

ANTHROPOGENIC ACTIVITIES ON COASTAL SAND DUNES: EVIDENCE FROM PANAMA TO SANGAMANKANDA COASTAL STRETCH, SRI LANKA

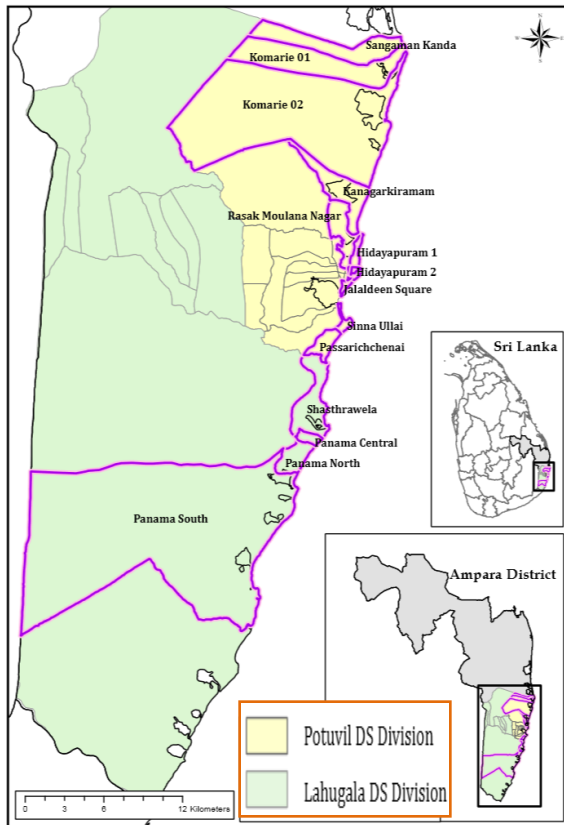
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Workshop on climate change and anthropogenic activities: Impact on coastal development and management. Organized by: Department of Geography, University of Colombo, Sri Lanka and Island Research Centre, State Oceanic Administration, R.P. China.

***28 & 29 October 2016
Hotel Janaki, Colombo 05, Sri Lanka.***



STUDY AREA

Coastal dune and lagoon system from Panama ($6^{\circ}44'39''\text{N}$ & $81^{\circ}48'32''\text{E}$) to Sangamankanda ($7^{\circ}1'22''\text{N}$ & $81^{\circ}52'35''\text{E}$) selected as a study area for the discussion of anthropogenic activities and their impact.

(Study area of Lahugala and Pottuvil divisional secretariat divisions have a coastal length of 23.67 km and 28.65 km respectively)

Study Covers

- 1 Calculate Sand Dune Extend
- 2 Identify Anthropogenic Activities & Impact
- 3 Identify Critical areas to Future Management

The term anthropogenic designates an effect or object resulting from human activity.

PURPOSE OF THE PRESENTATION

Thus, this paper examines the human activities and impacts on biophysical environments, biodiversity, and other resources of the Panama dune to Sangamankanda dunes stretch in Ampara District, Sri Lanka.

METHODOLOGY

For this study the primary and secondary data collected from 28 February, 1st to 2nd March 2015 and from August to October, 2015.

Also 1:50,000 topographic sheets 71&72 and 78 and Google Images used.

In order to explore primary data, the study was subdivided into key tasks by relevant professionals of team the DCC&CRM:

- (a) Assessment on dune geomorphology;**
- (b) assessment of biophysical characteristics of coastal dune ecosystems; and**
- (c) Social assessment.**

Preparation of a set of maps using GIS and RS and information data base of the coastal habitats in the study coastal zone was undertaken by the team.



Data Collection Manual

Example of filling the GPS [data sheet](#)

No	Waypoint No		Type of item	Remarks
	Start	End		

Map Preparation

Two types of data used in this study such as spatial data and attribute data; collected from various secondary data sources. GIS (Geographical Information System) and RS (Remote Sensing) are used in developing the spatial databases and in the preparation of all types of digital maps. Hence the methodology implemented in this assignment can be characterized in to major two parts;

- Remote Sensing techniques
- GIS techniques

GIS and RS techniques will be organized into the following logical steps in order to achieve major tasks of this assignment

- Data acquisition
- Data validating and processing
- Data analyzing

DATA ACQUISITION

Following are the specifications of the utilities to be deployed in the project

- Latest Satellite Images – [World View-2- 0.4 m bundle 3D Stereo Images](#)

World View 2 Satellite 3D Stereo images with 0.4m Resolution (Panchromatic, Multispectral) of 103km² Archive

Product Information:

Satellite/Sensor: WV-2 Image Resolution: 0.4m Bundle (Panchromatic + Multispectral)

Imagery Source: Stereo/ Archive

Area : 103km², Panma, Arugambe

Specification of Area : By shape Files: 20150730_Thik Solutions_Panma_0.4m_103sq.km_Stereo_Archive

Licensing : Internal (perpetual)

Product band combination:

Band Combination	Included Files
☐ Black/White (Panchromatic)	☐ Single –band,1-File(Panchromatic band only)
☐ Multispectral	☐ 3-Band ,1-File RGB (True /Natural Color)
☐ Color (Pan sharpened)	☐ 3-Band ,1-File NRG (False color)
☒ Bundle (Panchromatic + Multispectral)	☒ 4-Band ,1-File BGRN (All Bands – Single)
	☐ 8-Band ,1-File BGRGCIYR1,2 (All Bands –Single)

- DEM / Contour Lines (Digital Elevation Model) - [Leica Photogrammetry Suite \(Survey Department\)](#)
- GPS Device– Garmin Monterra & Garmin eTrex 30
Verify Sea ward/Land ward borders of sand dunes & Identify differentiation of the sand dune contours from the rock contours.
- GPS Camera - Canon PowerShot SX280 HS
- 1:10,000 Latest Digital topographical map layers from Survey department

Following computer mapping software utilized to validate, to process and to analyze spatial data.

Arc GIS – (+ Extensions: Spatial Analyst, 3D Analyst, Network Analyst)

ERDAS Imagine

Leica Photogrammetry Suite (Survey Department)

RESULTS

In Coastal Geomorphology, the Ridge and Runnel Systems (RRS) are formed due to the interaction of tides, currents, sediments (sand) and the beach topography.

The Holocene RRS in the area are found as raised beaches, about 3.0-12.0m high in Ureni, Arugambay headland, Sastrawela and Panama areas from the present MSL.

These are formed due to the sea level fluctuations and climate changes since 10,300 yr B.P. and show the historical behavior.

The nearest incipient dunes have ridge and runnels (about 2-4m in high) and are covered by creeping dune vegetation.

The Holocene raised beach ridges with lower dune systems are about 2.0-4.0m and the upper inland sand dunes are 4.0m-12.0m high from MSL.

From Panama to Sangamankanda, small townships have been developed with housing schemes; individual houses & home gardens; educational, religious and other cultural places; beach scene and fishing camps and commercial activities.

Based on Arugam bay and other crescent shaped beaches, geotourism is the main commercial activity in the study area. For the existence of these townships, tourism, lagoon and boat fishing and associated other activities, the road network and infrastructure facilities drastically developed during the past two-three decades.

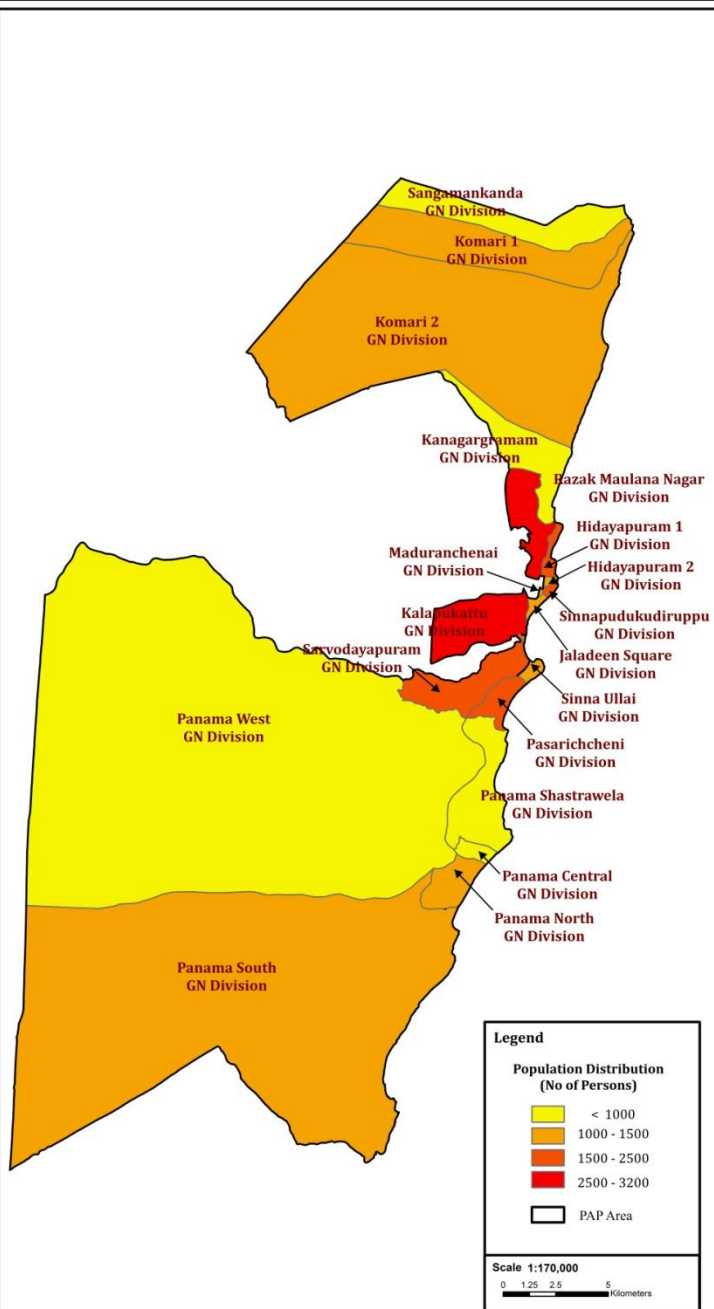
Mismanagement of this coastal area, it could distract the beach and dune ecosystems and have an impact on coastal protection as well as biodiversity.

