

Integrating GIS and Remote Sensing Techniques in Kingdom of Bahrain Vegetation Survey



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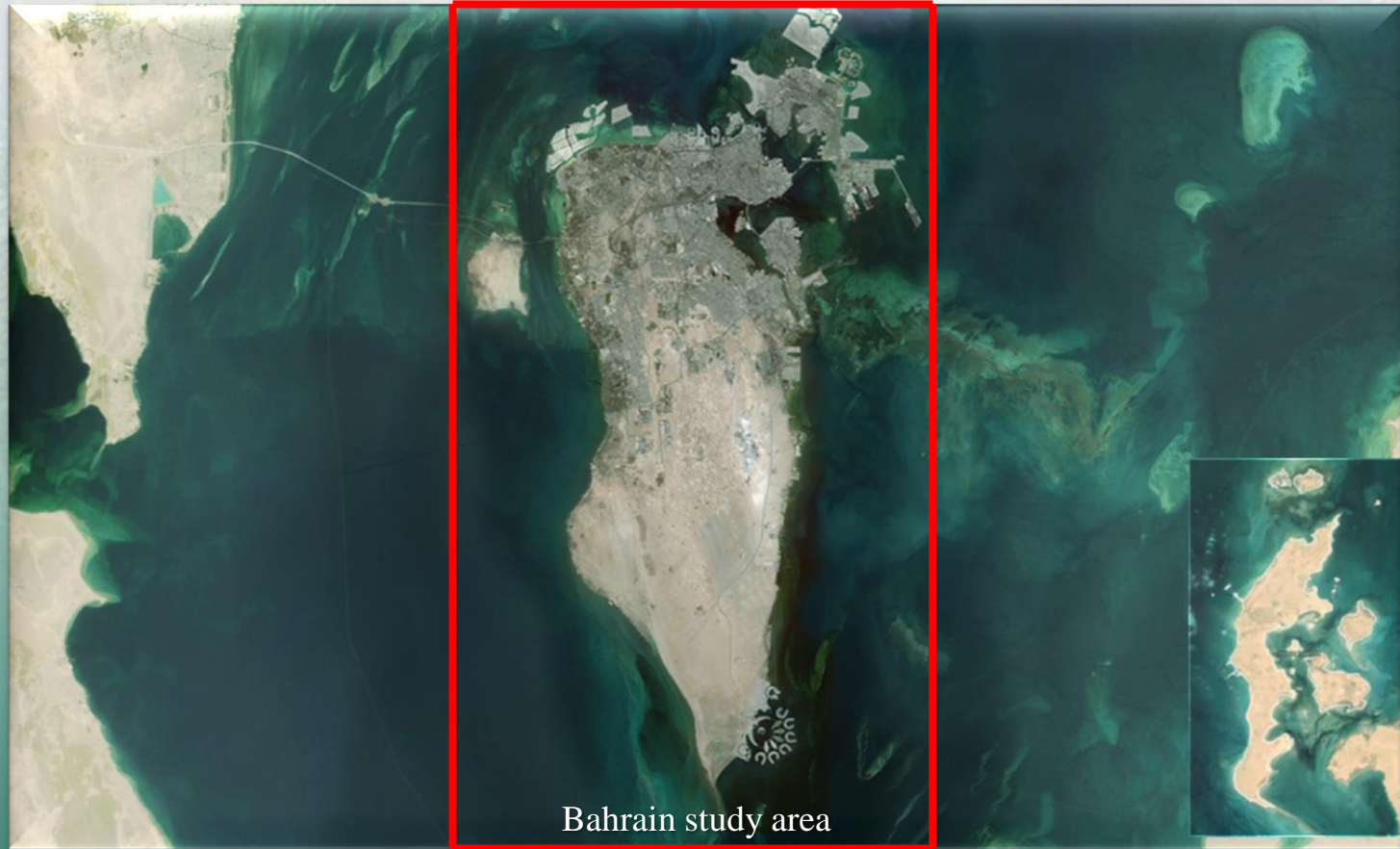
Information & eGovernment Authority (iGA),
Kingdom of Bahrain



