

Use of Earth Observation and Allied Tools – Operational Challenges, and Lesson Learned from 2015 Nepal Earthquake

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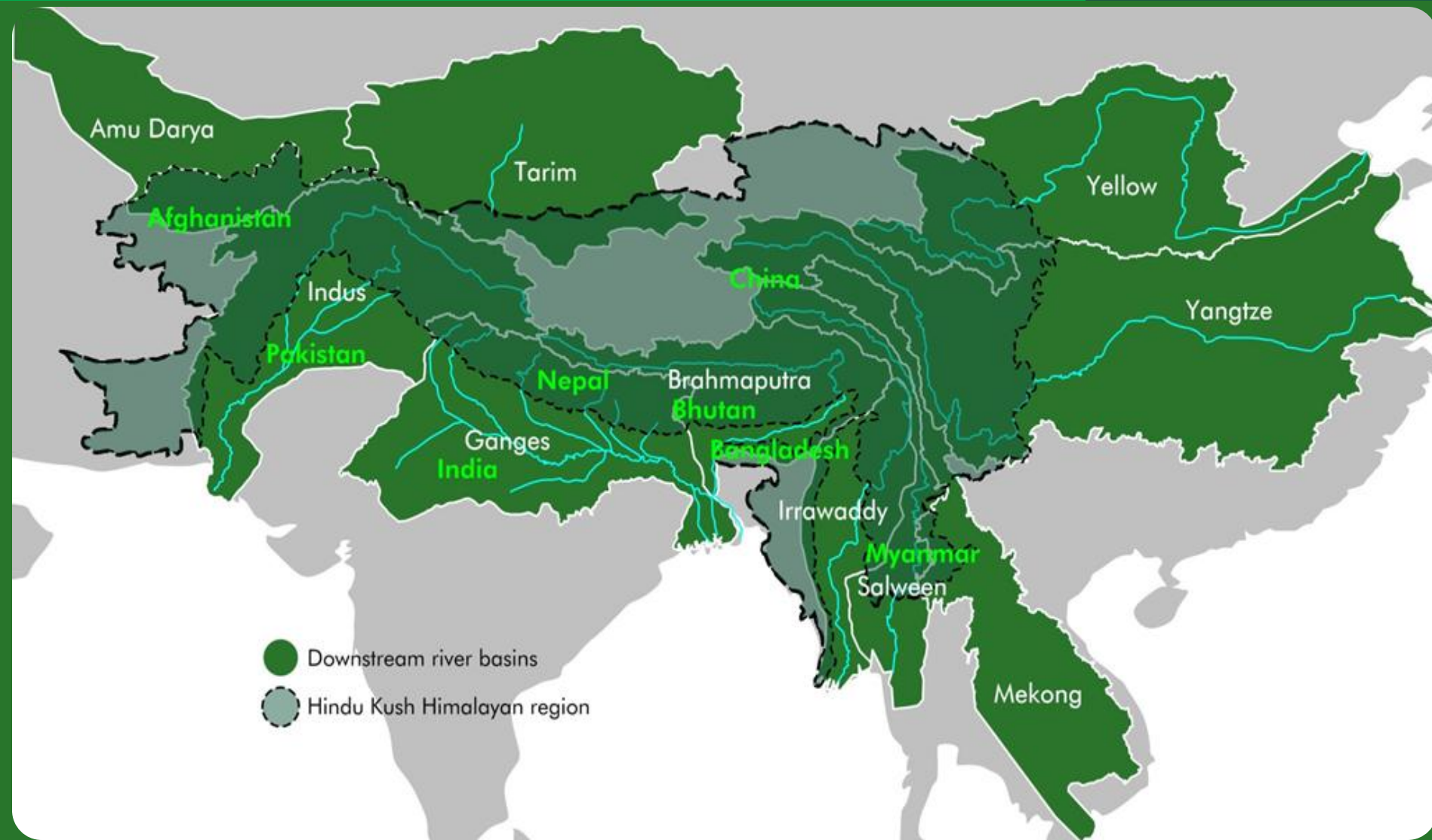
The Use of Earth Observation Data in Disaster Management and Risk Reduction: Sharing the
Asian Experience

Hyderabad, 8-10 March 2016

ICIMOD: International Centre for Integrated Mountain Development

ICIMOD

FOR MOUNTAINS AND PEOPLE



Nepal Earthquake 2015



NEPAL EARTHQUAKE 2015

Post Disaster Needs Assessment

VOL. A: KEY FINDINGS



~ 9000 lives lost;

~ 22000 people injured

~ US\$ 7 billion in loss/damage



Managing expectation – a critical challenge

The day is reported to be sunny. Can you take image now and send it to me.



Decision maker

Responder in the field

Sunny and clear day.