Bulldoze and flatten the old coastal barriers and sand dunes lead to flooding of beachside communities, and the destruction of productive beaches.

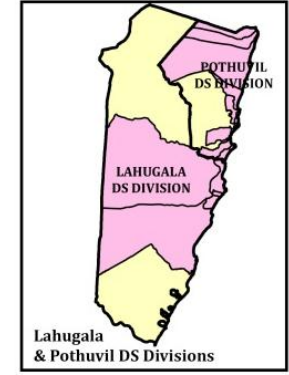
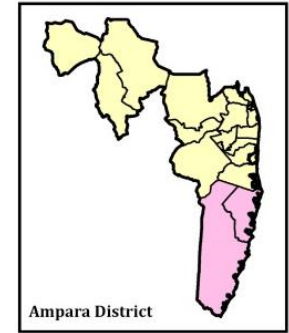
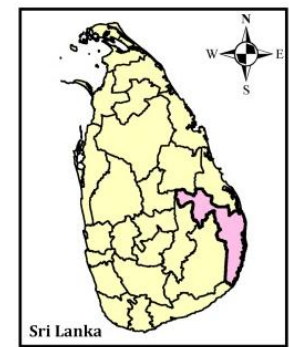
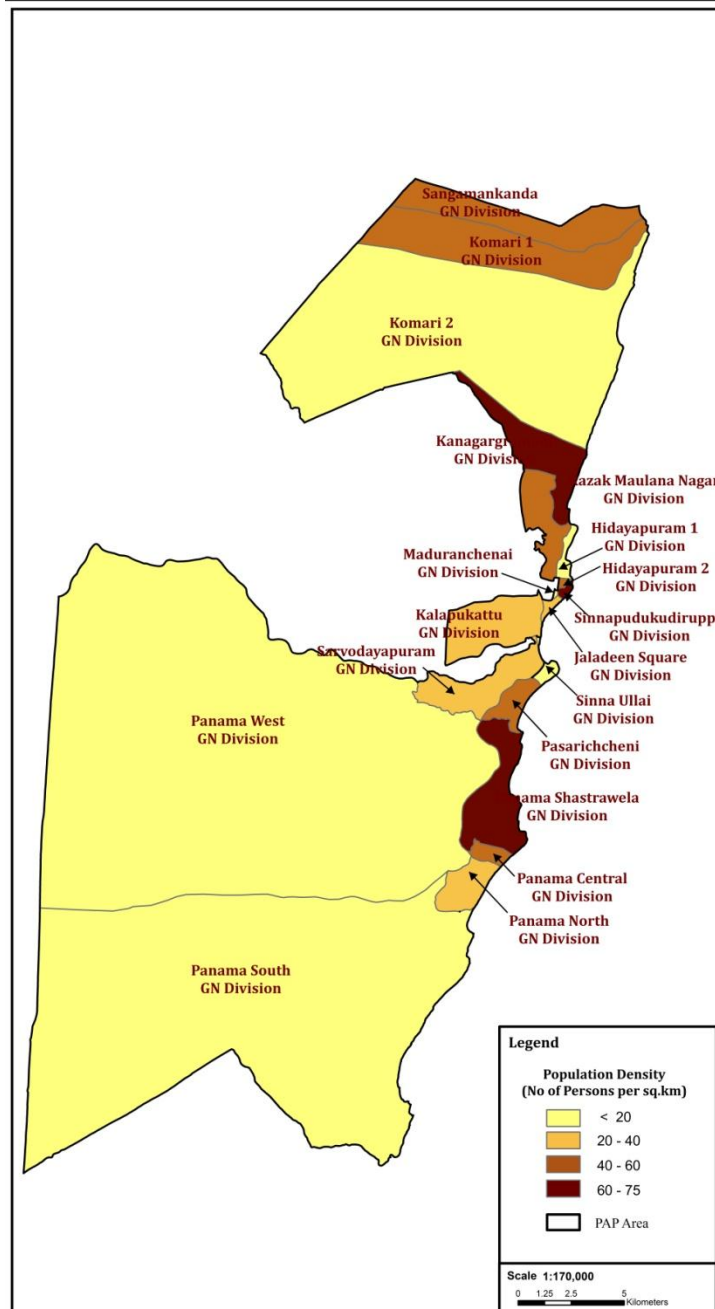
Many garbage sites, fish wastes, stagnant polluted dug wells, dumped dug wells, beach and dune sand mining, encroachment of dune lands for settlement and other construction, cultivation and building construction and for other purposes are the major visual threats.

Most of these have been exploited by individuals, government institutions as well as politicians and their followers.

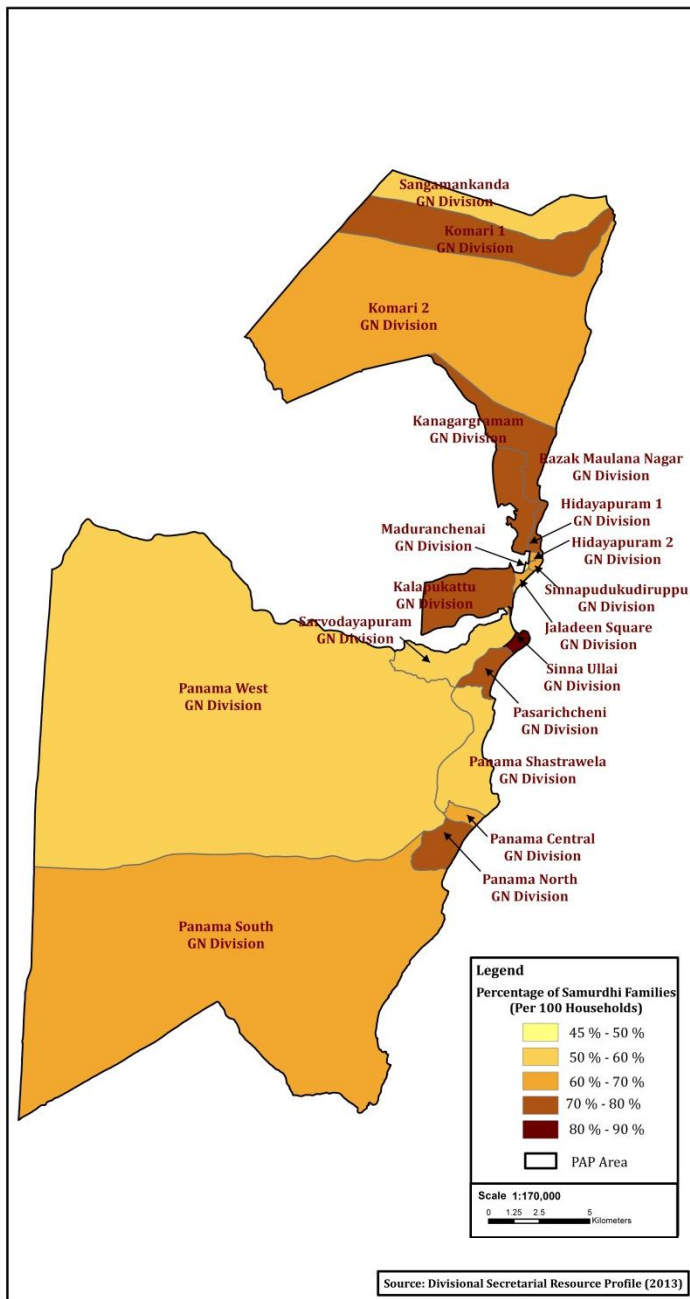
PAP Area - Population Distribution



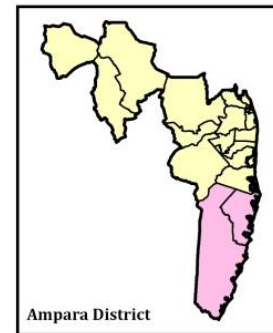
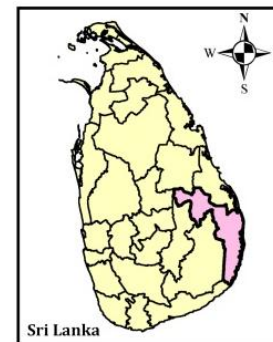
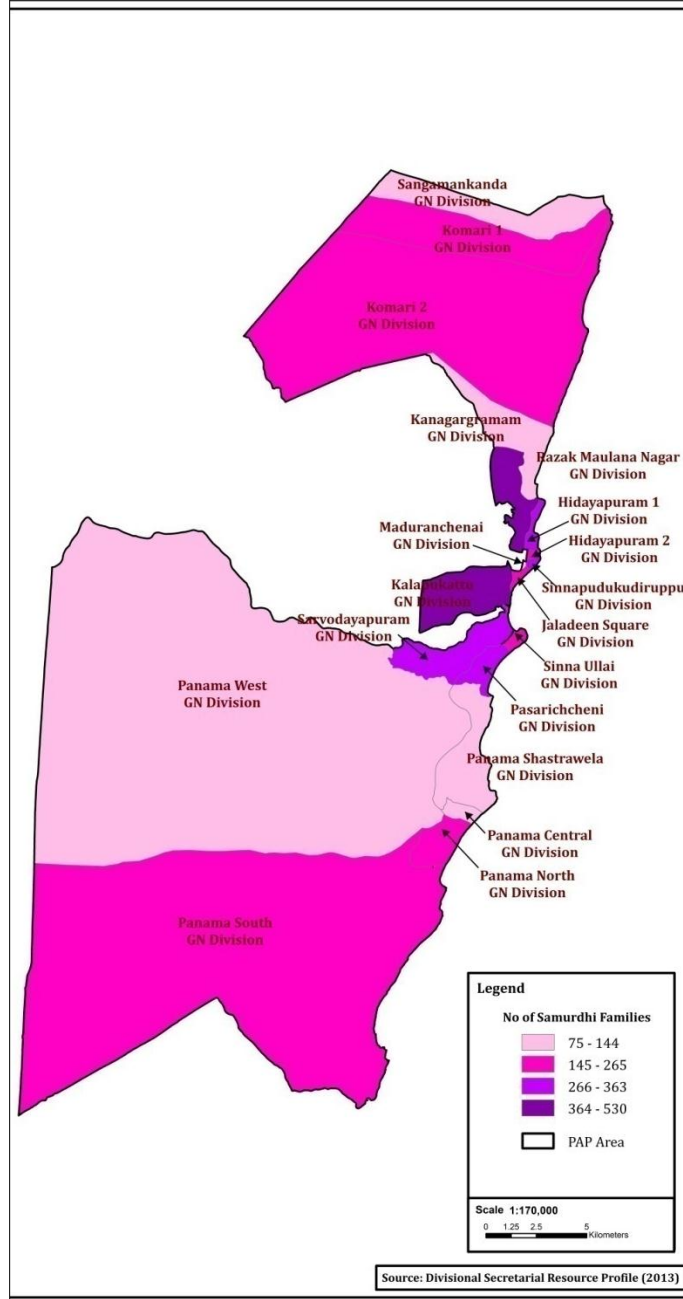
PAP Area - Population Density



