

# Drones and Its Applications

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# What is a Drone?

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**Drone** is a relatively small size remote controlled or automatic pilotless aircraft.

Advantages	Disadvantages
<ul style="list-style-type: none"><li>• Cheap and cost effective</li><li>• High spatial resolution</li><li>• High accuracy</li><li>• Easier to deploy</li><li>• No hindrances from clouds</li><li>• A great tool for surveillance</li></ul>	<ul style="list-style-type: none"><li>• Limited capabilities and coverages</li><li>• Care required to use in populated areas</li><li>• Chances of misuse due to easy operation</li></ul>

# Types Drones and Their Uses

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## Multirotor

- Flying height: Up to 500 m
- Flying time: 20-30 mins.
- Coverage: 0.4-0.8 km<sup>2</sup> per flight
- Range: 5 km



## Fixed-wing

- Flying height: Up to 1,000 m
- Flying time: 50-60 mins.
- Coverage: 10-40 km<sup>2</sup> per flight
- Wing span: 1-2 m
- Range: 30-60 km

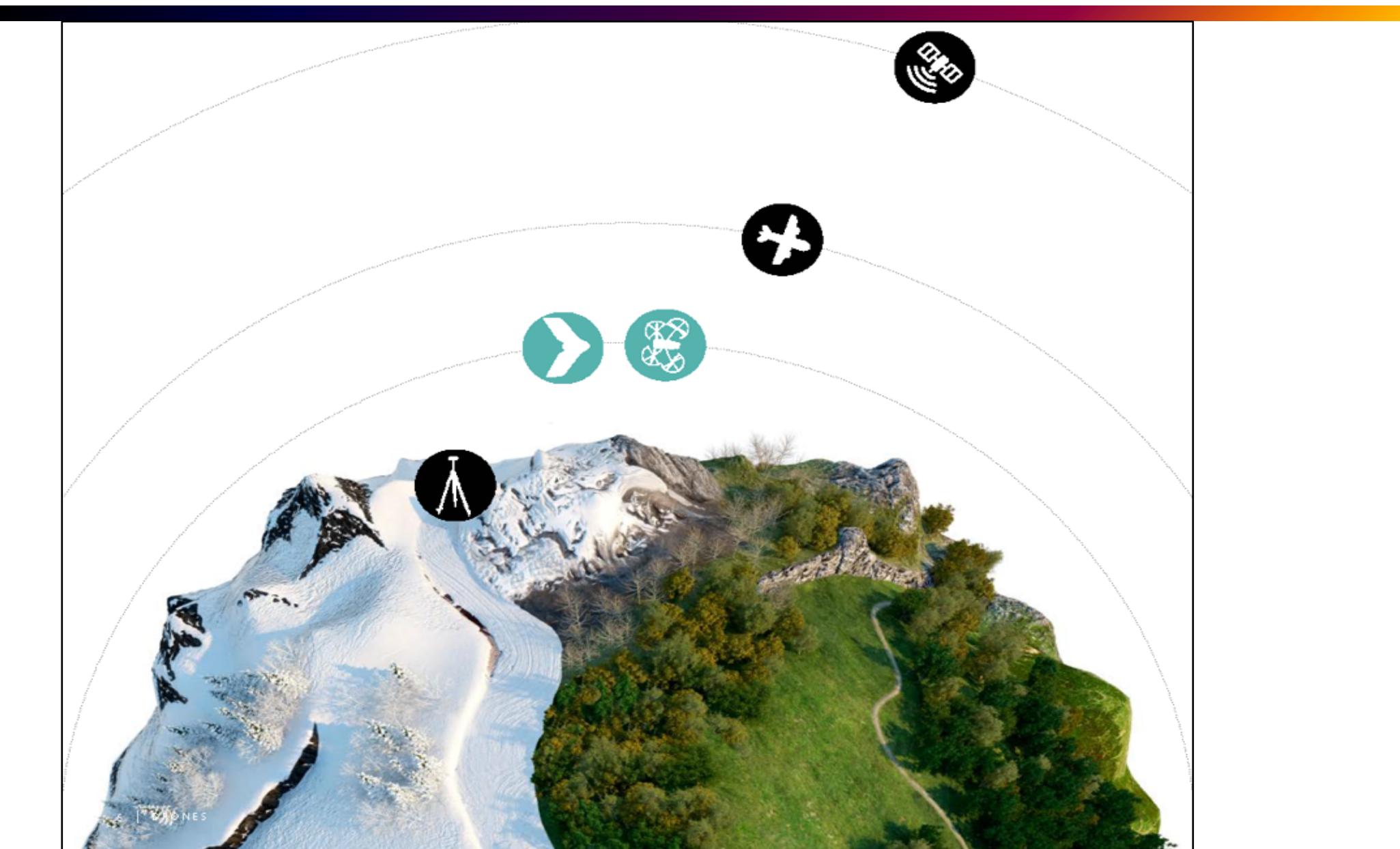


# Multi-rotor Vs. Fixed-Wing Drones

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Multi-rotor	Fixed-wing
<ul style="list-style-type: none"><li>• Cheap</li><li>• Easier to operate</li><li>• Vertical and easy landing</li><li>• Short flights and low coverage</li><li>• Suitable for local mapping</li><li>• Comply with aviation regulations</li></ul>	<ul style="list-style-type: none"><li>• Relatively expensive</li><li>• Need experienced operators</li><li>• Horizontal landing and need sufficient space</li><li>• Long flights and high coverage</li><li>• Suitable for large area mapping</li><li>• Often needs permission to fly</li></ul>

