

# Promoting EO Applications for Disaster Risk Reduction in Asia and the Pacific

Mr. Keran Wang  
Chief, Space Applications Section  
Information and Communications Technology and  
Disaster Risk Reduction Division (IDD)  
UN ESCAP



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# I Overview of ESCAP

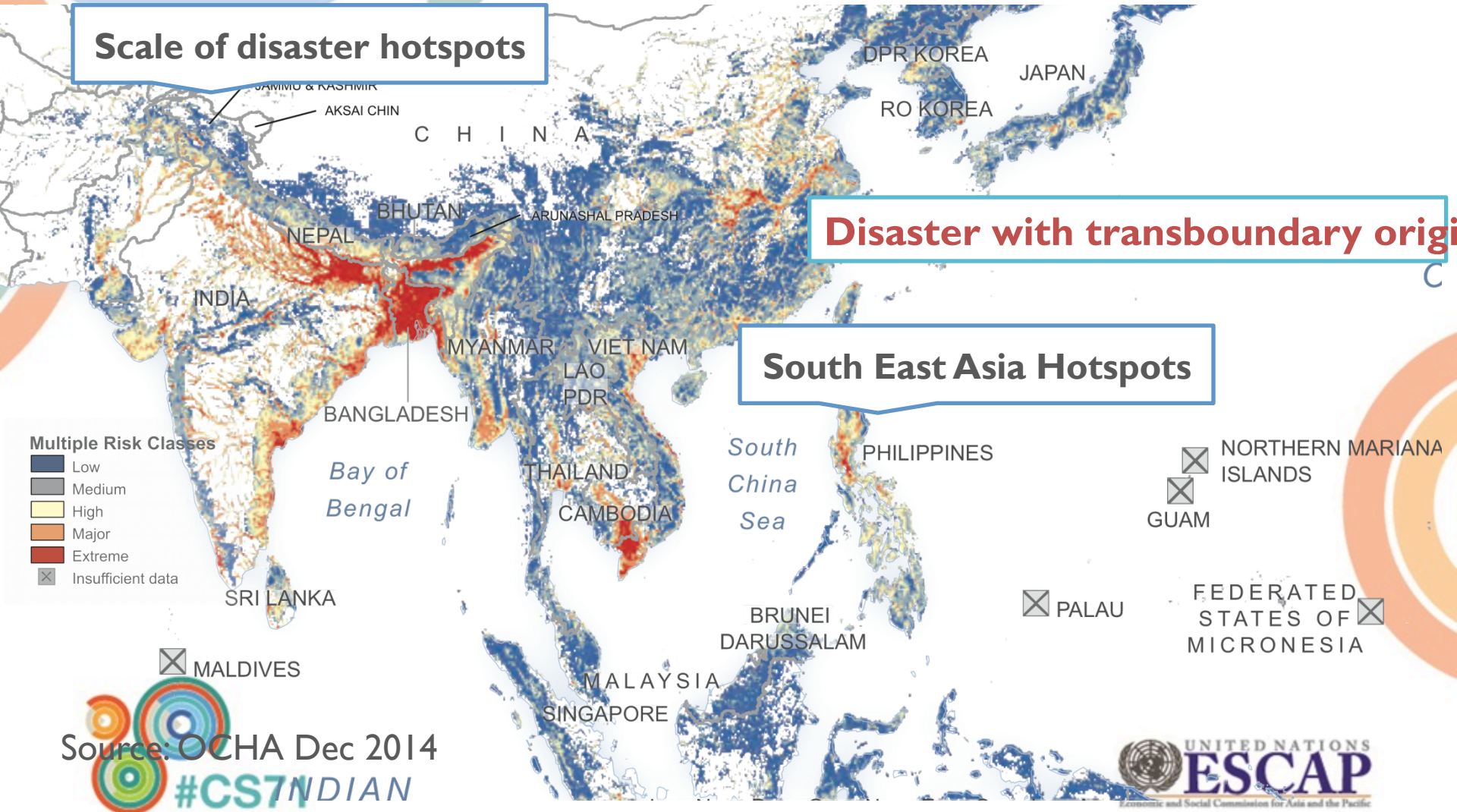
- **Made up of 53 Member States and 9 Associate Members;**
- **Asia-Pacific region is home to 4.1 billion people, or two thirds of the world's population.**
- **Asia and the Pacific continued to be the region most affected by natural disasters in last decades.**



- 
- **In 2014, Asia and the Pacific continued to be the region most affected by natural disasters**
    - Over half of the world's 226 natural disasters occurred in Asia and the Pacific; 6,050 lives lost; 80 million people affected; cost \$60 billion
  - **In 2015, large scale natural disasters brought devastation**
    - Cyclone Pam wrecked havoc in Vanuatu and affected the Pacific; the recent earthquakes devastated Nepal
  - **Sendai Framework for DRR 2015-2030 calls for regional solutions**
    - For sharing policy lessons and good practices; monitoring and early warning systems; sharing scientific knowledge and technology



# Regional Multi-hazard Estimated Risk Map (Cyclone, Earthquake, Floods and Landslides)



# Many urban risk hot spots in the region...

Of the 305 urban agglomerations, 119 are situated along coastlines, large number of cities with high seismic risk



## II Enables timely access to and use of space-derived products and GIS for effective disaster risk reduction

- Just in 2015, 150 Near real-time satellite imagery and 35 damage maps have been provided to Vanuatu, Tuvalu, Nepal and Myanmar for effective disaster response and relief;
- Guidelines on rapid assessment of damage and losses (with SAARC);
- SOPs for utilizing space based data during disasters (with ASEAN);



# Satellite Image of Vanuatu (part)

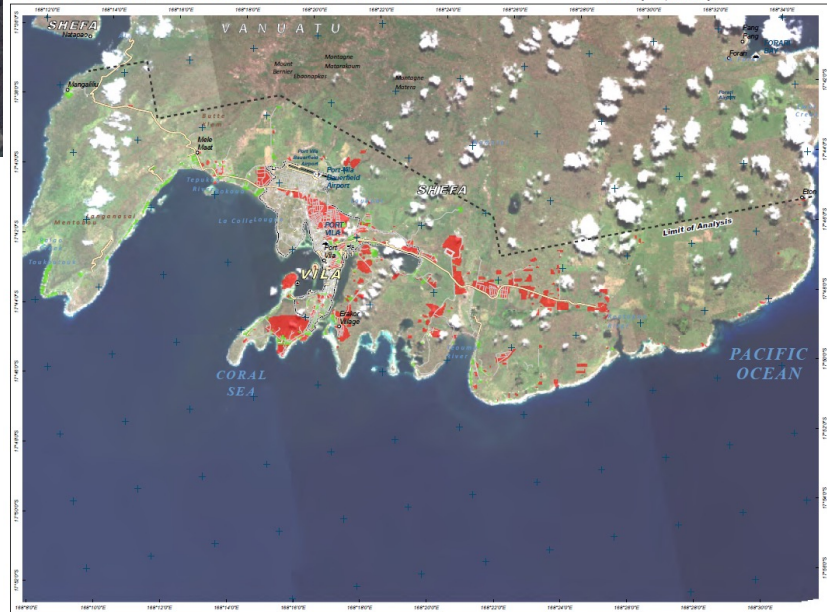


## POTENTIALLY DAMAGED ZONES IN SOUTHERN EFATÉ ISLAND, VANUATU

Analysis with Pleiades Data Acquired 15 & 16 March 2015 and WorldView2 Data Acquired 15 March 2015

This map displays satellite-derived areas of potentially damaged zones in the southern part of Efate Island, Vanuatu, based on imagery acquired on 15 and 16 March 2015 and WorldView2 imagery acquired 15 March 2015. UNCAT's mission report of Port Vila and surrounding areas will be made available once damage caused by Tropical Cyclone Pam. This is a preliminary analysis and has not yet been validated in the field. Please refer to the UNCAT website for more information.

Tropical Cyclone  
 Production Date: 20/03/15  
 Version: 1.0  
 Activation Number: TC-2015-00023-VUT



Pontoon Bay, Weila Bay



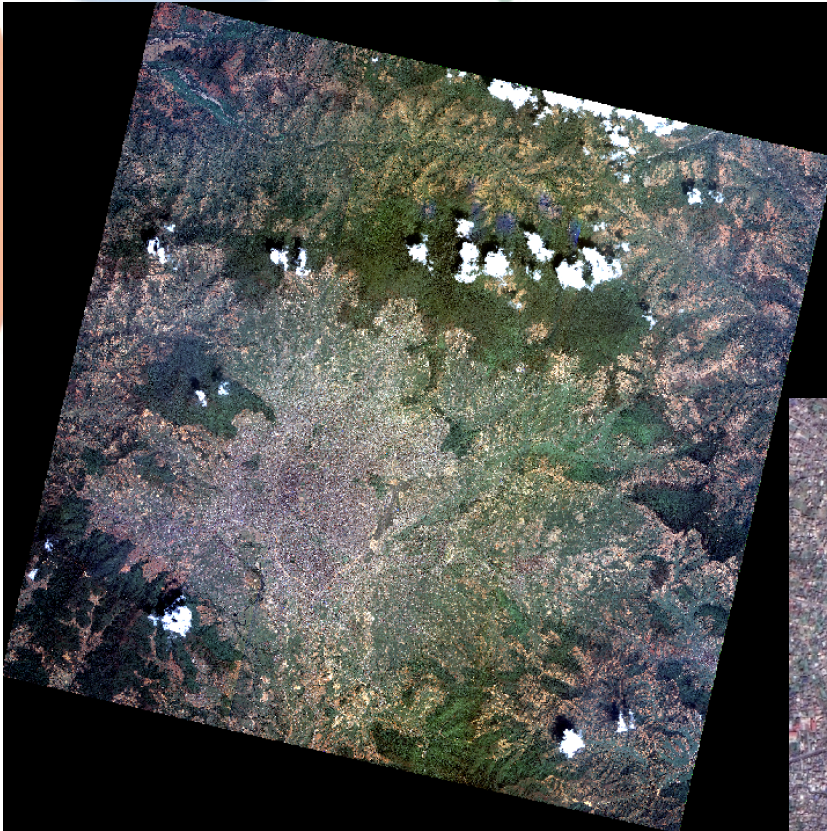


# Satellite Image of Nepal (a whole scene)

Satellite: ChinaGF-1

Location: Kathmandu, Nepal

Date: 2015Apr11



# Compared Map (China GF-1 Satellite)

China\_GF-1 Satellite acquired on 11 April 2015



China\_GF-1 Satellite acquired on 27 April 2015

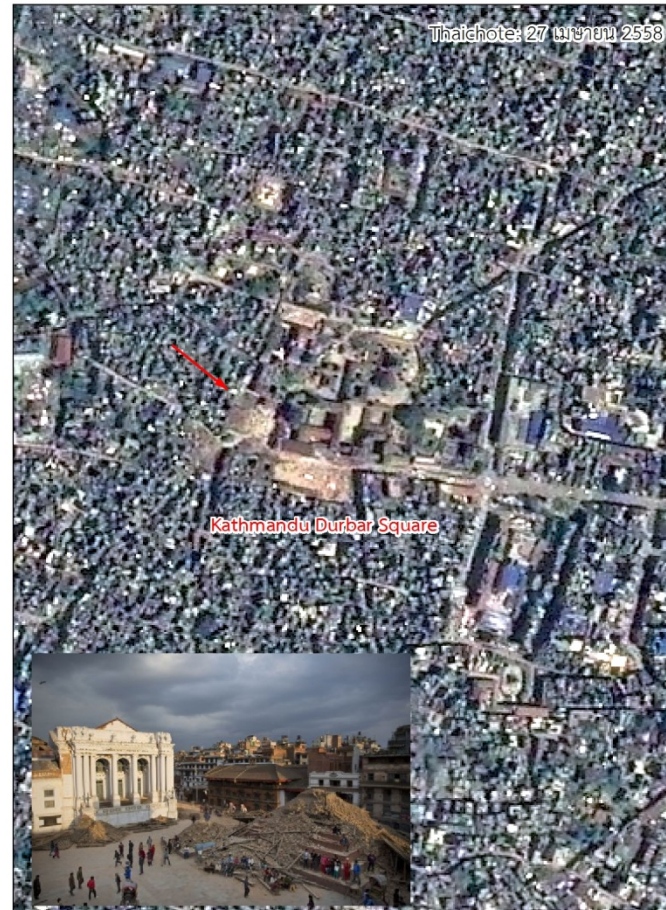


Kathmandu Nepal

# Compared Map (ThaiChote Satellite)



ข้อมูลจากดาวเทียม ThaiChote บันทึกภาพวันที่ 8 เมษายน 2557 และวันที่ 27 เมษายน 2558 พื้นที่ที่ได้รับผลกระทบจากแผ่นดินไหว เมื่อวันที่ 25 เมษายน 2558  
บริเวณจตุรัสกาฐมาณฑุ ดุบาร์ เมืองกาฐมาณฑุ ประเทศเนปาล