PAP Area - Percentage of Samurdhi Families



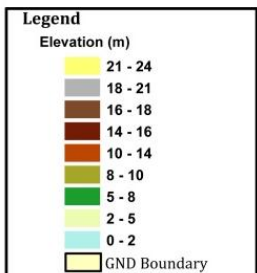
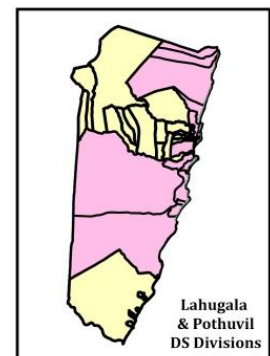
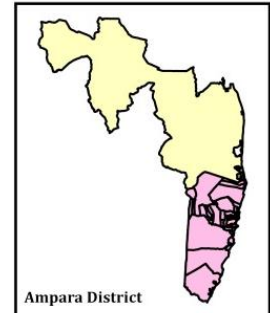
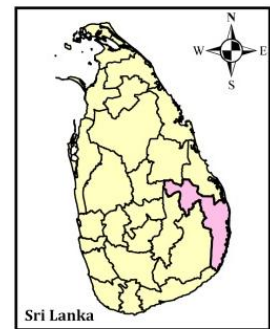
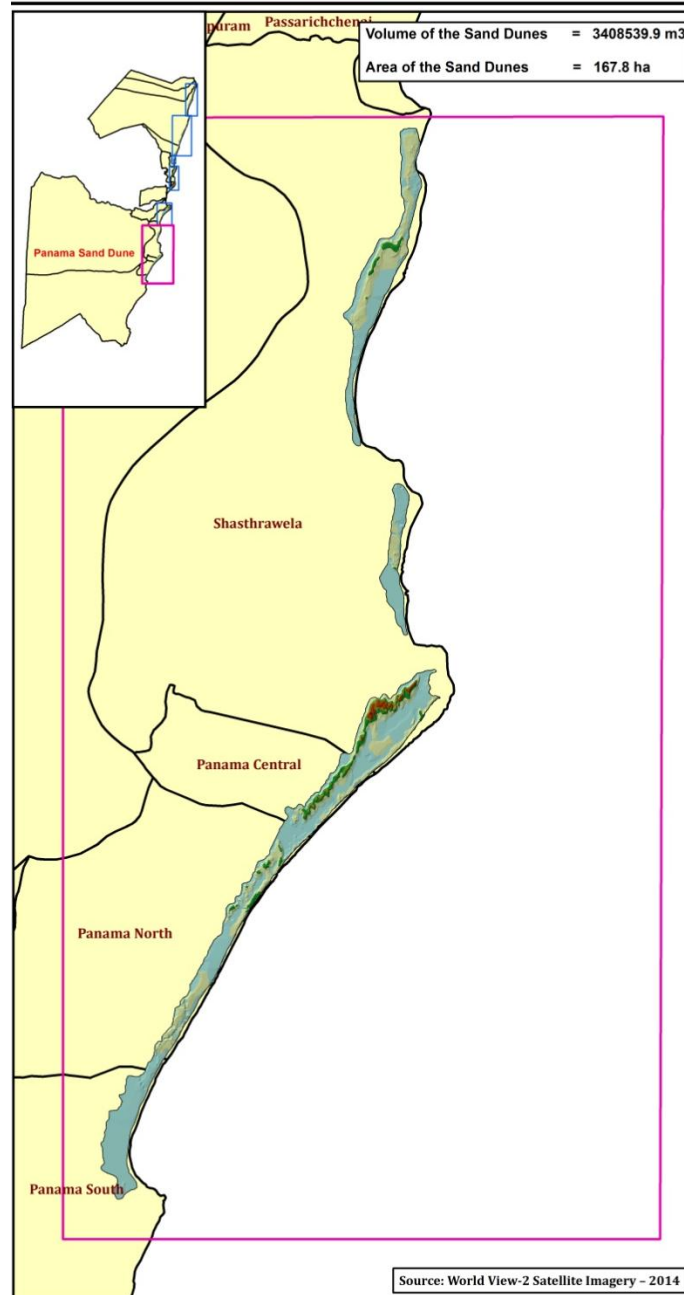
PAP Area - No of Samurdhi Families



PAP Area - Sand Dunes

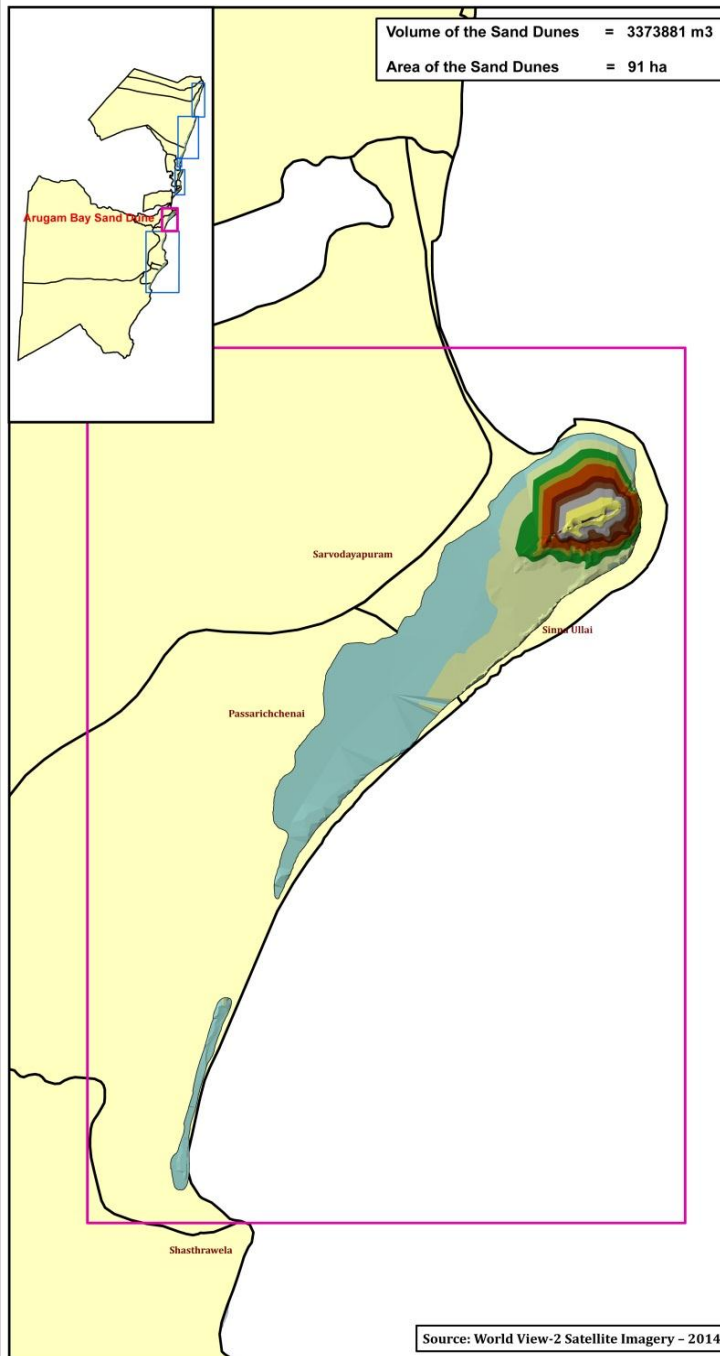


Panama Sand Dune



Arugam Bay Sand Dune

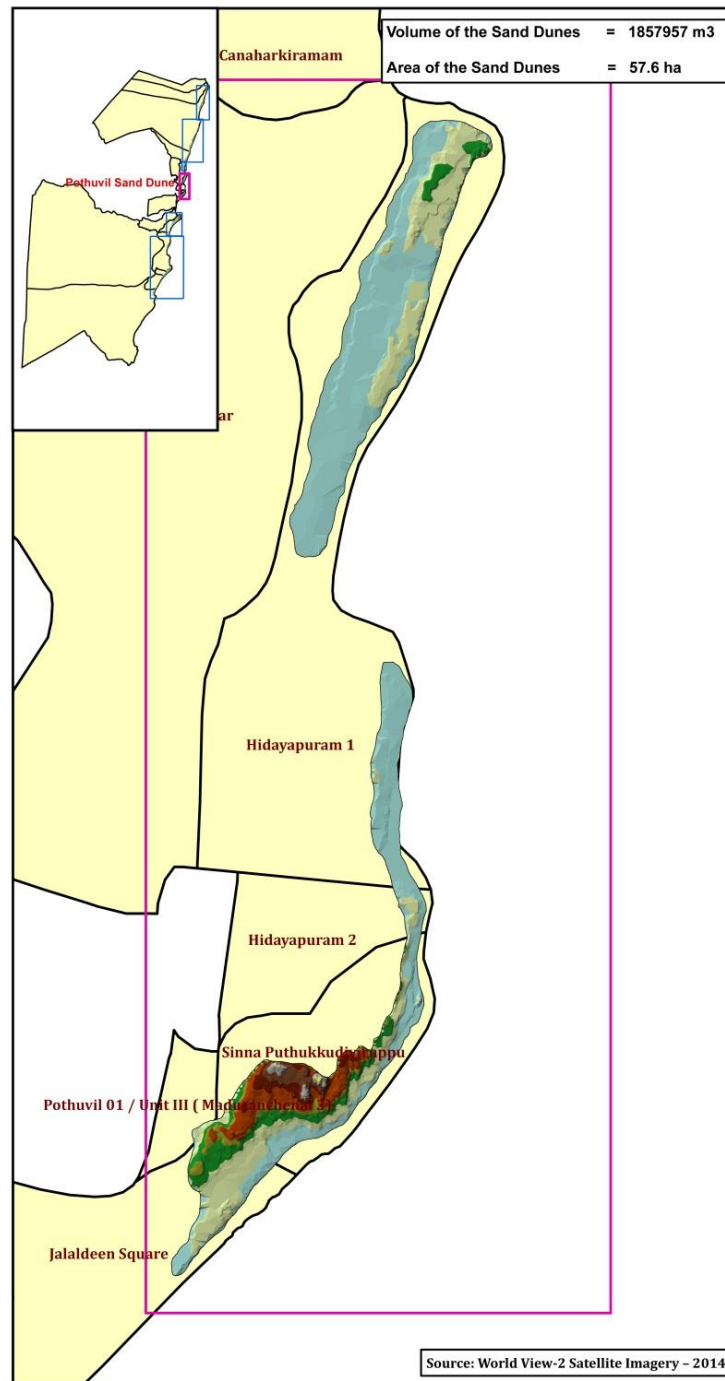
Volume of the Sand Dunes = 3373881 m³
Area of the Sand Dunes = 91 ha



