Geospatial analysis of irrigable lands in Essex Valley, St. Elizabeth, Jamaica using remote sensing and GIS techniques

Rupert Green

Content

Introduction

UKCIF/CDB* Funded Projects

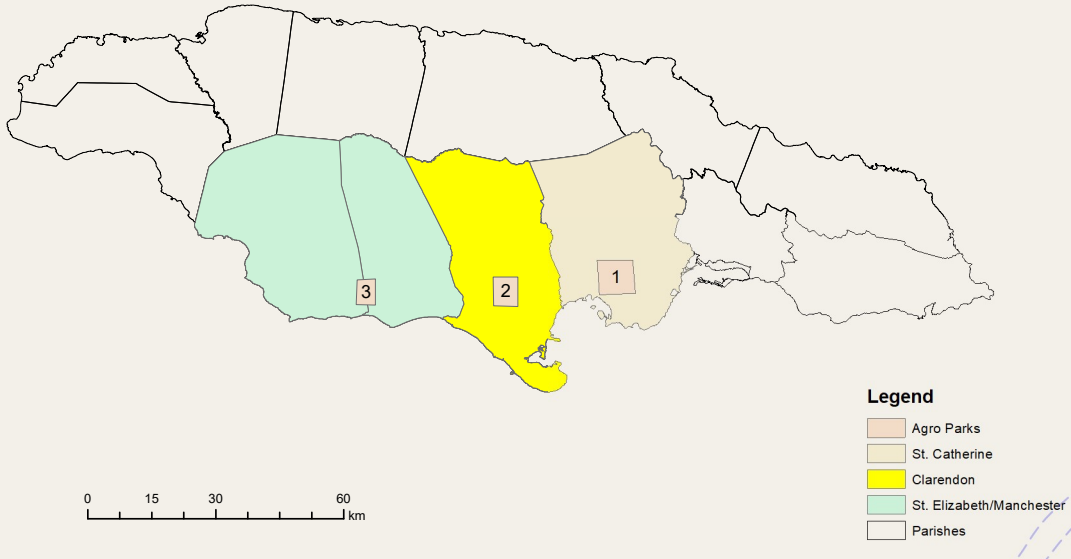
South Plains Agriculture Development Project

