

# RAPID DAMAGE ASSESSMENT USING SATELLITE IMAGES

(Before and After Typhoon Yolanda)

Department of Science and Technology  
UP Disaster Risk and Exposure Assessment for Mitigation  
(DREAM) Program  
Nationwide Operational Assessment of Hazards (NOAH)

# The DREAM LiDAR Program

## OBJECTIVE

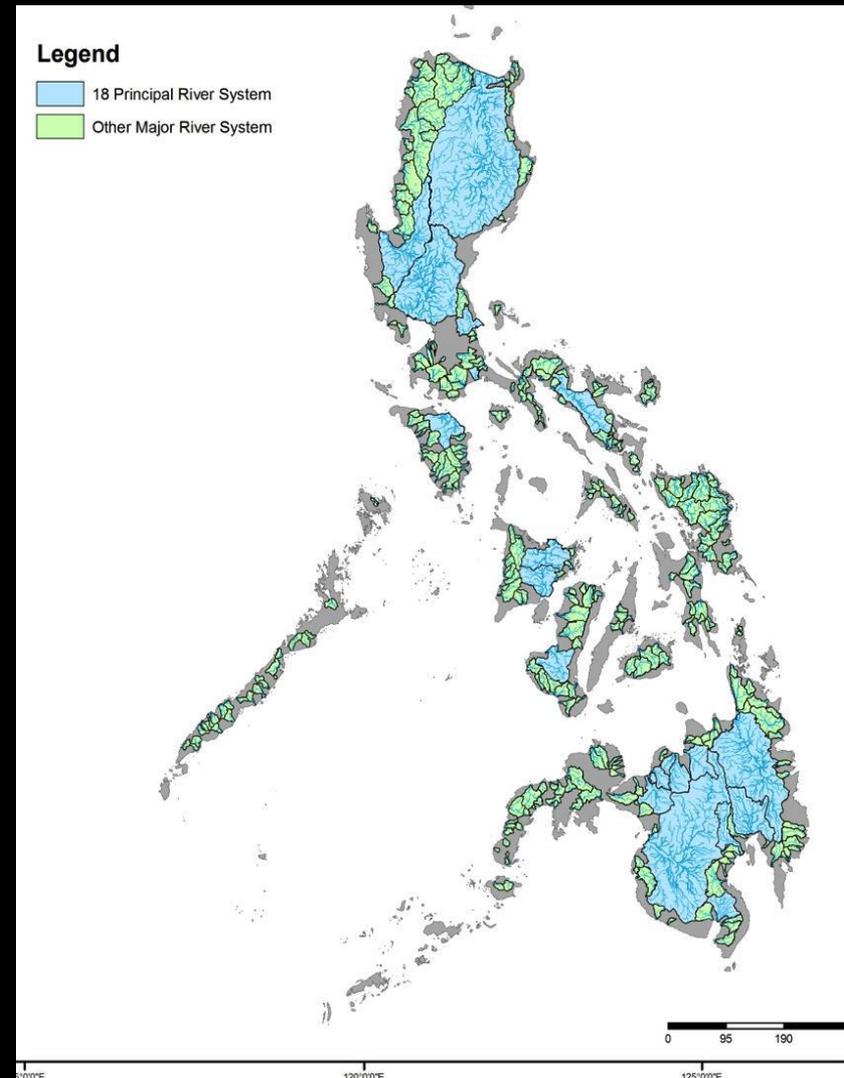
To generate **finer-scale flood hazard maps** and **inundation models** to be used for 6-hr early warning

## COVERAGE

Surveyed the 18 Major River Basins (RBs) prone to flooding through Airborne LiDAR (3D mapping)

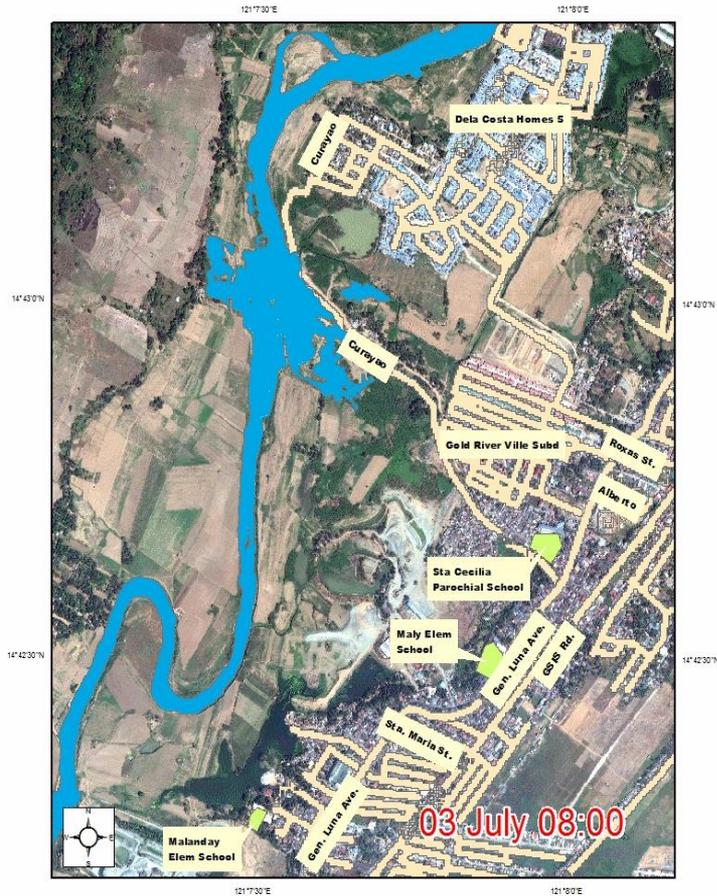
## Phil-LiDAR 1: DREAM Phase 2

- Covers 300 other river systems in the Philippines
- Will prioritize floodplain areas then the upland areas
- Government agencies are asked to send priority sites for flight planning purposes