# Data Acquisition Platforms

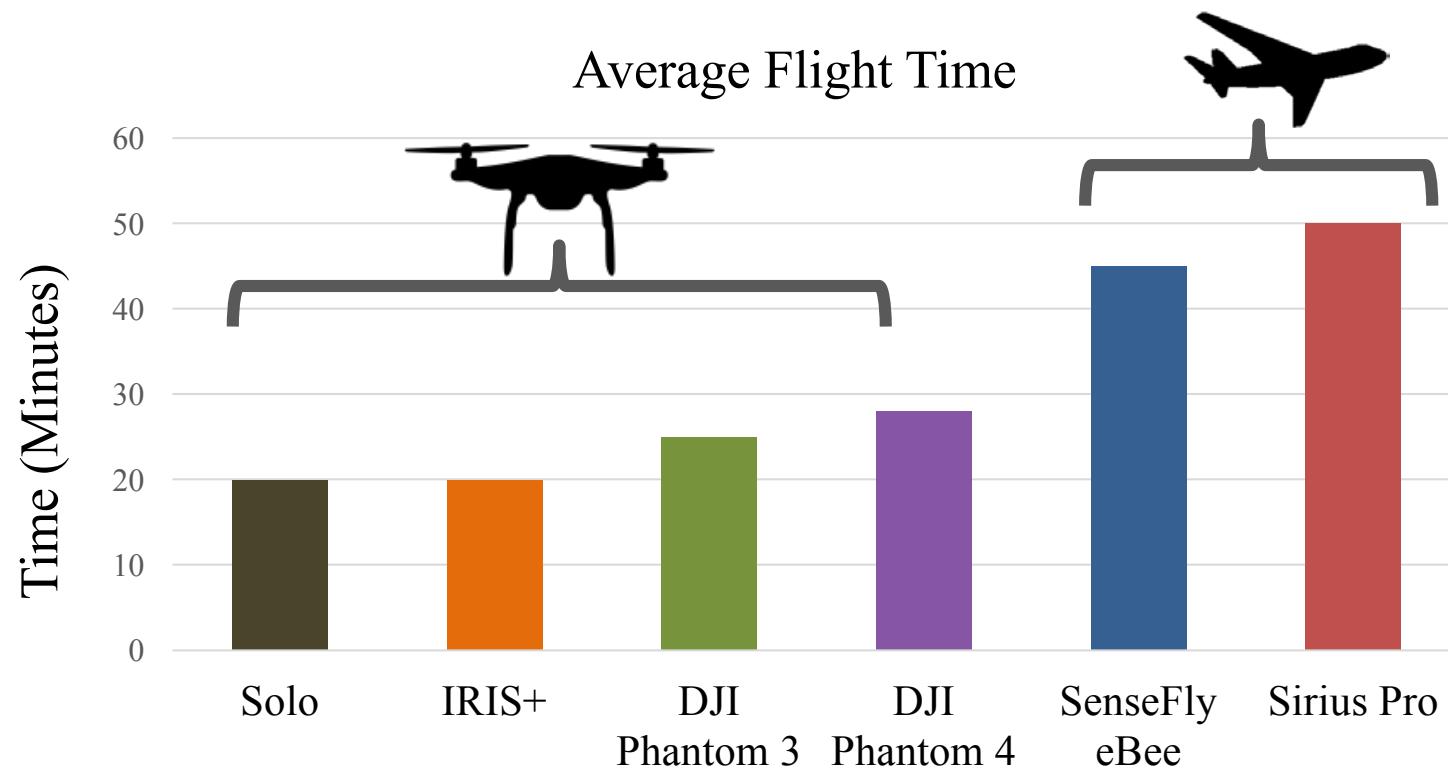


# Data Acquisition Platforms - Pros and Cons

Platforms	Pros	Cons
Satellite 	+ Extensive coverage + Wide spectral capabilities	- Expensive data - Relatively low-resolution (50 cm/pix) - Data acquisition bi-weekly/weekly
Aircraft 	+ Large single-flight coverage + High-resolution (7 cm/pix) + Wide spectral capabilities	- Very expensive (for large projects) - Image timing controlled by provider - Operations susceptible to weather
Drone 	+ Image acquisition on demand + Very high-resolution (1 cm/pix) + Unaffected by cloud cover + Cost effective and safe	- Relatively small coverage - Drone regulations can restrict usage - Operations susceptible to weather
Surveying 	+ Excellent positional accuracy + Very high-resolution	- Slow, tedious, and labour-intensive - Difficult to record tops of features - Some sites inaccessible on foot

# Flying Time of Specific Drones

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# Cameras/Sensors Used in Drones

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## RGB Cameras

Image what we see for scouting and monitoring



Cannon S110



DJI Phantom  
built-in Camera

## LiDAR Sensors

Provide high definition 3-dimensional information about the surrounding environment



