K&C Phase 3 – Brief project essentials

Mangrove extent, change and structure in Africa and the Americas

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Project objectives and schedule

We propose to produce detailed maps of land cover and forest structure change in mangrove forests of the Americas and Africa using the K&C PALSAR data.
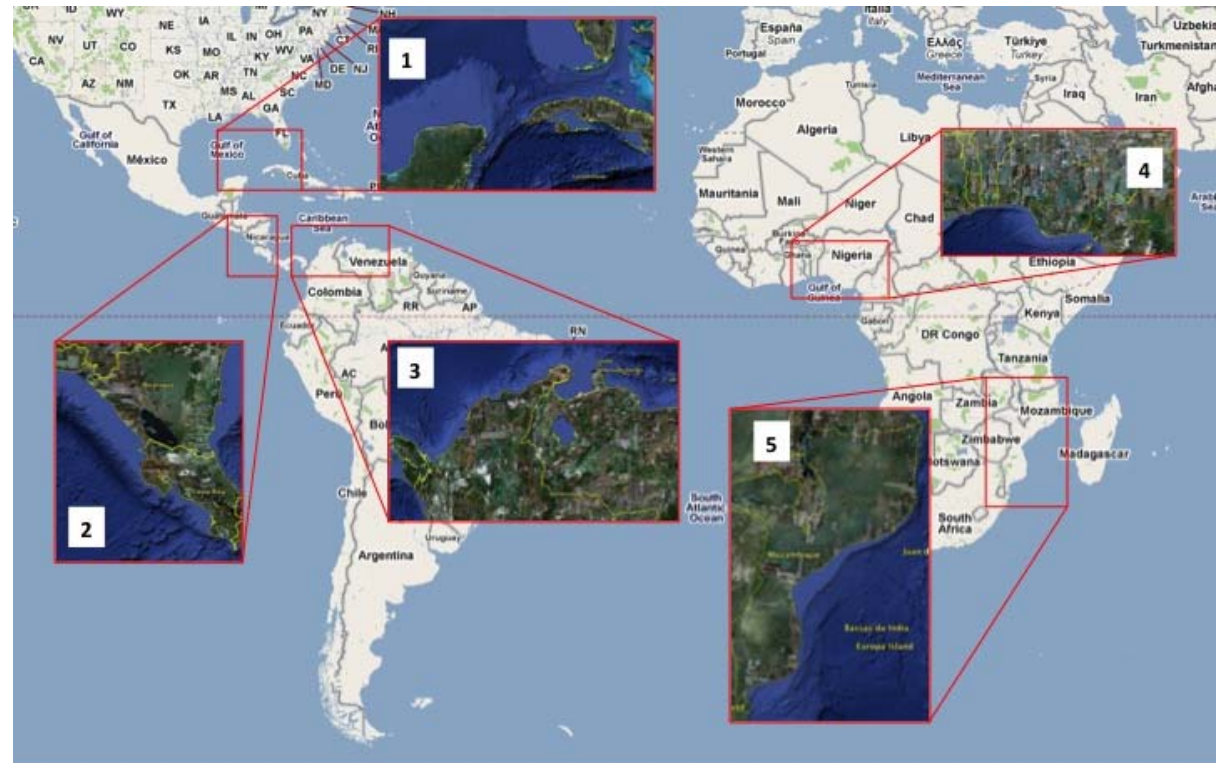
Objectives :

1) Improve current global maps of mangrove cover,

2) Produce annual land cover change products for key sites in the Americas and Africa, and

3) Produce tree height, biomass and carbon storage estimates for these sites

☐ This project responds to the original K&C objective of "developing of a regional scale application" by producing annual land-use change and forest structure products for regional sites in the Americas and Africa.

☐ We have chosen sites based on our access to field and remote sensing data (PALSAR, UAVSAR, GLAS, airborne lidar, SRTM).

☐ These mangrove systems are also chosen for the importance in terms of biodiversity, ecosystem function, local-regional livelihoods and landscape change, as well for their locations across distinct yet representative regional and bio-geographic contexts.

Project areas

Project area(s)

- Gulf of Mexico:
  - Yucatan Peninsula, Mexico;
  - Southern Florida, USA)
- Central American Pacific Coast:
  - Gulf of Fonseca, Honduras;
  - Sierpe, Costa Rica
- Caribbean Coast of South America:
  - Cienaga Grande de Santa Marta, Colombia;
  - San Juan estuary, Venezuela
- Gulf of Guinea:
  - Togo-Benin-Nigeria Lagoons
- Mozambique:
  - Maputo Bay,
  - Zambezi Delta

1. Gulf of Mexico
2. Central American Pacific Coast
3. Caribbean Coast of South America
4. Gulf of Guinea
5. Mozambique

Project objectives and schedule

This project responds to all three of the K&C "3C" thematic drivers:

☐**International Conventions:**

- o the data products of land cover and change, forest height and biomass are crucial for the UN Reduced Emissions from Deforestation and Degradation (REDD) initiative, the UN Blue Carbon Initiative and the Ramsar Convention as they provide background and repeat data needed for the MRV (measuring, reporting and verification) process.

☐**Carbon cycle science**:

- o The proposed data products will improve current estimates of carbon storage in forest and coastal ecosystems.

☐**Environmental Conservation**:

- o the proposed products will also help in determining high conservation priority areas based on threats to and the health of the forest.