(a) Before earthquake

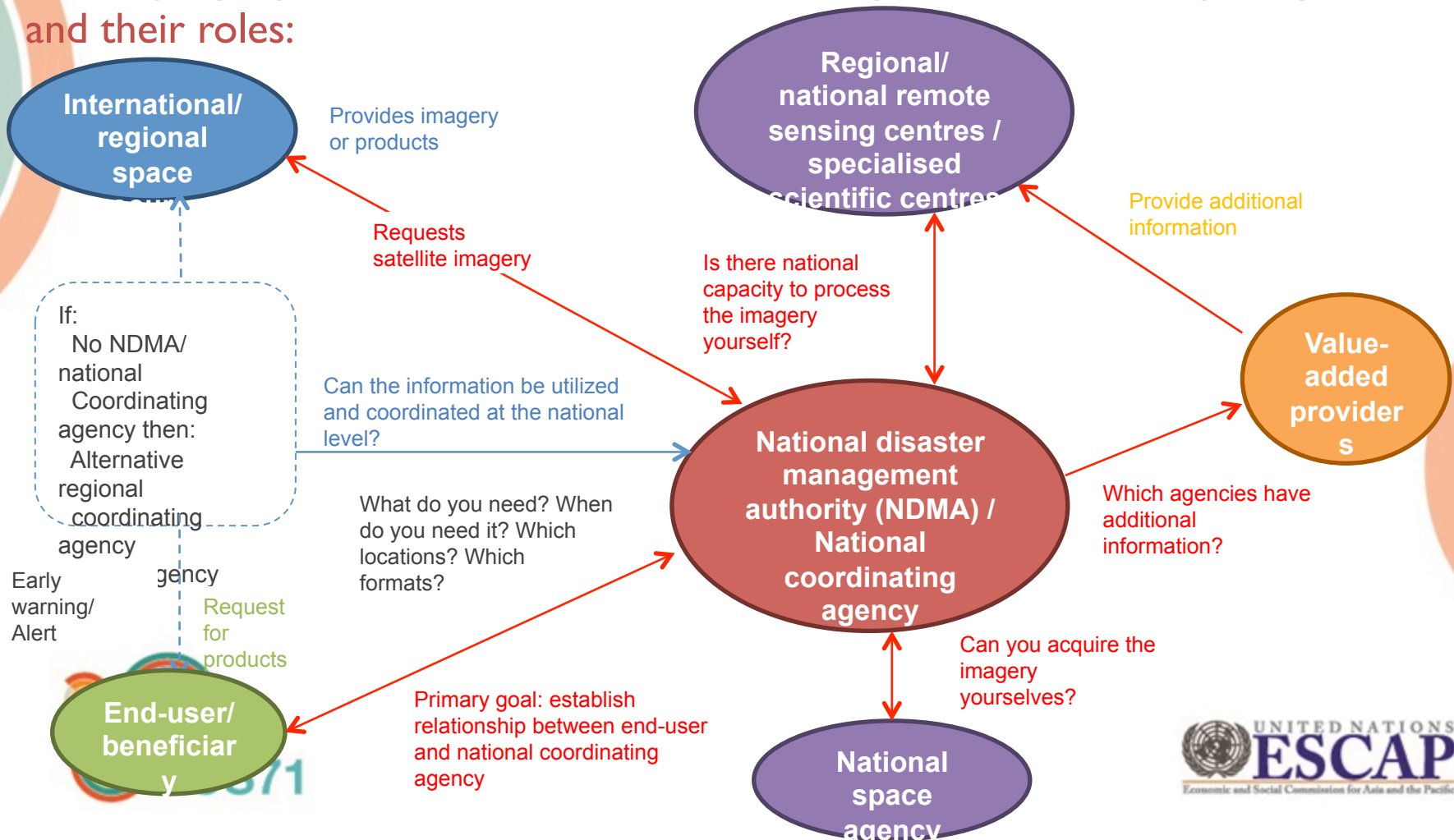
(b) After earthquake





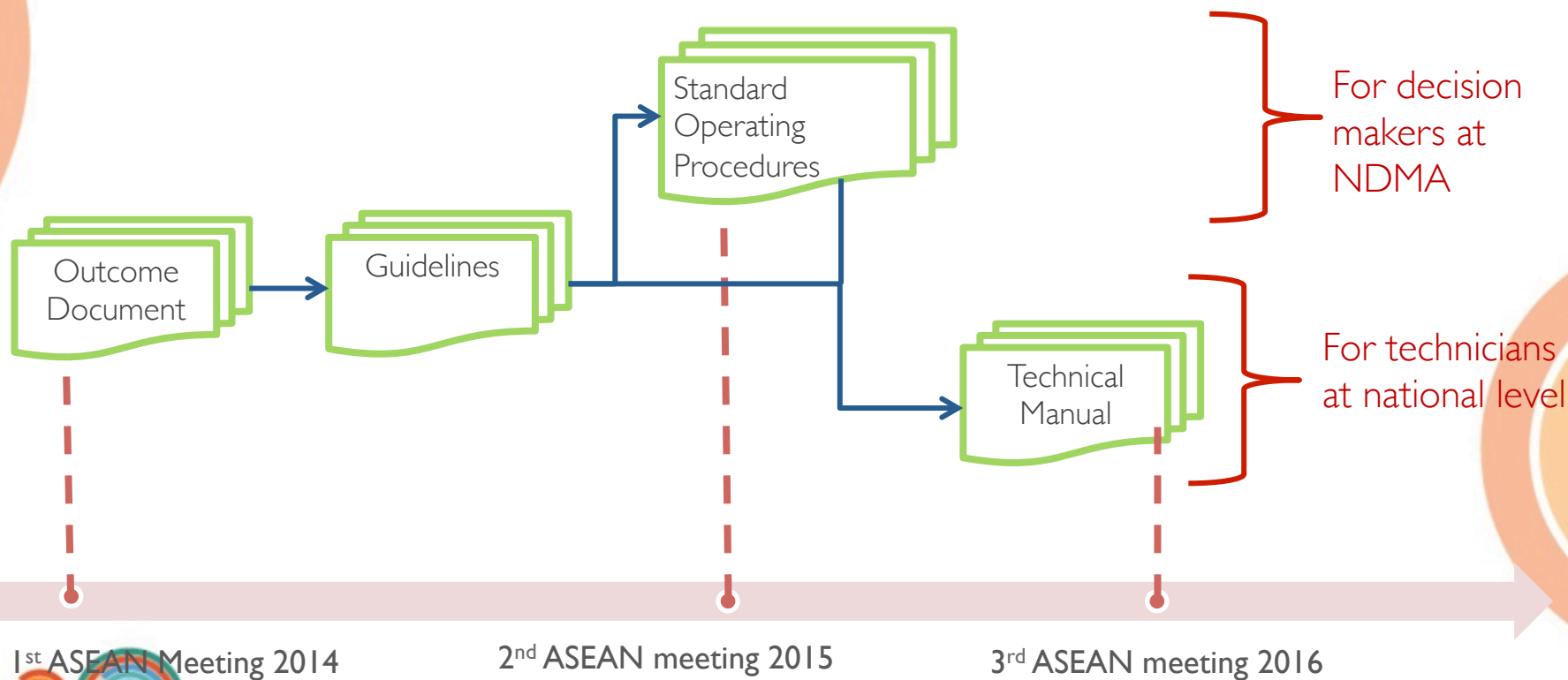
# 1<sup>st</sup> ASEAN meeting

Meeting highlighted the need for coordination by NDMA and complexity of actors and their roles:



# UN-ASEAN workshops on SOPs and guidelines

ESCAP, UN-SPIDER and UNOSAT proposed 2 products going forward:



1<sup>st</sup> ASEAN Meeting 2014



2<sup>nd</sup> ASEAN meeting 2015

3<sup>rd</sup> ASEAN meeting 2016

# Integrating geospatial products and services In Damage and Loss Assessment (DaLA)/PDNA

**A step-by-step guide on conducting rapid damage assessments for some specific sectors -Housing, Infrastructure, Agriculture and future Disaster Risk.**

**Contribute towards the development of South Asia Recovery Framework by the SAARC.**

**Targeted to managers or practitioners from government agencies who often participates and supports rapid disaster needs assessment and responsible for post-disaster relief, response, recovery and reconstruct programmes.**

**It will be used for capacity building training.**



Manual  
**Rapid Assessment of Damage and Loss**  
using innovative technology and space applications



**It introduces how to capitalize upon the innovative technologies – space applications, geo-spatial databases and crowdsourcing for making disaster assessment faster, evidence-based and monitorable?**



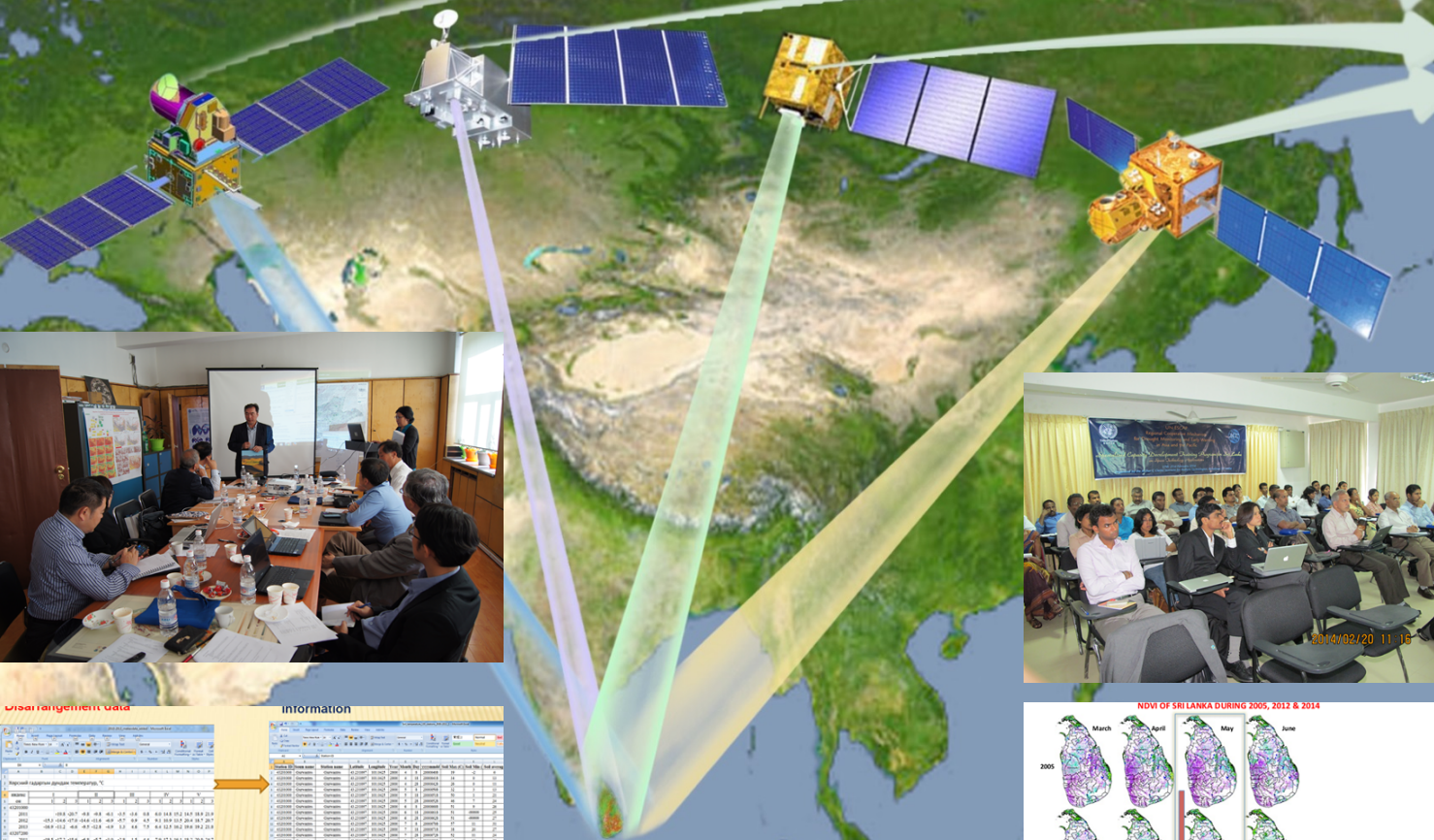
### **III. Effective monitoring and early preparedness for drought helps save lives and livelihoods**

- The Regional Drought Mechanism Covers the most drought prone countries in Asia-Pacific region;
- Provides space based data, strengthens capacity/coordination for effective drought monitoring and early warning;
- Helps drought-affected developing countries establish operational monitoring system, through integration of space-derived information and in-season ground data.
- Initially operationalized in pilot countries, with the technical support of two regional service nodes in China and India.
- The Mechanism brings regional resources in space applications, contributed by China, India, Japan, Thailand and others.





# ESCAP Drought Monitoring and Early Warning - Sri Lanka Pilot Project



**Final arrangement data**

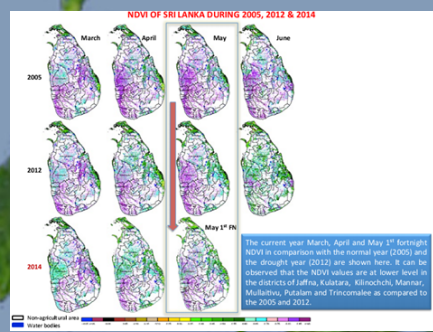
**Information**

Year	Station	Temperature (°C)
2005	1	28.5
2005	2	27.8
2005	3	29.1
2005	4	28.2
2005	5	27.5
2005	6	28.8
2005	7	27.9
2005	8	28.3
2005	9	27.6
2005	10	28.7
2005	11	27.4
2005	12	28.9
2005	13	27.7
2005	14	28.4
2005	15	27.5
2005	16	28.6
2005	17	27.8
2005	18	28.1
2005	19	27.6
2005	20	28.5
2005	21	27.9
2005	22	28.2
2005	23	27.5
2005	24	28.7
2005	25	27.4
2005	26	28.9
2005	27	27.7
2005	28	28.4
2005	29	27.5
2005	30	28.6
2005	31	27.8
2005	32	28.1
2005	33	27.6
2005	34	28.5
2005	35	27.9
2005	36	28.2
2005	37	27.5
2005	38	28.7
2005	39	27.4
2005	40	28.9
2005	41	27.7
2005	42	28.4
2005	43	27.5
2005	44	28.6
2005	45	27.8
2005	46	28.1
2005	47	27.6
2005	48	28.5
2005	49	27.9
2005	50	28.2
2005	51	27.5
2005	52	28.7
2005	53	27.4
2005	54	28.9
2005	55	27.7
2005	56	28.4
2005	57	27.5
2005	58	28.6
2005	59	27.8
2005	60	28.1
2005	61	27.6
2005	62	28.5
2005	63	27.9
2005	64	28.2
2005	65	27.5
2005	66	28.7
2005	67	27.4
2005	68	28.9
2005	69	27.7
2005	70	28.4
2005	71	27.5
2005	72	28.6
2005	73	27.8
2005	74	28.1
2005	75	27.6
2005	76	28.5
2005	77	27.9
2005	78	28.2
2005	79	27.5
2005	80	28.7
2005	81	27.4
2005	82	28.9
2005	83	27.7
2005	84	28.4
2005	85	27.5
2005	86	28.6
2005	87	27.8
2005	88	28.1
2005	89	27.6
2005	90	28.5
2005	91	27.9
2005	92	28.2
2005	93	27.5
2005	94	28.7
2005	95	27.4
2005	96	28.9
2005	97	27.7
2005	98	28.4
2005	99	27.5
2005	100	28.6

**Data information**

Type	Soil Temperature
1	2000-2011
2	10 days
3	10 days
4	Celsius
5	Altitude
6	-99999
7	Station information
	130

Finally arrangement data record is totally 30183



# Approach and Methodology

Need assessment

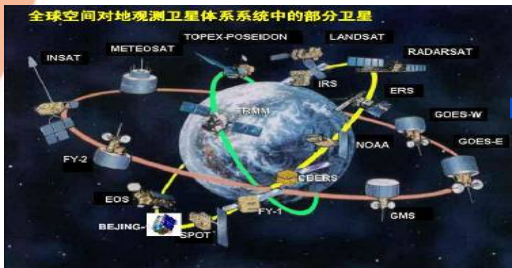
Specialized training

Country Profile

Regional Service Nodes

Regional Service Nodes

Field observation



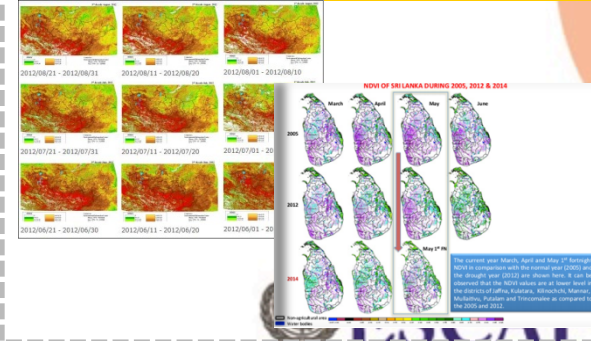
Meteorological data



Data processing  
Drought Index calculating



Drought monitoring results



# PRECIPITATION

Disarrangement data

Good arrangement data with other information

Year	Date	Depth	Sum	Unit
2009	4/6/2009	1	11.8	
2009	4/26/2009	1	8.8	
2009	4/26/2009	1	32.9	
2009	5/6/2009	1	5.8	
2009	5/26/2009	1	30.8	
2009	5/26/2009	1	4.6	
2009	6/6/2009	1	4.3	
2009	6/6/2009	1	30.8	
2009	6/26/2009	1	6.5	
2009	6/26/2009	1	35.9	
2009	5/6/2009	1	9.2	
2009	5/26/2009	1	32.0	
2009	4/26/2009	1	8.8	
2009	6/6/2009	1	6.3	
2009	4/6/2009	1	11.4	
2009	4/26/2009	1	6.8	
2009	4/26/2009	1	9.3	
2009	5/6/2009	1	5.8	
2009	5/26/2009	1	8.8	
2009	5/26/2009	1	29.3	
2009	6/6/2009	1	7.0	
2009	4/26/2009	1	8.3	

