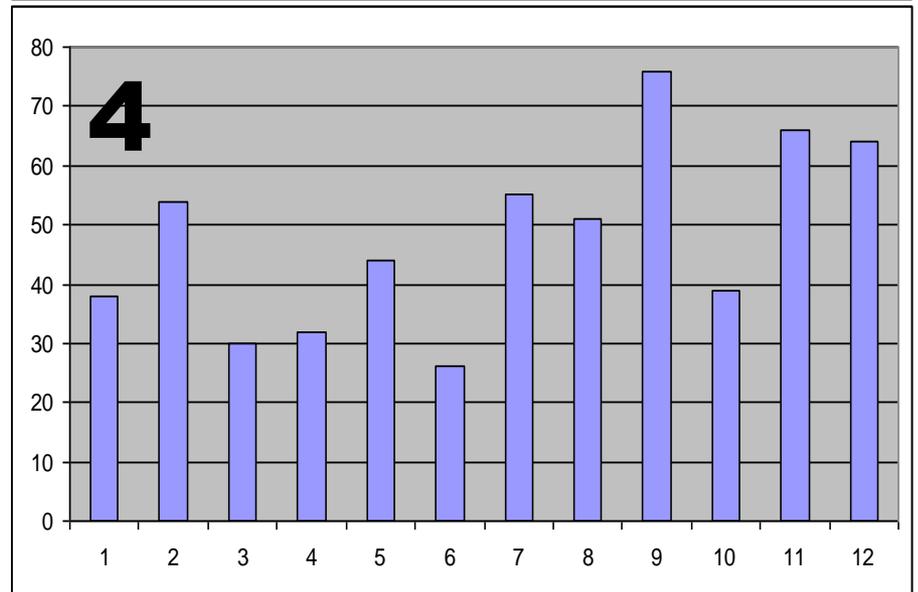
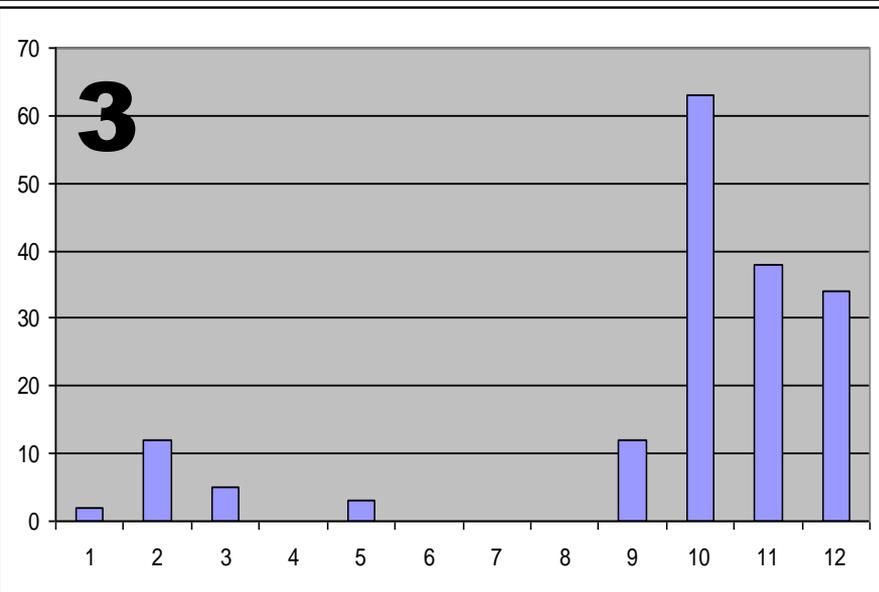
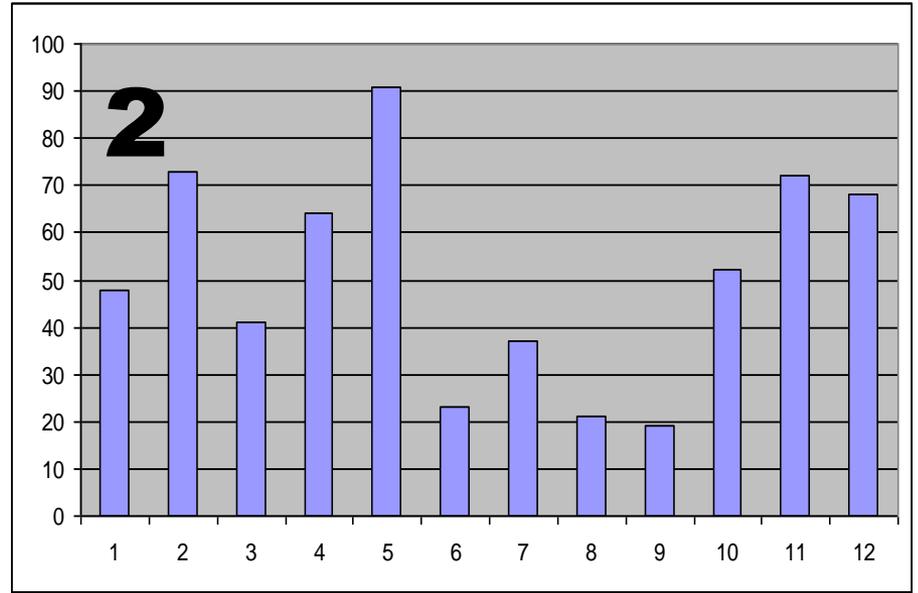
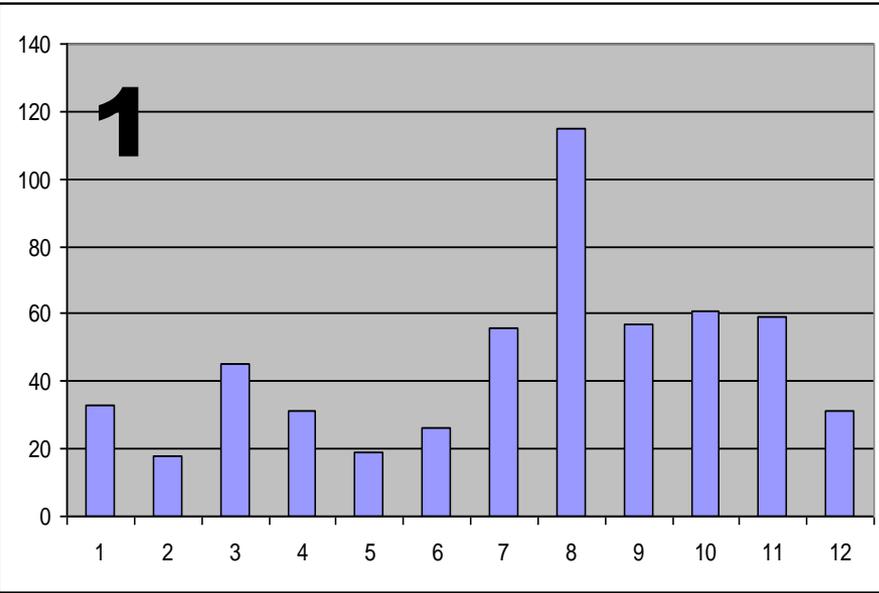
Peak greenness is not likely to occur at the same time so we split the pan tropics into 4 regions:

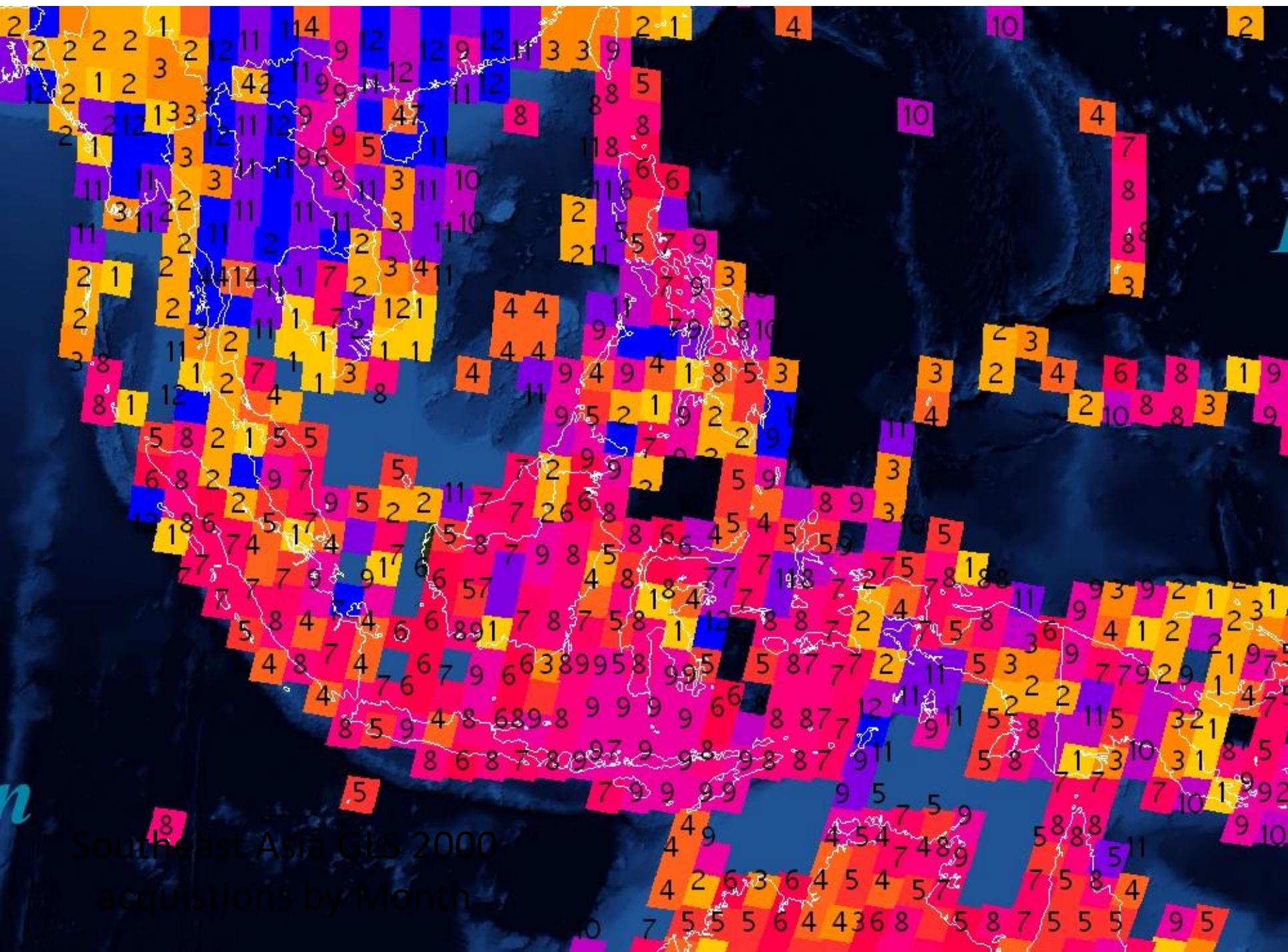
- **region 1 is North, Central and South America**
- **region 2 is Africa**
- **region 3 is South Asia**
- **region 4 is Southeast Asia**

Month in which Ortho ETM acquisition peaks for each region:

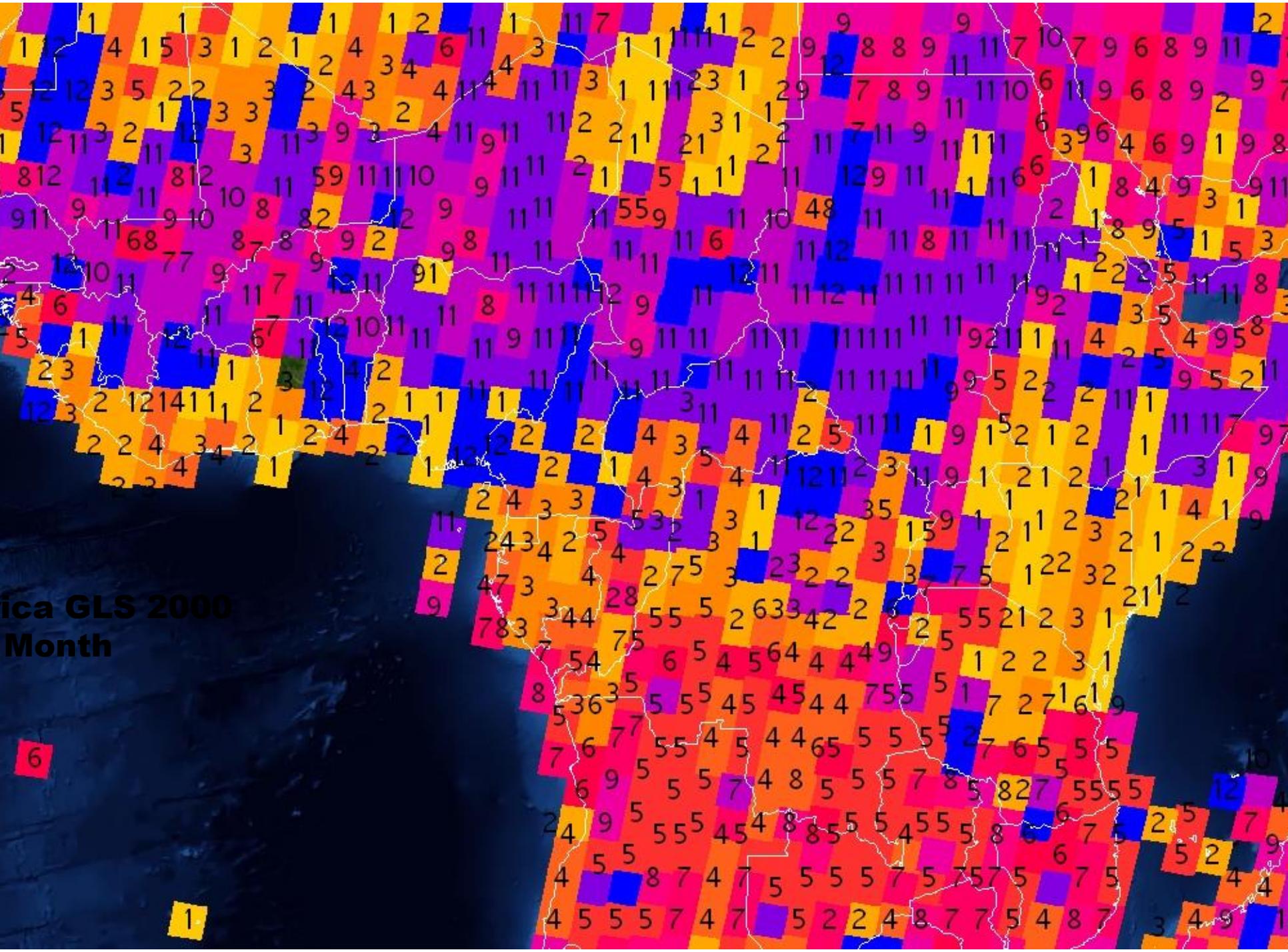
- **region 1 = August**
- **region 2 = May**
- **region 3 = October**
- **region 4 = September**

GLS 2000 Acquisitions By Month for each region





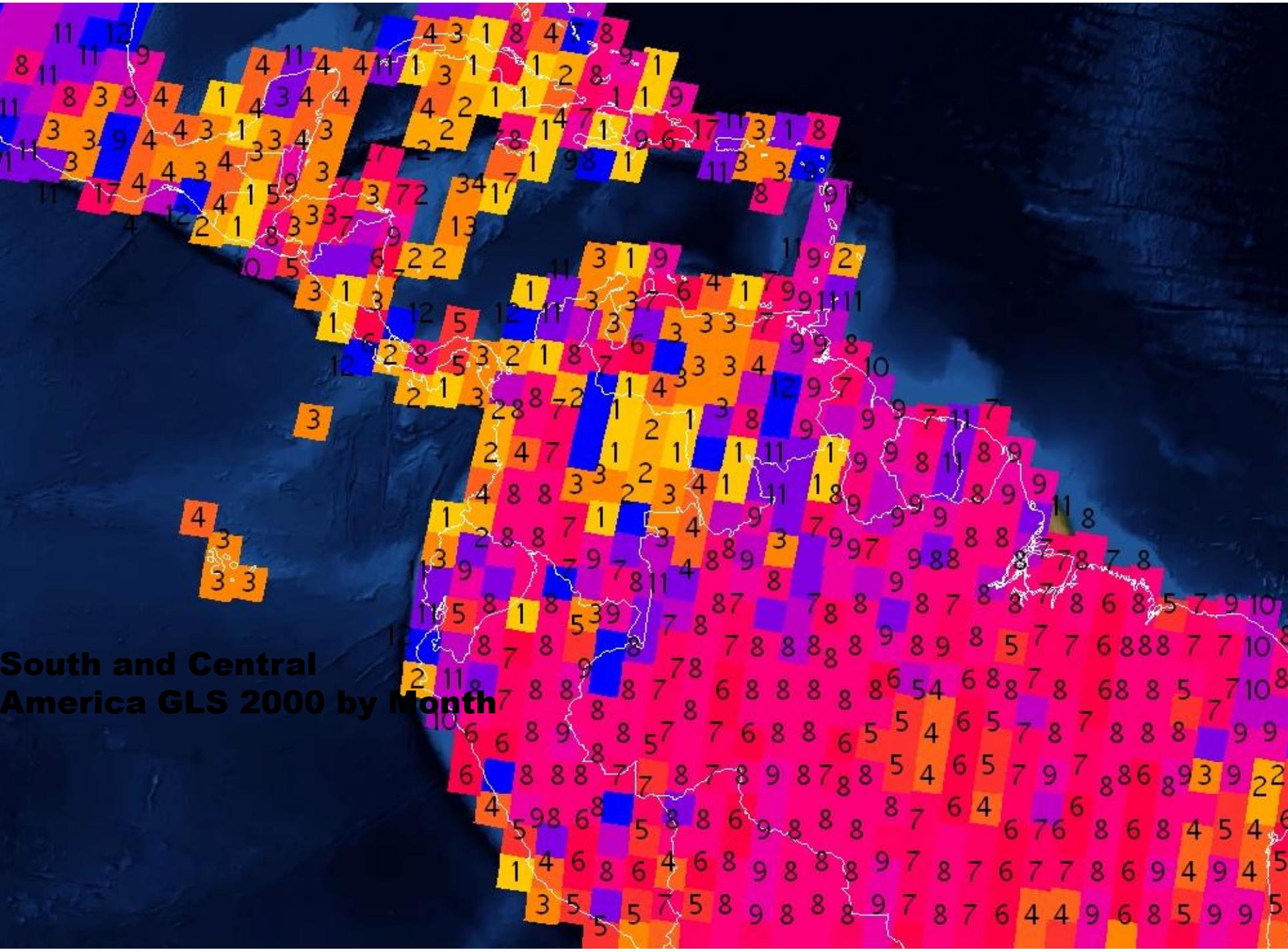
South East Asia GLS 2000
acquisitions by Month



ica GLS 2000
Month

6

1



**South and Central
America GLS 2000 by Month**

GLS 2000 Peak Acquisition Month Comparison

➤ **Comparison of granules in the GLS 2000 and granules available in the Landsat 7 archive using the following criteria:**

- **target year = 2000**
- **cloud = 0**
- **month = target phenology**

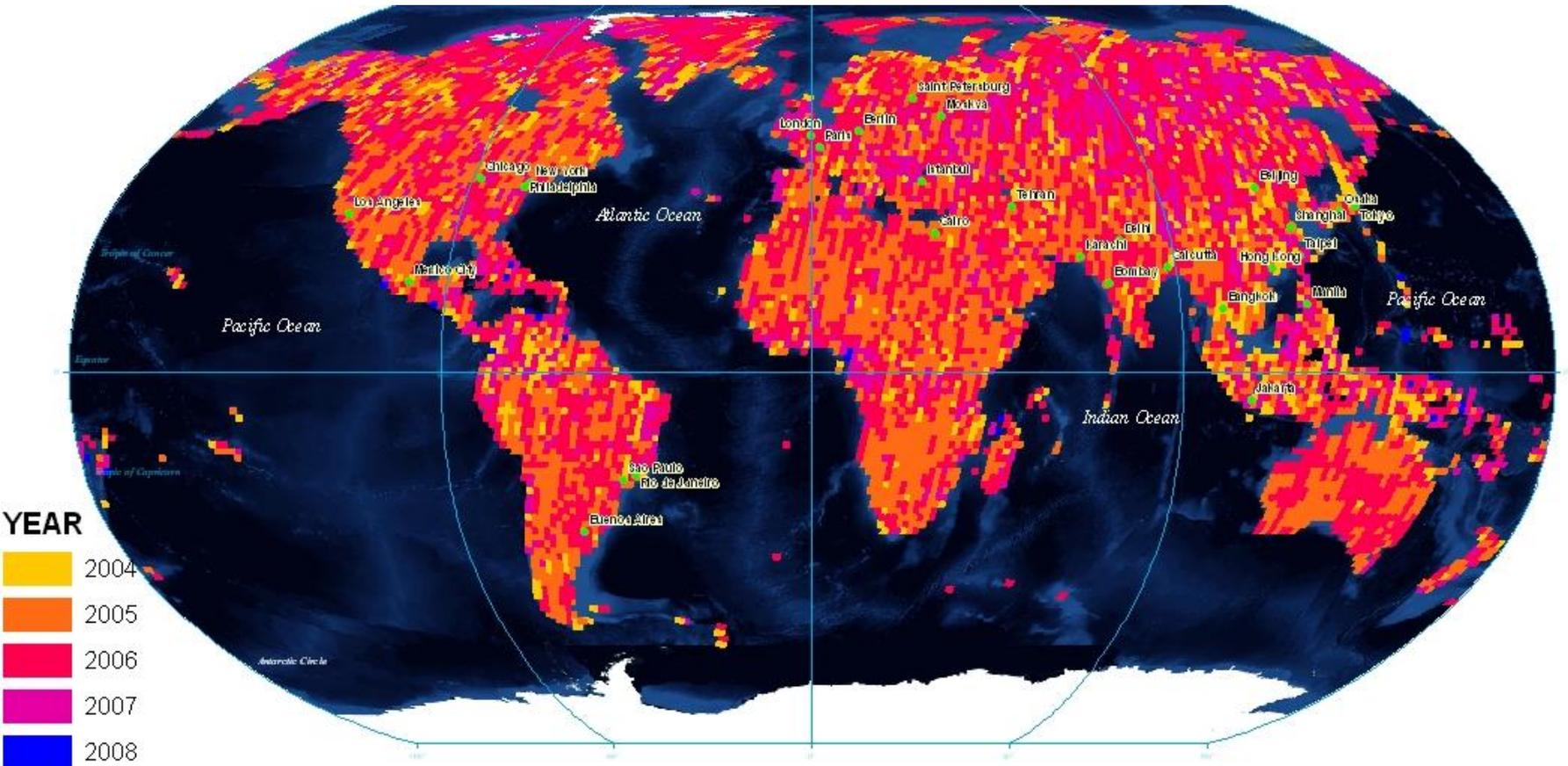
➤ **In region 2 19 granules are in the GLS 2000 for the peak acquisition month. Landsat 7 collected 107 cloud free images in the same region and month.**

➤ **The Landsat7 archive was underutilized when selecting data for the pan-tropical portion of the ortho ETM archive.**