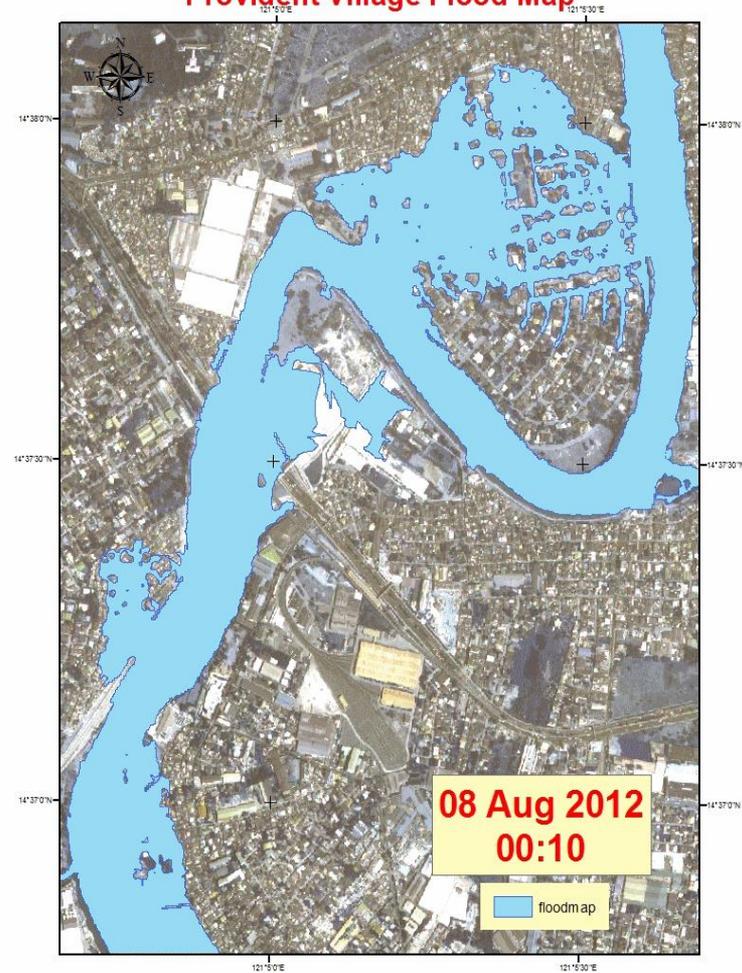


# Rapid Flood Simulation for Flood Events

Marikina River Flood Animation



Provident Village Flood Map

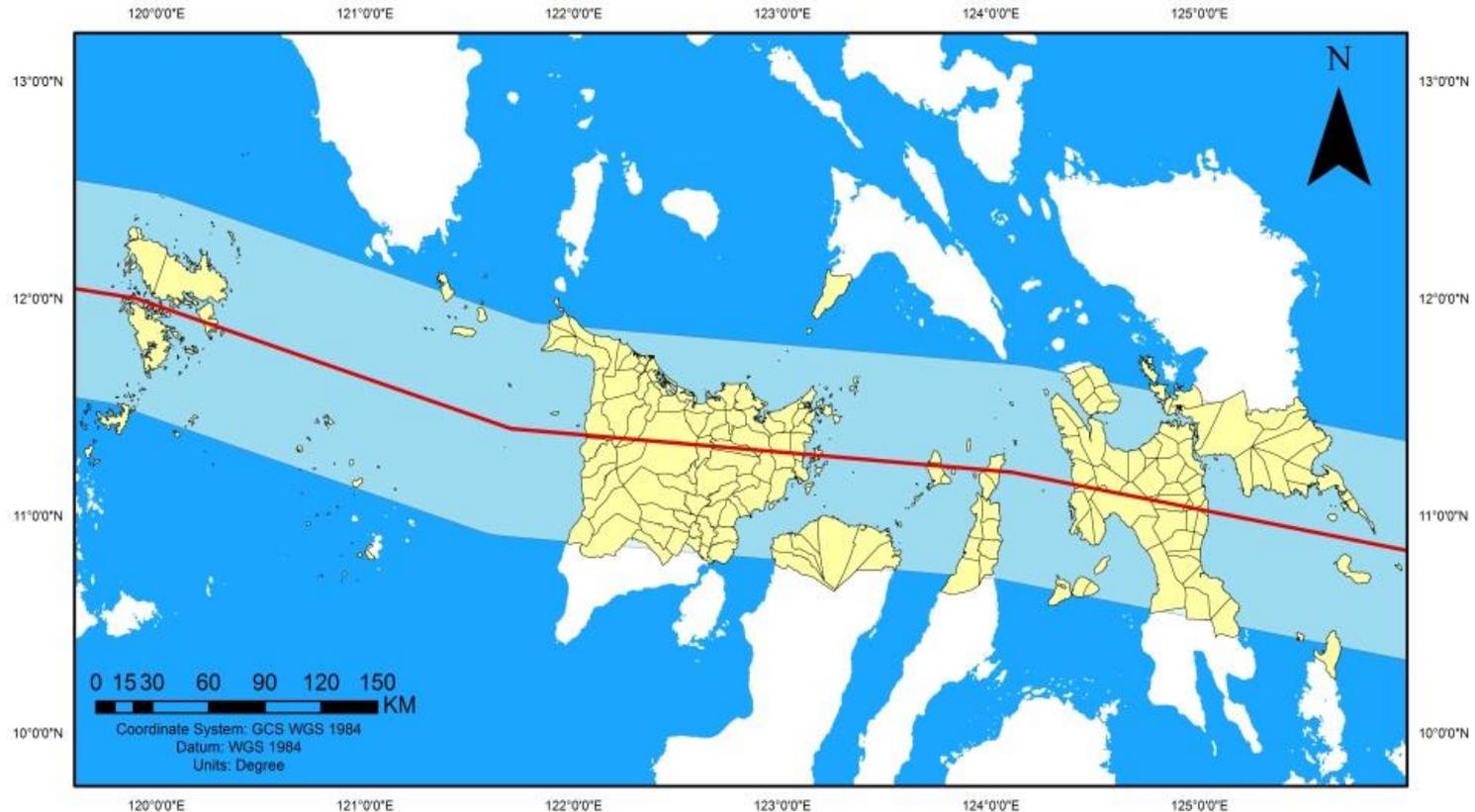


Implementing a Satellite-based  
Monitoring and Assessment of  
Rehabilitation in Typhoon-Affected  
Regions (SMARTER Visayas)

# Objectives

1. Archive or Catalogue the delivered Satellite Images covering 171 target Municipalities;
2. Pre – process Images prior to Damage Assessment;
3. Perform damage assessment comparing Pre – Yolanda (Before) with Post – Yolanda (After) Images;
4. Generate up to date statistic of damages intersected with the municipalities and in barangay levels;
5. Output the statistics in spread sheet, tables, graphs or GIS Map Format.

# Municipalities/Cities Affected by Typhoon Yolanda



## Legend

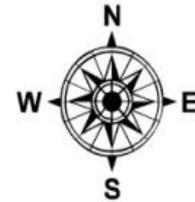
-  Typhoon Yolanda Track (Nov 6 - 9 2013)
-  171 Municipalities/Cities Covered by the 50 Km Buffer Zone
-  50 Km Radius Buffer Zone

*Administrative boundaries are approximate and unofficial*

Prepared by:

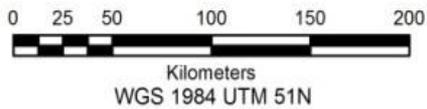


# Post-Yolanda Total Image Coverage

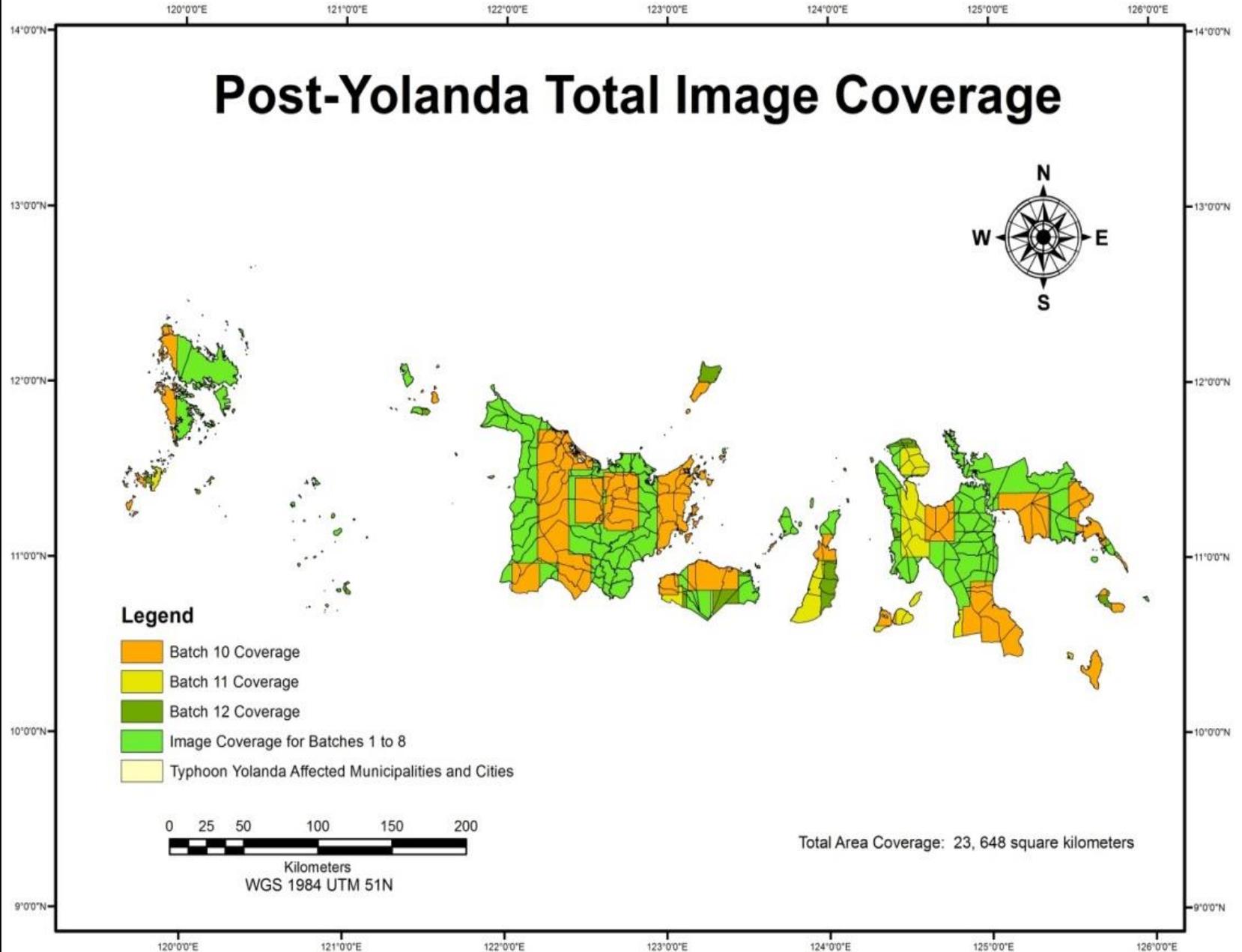


## Legend

- Batch 10 Coverage
- Batch 11 Coverage
- Batch 12 Coverage
- Image Coverage for Batches 1 to 8
- Typhoon Yolanda Affected Municipalities and Cities



