ESA - MOST Dragon 2 Programme

2011 DRAGON 2 SYMPOSIUM

中国科技部-欧洲空间局合作 "龙计划"二期

"龙计划"二期2011年学术研讨会

EARLY WARNING AND DAMAGED ASSESSMENT FOR FOREST FIRE (5258) Progress Report Report

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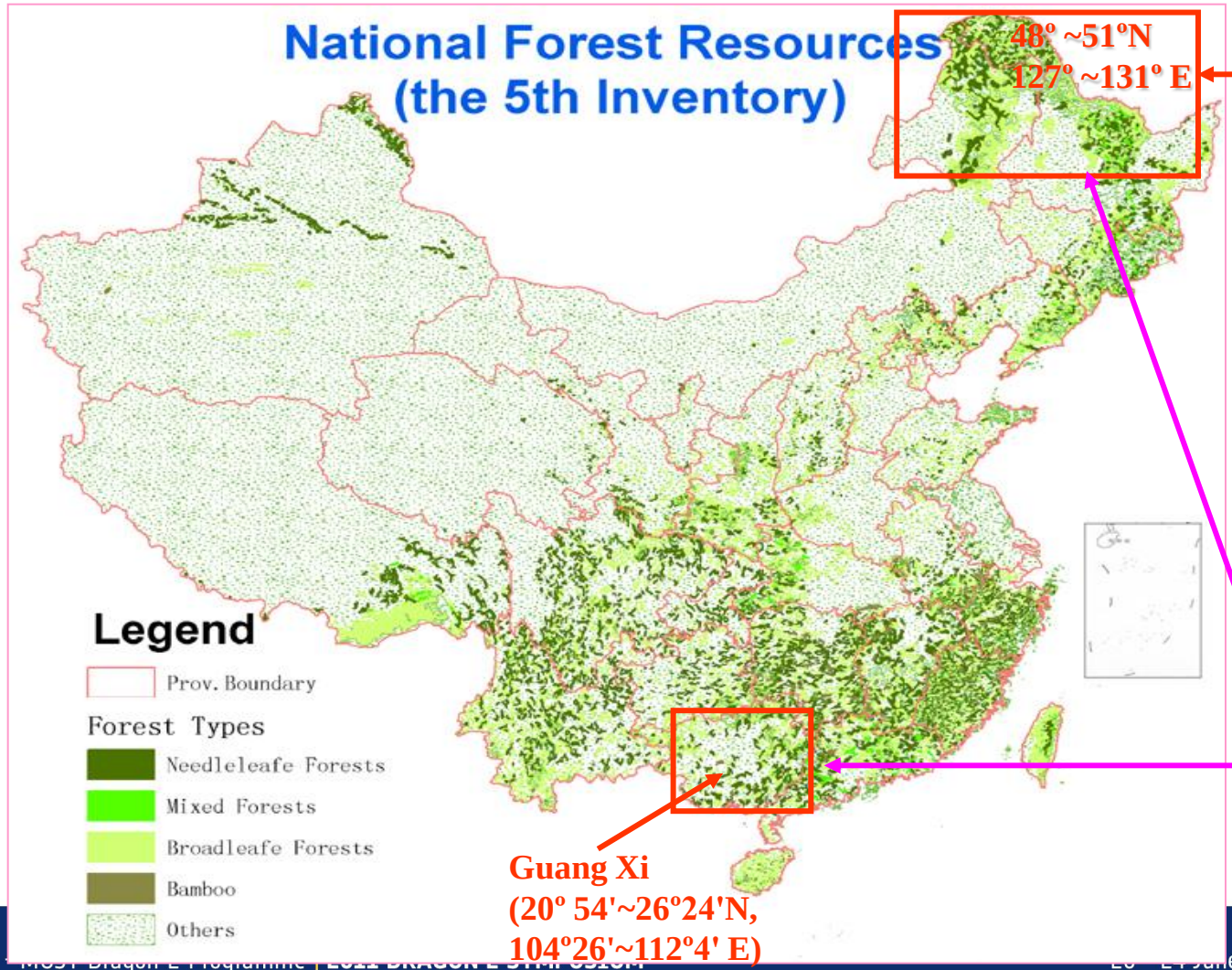
CONTENT

1. Activities

2. Future Work Plan

Experimental Area



1. Activities

1.1 Data collection

1.2 Early Warning Techniques

1.3 Forest Fire Monitoring

1.4 Others

1.1 Data Collection

Satellite Data Collection

Production	Years	Total
SCI_NL__1P	2005,2008	50
SCI_NL__2P	2003, 2004,2005	653
SCI_0L_2P	2002, 2003, 2004,2006	227
GOMS_0_3-NO_2_L2	May 25 to 31, 2006	41
ASAR	March to May, 2009	75
FY 3A/B	2009,2010, 2011	21800
HJ	2009,2010, 2011	80
Total		22926

1.1 Data Collection

Ground Information Collection

- **Forest Fire Information**
  The fire information includes fire location, on fire time, fire duration, etc.

- **Background Information**
  Vegetation map, Forest map, Administrative Boundary, etc.

- **Field work**
  Burnt Area, Fuel Moisture Content, etc.

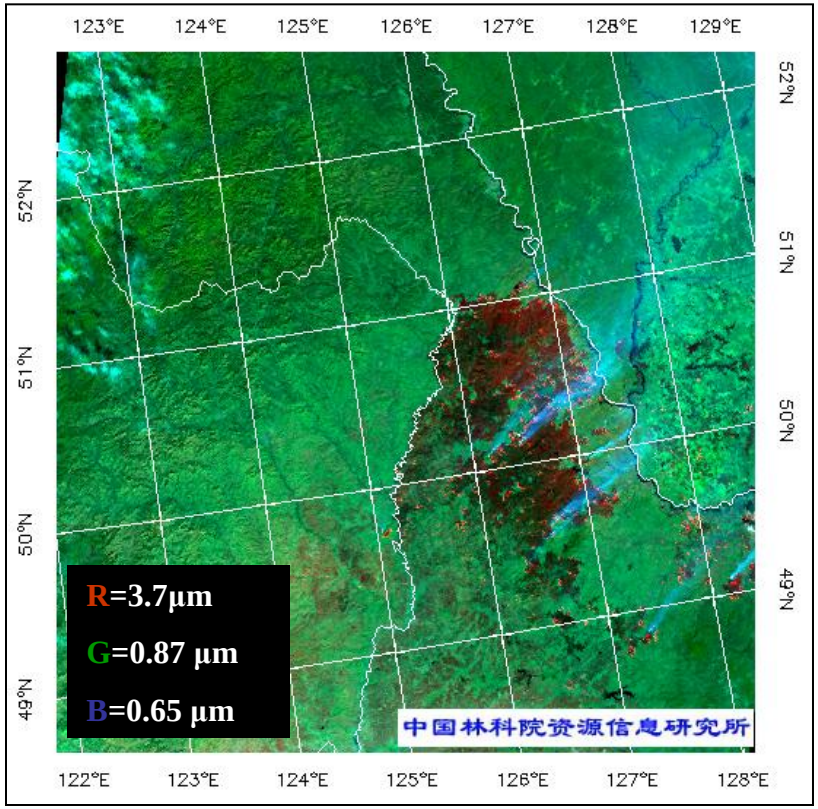
1.2 Early Warning Techniques

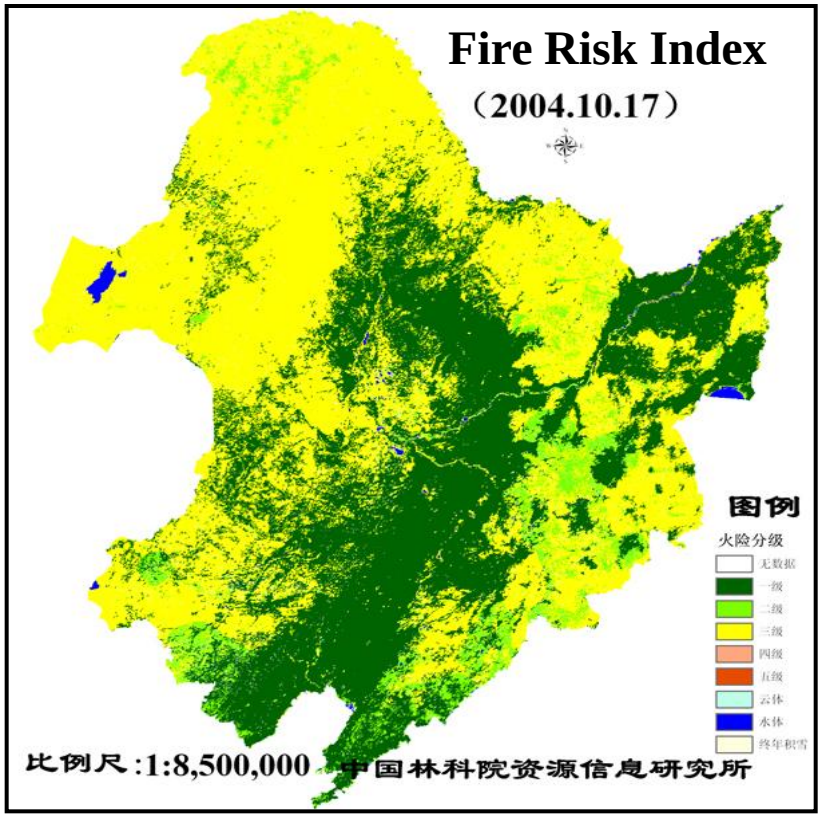
- To get the method to monitor forest greenness
- To develop a suitable early warning technique