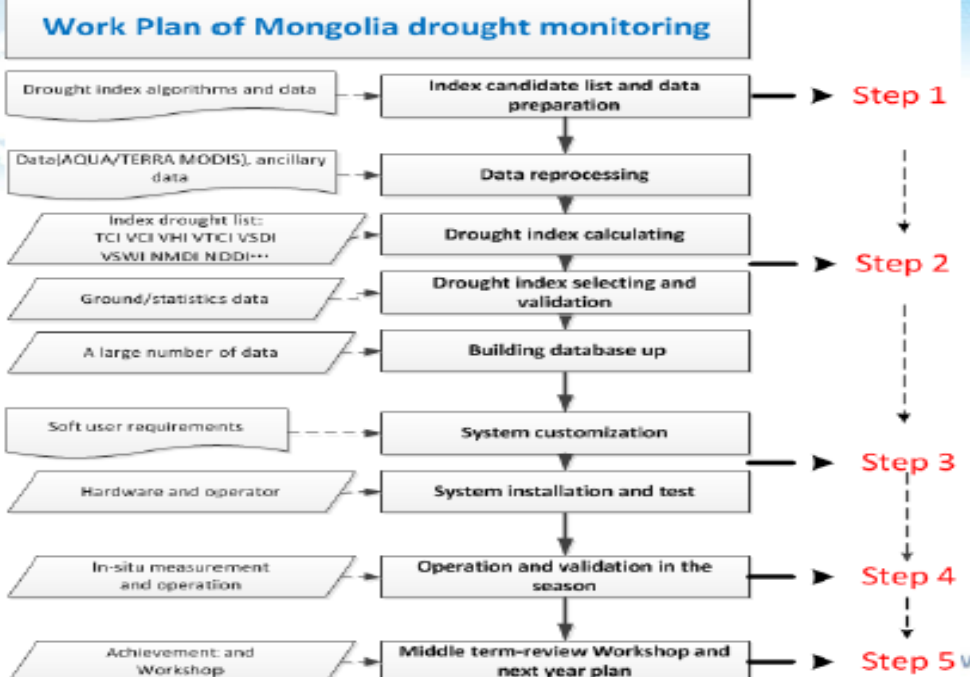
Station No.	Name	Address	Latitude	Longitude	Year	Month	Precipitation	1st 20 days	2nd 20 days
11070031	Tereljlaabai	Tereljlaabai	47.1889	103.9998	2009	3	0.0000	3.00	6.30
21070031	Tereljlaabai	Tereljlaabai	47.1889	103.9998	2009	8	20000.00	6.00	7.10
31070031	Tereljlaabai	Tereljlaabai	47.1889	103.9998	2009	7	0.0000	11.40	10.00
41070031	Tereljlaabai	Tereljlaabai	47.1889	103.9998	2009	8	0.0000	41.20	20.00
51070031	Tereljlaabai	Tereljlaabai	47.1889	103.9998	2009	3	0.0000	5.30	1.30
61070031	Tereljlaabai	Tereljlaabai	47.1889	103.9998	2009	8	20000.00	2.00	8.00
71070031	Tereljlaabai	Tereljlaabai	47.1889	103.9998	2009	6	0.0000	6.00	11.40
81070031	Tereljlaabai	Tereljlaabai	47.1889	103.9998	2009	3	0.0000	11.40	10.00
91070031	Tereljlaabai	Tereljlaabai	47.1889	103.9998	2009	8	20000.00	41.20	10.00
101070031	Tereljlaabai	Tereljlaabai	47.1889	103.9998	2009	7	0.0000	4.00	2.00
111070031	Tereljlaabai	Tereljlaabai	47.1889	103.9998	2009	7	0.0000	11.40	10.00
121070031	Tereljlaabai	Tereljlaabai	47.1889	103.9998	2009	8	20000.00	6.00	10.00
131070031	Tereljlaabai	Tereljlaabai	47.1889	103.9998	2009	3	0.0000	30.20	4.00
141070031	Tereljlaabai	Tereljlaabai	47.1889	103.9998	2009	8	20000.00	2.00	7.00
151070031	Tereljlaabai	Tereljlaabai	47.1889	103.9998	2009	8	20000.00	19.20	14.20
161070031	Tereljlaabai	Tereljlaabai	47.1889	103.9998	2009	8	20000.00	6.00	8.00
171070031	Tereljlaabai	Tereljlaabai	47.1889	103.9998	2009	7	0.0000	11.00	10.00
181070031	Tereljlaabai	Tereljlaabai	47.1889	103.9998	2009	8	20000.00	10.00	25.00
191070031	Tereljlaabai	Tereljlaabai	47.1889	103.9998	2009	3	0.0000	11.20	1.00
201070031	Tereljlaabai	Tereljlaabai	47.1889	103.9998	2009	8	20000.00	5.00	5.00
211070031	Tereljlaabai	Tereljlaabai	47.1889	103.9998	2009	8	20000.00	23.00	6.20
221070031	Tereljlaabai	Tereljlaabai	47.1889	103.9998	2009	8	20000.00	6.00	10.00
231070031	Tereljlaabai	Tereljlaabai	47.1889	103.9998	2009	8	20000.00	5.00	4.00
241070031	Tereljlaabai	Tereljlaabai	47.1889	103.9998	2009	3	0.0000	2.70	3.00
251070031	Tereljlaabai	Tereljlaabai	47.1889	103.9998	2009	8	20000.00	3.00	2.00
261070031	Tereljlaabai	Tereljlaabai	47.1889	103.9998	2009	7	0.0000	60.00	10.00
271070031	Tereljlaabai	Tereljlaabai	47.1889	103.9998	2009	8	20000.00	10.00	10.20
281070031	Tereljlaabai	Tereljlaabai	47.1889	103.9998	2009	8	20000.00	1.00	0.20

Two experts from Mongolia have been trained in China for two months to develop and assess indices appropriate for Mongolia, one field mission has been conducted, field mission to verify the customized drought indices and methodology.

Finally arrangement data record is totally 23

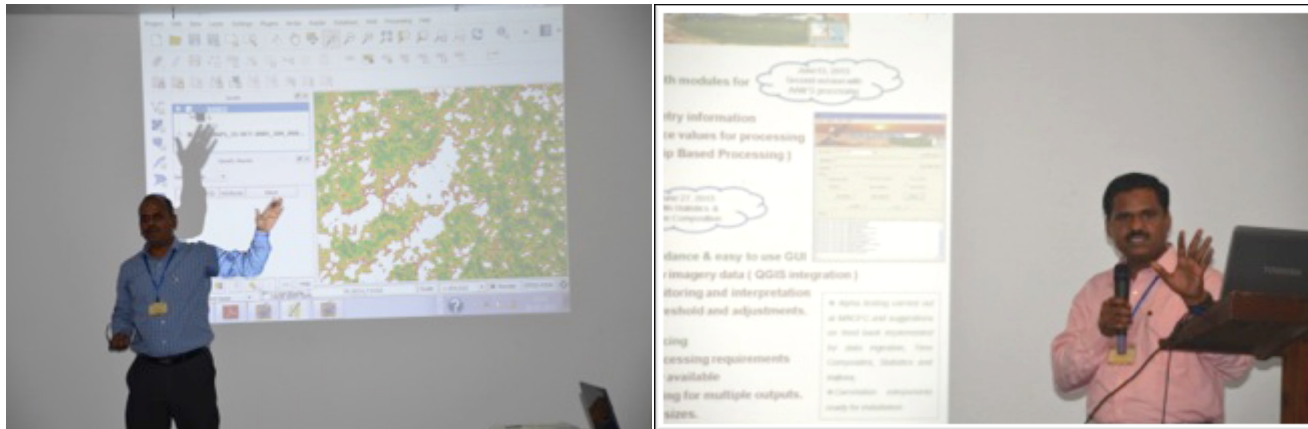
Data information

## Outline of implementation plan



# Specialized training on drought monitoring for country team in Sri Lanka, in February 2015.

Drought Monitoring System and Drought Watch system developed by India and China have been installed for the users in Sri Lanka.



## **IV Strengthening capacity to build multi-disciplinary approach, collating and consolidating information system for disaster risk management**

- Special focus on high-risk and low capacity developing countries. Over 400 experts, and government officials from 31 countries trained in 2014.
- Focus areas
  - ❖ Mainstreaming space applications into disaster risk management.
  - ❖ Use of space and GIS in flood-risk mapping, drought monitoring and early warning.
  - ❖ Facilitate the establishment and use of the geo-referenced information system for DRR (Geo-DRM) in CSNs.
  - ❖ Technical advisory service in effective use of space and GIS for DRR.
- Needs identified through Surveys and Regional Inventory on capacity of space applications
- RESAP Training and Education Networks – China, India (CSSTEAP – Dehradun), Indonesia and ESCAP – APCICT (Republic of Korea)



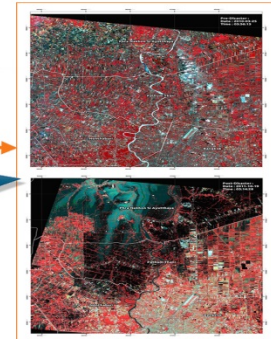
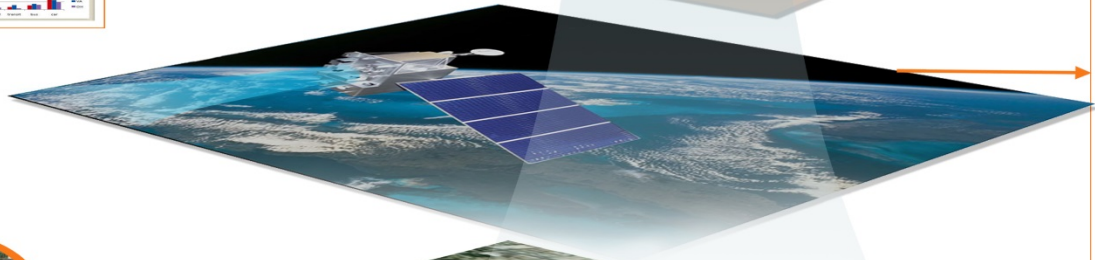
# Evidence based decision making-Geo-referenced information system for disaster risk management (Geo-DRM)

Date	Year	Country	Location	Type	Sub-Type	Phase	Deaths	Injured	Displaced	Other
04/03/2013	2013	India	Andhra Pradesh	Earthquake	Earthquake	Phase 1	3	30000	100	2000
11/09/2013	2013	India	Andhra Pradesh	Earthquake	Earthquake	Phase 2	307	10000	100	2000
21/03/2013	2013	India	Andhra Pradesh	Earthquake	Earthquake	Phase 3	70	10000	100	2000
25/08/2013	2013	India	Andhra Pradesh	Earthquake	Earthquake	Phase 4	74	10000	100	2000
24/08/2013	2013	India	Andhra Pradesh	Earthquake	Earthquake	Phase 5	80	10000	100	2000
06/07/2013	2013	India	Andhra Pradesh	Earthquake	Earthquake	Phase 6	174	10000	100	2000
12/08/2013	2013	India	Andhra Pradesh	Earthquake	Earthquake	Phase 7	6054	100000	1000	2000
22/11/2013	2013	India	Andhra Pradesh	Earthquake	Earthquake	Phase 8	10	100	100	2000
02/10/2013	2013	India	Andhra Pradesh	Earthquake	Earthquake	Phase 9	32	1000	100	2000
12/10/2013	2013	India	Andhra Pradesh	Earthquake	Earthquake	Phase 10	47	100000	1000	2000
16/03/2013	2013	India	Andhra Pradesh	Earthquake	Earthquake	Phase 11	4	100	100	2000
18/03/2013	2013	India	Andhra Pradesh	Earthquake	Earthquake	Phase 12	8	100	100	2000

Est. Damage and Killed



Critical Social Economy Data



# ESCAP facilitated Bangladesh, Cook Islands, Fiji, Kyrgyzstan, Mongolia and Nepal establishing the Geo-DRM portal

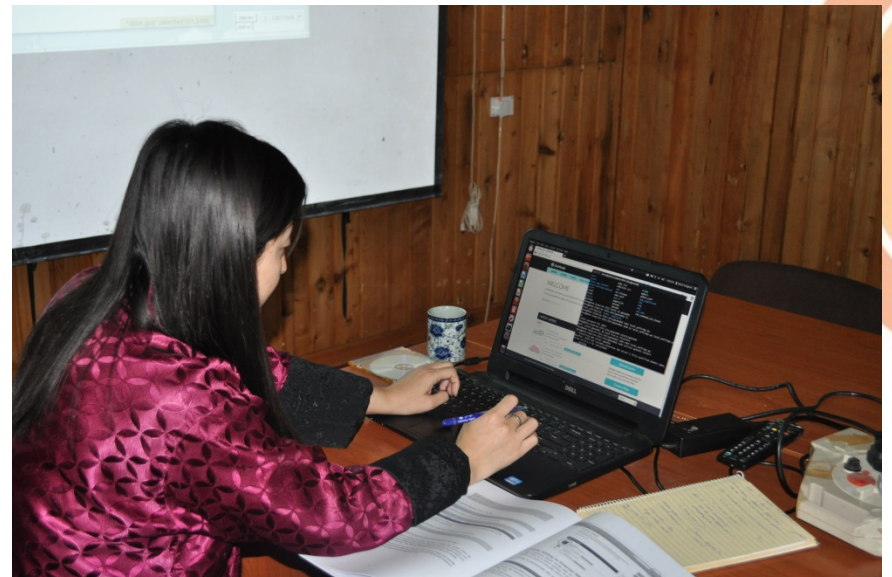
Geo-portal of the Cook Islands

The screenshot displays a web browser window titled "Cook Island Maps : Form". The main content area is titled "MAPS OF THE COOK ISLANDS" and shows a satellite map of Kiribati. A secondary window titled "Demographics data and Maps - 2" is overlaid, showing "ISLAND MAPS OF THE COOK ISLANDS" for the "SOUTHERN GROUP ISLAND". It provides detailed information for the island of Aitutaki, including its land size (18.0), height above MSL (124.1), coordinates (159° 46'), and distance from Raiot (142 nm). The interface includes a map viewer showing an aerial view of the island and a sidebar with navigation options.

Geo-portal of ministry of Home Affairs, Nepal

The screenshot shows the "Government of Nepal Nepal Disaster Risk Reduction Portal" website. The header includes the national flag and navigation links: Home | Contact Us | Feedback | FAQs | Sitemap. The main content area features a map of Nepal with numerous red location pins indicating disaster risk reduction sites. A sidebar on the left lists various resources: Home, News & Events, Nepal DRR Landscape, District Risk Profile, Nepal DRR Projects, Nepal Risk Information, Online Documents, Geo-Portal, Gallery, Discussion Forum, and Disaster Preparedness Response Plan. Below the sidebar are four featured projects: Sahana Disaster Management System, Flood Forecasting Project, Forest Fire Detection & Monitoring in Nepal, and Kathmandu Valley Earthquake Emergency & Response Management System. The footer contains a brief description of the portal's purpose: "The Nepal Disaster risk reduction portal (Nepal DRR Portal) is one-stop online information on Disaster risk reduction in Nepal facilitated by the Ministry of Home Affairs, Government of Nepal with support of the line ministries and the Development Partners. This portal provides seamless information from relief to recovery and from mitigation to preparedness. Its overall objective is to make DRR information from policy to technical guideline and from risk profile to stakeholders opinion on DRR in Nepal accessible to one and all, thus to contribute towards risk reduction and safer Nepal."