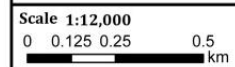
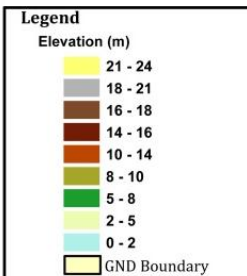
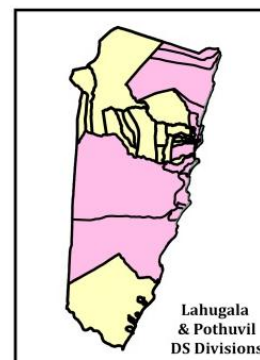
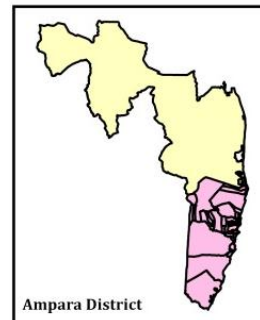
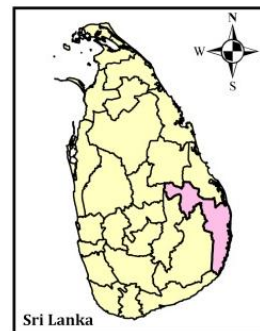
Source: World View-2 Satellite Imagery - 2014

Pothuvil Sand Dune

Volume of the Sand Dunes = 1857957 m³
Area of the Sand Dunes = 57.6 ha



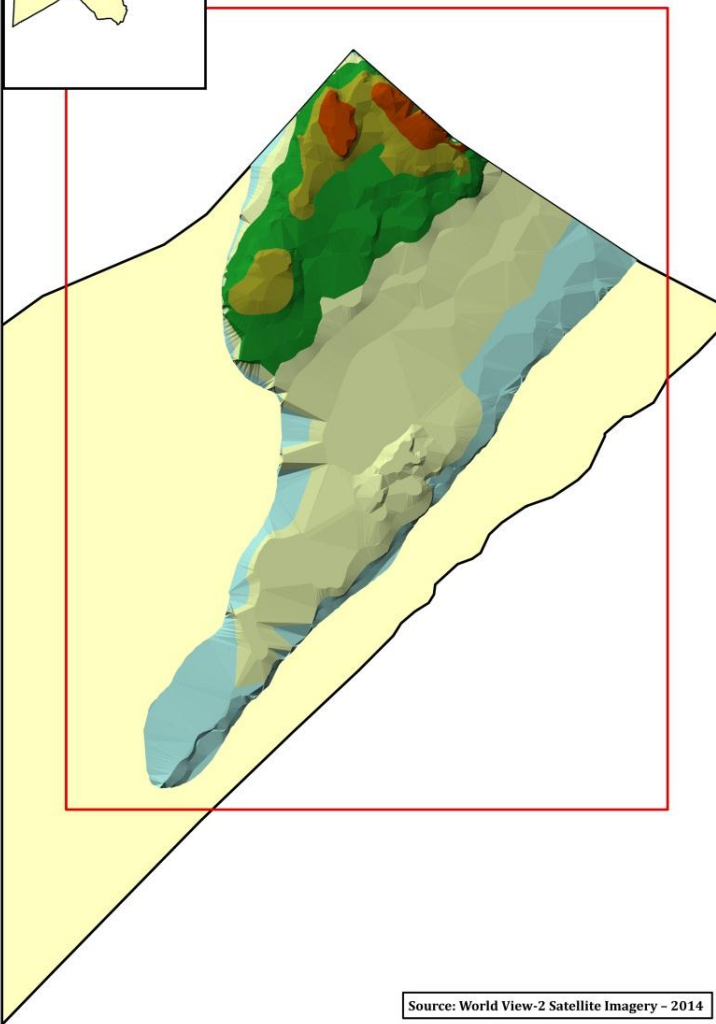
Source: World View-2 Satellite Imagery - 2014



Sand Dunes in Jalaldeen-Square GN Division

Volume of the Sand Dunes = 277900 m³

Area of the Sand Dunes = 6.9 ha

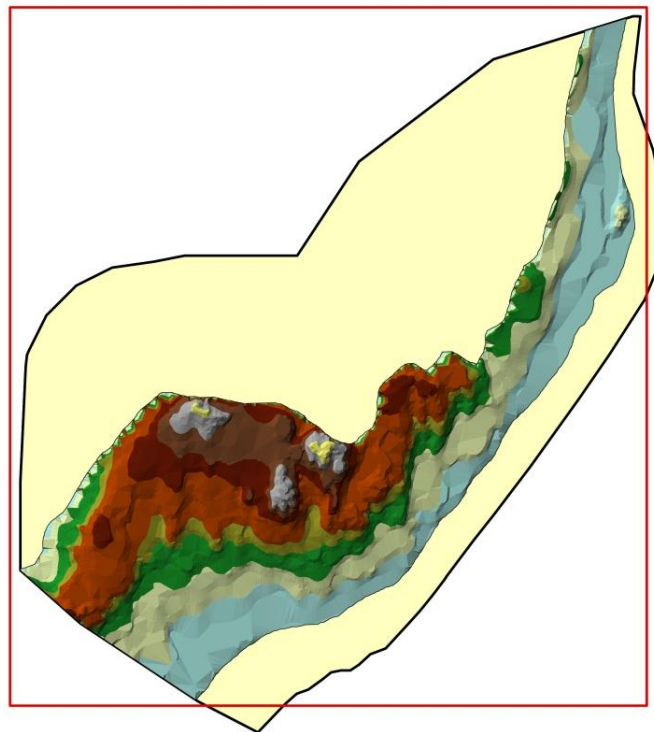
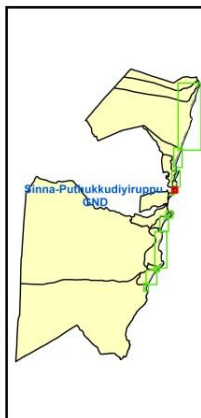


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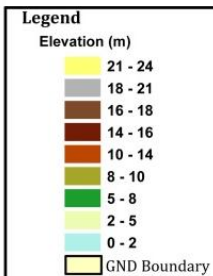
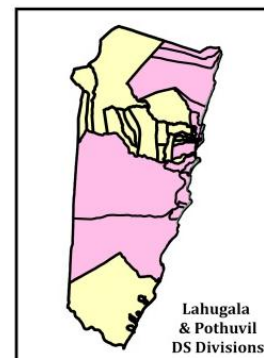
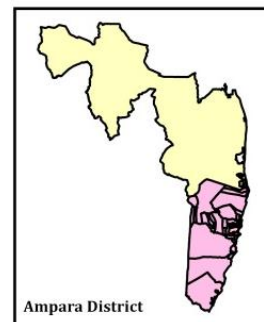
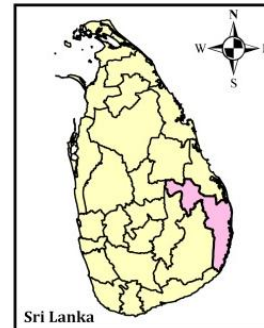
Sand Dunes in Sinna-Puthukkudiyiruppu GN Div