1.2 Early Warning Techniques

DRAGON 1

Using AATSR





1.2 Early Warning Techniques

- **To get the method to monitor greenness**

FY-3A launch on May 27, 2008

FY-3B launch on November 5, 2010

Data: FY 3A MERSI (Data Format is HDF 5)

The temporal change of 2 classes of vegetation index have been analyzed

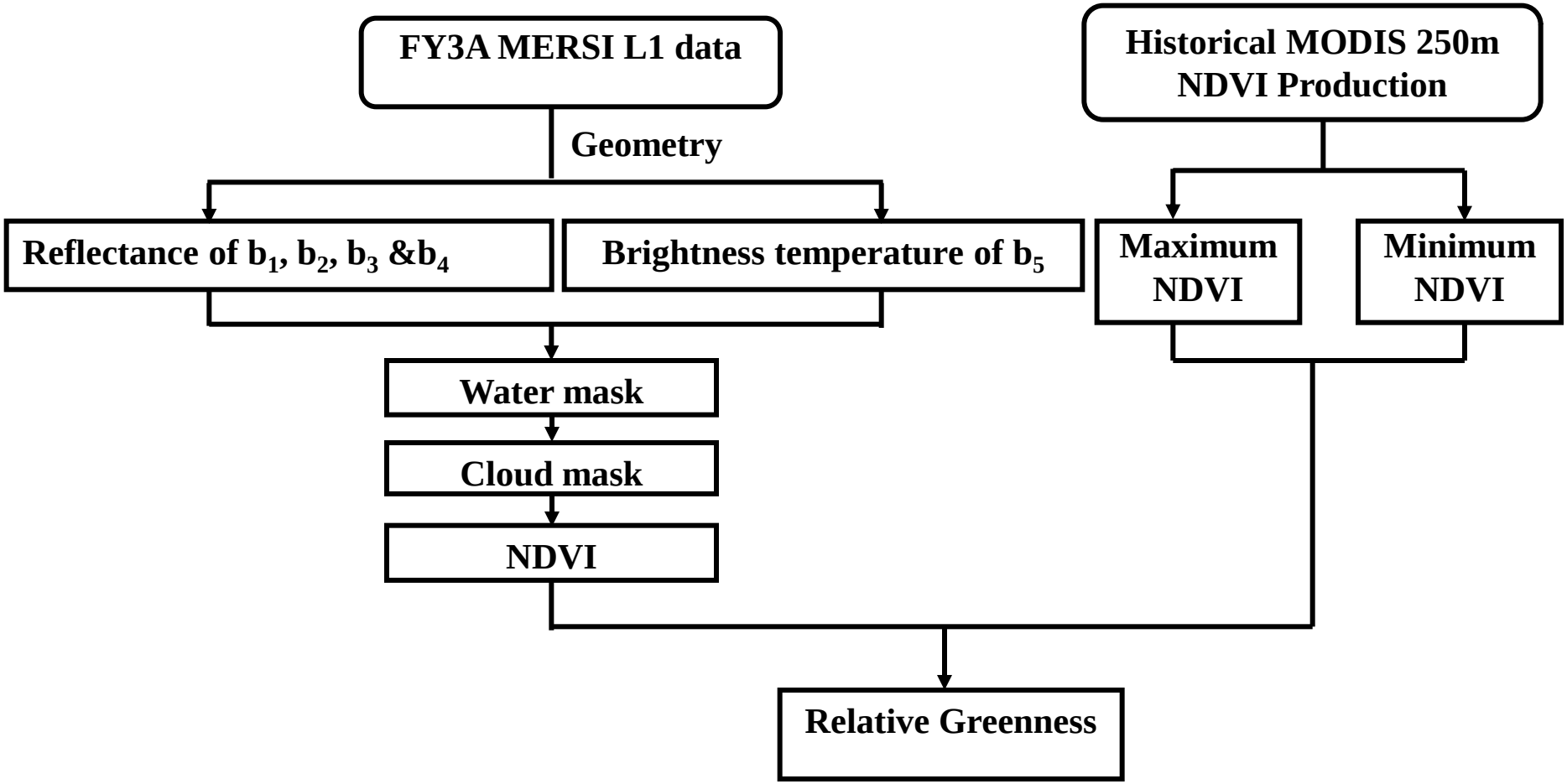
Medium Resolution Spectral Imager (MERSI)

Channel	Central wave (μm)	Spatial resolution at nadir (m)	Noise-equivalent reflectance (%), ΔT at 300 K	Dynamic range (max reflec., max T)	Primary use
1	0.470	250	0.45	100%	Land/cloud/ aerosols boundaries
2	0.550	250	0.4	100%	
3	0.650	250	0.3	100%	Land/cloud/ aerosols
4	0.865	250	0.3	100%	
5	11.25	250	0.4 K	330k	
6	0.412	1000	0.1	80%	
7	0.443	1000	0.1	80%	

Medium Resolution Spectral Imager (MERSI)

Channel	Central wave (μm)	Spatial resolution at nadir (m)	Noise-equivalent reflectance (%), ΔT at 300 K	Dynamic range (max reflec., max T)	Primary use
8	0.490	1000	0.05	80%	Ocean Color/ Phytoplankton/ Biogeochemistry
9	0.520	1000	0.05	80%	
10	0.565	1000	0.05	80%	
11	0.650	1000	0.05	80%	
12	0.685	1000	0.05	80%	
13	0.765	1000	0.05	80%	
14	0.865	1000	0.05	80%	
15	0.905	1000	0.10	90%	
16	0.940	1000	0.10	90%	
17	0.980	1000	0.10	90%	Atmospheric water vapor
18	1.030	1000	0.10	90%	
19	1.640	1000	0.05	90%	
20	2.130	1000	0.05	90%	

Method



Flowchart of Relative Greenness Calculation

Method

- **NDVI (Normal Difference Vegetation Index)**

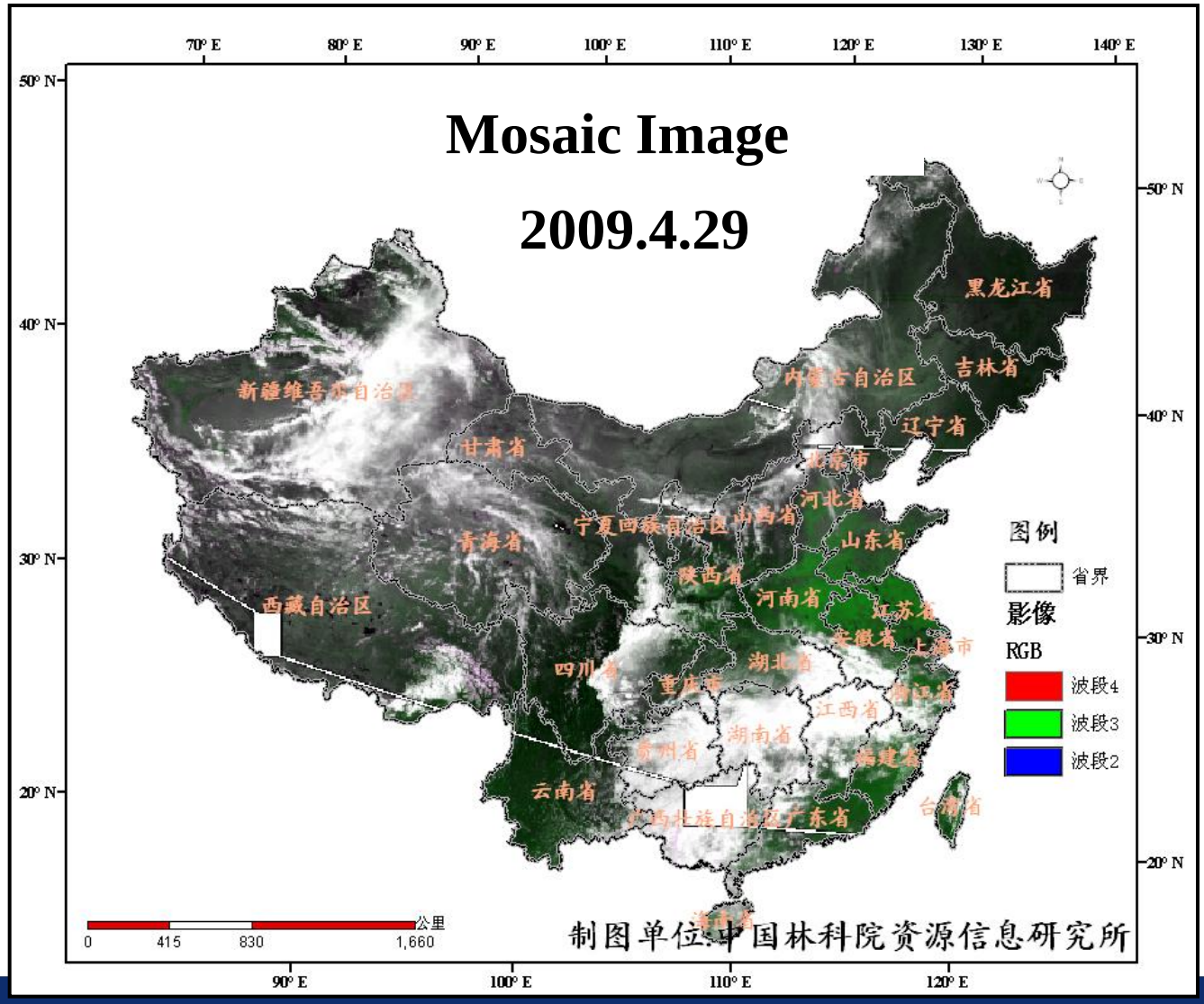
$$NDVI=(R_{nir}-R_{red})/(R_{nir}+R_{red})$$