Total Area Coverage: 23,648 square kilometers



# Preprocessing of Satellite imagery



Multispectral Satellite  
Imagery

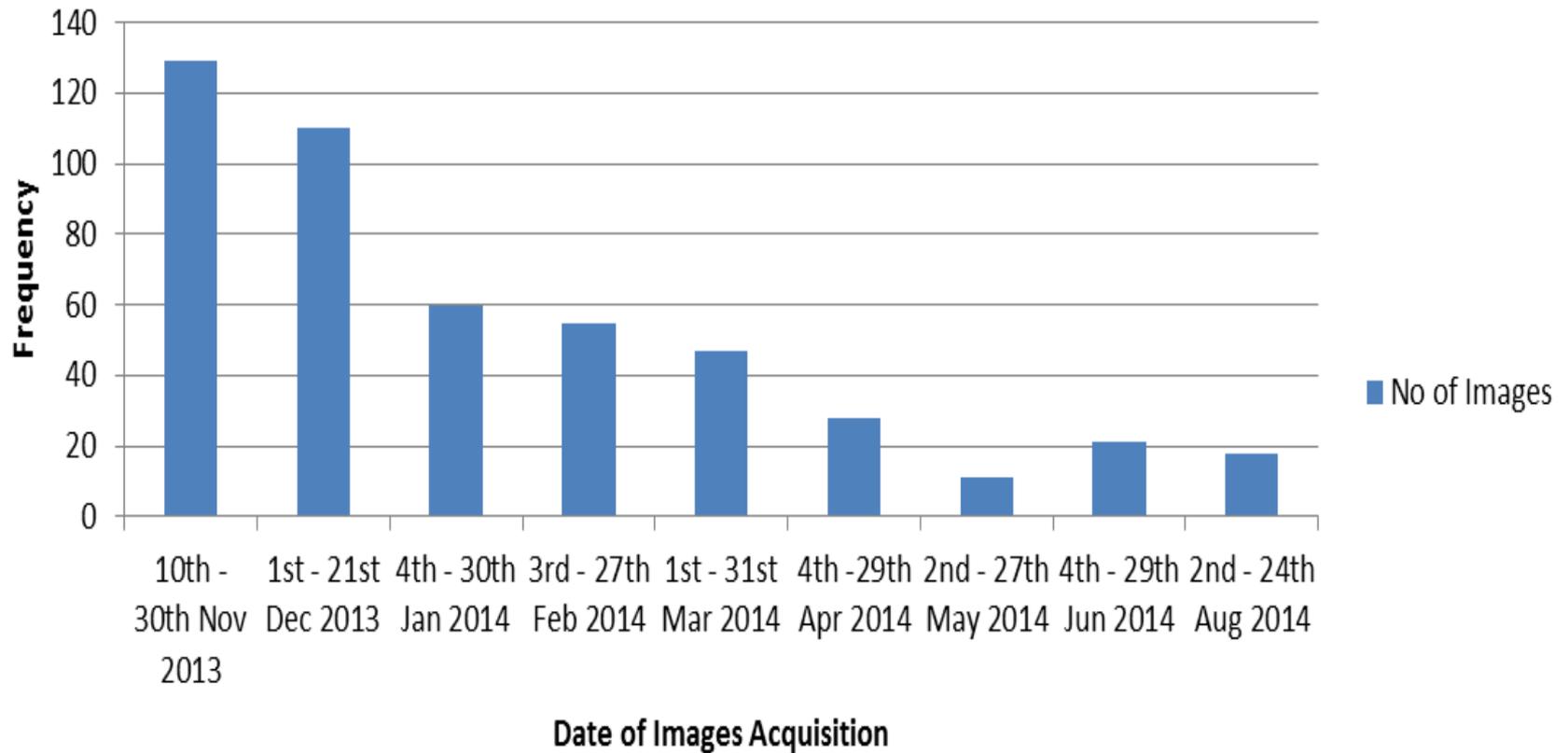


Hi-resolution  
Panchromatic  
Satellite Imagery



Fused Multispectral  
and Panchromatic  
Satellite Imagery

# Acquisition Planning of Satellite Imagery



# Before and After Animation of Super typhoon Yolanda Tacloban City

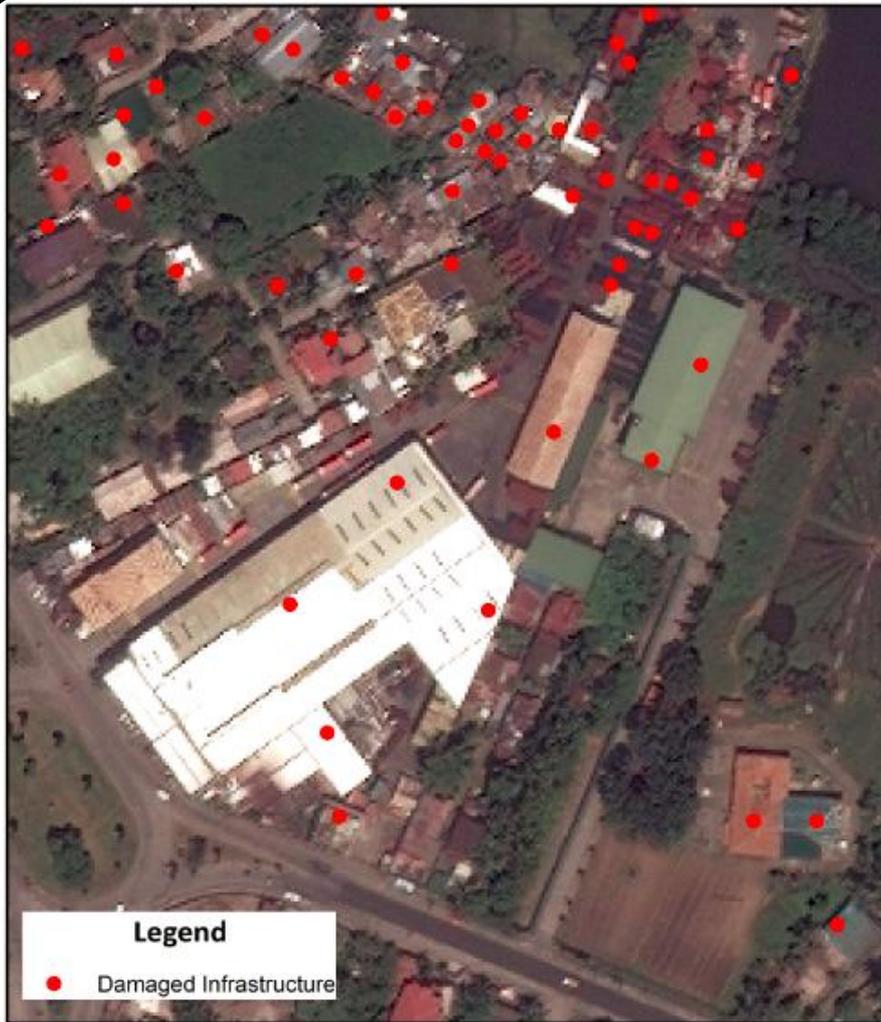


# Rapid Damage Assessment Using Satellite Images

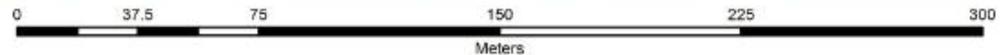
Tacloban City, Leyte

BEFORE (September 9, 2013)

AFTER (November 13, 2013)



SOURCE: WorldView Satellite Imagery

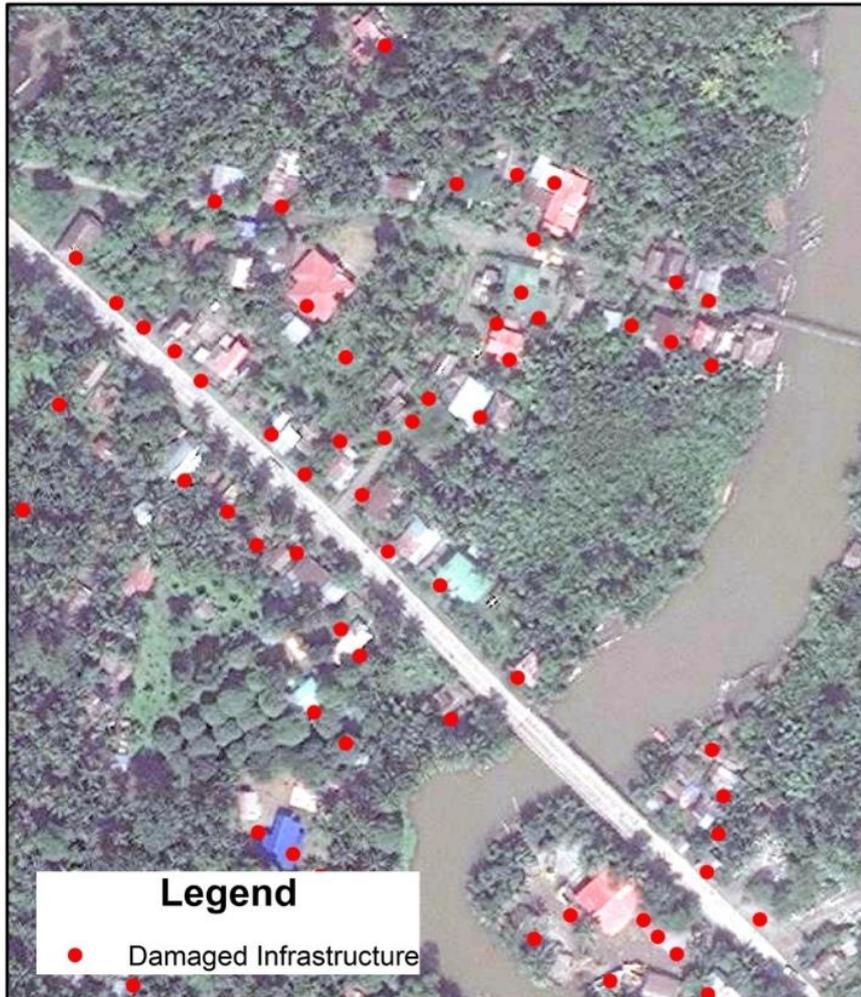


# Rapid Damage Assessment Using Satellite Images

Bislig, Tanauan

BEFORE (September 9, 2013)

AFTER (November 13, 2013)