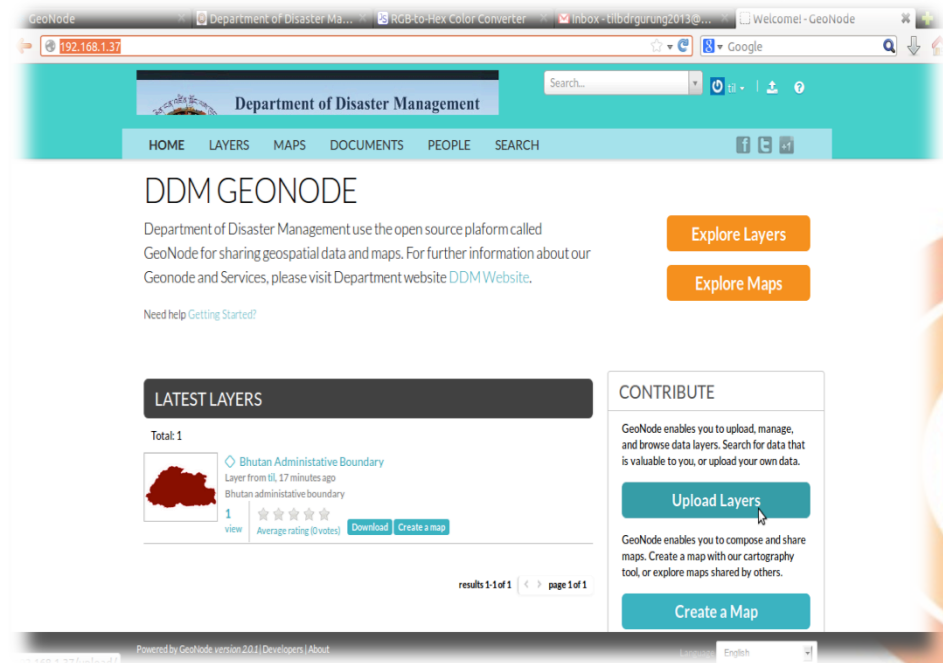
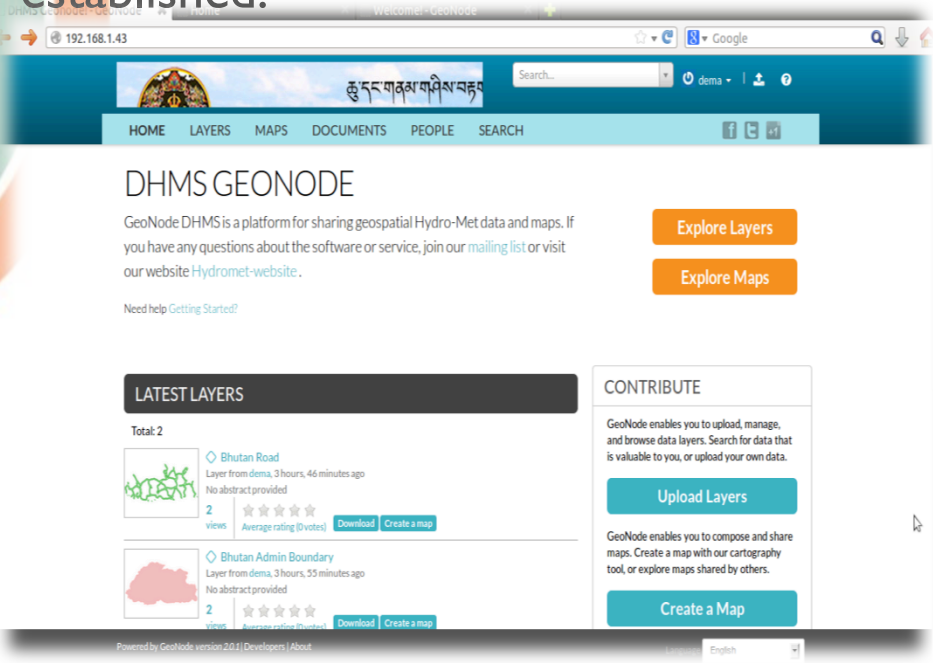
# Technical assistance on Geo-DRM in Bhutan, June 2015



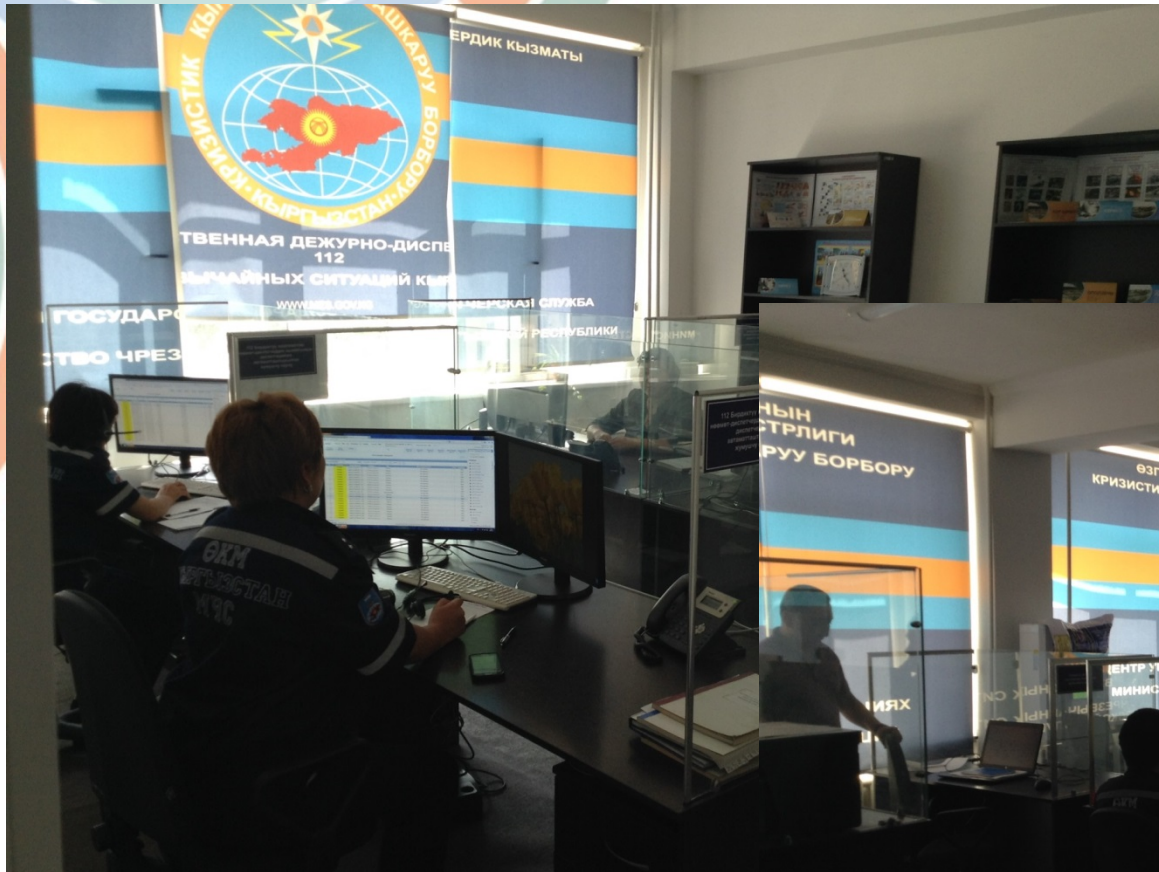


# Technical assistance to Bhutan

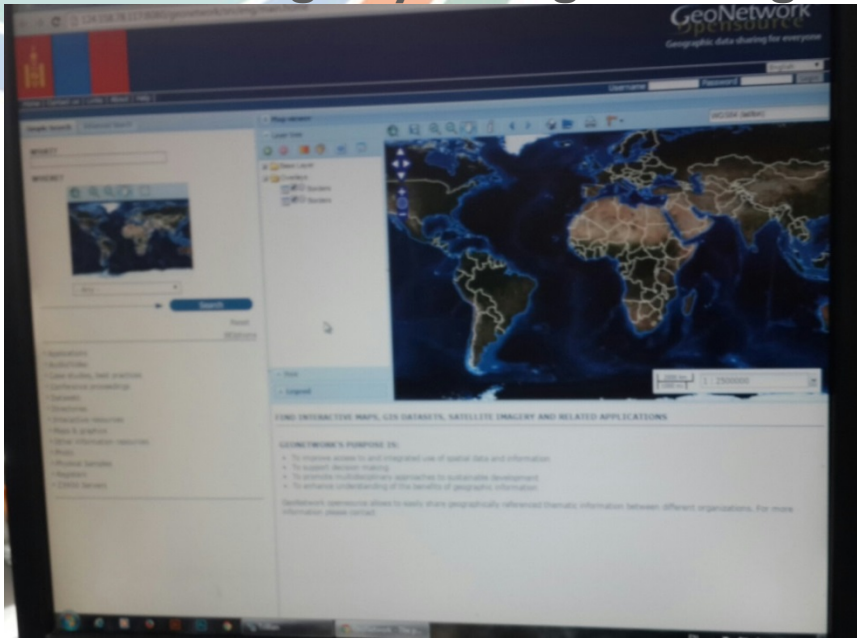
Participants from Department of Disaster Management (DDM), Ministry of Home & Cultural Affairs (MoHCA) and Department of Hydro Met Services, Ministry of Economic Affairs (MoEA) have been trained and the Geo-DRM portal have been established.



# Technical assistance on establishing Geo-DRM portal at Center of Minister of Emergency Situation in Bishkek and Osh, Kyrgyzstan, in May 2015



# Technical assistance on establishing Geo-DRM portal at National Emergency Management Agency, Mongolia, in April 2015



# NEW

## ESCAP's DRM E-Learning Platform

The screenshot shows the ESCAP's DRM E-Learning Platform interface. At the top left is the ESCAP logo with the text "UNITED NATIONS ESCAP Economic and Social Commission for Asia and the Pacific" and "Disaster Risk Management E-Learning Platform". To the right is a login form with fields for "Username" and "Password" and a green arrow button. Below the header is a navigation bar with "Welcome" on the left and "Search website" with a magnifying glass icon on the right. The main content area features a large image of a city (Hong Kong) with a typhoon swirling in the background. A yellow banner over the image reads "Preparing for the disaster" and a grey banner below it says "Being prepared saves lives and livelihoods". At the bottom left is a "Navigation" sidebar with a home icon and a list: "Home", "Courses", "GeoDRM", "HEC-RAS", "GISSD", and "OSG for NDMMR". In the center, a section titled "Available Courses" is circled in orange. Below this section are four course thumbnails: "INTRO TO RS&GIS USING QGIS" (showing a satellite map), "FLOOD MODELLING" (showing a river with flood zones), "SPATIAL DATABASES" (showing a city map with data overlays), and "QGIS" (showing the QGIS software interface). An orange arrow points from the "Available Courses" section to the first course card on the right.

1.

### INTRO TO RS&GIS USING QGIS

Course for those new to GIS and remote sensing and who want to use GPS in their work.

PRESS TO ENTER

2.

### FLOOD MODELLING

A brief introduction on the use of HEC-GeoRAS 10.1 with ArcGIS 10.1 and HEC-RAS 4.1.0

PRESS TO ENTER

3.

### CONFIGURING GEODRM

Course on installing, configuring and population data on GeoNode and GeoNetwork.

PRESS TO ENTER

4.

### QGIS FOR DISASTER MGMT

A QGIS tutorial with a focus on natural disaster mitigation, management and rehabilitation.

PRESS TO ENTER

## Launch and Future Plans

- End of June 2015 - - Initial focus now is Geo-DRM, but plans are underway to:

### *1. Support existing and new space and GIS applications programmes*

#### **Elements:**

Geo-DRM Portal  
Development within  
countries etc.

Regional Drought  
Mechanism-Drought watch  
and Drought Monitoring  
System.

Satellite-derived data for  
exchange and sharing for  
disaster response.

### *2. Establish a DRR compendium*

#### **Makeup:**

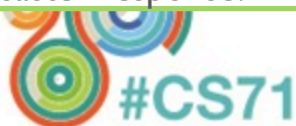
Collection and analysis of  
regional DRR info and data,  
Regional online network of  
DRR practitioners,  
Knowledge sharing  
network and profiling  
regional cooperation  
mechanisms.

### *3. Incorporate the Asia-Pacific Gateway for DRR and Development*

#### **Objective:**

Serve as an online "one-stop  
shop" or "toolbox"

Promote the mainstreaming  
of DRR policies and  
sustainable development.



# Implementation of Sendai Framework 2015-2030: mandate to ESCAP

## Sendai Framework

1. Understanding disaster risk;
2. Strengthening disaster risk governance to manage disaster risk;
3. Investing in disaster risk reduction for resilience;
4. Enhancing disaster preparedness for effective response, and to “Build Back Better” in recovery, rehabilitation and reconstruction.



## **Mandates given by member States on space and GIS applications for disaster risk reduction**

**Resolution 69/11: Implementation of the Asia-Pacific Plan of Action for Applications of Space Technology and Geographic Information Systems for Disaster Risk Reduction and Sustainable Development, 2012-2017.**

- 1. Include space and GIS applications in national policies, regulation and implementation plans;**
- 2. Strengthen mutual understanding ,coordination and institutional infrastructure across relevant government agencies;**
- 3. Systematize and promote National spatial data infrastructure, data policies and data-sharing arrangements; Spatial and GIS products and services should be shared and made available at all levels;**
- 4. Prioritize and support capacity-building and the creation of professionals;**
- 5. Enhance the collaboration with UN agencies, international organizations such as UNITAR/UNOSAT, UN-GGIM, UN-SPIDER, GEO, WMO, regional organizations as well as private sectors.**

# Implementation of Sendai Framework 2015-2030: mandate to ESCAP

## **Res. 71/12:** Strengthening regional mechanisms for the implementation of the Sendai Framework 2015-2030

### *Invites member States:*

to attach priority to promoting ICT and space applications for effective disaster risk management.

### *Request the secretariat:*

1. Lead the implementation of Sendai Framework at regional level;
2. Strengthen disaster risk modelling, assessment, mapping, monitoring and multi-hazard early warning systems;
3. Enhance the technical assistance to the developing countries, in particular for Pacific, in applications of space technology and GIS;
4. Strengthen regional cooperative mechanisms and collaboration with other UN agencies and international/regional organizations;



## V. Understanding the risk and building resilience: Regional Land Cover Dataset

- Focus on baseline data on land use which is critical to disaster risk reduction, monitor climate change and implementation of post-2015 sustainable development goals.
- Develop the customized methodology and tools:
  - Free open source software and commercial software;
  - Joint efforts with **UNITAR/UNOSAT** and experts from member countries;
  - Tested and verified by pilot countries.
- Select pilot countries in **Asia and the Pacific**;
  - Need survey and select thematic areas in the pilot countries;
  - Verification with local data;
  - Work with country team.
- Enhance the capacity on developing national dataset, customized tools and products to assess the risk, monitor the changes and building resilience.



