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INTRODUCTION

Always considered an undisturbed Eden, Maldives are better known for resorts and uninhabited islands, beautiful seawater and coral reefs. Although, in this paradise of international tourism there are also several islands inhabited by locals. They were highly modified in the last fifteen years and the deepest changes regard the land use. This project is meant to create the first land use map of the Maldives. It will be done using GIS technologies for recovery, storage and processing spatial data. The project will be divided into two steps.

During the early one a virtual map and a database, based upon the USGS (NLCD 92) classification, will be created using free satellite images. Lately, there will be a test period on field to verify the geographic and informative aspects of the map. The system will be open and modular, and it will provide a constant upload of data also thanks to the helping of the local population (VGI, volunteered geographic information). Once completed, the map will be published using a WebGIS. This will allow it to be fully accessible and approachable to everyone.

MATERIALS AND METHODS

The satellite images belong to different databases, mainly from the Basemap service of the ArcGIS software. They are all georeferenced images (WGS 84), linked to their metadata and with a high resolution (1-0,3 m). The Maldives archipelago is completely covered by good quality images, with the only exception of small parts of a couple of atolls. The pictures were taken between December 2010 and March 2011: the exact time is associated with every image. Pictures were taken by the Remote Sensing Source Digital Globe.

Also, images from Bing Maps and Google Earth were used; they have a resolution as high as the previous ones, but it was not possible to find the exact time of acquisition for any of them, with rare exceptions. These images were useful to create an historical data archive covering a period between 2004 and 2012.

The geographical precision of the images was tested using GPS control points taken directly on the field.

Images were processed using a Visual Image Satellite Interpretation through the ArcGIS software; one or more polygons were manually drawn above every island, delimiting the whole island perimeter and the different land usages recognizable on it. Classification was manually provided, because every operator had a direct experience and familiarity with the analyzed territory¹.

A hierarchical approach for the construction of the land use legend was chosen, taking inspiration from the USGS Land Use And Land Cover Classification System. Eight main categories were created, each one of them presenting one or more subclasses. These classes describe the Maldivian land use to an exhaustive degree.

Into the so-created database, information about the area of each island and its intended use (provided by the Maldivian government itself²) were added as well.

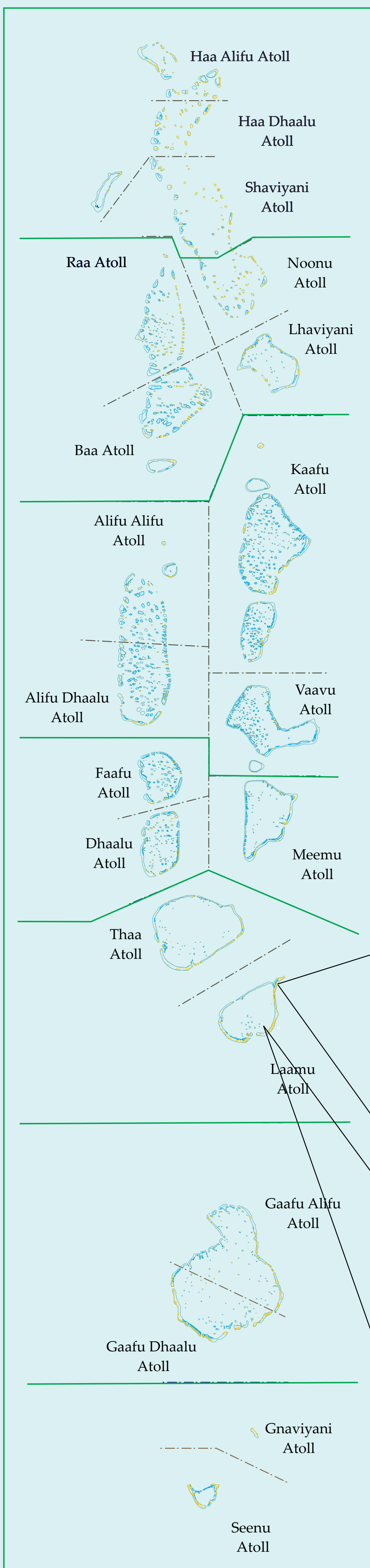


Fig.1 Olhuveli Beach and Spa Resort, Google Earth 2005



Fig. 2 Olhuveli Beach and Spa Resort , Google Earth 2005 with overlay of Land Use Polygons 2011. The island in five years changed completely with land reclamation and new water villas.