SOURCE: WorldView Satellite Imagery

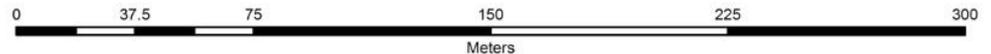
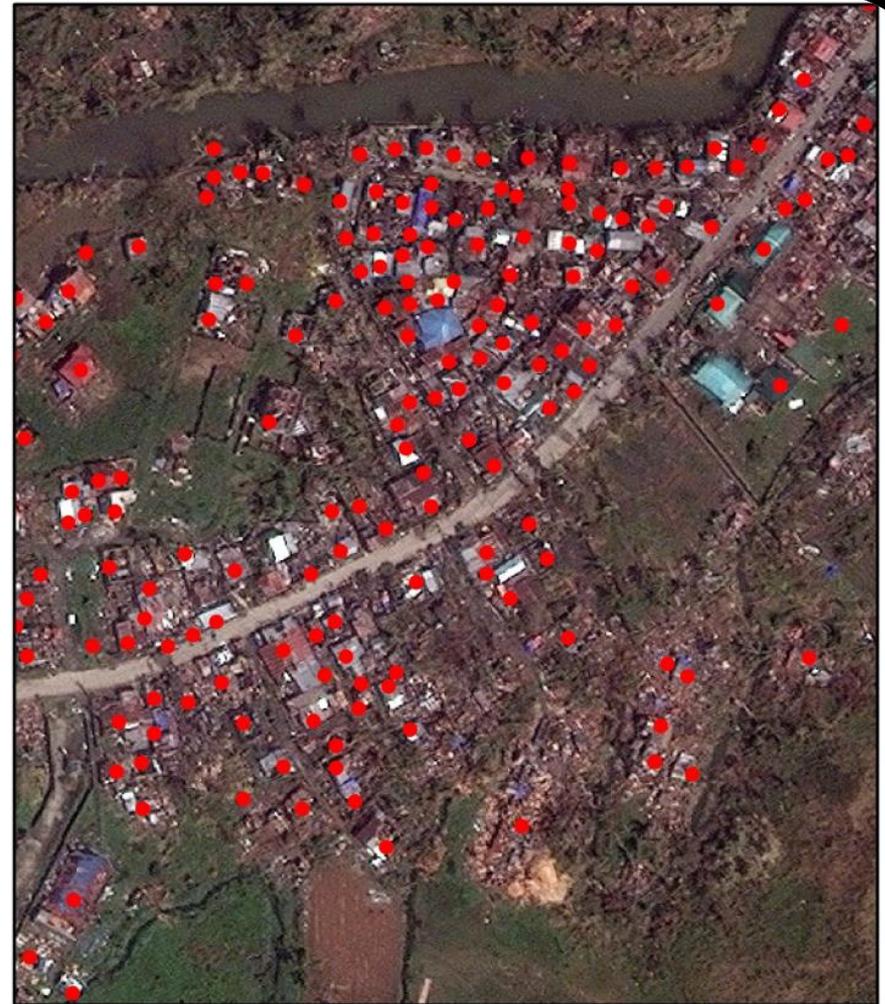
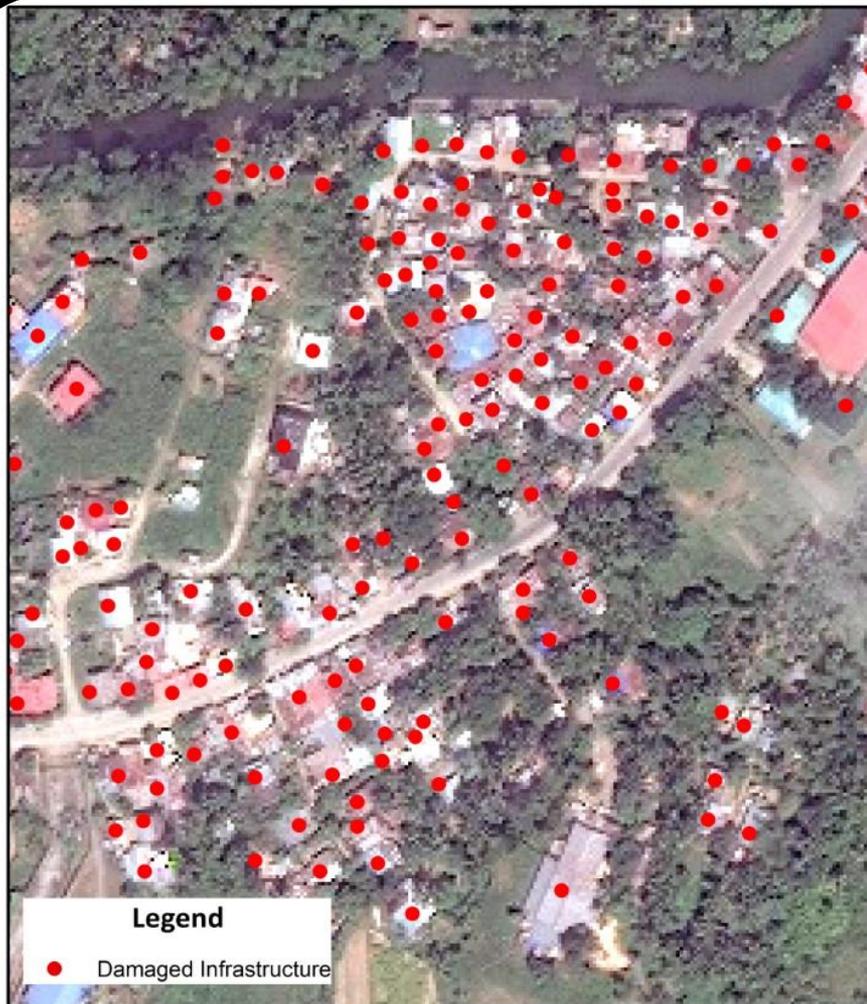
0 37.5 75 150 225 300  
Meters

# Rapid Damage Assessment Using Satellite Images

Leyte

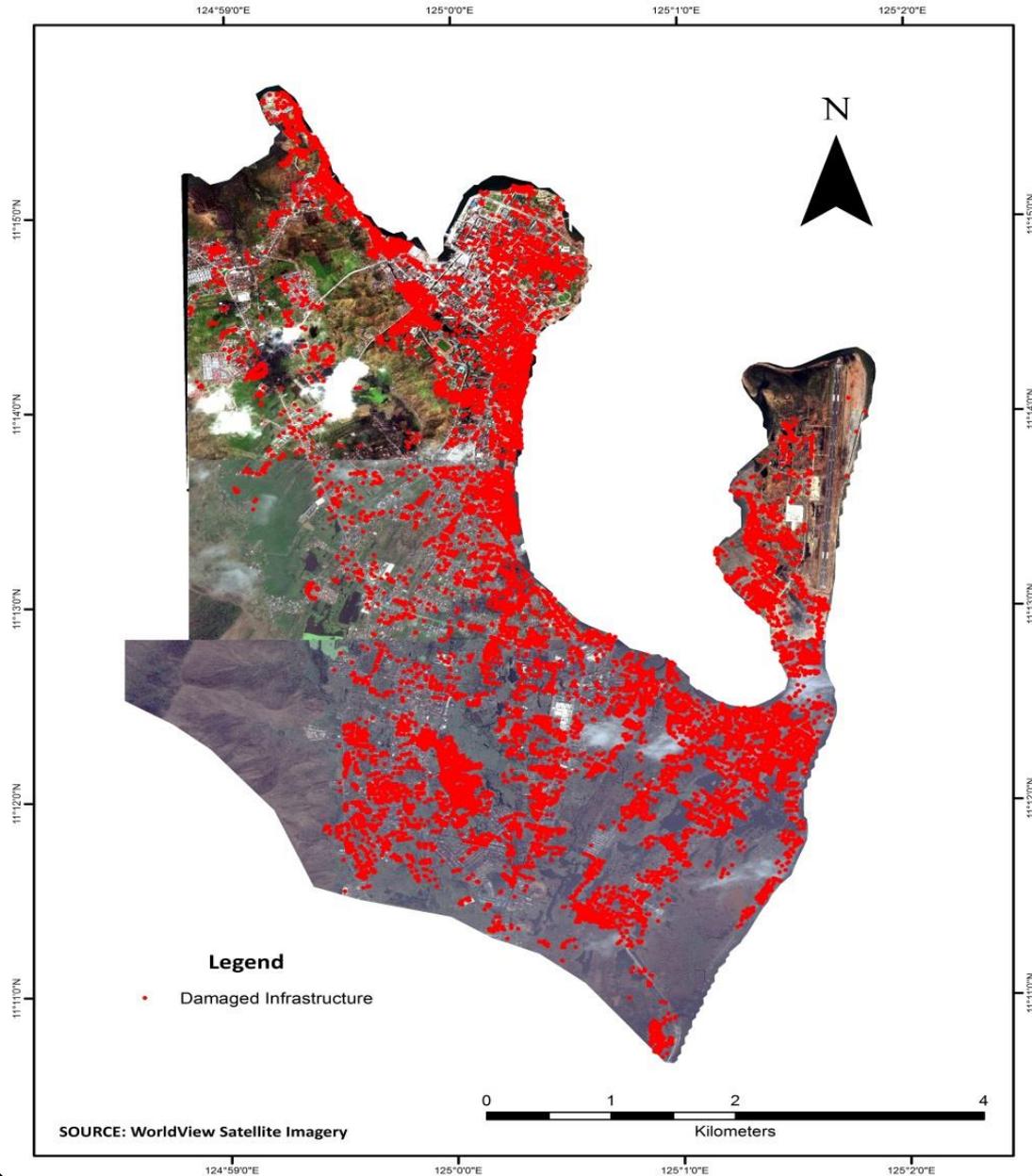
BEFORE (September 9, 2013)

AFTER (November 13, 2013)