Valodyne Puck LITE

# Sensors Used in Drones

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## Thermal Sensors

Capable of measuring temperature from -40 to 160 Deg. C with a resolution of down to 0.1 C.



**FLIR Duo**

## Multi Spectral Cameras

Analyse crop conditions



**Parrot Sequoia**



**Micasense RedEdge**

# Cost of Fixed-Wing Drones

Model/Brand	Specifications	Price
Trimble UX-5 	Flying time: 59 min. Coverage: 10-40 km <sup>2</sup> /flight Resolution: up to 1 cm/pix Accuracy: 3cm (H) / 5cm (V)	30,000 USD
SenseFly eBee Plus 	Similar to above	25,000 USD
Custom-built (AIT/NIED) 	Similar to above	10,000 USD

# Cost of Multi-rotor Drones

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Model/Brand	Specifications	Price
DJI-Phantom 	Flying time: 20-30 min. Coverage: 0.5 km <sup>2</sup> /Flight Resolution: up to 1 cm/pix Accuracy: 3cm (H) / 5cm (V)	1,200 USD

# Our Own Custom Built UAVs

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**Fixed-Wing**



**Testing**

# Drone Regulations

Country	Regulations
Philippine	<ul style="list-style-type: none"><li>- Drone owners and/or operators are now required to register their equipment with the CAAP, and secure a certification to operate from the agency-</li></ul>