Project objectives and schedule

Foreseen deliverables/products:

☐Annual mangrove cover and change maps for regional sites in the Americas and Africa for 2007 through 2014.

☐Mangrove Tree height maps from K&C mosaics and ancillary field and GLAS data for the regional sites using a decision tree approach.

☐Mangrove Biomass maps and changes from K&C mosaics and ancillary field and GLAS data for regional sites using a decision tree approach.

Milestones and Target dates (expect at least a 3 months delay from original proposal)

☐12/2011: Mangrove cover product for the regional sites in America and Africa for 2007

☐12/2012: Mangrove cover change product for the proposed regional sites from 2007-2012

☐12/2013: Mangrove Above Ground Biomass, Tree height and cover change products for the regional sites through 2013

☐12/2014: Updates of all products with new data (up to 2014)

Support to JAXA's global forest mapping effort

The project can support JAXA's global forest mapping effort and help improve and validate the JAXA forest cover maps by:

☐ Improving the classification and algorithm development of the K&C annual map of global mangrove cover and changes in Africa and the Americas. Specifically, we will develop annual maps of mangrove cover and change in the five regions.

☐ Validating the K&C annual mangrove map from field data and other available remotely sensed data such as Landsat and UAVSAR.

☐ Validate the development of above ground biomass estimates in mangrove forests and help support the calibration and validation of the global mangrove biomass estimates developed by JAXA.
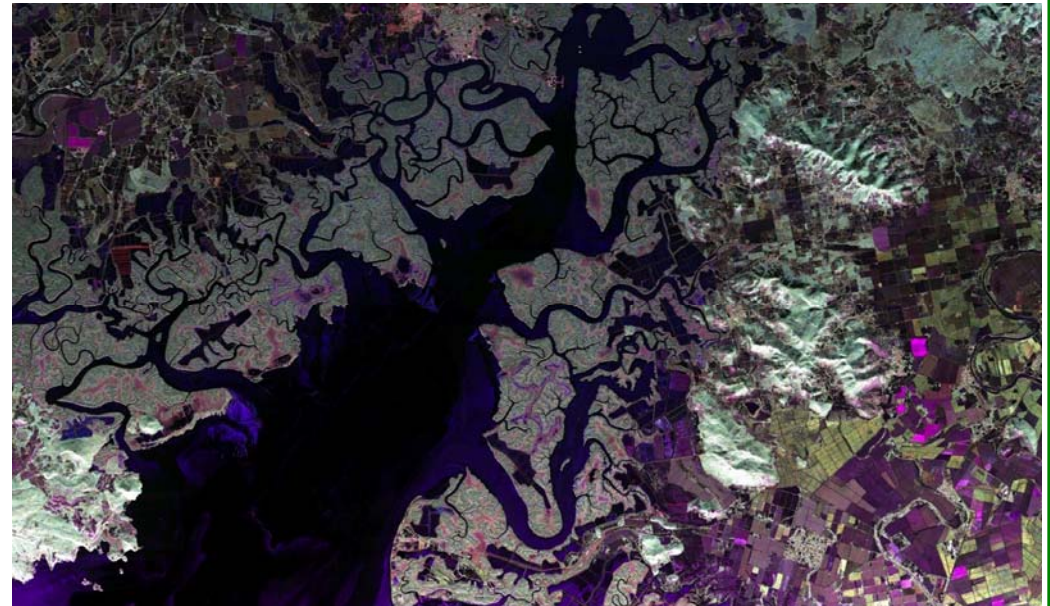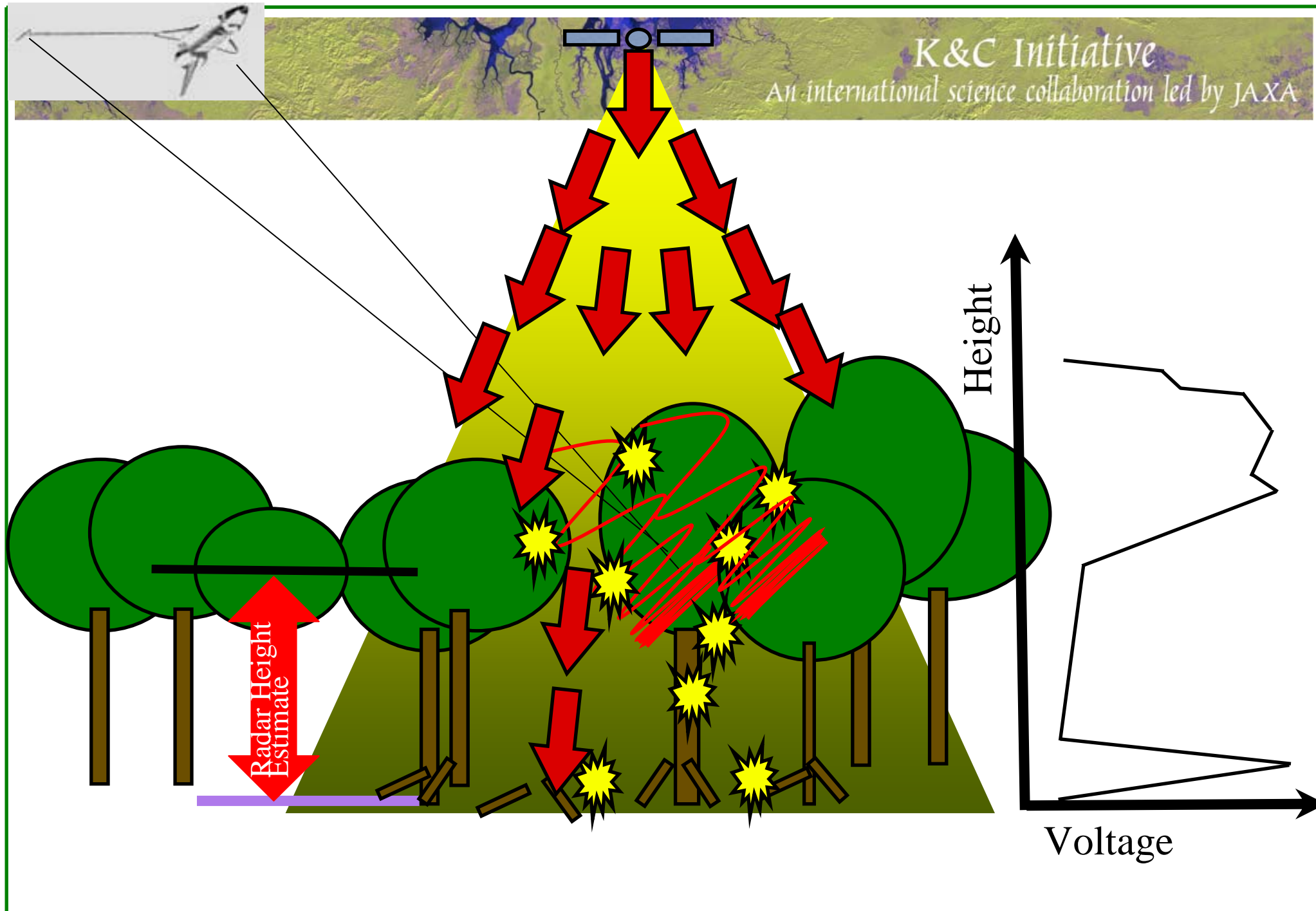