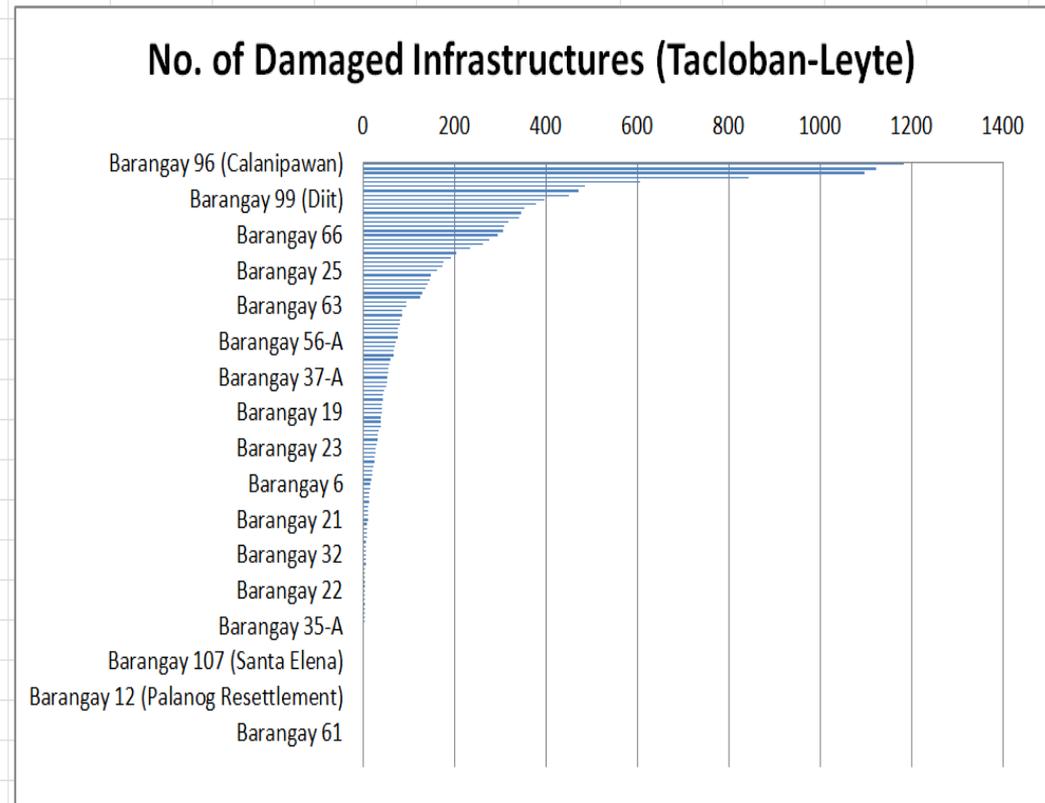
SOURCE: WorldView Satellite Imagery

# TYPHOON YOLANDA: DAMAGED INFRASTRUCTURE IN TACLOBAN CITY

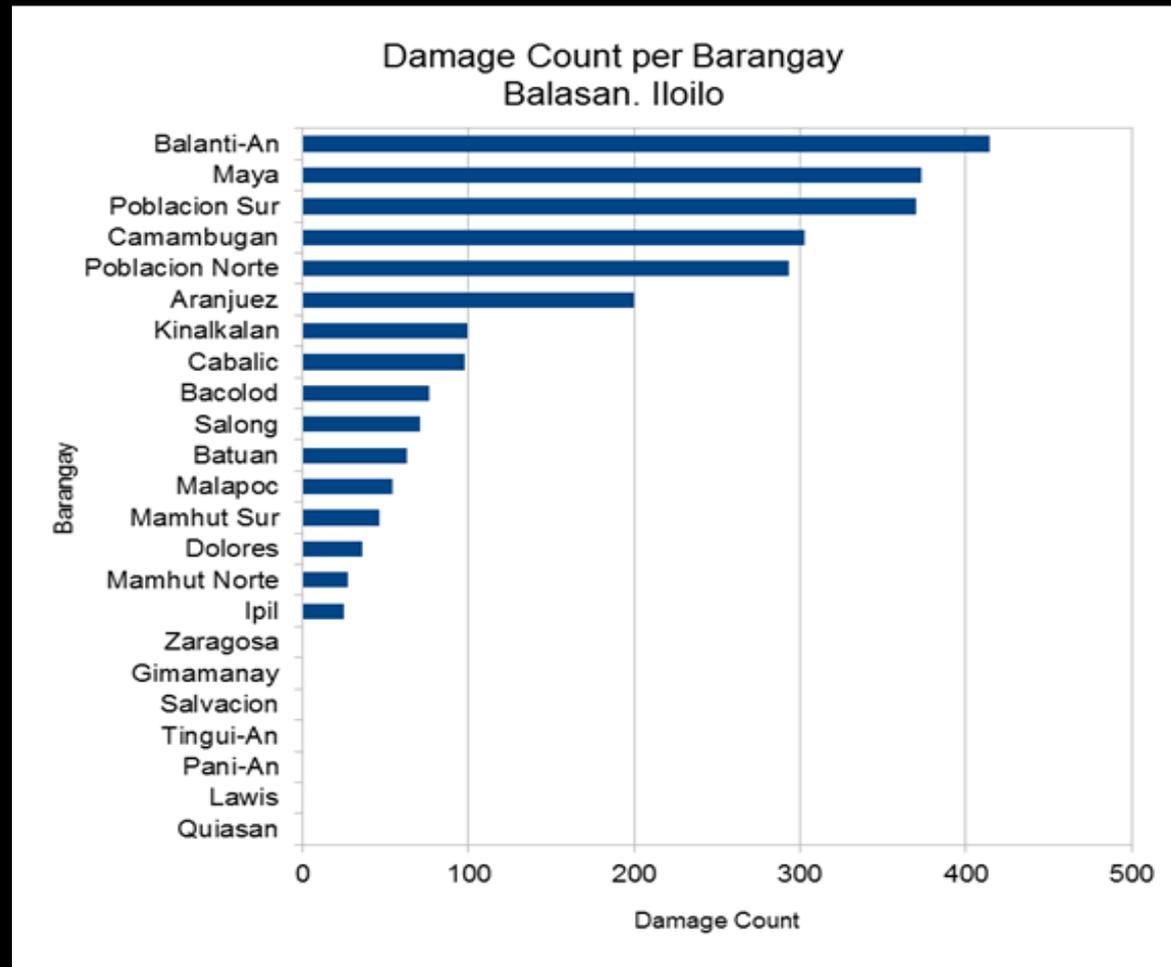


# Summary: Inventory of Damaged Buildings per Barangay

Barangays	Population	Damaged Infrastructure
136	215944	14136
Barangay	2010 Population	Damaged Infrastructure
Barangay 96 (Calanipawan)	5672	1183
Barangay 89	4234	1121
Barangay 88	9806	1096
Barangay 94 (Tigbao)	2802	842
Barangay 90 (San Jose)	382	606
Barangay 95 (Caibaan)	4361	486
Barangay 109-A	8163	470
Barangay 78 (Marasbaras)	1788	451
Barangay 99 (Diiit)	5190	396
Barangay 71	5526	379
Barangay 80 (Marasbaras)	1231	352
Barangay 66-A	1236	346
Barangay 94-A	1320	340
Barangay 83-A (San Jose)	1782	318
Barangay 77	3680	309
Barangay 87	3464	305
Barangay 66	1419	294
Barangay 79 (Marasbaras)	1446	276
Barangay 74	7291	263
Barangay 69	2099	233



# Summary: Inventory of Damaged Buildings per Barangay



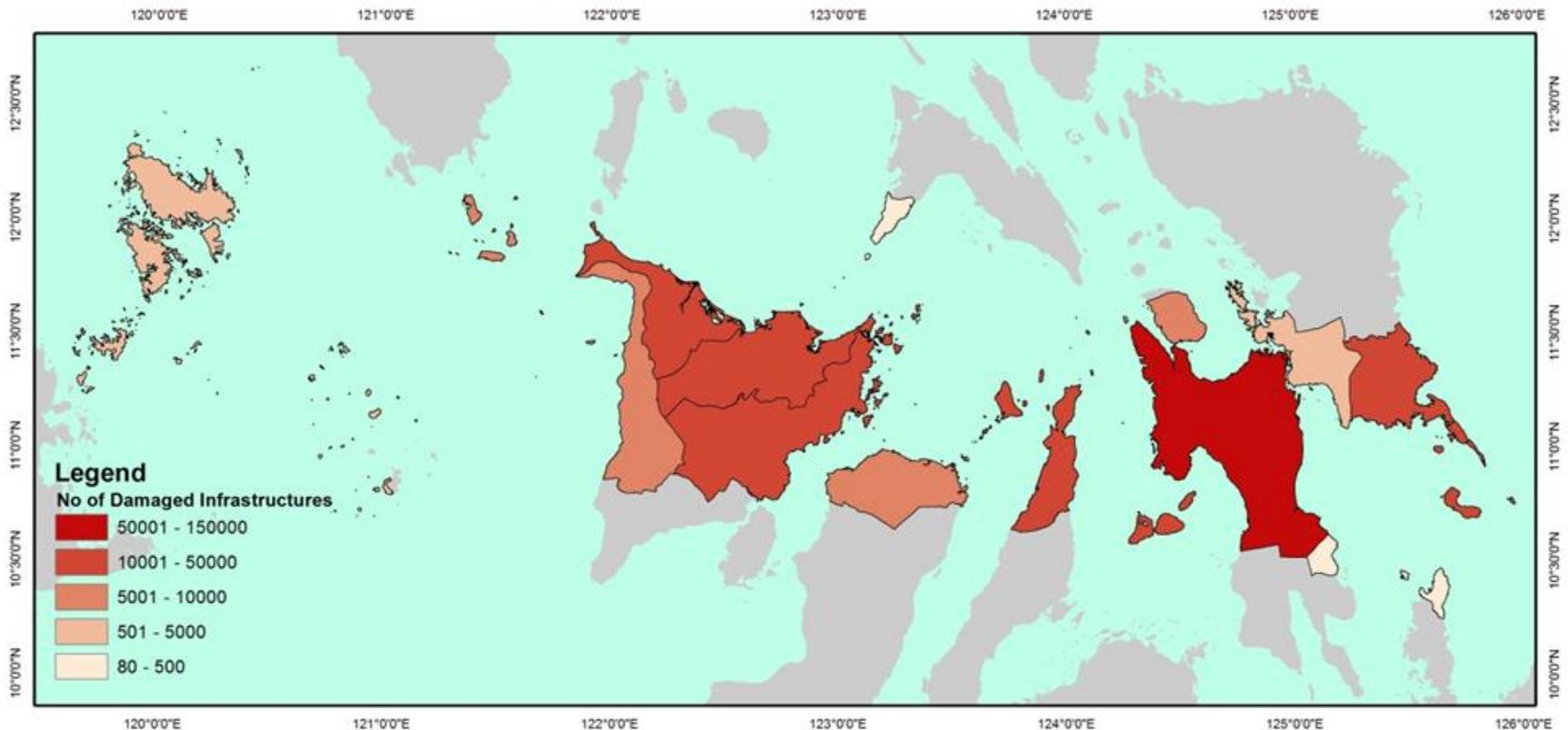
# Summary: Inventory of Damaged Buildings per Municipality