Hazard



Data provider /technician

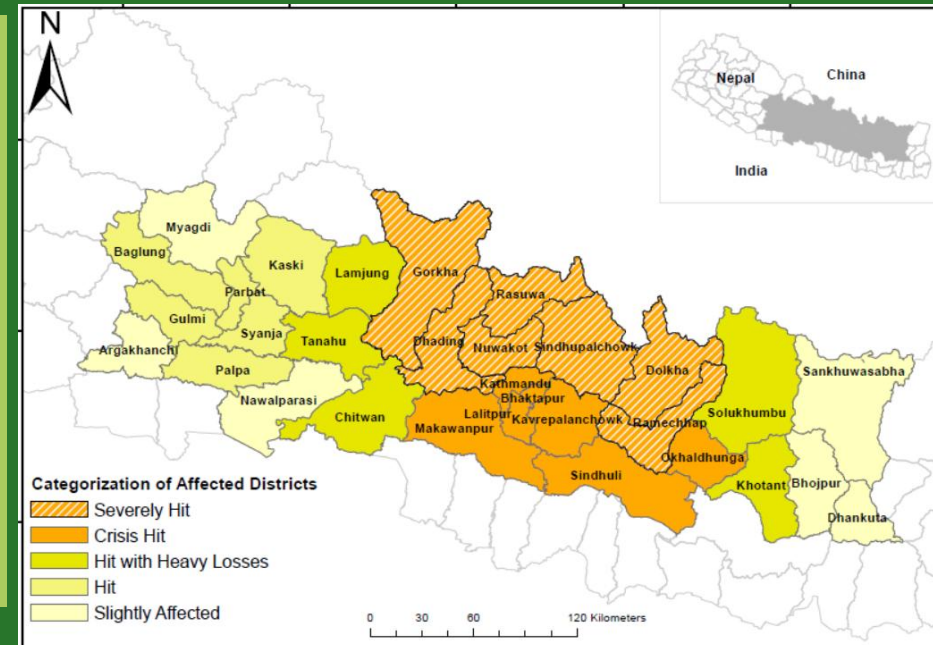


Incomplete communication resulted in over expectation.

Miss-directed priorities

The nomenclature of the event (earthquake) was partly responsible for miss-directed priorities.

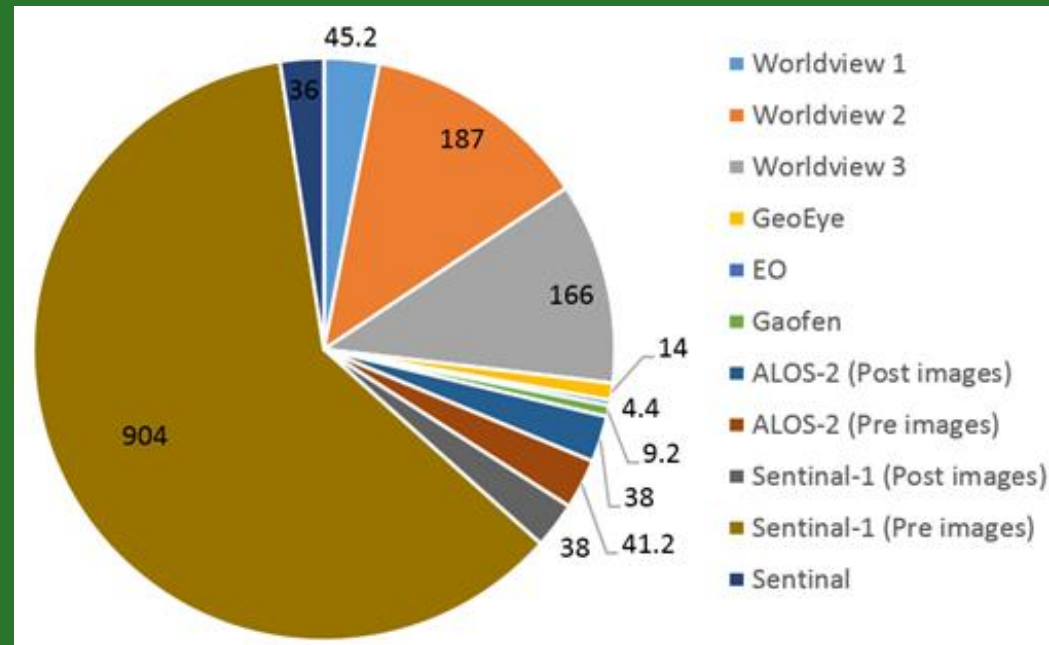
Thus both ways communication between suppliers and users is critical for coordination.



Satellite data – availability Vs. accessibility

Accessibility and not availability of satellite data was a biggest challenge during Nepal Earthquake.

About 1.5 TB data accessed by ICIMOD team immediately after the Nepal Earthquake.



In case of Haiti Earthquake, USGS provided 54 TB of data (Duda and Jones, 2011).