Volume of the Sand Dunes = 1052406.8 m³

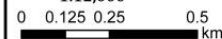
Area of the Sand Dunes = 14.4 ha



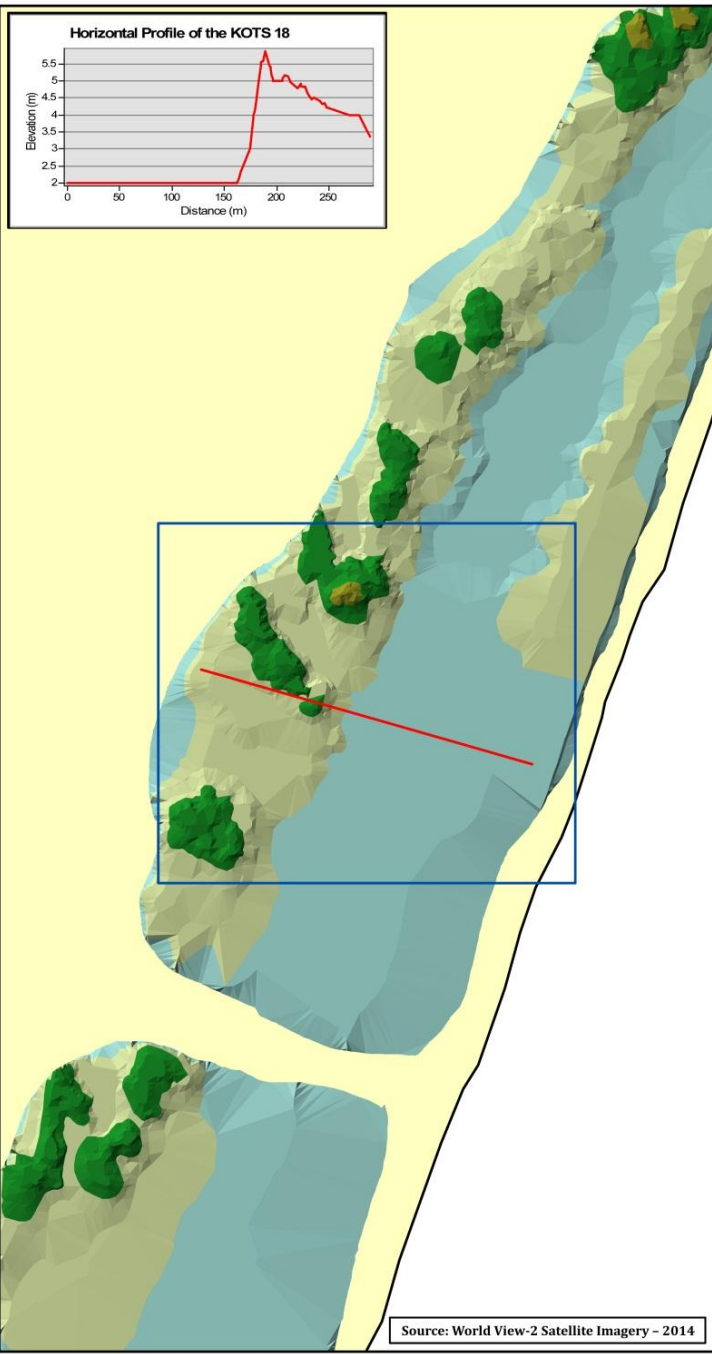
Source: World View-2 Satellite Imagery - 2014



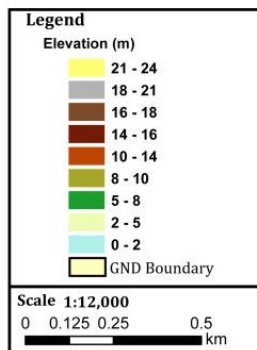
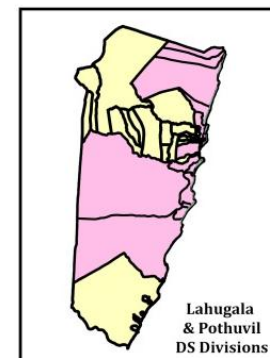
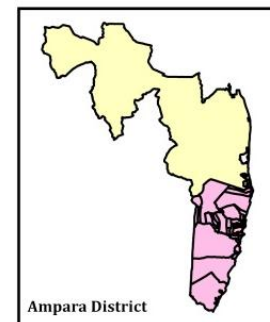
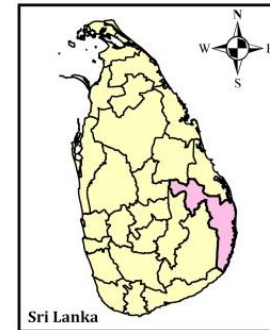
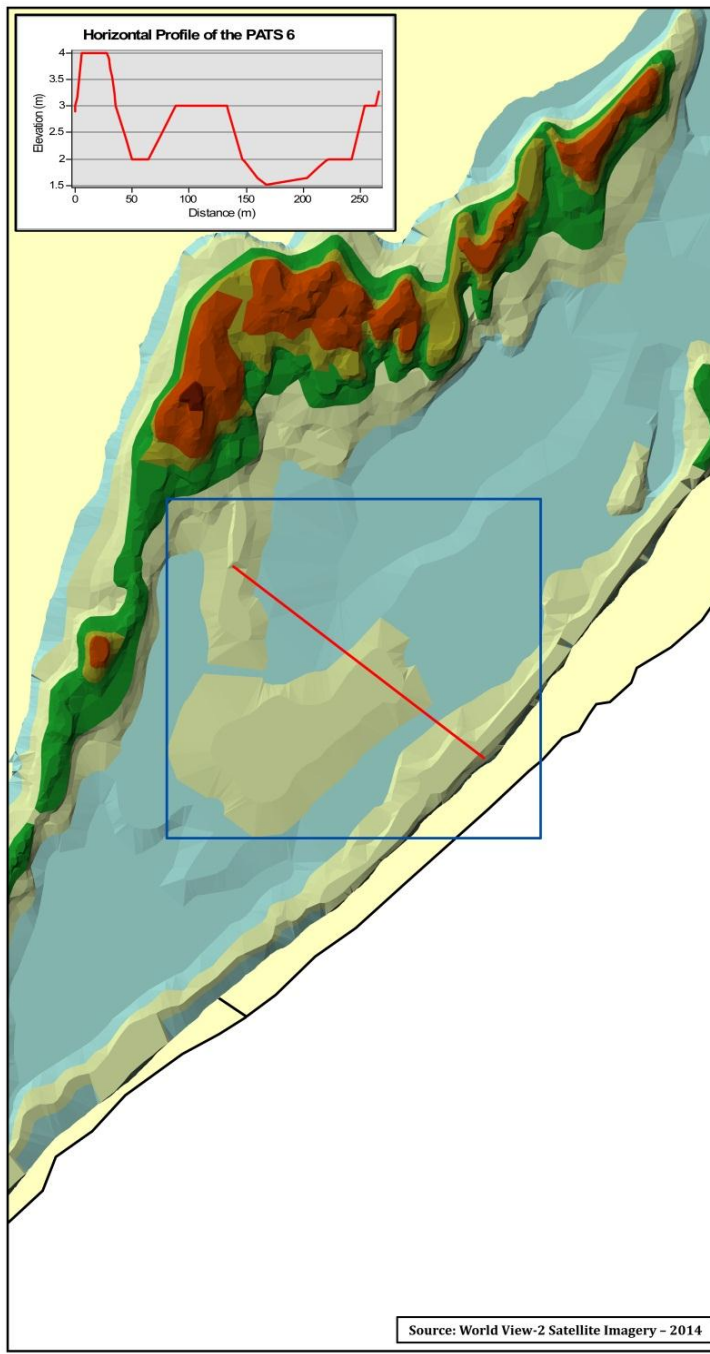
Scale 1:12,000



Elevation Profile of KOTS 18

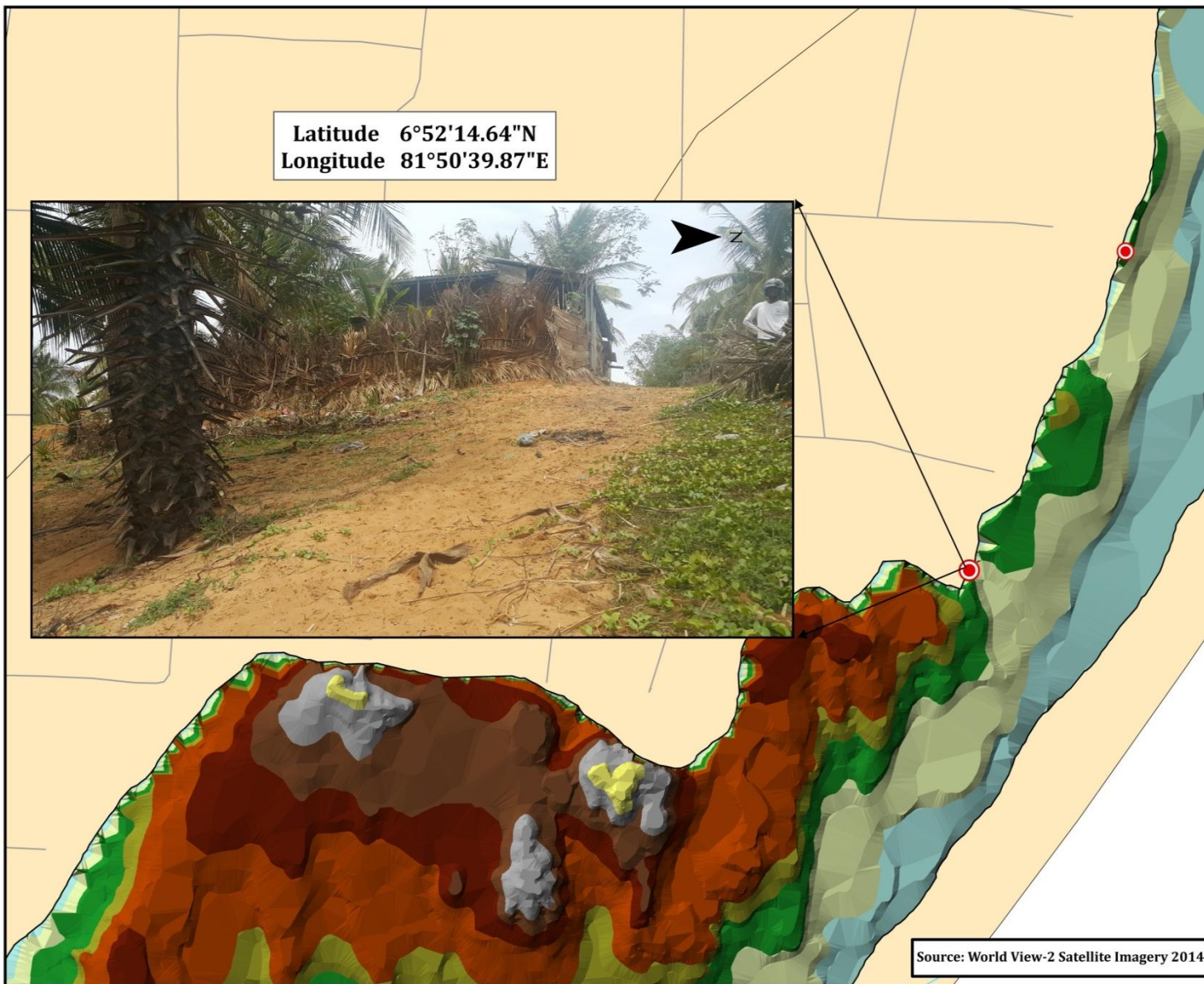


Elevation Profile of PATS 6

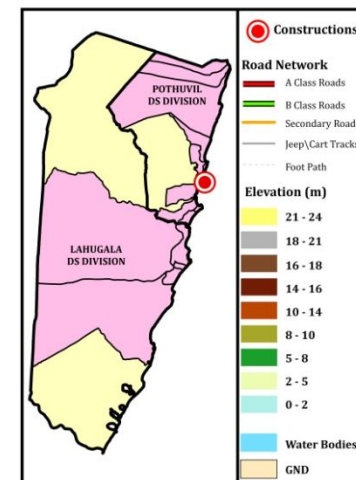
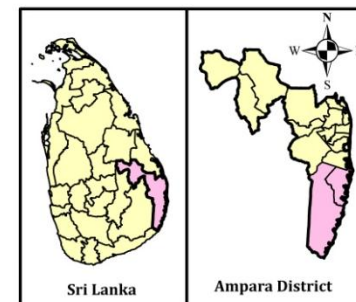