NDVI: Normal Difference Vegetation Index
R_{nir}: Reflectance of Channel 3 of MERSI
R_{red}: Reflectance of Channel 4 of MERSI

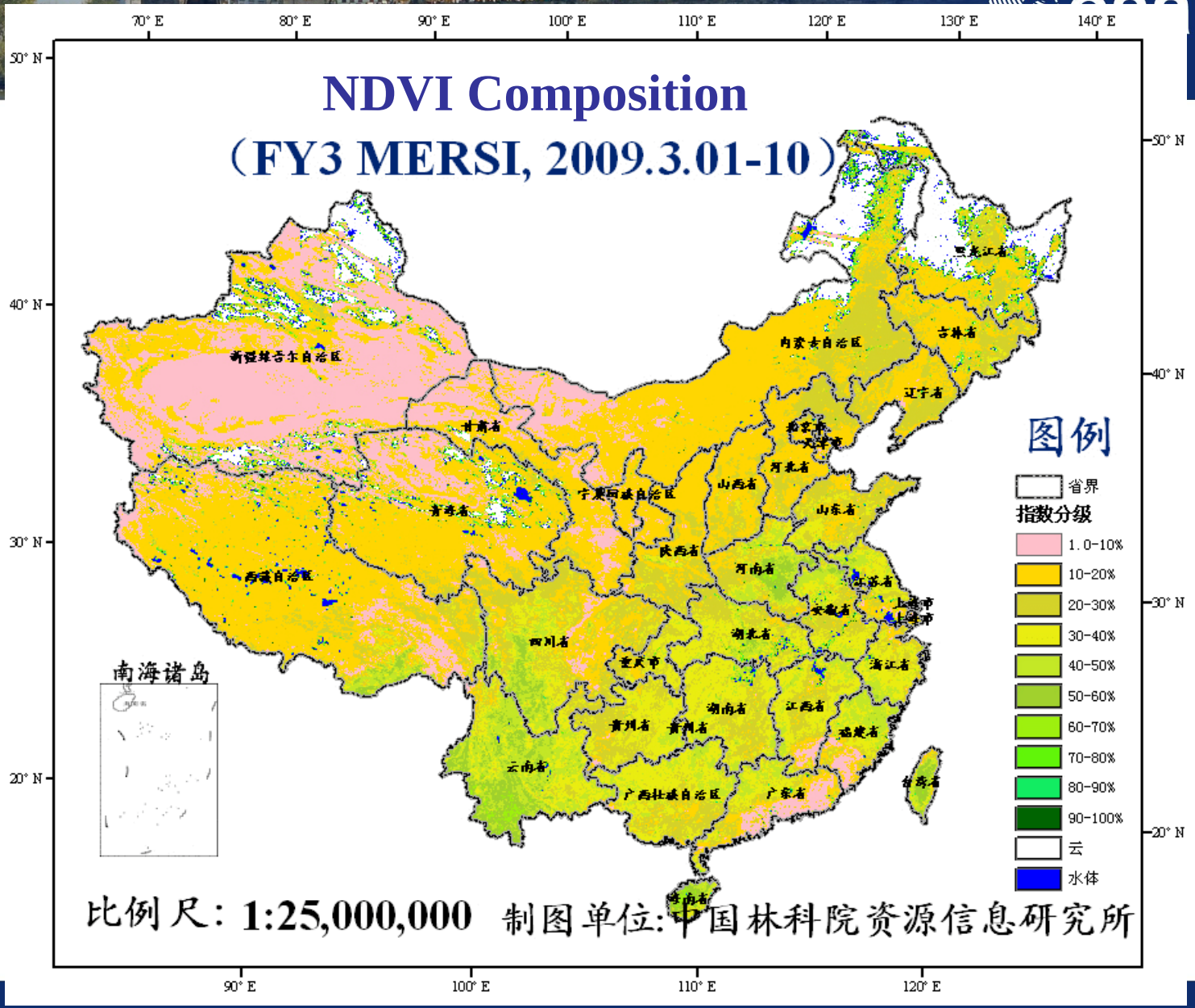
- **RG (Relative Greenness)**

$$RG=(NDVI-NDVI_{min})/(NDVI_{max}-NDVI_{min})$$

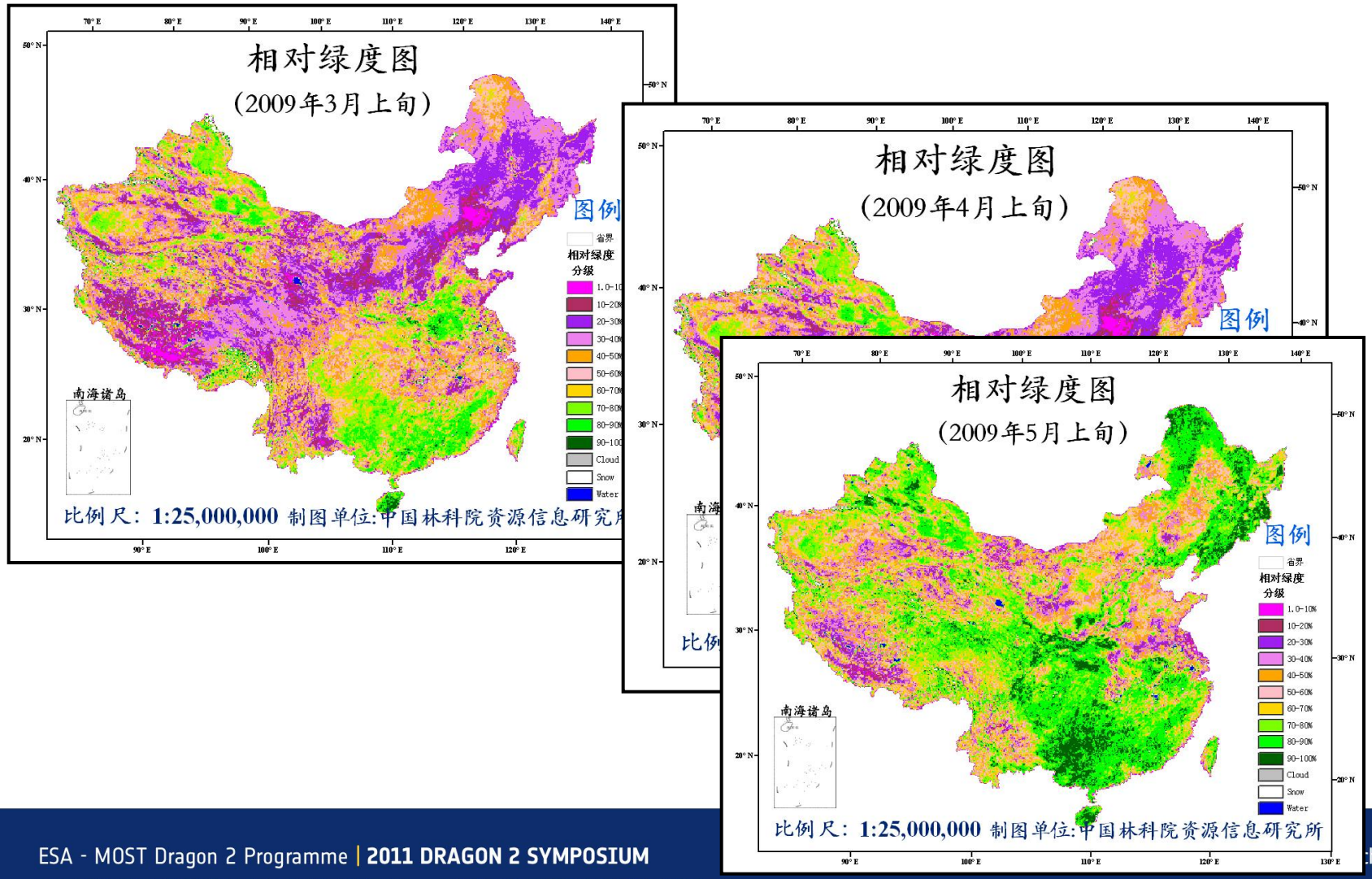
RG: Relative Greenness
NDIVmin: Minimum of historical NDVI (MODIS)
NDIVmax: Maximum of historical NDVI (MODIS)