Data transfer – a challenge



- Tiling
- Compressing

Cloud server



Physically transferred



Data management system

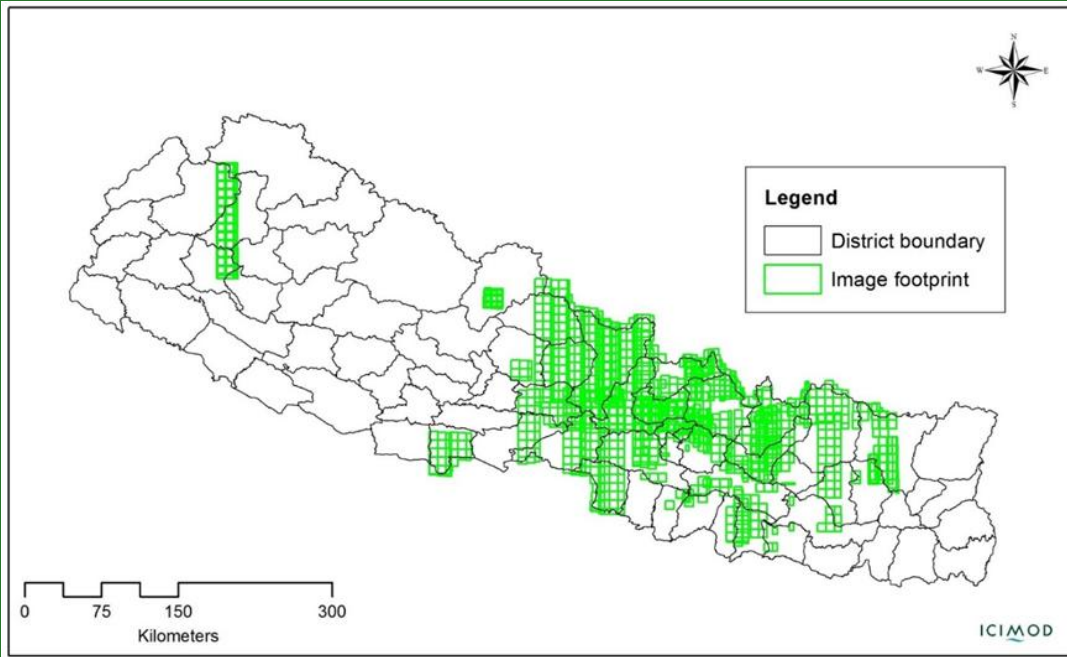
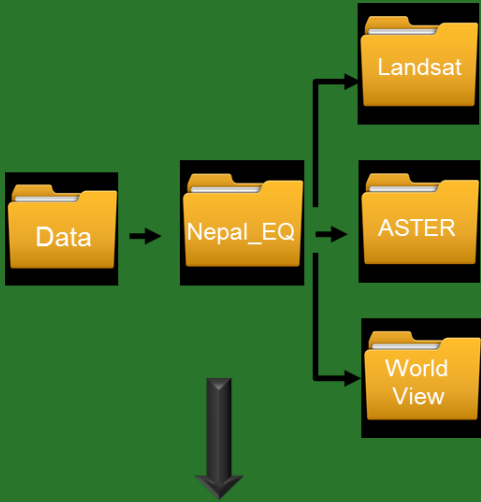


Image footprint

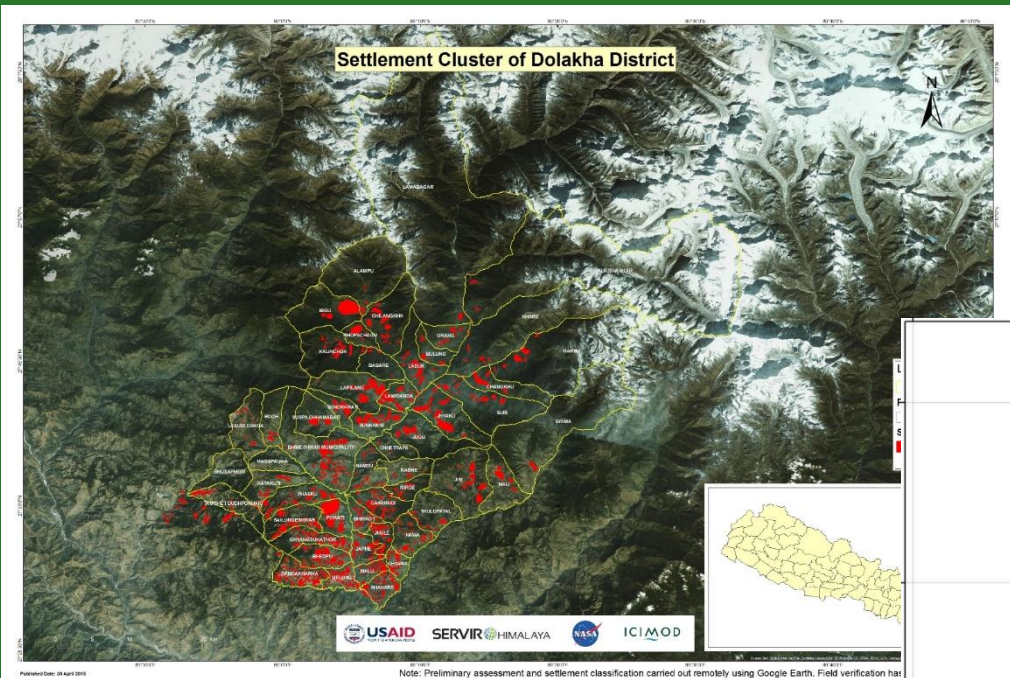


Mosaic raster file ensured mapping of all the satellite data within a single frame, easing mapping for gap identification and location based searching.