1 – Amity Hall/ Bridge Pen Agro Park

2 – Parnassus Agro Park

Essex Valley Agriculture Development Project

3 – Essex Valley Agro Park

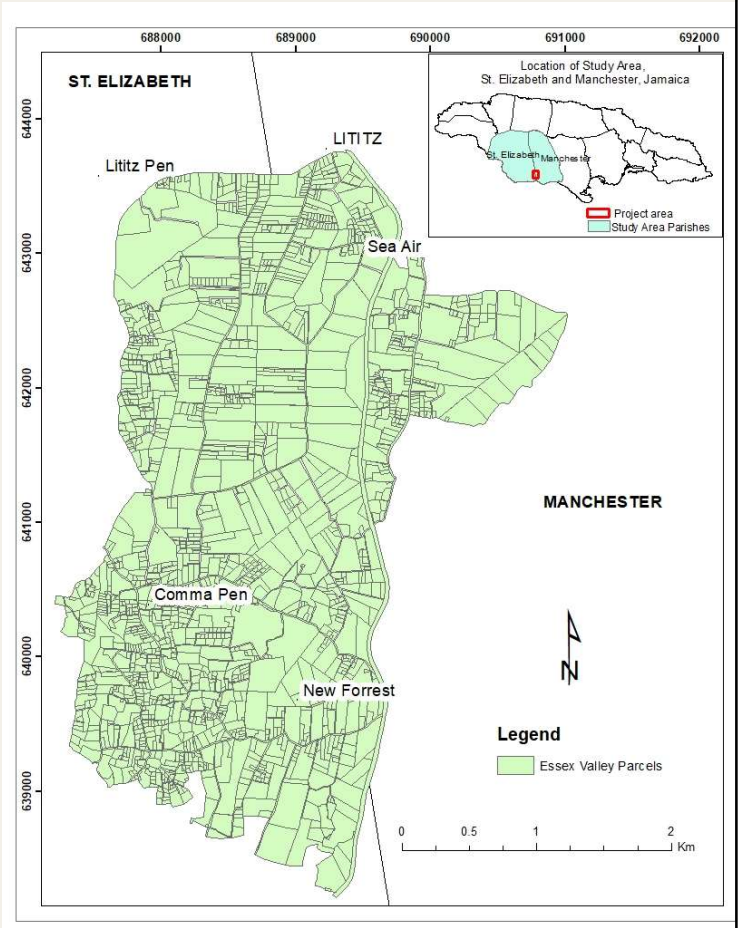


Study Area - Essex Valley

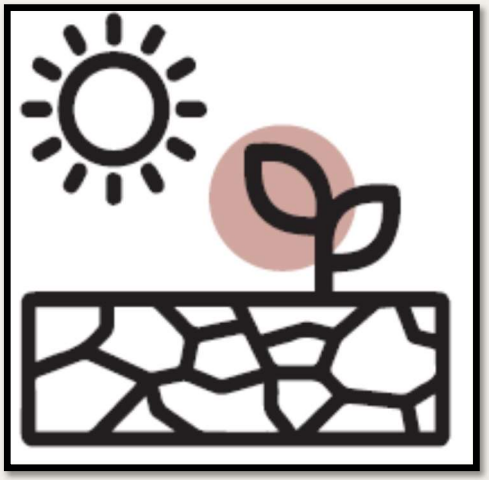
+ Essex Valley is located in the southern part of the parishes of St. Elizabeth and Manchester