Presentation Agenda

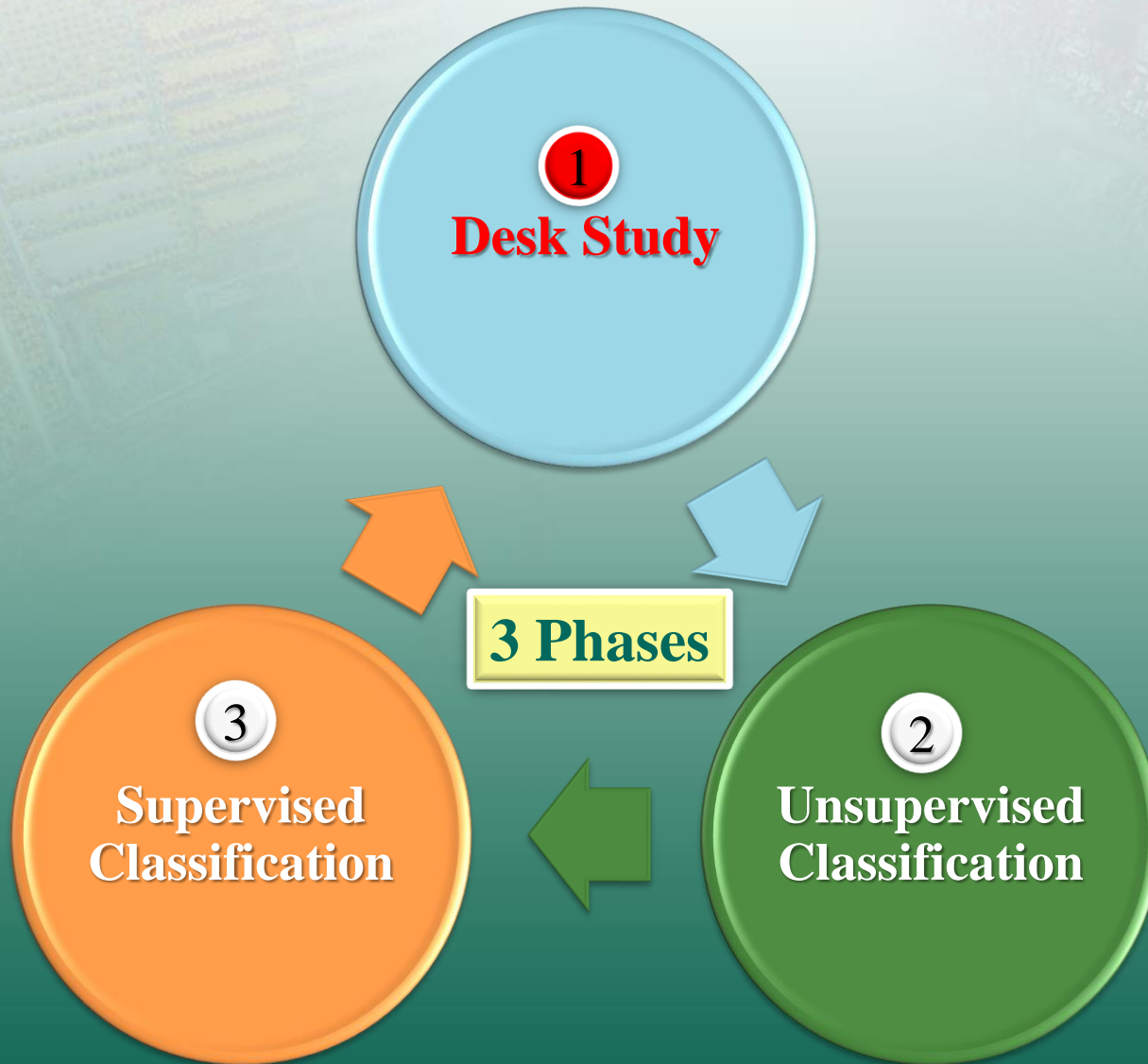
- 1. Introduction**
- 2. Study Execution**
- 3. Phase I – Desk Study**
- 4. Phase II – Unsupervised Classification**
- 5. Phase III – Supervised Classification**
- 6. Final Deliverables**
- 7. Conclusions**