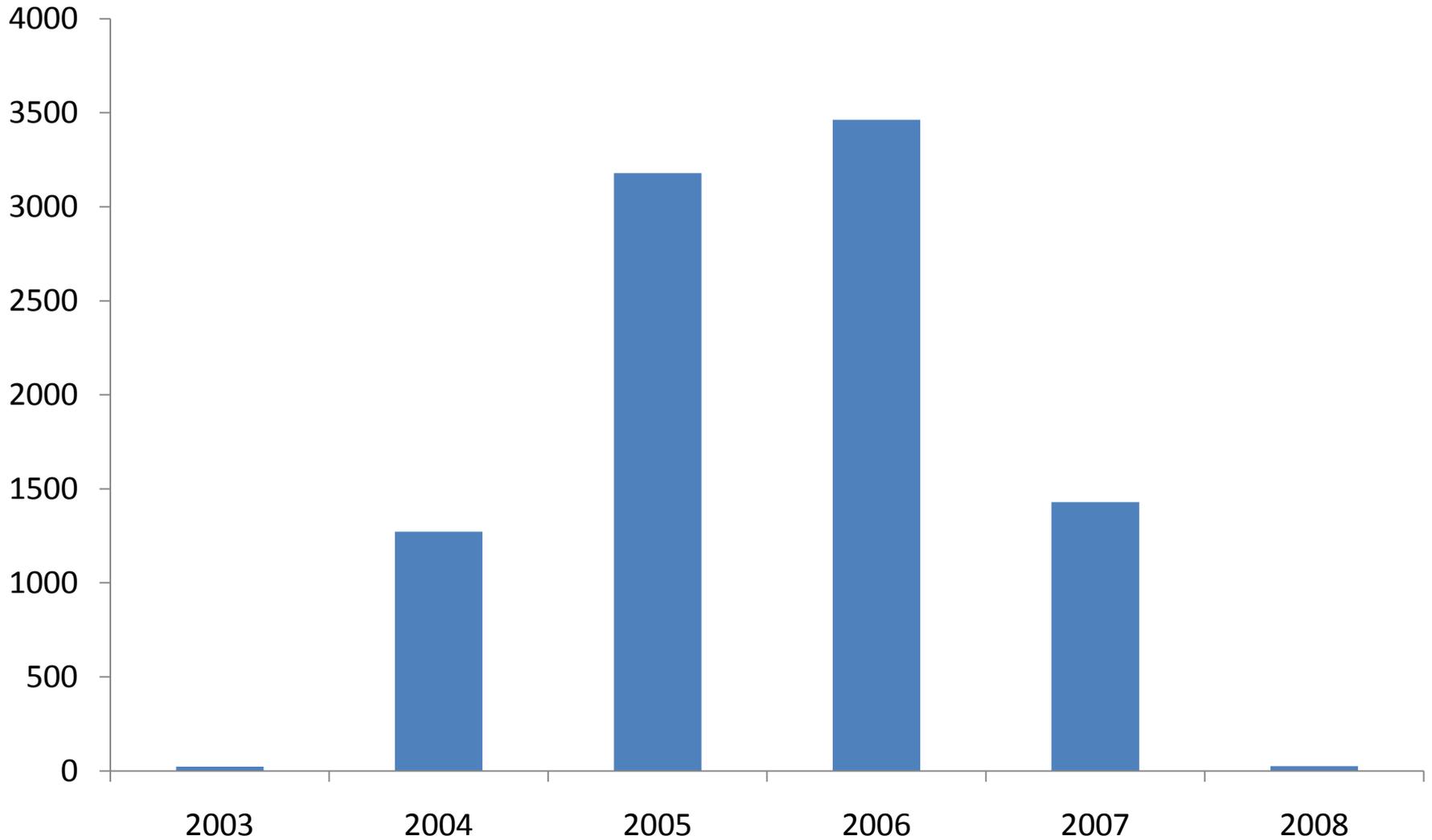
Region	granules in peak month	
	Ortho	Landsat 7
1	29	124
2	19	107
3	26	62
4	17	67

Detailed Analysis for 2005

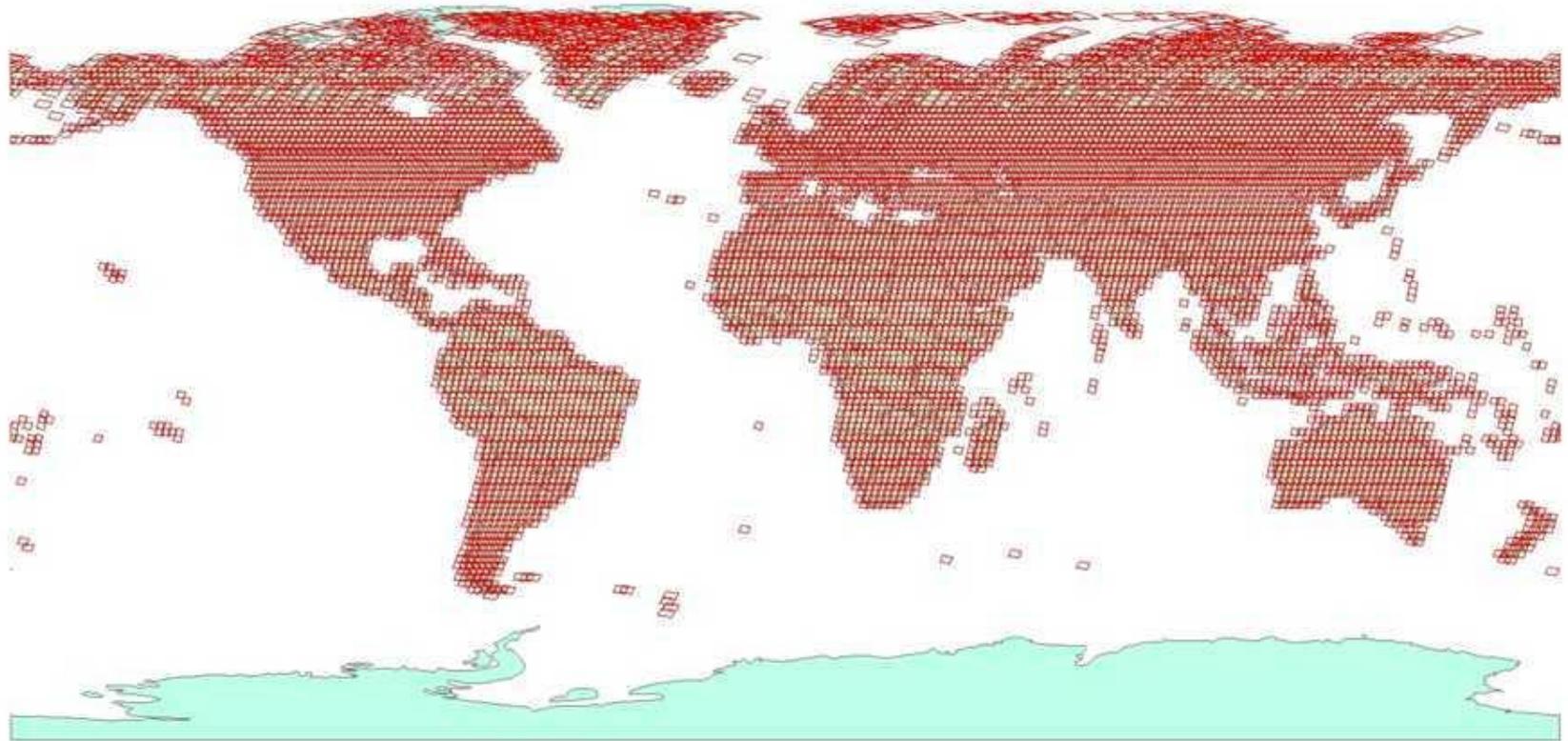
GLS2005 archive by year



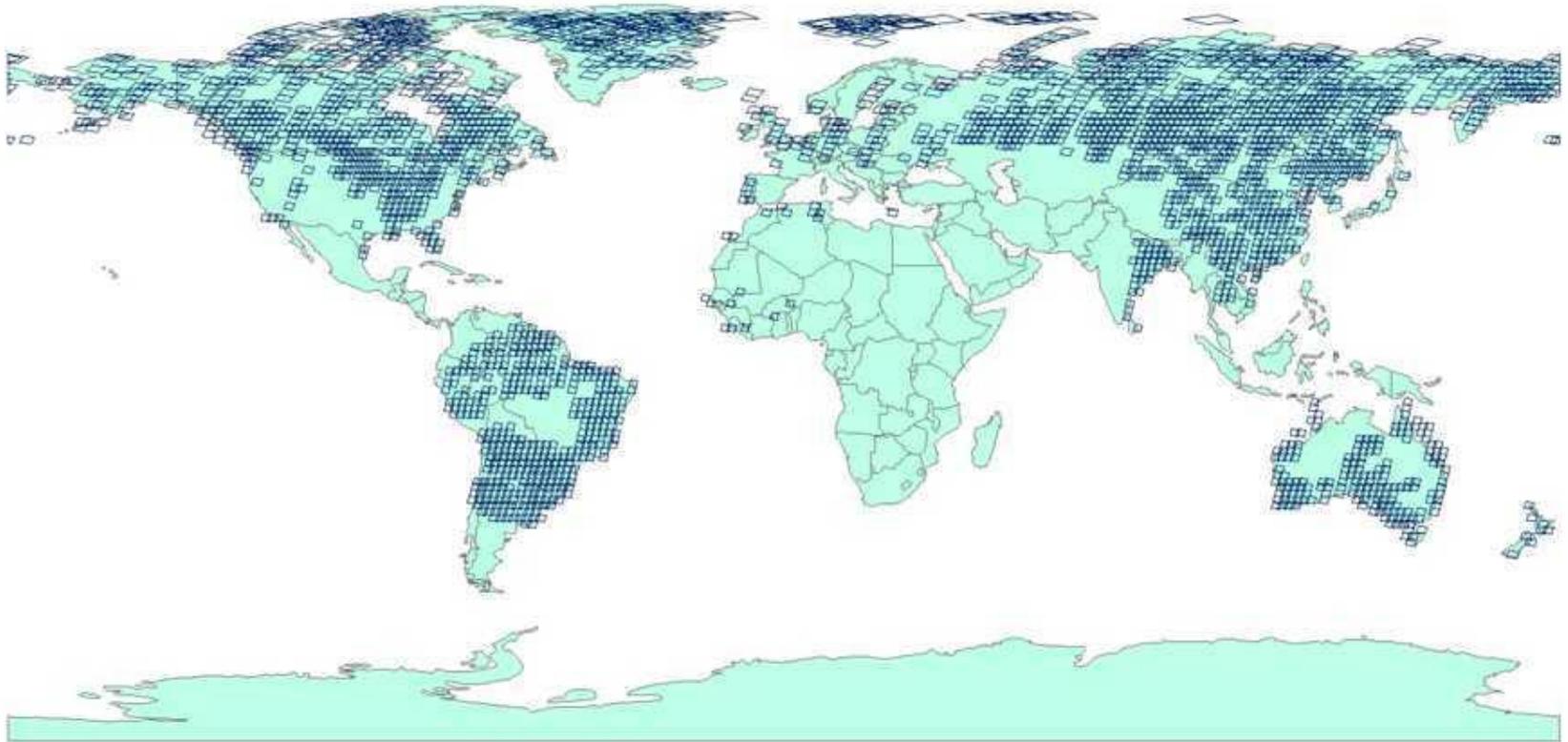
GLS2005 acquisition by year— Best effort yet



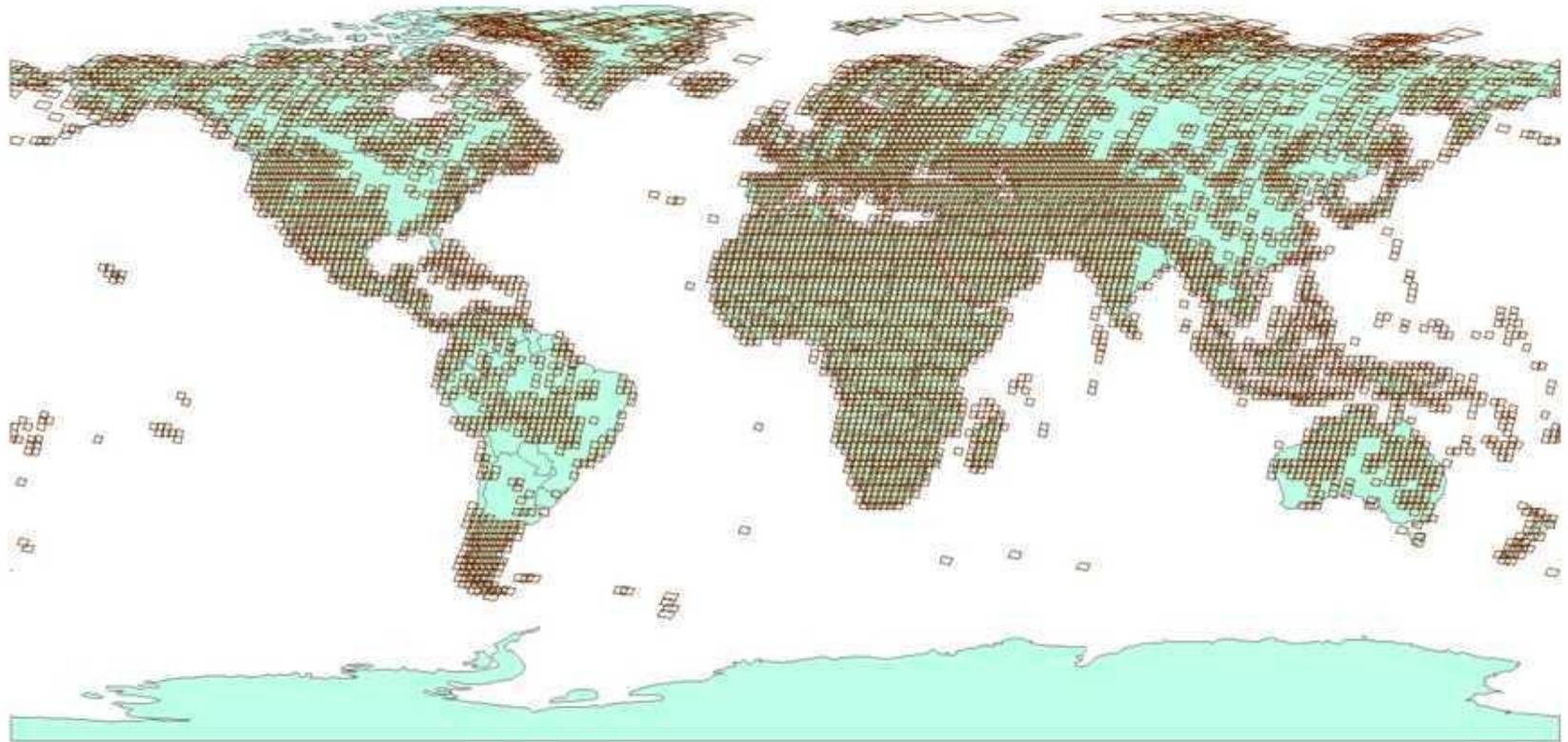
Coverage Map: All Granules



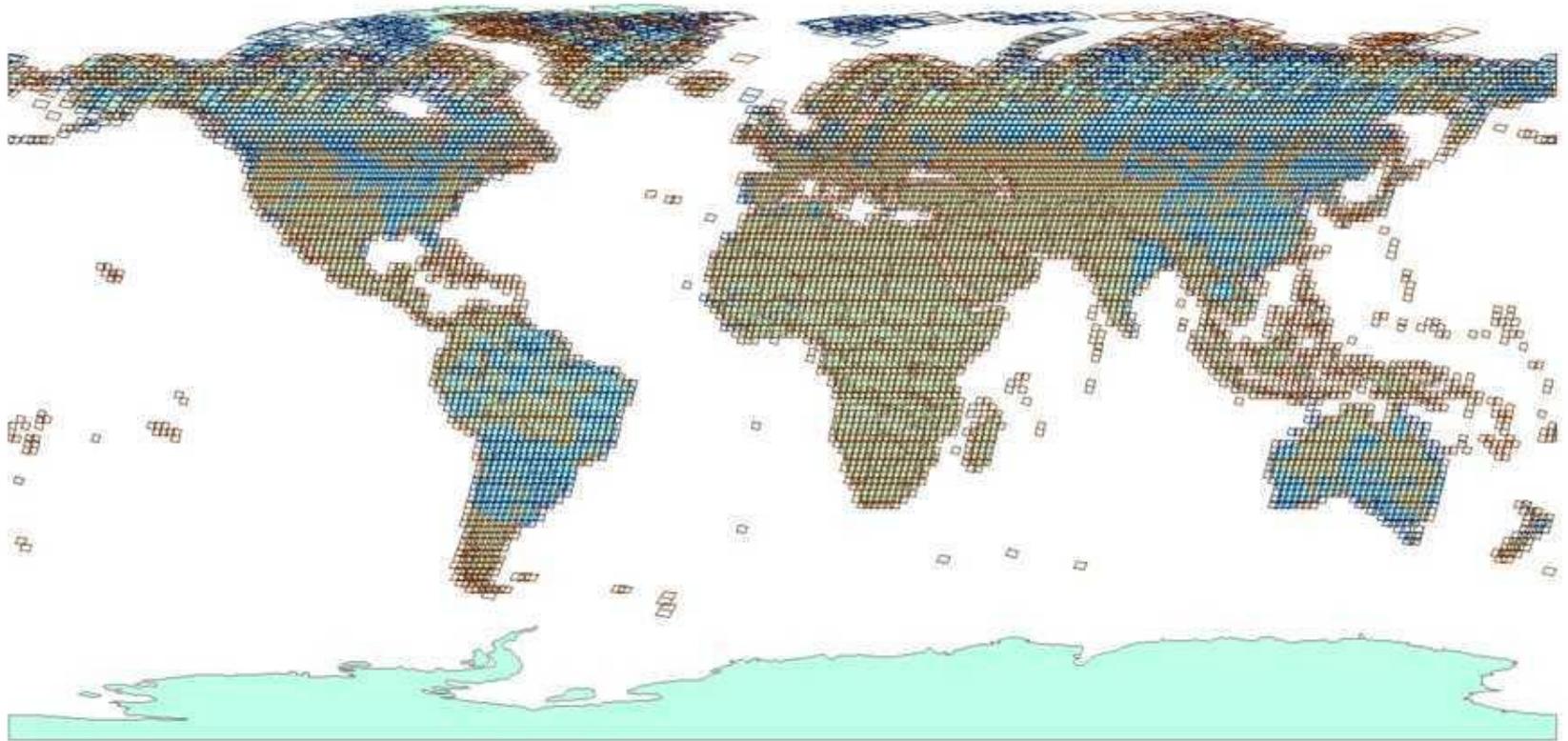
Coverage Map: Landsat 5



Coverage Map: Landsat 7



Coverage Map – Transition areas between Landsat 5 and 7

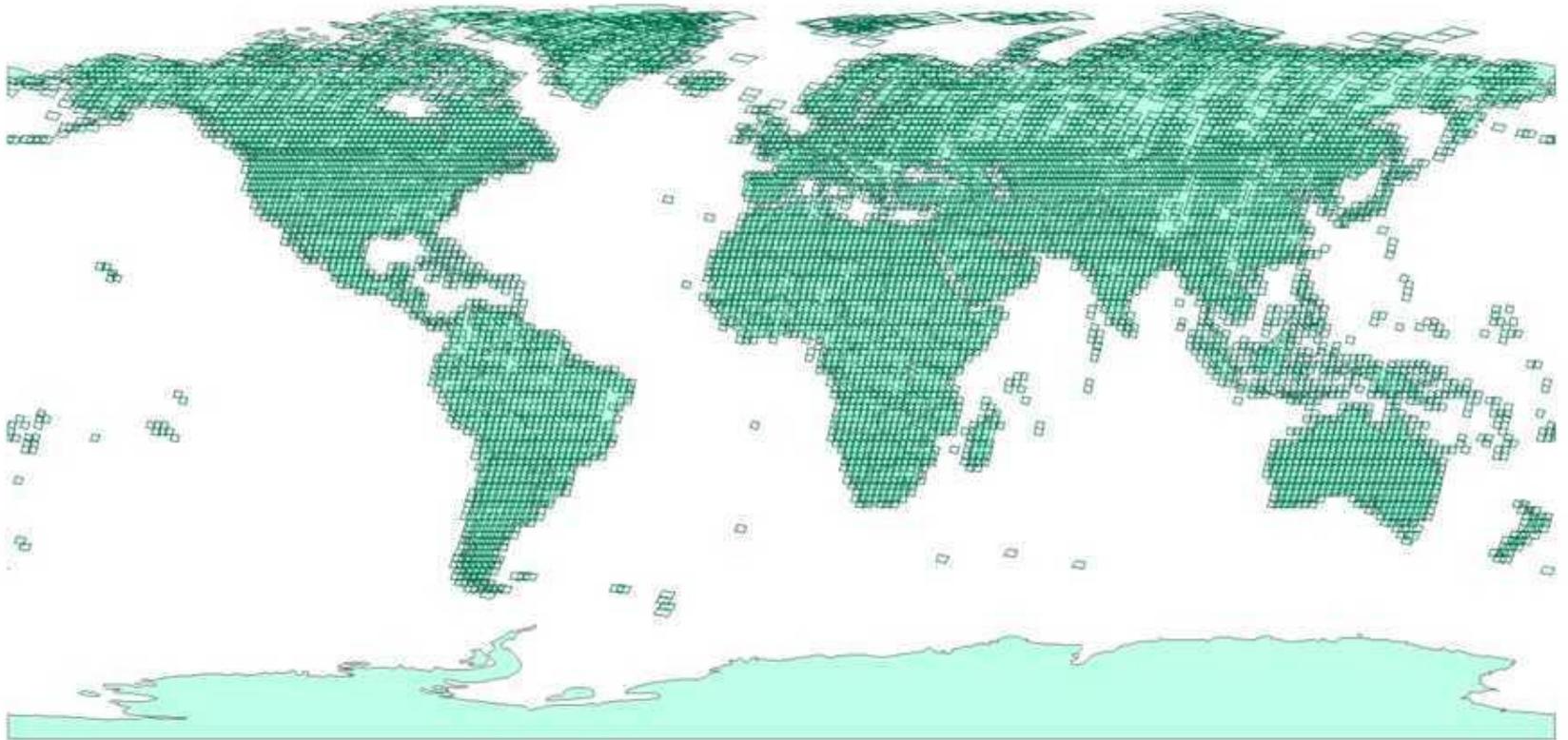


Granules by Year of Acquisition

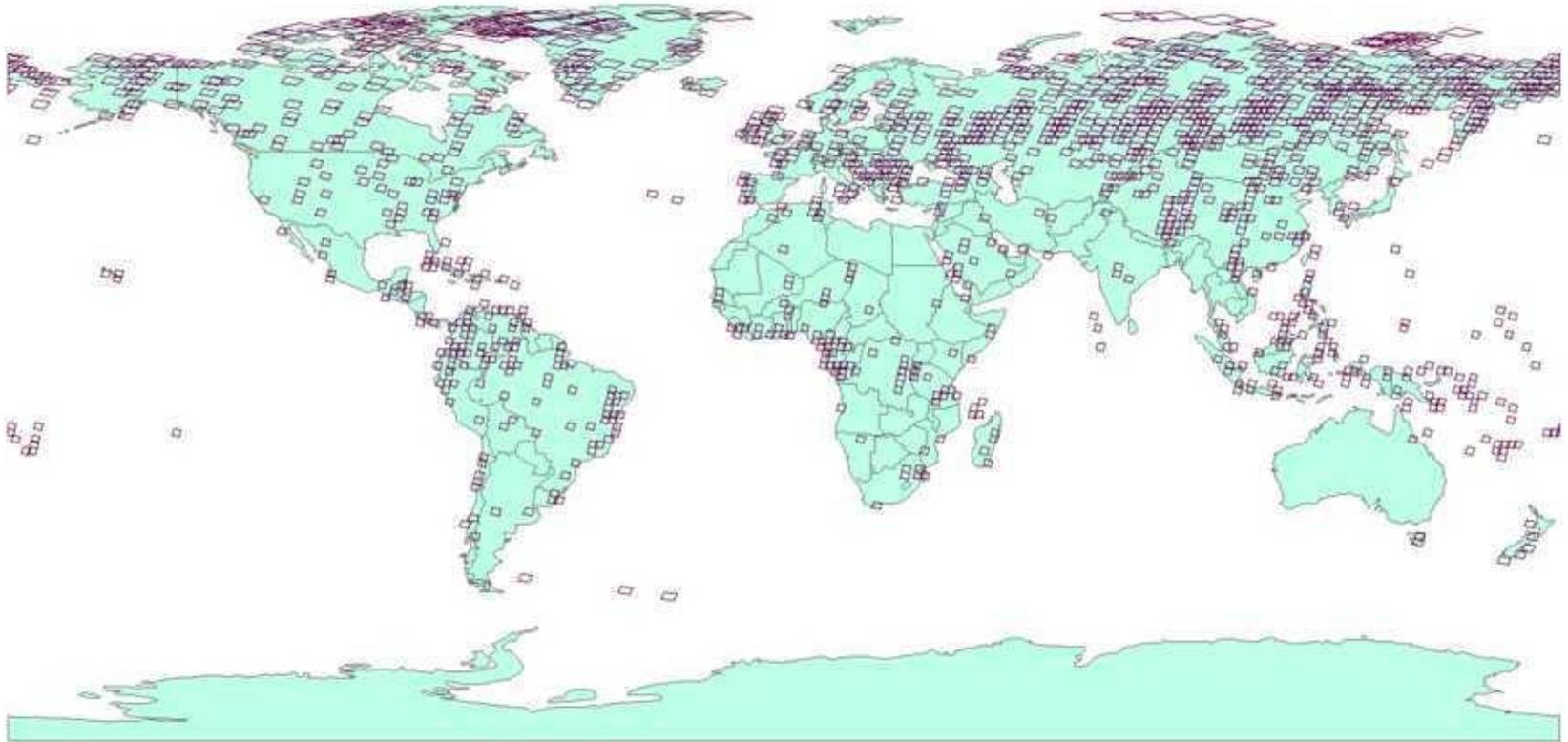
Year	Count	%
2003	23	0.24%
2004	1272	13.55%
2005	3179	33.86%
2006	3462	36.87%
2007	1429	15.22%
2008	25	0.27%