Constructions on Sand Dunes in Sinna Pudukudiruppu

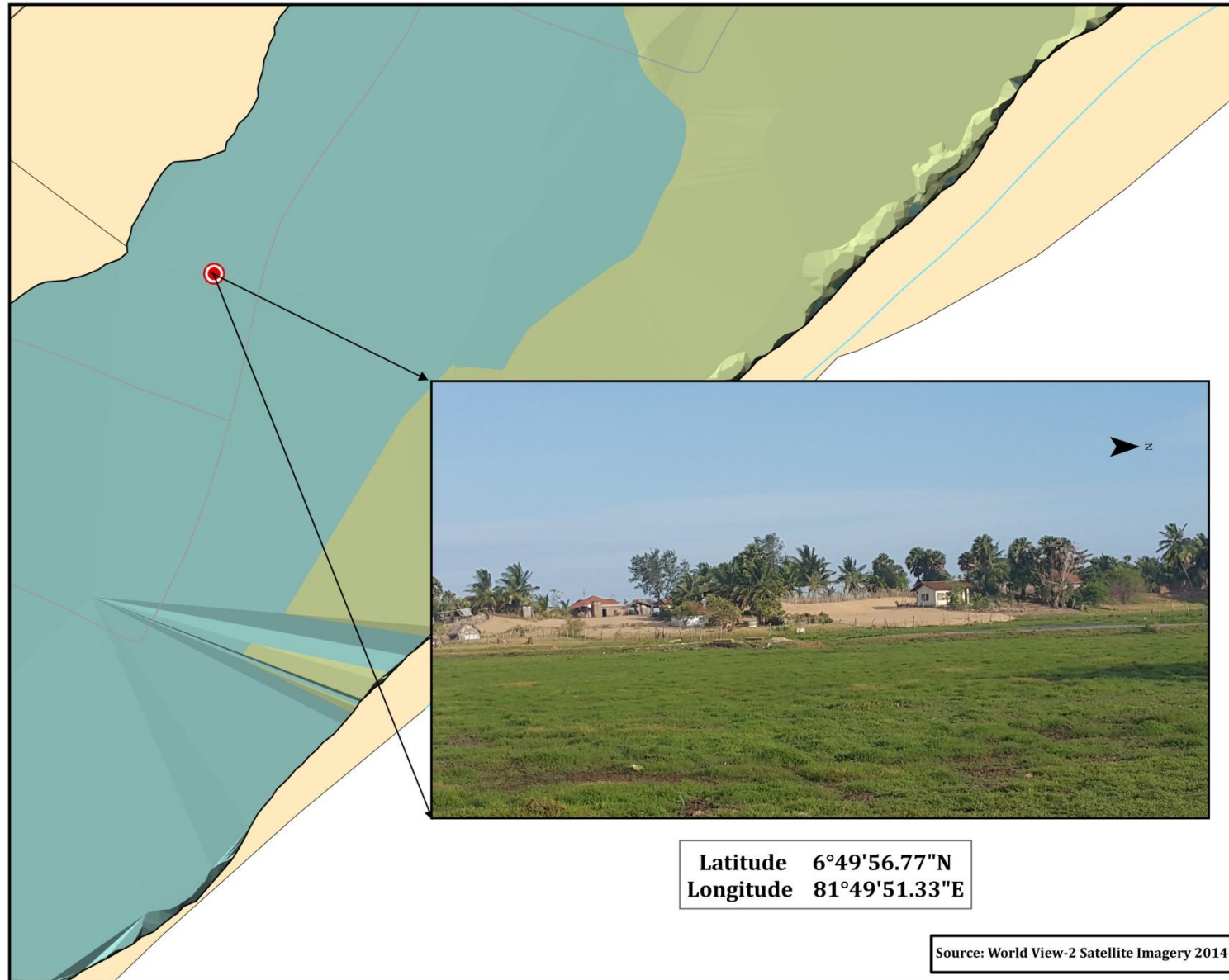
Latitude 6°52'14.64"N
Longitude 81°50'39.87"E



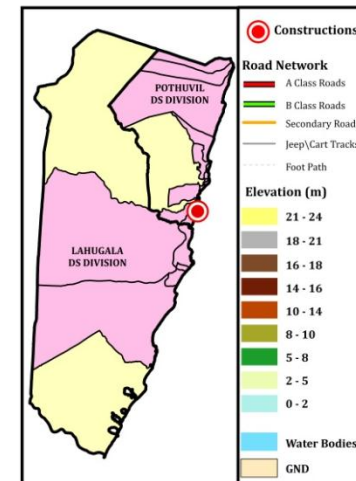
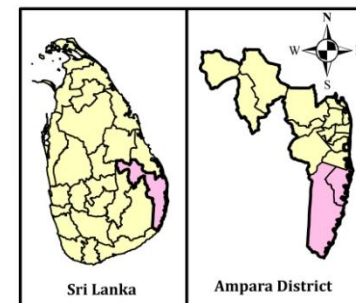
Source: World View-2 Satellite Imagery 2014



Constructions on Sand Dunes in Sinna Ullai



Source: World View-2 Satellite Imagery 2014



Scale 1:3,000

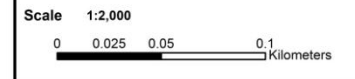
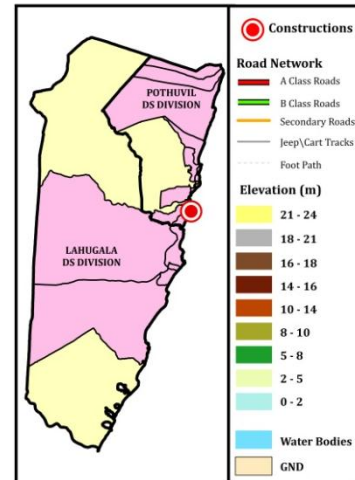
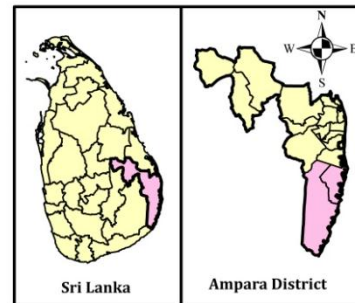
0 0.025 0.05 0.1 Kilometers

Constructions on Sand Dunes in Sinna Ullai

Latitude 6°50'4.10"N
Longitude 81°50'3.36"E



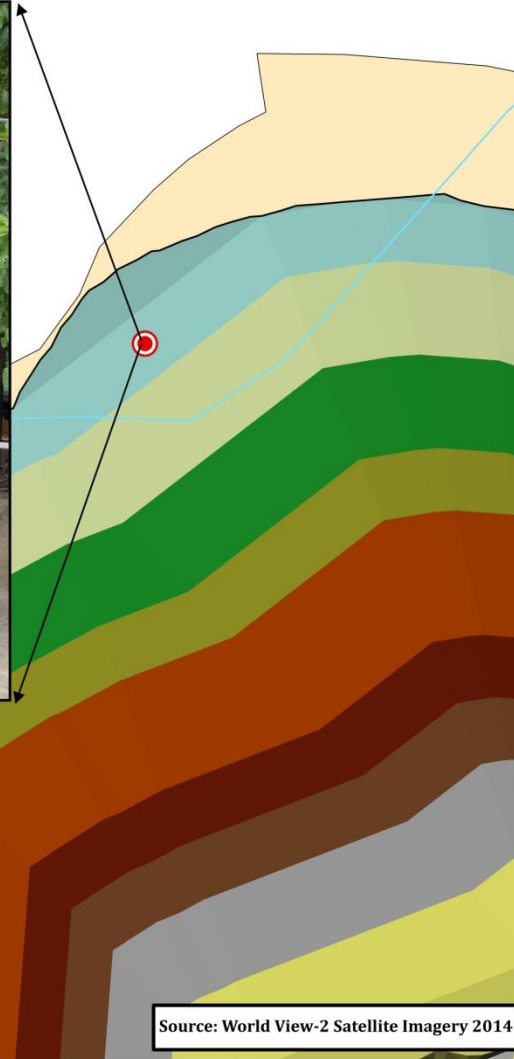
Source: World View-2 Satellite Imagery 2014



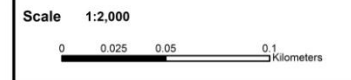
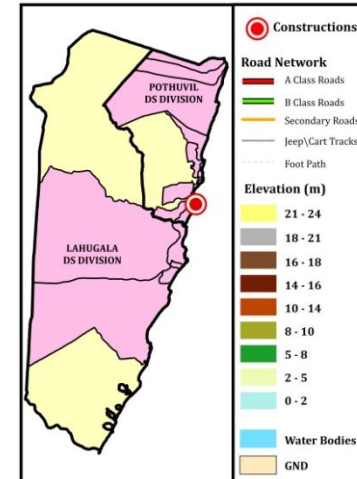
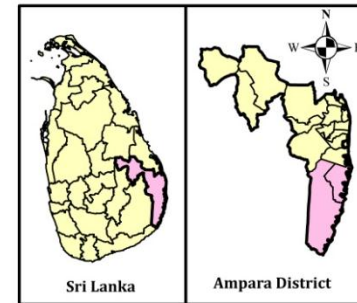
Constructions on Sand Dunes in Arugam Bay