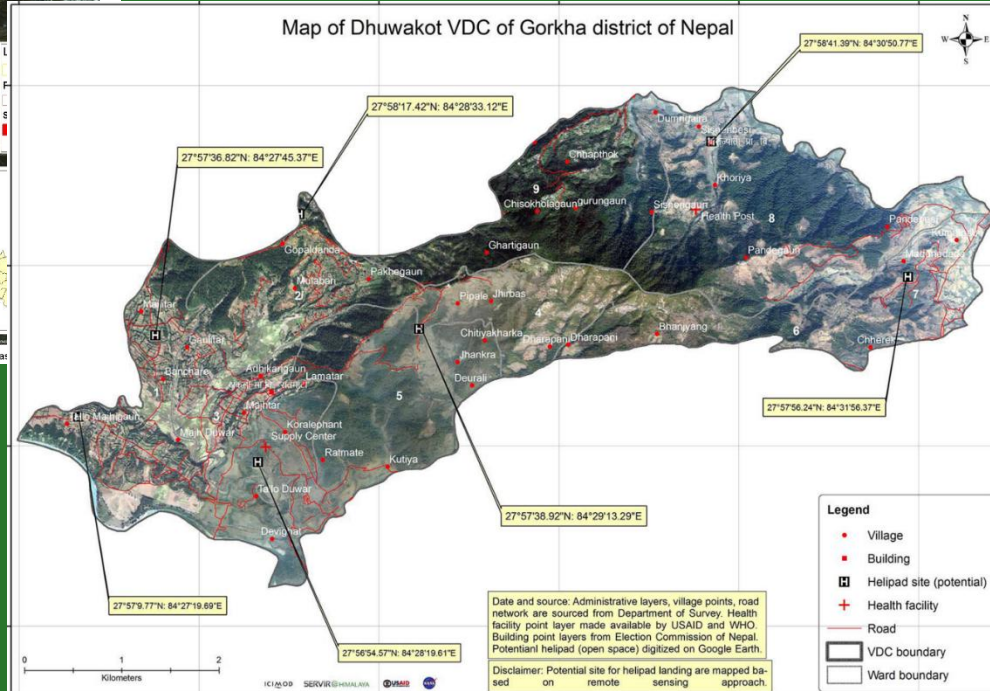
Mosaic Raster datasets in geo-database

Rapid mapping support

Settlement cluster mapping



Mapping of helipad sites



Polling station database

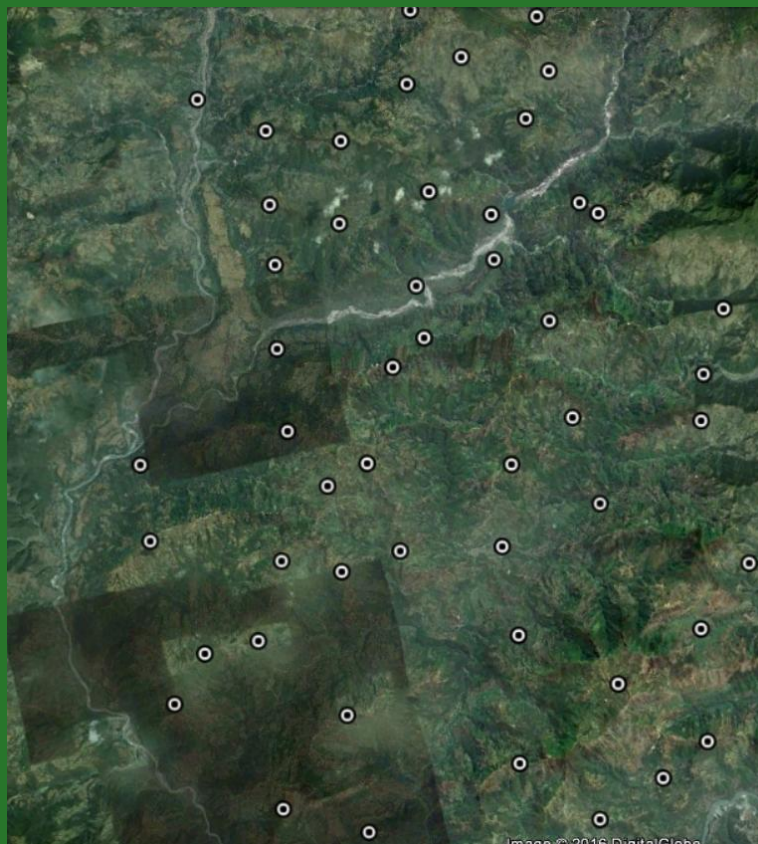
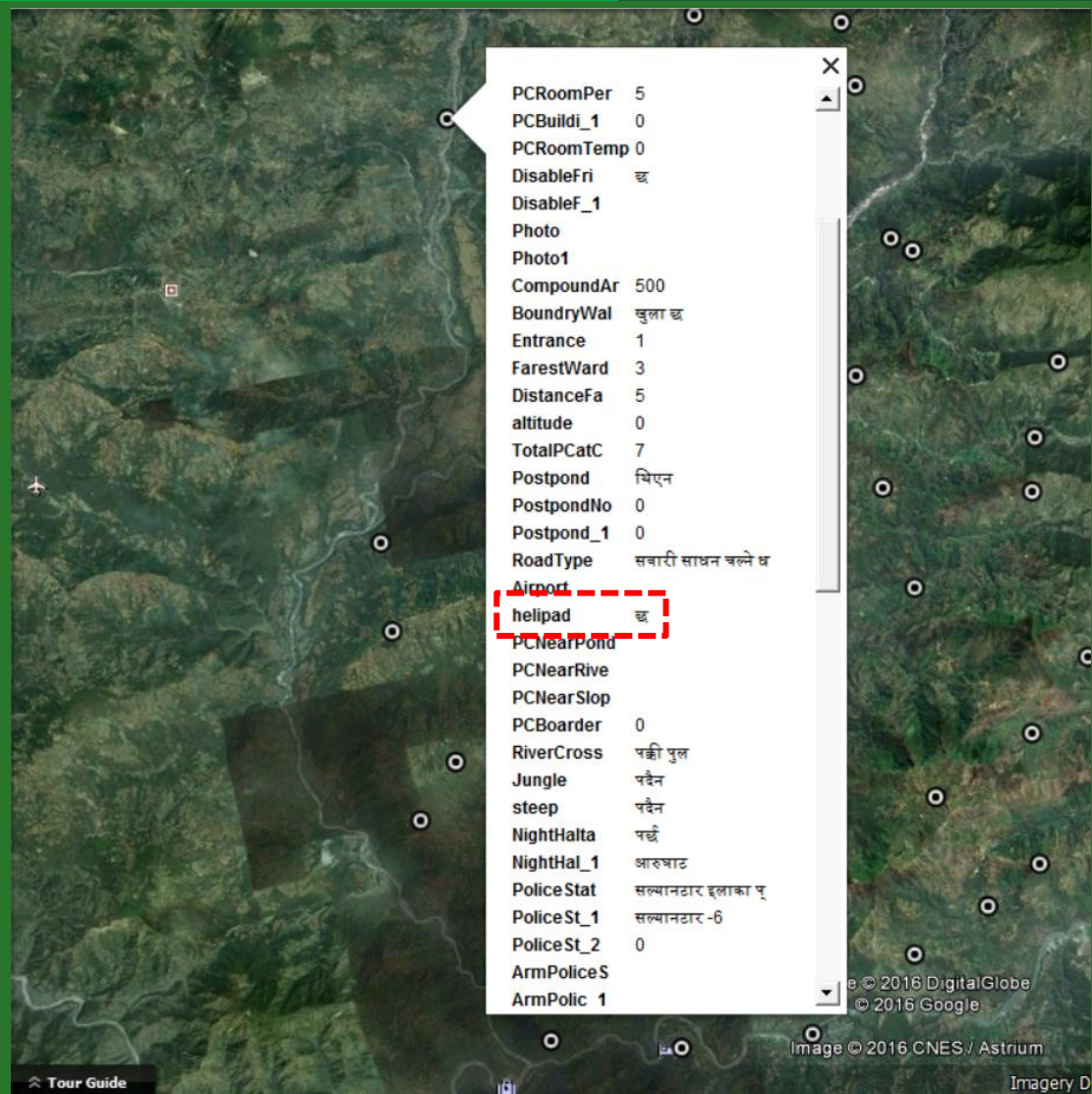