7913 (84.27%) of acquisition 2005 +/- 1 year

Coverage Map: 2005 +/- 1 Year



Coverage Map: > 2005 +/- 1 Year



Granules by Month of Acquisition

Month	Count	%
1	488	5.20%
2	497	5.29%
3	634	6.75%
4	573	6.10%
5	764	8.14%
6	962	10.24%
7	1571	16.73%
8	1432	15.25%
9	1117	11.90%
10	575	6.12%
11	465	4.95%
12	312	3.32%

SE Asia: Acq. Month

Legend

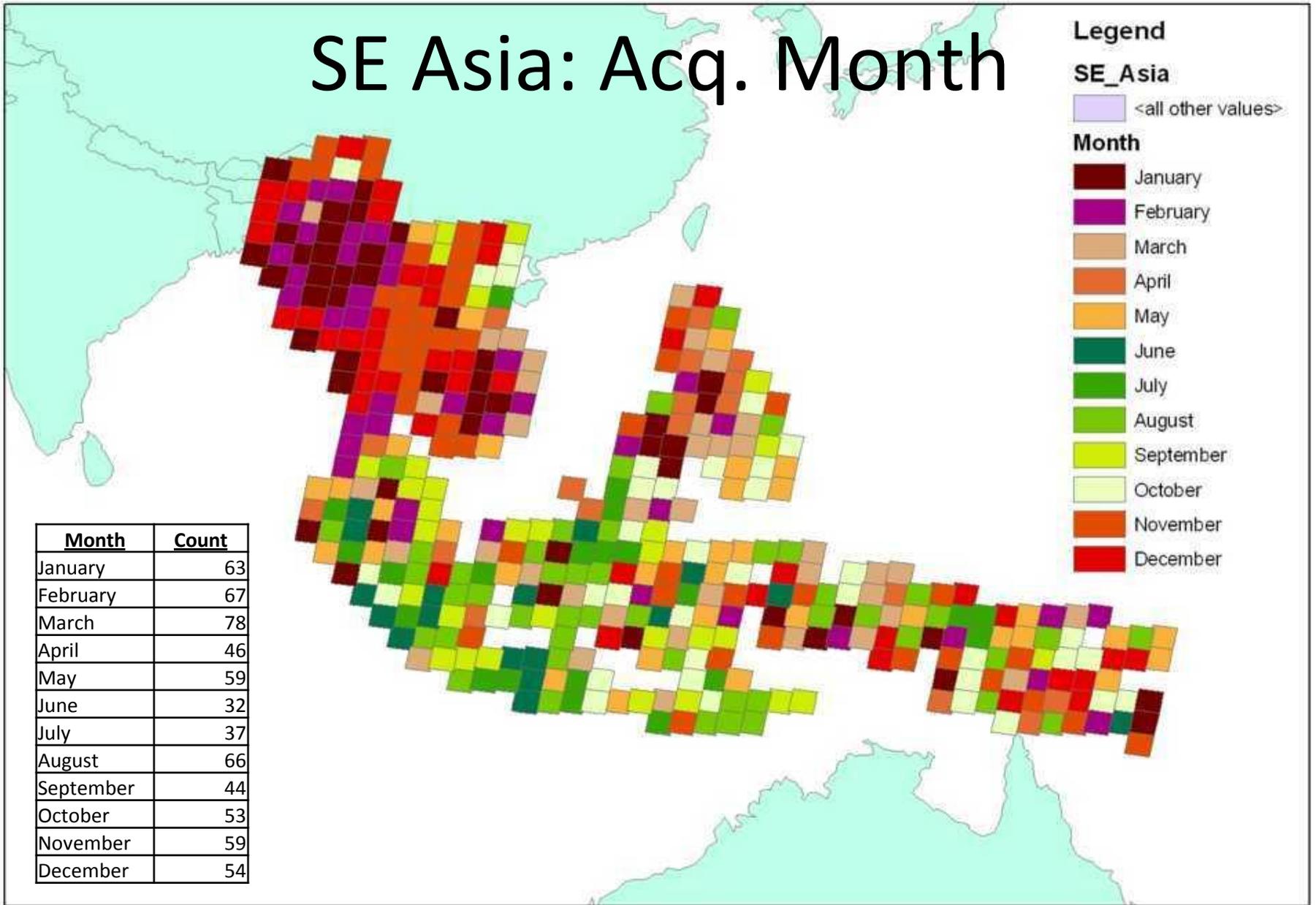
SE_Asia

<all other values>

Month

- January
- February
- March
- April
- May
- June
- July
- August
- September
- October
- November
- December

Month	Count
January	63
February	67
March	78
April	46
May	59
June	32
July	37
August	66
September	44
October	53
November	59
December	54



S. America: Acq. Month

Legend

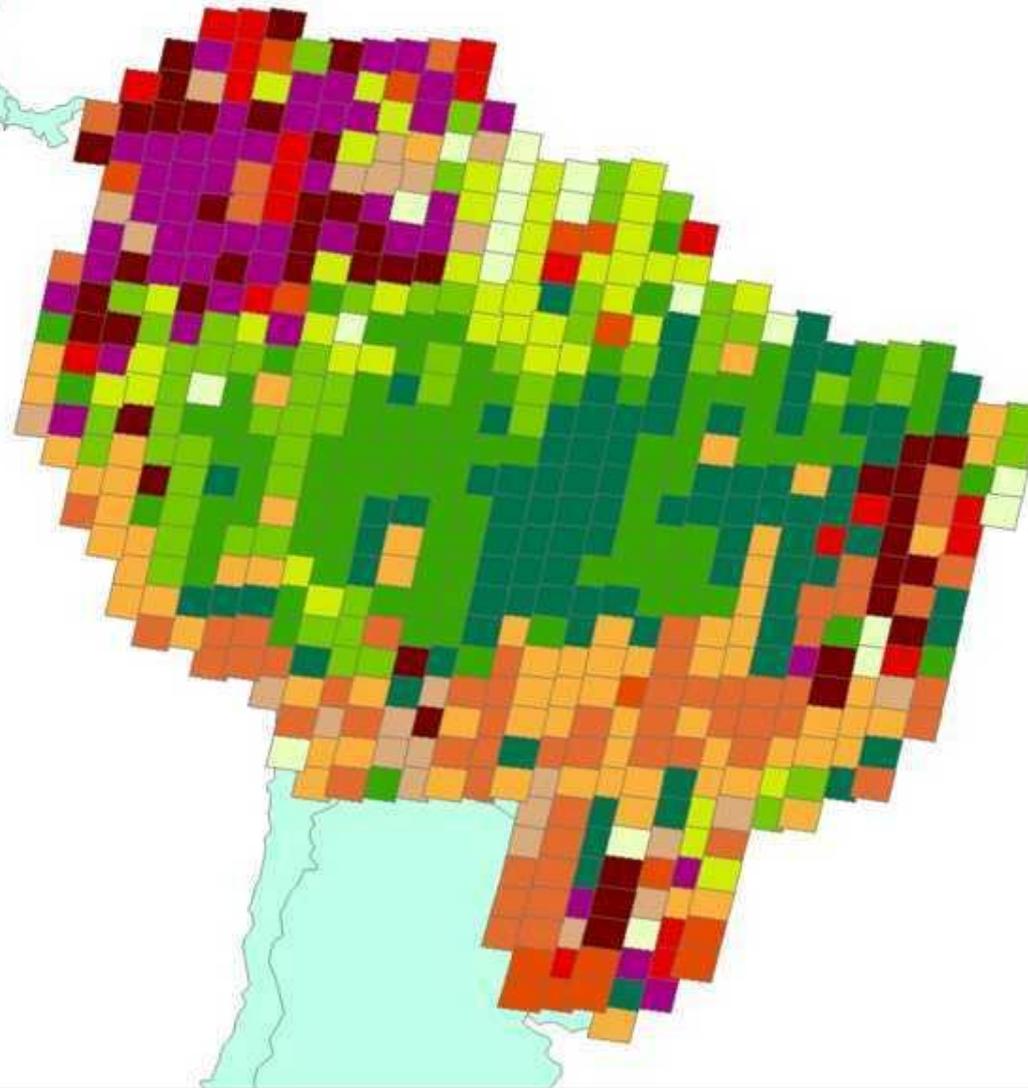
S_America

<all other values>

Month

- January
- February
- March
- April
- May
- June
- July
- August
- September
- October
- November
- December

Month	Count
January	64
February	56
March	31
April	70
May	79
June	97
July	108
August	75
September	52
October	28
November	19
December	31



Africa: Acq. Month

<u>Month</u>	<u>Count</u>
January	115
February	92
March	164
April	128
May	133
June	63
July	25
August	35
September	50
October	100
November	133
December	76

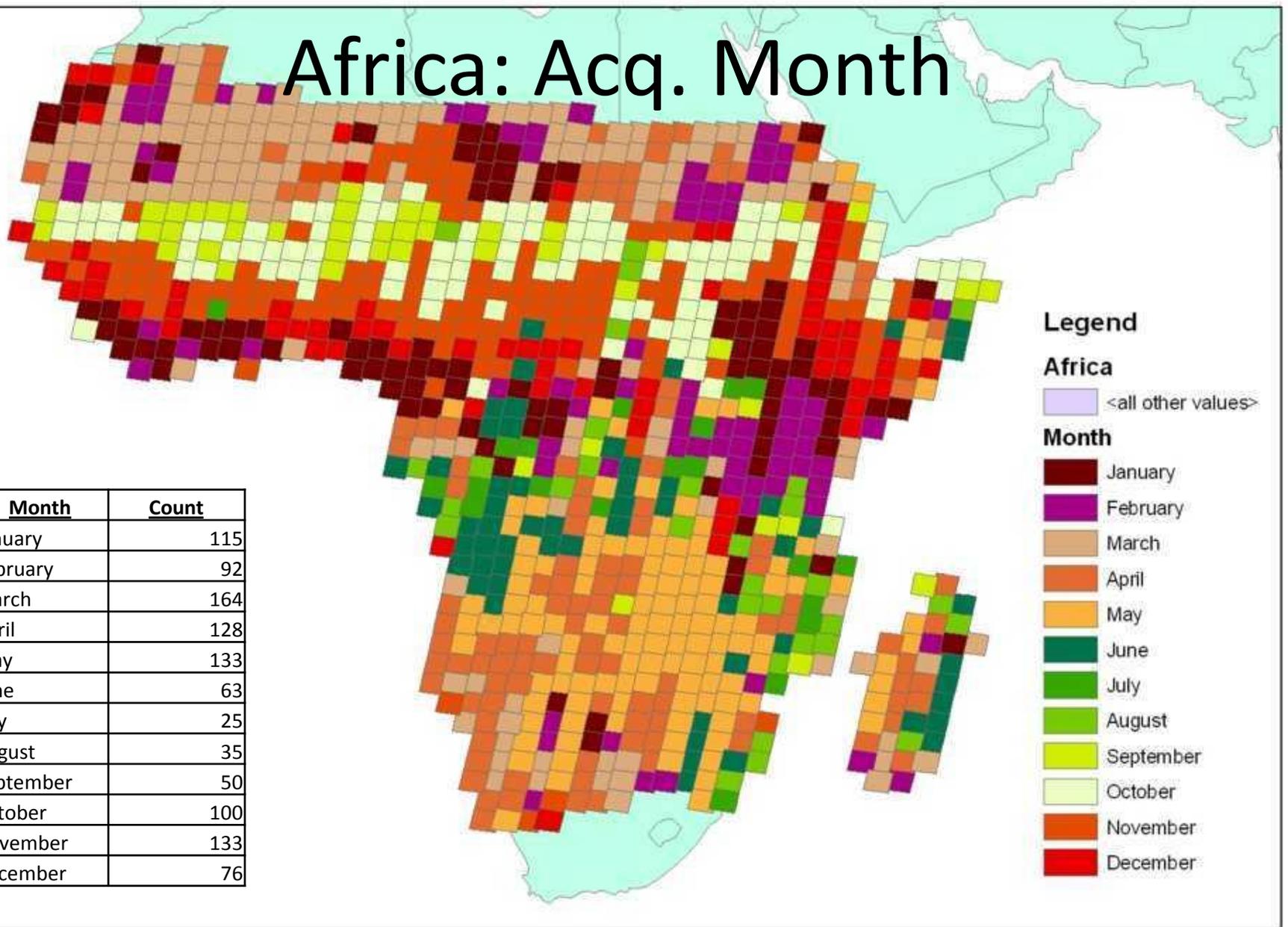
Legend

Africa

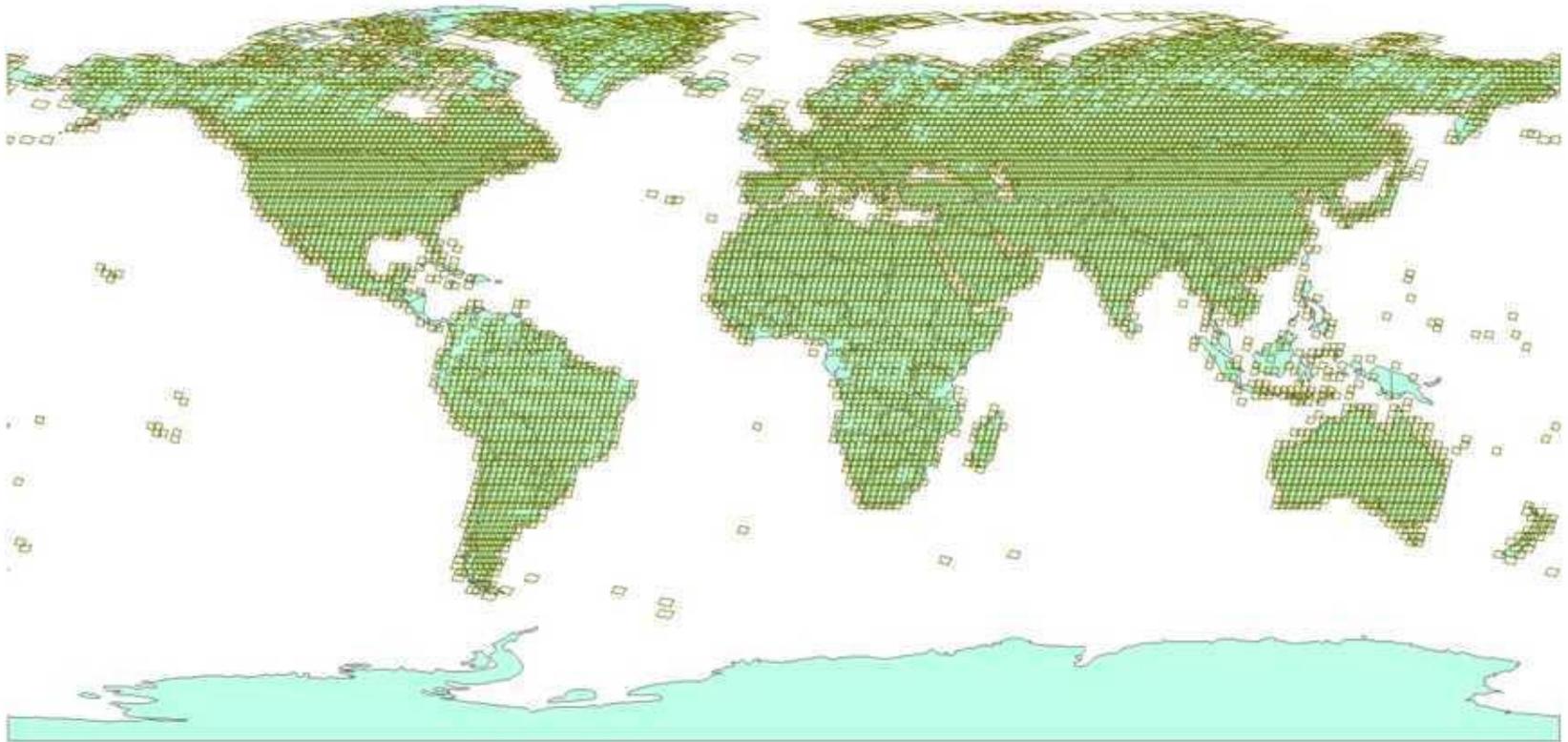
 <all other values>

Month

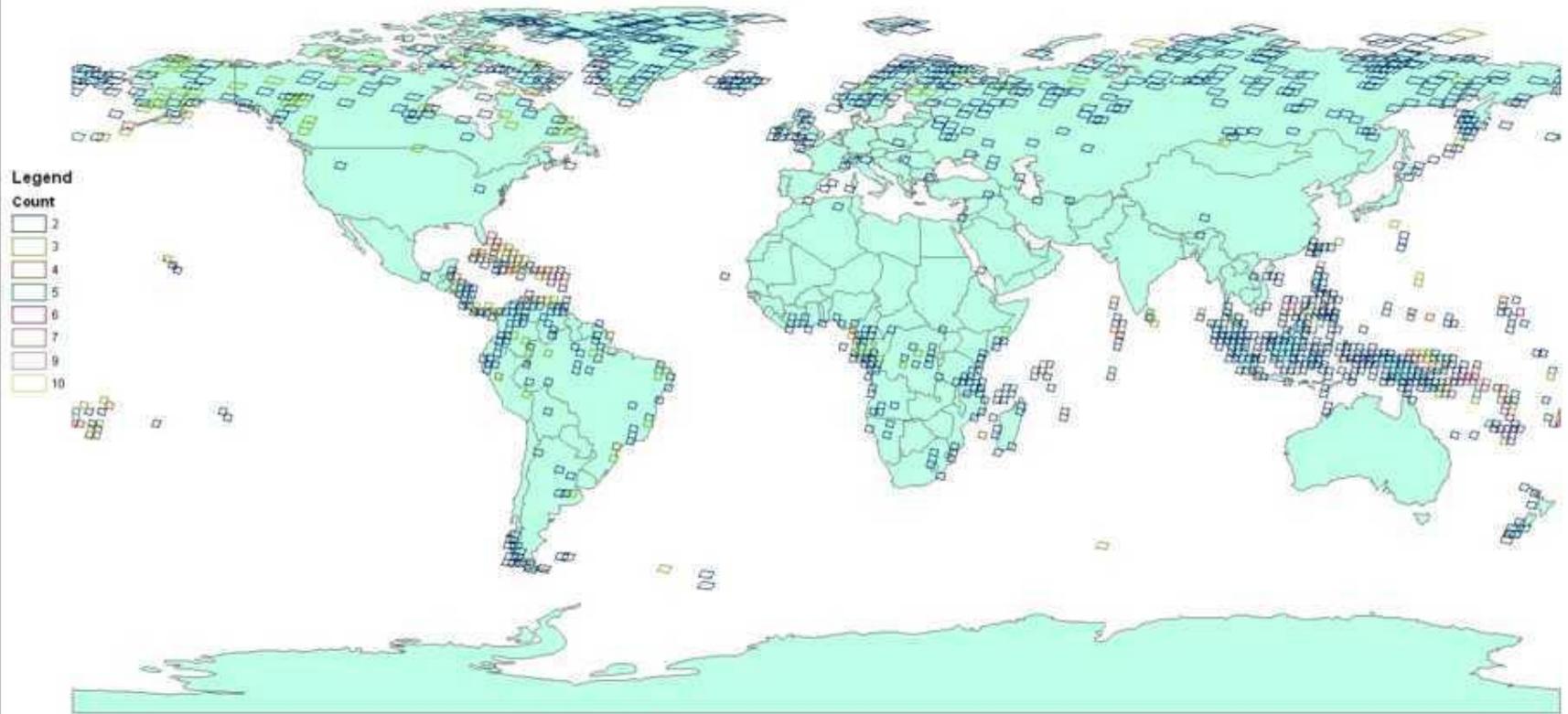
-  January
-  February
-  March
-  April
-  May
-  June
-  July
-  August
-  September
-  October
-  November
-  December