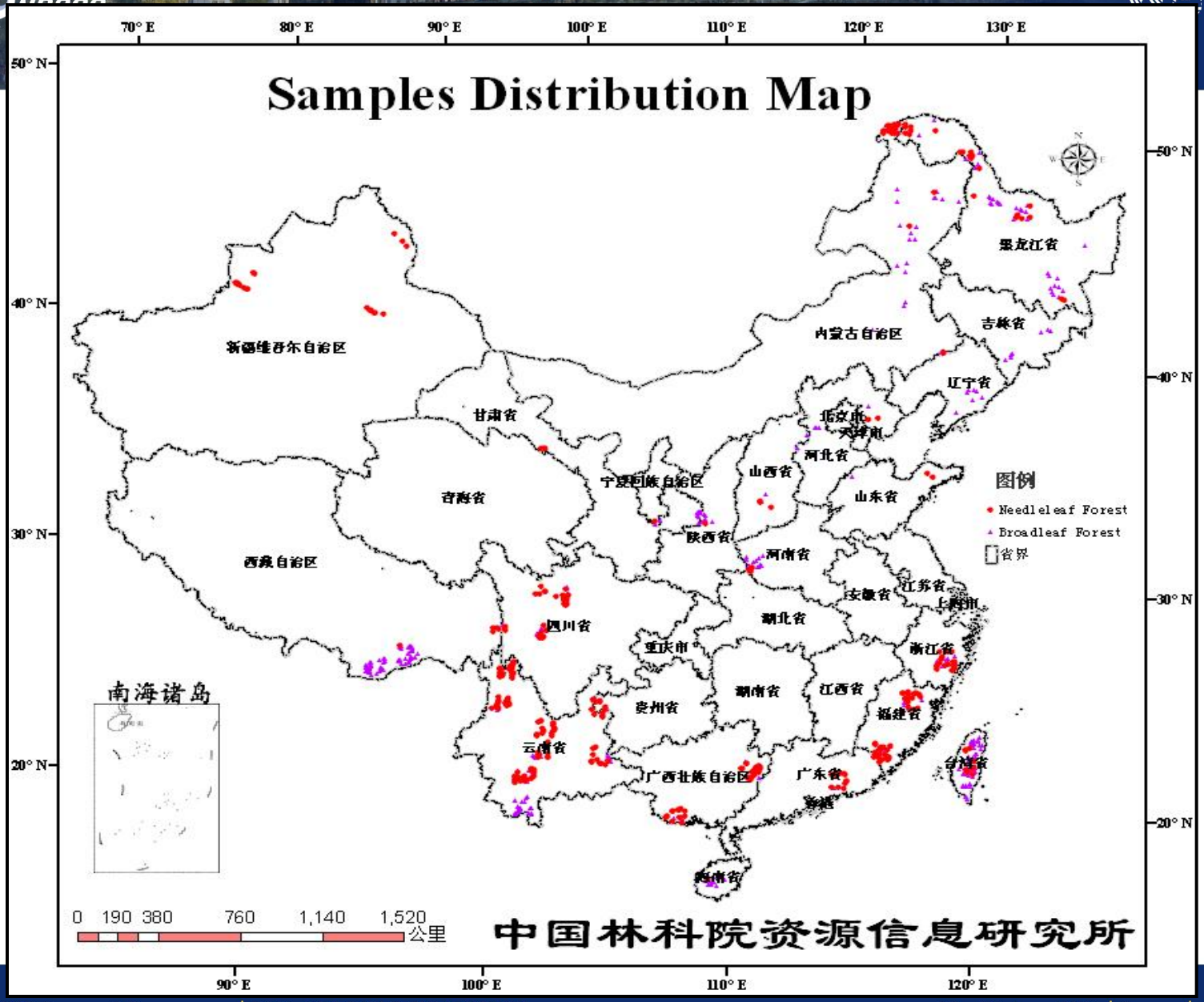

Mosaic Image
2009.4.29
70° E
80° E
90° E
100° E
110° E
120° E
130° E
140° E
50° N
40° N
30° N
20° N
黑龙江省
吉林省
辽宁省
内蒙古自治区
新疆维吾尔自治区
甘肃省
北京市
河北省
宁夏回族自治区
山西省
青海省
山东省
陕西省
河南省
江苏省
西藏自治区
安徽省
上海市
四川省
湖北省
重庆市
浙江省
江西省
湖南省
贵州省
福建省
云南省
广西壮族自治区
广东省
台湾省
海南省
图例
省界
影像
RGB
波段4
波段3
波段2
公里
0
415
830
1,660
制图单位:中国林科院资源信息研究所