Image © 2016 DigitalGlobe



PCRoomPer	5
PCBuildi_1	0
PCRoomTemp	0
DisableFri	छ
DisableF_1	
Photo	
Photo1	
CompoundAr	500
BoundryWal	खुला छ
Entrance	1
FarestWard	3
DistanceFa	5
altitude	0
TotalPCatC	7
Postpond	भिएन
PostpondNo	0
Postpond_1	0
RoadType	सवारी साधन चले छ
Airport	
helipad	छ
PCNearPond	
PCNearRive	
PCNearStop	
PCBoarder	0
RiverCross	पक्की पुल
Jungle	पहेन
steep	पहेन
NightHalta	पछे
NightHal_1	आरुमाट
PoliceStat	सल्यानटार इलाका प्
PoliceSt_1	सल्यानटार -6
PoliceSt_2	0
ArmPoliceS	
ArmPolic_1	

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Damage survey – Remote sensing based (satellite data)



Image of Barpak - epicenter

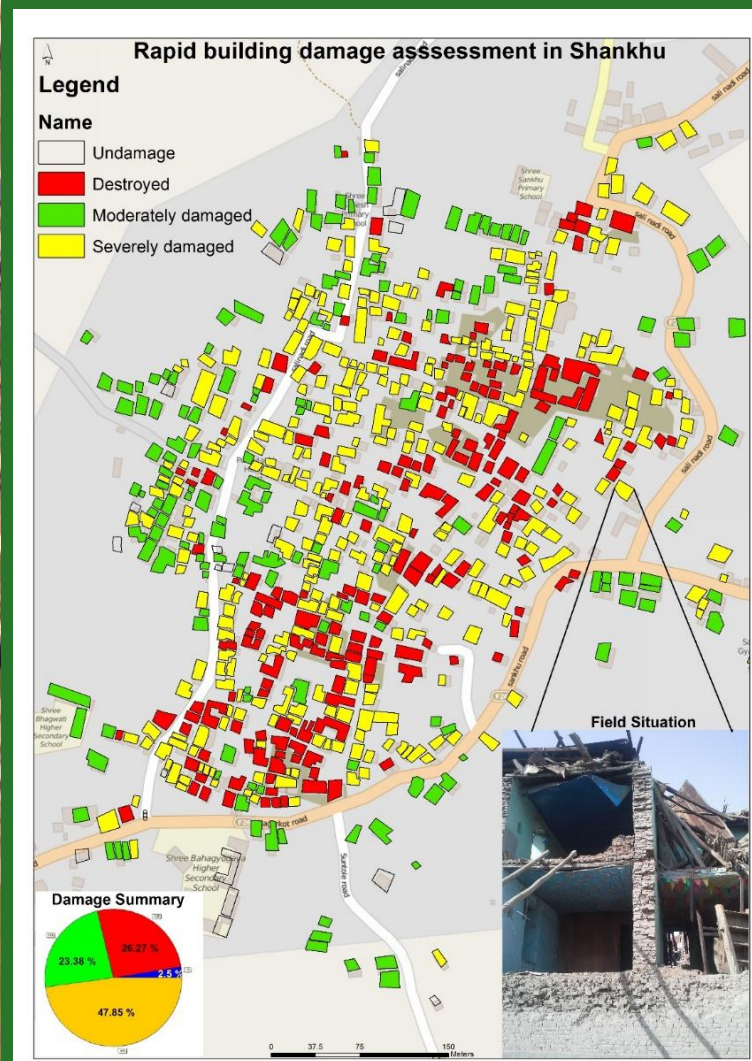
Limitation:

- Cloud;
- Resolution;
- View angle;
- Distortion;