Coverage Map: Path Row Tiles Freq = 1



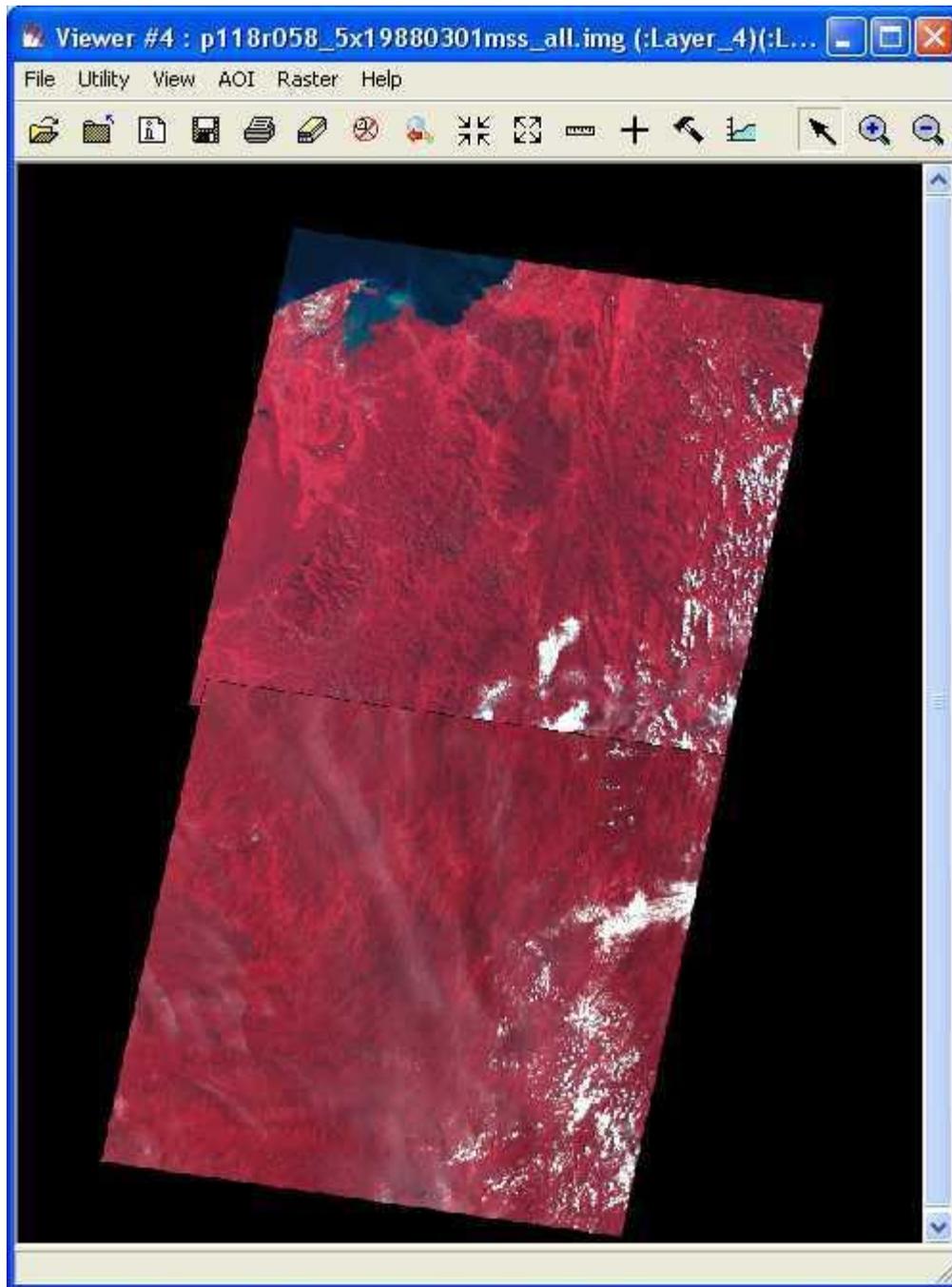
Coverage Map: Path Row Tiles Freq > 1



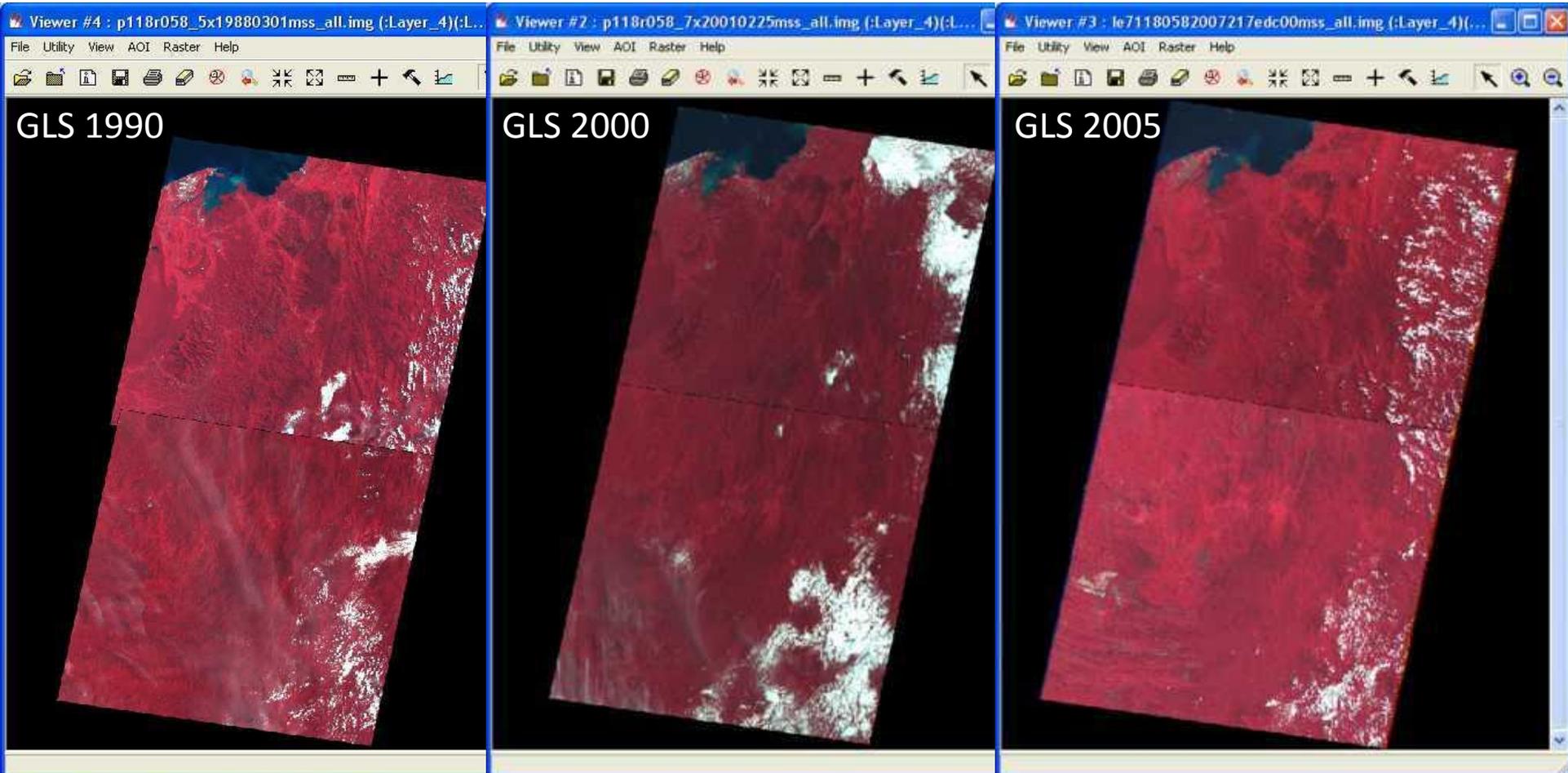
Needs for Better Temporal Fidelity

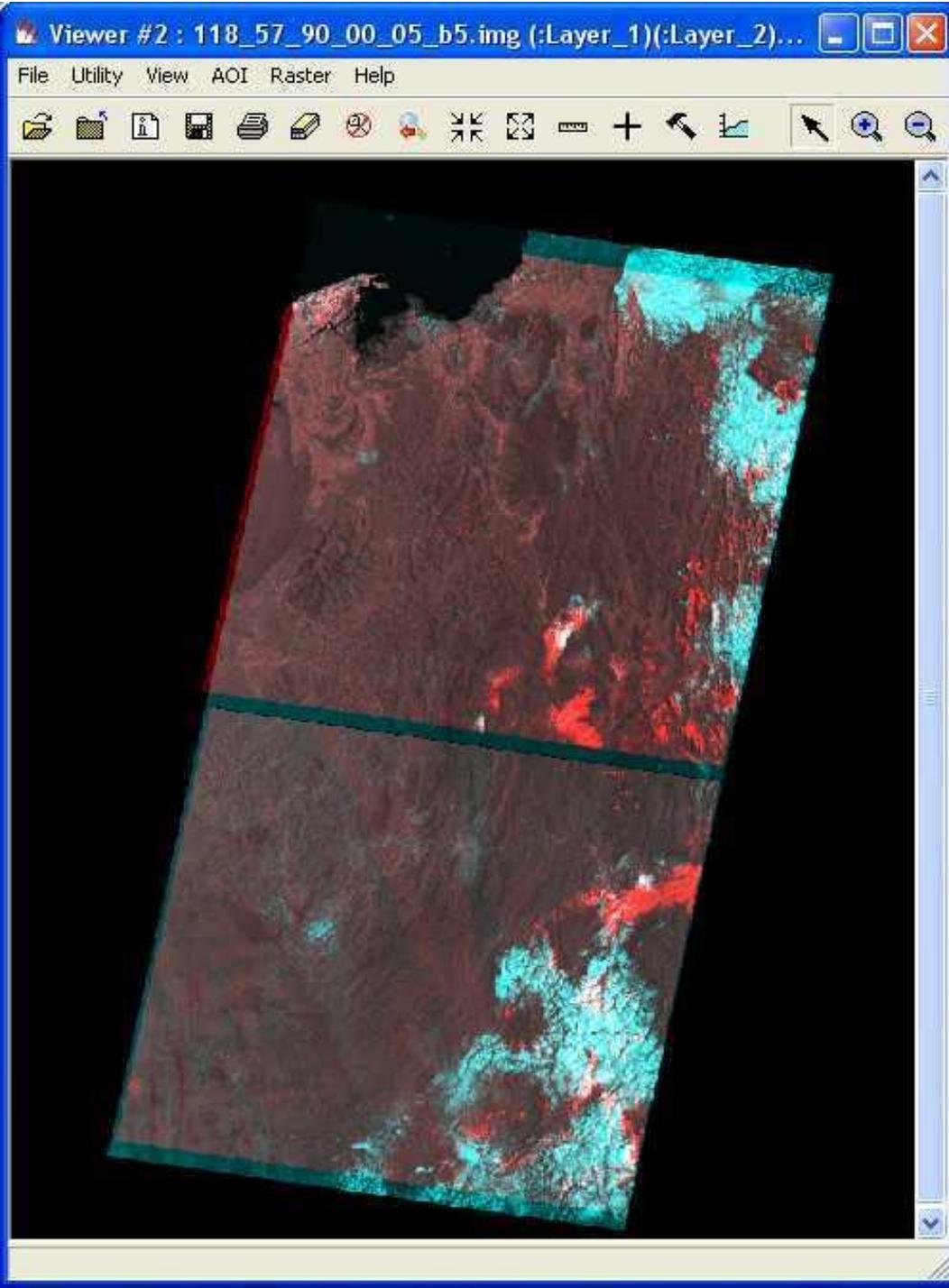
Borneo – Cloud Cover



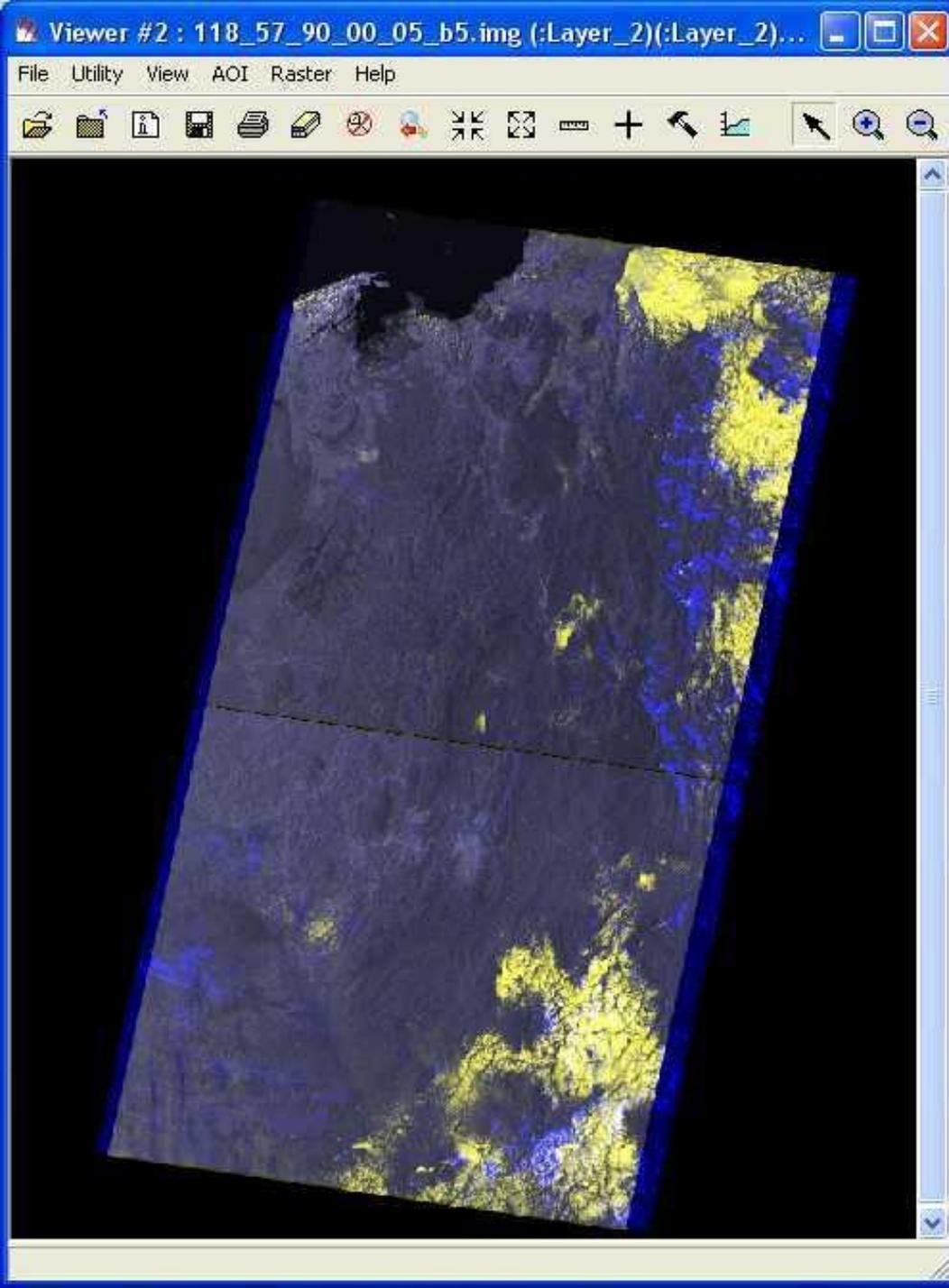


Clouds – Western part of images all three dates

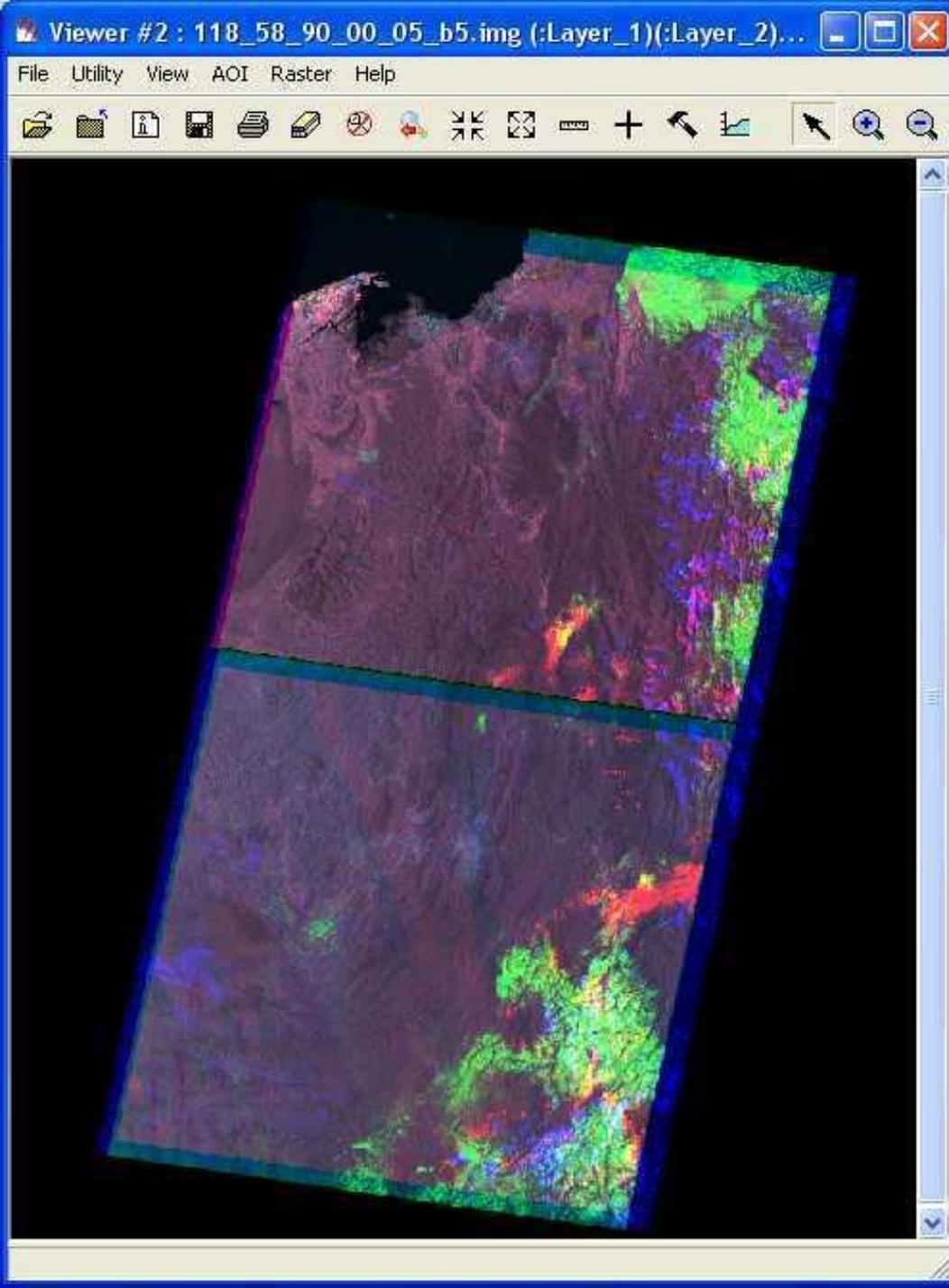




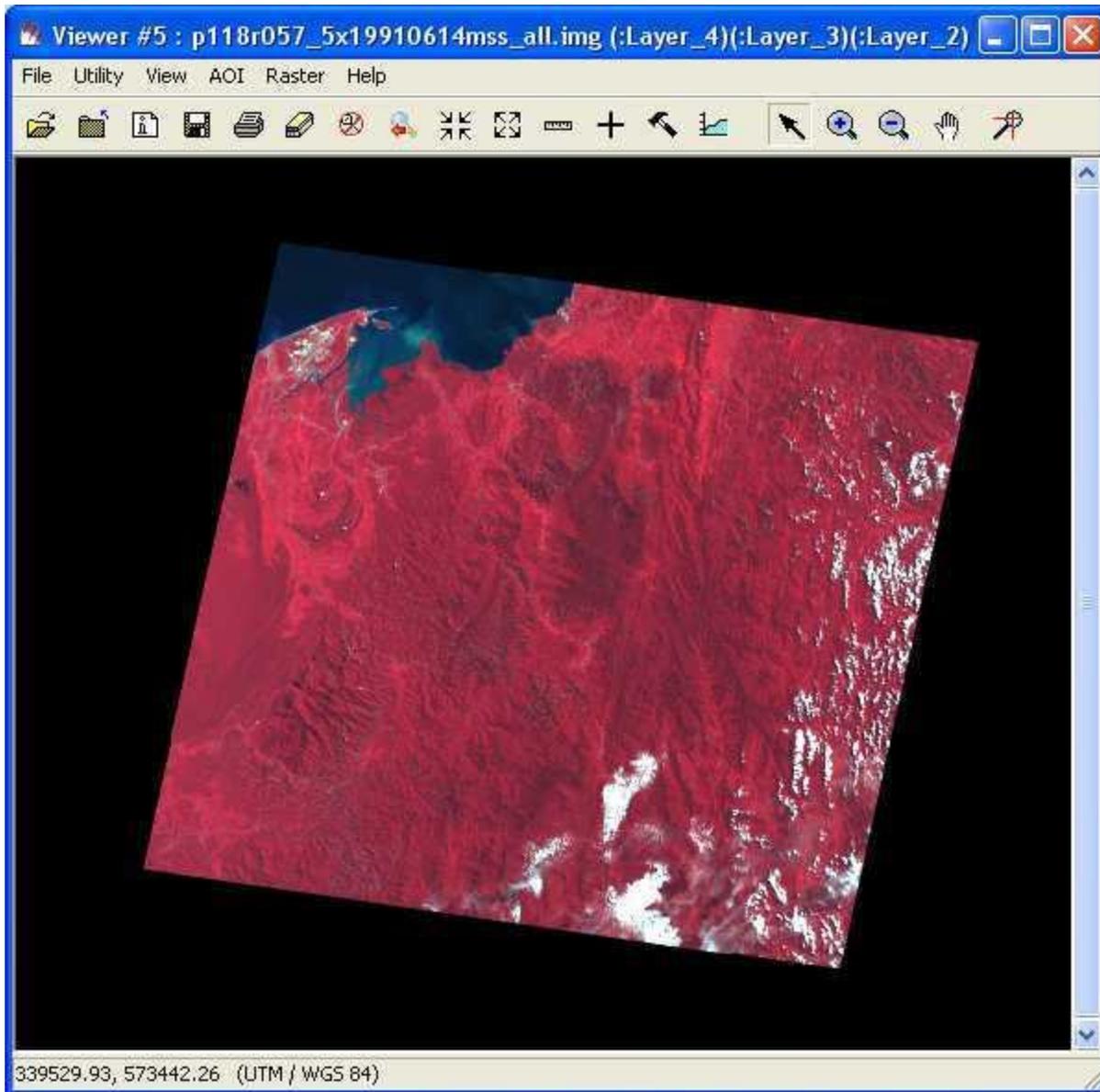
Composite Band 5:
RGB: 1990, 2000, 2000



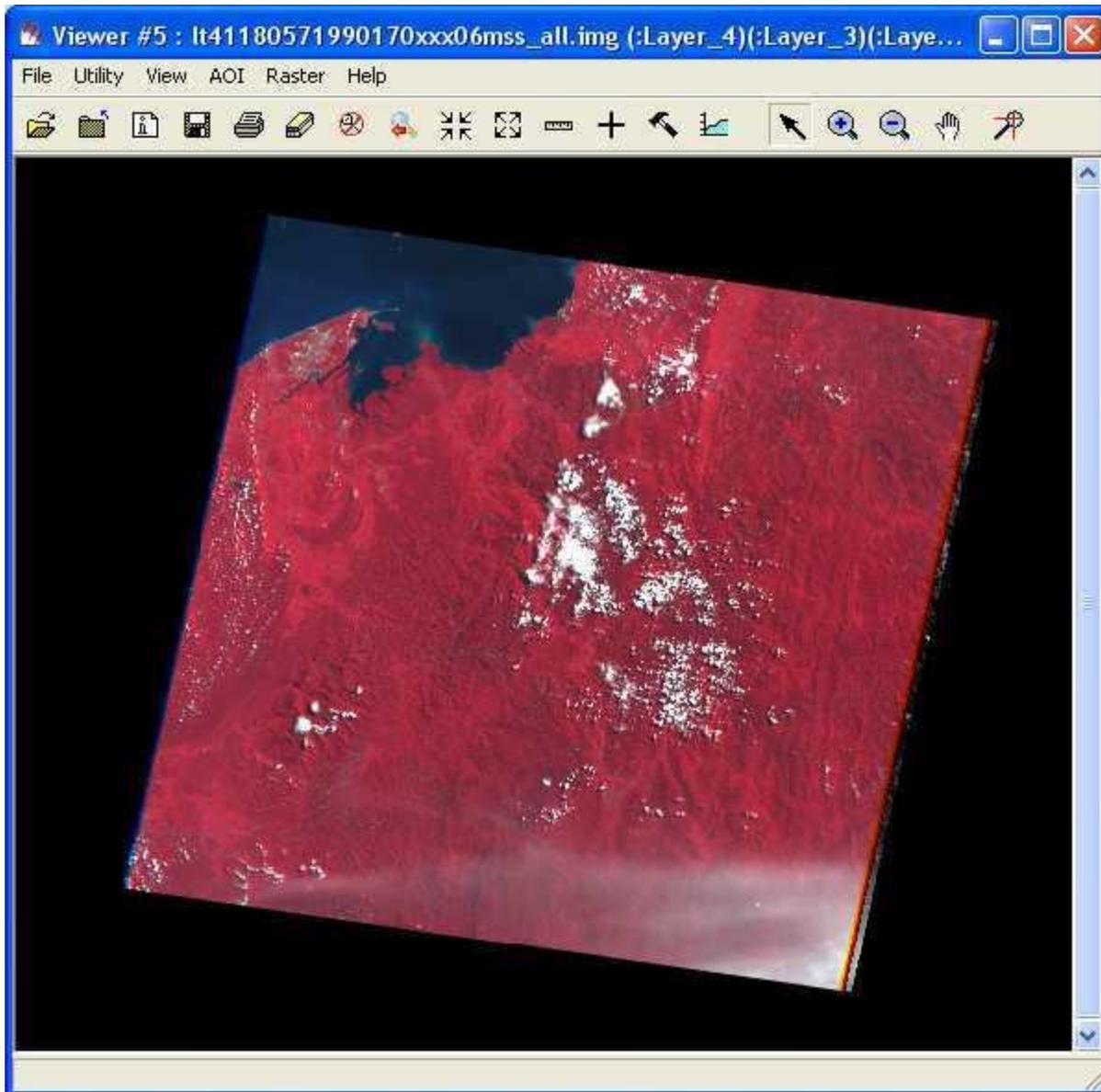
Composite Band 5:
RGB: 2000, 2000, 2006



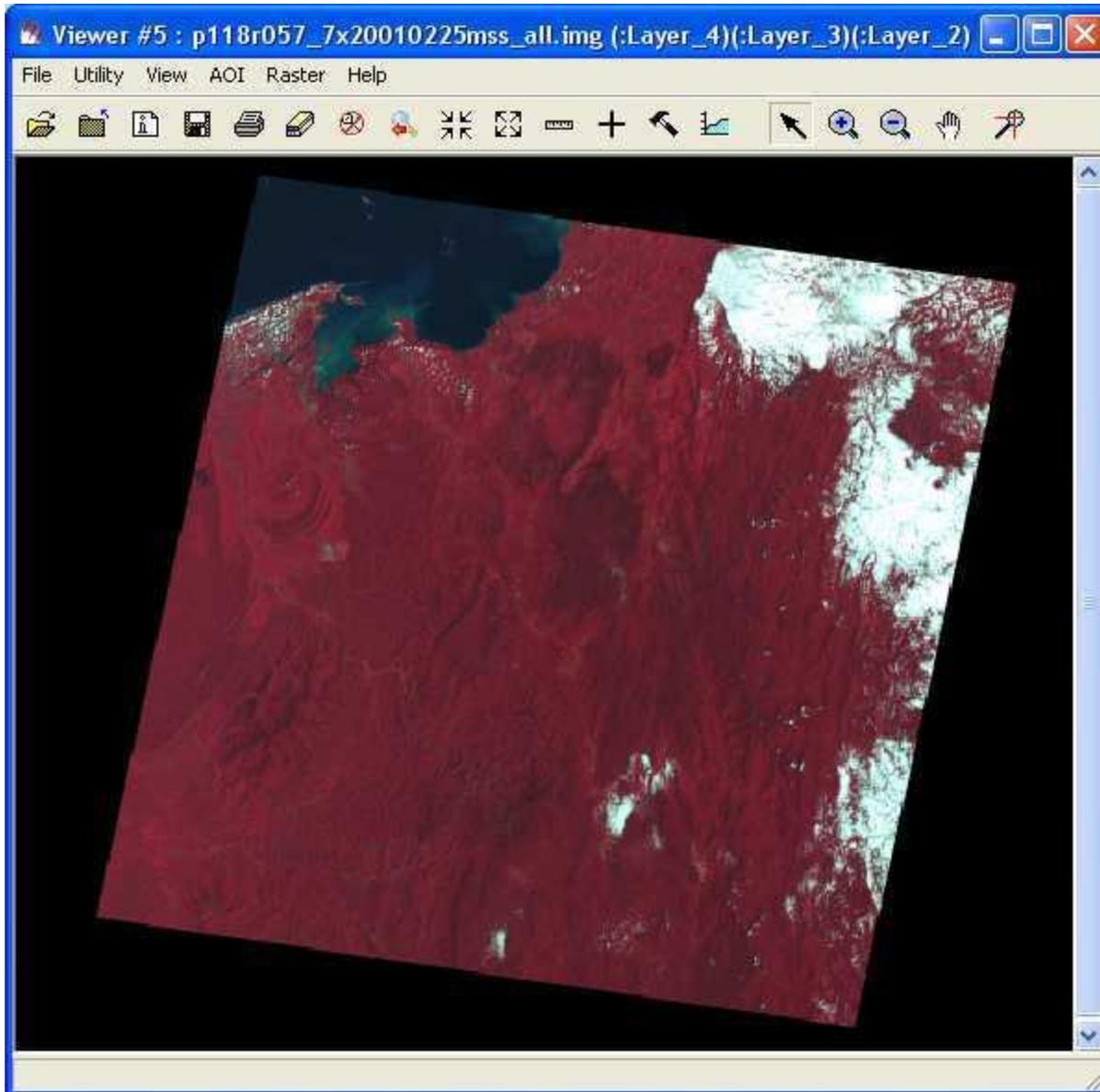
Composite Band 5:
RGB: 1990, 2000, 2005



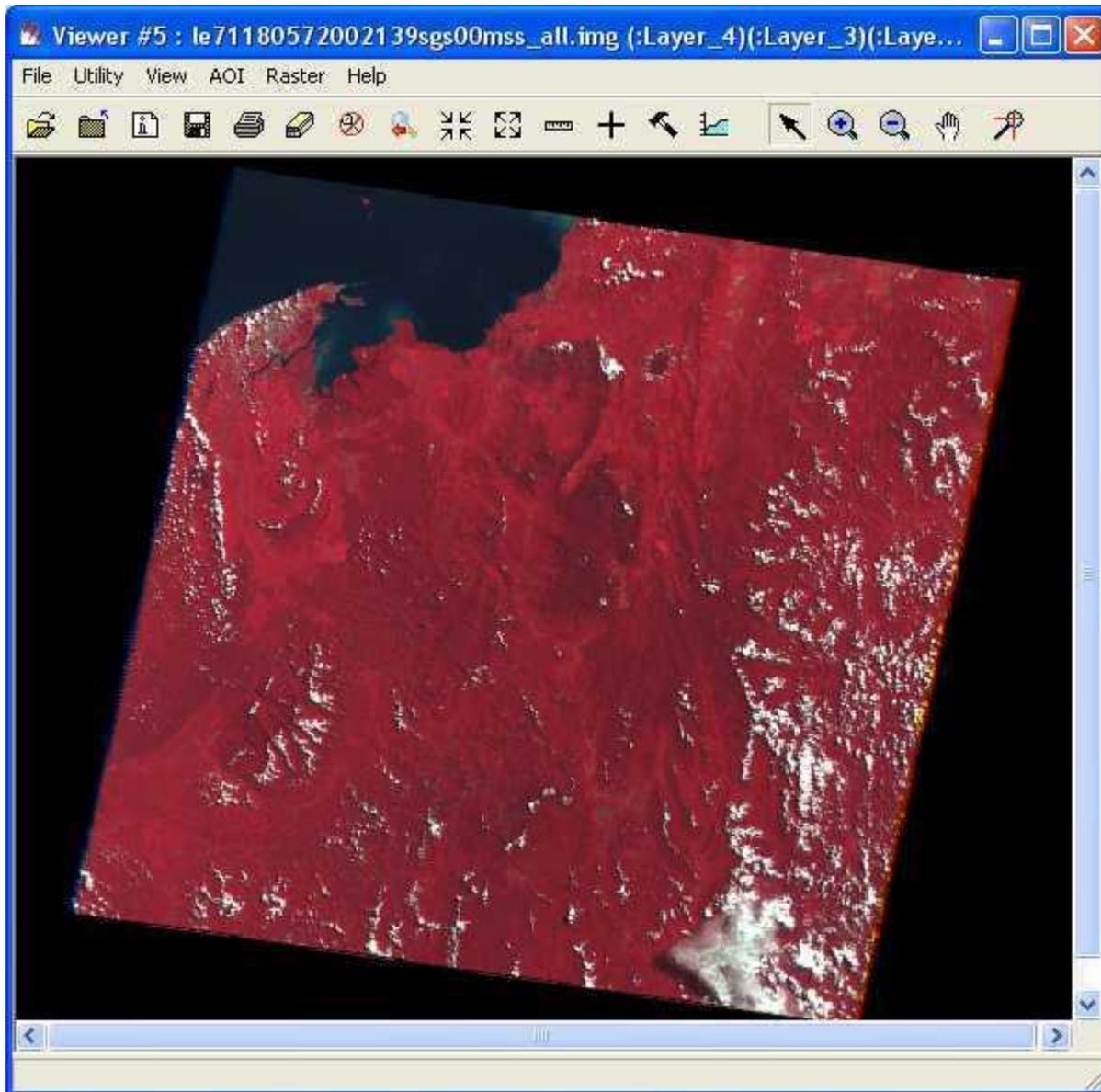
GLS 1990
p118r57
June 14, 1991



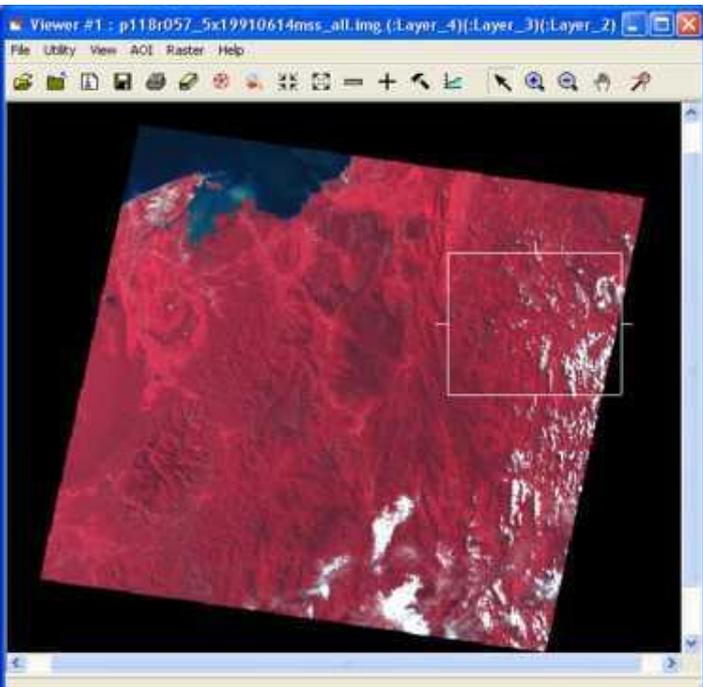
Landsat 4 TM