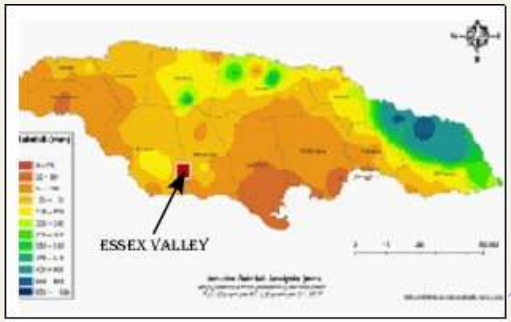
+ traditionally known as the “bread basket” of Jamaica

+ Important area for food supply and nutrition needs of Jamaica.



Study Area - Climatic and Physiography of Essex Valley





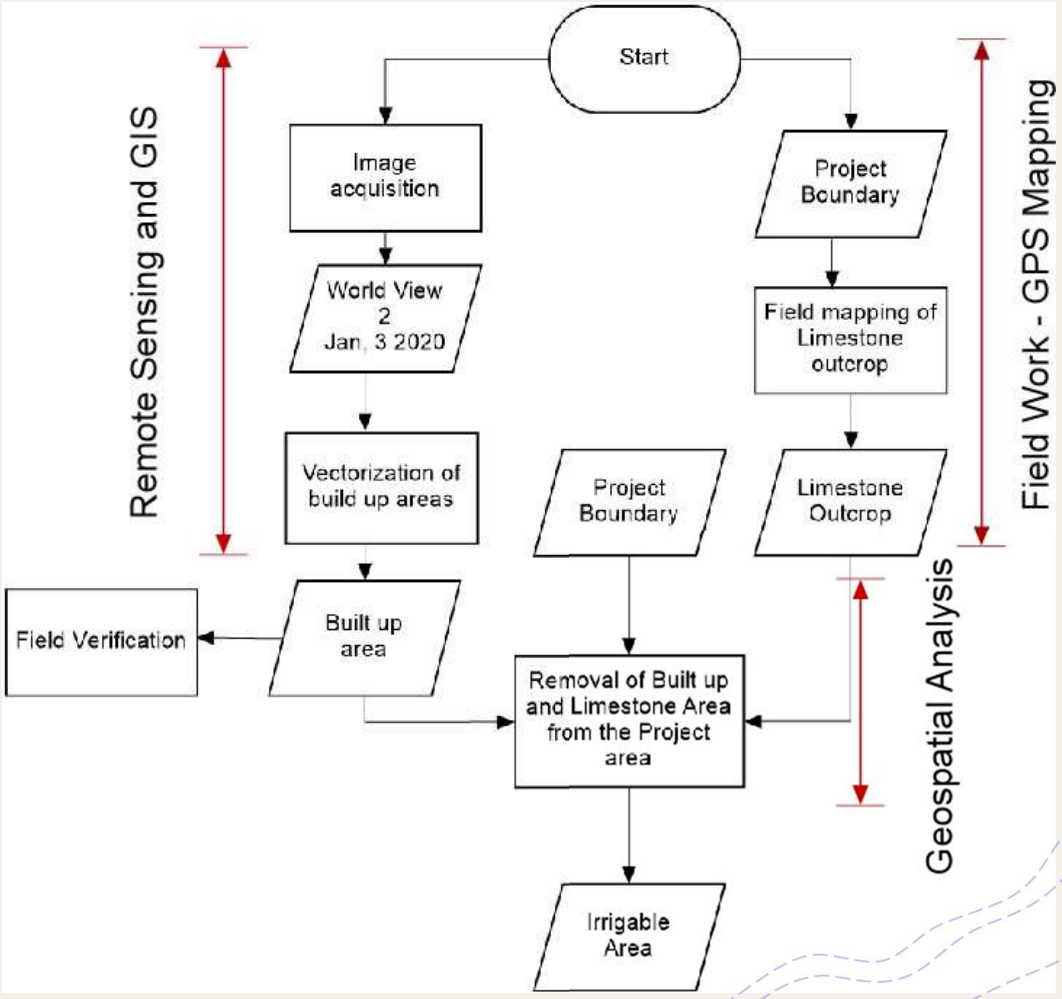
Source: Thirty-year (1971-2000) Mean Island Rainfall for December – Meteorological Service, Jamaica