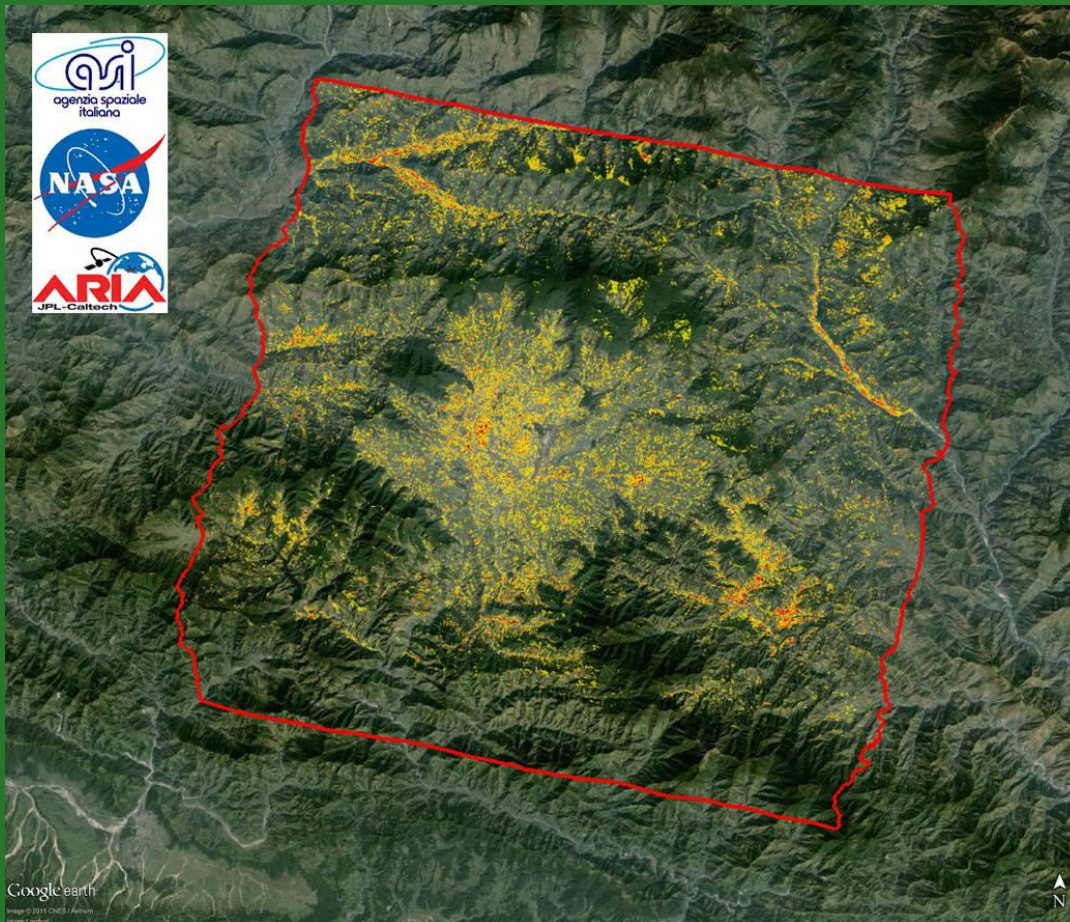
Damage survey – Remote sensing based (satellite data)

- Accuracy of EO for damage assessment is influenced by factors such as sensor type, ground sample distance, off-nadir angle, and spectral resolution that (Boccardo and Tonolo, 2012)
- Accuracy of remotely sensed damage assessment is reported to vary from 60% to 70% (Corbane et al, 2011; Ajmar et al, 2011)

Damage survey – Remote sensing based (UAV)



Damage proxy map



- Over estimates;
- Base line database – building footprint was not readily available.

Damage Proxy Map (DPM) generated using synthetic aperture radar (SAR) interferometric by NASA and Caltech scientists.

Field based survey - Rapid assessment



- RAPID ASSESSMENT
- Post-disaster damage assessment - Binay Shrestha
- Post-earthquake Building Usability Assessment Level 1: Rapid Evaluation Geotechnical Issues By Jitendra Bohara
- Post-earthquake Building Usability Asse Level 1: Rapid Evaluation By Jitendra Bohara
- Presentation on Repair and Rehabilitation
- Some Failures & Remedies - Jagadiswar
- Damage Assessment Gu
- Rapid Evaluation Safety A
- Post Disaster Damage Asse

1. Bio Data		1.1	1.2	1.3	1.4	1.5	1.6
1.1	Sex	Male	Female				
1.2	Age	< 20	21-30	31-40	41-50	51-60	> 60
1.3	Address of your home	< 500	500-1,000	1,000-2,000	2,000-3,000	3,000-4,000	> 4,000
1.4	Monthly Income Level of Family (in thousands of Rupees/Months)	Owner	Rent	Not available			
1.5	Availability of electricity	Owner	Rent	Not available			
1.6	Availability of car	Owner	Rent	Not available			
2. Trip Characteristic		2.1	2.2	2.3	2.4	2.5	2.6
2.1	Frequency of Trip	Work Related	School	Go home	Business	General Shopping	Others
2.2	Frequency of Trip	< 10 min	10-30 min	31-60 min	61-90 min	91-120 min	> 120 min
2.3	Do you use public transport for your transfer from your home to work?	No (walking)	Footpath	Motorcycle	Bus	Train	Others
2.4	Do you use public transport for your transfer to your work or school?	No (walking)	Footpath	Motorcycle	Bus	Train	Others
3. General Opinions for Existing Situation		3.1	3.2	3.3	3.4	3.5	3.6
3.1	Existing Traffic Congestion	Very Bad	Somewhat Bad	Neutral	Somewhat Good	Very Good	
3.2	Plan 1 Program has reduced Traffic Congestion	Somewhat Disagree	Somewhat Agree	Neutral	Somewhat Disagree	Somewhat Agree	
3.3	Transportation has reduced Traffic Congestion	Very Bad	Somewhat Bad	Neutral	Somewhat Good	Very Good	
3.4	Current Air Pollution	Very Bad	Somewhat Bad	Neutral	Somewhat Good	Very Good	
3.5	Traffic Safety	Very Bad	Somewhat Bad	Neutral	Somewhat Good	Very Good	
3.6	Have you used the services you use the below mode of public transport?	Never	A couple of times a week	Once a month	Once a week	More than once a week	
3.7	Major reasons for using Public Transport	Cost	Time	Convenient	Safe	Comfortable	No Other Option
3.8	Major reasons for not using Transport	No Route	Time/Not Convenient	Expensive	Slow	No Traffic	Overcrowded
3.9	Major reasons for using Public Transport	Cost	Time	Convenient	Safe	Comfortable	No Other Option
3.10	Major reasons for not using Transport	No Route	Time/Not Convenient	Expensive	Slow	No Traffic	Overcrowded