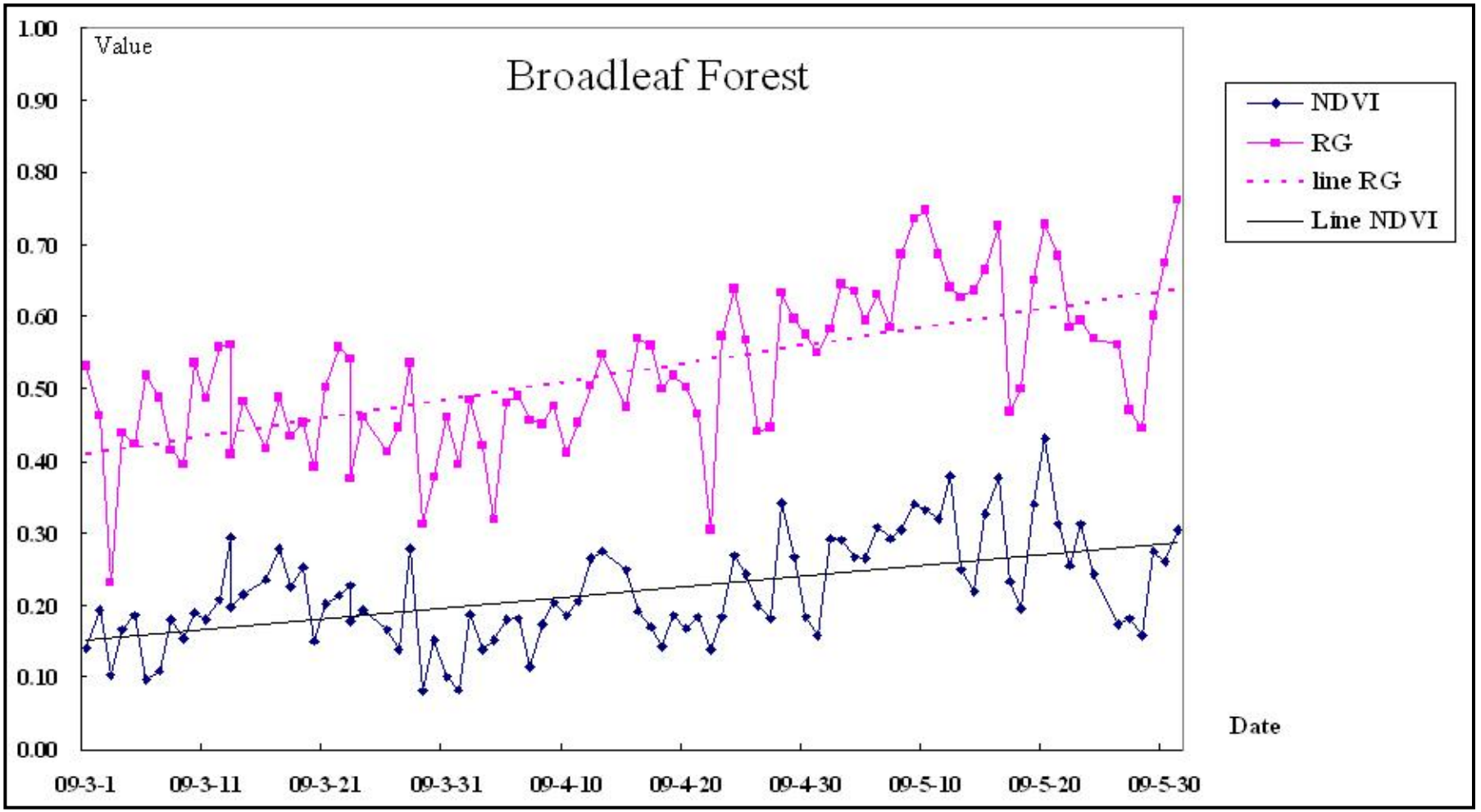
Results

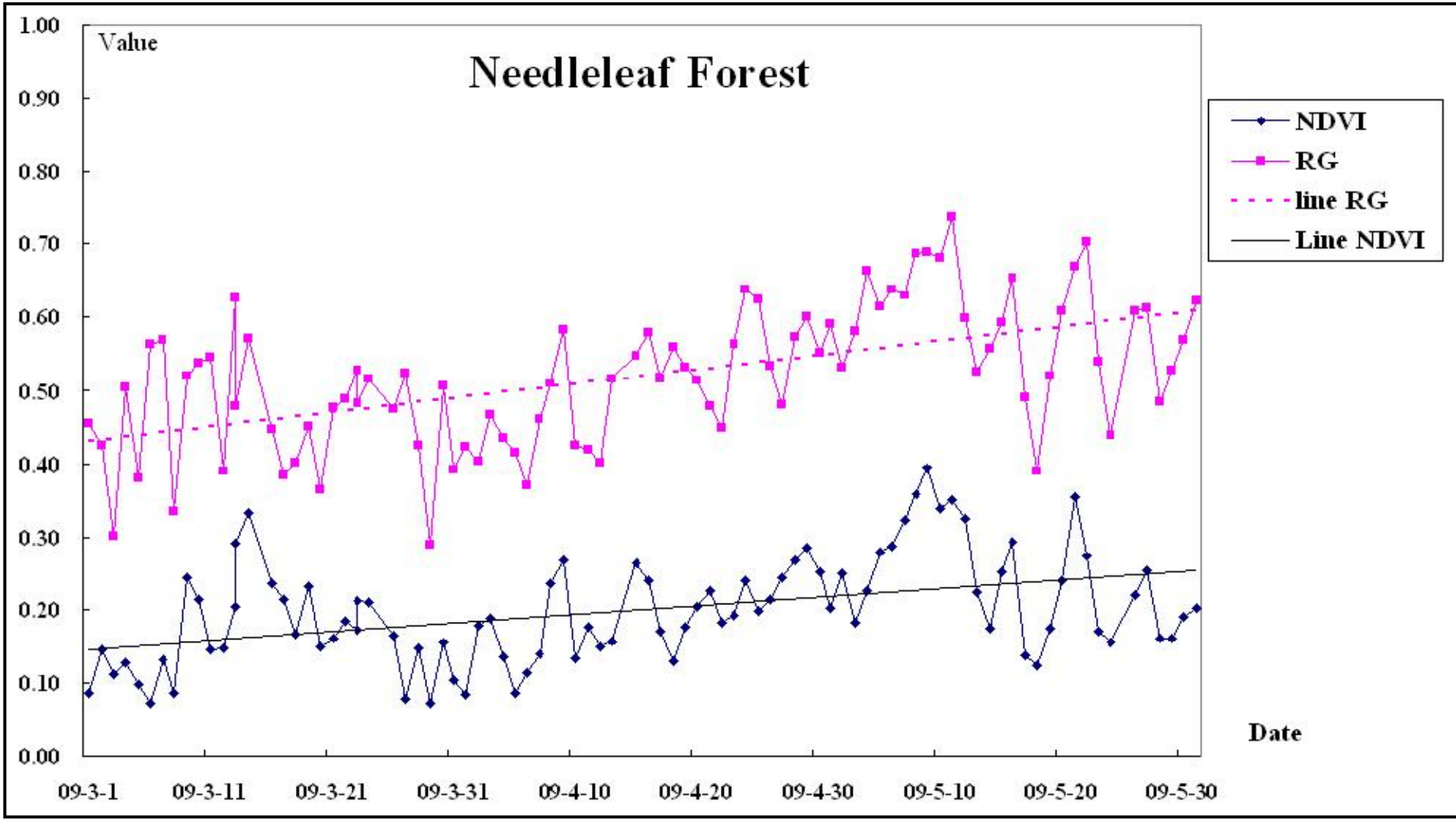

NDVI Composition
（FY3 MERSI, 2009.3.01-10）
70° E
80° E
90° E
100° E
110° E
120° E
130° E
140° E
50° N
40° N
30° N
20° N
图例
省界
指数分级
1.0-10%
10-20%
20-30%
30-40%
40-50%
50-60%
60-70%
70-80%
80-90%
90-100%
云
水体
南海诸岛
比例尺：1:25,000,000
制图单位:中国林科院资源信息研究所

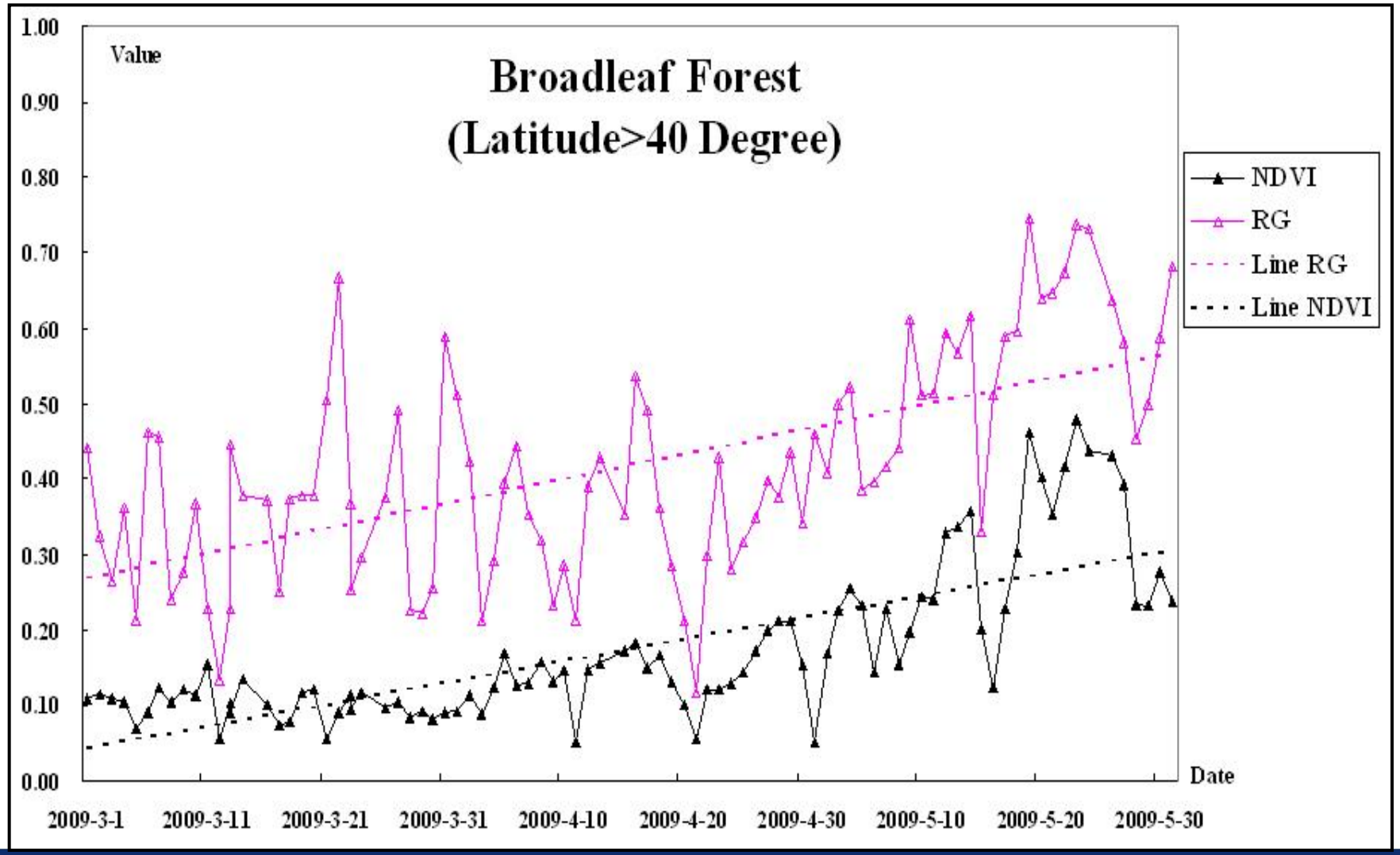
Results

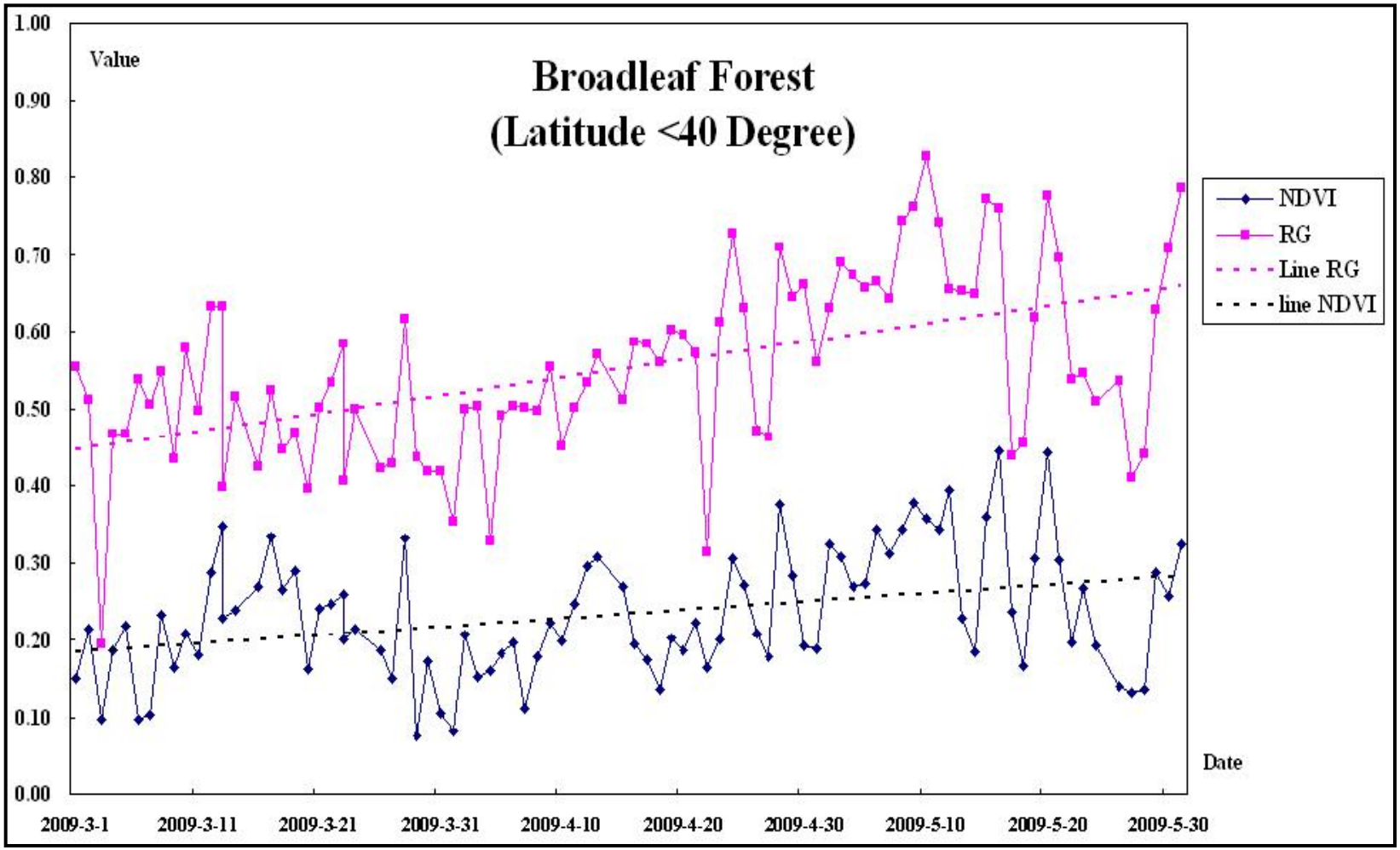

相对绿度图
(2009年3月上旬)
图例
省界
相对绿度
分级
1.0-10%
10-20%
20-30%
30-40%
40-50%
50-60%
60-70%
70-80%
80-90%
90-100%
Cloud
Snow
Water
南海诸岛
比例尺: 1:25,000,000 制图单位:中国林科院资源信息研究所
相对绿度图
(2009年4月上旬)
图例
相对绿度图
(2009年5月上旬)
图例
省界
相对绿度
分级
1.0-10%
10-20%
20-30%
30-40%
40-50%
50-60%
60-70%
70-80%
80-90%
90-100%
Cloud
Snow
Water
南海诸岛
比例尺: 1:25,000,000 制图单位:中国林科院资源信息研究所