The significant agricultural features of the area are:

- Low rainfall with droughts (increasing in frequency and intensity due to CV/CC)
- Relatively flat lands with intermittent hills
- Soils with rapid internal drainage and poor moisture-holding capacity.

Methods

+ Data – World View 2 imagery
+ Software – ArcGIS 10
+ Equipment –Trimble Geo 7X



Methods

Remote Sensing and Vectorization

- Acquisition of World View 2 – Jan 3, 2020
  - 50cm resolution
  - 4 band data (B, G, R, NIR)
- Vectorization of Built-up area (ArcGIS 10)
  - Using both Natural and Traditional False colour composite to aid in the extraction of built-up areas

Field Mapping of Limestone

+ Trimble GPS mapping units were used to map the spatial extent of the limestone outcrop.
  + Mapped around for small and medium-sized limestone hills
  + For very large hills, several location points were mapped around the outcrop.

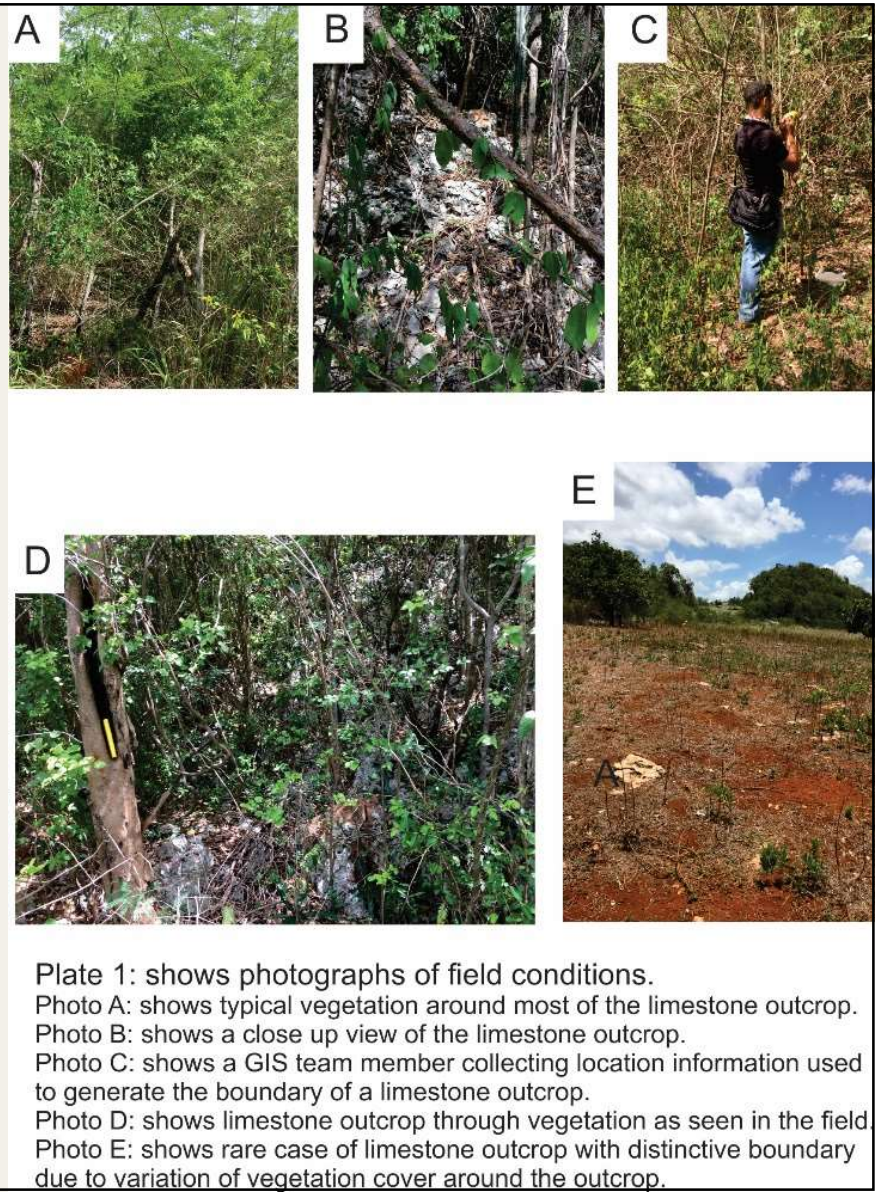
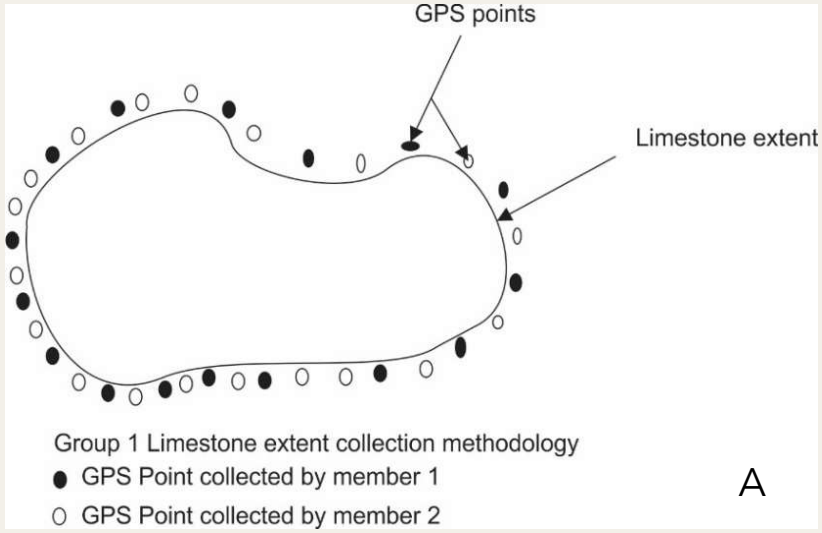
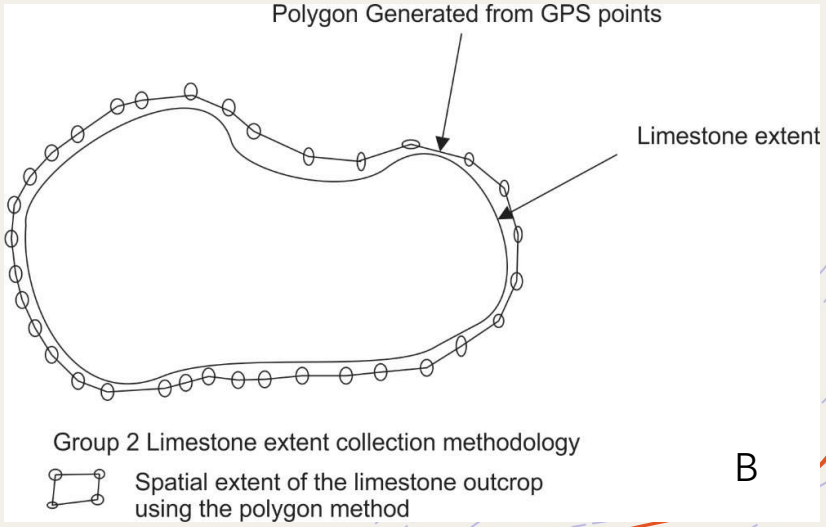