- **Conduct thematic projects, including urbanization, disaster management, agriculture, forestry, coast hazard, environment, etc. for the country to monitor the implementation of post-2015 SDGs and Sendai Framework 2015-2030.**
- **Update the regional land cover map every five years until 2030.**
- **In collaboration with NASG, UN-GGIM, UNOSAT, GEO, related UN agencies, regional organizations and private sectors.**

## Land Cover Types



Water  
bodies



Wetland



Artificial  
Surfaces



Tundra



Permanent  
snow and  
ice



Grass  
lands



Barren  
lands



Cultivated  
land



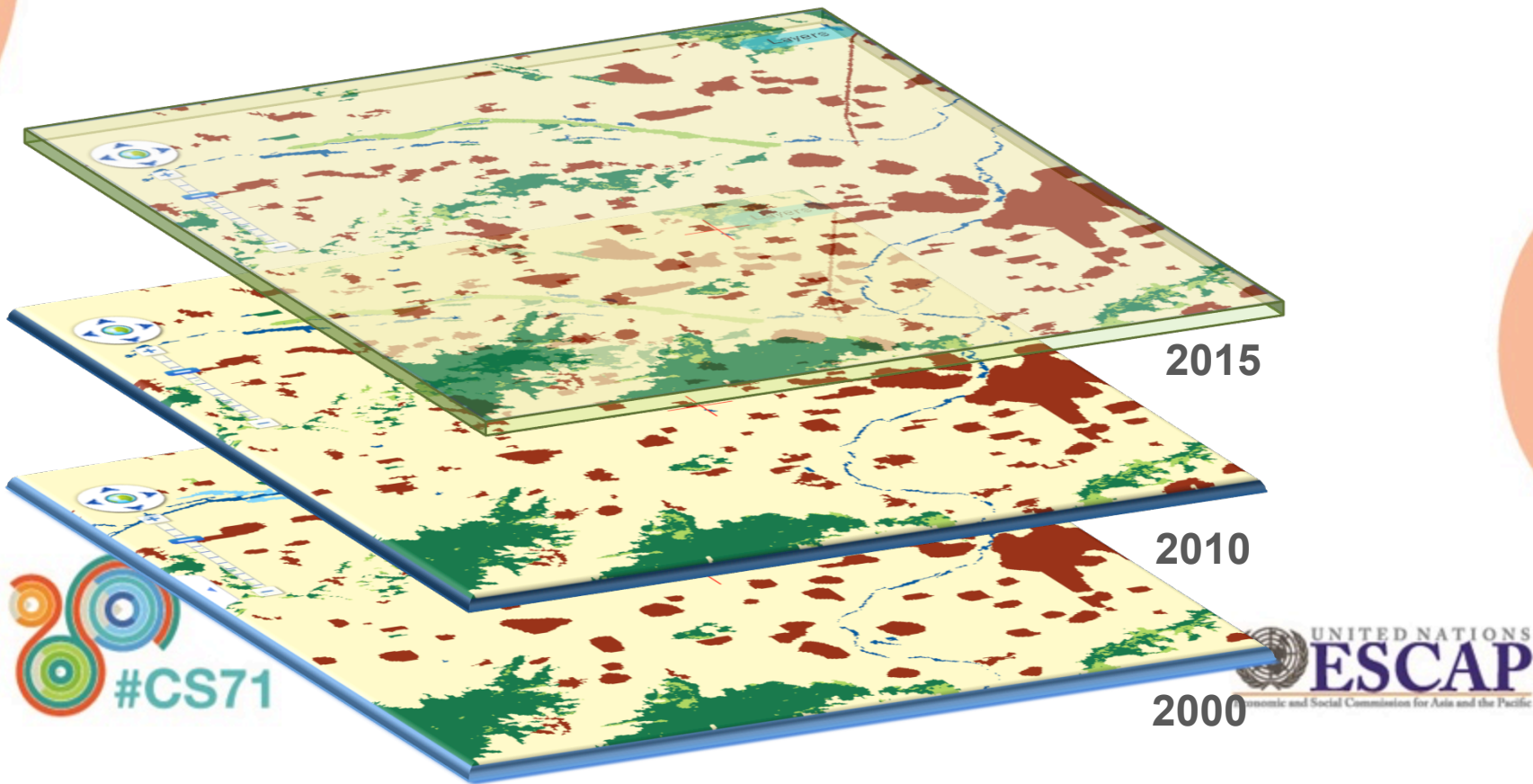
Shrub  
lands



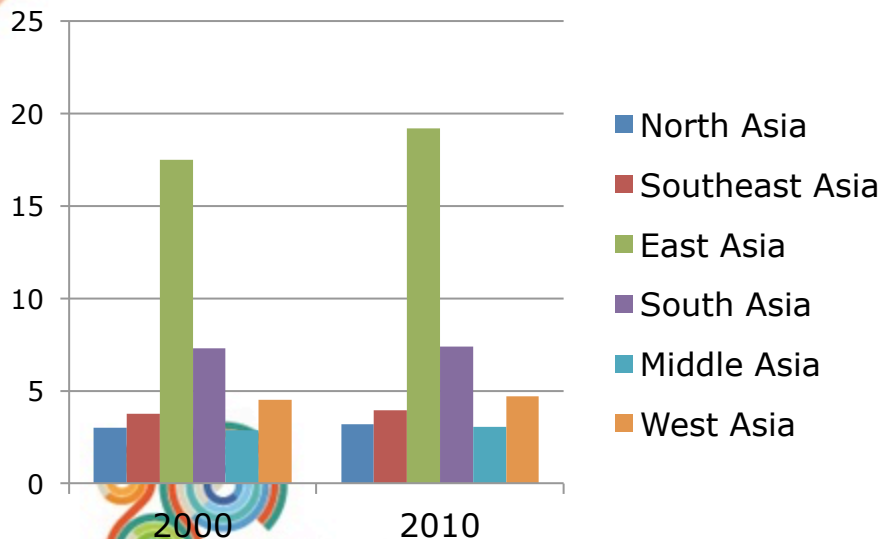
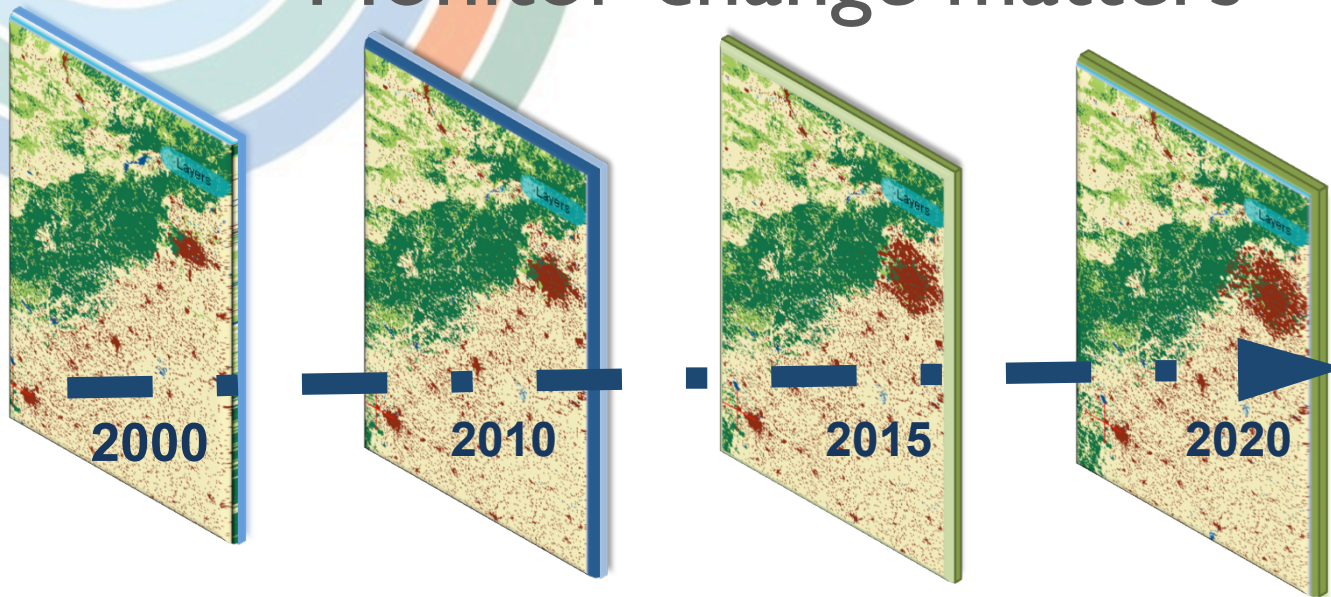
Forests

# Regional Baseline Dataset

- RLC is the baseline data for multi-sectors  
e.g. analyze the urbanization, land degradation, deforestation

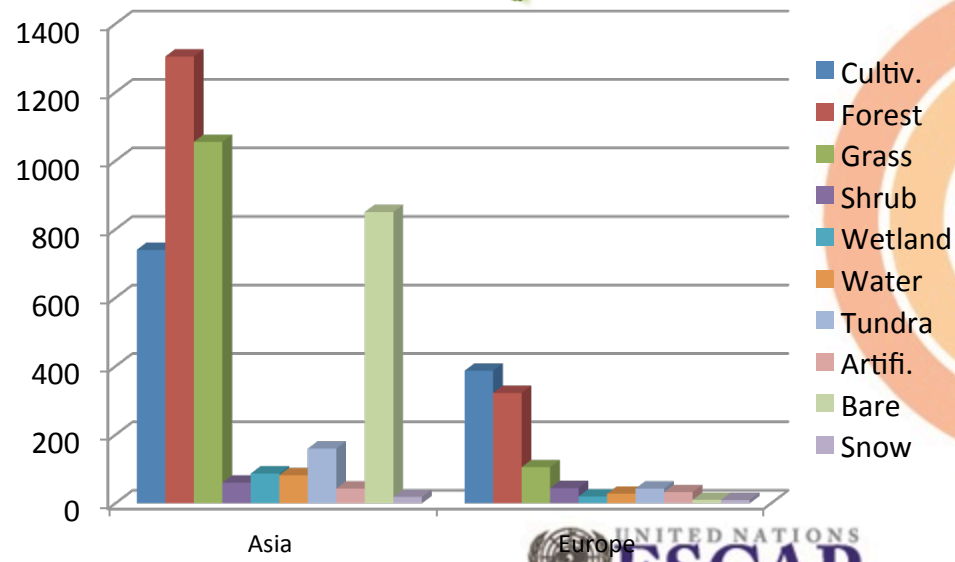


# Monitor change matters



The build-up area of Asia(2000-2010)

unit: 10,000 Km<sup>2</sup>



Area Statistics for all 10 Classes (2010)

unit: 10,000 Km<sup>2</sup>

# Pilot Countries

- Bangladesh
- Bhutan
- Cambodia
- Myanmar
- Kazakhstan
- Kyrgyzstan



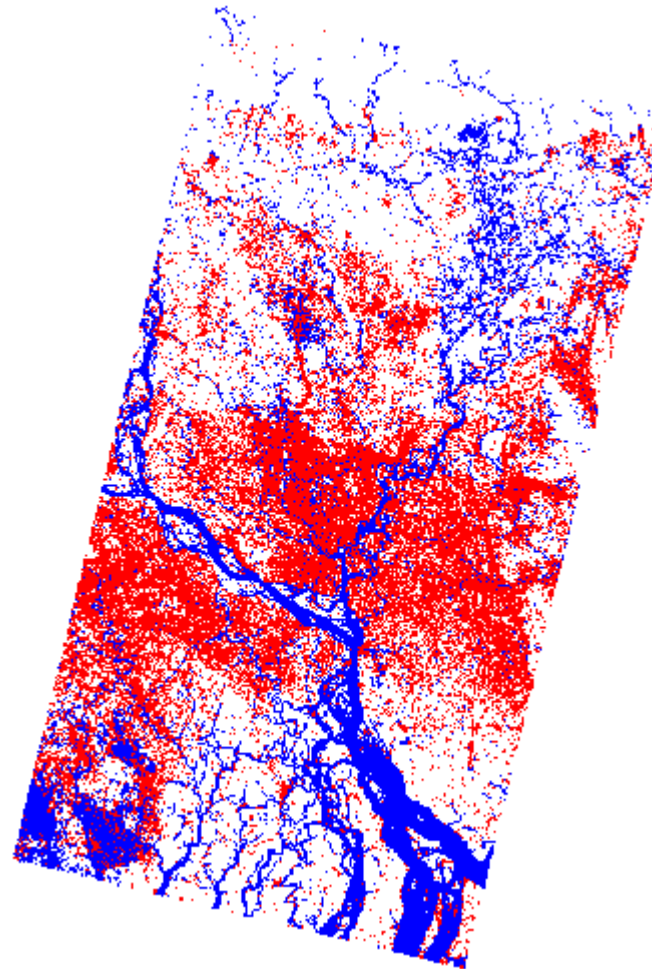
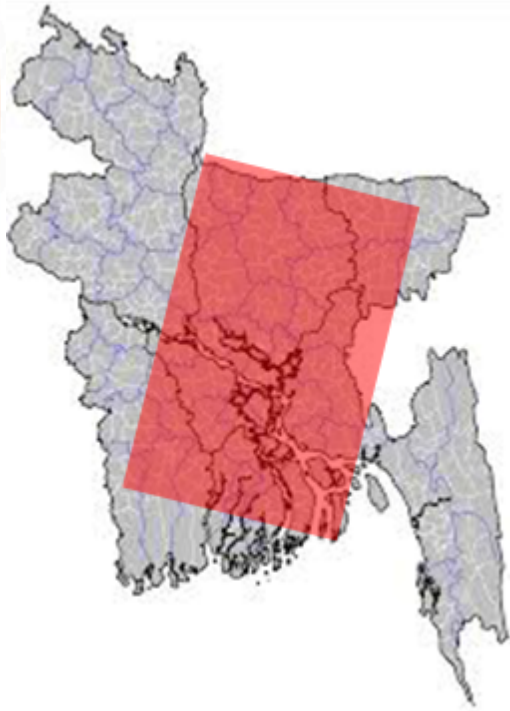
# Methodology

- Satellite image resources: Landsat 8
- Resolution: 30 meter
- Classification method