Disaster Reporting

Take Photo

Owner _____

Contact No _____

No of Occupants _____

Select Damage Type
Collapsed

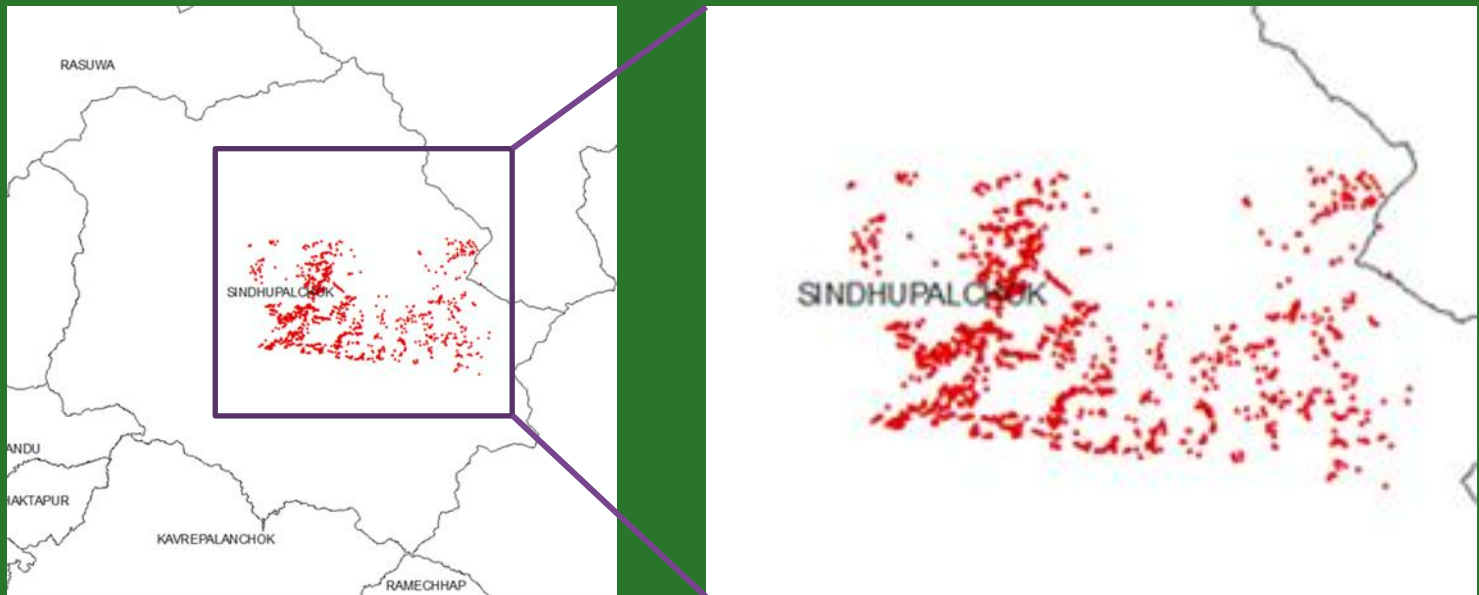
Source of Income

- Remittance
- Agriculture
- Business
- Civil Service
- Daily Wage
- Private Job



Landslide mapping

One of the sort after data layers in post Nepal EQ was of landslide



1422 landslide, Sindhupalchowk district (Source: ISRO)

Many parallel landslide inventories:

NASA, USGS, BGS, ISRO, IIT, ICIMOD, CAS, JAXA

Rapid landslide mapping

Result:

- Inconsistent landslide database (point and polygon)
- Landslide figures ranging from 3000 - 10000

Reason:

- Lack of uniform expertise – volunteers
- Lack of mapping guideline
- Mapping in silos – lack of coordination

Dissemination challenges

- Lack of systematic dissemination protocol/SoPs
- Lack of single gateway for share, discover and access data layers
- Lack of feed-back mechanism

The screenshot displays the ICIMOD website's interface for the Nepal Earthquake 2015. At the top, there is a navigation bar with the ICIMOD logo and the tagline 'FOR MOUNTAINS AND PEOPLE'. Below the navigation bar, a large image shows the aftermath of the earthquake, with a partially destroyed building and debris. The main content area is divided into several sections:

- Regional Member Countries:** A row of flags representing various countries.
- About ICIMOD:** A dropdown menu with options like Programmes, Mountain Topics, Resources, News, Events, Career, and Contact us.
- Nepal Earthquake 2015:** A central section with a blue header and a list of links: Geohazards, VDC maps, Message from the Director General, Settlement Maps (District), Stories, Earthquake briefs, News, Media coverage, Links, Emergency Numbers, and Swipe Map.
- NEPAL EARTHQUAKE 2015:** A detailed infographic showing the magnitude of the earthquake (7.8), the number of deaths (27), injured (383), and missing (95). It also includes a map of Nepal and a table of major earthquakes.
- Geo Hazards:** A section on the right with the text: 'In the aftermath of the 7.8 magnitude earthquake that struck Nepal on 25 April 2015, numerous landslides have occurred in the steep mountains and hills throughout the earthquake impacted zone. These landslides have potentials to impact people and built structure, obstruct river flow and cause outburst floods. READ MORE'.
- RESCUE AND RELIEF RESPONSE:** A section at the bottom with various statistics and a bar chart showing the top 10 contributors to the PM Relief Fund.