Municipality/City	Province	Number of Damages
Ormoc City	Leyte	26,665
Tacloban City	Leyte	14,136
Bantayan	Cebu	8,886
Roxas City	Capiz	8,847
Tolosa	Leyte	8,190
Palo	Leyte	8,181

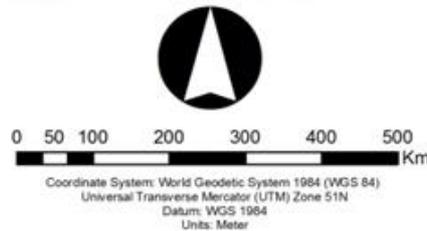
# Summary: Inventory of Damaged Buildings per Province

Province	No. of Damaged Buildings	2010 House Count
Aklan	31,553	116,123
Antique	5,484	67,868
Biliran	6,141	28,298
Capiz	25,296	159,061
Cebu	30,406	143,329
Dinagat Islands	143	2,182
Eastern Samar	12,006	38,341
Iloilo	30,254	264,078
Leyte	135,793	354,773
Masbate	76	7,240
Negros Occidental	9,206	152,054
Palawan	4,366	27,734
Samar	2,983	35,645
Southern Leyte	414	2,852
Total	294,119	1,399,578

# Typhoon Yolanda (Haiyan): Damage Assessment for 14 Provinces



*Administrative boundaries are approximate and unofficial*

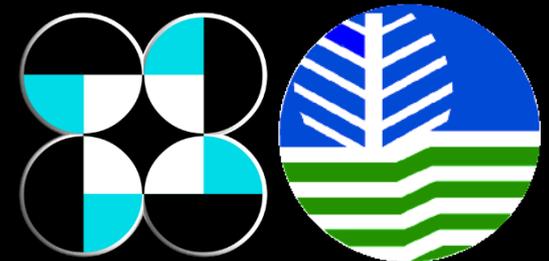


# Activities of Smarter Visayas

- During meetings with different Government Departments, it was agreed that DOST will provide a repository of all files, data and information related to Yolanda Rehabilitation Programs of the Government called YoRInfo Center giving SMARTER Visayas the responsibility to:
  - Create a repository system within DOST – ASTI and or DREAM to be known as YoRInfo Center;
  - Archive all SMARTER Visayas data, information and outputs in the system;
  - Store all data from other government agencies such as Hazard Maps, GIS Shapefiles, Statistics and other relevant information regarding Yolanda Rehabilitation efforts; and
  - Release of data to organizations or agencies after proper documentation and submission of necessary documents of request.

# YorInfo Center:

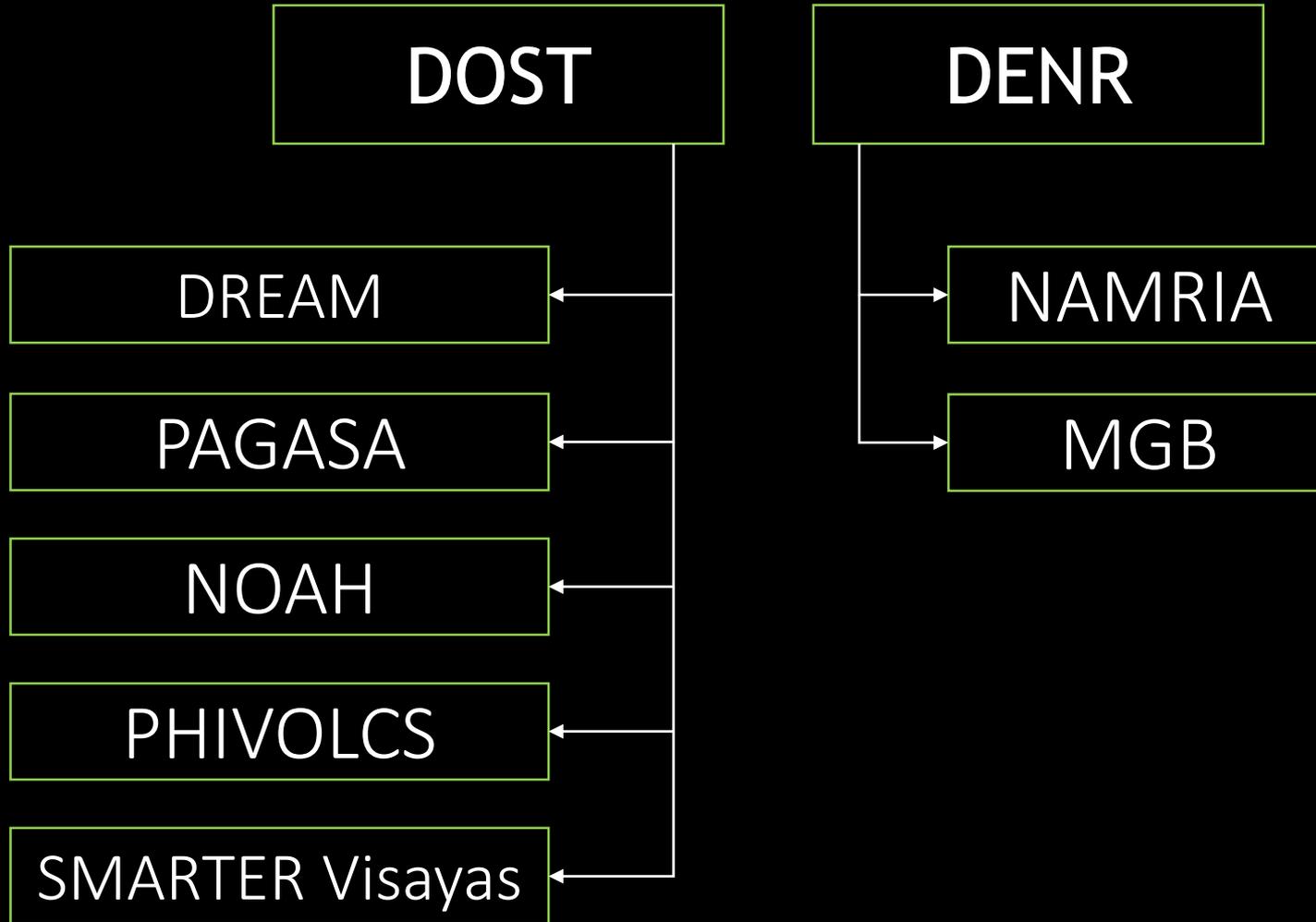
Yolanda Rehabilitation Scientific  
Information Center