# Drones Applications

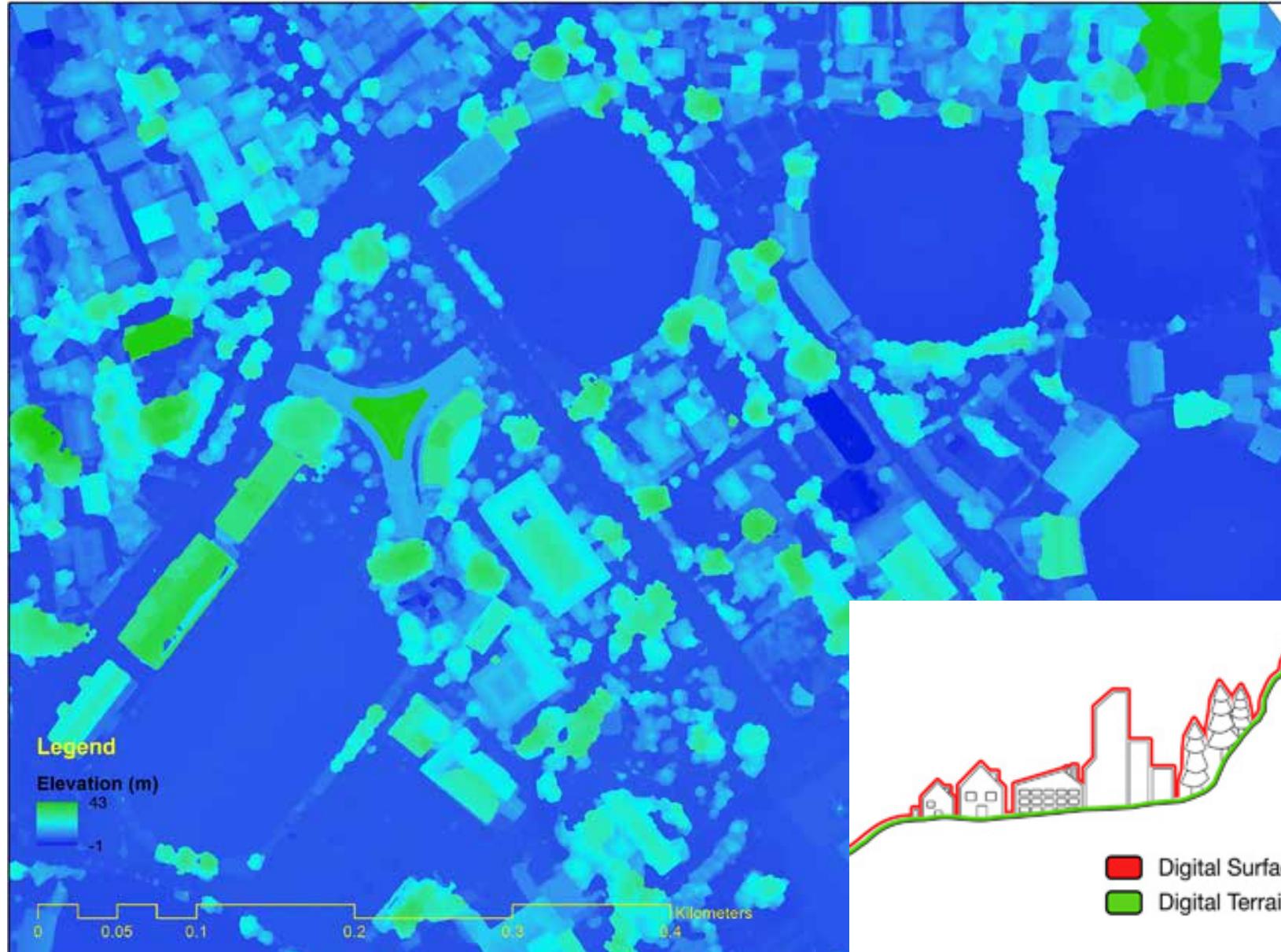
# Urban Planning Related Applications Using Drones

Area	Applications
Surveying and Mapping 	<ul style="list-style-type: none"><li>- Prepare accurate geo-referenced maps, including the base-maps</li><li>- Extract point clouds and digital surface/elevation models</li><li>- Provide ortho-mosaic</li><li>- Prepare and provide contour Lines</li><li>- Make 3D renderings of buildings and geographic feature</li><li>- Estimation of cut/fill volume</li></ul>
Infrastructure Planning 	<ul style="list-style-type: none"><li>- Site analysis, planning and design</li><li>- Construction management and monitoring</li><li>- Asset mapping and monitoring</li><li>- 3D modelling and extraction of features (vegetation, buildings, roads etc.)</li></ul>
Disaster Management 	<p><u>Pre-disaster</u></p> <p>Hazard and exposure mapping and risk assessment</p> <p><u>Post-disaster</u></p> <p>Mapping and monitoring the extent of disasters</p> <p>Situational awareness for emergency response coordination</p> <p>Search and rescue operations</p> <p>Damage mapping for insurance industries for assessing the insurance claims</p>