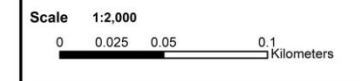
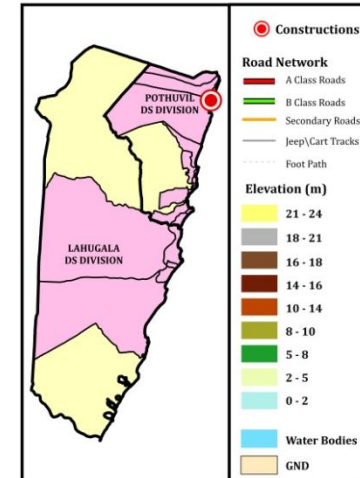
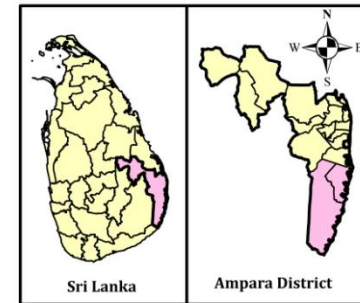
Latitude 6°50'22.40"N
Longitude 81°50'11.57"E



Source: World View-2 Satellite Imagery 2014



Constructions on Sand Dunes in Komari



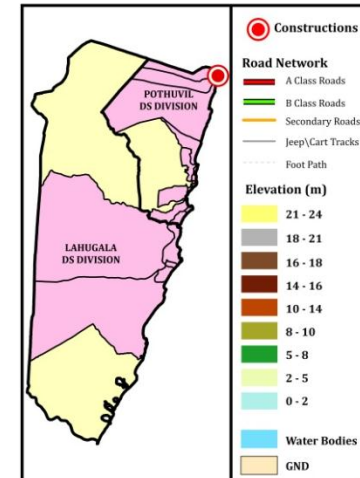
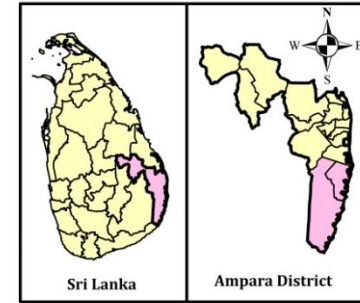
Latitude 6°59'37.60"N
Longitude 81°51'59.37"E

Source: World View-2 Satellite Imagery 2014

Constructions on Sand Dunes in Sangamankandy



Latitude 7° 1'20.91"N
Longitude 81°52'35.99"E



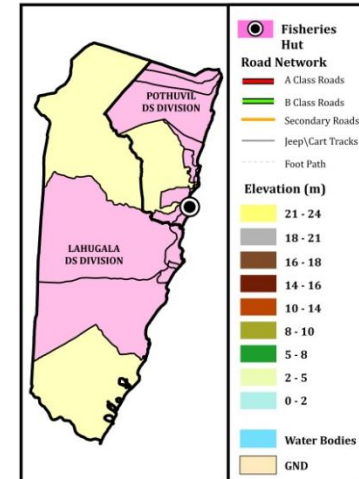
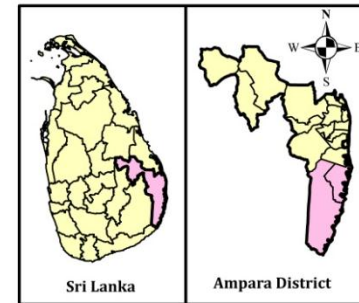
Source: World View-2 Satellite Imagery 2014

Fisheries Huts in Arugmbay



Latitude 6°49'38.16"N
Longitude 81°49'45.29"E

Source: World View-2 Satellite Imagery 2014



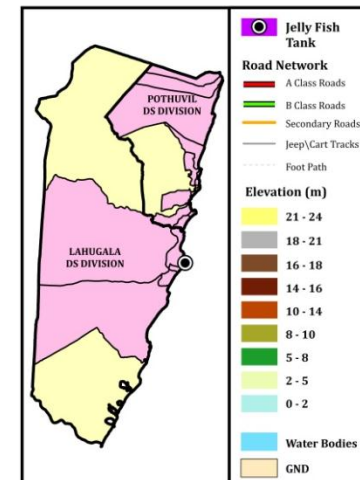
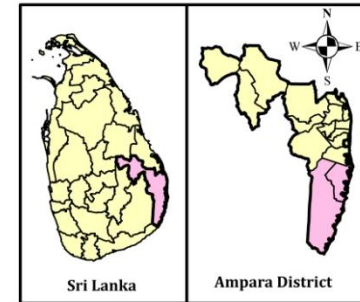
Scale 1:5,000
0 0.05 0.1 0.2 Kilometers

Jelly Fish Tanks in Panama



Latitude 6°45'58.61"N
Longitude 81°49'31.74"E

Source: World View-2 Satellite Imagery 2014



Scale 1:5,000

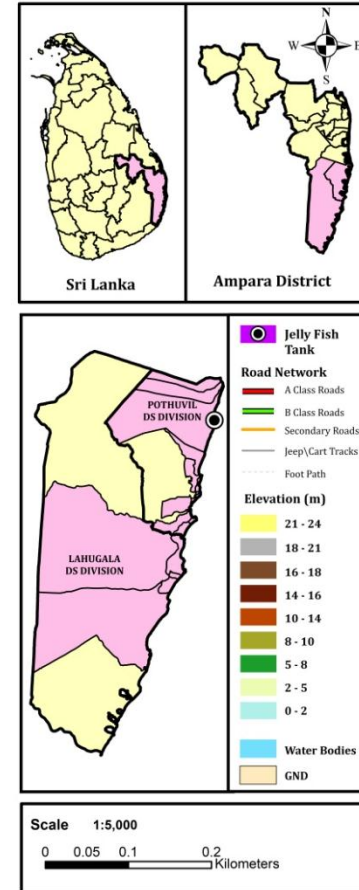
0 0.05 0.1 0.2 Kilometers

Jelly Fish Tank in Urani



Latitude 6°58'31.64"N
Longitude 81°51'58.70"E

Source: World View-2 Satellite Imagery 2014

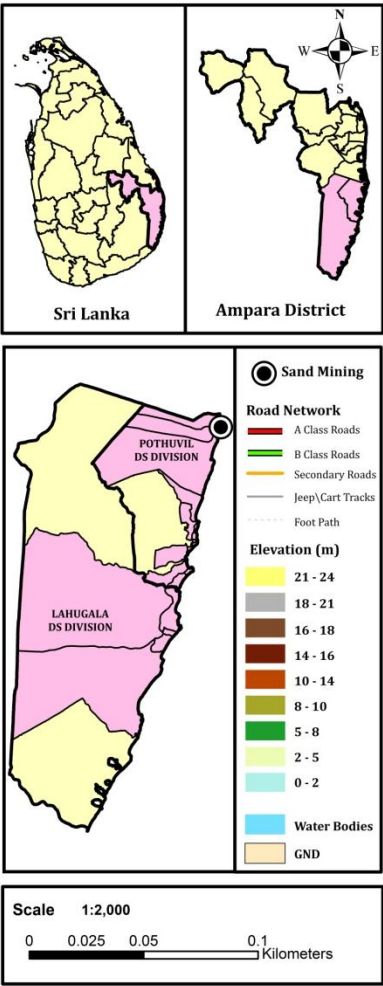


Sand Mining in Urani

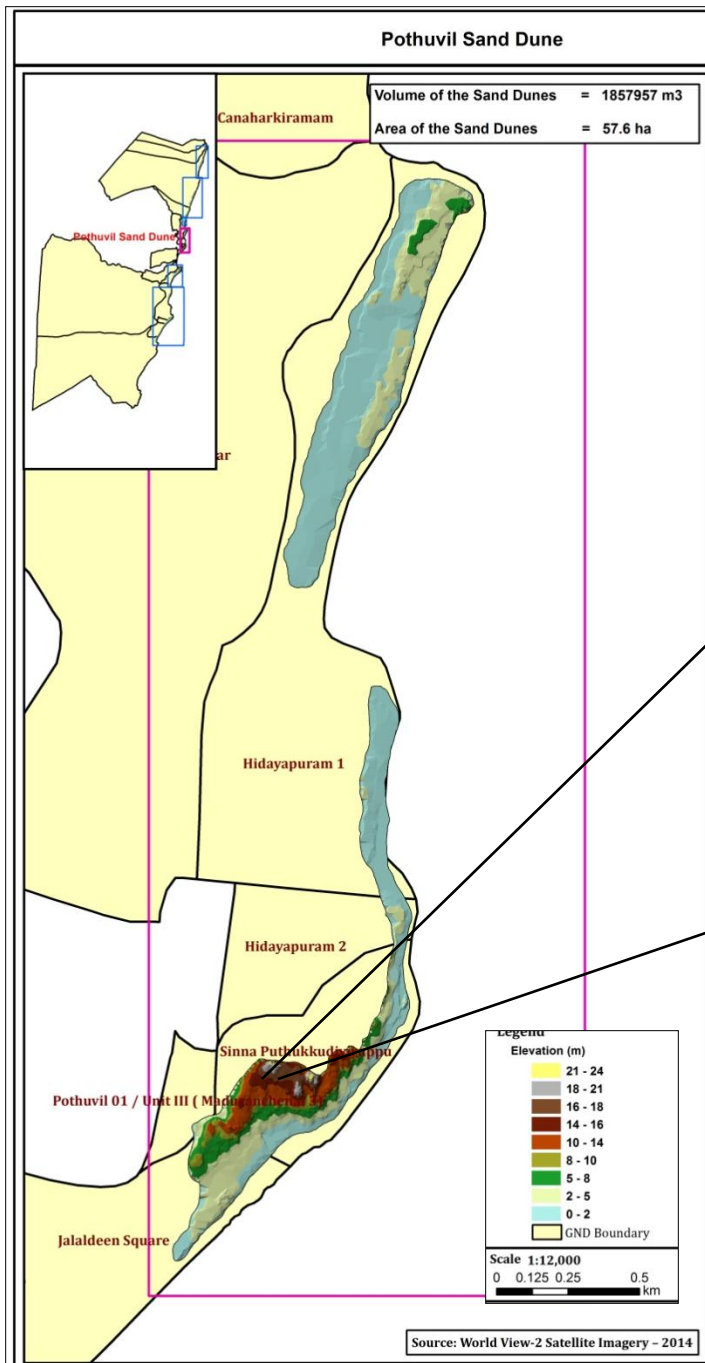
Latitude 7° 1'2.32"N
Longitude 81°52'34.44"E