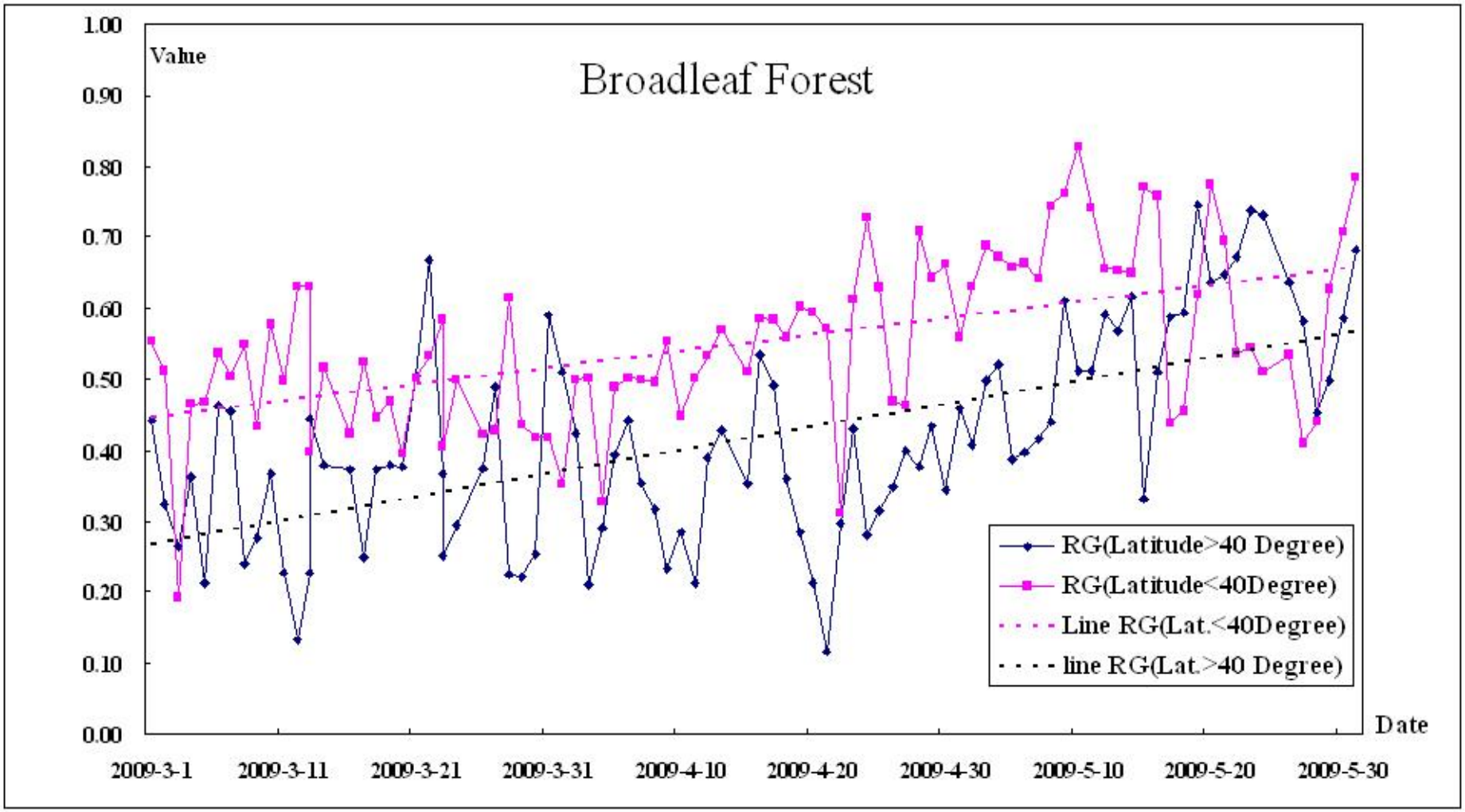

Samples Distribution Map
70° E
80° E
90° E
100° E
110° E
120° E
130° E
50° N
40° N
30° N
20° N
新疆维吾尔自治区
甘肃省
青海省
西藏自治区
内蒙古自治区
黑龙江省
吉林省
辽宁省
北京市
天津市
河北省
山西省
宁夏回族自治区
陕西省
山东省
河南省
安徽省
江苏省
上海市
湖北省
四川省
重庆市
浙江省
湖南省
江西省
贵州省
福建省
云南省
广西壮族自治区
广东省
台湾省
海南省
南海诸岛
图例
Needleleaf Forest
Broadleaf Forest
省界
0 190 380 760 1,140 1,520
公里
中国林科院资源信息研究所

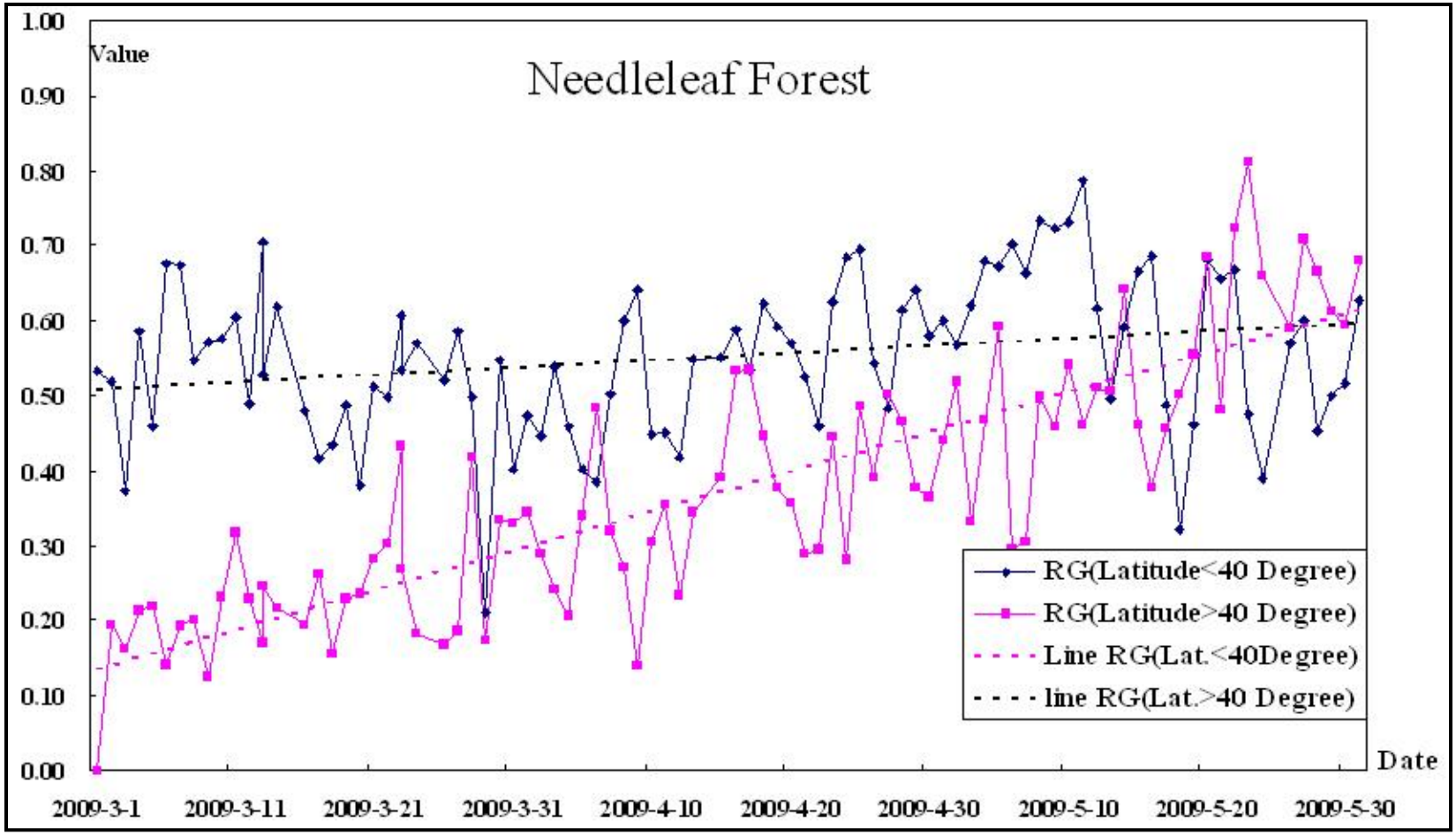

Broadleaf Forest
Value
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
09-3-1
09-3-11
09-3-21
09-3-31
09-4-10
09-4-20
09-4-30
09-5-10
09-5-20
09-5-30
Date
NDVI
RG
line RG
Line NDVI


Needleleaf Forest
Value
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
09-3-1
09-3-11
09-3-21
09-3-31
09-4-10
09-4-20
09-4-30
09-5-10
09-5-20
09-5-30
Date
NDVI
RG
line RG
Line NDVI


Broadleaf Forest
(Latitude>40 Degree)
Value
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
NDVI
RG
Line RG
Line NDVI
Date
2009-3-1
2009-3-11
2009-3-21
2009-3-31
2009-4-10
2009-4-20
2009-4-30
2009-5-10
2009-5-20
2009-5-30


Broadleaf Forest
(Latitude <40 Degree)
Value
Date
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
2009-3-1
2009-3-11
2009-3-21
2009-3-31
2009-4-10
2009-4-20
2009-4-30
2009-5-10
2009-5-20
2009-5-30
NDVI
RG
Line RG
line NDVI