# Surveying & Mapping - Prepare Accurate Latest City Maps



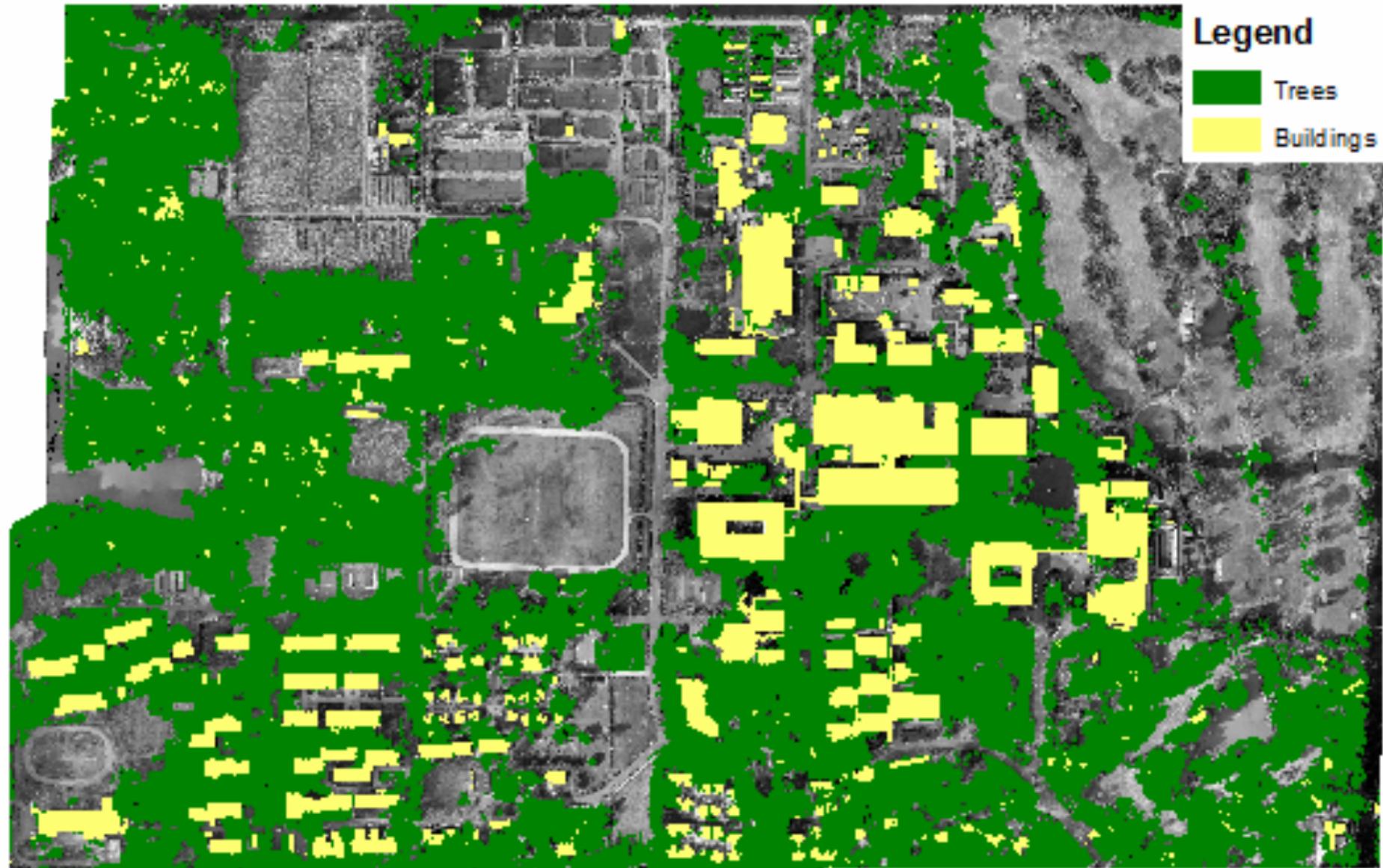
# Surveying & Mapping - DEM (DSM and DTM)