# YorInfo Center

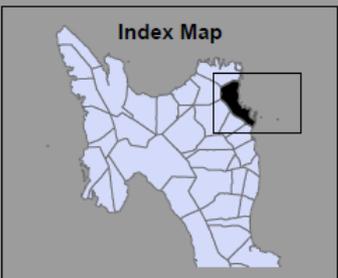
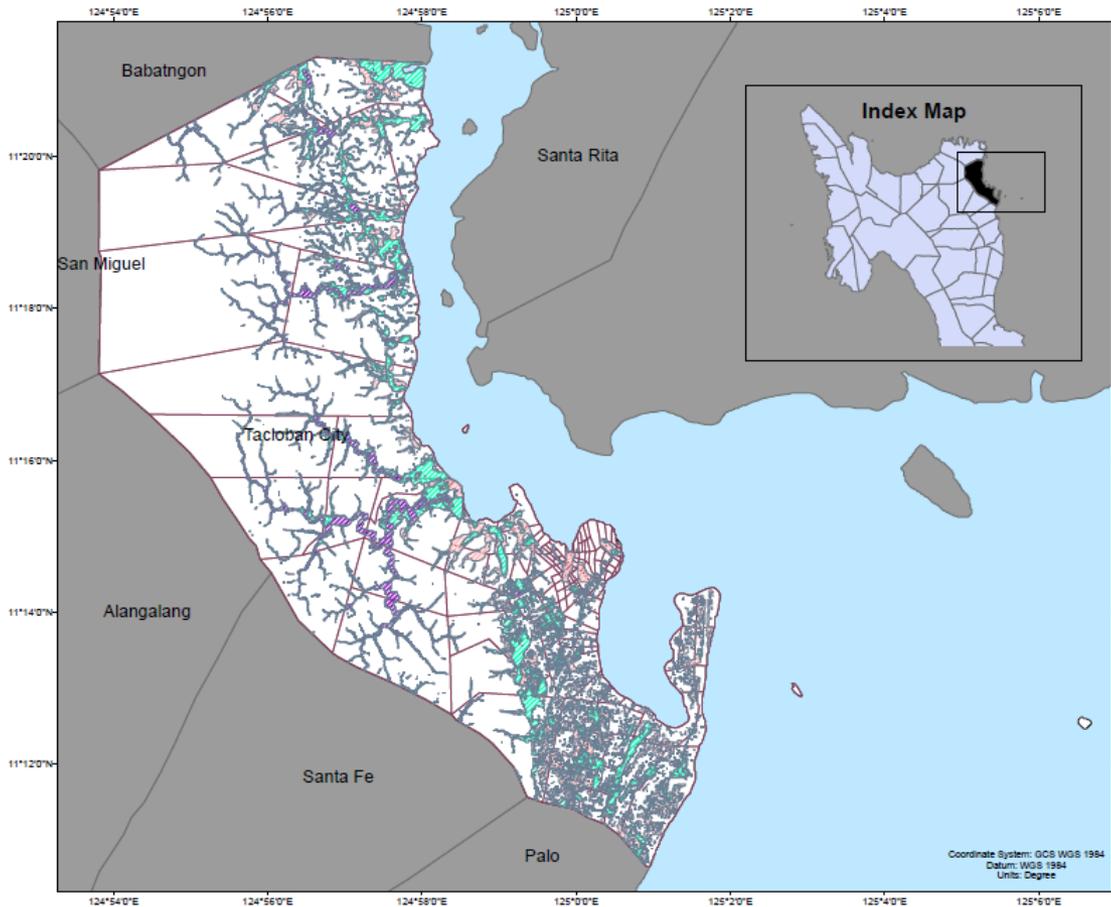
- Established for sharing and exchange of scientific data on 17 May 2014
- Combined various hazard maps generated by the different government agencies
  - Floods, Landslides, Storm Surges, Earthquake, etc.
  - Served as distribution center for the pre-and postsatellite images
- Meant to support post-disaster activities (rehabilitation and reconstruction) by providing a data and information sharing portal

# YorInfo Center



# DOST/DENR: DREAM and MGB

## Flood Hazard Map Tacloban City, Leyte

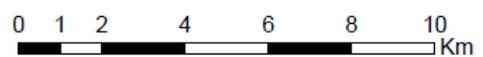


- Legend**
- Flood\_Hazards**
- Low (Flood Height: 0.1 m-0.5m AND Flood Velocity: 0.1 to 0.5m/s)
  - Moderate (Flood Height: 0.5 m-1.5m OR Flood Velocity: 0.5 to 1.5m/s)
  - High (Flood Height: >1.5m AND Flood Velocity: >1.5 m/s)

Topographic Data Source: Interferometric Synthetic Aperture Radar (IfSAR)



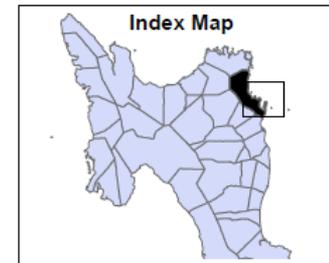
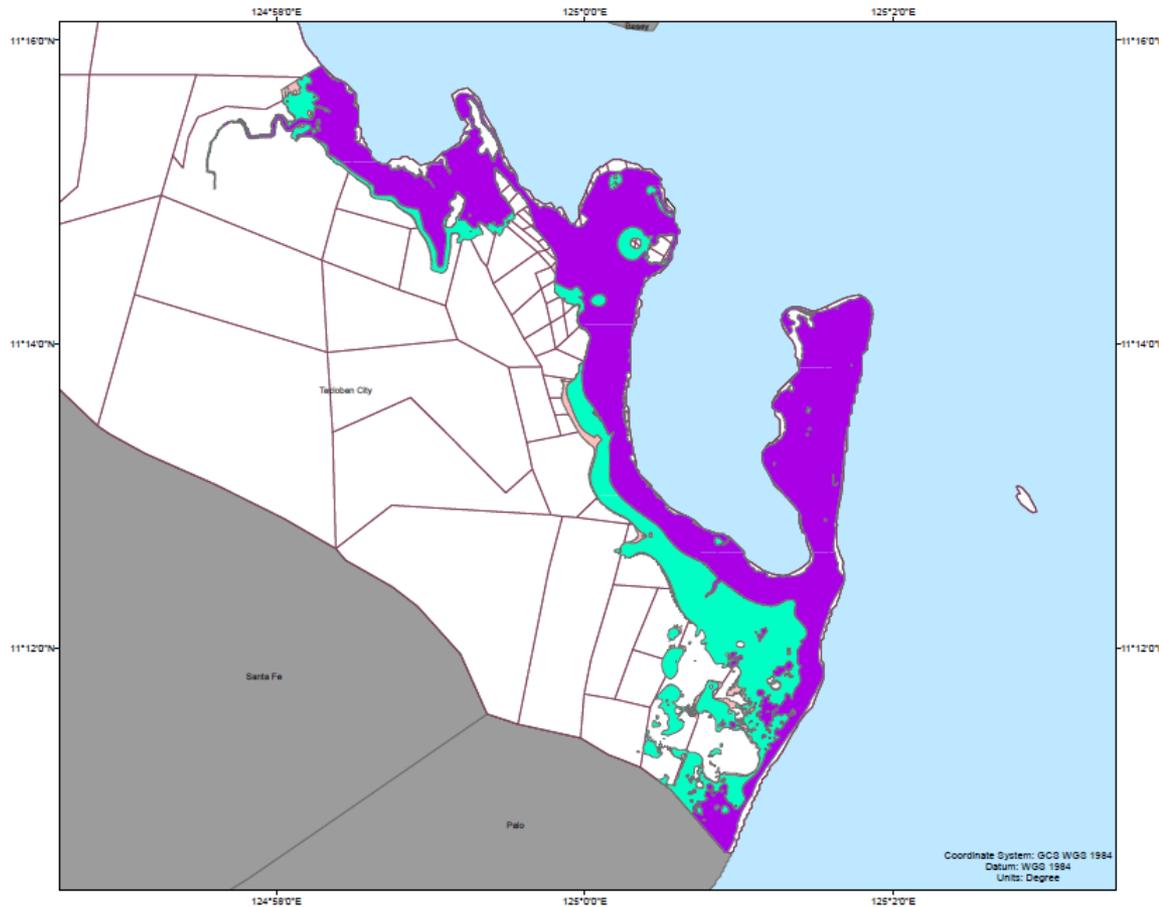
Scale 1:50,000



Coordinate System: GCS WGS 1984  
Datum: WGS 1984  
Units: Degree

# DOST: NOAH and PAGASA

## Storm Surge Hazard Map Tacloban City, Leyte



### Legend

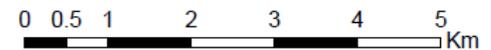
#### Storm\_Surge\_Hazard

- Low (Flood Height: 0.1 m-0.5m AND Flood Velocity: 0.1 to 0.5m/s)
- Moderate (Flood Height: 0.5 m-1.5m OR Flood Velocity: 0.5 to 1.5m/s)
- High (Flood Height: >1.5m AND Flood Velocity: >1.5 m/s)

Topographic Data Source: Interferometric Synthetic Aperture Radar (IFSAR)



Scale 1:25,000



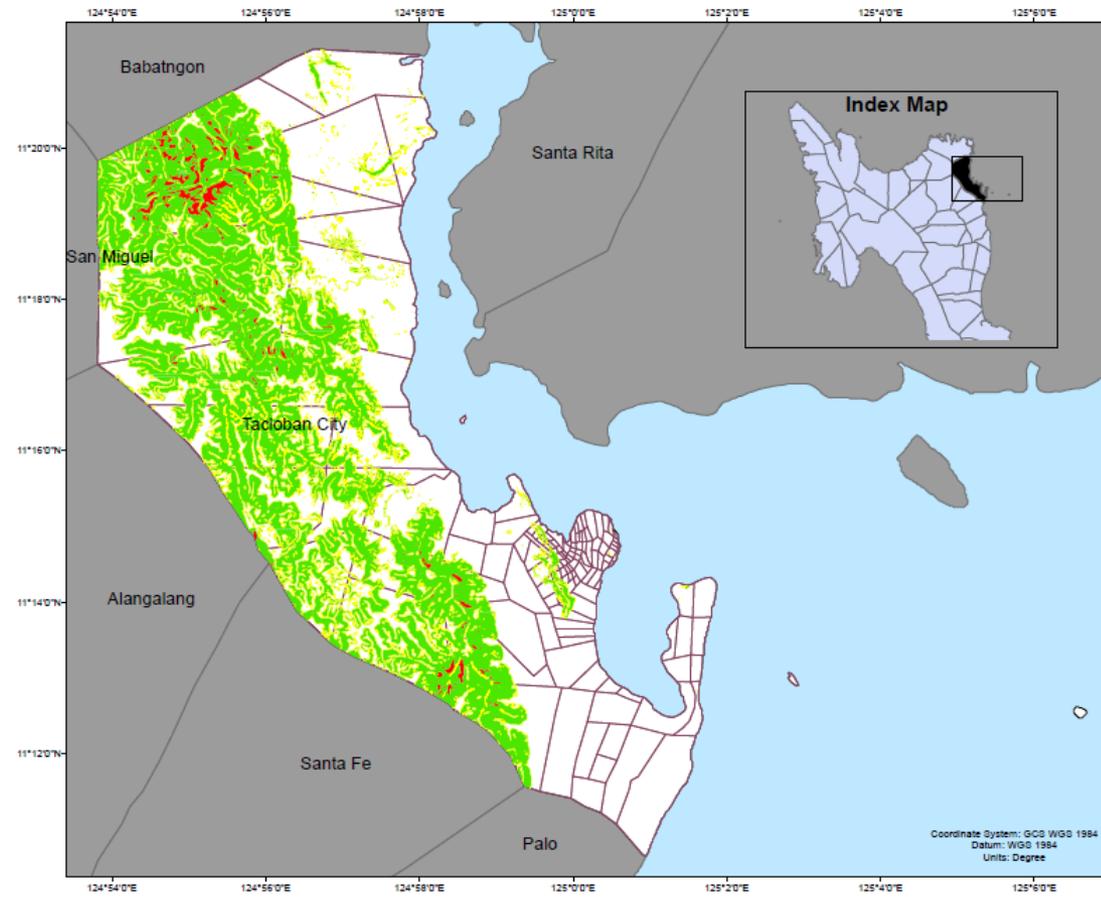
Department of Science and Technology

Disaster Risk and Exposure Assessment for Mitigation (DREAM)