p118r57
June 19, 1990



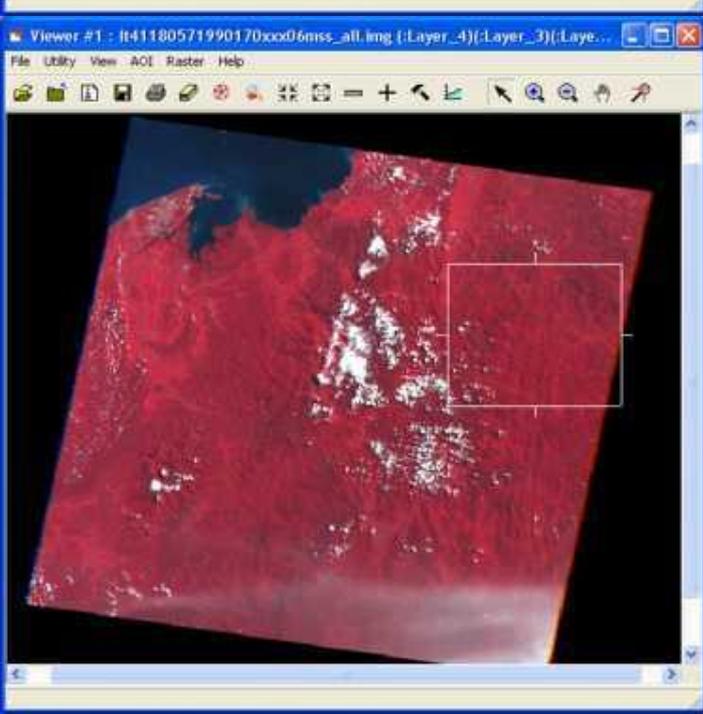
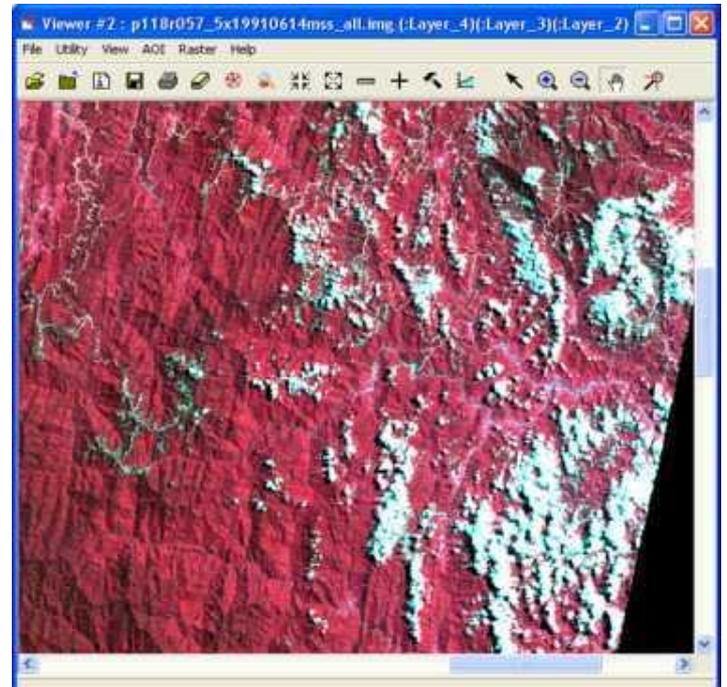
GLS 2000
p118r57
Feb. 25, 2001



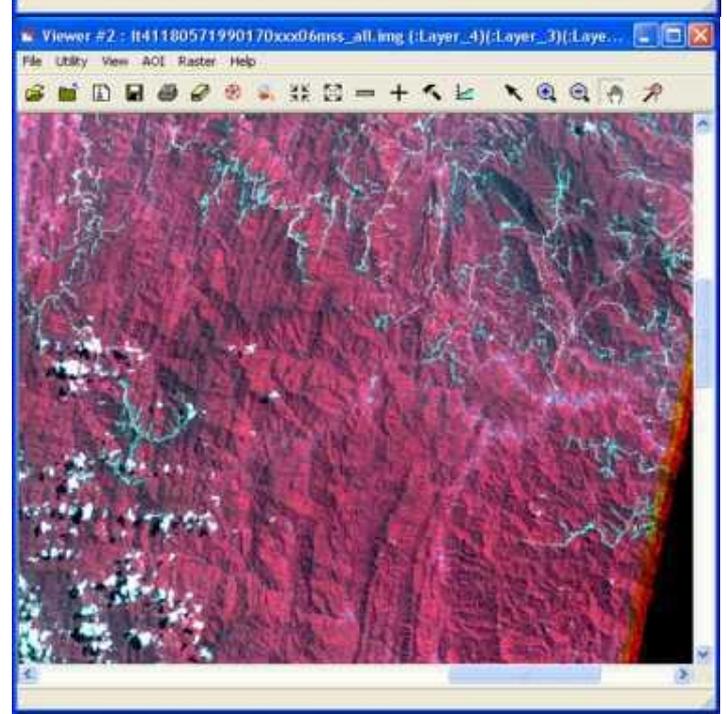
Landsat 7 ETM+
p118r57
May 19, 2002



GLS 1990
p118r57
June 14, 1991



Landsat 4 TM
p118r57
June 19, 1990



Fill with ASTER VNIR

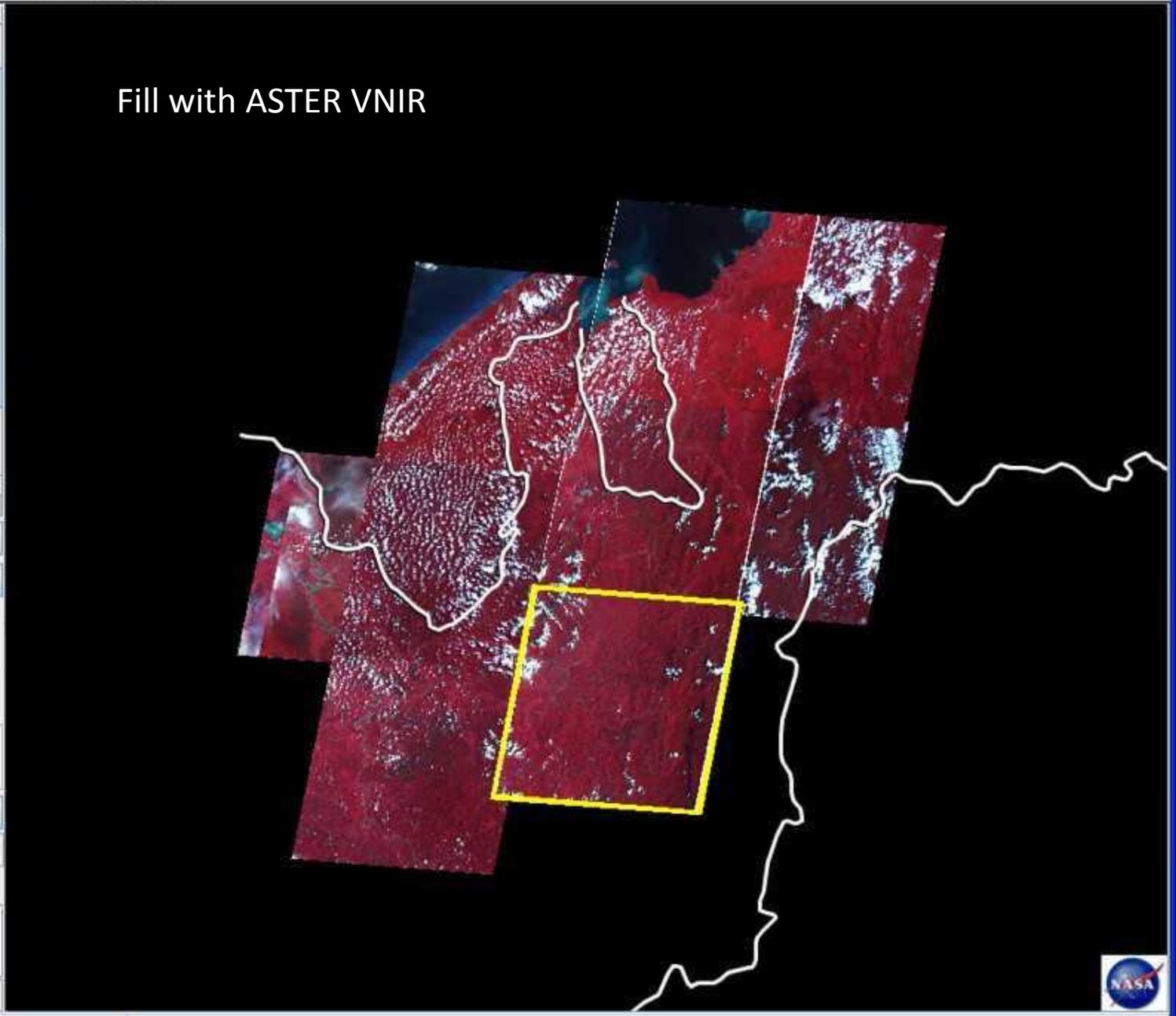


WRS-2 Path Row: 118 57 Go
Lat/Long: 3.8 115.1 Go
Max Cloud: 20% [Left Arrow] [Up Arrow] [Down Arrow] [Right Arrow]

Scene Information:
ID: AST_L1A.003:2071358076
Cloud Cover: 2%
Date: 2009/3/3
Mar 2009 Go

Prev Scene Next Scene

ASTER L1A VNIR Scene List
Add Delete Order





©GISTDA 2010

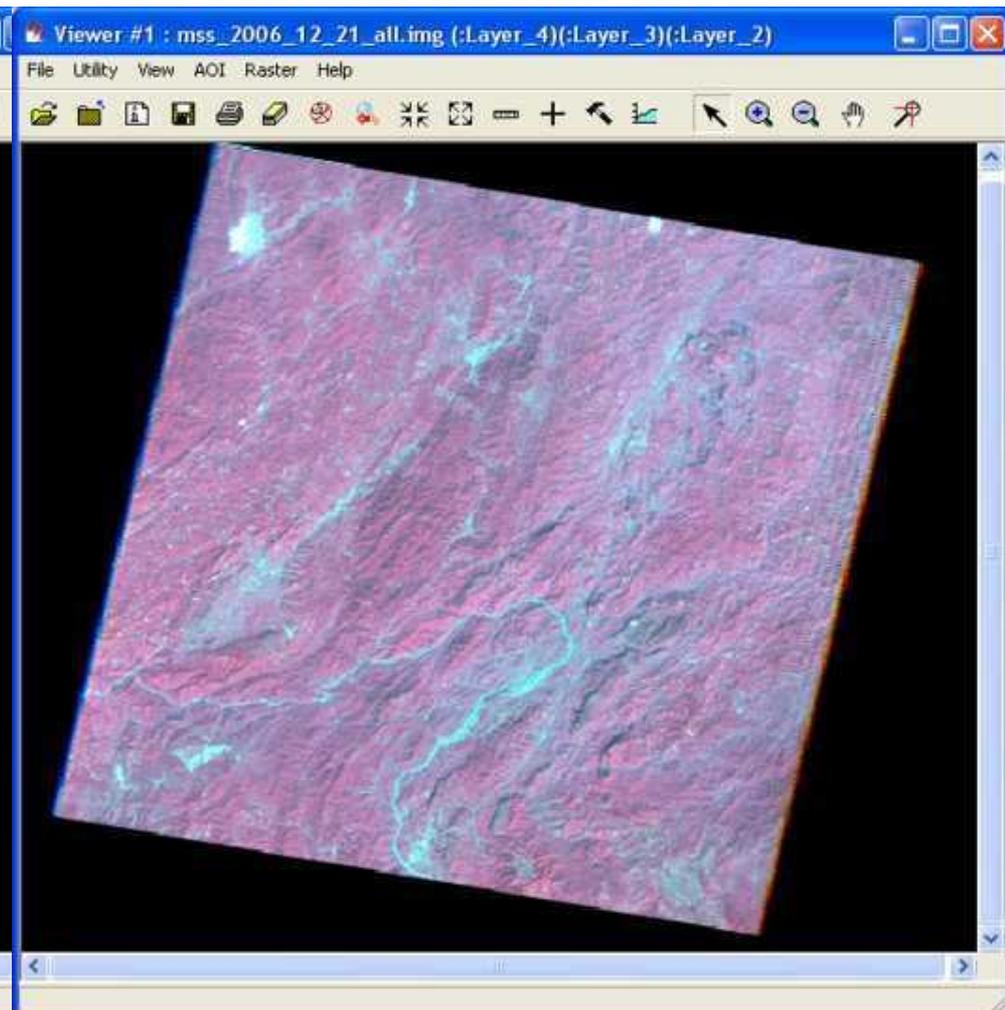
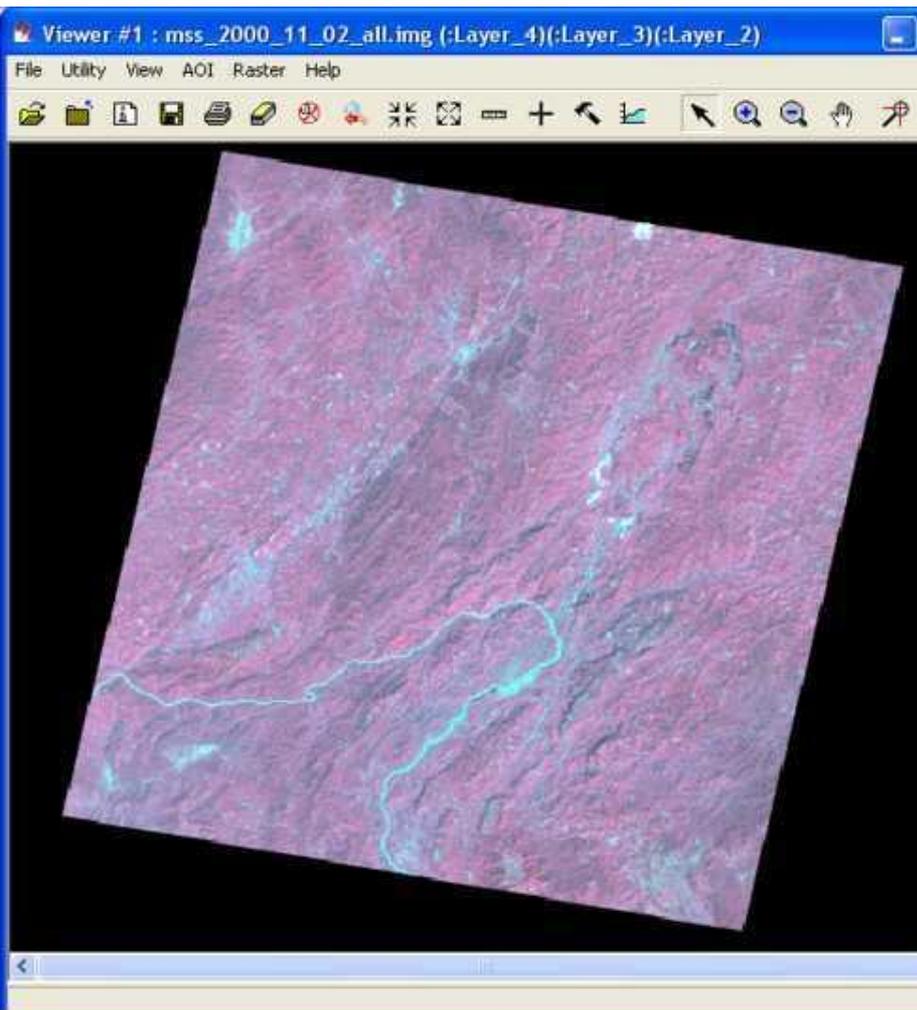
SE Asia Uplands: Shifting Cultivation (Laos)