Source: World View-2 Satellite Imagery 2014

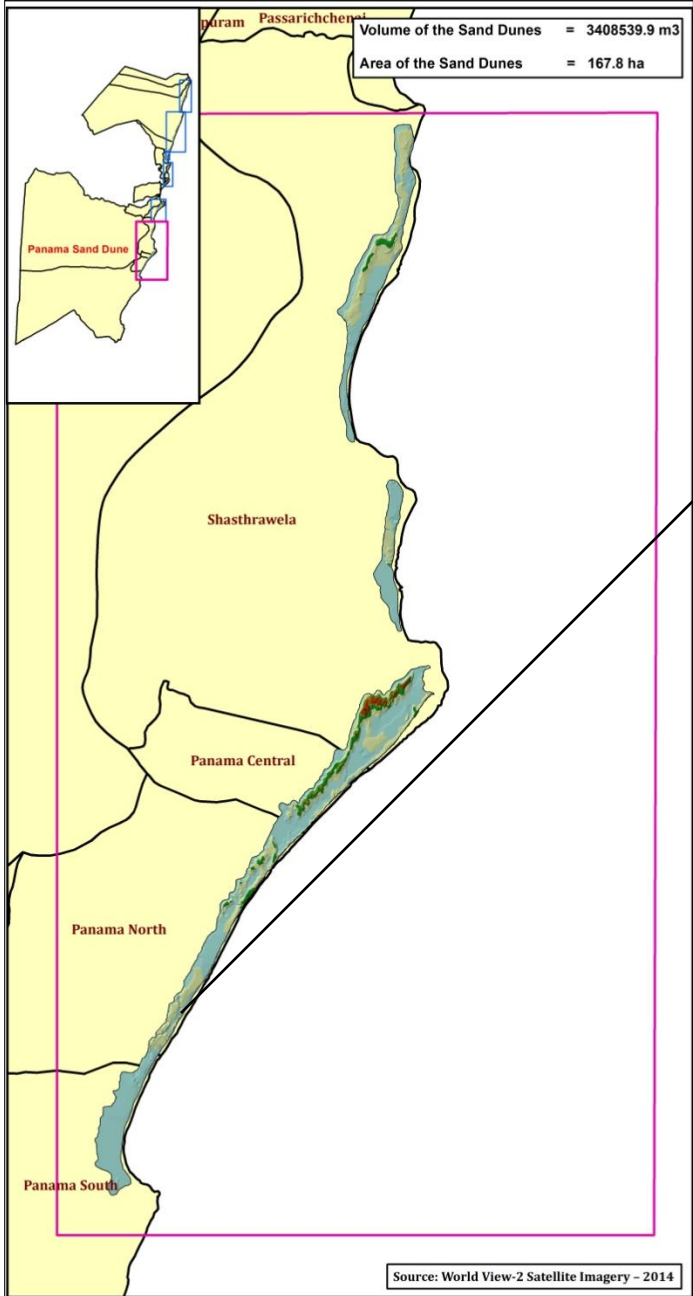


Sand Mining in Pottuvil



Panama Sand Dune

Volume of the Sand Dunes = 3408539.9 m³
Area of the Sand Dunes = 167.8 ha



Source: World View-2 Satellite Imagery - 2014

Sand Dune Encroachment -Panama



Images 1956 & 2012 Sinna Ulla



1956 - 2012 – Arugambay-Ulla Area



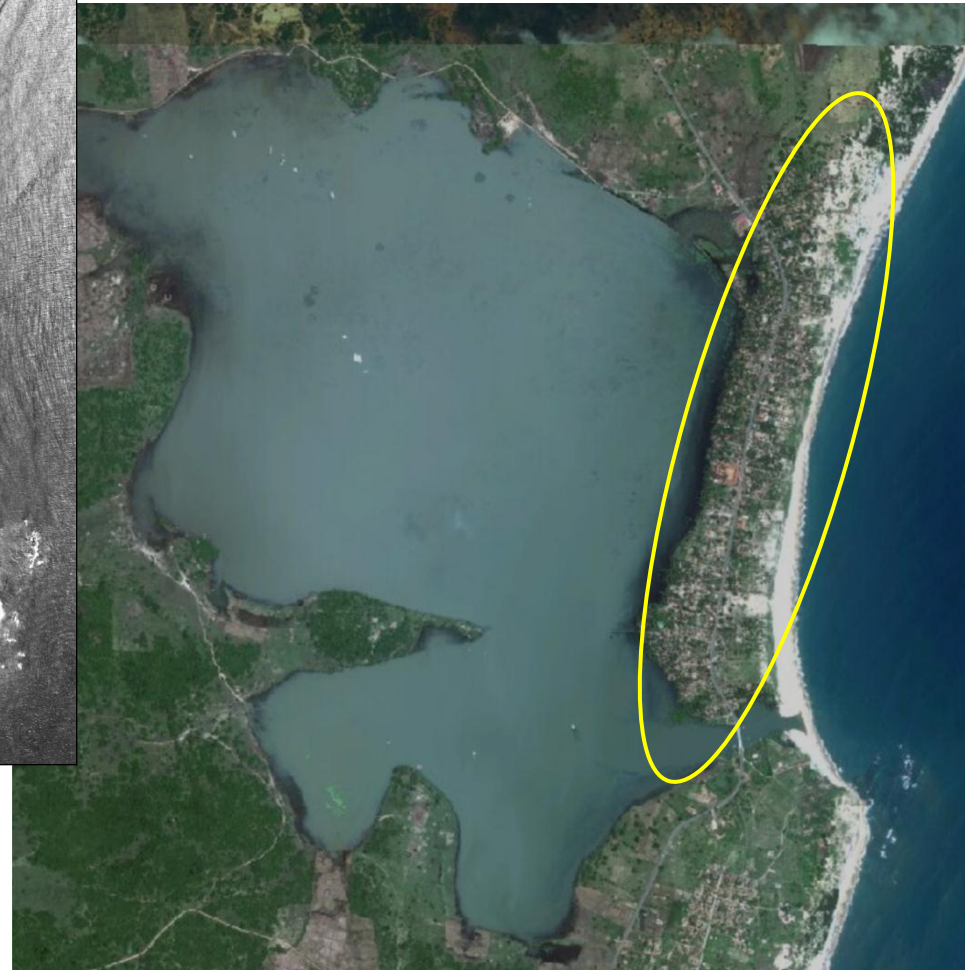
Images 1956 & 2012 Kudakalli



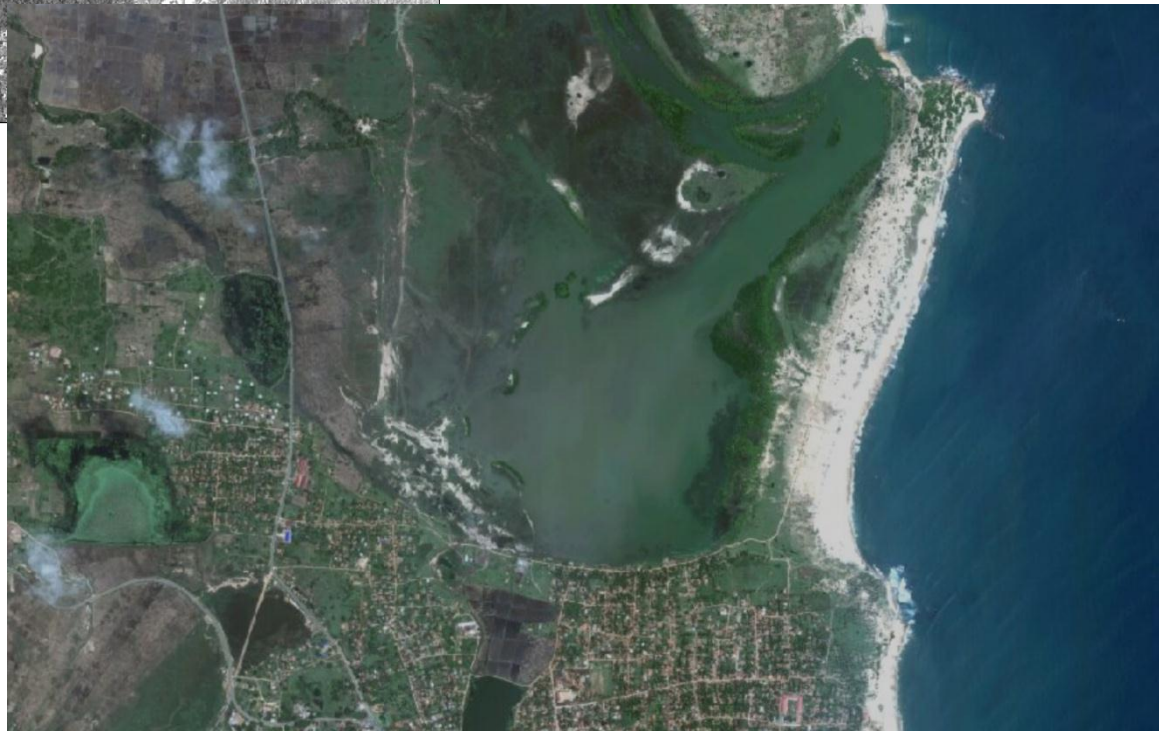
1956 & 2012 - Panama Area



Images 1956 & 2014 in Komari Lagoon



Images 1956 & 2014 in Pottuvil Lagoon



CONCLUSION

From Panama to Sangamankanda coastal stretch is a beautiful place with lots of white sands, heavy mineral sands and sand dunes, seagulls, and little lanes and fishing boats.

The study area is probably the driest, most barren wetlands intermittently. Among the natural landform features such as irregular and straight shorelines; sandy shore and beaches; well developed dunes; water ways, water holes and lagoons are salient morphology in this area.



These morphological development and their formative processes are changing under the influence of the coastline configuration, monsoon winds, waves, currents, and sea-level changes.

Most of these have been exploited and by men or utilized for cultivation, building construction and for other purposes.

Therefore, there is an urgent need to preserve and manage remaining landforms for posterity.

THANK YOU