Introduction

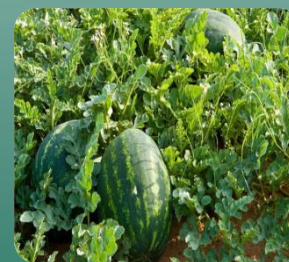


- ❑ In 2010 the General Directorate for Statistics of Bahrain undertook a general census in which part of it focused on agriculture and vegetation cover
- ❑ GIS and remote sensing (RS) techniques were used for the first time ever in the Kingdom
- ❑ The Vegetation Survey utilized high resolution (0.41 m) multi-spectral (near IR + BGR) imagery
- ❑ The survey was executed in three (3) phases for entire area for the Kingdom of Bahrain

Study Execution



Phase I – Desk Study



****Collection and review of existing information of vegetation cultivated and indigenous to Bahrain****

Phase I – Desk Study

Organizations contributing with information and data pertaining to vegetation in Bahrain



Provided information regarding the land cover and land use.



Provided information regarding the vegetation type local to Bahrain.

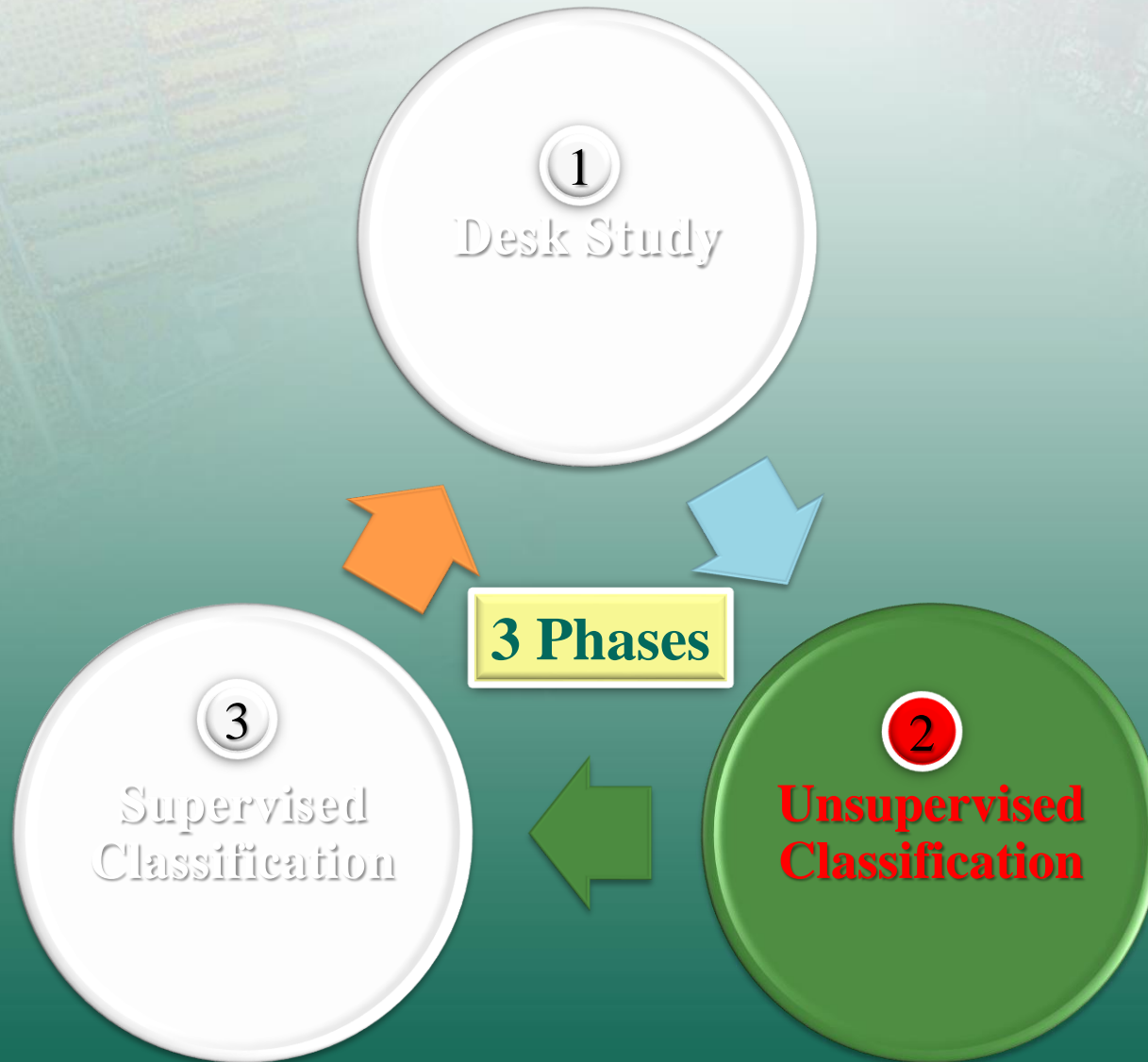


Provided information regarding the topological features of Bahrain.

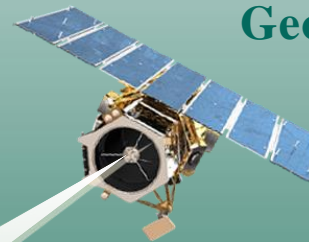


Websites for different Bahraini government agencies were accessed for additional relevant information.

Study Execution



Phase II – Unsupervised Classification (Calculated by Software)



GeoEye sensor

Phase II – Unsupervised Classification

1

- Acquiring high resolution satellite imagery (41cm to 50cm)



2

- Apply Normalized Difference Vegetation Index (NDVI)