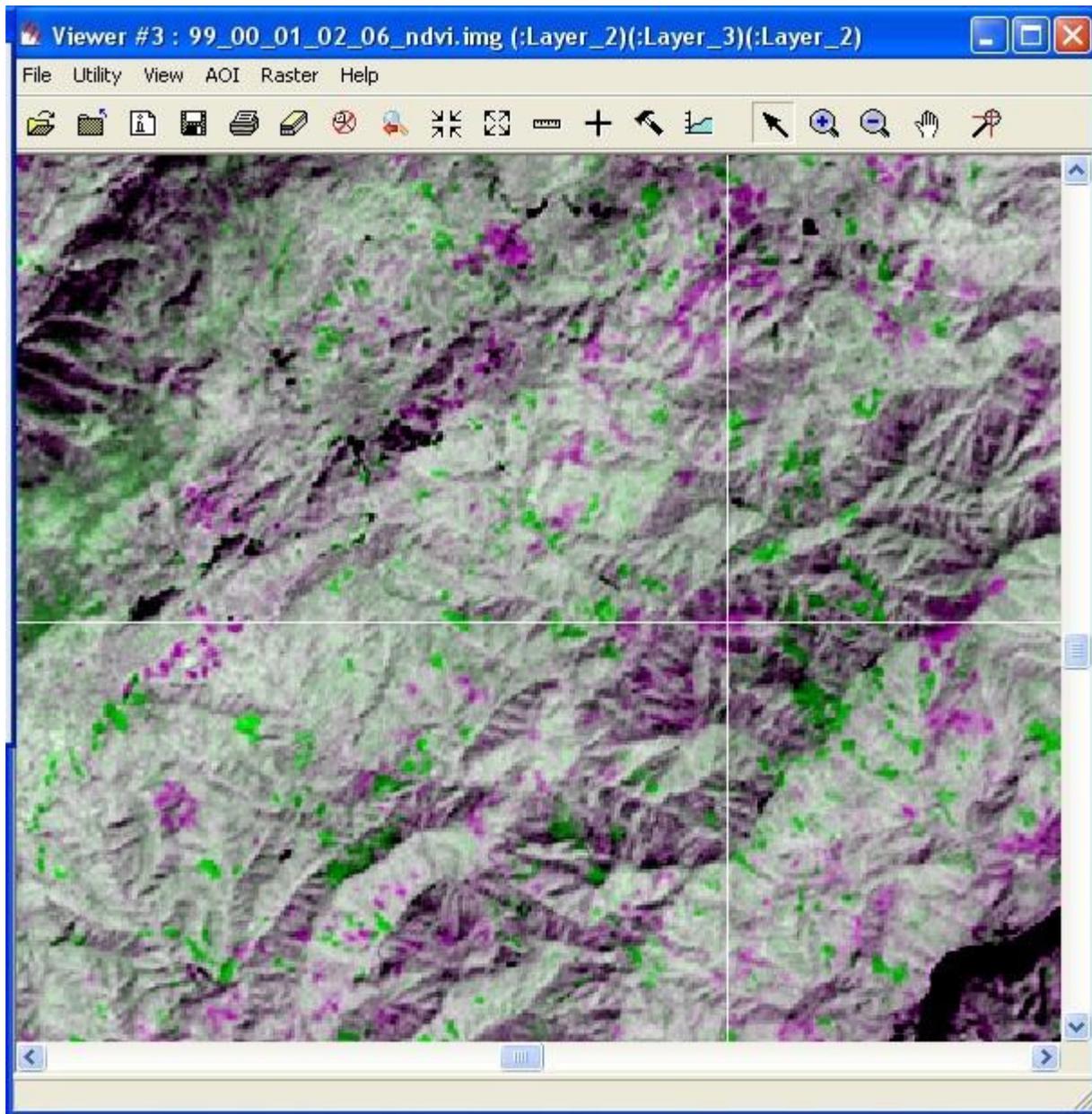


GLS 2000 and 2005 Data

Nov. 2, 2000

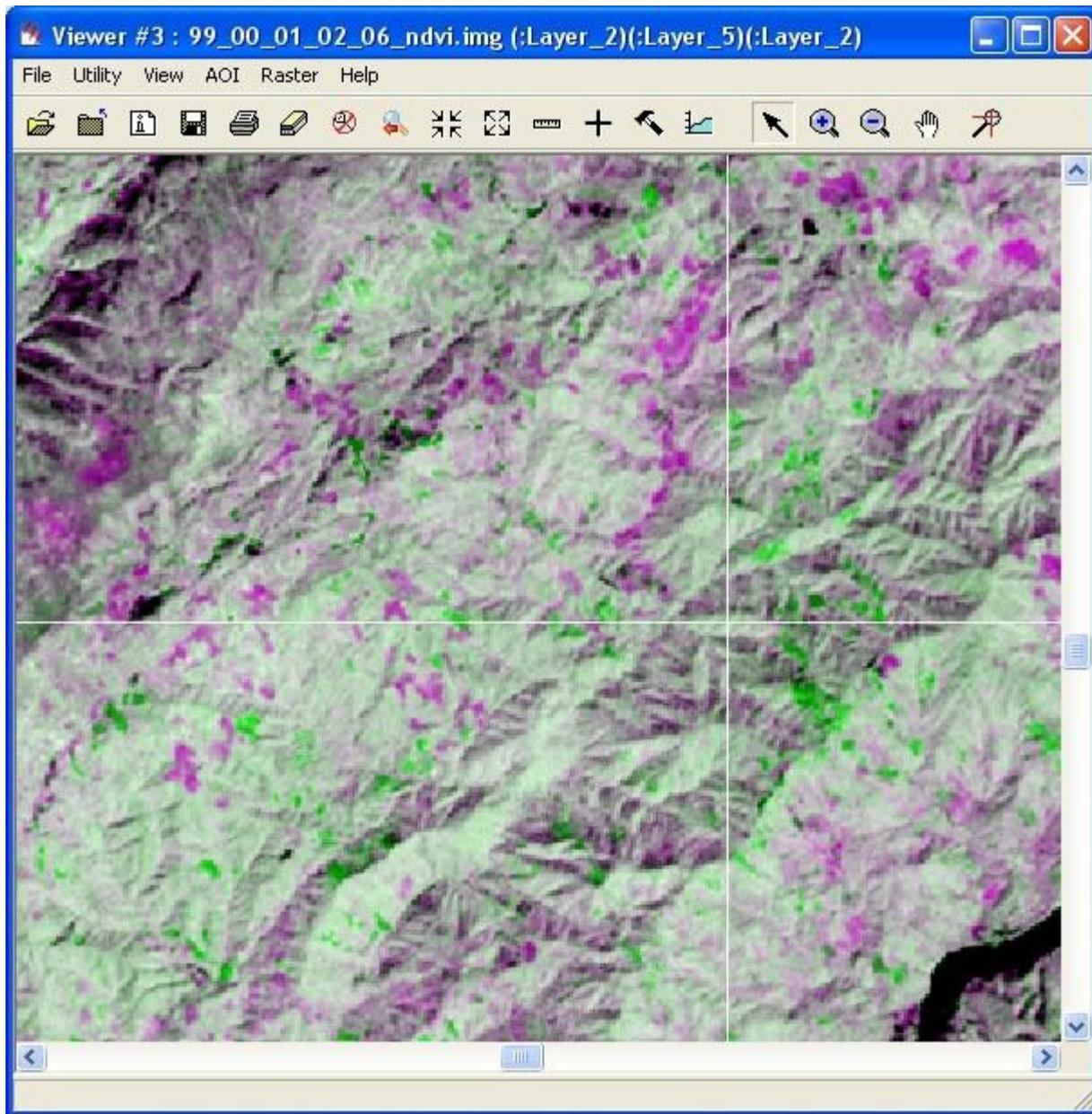
Dec. 21, 2006





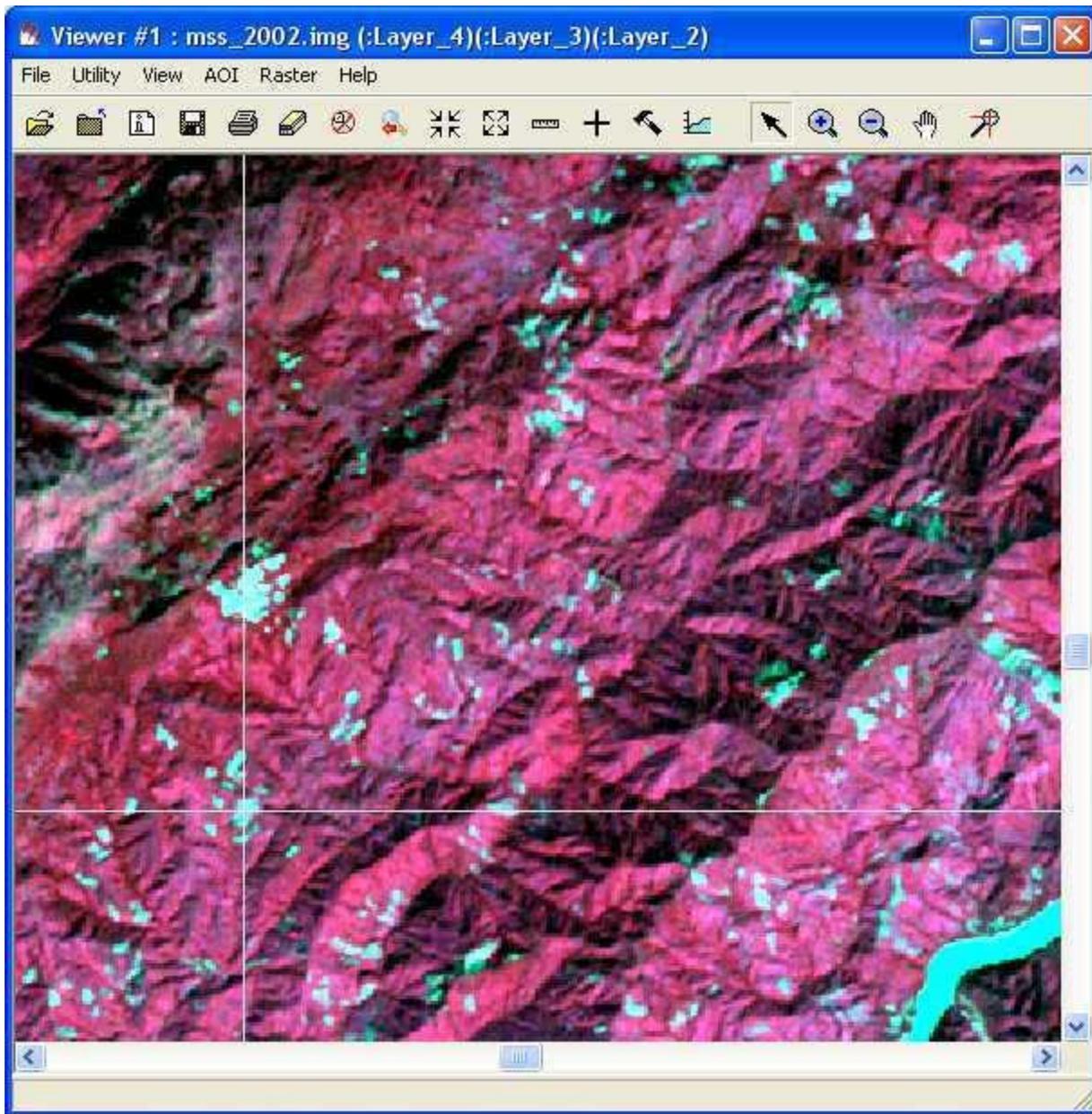
2000 – 2001
Areas in “red”
Non-veg 2001

NDVI Composite
RGB: 2000-2001-2000



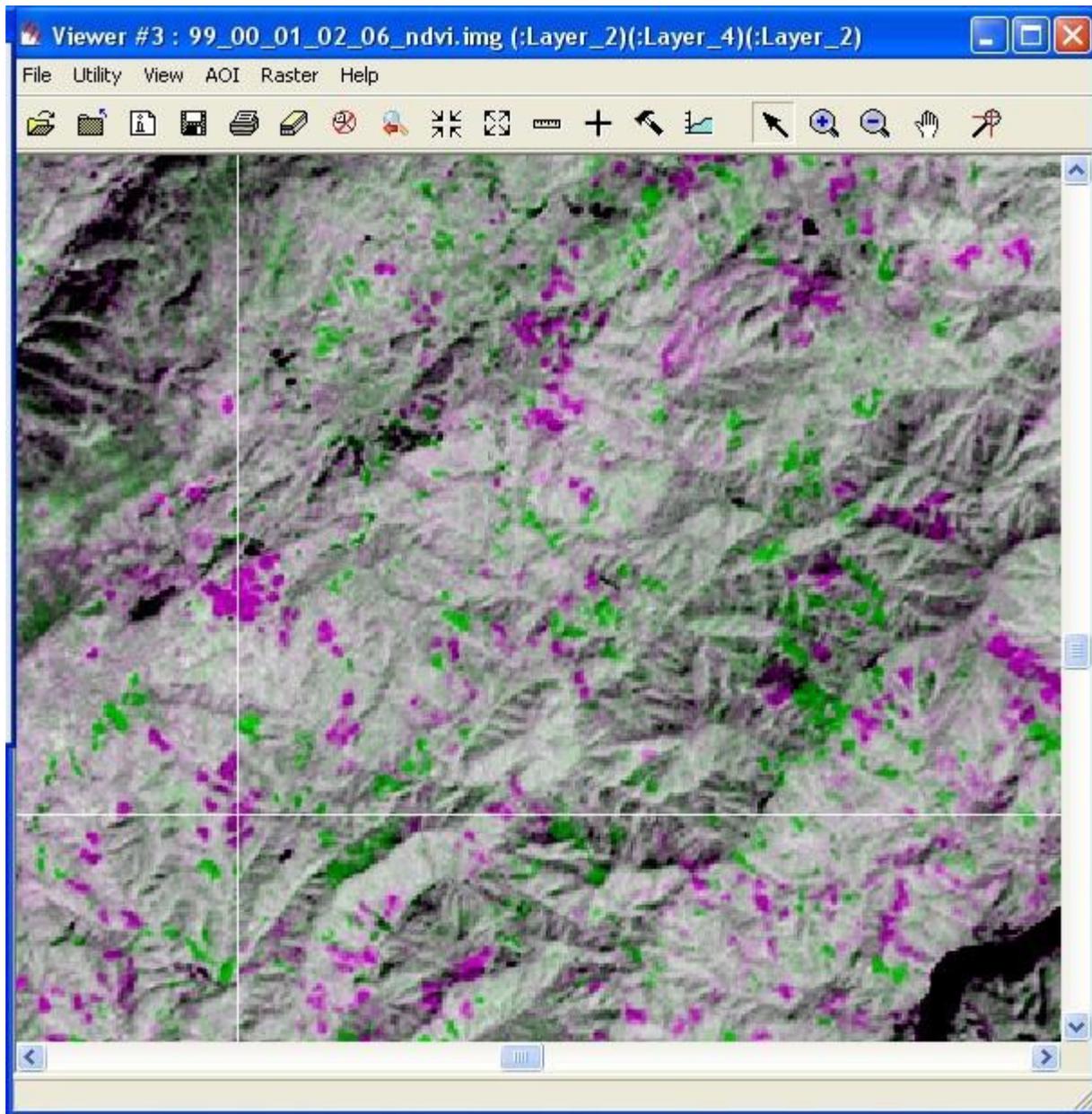
Dynamic not
Seen in 2006

NDVI Composite
RGB: 2000-2006-2000



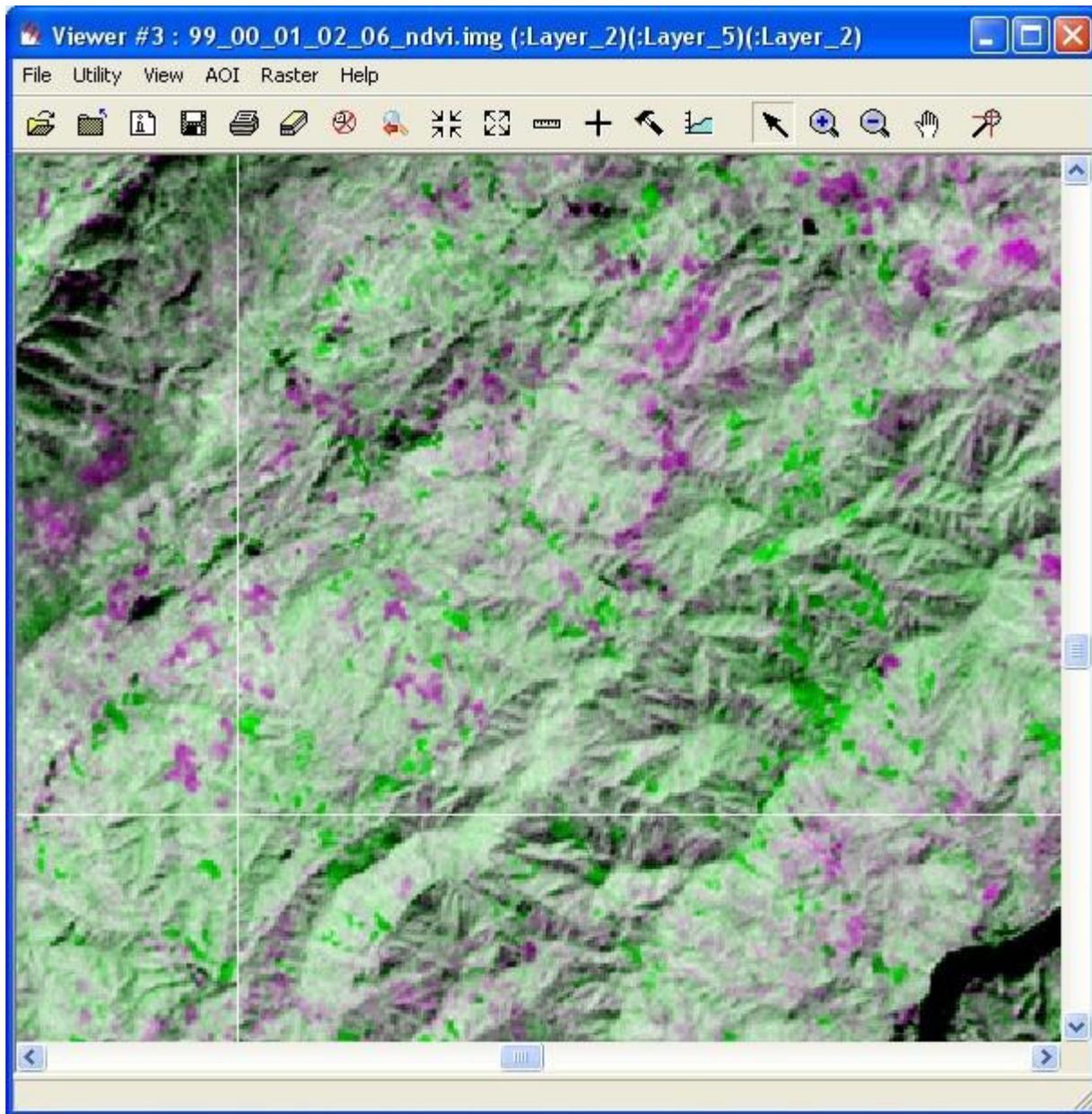
2002 = Cleared

Landsat 7: Nov. 8, 2002
RGB: 4, 3, 2



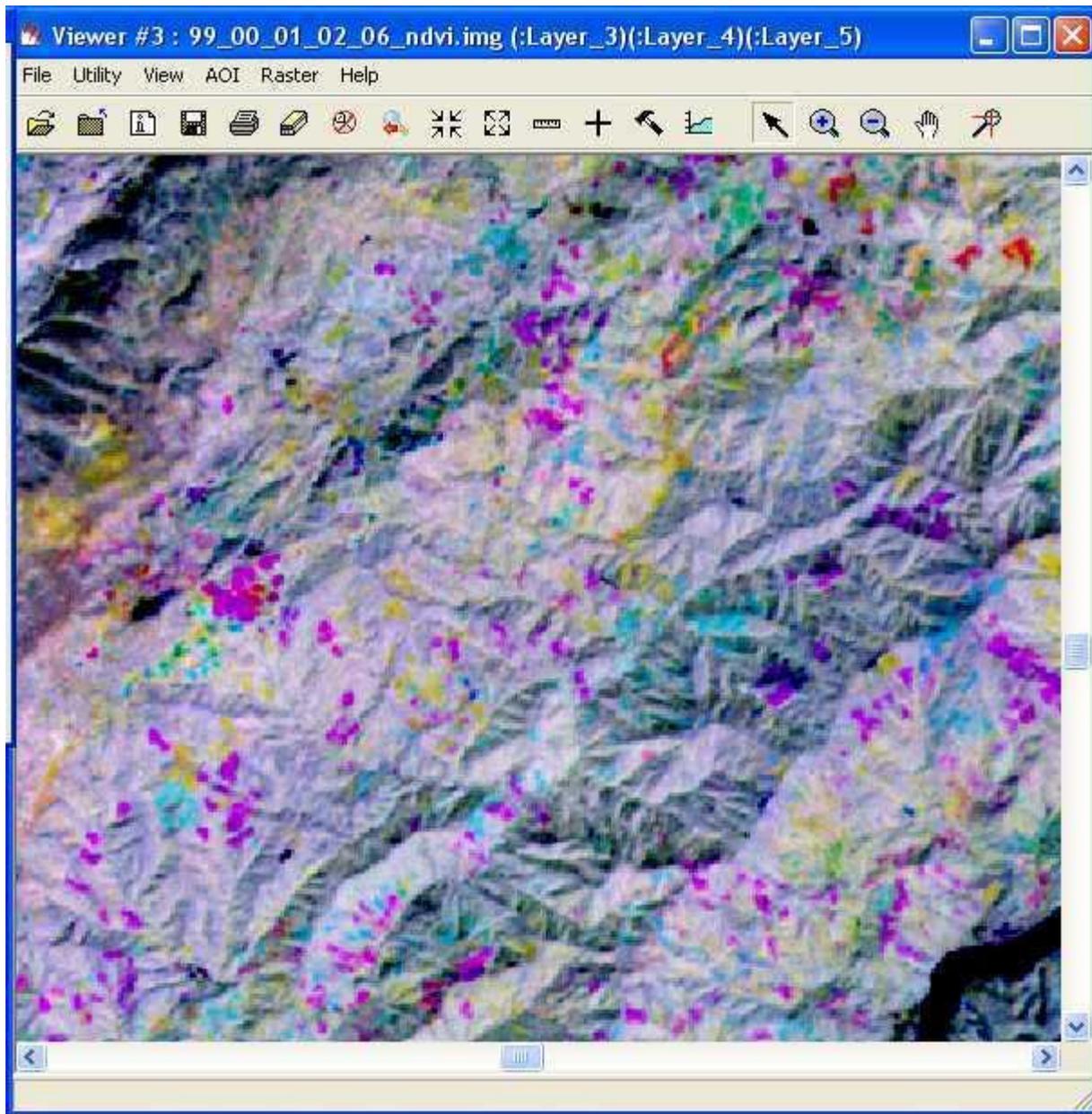
2000 - 2002
Areas in "red"
Non-veg 2002

NDVI Composite
RGB: 2000-2002-2000



Dynamic not
Seen in 2006

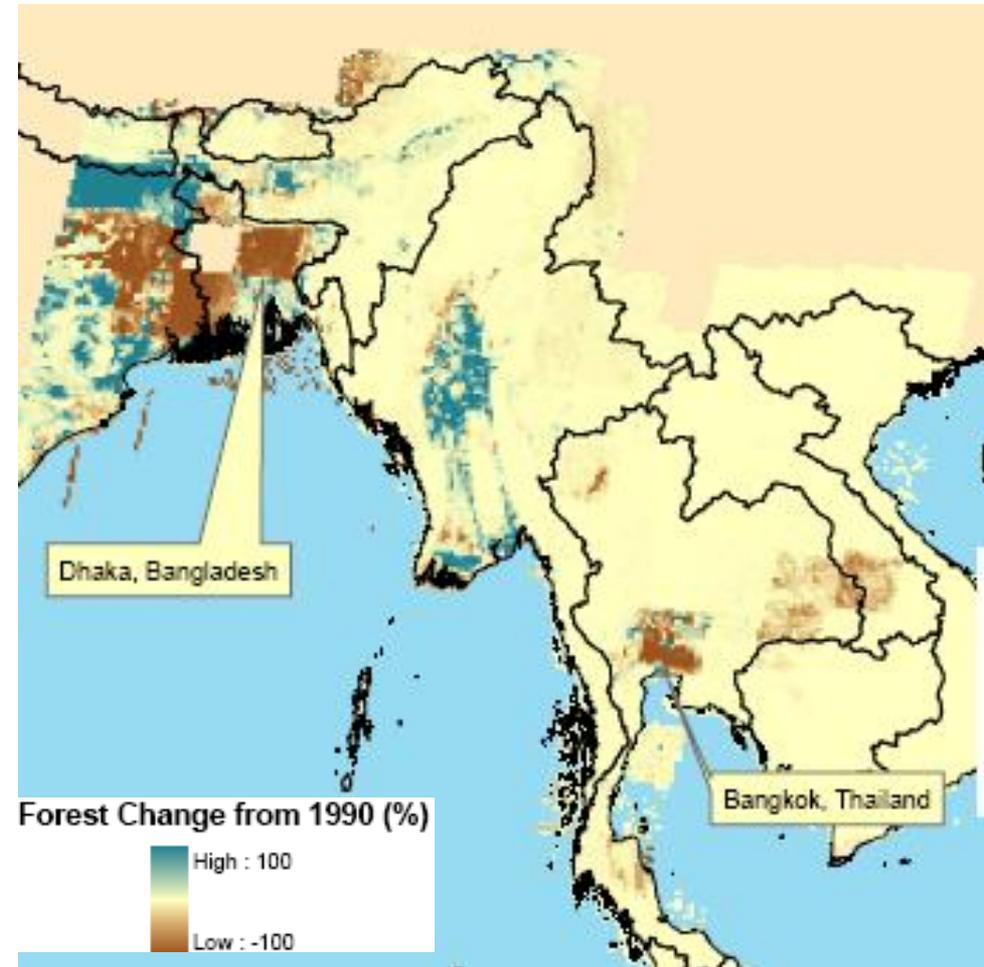
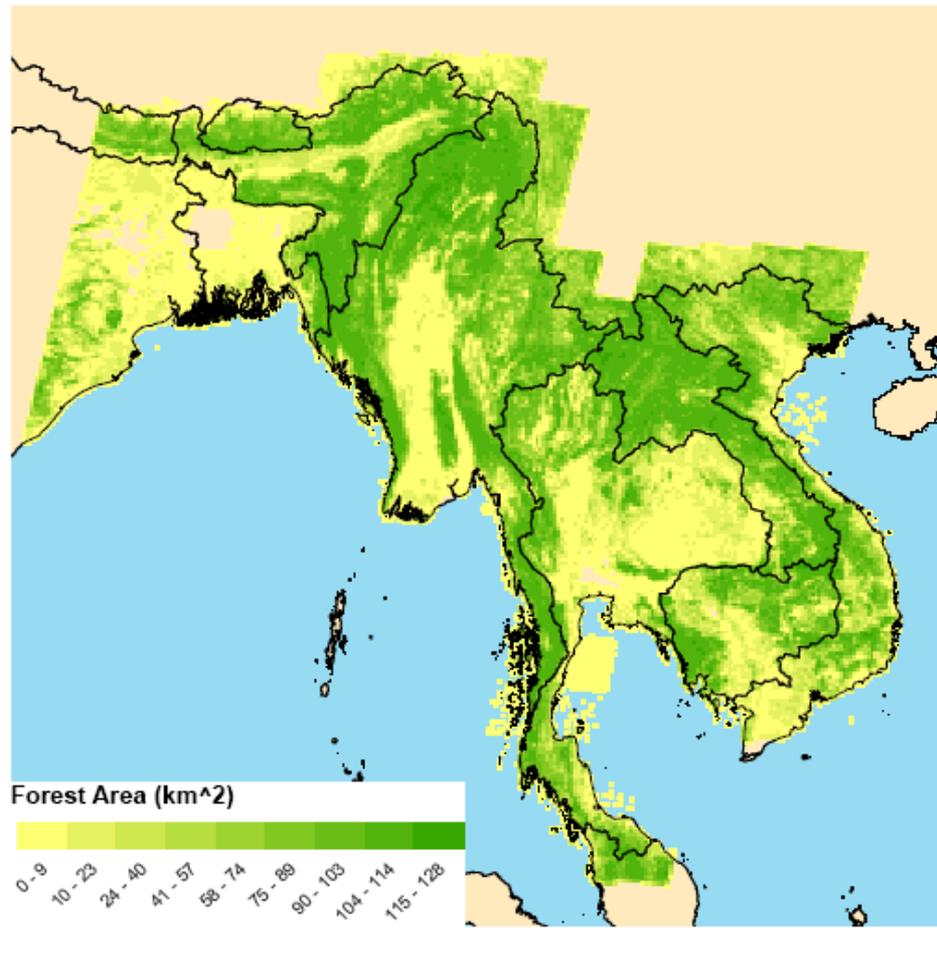
NDVI Composite
RGB: 2000-2006-2000