Broadleaf Forest
Value
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Date
2009-3-1
2009-3-11
2009-3-21
2009-3-31
2009-4-10
2009-4-20
2009-4-30
2009-5-10
2009-5-20
2009-5-30
RG(Latitude>40 Degree)
RG(Latitude<40Degree)
Line RG(Lat.<40Degree)
line RG(Lat.>40 Degree)


Needleleaf Forest
Value
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Date
2009-3-1
2009-3-11
2009-3-21
2009-3-31
2009-4-10
2009-4-20
2009-4-30
2009-5-10
2009-5-20
2009-5-30
RG(Latitude<40 Degree)
RG(Latitude>40 Degree)
Line RG(Lat.<40Degree)
line RG(Lat.>40 Degree)

Summary

- Relative Greenness can stand for the growth of Forest
- The growth is difference between broadleaf forest and needleleaf forest
- The growth trend is difference between different location

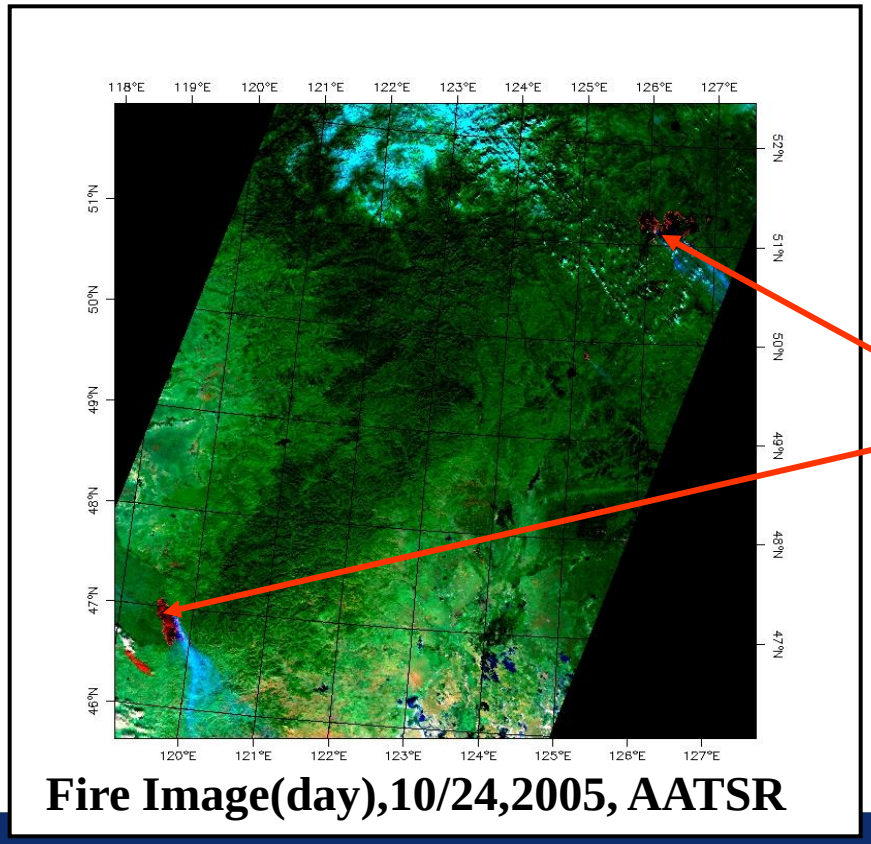
1.3 Forest Fires Monitoring

- To detect burning in the vast forest areas
- To monitor fire combustion phase in the key regions

1.3 Forest Fires Monitoring

DRAGON 1

Monitoring Forest Fires in CHINA using ENVISAT-AATSR



Fire Image(day),10/24,2005, AATSR

1.3 Forest Fires Monitoring

- **FY3A/B VIRR**

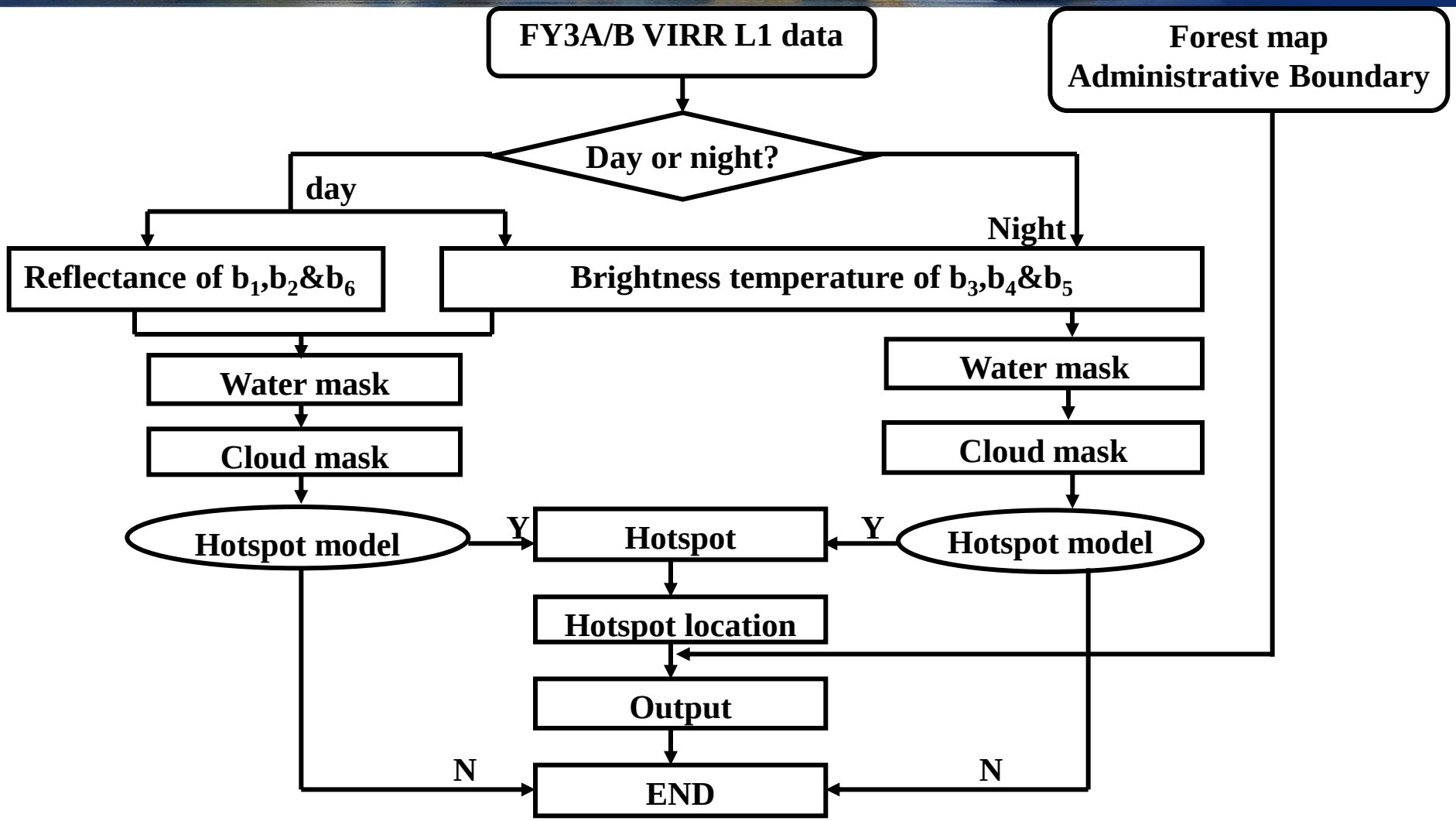
FY-3A launch on May 27, 2008

FY-3B launch on Nov., 2010

To caver the same place: nearly 4 times/every day

VIRR (Visible and Infrared Radiometer)

Channel	Spectral range (μm)	Spatial resolution at nadir (m)	Noise Equivalent Reflectance (%) or NEΔT (at 300 K)	Dynamic range (% or K)
1	0.58-0.68	1000m	0.1%	0-100%
2	0.84-0.89	1000m	0.1%	0-100%
3	3.55-3.93	1000m	0.3k-0.4k	180-350k
4	10.3-11.3	1000m	0.2k	180-330k
5	11.5-12.5	1000m	0.2k	180-330k
6	1.55-1.64	1000m	0.15%	0-90%
7	0.43-0.48	1000m	0.05%	0-50%
8	0.48-0.53	1000m	0.05%	0-50%
9	0.53-0.58	1000m	0.05%	0-50%
10	1.325-1.395	1000m	0.19%	0-90%