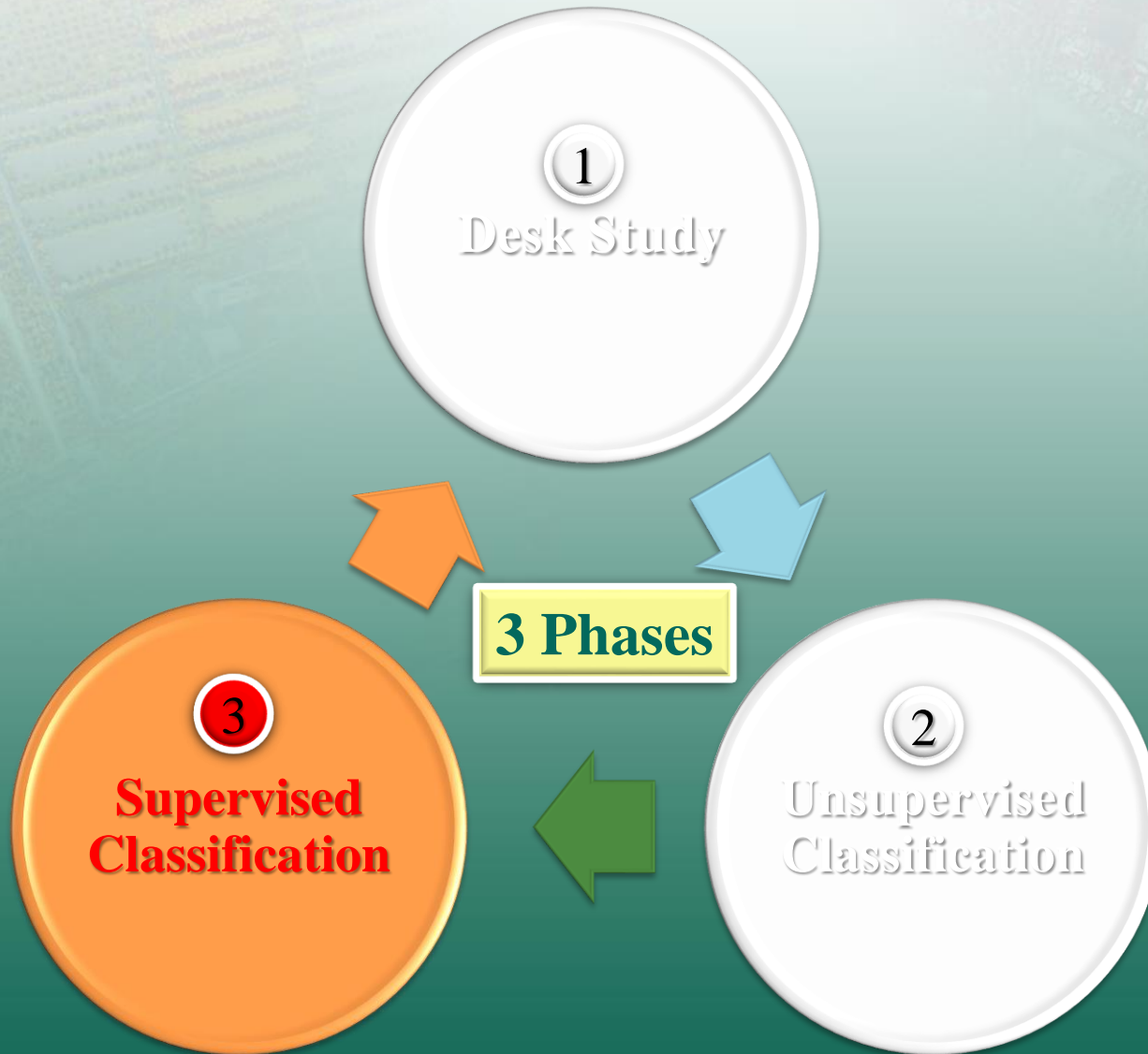


3

- Perform Unsupervised Classification



Study Execution



Phase III – Supervised Classification (Human-guided)

Field survey



179 sites were randomly selected

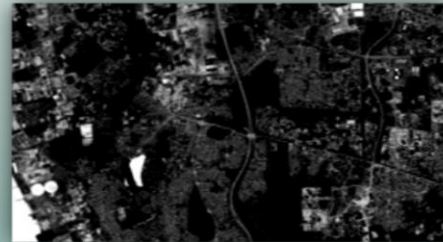


A map showing a sample of the collected field survey data



- 5 GIS specialists
- 20 sites covered per day
- GPS receivers were used

Supervised Classification



NDVI image



75 different vegetation types found such as palm trees, mangroves, tomatoes, etc.



An example of the vectorized vegetation classification map

Accuracy Assessment

Ground truth data for 110 randomly selected locations representing the various classes of vegetation were obtained

Accuracy Assessment in ERDAS Imagine

- Make a file in Excel with ONLY the X-Y coordinates for your GPS points collected in field



The measured accuracy was 87% accurate which is according to international standards is quite an acceptable level

Final Deliverables

- 1. Total vegetation cover**
- 2. Total agricultural crops**
- 3. A smart GIS location maps of the various vegetation**
- 4. A list of all vegetation types and their areas**
- 5. The general health of the vegetation**

Results

A range of statistical results obtained from the vegetation Survey. Many of these results were also produced as Thematic Maps, while some data was produced in tables.