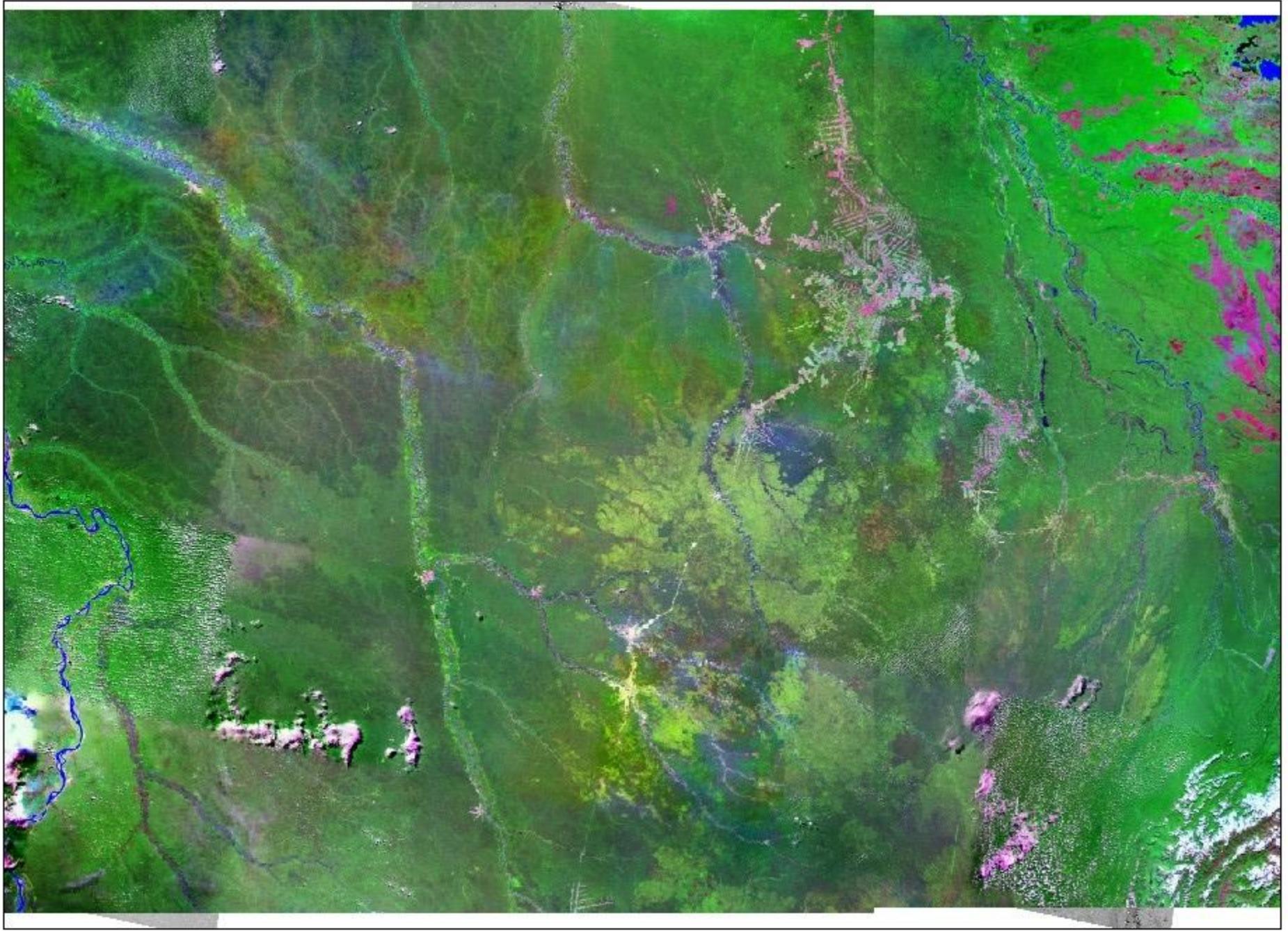


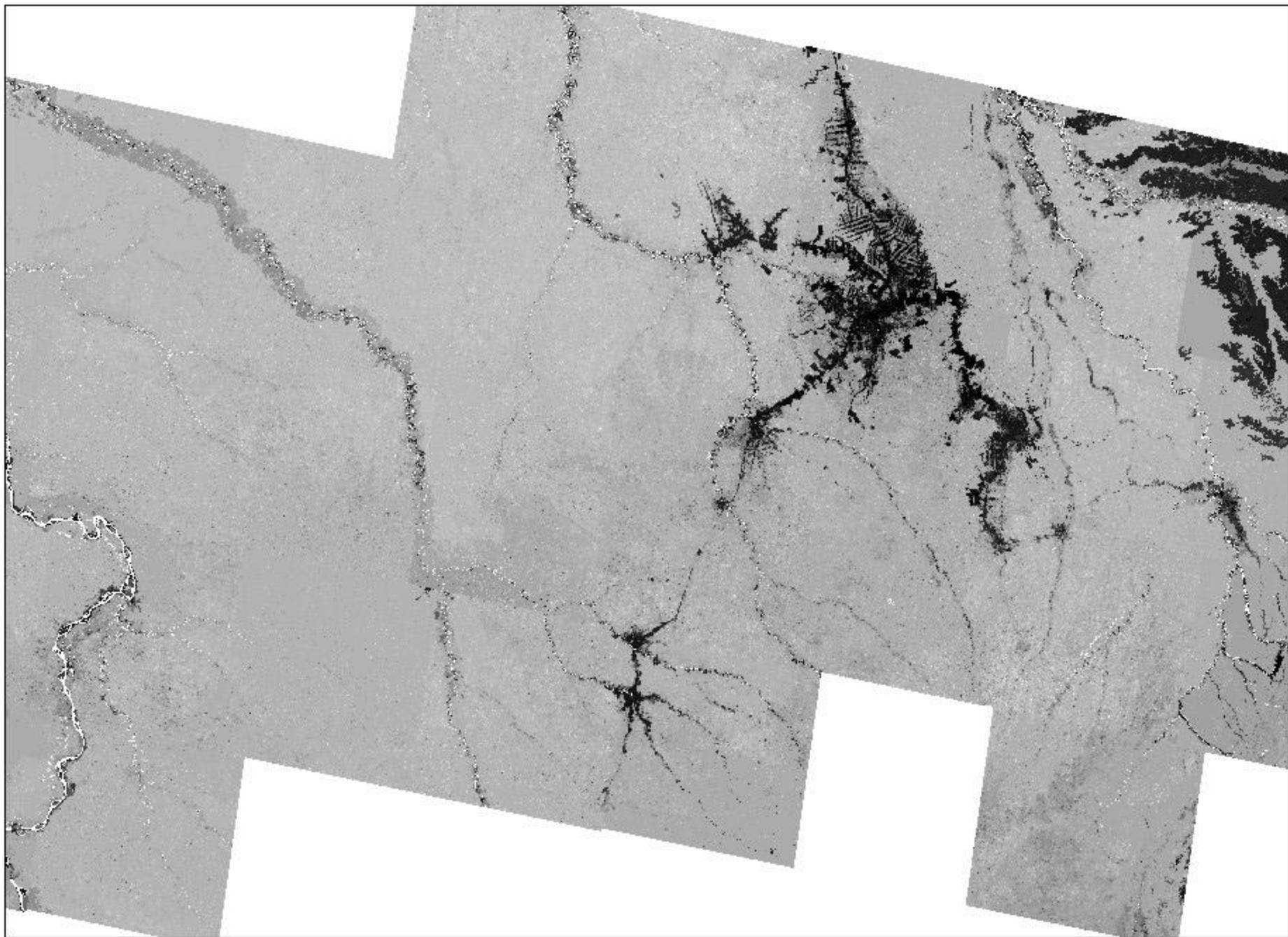
2001 - 02 - 06

NDVI Composite
RGB: 2001-2002-2006

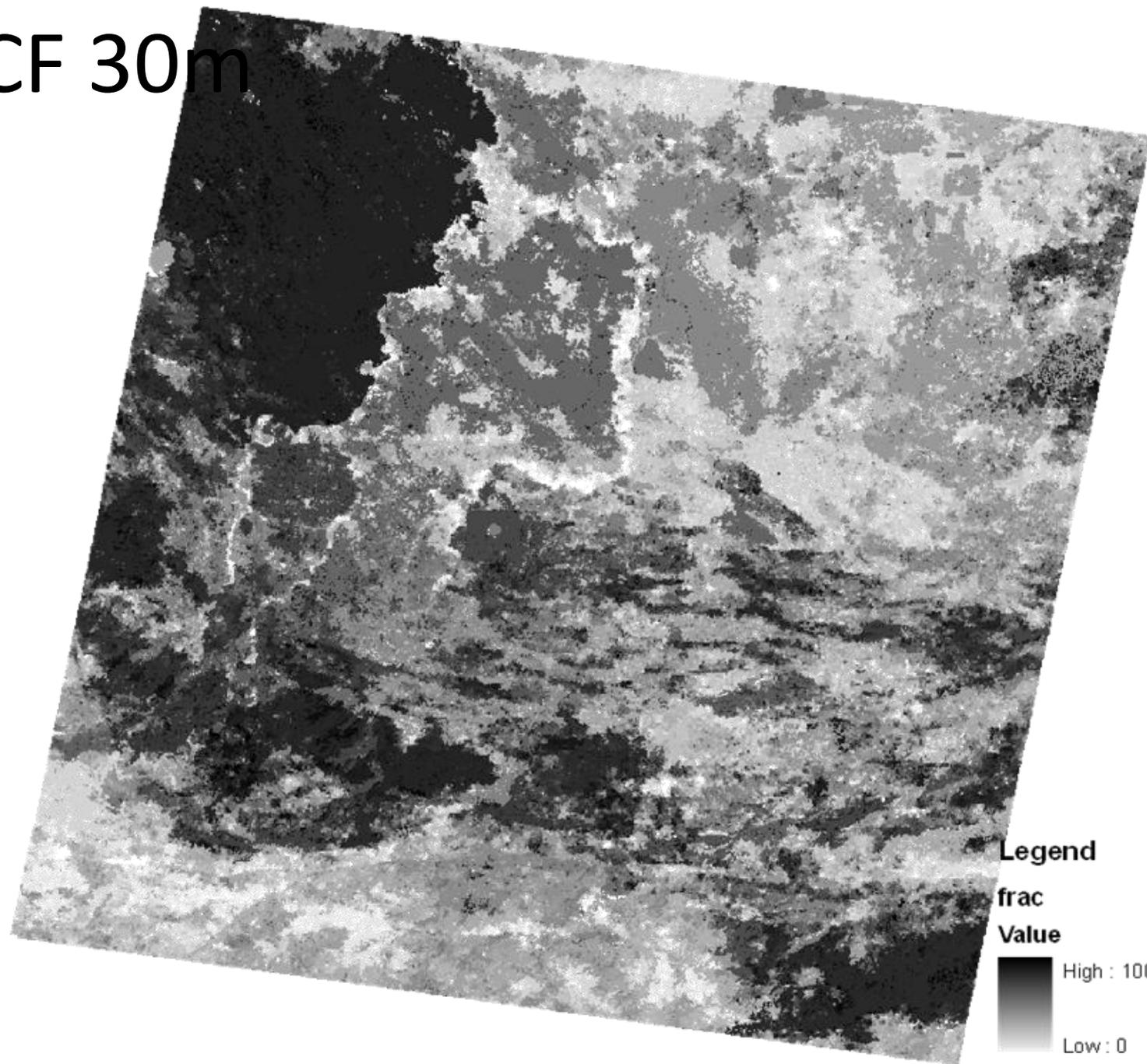
Landset Satellite Data 1990 & 2000



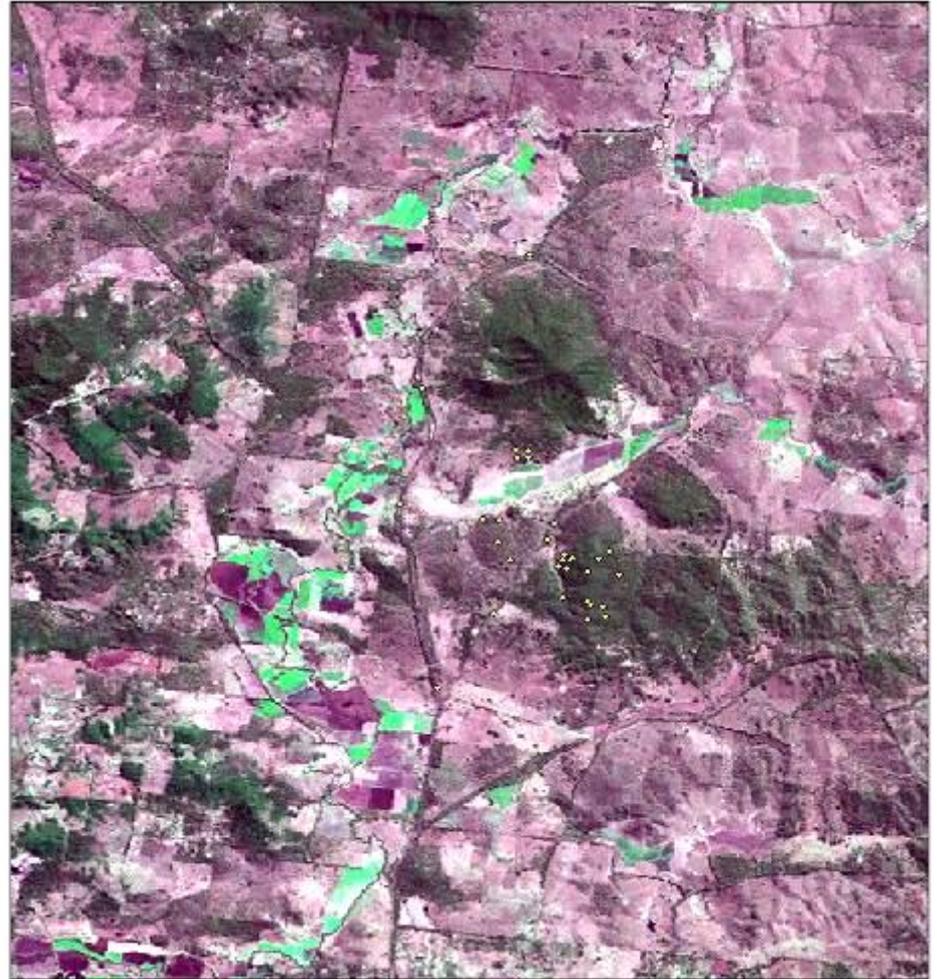




VCF 30m



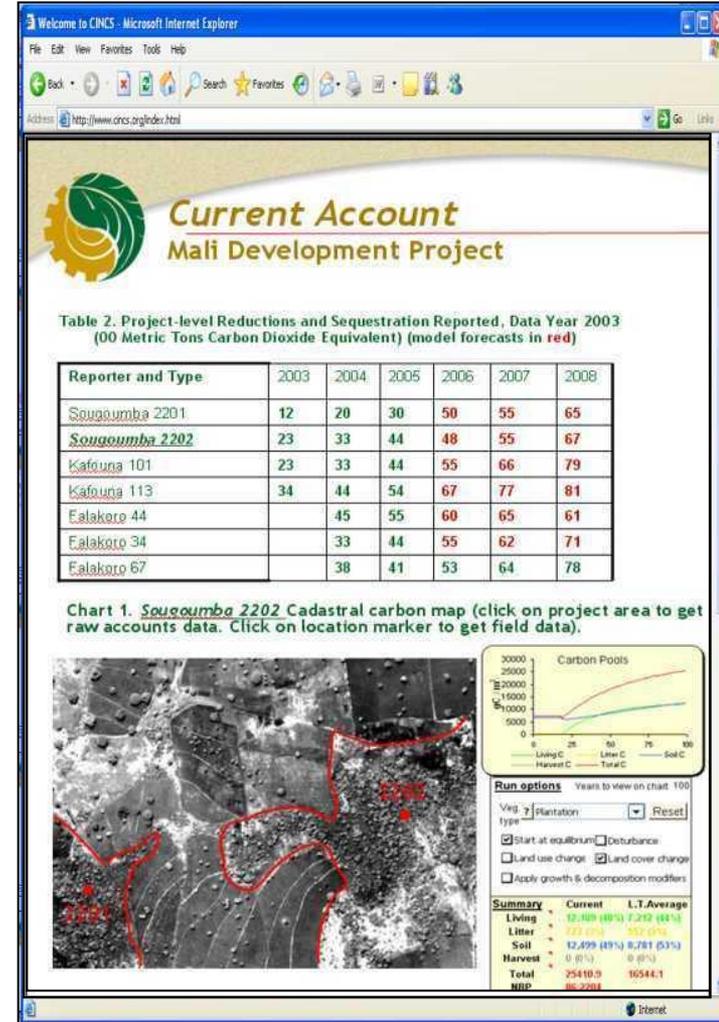
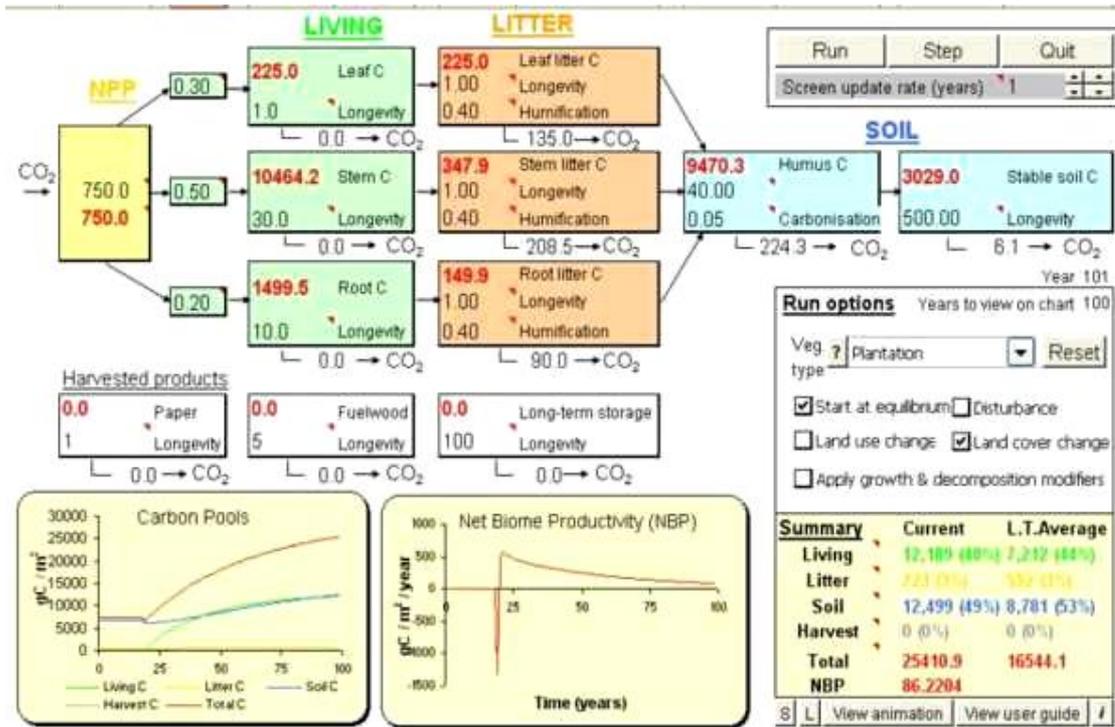
Current Landsat imagery used way points are small yellow dots

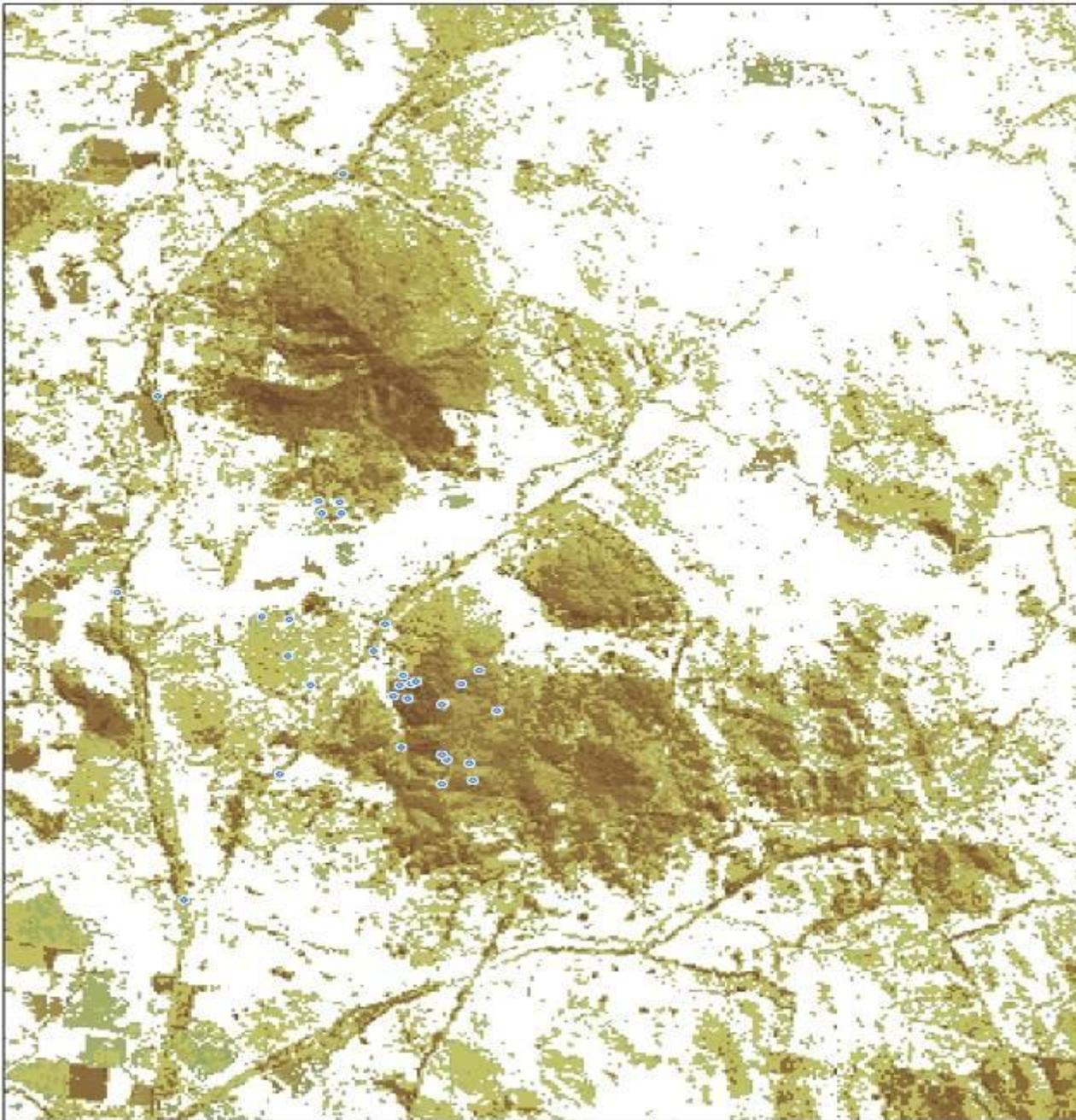


Zoom in at high resolution



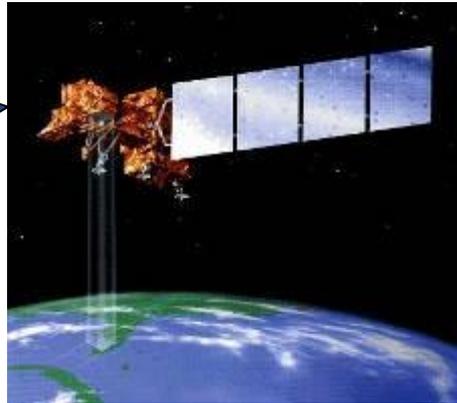
Carbon Account System





Region east of Kingaroy, north of Nanango. Small blue dots are waypoints. White is non forest/trees. Carbon sequestration range: 4-8 tCO₂e per ha per yr (light to dark)

An Operational System using EO



Earth Observation System



Carbon Sellers



WWW

Markets Buyers



News
January 01, 2000) Bridgestone Finishes Americas Commercial Truck & Bus Promotion
January 21, 2000) Bridgestone Finishes Pub: You In: The Drivers Seat With New Tire-Grade-It
January 26, 2000) Bridgestone Exceeds Expectations RRP50A RFT Tires Are Original Equipment On Newly Introduced 2000 Mazda MX-6 Sedan
January 10, 2000) Foycote University Student Wins Bridgestone Finishes Canada Truck Contest
January 10, 2000) Bridgestone Names New President
January 9, 2000) Two Top Of Bridgestone Brand Potenza Concept Tires To Be Featured At North American International Auto Show



Satellite Database Data Analysis



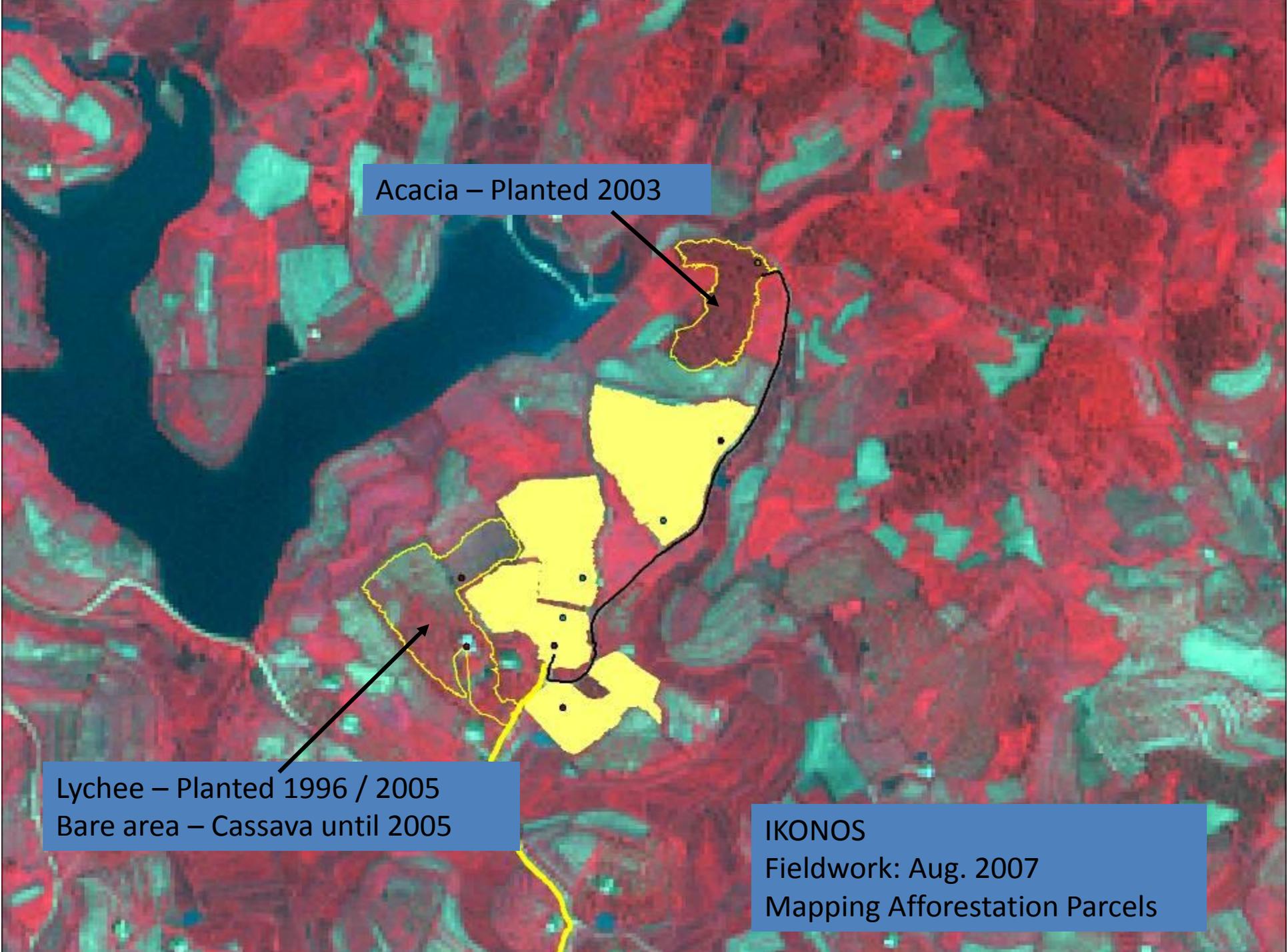
Carbon Models Carbon Accounts

Viet Nam



Vietnam Reforestation: Acacia sp.



The image is a false-color satellite photograph from IKONOS, showing a landscape with a large body of water on the left. A central area is outlined in black and contains several smaller parcels. One parcel at the top is outlined in yellow and labeled 'Acacia - Planted 2003'. A larger area below it is outlined in yellow and labeled 'Lychee - Planted 1996 / 2005'. A third area, outlined in yellow and located to the left of the Lychee area, is labeled 'Bare area - Cassava until 2005'. The background is a mix of red and cyan colors, representing different vegetation types. A yellow line runs vertically through the bottom of the central area.

Acacia – Planted 2003

Lychee – Planted 1996 / 2005
Bare area – Cassava until 2005

IKONOS
Fieldwork: Aug. 2007
Mapping Afforestation Parcels

Thailand



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http://www.carbon2markets.org/gpms/projects.htm

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Carbon2Markets :: Geospatial Management System

Carbon 2 Markets™

- Kien Lao & Cam Son Communes, Luc Ngan, Bac Giang, Vietnam
- Luang Prabang Province, Lao PDR
- Model Training Forest (FoF NUOL) Vientiane Prov., Lao PDR
- Inpang Community Network, Thailand
- Nakhon Ratchasima Province, Thailand
- Rayong Province, Thailand
- Trat Province, Thailand
- Cambodia Takeo Province, Cambodia

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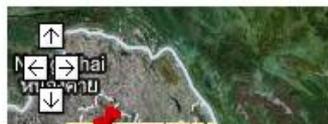
Inpang Community, Thailand - Small-holder Teak(Project ID: IN_1_T)



Farmers who belong to the Inpang Community Network embrace the tenants of His Majesty King Bhumibol Adulyadej's Sufficiency Economy. Most of the Inpang-member, small-holder teak plantations have been established on farms previously planted with cassava. Inpang teak plantations are part of a whole farm systems that includes annual crops, fish ponds, and multi-species agro-forestry that support a number of traditional non-timber forest goods as well as marketable commodities. Sequestering carbon is an ecosystem service Inpang teak plantations provide, and this carbon is now a commodity. The sale of carbon offsets will help sustain the diverse, socially-conscious agro-forestry systems practiced by Inpang members and mitigate climate change.

To see an example of a detailed project management and measurement system for one of these sites [click here](#).

Land_Owner	Date_Planted	Teak_Area (ha)
Thanakorn Promburom	1993	12.00
Uean Lamkham	1993	0.32
San Lamkham	1994	0.32
Framun Kamkot	1994	0.32
Yuanchai Chaitamat	1993	0.80
Adisai Chaitamat	1993	0.80
Sot Lasuk	1994	0.80
Bunkaen Chantawan	1994	0.48
Somchit Kanburom	1994	0.98
Kampan Sunyarat	1993	0.18
Nintha Chuni	1995	4.00
Bunruam Thokaewkheaw	1994	0.80
Reanthong Thokaewkheaw	1994	1.80
Kum Thothumphon	1994	2.40
Samli Khamthong	1993	1.80
Sawat Hanket	1994	2.58



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Inpang Community Project - Teak(IN_1_T)

[Click here to download data](#)

Site 026



Project_ID	IN11
Land_ID	127
SiteID	026
Number of Sampling Plots	2
Initial	Mr