FIRST RESULTS

As today, every atoll was analyzed and completely classified using the reported method. Comparing this work with previous publications developed using extensive data mining in loco (i.e. Terrestrial Ecosystem Monitoring³), it's possible to notice how the results are similar, when not identical.

An informatics overtures is surely less expensive, in terms of both time and money, than the classic on-field proceedings.

Using free-to-access images, like the basemaps from GIS and Google Earth softwares, we were able to create a reliable land use map, both geographically and thematically, without the need to buy high-resolution satellite images.

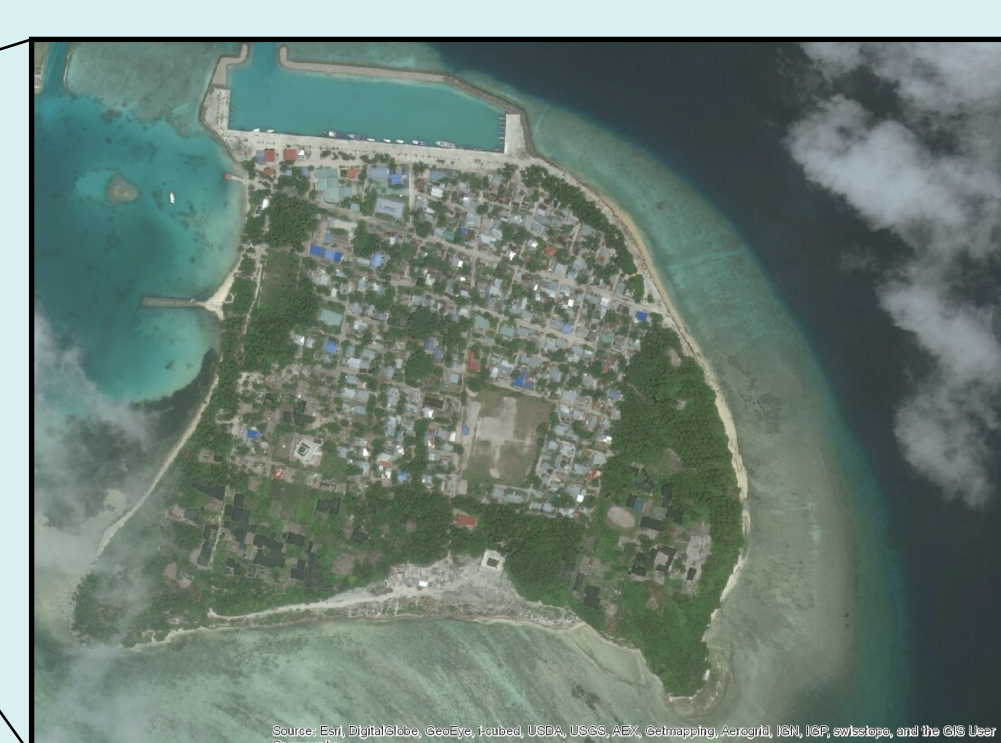


Fig. 3-4 Veymandoo, Imagery Esri 2011



Fig. 5 Thimarafushi, Google Earth 2005



Fig. 6 Thimarafushi, Imagery Esri 2011

FUTURE APPLICATIONS

Once completed, the map will be ready to use for privates and institutions, in order to monitor the territory and manage future interventions.

The project will be constantly updated by operators, as well as local population, who will be able to send data on the land use through an application for smartphones and tablets (currently under development).

The map will be published online with a dedicated webGIS and will be free-to-access for everybody.

REFERENCES

1 Remote sensing resources; Biodiversity informatics Facility 2 Infrastructures map of Maldives; Department of National planning (Rep. Of Maldives) 3 Terrestrial ecosystem monitoring – North Provinces, Republic Of Maldives; D. Cesarini, L. Bernasconi

Land Use 1	Land Use 2
1. Urban or build up land	1.1 Low intensity Residential 1.2 High intensity Residential 1.3 Resort
2. Agricultural land	2.1 Cropland 2.2 Nursery (Greenhouse) 2.3 Non-Natural woody
3. Herbaceous up land	3.1 Grassland/Herbaceous
4. Shrubland	4.1 Shrubland
5. Forestland	5.1 Evergreen tropical forest 5.2 Tropical forest patch
6. Barrenland	6.1 Beach 6.2 Transitional 6.3 Land reclamation
7. Wetlands	7.1 Water
8. Infrastructure (or Facilities)	8.1 Airport 8.2 Harbour