High resolution UAVSAR image of the Gulf of Fonseca, Honduras
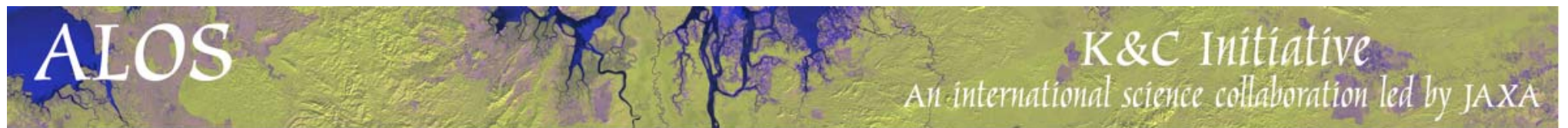
Our K&C project will benefit from significant heritage

Height

Voltage

Radar Height Estimate

Marc Simard (marc.simard@jpl.nasa.gov)

—Mangrove ecosystems are among the most productive on Earth, contributing 11% of global total C export to the ocean;

--- Already 35% of mangrove forests have disappeared and 60% could be lost by 2030;

—The estimated economical value varies between $200 000 to $900 000 per km² (UN report 2006);

—They act as a protection of shoreline against topical storms, hurricanes, storm surges and Tsunamis;
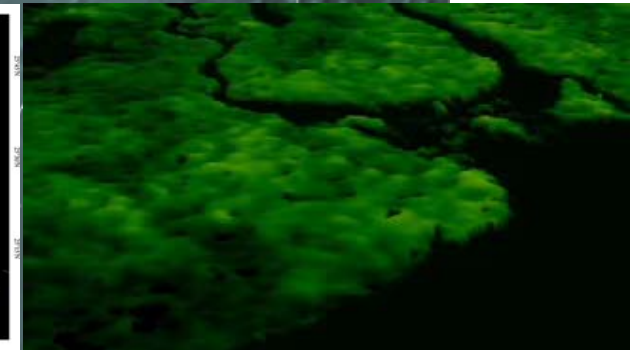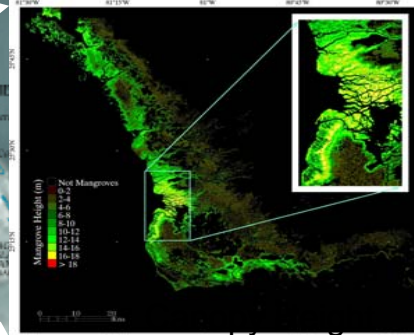
Simard et al., 2006
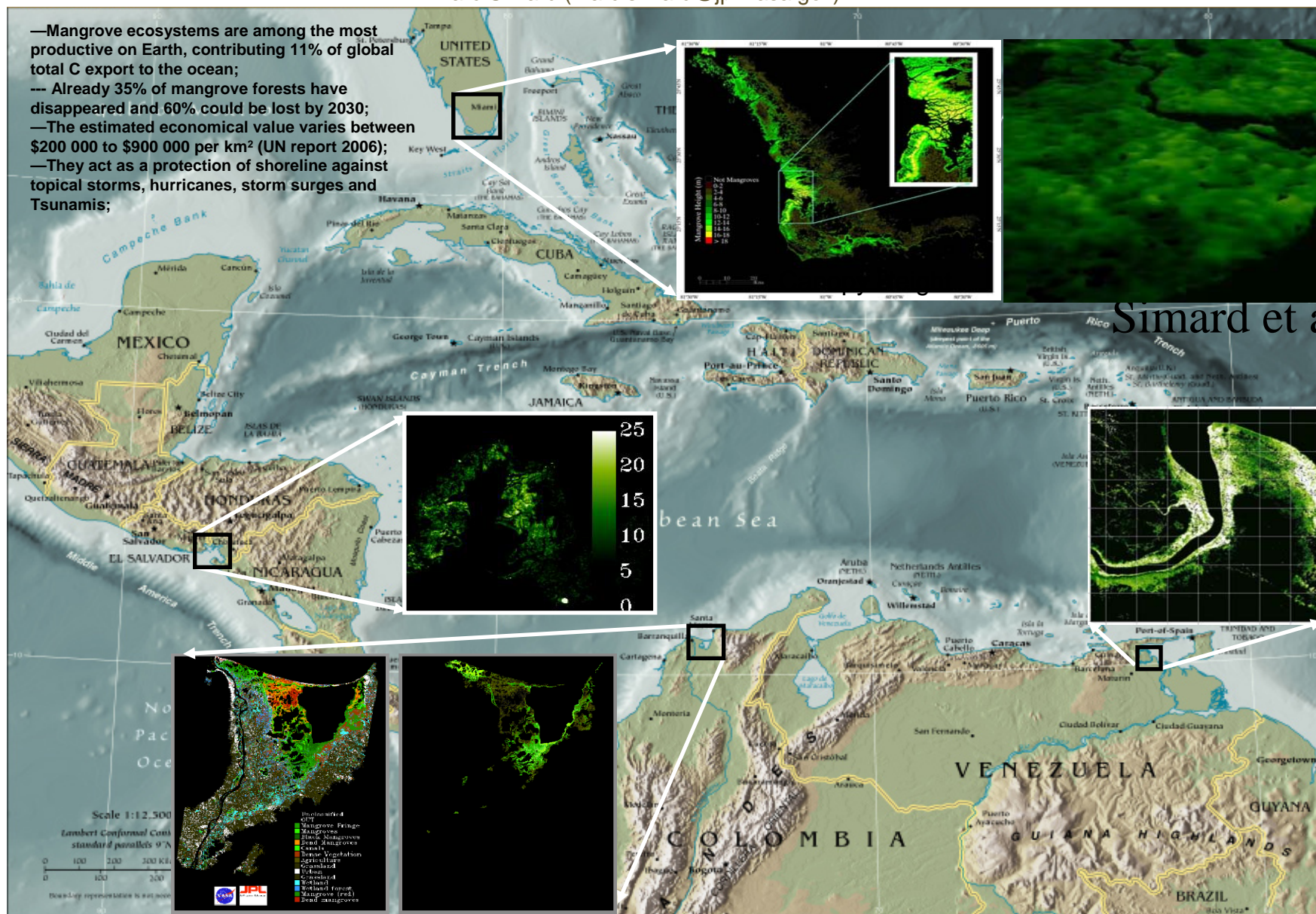
Cienaga Grande de Santa Marta, Colombia
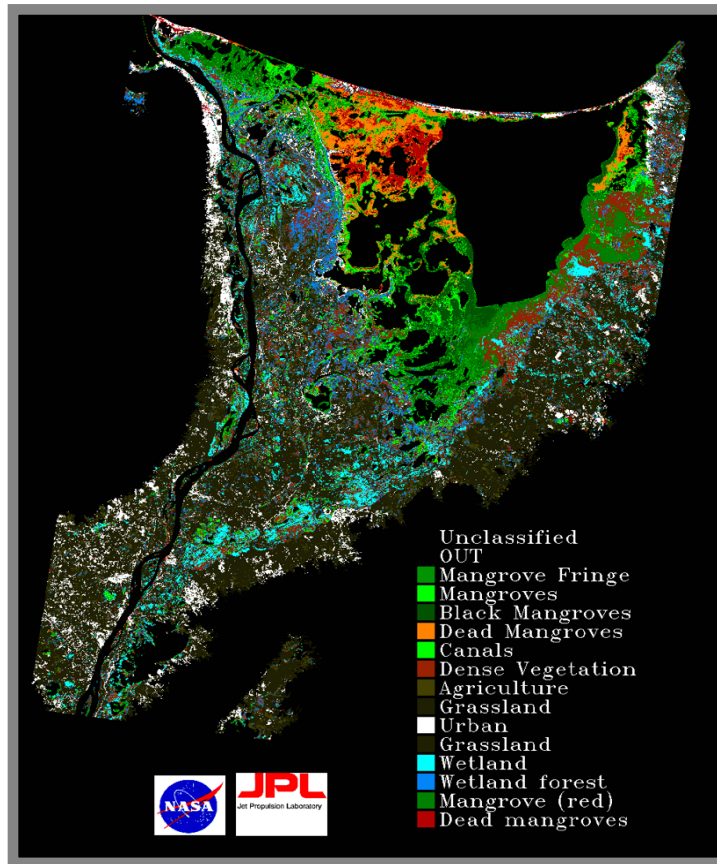
Landsat Land Cover Classification
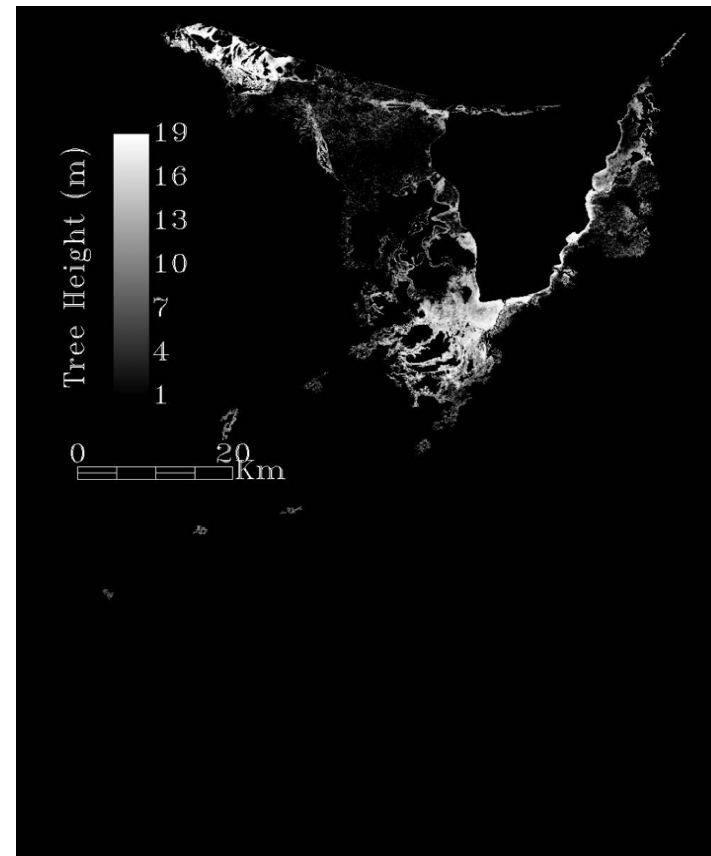
Mean Mangrove Tree Height