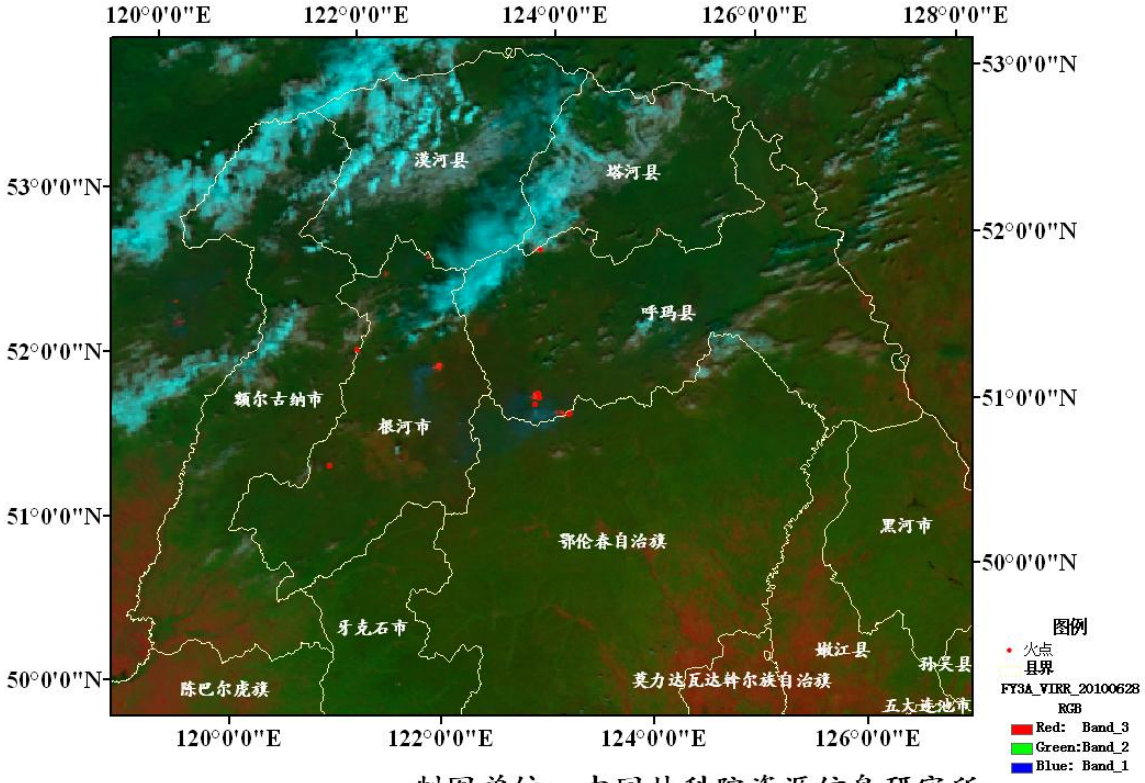
Flowchart of Forest Fire Identification

Results

科学技术部国家遥感中心

森林火情监测结果

2010年6月28日10:25



比例尺：1:3,000,000

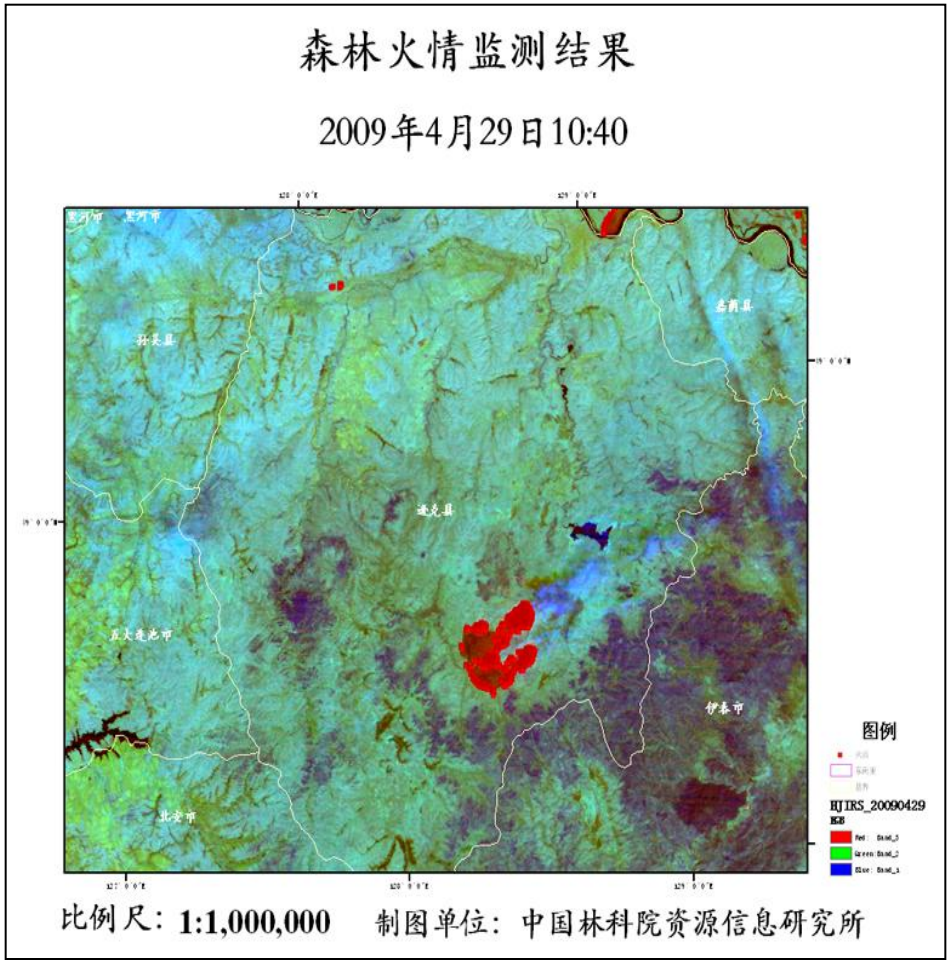
制图单位：中国林科院资源信息研究所

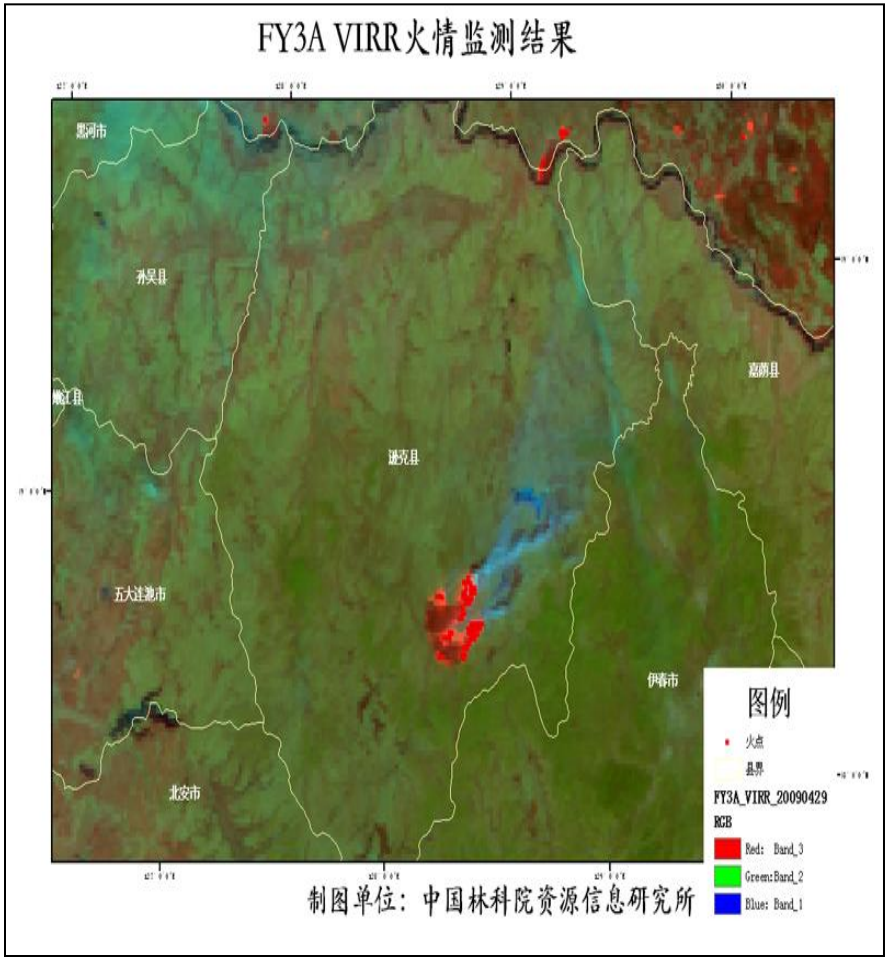
上报时间：2010年6月28日

Results

Num	Longitude	Latitude	Satellite	Province	County	Vegetation Type	Burning Area (ha)
1	121°59'33.42"	52°17'19.71"	FY3A 2010-6-28 10:25	Inner Mongolia	Genhe	needleleaf forest	200.0
2	122°25'26.86"	52°21'9.14"	FY3A 2010-6-28 10:25	Inner Mongolia	Genhe	Broadleaf forest	200.0
3	122°24'2.26"	51°41'24.41"	FY3A 2010-6-28 10:25	Inner Mongolia	Genhe	shrub	1750.0
4	123°17'15.86"	51°26'19.16"	FY3A 2010-6-28 10:25	Heilongjiang	Huma	mixed forest	1300.0
5	123°32'36.38"	51°18'34.29"	FY3A 2010-6-28 10:25	Heilongjiang	Huma	needleleaf forest	900.0
6	123°29'7.42"	52°19'5.35"	FY3A 2010-6-28 10:25	Heilongjiang	Tahe	needleleaf forest	200.0
7	123°7'35.08"	52°0'11.13"	FY3A 2010-6-28 10:25	Heilongjiang	Huma	needleleaf forest	200.0

Validation





HJ-1B IRS

1.4 Others

Papers

(1) QIN Xian-lin, Deng Guang, LI Zeng-yuan. Forest Canopy Moisture Content Monitoring Method Using HJ-1B IRS Data, the 34th International Symposium on Remote Sensing of Environment, 10–15 April, 2011, Sydney, Australia.

(2) Qin Xianlin, Li Zengyuan, Zhangxu et al. Damaged Assessment Methodology for Large Forest Fires. Proceeding of the Symposium, Dragon 2 Programme Mid-Term Results 2008-2010, 17-21, May, 2010, Guilin City, P.R.China.

2. Future Working Planning

- **Early Warning Techniques**
  - To validate indicator of vegetation
  - To get the Fire danger Index

- **Fire Monitoring Technique**
  - To Validate the fire detection method.
  - To validate the damage assessment method.

Thanks!