Satellite-based Monitoring and Assessment of Rehabilitation in Typhoon-affected Regions (SMARTER) Visayas

# DOST/DENR: NOAH and MGB

## Landslide Hazard Map Tacloban City, Leyte



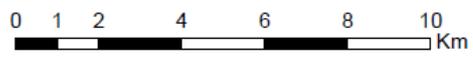
### Legend

- Landslide\_Hazard
- NO BUILD ZONE
- BUILD WITH SLOPE INTERVENTION, PROTECTION & MONITORING
- BUILD WITH SLOPE INTERVENTION

Topographic Data Source: Interferometric Synthetic Aperture Radar (IFSAR)



Scale 1:50,000



Coordinate System: GCS WGS 1984  
Datum: WGS 1984  
Units: Degree

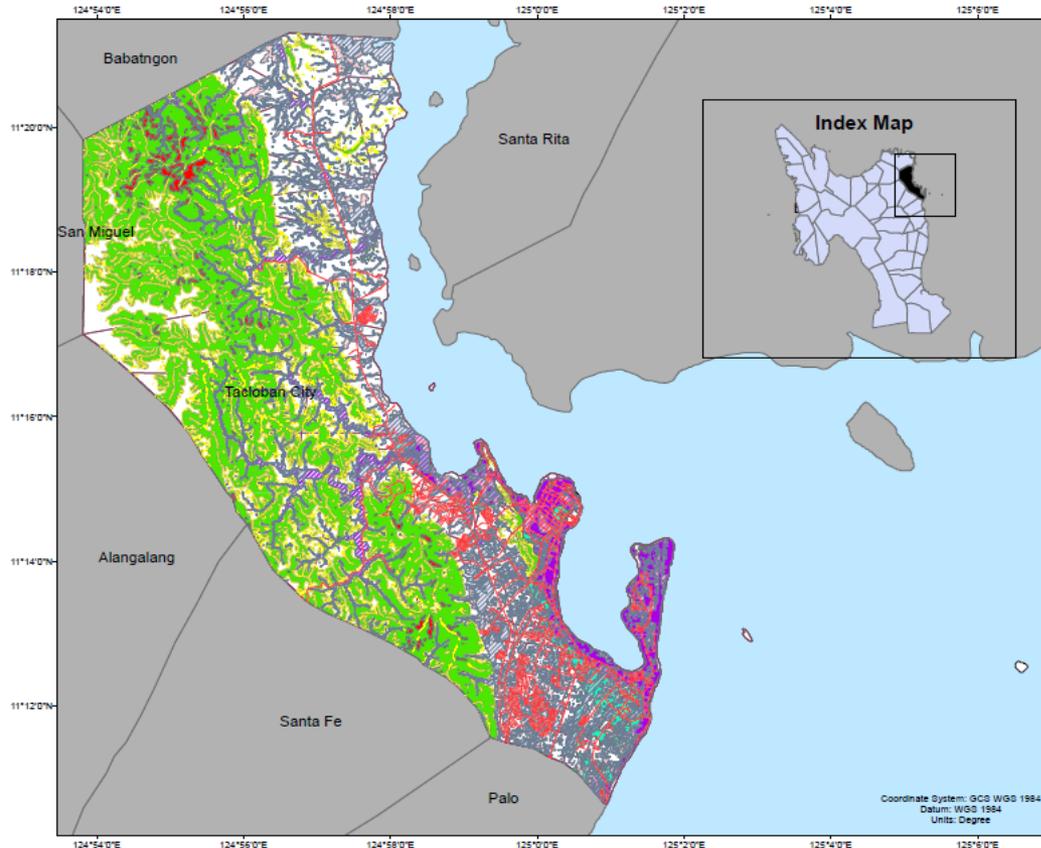


Department of Science and Technology  
Disaster Risk and Exposure Assessment for Mitigation (DREAM)  
Satellite-based Monitoring and Assessment of Rehabilitation in Typhoon-affected Regions (SMARTER) Visayas



# Multi-Hazard Mapping Efforts

## Multi - Hazard Map Tacloban City, Leyte



### Legend

Tacloban\_Roads

### Flood Hazard

- Low (Flood Height: 0.1 m-0.5m AND Flood Velocity: 0.1 to 0.5m/s)
- Moderate (Flood Height: 0.5 m-1.5m OR Flood Velocity: 0.5 to 1.5m/s)
- High (Flood Height: >1.5m AND Flood Velocity: >1.5 m/s)

### Landslide Hazards

- NO BUILD ZONE
- BUILD WITH SLOPE INTERVENTION, PROTECTION & MONITORING
- BUILD WITH SLOPE INTERVENTION

### Storm Surge

- Low (Flood Height: 0.1 m-0.5m AND Flood Velocity: 0.1 to 0.5m/s)
- Moderate (Flood Height: 0.5 m-1.5m OR Flood Velocity: 0.5 to 1.5m/s)
- High (Flood Height: >1.5m AND Flood Velocity: >1.5 m/s)

Topographic Data Source: Interferometric Synthetic Aperture Radar (IFSAR)



Scale

1:50,000



Department of Science and Technology

Disaster Risk and Exposure Assessment for Mitigation (DREAM)

Satellite-based Monitoring and Assessment of Rehabilitation in Typhoon-affected Regions (SMARTER) Visayas

## Data Access and Sharing

- Interested LGUs and Organizations may request for the hazard maps/data through OPARR
- For inquiries, you may visit our office at Room 304, National Engineering Center, Juinio Hall, UP Diliman

Daghang Salamat 😊

## DOST: First Satellite Made by Filipinos Named Diwata to Launch on 2016

Here's something that we can all be proud of – the Philippines is set to launch its very own and proudly *Pinoy-made* micro-satellite codenamed **Diwata** or 'Fairy' in 2016.

Tweet

It will be made by **Filipino students** currently undertaking their Masteral program in Tohoku and Hokkaido universities in Japan. *The micro-satellite is their thesis!*

### Here's how Diwata might look like:



Since Japan is involved, Diwata might look like JAXA's SDS-1. (Image: JAXA)

A micro-satellite weighs around **50 kilograms only** – considerably lighter and smaller than ordinary satellites. This makes it cheaper to launch but still provides sufficient observational data such as pictures and measurements.

**Diwata will be able to capture up to 3,600 images daily** using a High Precision Telescope and a Spaceborne Multispectral Imager. These photos can be used for disaster preparedness and response, environmental conservation and analysis as well as security purposes among others.

Home » News » National » PH to launch own microsatellite in 2016

## PH to launch own microsatellite in 2016

by Edd K. Usman and Francis Wakefield  
June 30, 2014

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The Philippines is blasting off into the space age with the planned launching of its own microsatellite in July ,2016, with the cooperation of the Japan Aerospace Exploration Agency.

The Department of Science and Technology (DOST) said the space venture is part of the government's disaster risk management program.

The space program has two components: the Development of the Philippines' Earth Observation Microsatellite (DIWATA), with a budget allocation of P800 million; and the Philippine Earth Data Resources and Observation Center (PEDRO), with a budget of P600 million, DOST Secretary Mario Montejo said.

DOST's Philippine Council for Industry, Energy, and Emerging Technology Research and Development (PCIEERD) said DIWATA is expected to gather "on-demand and real-time status of the country's environment, particularly for applications such as disaster risk management, land-use, and aquatic resource assessment and monitoring."

On the other hand, PEDRO will serve as an earth-receiving station that will "securely receive, process, and exploit and distribute space-borne imagery and derive information from the supported remote sensing satellites."

The government-owned microsatellite can be used to improve weather detection and forecasts, agricultural growth patterns, and monitor forest cover and the country's territorial borders, Montejo said.

"We can develop a lot more uses for the microsatellite if we keep on improving its capability to expand its applications," he added, citing that the Philippines presently relies on third-party service providers and commercial vendors for satellite data and interpretation.

He also said that with a microsatellite and receiving station, the country will be able to gather its own satellite images and other data and not rely anymore on foreign sources.

PCIEERD Executive Director Dr. Rowena Cristina L. Guevarra said DIWATA will be developed in partnership with the Tohoku University and Hokkaido University of Japan.

She said PCIEERD will monitor the implementation of the space program to be implemented by the University of the Philippines.

"We are going to launch the microsatellite development program this coming July. Then, we will be sending seven engineers to Japan for the training with the two universities," Guevarra said.