Simard et al. Remote Sensing of the Environment, 2008.

Ground Truth Data

Site	Plot data	Field Photos	High Res SAR	30m Height and Biomass for 2000	GLAS canopy height
Gulf of Mexico	✔	✔	✔	✔	✔
Central America	✔	✔	✔	✔	✔
Carribbean	✔	✔	x	✔	✔
Gulf of Guinea	✔	✔	x	✔	✔
Mozambique	✔	✔	x	✔	✔

Nigeria

Cameroon

Mangrove Height (m)

45
40
35
30
25
20
15
10
5
0

0   250
        Km

Mangroves, Rep. of Benin

Mozambique

Mean Tree Height (m)

Fatoyinbo et al., 2008
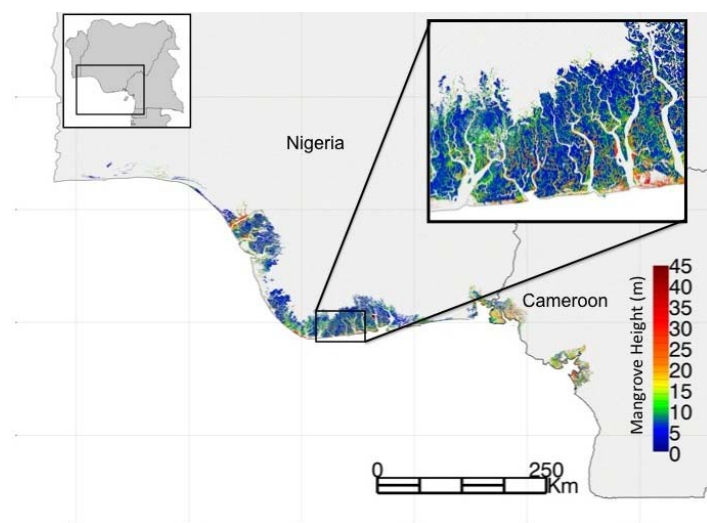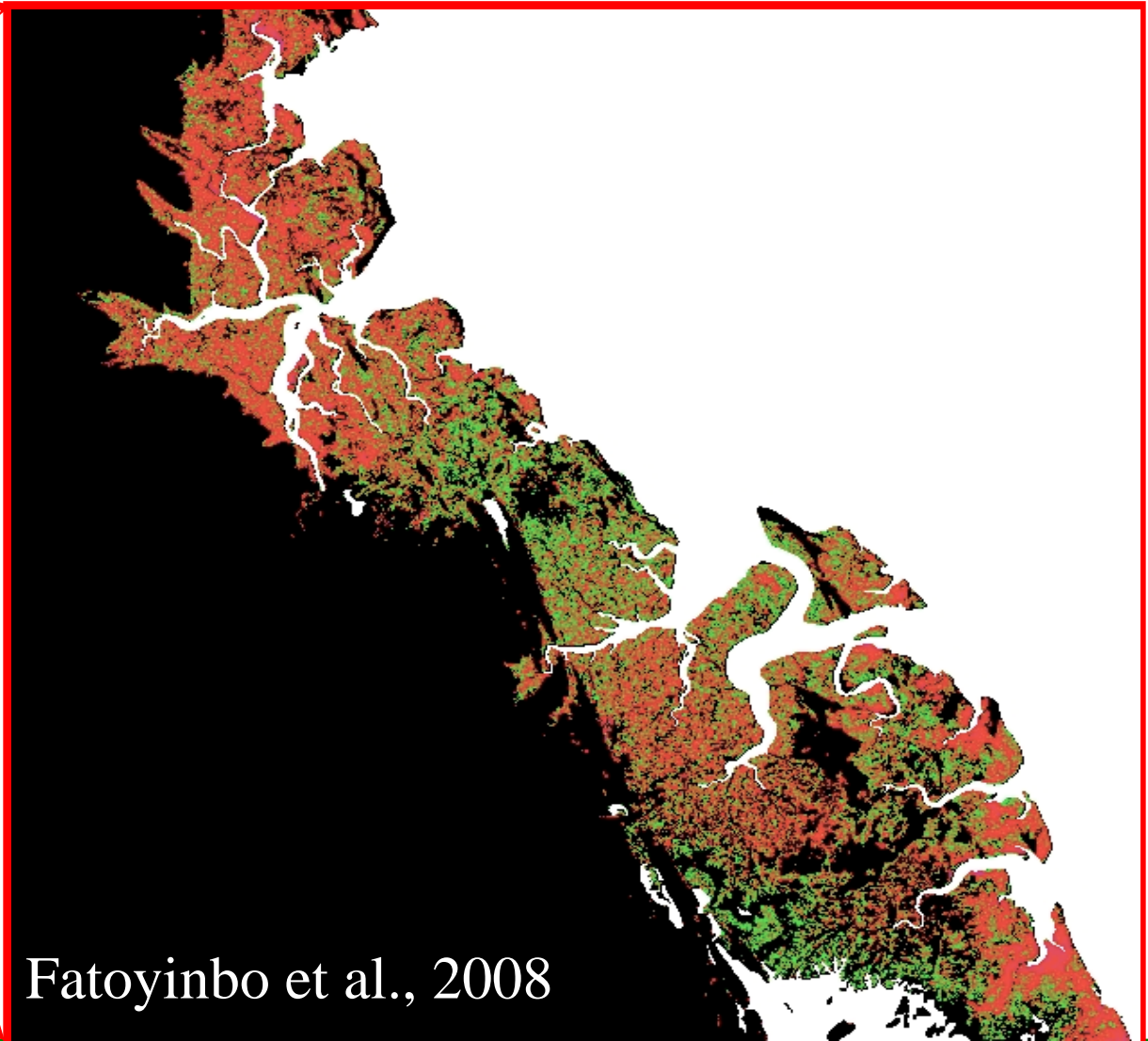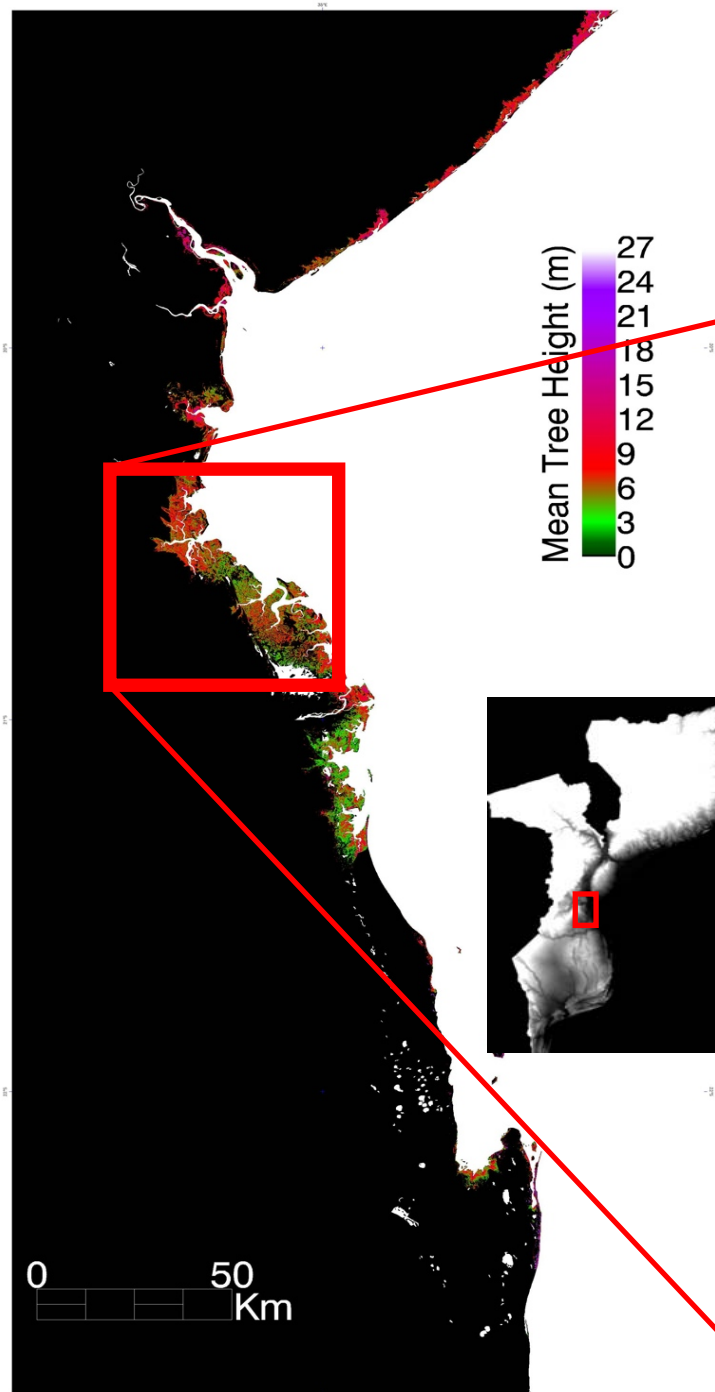
Height and Biomass Map of All Mangrove Forests of Africa