Land Owner Name	Sak Sawaengphet
Carbon Offset	Managed Forest
Tree Species	Tectona grandis
Other Vegetation	None
Year Planted(Bhuddist)	2538
Year Planted (Mod)	1995
Age of Trees	13
Teak Area(rai)	7
Teak Area(ha)	1.12
Area Estimate or Measured	Measured
Land Use Before 1990	Cassava
Plant to Harvest	No
Year of Harvest	NA
Use for Harvested Wood	NA
Wood fuel	No
Survey Date	12-Oct-2008
Ave Total tCO2 per plot	11.65801803
Total tCO2 per ha	233.1603607
Total tCO2	261.139804

Allometric Equation

$$\text{LOG } Y = -0.85 + 2.382 * \text{LOG}(\text{DBH})$$

Y = biomass in kg

Plot Level Data

◆ Plot 1

◆ Plot 2

Ex Ante Carbon Sequestration





Inpang Community Project - Teak(IN_1_T)

Site 026



[Click here to download data](#)

General Information Site 26

- [Plot Data Generalized](#)
- [Plot 1 Field Data Set](#)
- [Plot 2 Field Data Set](#)
- [Ex Ante Carbon Calculation](#)

Field Name	Value
Carbon Offset	Managed Forest
Tree Species	Tectona grandis
Other Vegetation	None
Year Planted(Bhuddist)	2538
Year Planted (Mod)	1995
Age of Trees	13
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- Plot Level Data
- ◆ Plot 1
 - ◆ Plot 2

Ex Ante Carbon Sequestration



Navigation bar with address bar: http://www.carbon2markets.org/kml/site_026/xls/IN_1_T_26_plot1.xls

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Project ID	Site ID	Plot ID	Tree ID	Species	Height (m)	Circum (cm)	DBH (cm)	Above-Ground Biomass (tons)	Above-Ground C (tons)	Above-Ground CO2 (tons)	Below-Ground Biomass (tons)
IN_1_T	26	1	IN1-26-1-1	Tectona grandis	13.0	49.0	15.59718442	0.106374141	0.05318707	0.195019258	
IN_1_T	26	1	IN1-26-1-2	Tectona grandis	10.0	25.5	8.116902098	0.022447486	0.011223743	0.041153725	
IN_1_T	26	1	IN1-26-1-3	Tectona grandis	15.0	65.0	20.6901426	0.208520433	0.104260217	0.382287461	
IN_1_T	26	1	IN1-26-1-4	Tectona grandis	12.0	34.0	10.82253613	0.044542212	0.022271106	0.081660723	
IN_1_T	26	1	IN1-26-1-5	Tectona grandis	11.0	37.6	11.96845172	0.056609126	0.028304563	0.103783398	
IN_1_T	26	1	IN1-26-1-6	Tectona grandis	11.0	38.5	12.25493062	0.059890296	0.029945148	0.109798876	
IN_1_T	26	1	IN1-26-1-7	Tectona grandis	6.0	29.0	9.230986699	0.030494466	0.015247233	0.055906521	
IN_1_T	26	1	IN1-26-1-8	Tectona grandis	12.0	41.0	13.05070533	0.069572907	0.034786453	0.127550329	
IN_1_T	26	1	IN1-26-1-9	Tectona grandis	11.0	40.0	12.73239545	0.065598801	0.032799401	0.120264469	
IN_1_T	26	1	IN1-26-1-10	Tectona grandis	10.0	26.0	8.276057041	0.023510156	0.011755078	0.043101953	
IN_1_T	26	1	IN1-26-1-11	Tectona grandis	8.0	22.0	7.002817496	0.015792098	0.007896049	0.02895218	
IN_1_T	26	1	IN1-26-1-12	Tectona grandis	11.0	46.0	14.64225476	0.091512023	0.045756012	0.167772043	
IN_1_T	26	1	IN1-26-1-13	Tectona grandis	6.0	24.6	7.8304232	0.02060613	0.010303065	0.037777904	
IN_1_T	26	1	IN1-26-1-14	Tectona grandis	10.0	37.0	11.77746579	0.054481055	0.027240528	0.099881934	
IN_1_T	26	1	IN1-26-1-15	Tectona grandis	7.0	19.0	6.047887837	0.011137304	0.005568652	0.020418391	
IN_1_T	26	1	IN1-26-1-16	Tectona grandis	14.0	49.0	15.59718442	0.106374141	0.05318707	0.195019258	
IN_1_T	26	1	IN1-26-1-17	Tectona grandis	10.0	38.0	12.09577567	0.058054185	0.029027092	0.106432672	
IN_1_T	26	1	IN1-26-1-18	Tectona grandis	14.0	45.0	14.32394488	0.086844278	0.043422139	0.15921451	
IN_1_T	26	1	IN1-26-1-19	Tectona grandis	8.0	15.0	4.774648293	0.006342177	0.003171089	0.011627325	
IN_1_T	26	1	IN1-26-1-20	Tectona grandis	11.0	45.2	14.38760686	0.087766495	0.043883248	0.160905241	
IN_1_T	26	1	IN1-26-1-21	Tectona grandis	6.0	20.6	6.557183655	0.013502703	0.006751352	0.024754956	
IN_1_T	26	1	IN1-26-1-22	Tectona grandis	10.0	45.0	14.32394488	0.086844278	0.043422139	0.15921451	
IN_1_T	26	1	IN1-26-1-23	Tectona grandis	12.0	41.0	13.05070533	0.069572907	0.034786453	0.127550329	
IN_1_T	26	1	IN1-26-1-24	Tectona grandis	12.0	39.0	12.41408556	0.06175966	0.03087983	0.113226044	
IN_1_T	26	1	IN1-26-1-25	Tectona grandis	11.0	36.5	11.61831085	0.052743702	0.026371851	0.096696786	
IN_1_T	26	1	IN1-26-1-26	Tectona grandis	11.0	47.4	15.08788861	0.098286306	0.049143153	0.180191561	
IN_1_T	26	1	IN1-26-1-27	Tectona grandis	11.0	34.5	10.98169107	0.046118385	0.023059192	0.084550372	
IN_1_T	26	1	IN1-26-1-28	Tectona grandis	10.0	30.5	9.708451529	0.034386757	0.017193379	0.063042388	
IN_1_T	26	1	IN1-26-1-29	Tectona grandis	10.0	41.0	13.05070533	0.069572907	0.034786453	0.127550329	
IN_1_T	26	1	IN1-26-1-30	Tectona grandis	8.0	22.0	7.002817496	0.015792098	0.007896049	0.02895218	
IN_1_T	26	1	IN1-26-1-31	Tectona grandis	8.0	25.5	8.116902098	0.022447486	0.011223743	0.041153725	
IN_1_T	26	1	IN1-26-1-32	Tectona grandis	11.0	38.5	12.25493062	0.059890296	0.029945148	0.109798876	