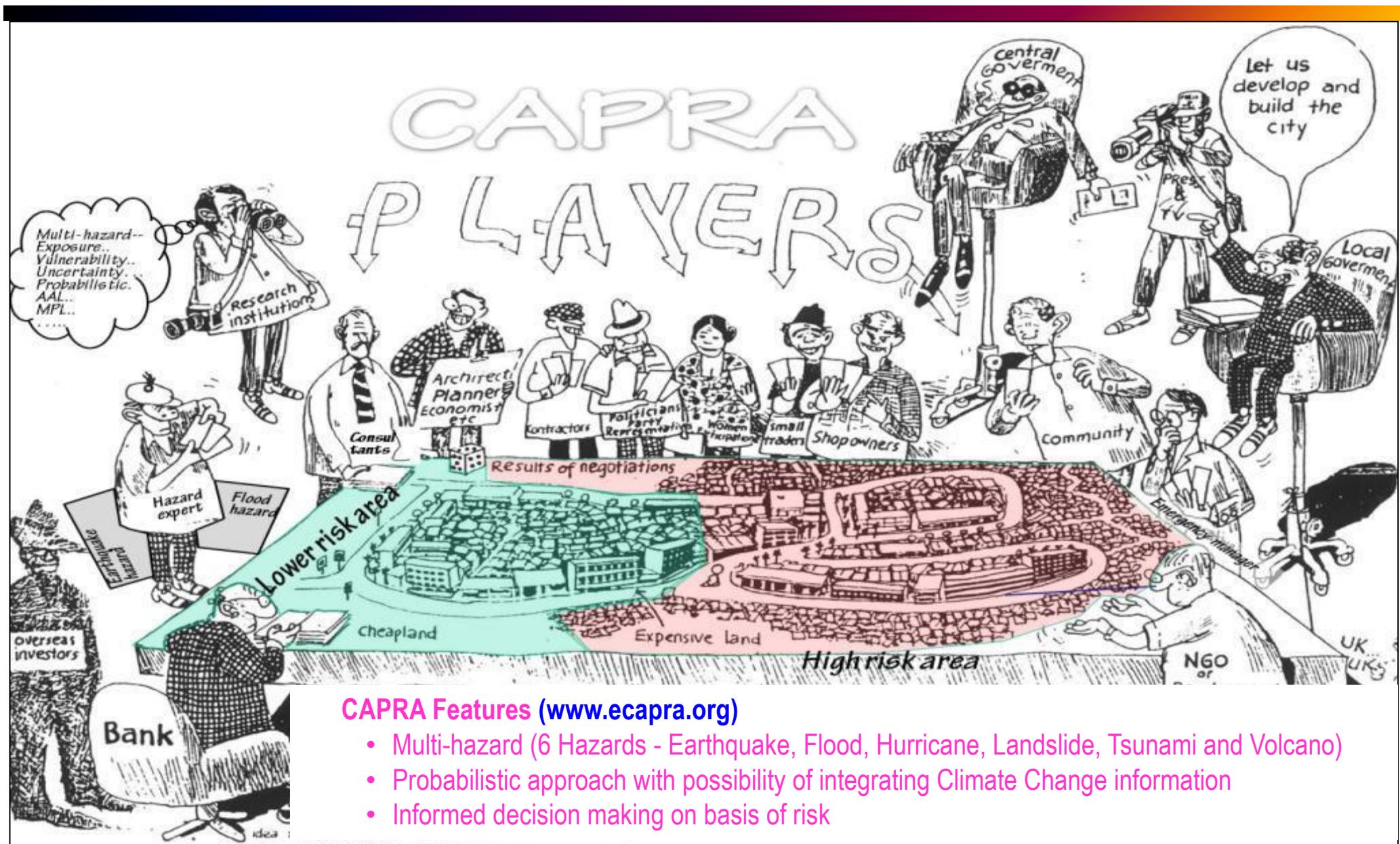
# Surveying & Mapping -3D Model of Buildings