Plate 1: shows photographs of field conditions.
Photo A: shows typical vegetation around most of the limestone outcrop.
Photo B: shows a close up view of the limestone outcrop.
Photo C: shows a GIS team member collecting location information used to generate the boundary of a limestone outcrop.
Photo D: shows limestone outcrop through vegetation as seen in the field.
Photo E: shows rare case of limestone outcrop with distinctive boundary due to variation of vegetation cover around the outcrop.

Field Mapping of Limestone

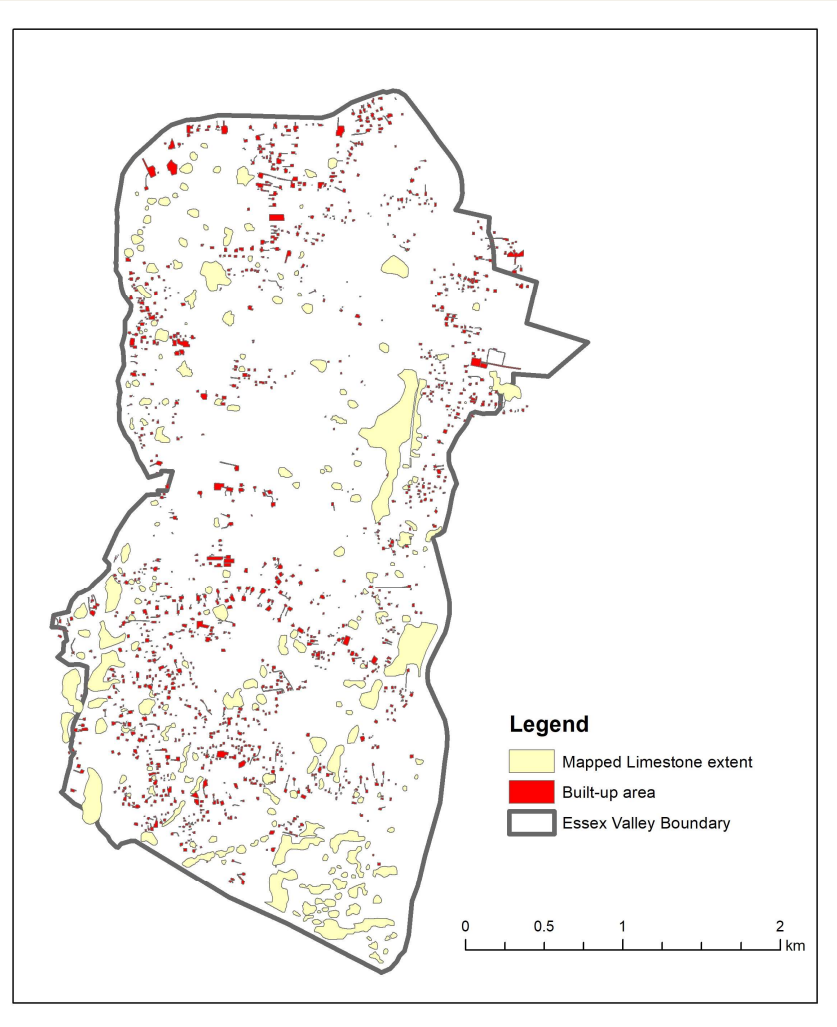
- Two methods were used for mapping around the limestone features
  - Point method - two members collected data using point coordinate location around the limestone outcrop, where each of the members collected alternative points around the outcrop as shown in A
  - Polygon method - used a polygon method in estimating the spatial extent of the limestone outcrop as shown in B