Supervised classification & Google Earth based modification



# Bangladesh





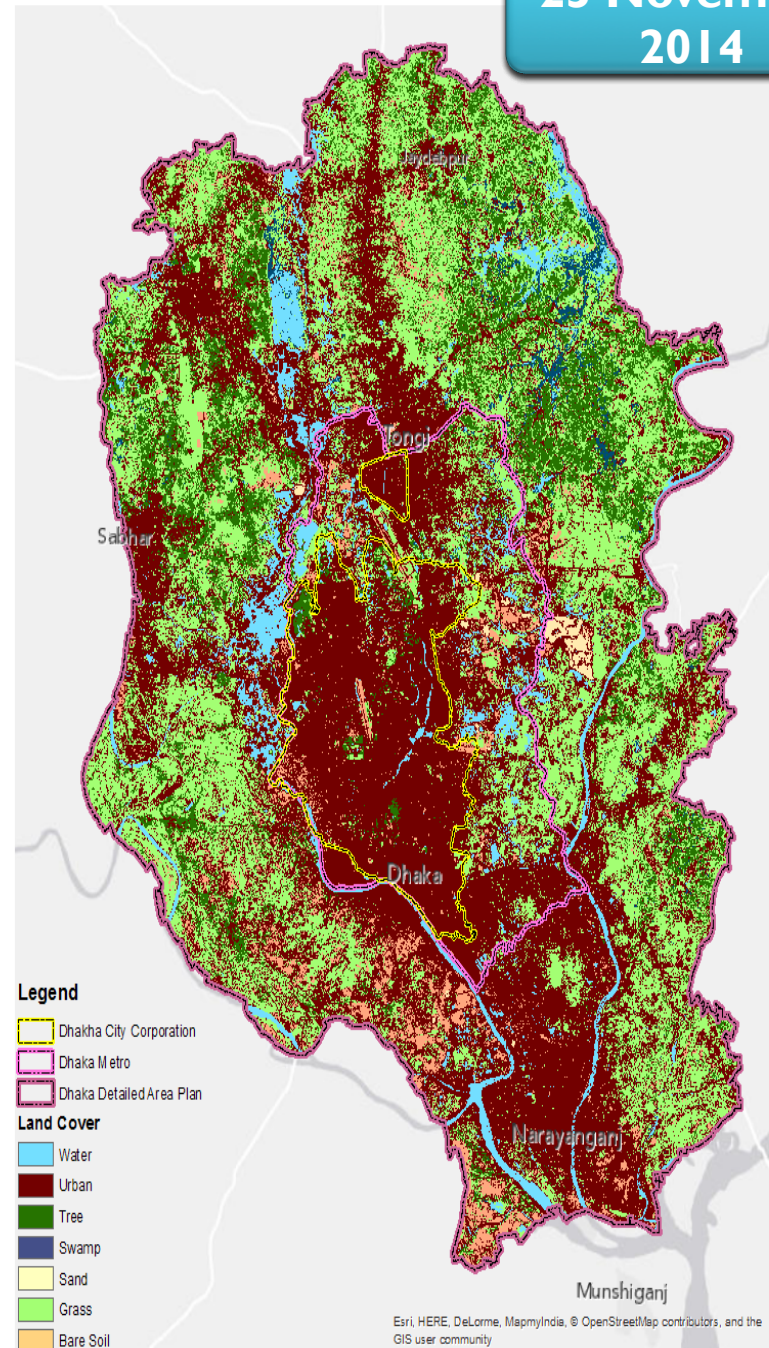
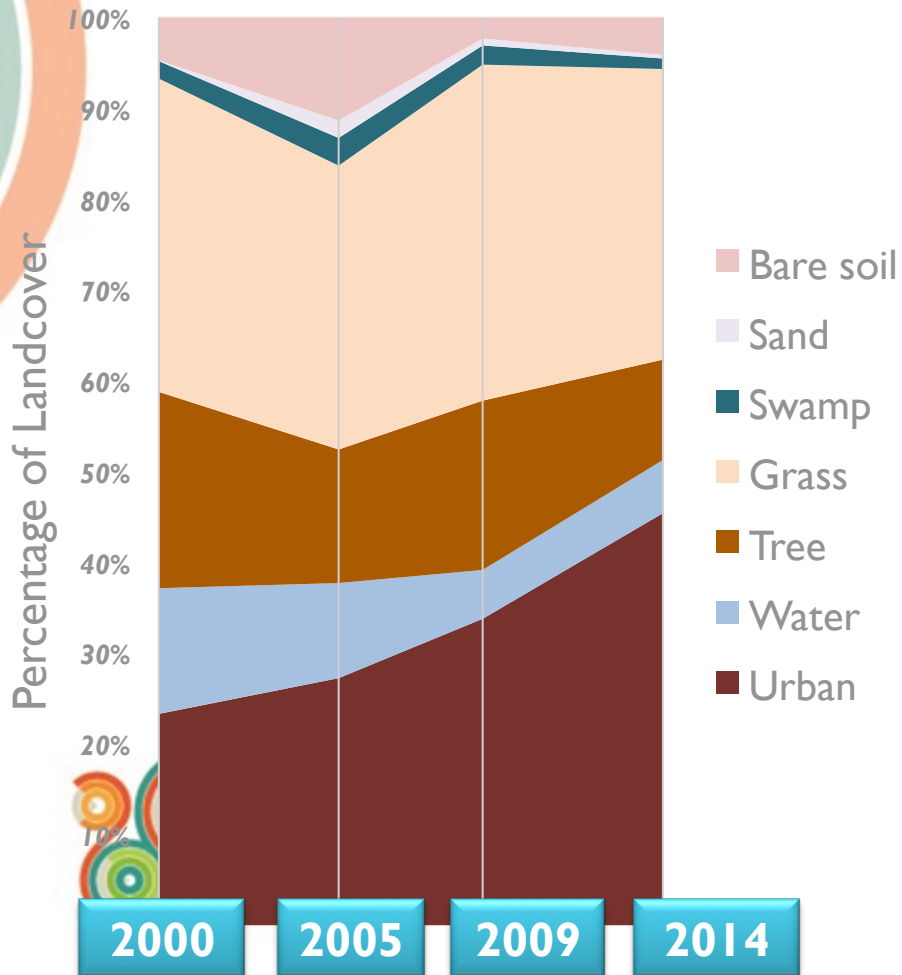
-  Water bodies
-  Artificial surfaces



Image date: 2014 Mar 30

# Landcover Change of Dhaka City from 2000 - 2014



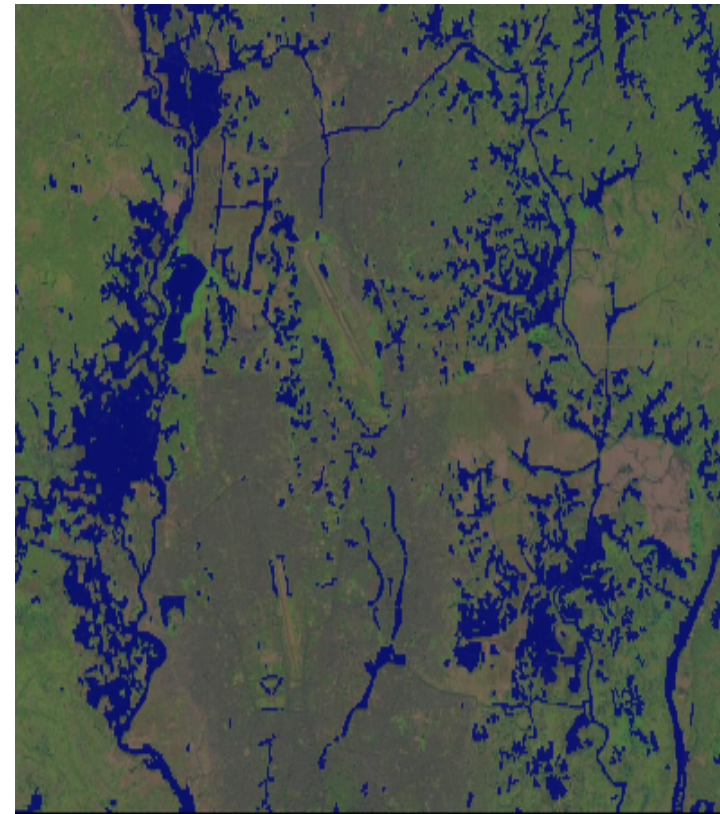
Draft Analysis: Under Revision



# Example: Shrinking buffer (water) in Dhaka, Bangladesh



Buffer area in 1999



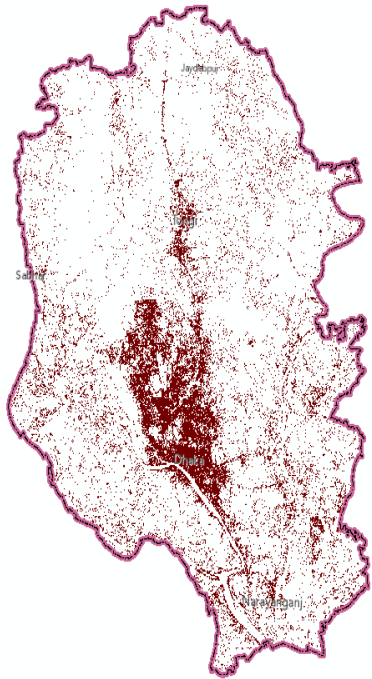
Buffer area in 2014

The buffer area in 2014 shrinks about 59% than in 1999. Among the decreased area:

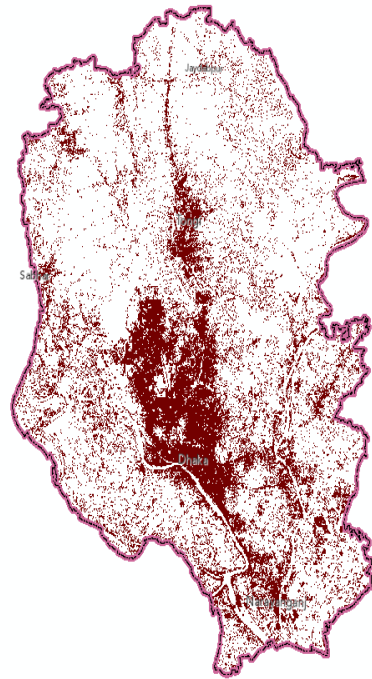
- 23% is contributed by urbanization;
- 27% is bare land in 2014;
- 9% is vegetation.



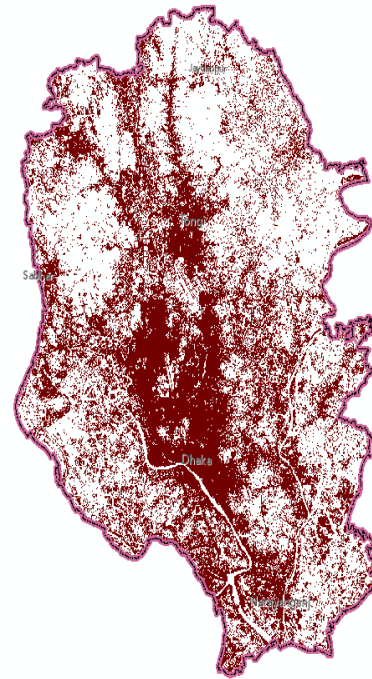
# Urbanization of Dhaka



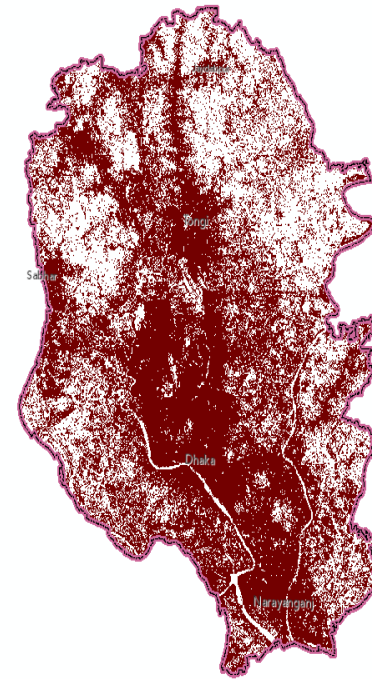
Munshiganj



Munshiganj



Munshiganj



Munshiganj



Draft Analysis: Under Revision

2000

2005

2014

2009



# Thimphu City(Bhutan)

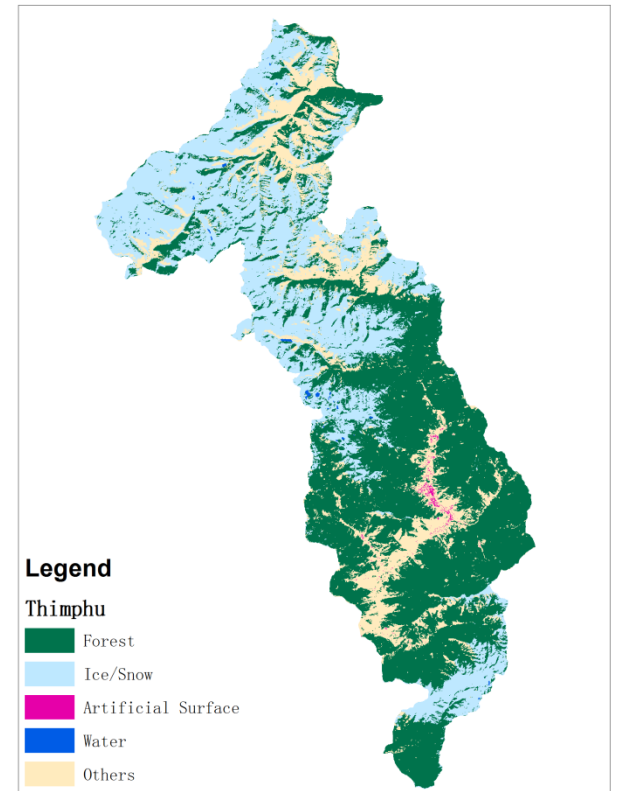
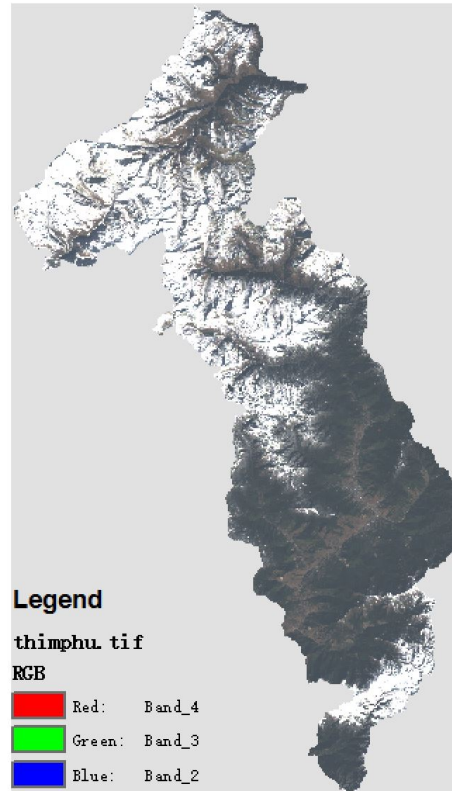
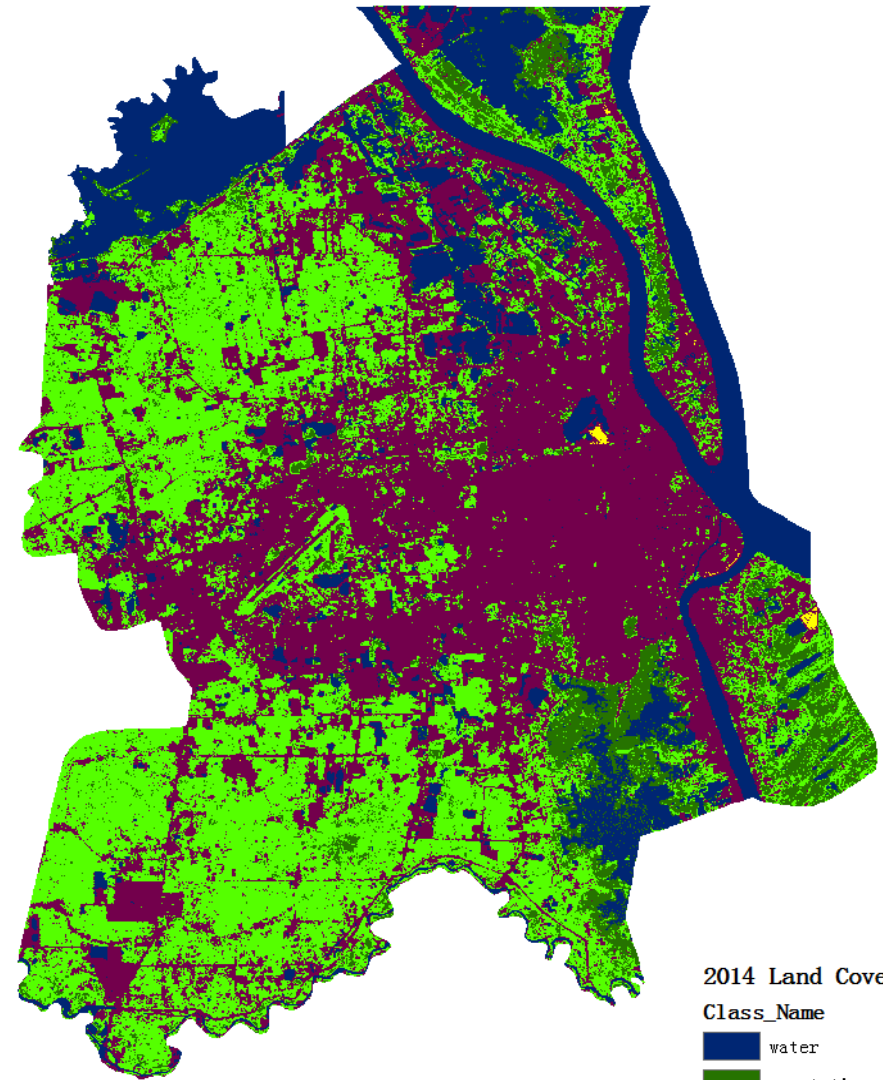
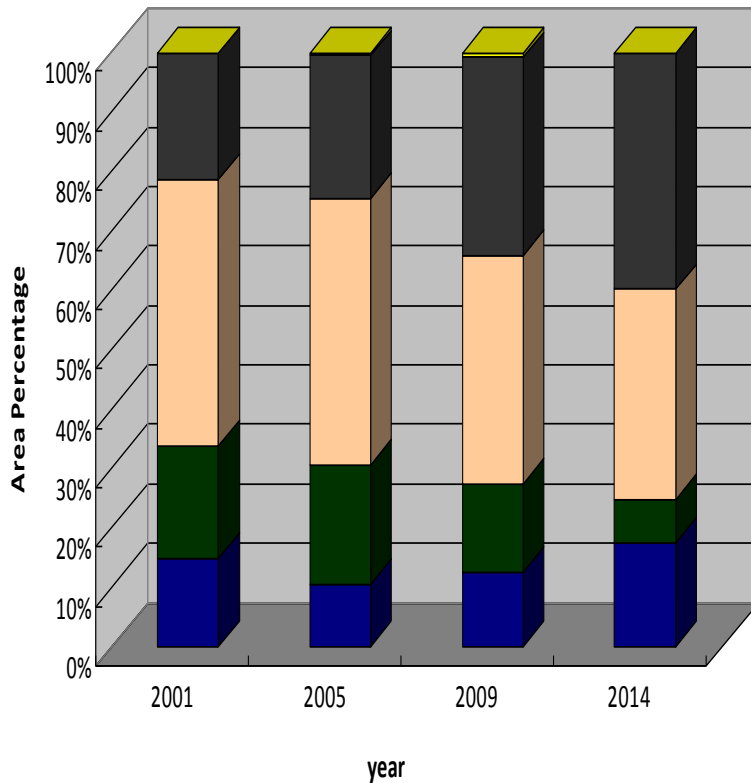