Fatoyinbo & Simard, 2011
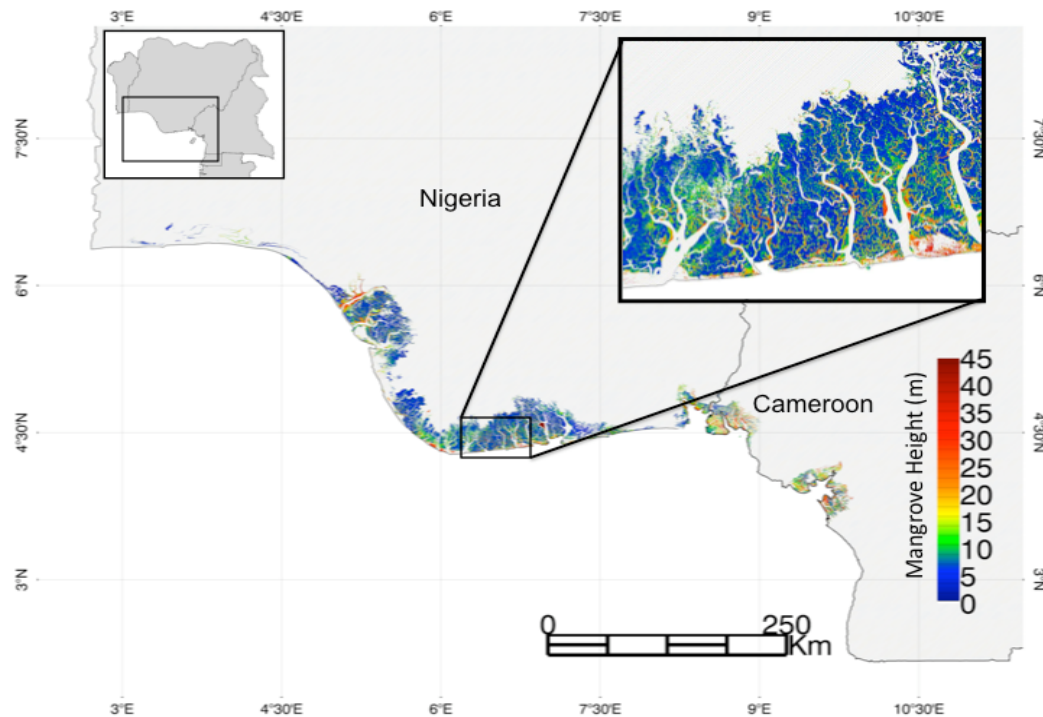
Country	Mean height in m	Total biomass in Mg	Mean Biomass in Mg/ha
Angola	7.6	2,226,915	144
Benin	3.9	171,326	95
Cameroon	16.3	14,393,930	97
Congo	17.05	122,583	81
Cote d'Ivoire	10.73	595,186	186
Djibouti	4.5	179,667	103
DRC	7.24	2,554,017	140
Egypt	6.1	8,849	124
Equatorial Guinee	12.3	3,719,552	205
Eritrea	5.15	550,347	112
Gabon	14.09	35,230,691	242
Ghana	7.56	7,607,178	147
Guinea	7.92	28,104,993	149
Guinea Bissao	9.4	47,291,626	168
Kenya	6.33	2,455,214	127
Liberia	8.96	3,069,580	163
Madagascar	8.53	31,888,567	155
Mauritania	5.1	4,862	111
Mozambique	7.33	43,007,973	141
Nigeria	8.35	132,242,206	154
Senegal	5.06	13,286,938	111
Sierra Leone	9.03	15,619,508	164
Somalia	2.98	248,894	83
Soudan	3.34	35,235	88
South Africa	9.81	208,514	174
Tanzania	11.77	16,181,258	200
Togo	4.67	21518.064	105
AFRICA	9	401,027,126	158

Mangroves of Africa

Country	Area in km2	Previous area estimate	Alternate estimate
Angola	154	607	1,250
Benin	18	17	69
Cameroon	1,483	2,434	
Congo	15	188	120
Cote d'Ivoire	32	644	150
Djibouti	17	10	NA
DRC	183	374	226
Egypt	1	861	NA
Equatorial Guinee	181	277	257
Eritrea	49	581	NA
Gabon	1,457	1,759	2,500
Ghana	76	241	100
Guinea	1,889	3,083	2,963
Guinea Bissao	2,806	3,649	2,484
Kenya	192	961	530
Liberia	189	427	190
Madagascar	2,059	3,403	3,270
Mauritania	0.4	1	10
Mozambique	3,054	3,459	1,000
Nigeria	8,573	11,134	10,515
Senegal	1,200	1,830	1,853
Sierra Leone	955	1,695	1,838
Somalia	30	910	NA
Soudan	4	937	NA
South Africa	12	353	11
Tanzania	809	2,456	1,155
Togo	2	NA	26
AFRICA	25,442	42,291	30,517