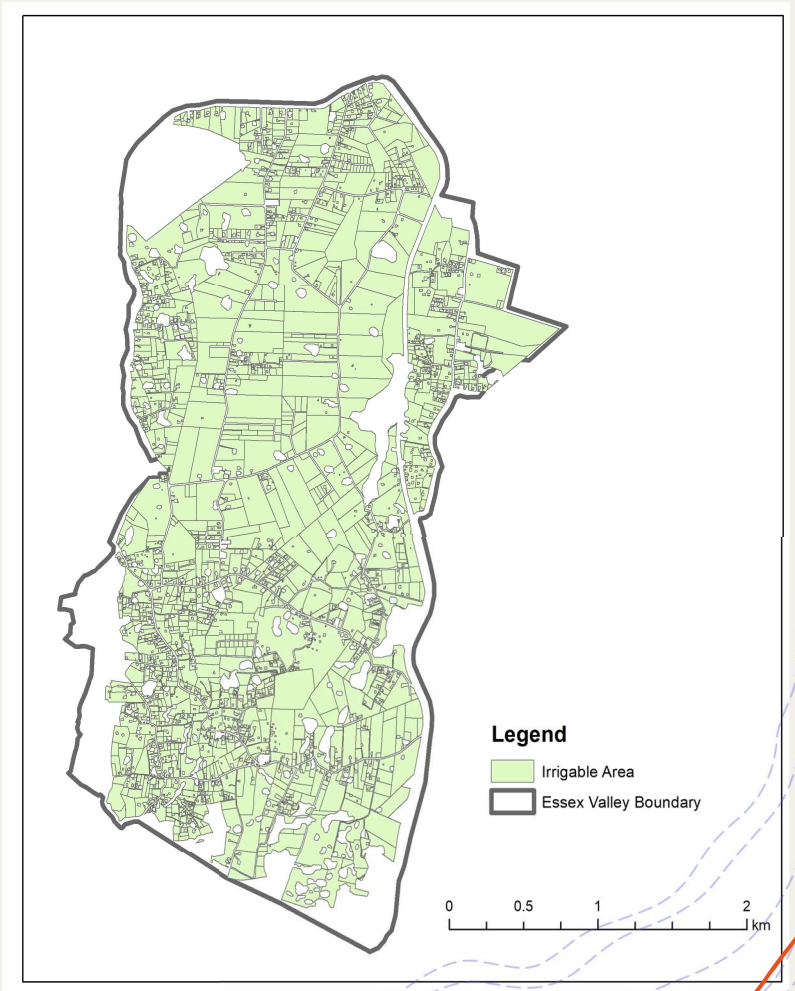
Geospatial Analysis

- The limestone outcrops were collated using ArcGIS
- The mapped limestone outcrops and the built-up areas were removed from the project area using the ‘Erase Tool’ in ArcGIS