Image date: 2014 Dec 18

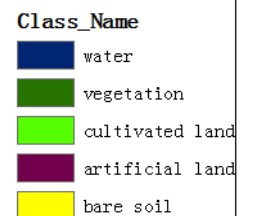
# Land cover Change of Phnom Penh, Cambodia from 2001 - 2014

30 November 2014

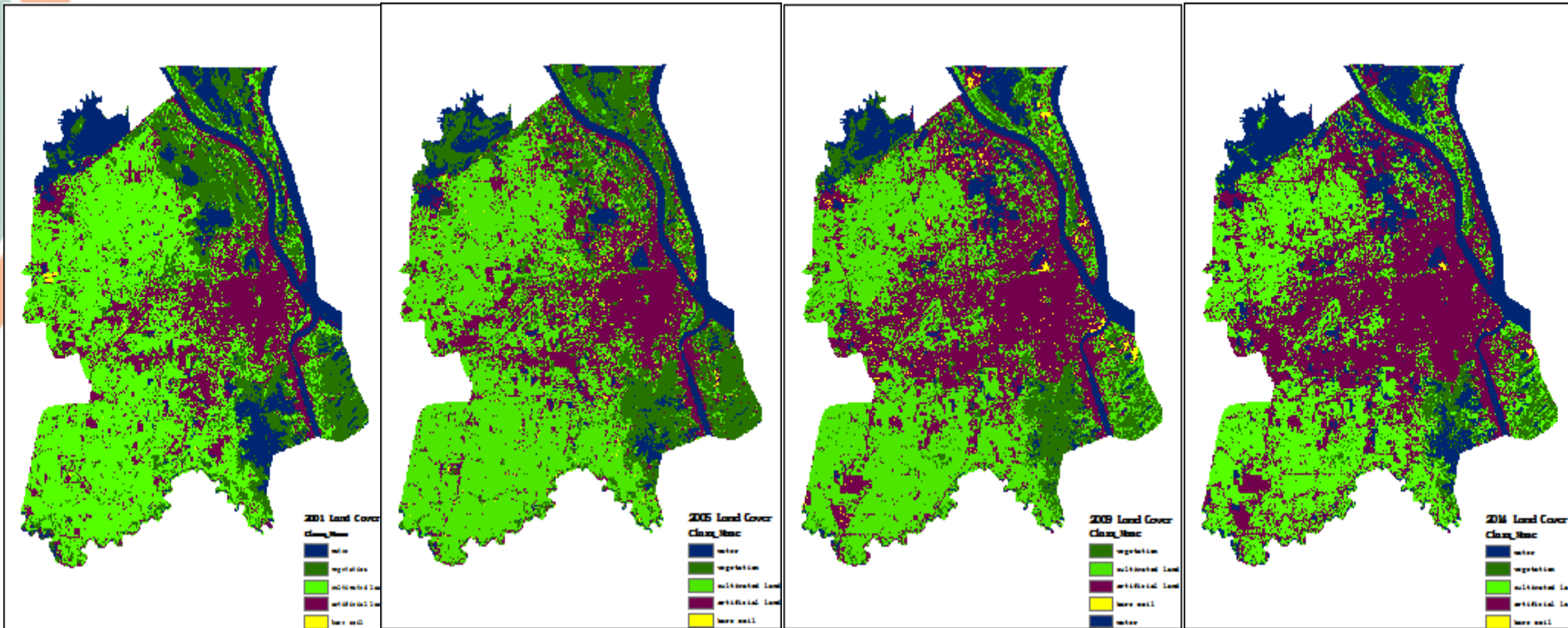
Land Cover Change



2014 Land Cover



# Urbanization of Phnom Penh, Cambodia



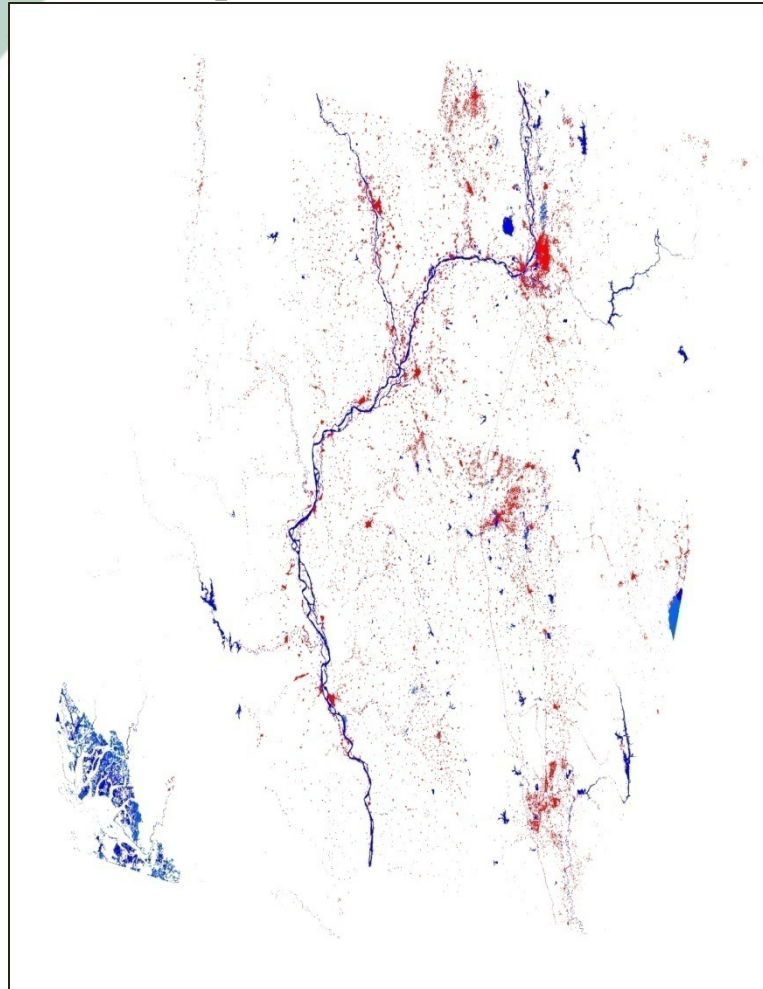
2001

2005

2009

2014

# Myanmar



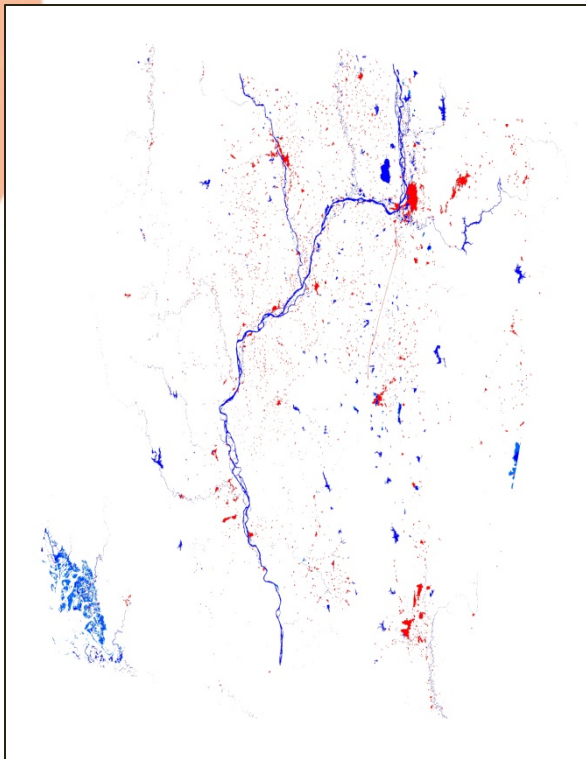
- Water bodies
- Artificial surfaces



Area: 126,000 km<sup>2</sup>  
Image date: 2014 Nov 29

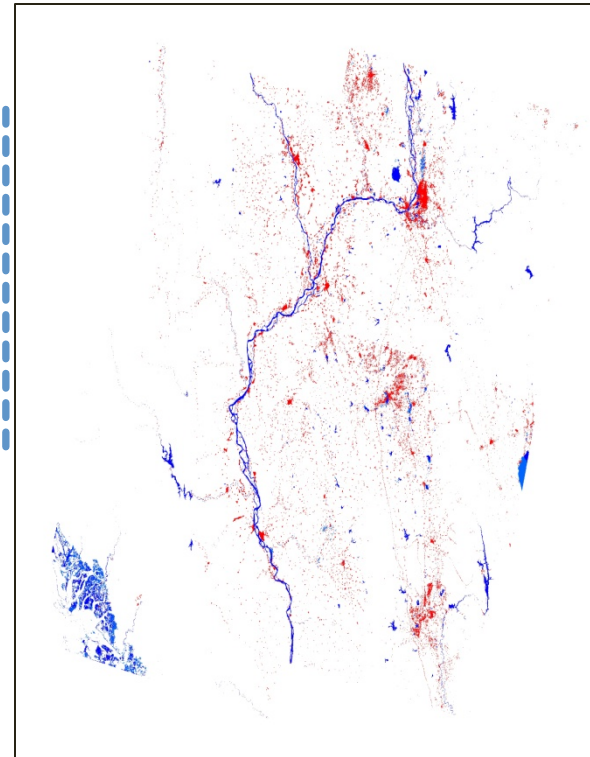
# Compare RLC30\_2015 with GLC30\_2010 (Myanmar)

GLC30\_2010 result






*Artificial  
surfaces grew  
much through  
the past four  
years!*

RLC30\_2015 result  
(2014 Nov 29)



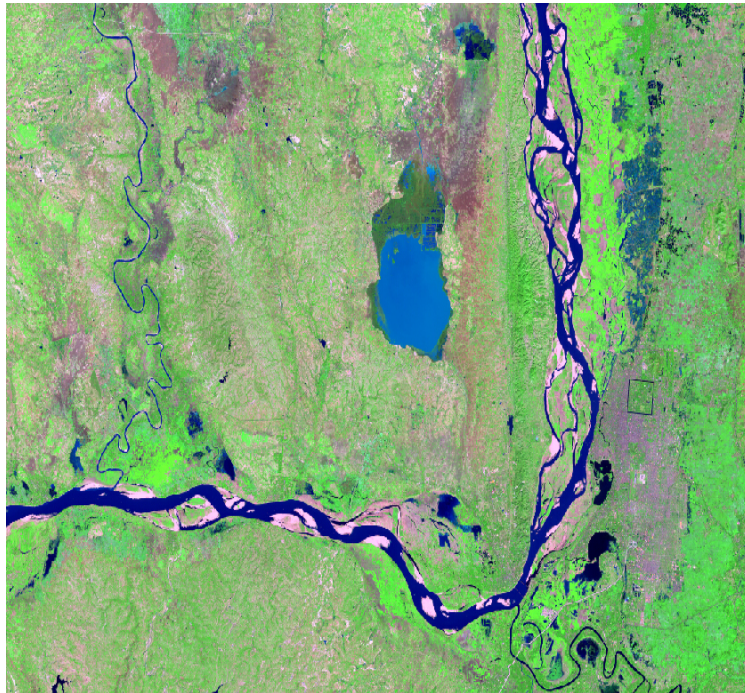
Legend

-  waterbody
-  wetland
-  artificial surfaces

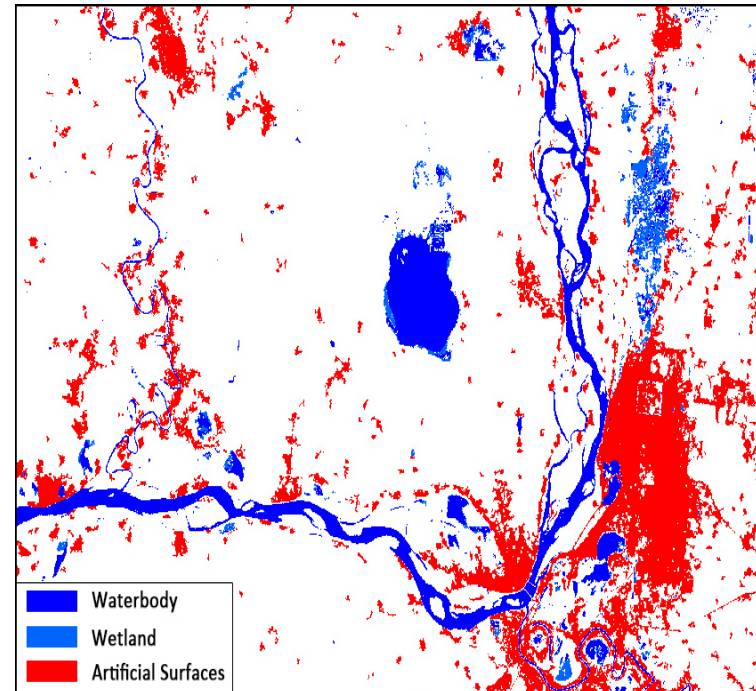
Area: 126,000 km<sup>2</sup>

# Sample region (Myanmar)

Image Source: Landsat 8  
(2014 Nov 29)