<http://www.icimod.org/nepalearthquake2015>

Nepal Earthquake 2015: Disaster Relief and Recovery Information Platform

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<http://drrportal.gov.np/>

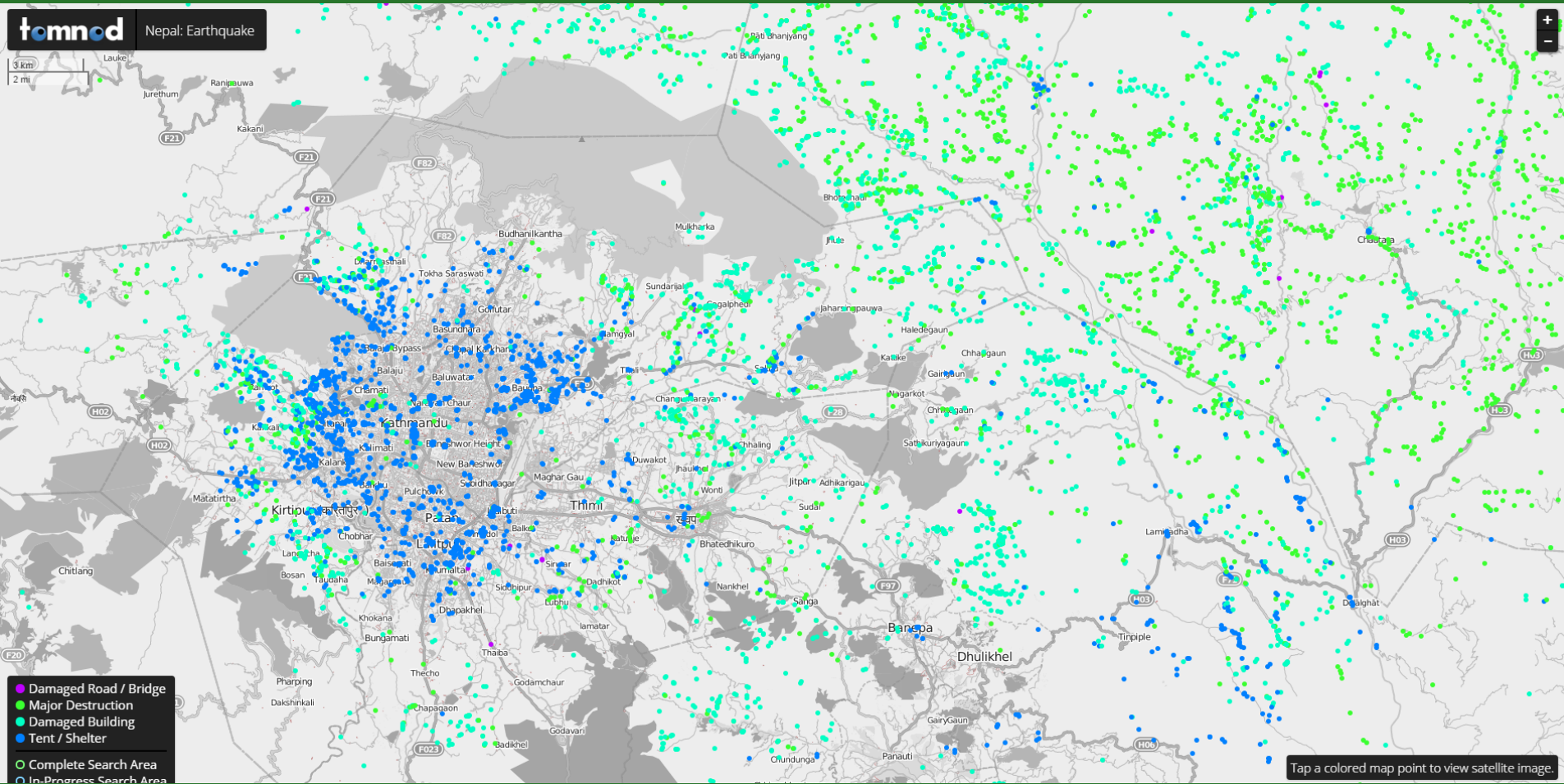
Nepal Earthquake 2015
Disaster Recovery and Reconstruction Information Platform

- Country Profile
- District Profile
- Municipality Profile
- VDC Profile
- Health
- Education
- Heritage
- Landslide Assessment

- One uniform system for data assimilation
- Knit data/information from different sources/teams to paint a larger picture
- Help data discover, share, and use.

Crowd sourcing – how good is open ended system

http://admin.tomnod.com/campaign/nepal_earthquake_2015/results



Conclusion

- Data sharing and two way information flow (demand & supply) is essential to generate actionable information , share and use
- Need for stronger role from Govt. agency to anchor coordination amongst multi-sectoral agencies should translate to information gathering and dissemination domain
- SOPs, guideline & mechanisms should be established, awareness build & familiarized well ahead of the event on mapping, access, dissemination, & should include feedback gathering.



Thanking you for your attention!