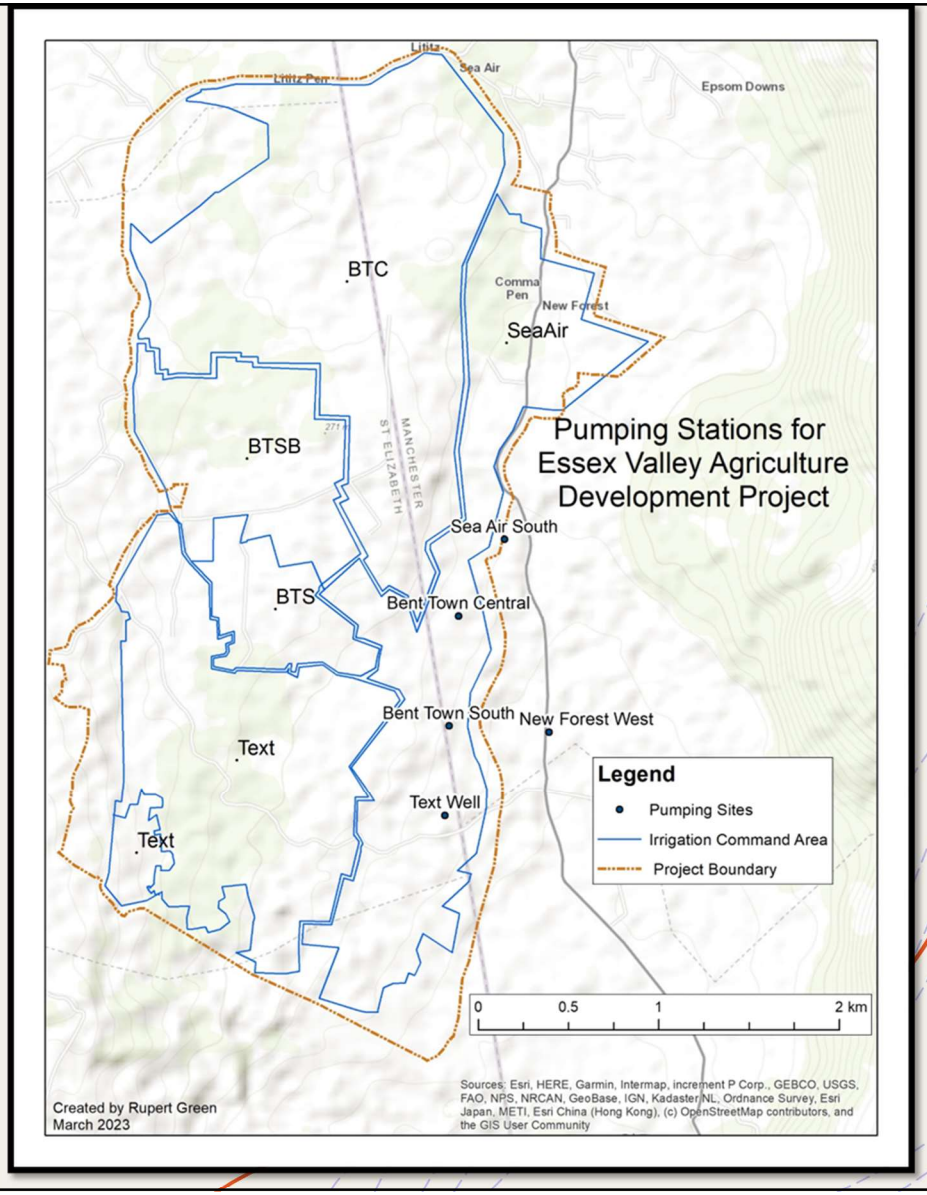
Results

+ The built-up area is estimated to be 39.23 ha
+ The limestone area is estimated to be 100 ha
+ The irrigable area is estimated to be 823 ha
+ A conservative estimate of 810 ha
    + changes to the built-up area
    + removal of other land use area