RLC30\_2015 result



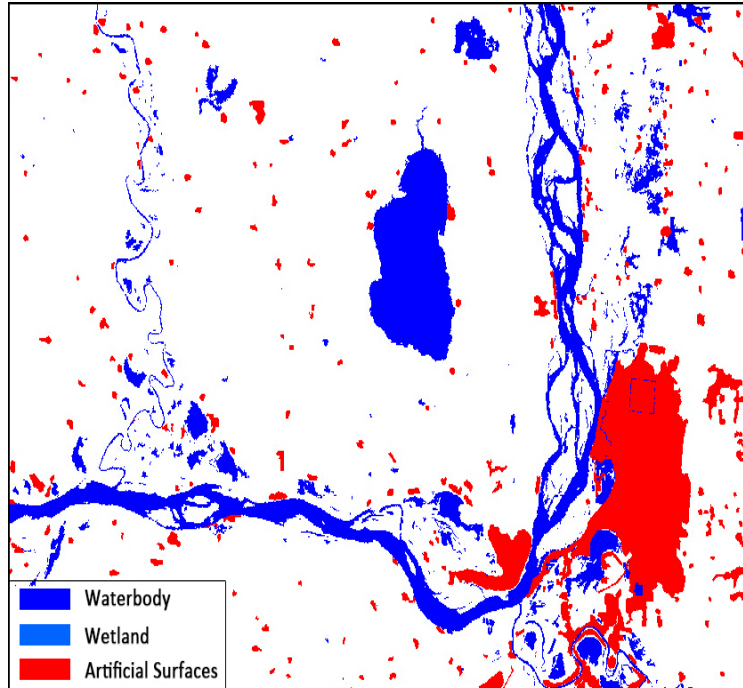
**Area:** 3,450 km<sup>2</sup>

**Location :** Mandalay (716 km north of Yangon on the east bank of the Irrawaddy River)

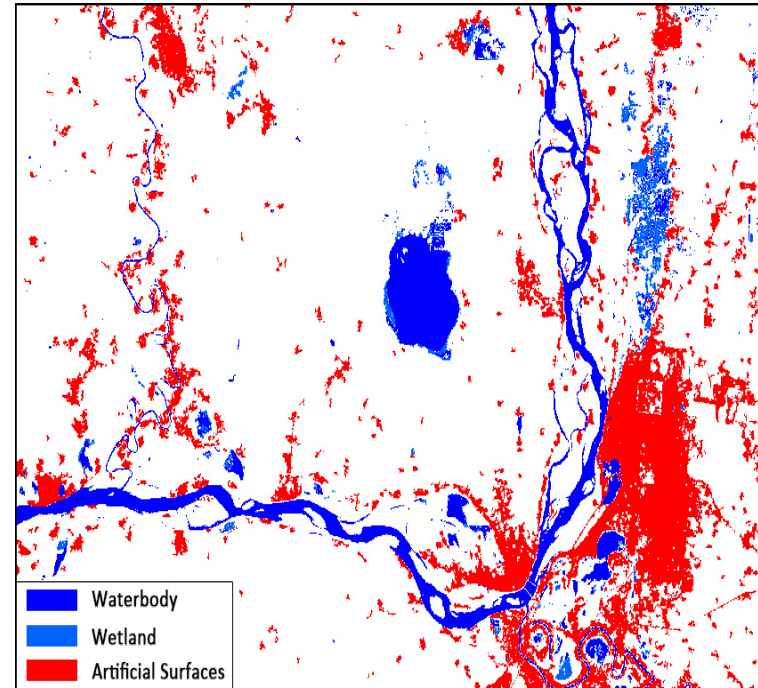


# Sample region (Myanmar)

GLC30\_2010 result



RLC30\_2015 result (2014 Nov 29)

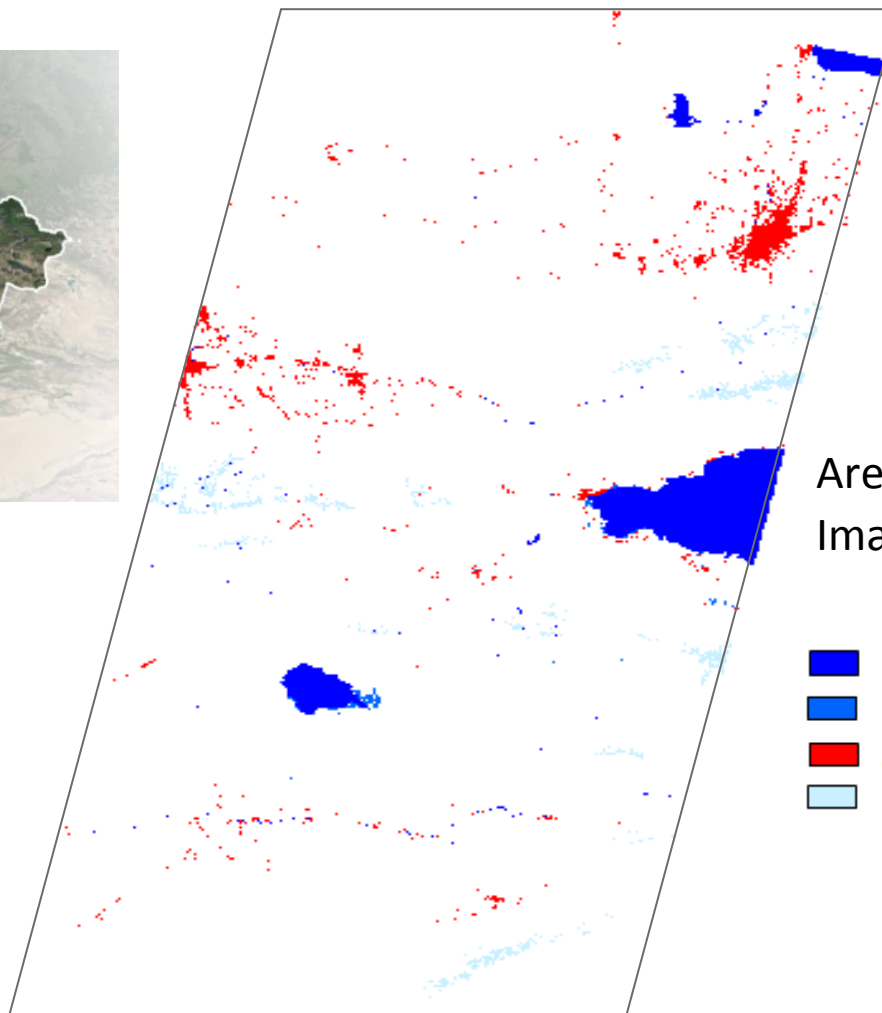


**Area:** 3,450 km<sup>2</sup>

**Location :** Mandalay (716 km north of Yangon on the east bank of the Irrawaddy River)







# Kazakhstan & Kyrgyzstan



Area: 66,563 km<sup>2</sup>

Image date: 2014 Sep 1st

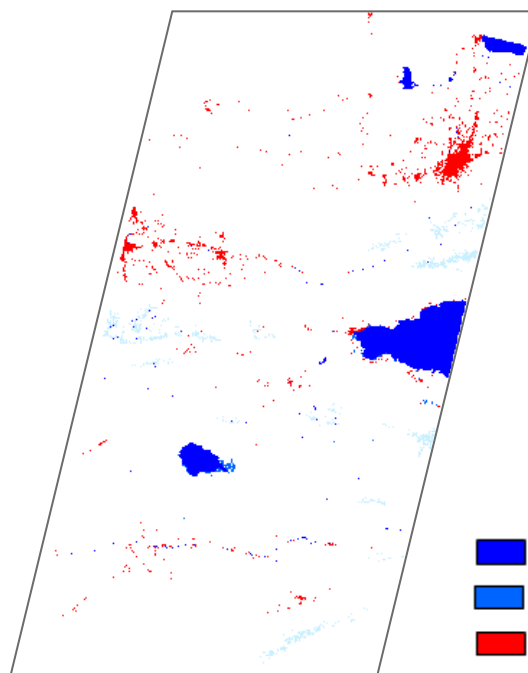
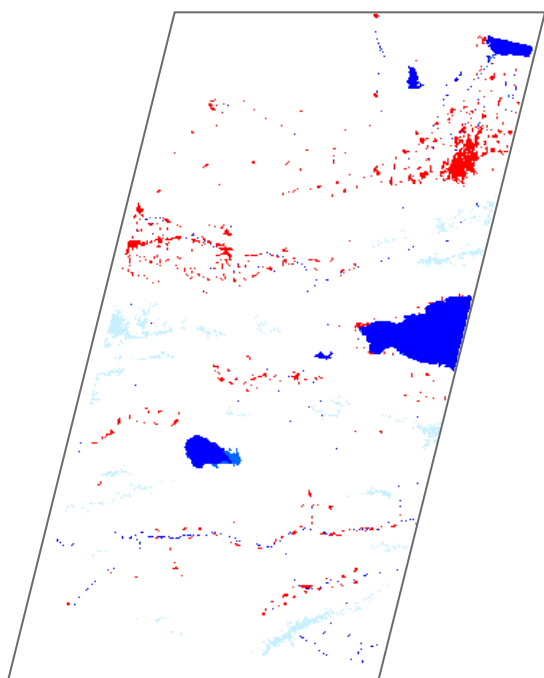
-  Water bodies
-  Wetland
-  Artificial surfaces
-  Permanent snow and ice



# Compare RLC30\_2015 with GLC30\_2010(Kyrghyzstan&Kazakhsta n)

GLC30\_2010 result

RLC30 2015 result (2014 Sep 1st)



- Water bodies
- Wetland
- Artificial surfaces
- Permanent snow and ice

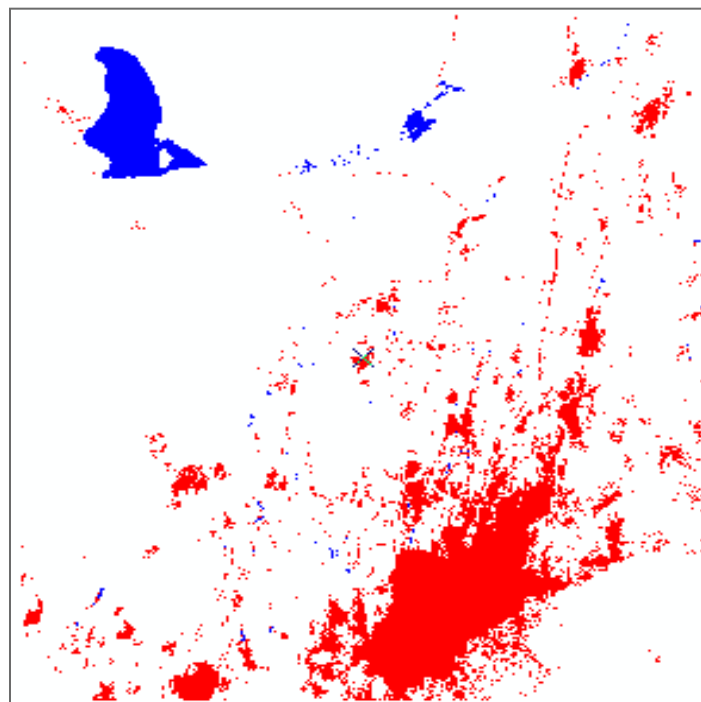
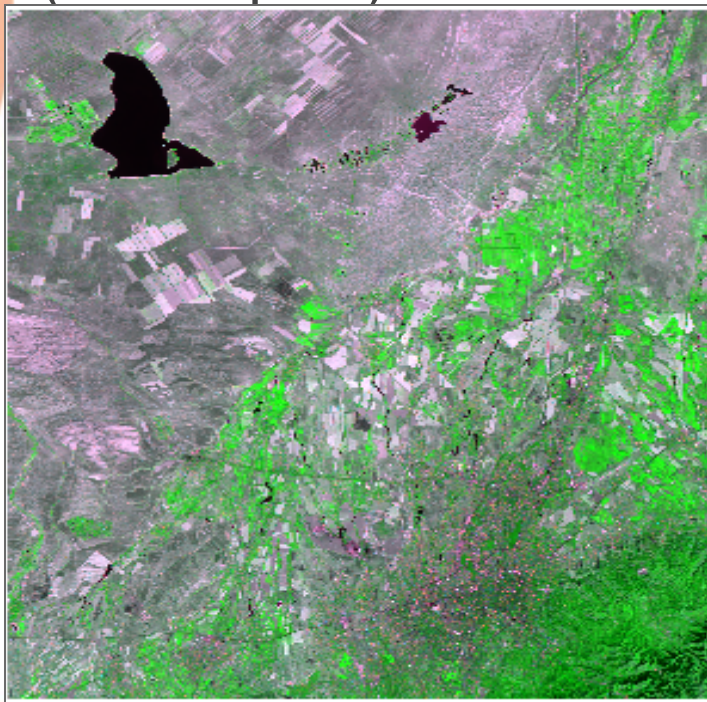
Area: 66,563 km<sup>2</sup>



# Compare RLC30\_2015 with GLC30\_2010 (Kyrgyzstan&Kazakhstan)

Image source: Landsat 8  
(2014 Sep 1st)

RLC30\_2015 result



Blue Water bodies  
Light Blue Wetland  
Red Artificial surfaces

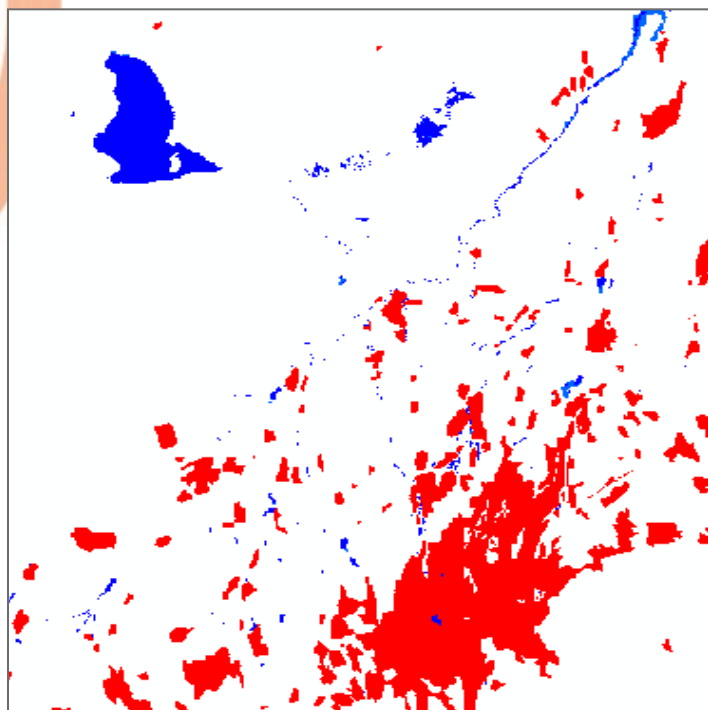


**Area:** 3,956 km<sup>2</sup>

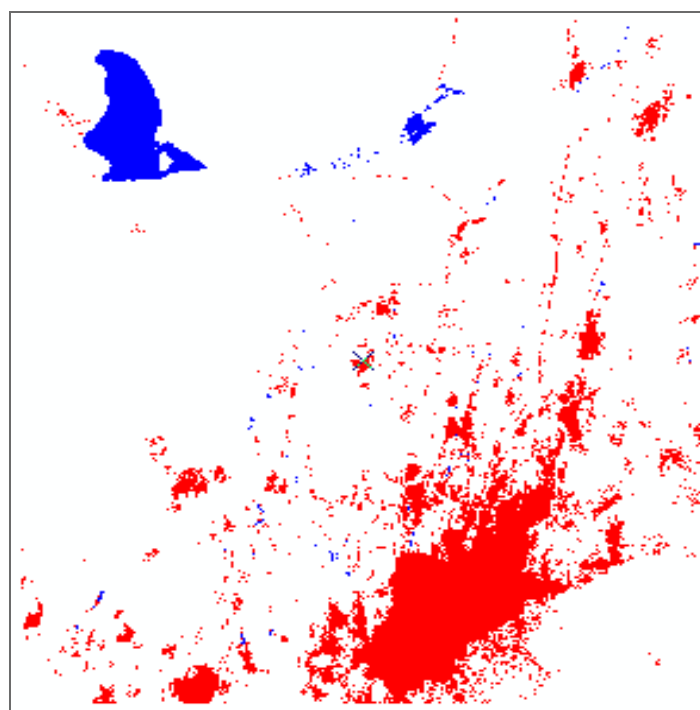
**Location :** Alma-Ata (The city region  
located at the south of Alma-Ata)

# Compare RLC30\_2015 with GLC30\_2010 (Kyrghyzstan&Kazakhstan)

GLC30\_2010 result



RLC30\_2015 result (2014 Sep 1st)



- Water bodies
- Wetland
- Artificial surfaces



Area: 3,956 km<sup>2</sup>

Location : Alma-Ata (The city region located at the south of Alma-Ata)



# Thank you

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