# Surveying & Mapping - Mapping of Urban Green Areas



# Pre-Disaster: Multi-hazard Risk Mapping



## CAPRA Features ([www.ecapra.org](http://www.ecapra.org))

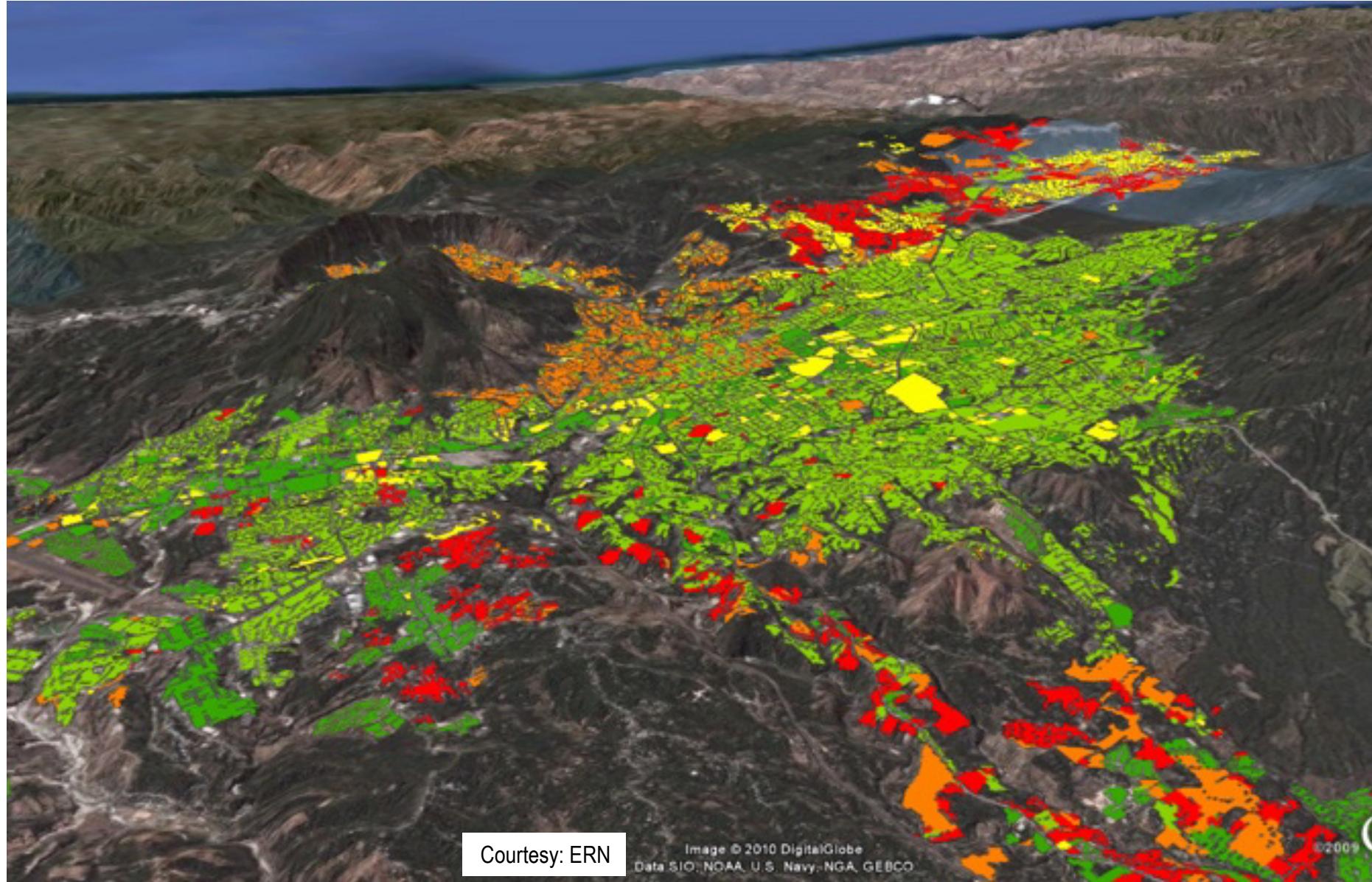
- Multi-hazard (6 Hazards - Earthquake, Flood, Hurricane, Landslide, Tsunami and Volcano)
- Probabilistic approach with possibility of integrating Climate Change information
- Informed decision making on basis of risk

# Pre-Disaster: Disaster Risk Maps (Building Level)

Relative economic loss. - Probabilistic analysis for Wind and storm (Hurricane) surge combined