Breaking News
Vulnerability assessment of mangroves in the Americas
(NASA's Land Cover Land Use Change program 2012-1015)

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- ☐ **Produce land cover, 3-dimensional mangrove forest structure, and ecogeomorphology** maps of all coastal regions with mangrove forests throughout the Americas using multi-sensor data fusion (radar, lidar, passive optical)

- ☐ Identify and map the spatial distribution of anthropogenic activities that act as **proximate sources of land use/change** in mangrove regions including shrimp farming, timber extraction, water diversions, urban and agricultural expansion.

- ☐ Produce user-friendly regional-local models to assess mangrove forest vulnerability to **human and climate change drivers** that can be adapted to diverse socio-demographic, economic, policy as well as ecogeomorphic contexts of the Americas.

NASA LCLUC sites
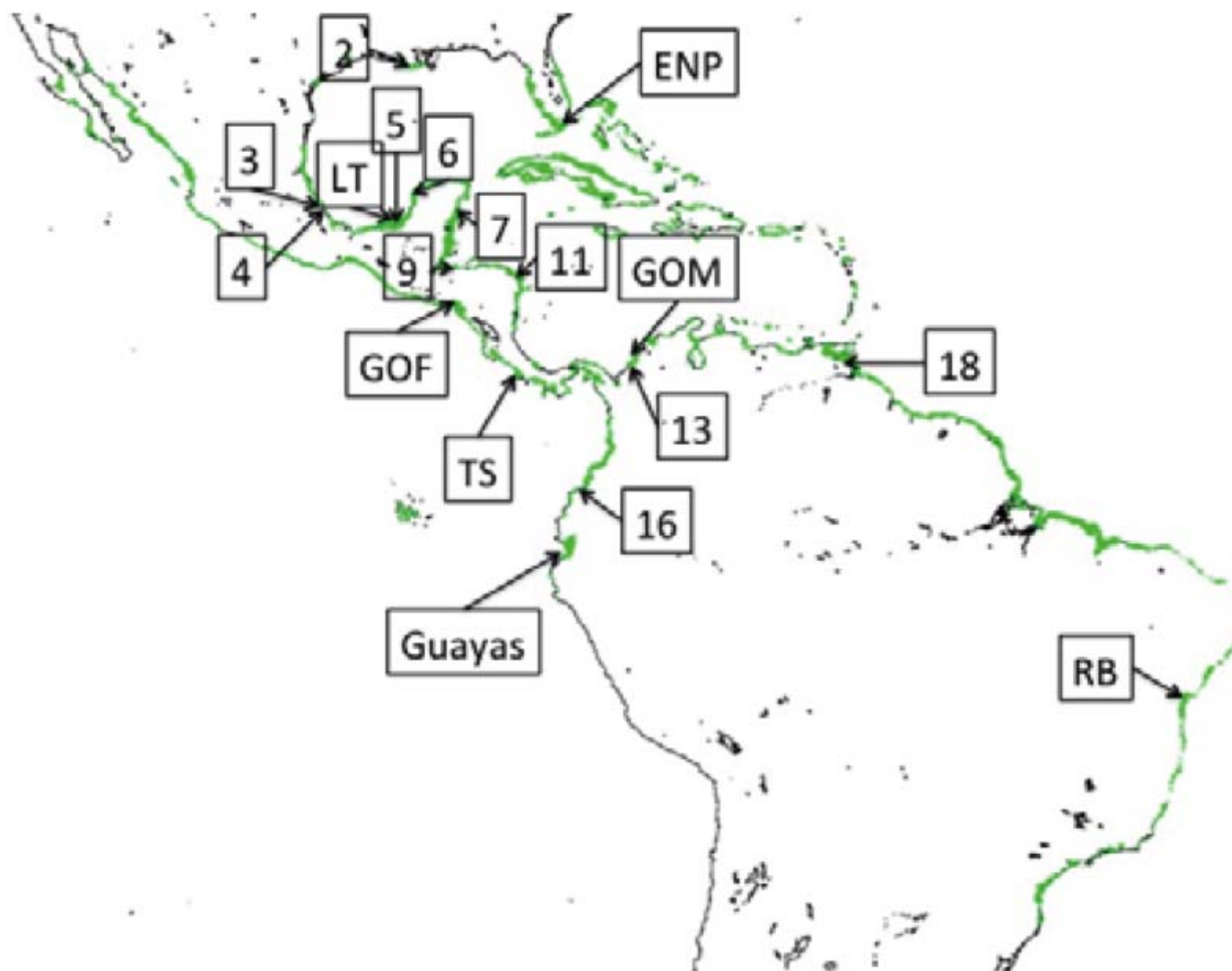
Deliverables

Planned output of the project.

☐ Annual mangrove cover and change maps for regional sites in the Americas and Africa for 2007 through 2014.

☐ Mangrove Tree height maps from K&C mosaics and ancillary field and GLAS data for the regional sites using a decision tree approach.

☐ Mangrove Biomass maps and changes from K&C mosaics and ancillary field and GLAS data for regional sites using a decision tree approach.