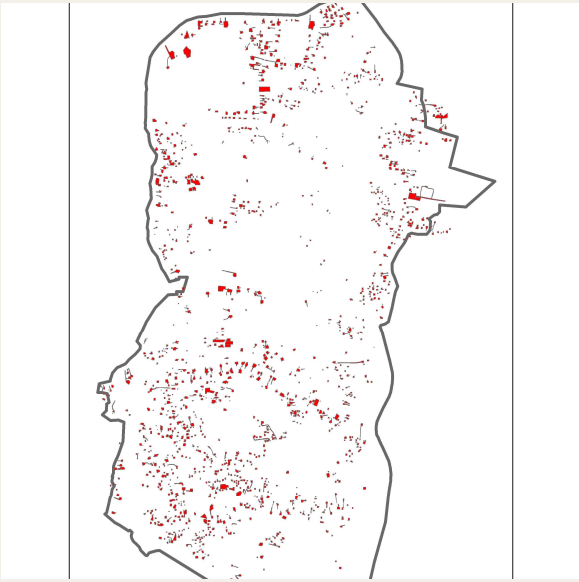
Discussion

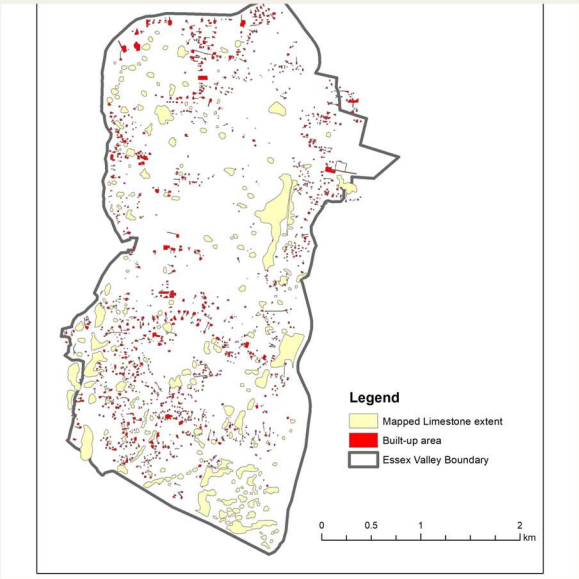
- Having a clear understanding of the lands that are irrigable
  - Allows for an efficient design of the irrigation system especially the case in Essex Valley with deep pumping wells and a complex farming landscape.

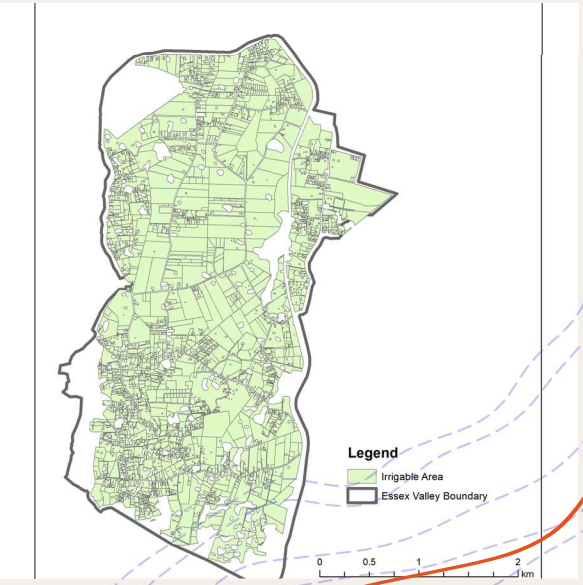


Discussion

- Using Remote sensing and geospatial analysis the irrigable area was estimated in 3 weeks in May 2021.
  - 2 days for built-up area vectorization
  - 2 weeks of the field mapping exercises
  - 2 days of collating and analysis



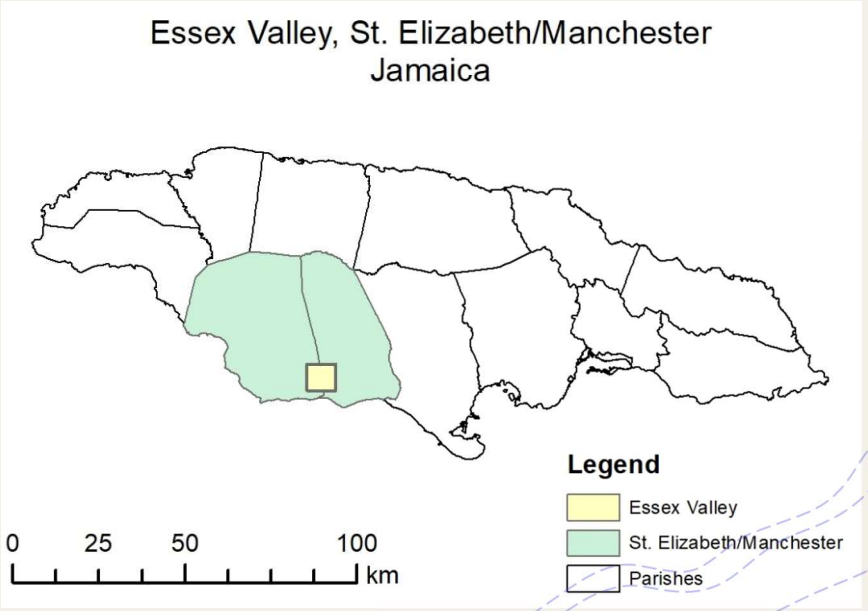




Conclusion

+ By using remote sensing and geospatial analysis, the irrigable area for the Essex Valley was estimated. This information plays a very key role in the water balance equation.

+ This information can be used to aid in a more efficient design of the irrigation network in light of climate change impacts on a small island state.



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from the British people

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Thank You

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