# Pre-Disaster: Disaster Risk Maps (City Level)



# Post-Disaster: Mapping of Disaster Affected Areas

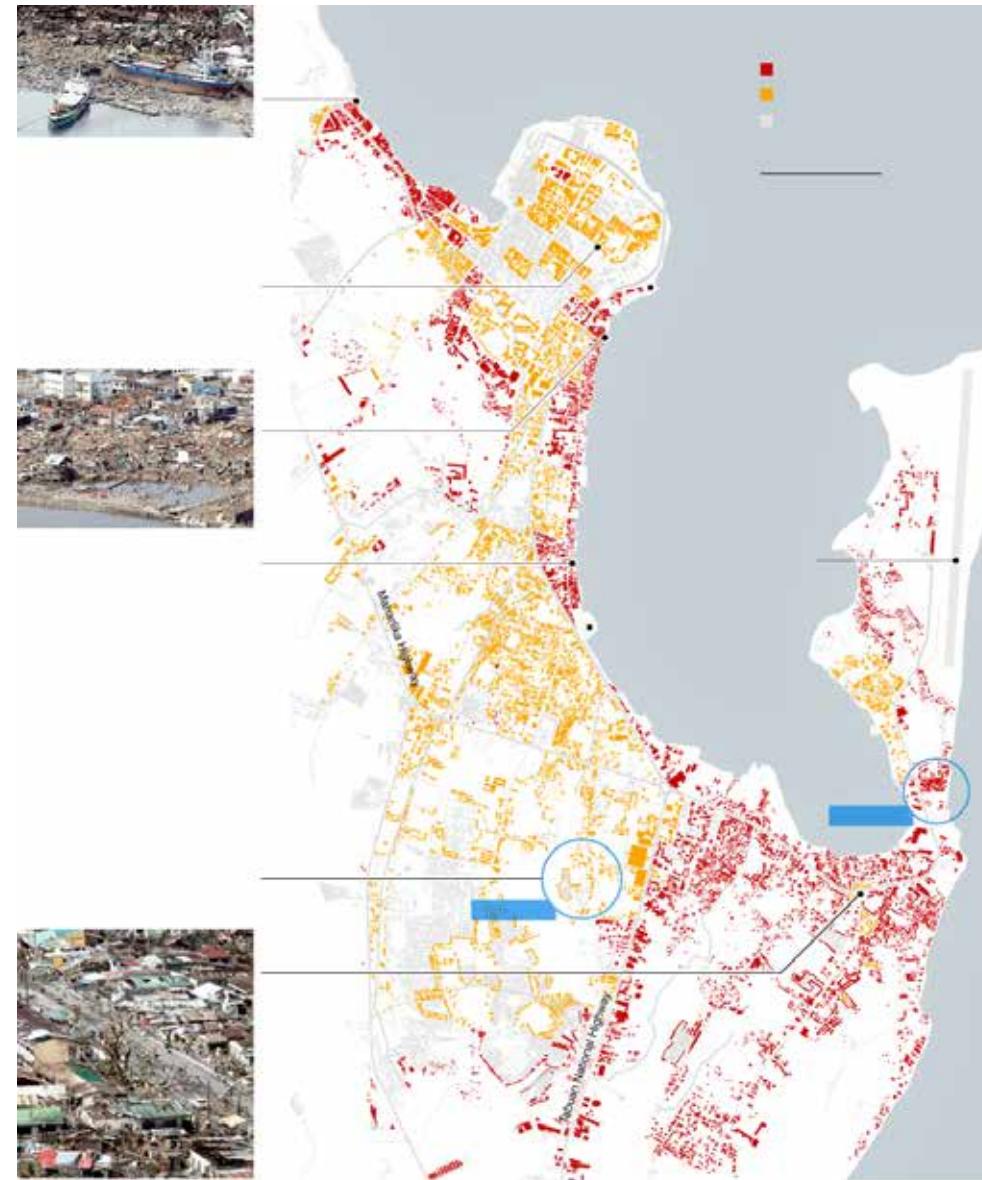
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# Post-Disaster: Assess the Extent of Damage by Insurance Companies



# Hurricane Haiyan Damage (High-resolution Satellite Images)



**Thank you for your kind attention**