A sample of vegetation classes

المساحة Area	دونم Dunam	كيلومتر مربع Km Sqr.	هكتار Hectares
Total vegetation cover	61216.25	61.216	6121.625
Total agricultural crops	10922.365	10.922	1092.23



Legend	لوحة المفتاح
Palm	النخيل
Fodder	العلف
Argula	جرجيد
Orchards	البساتين
Tomato	طماطم
Egg Plant	باننجان
Leek	بقل
Marsh	سيخة
Cabbage	ملفوف

Results

A sample of vegetation classes (documenting 75 types)

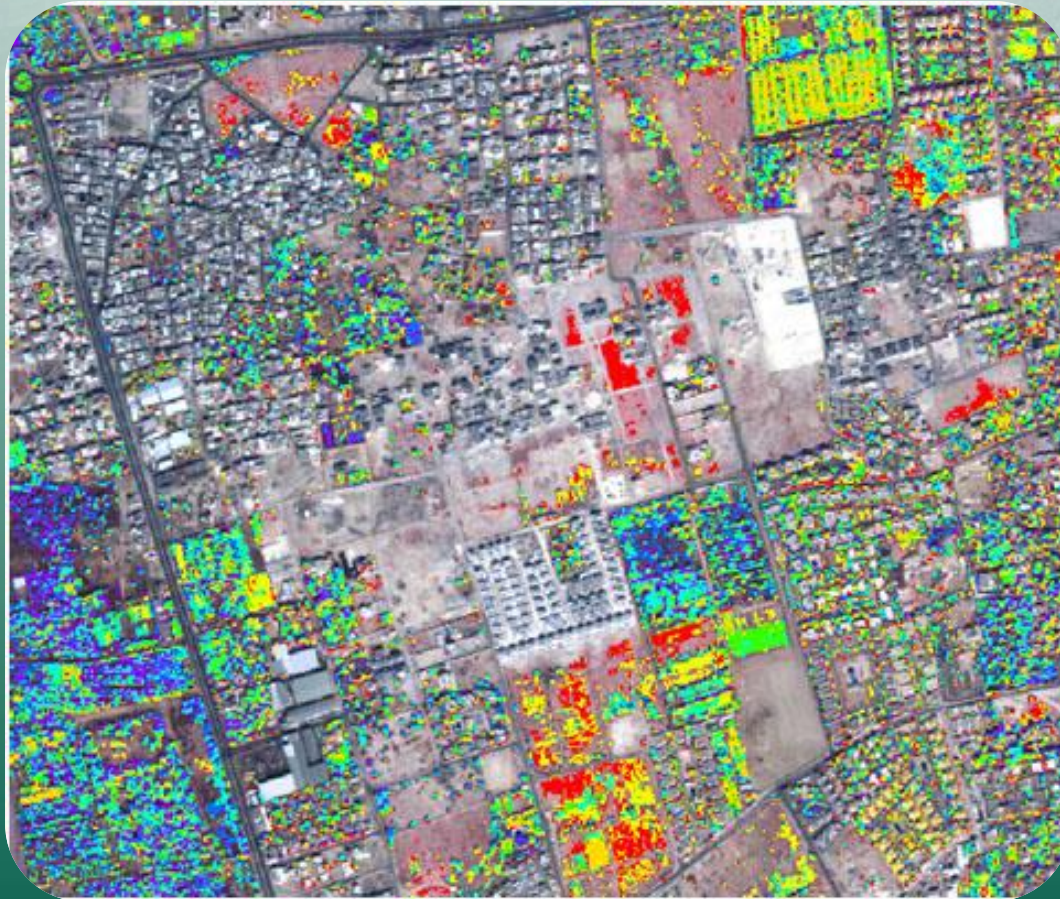
Area in SqrKM بالمتر المربع	التصنيفات Classes	
17.005	Date Palms	نخيل
0.978	Mixed Trees	أشجار متنوعة
1.644	Mixed Orchard	أشجار فواكه متنوعة
0.365	Kanar	كنار
0.356	Almonds	لوز
0.006	Tangerine	ترنج
0.006	Orange	برتقال
0.003	Banana	موز
0.042	Lemon	ليمون
0.036	Mango	مانجو
0.229	Neem	شجر النيم
0.285	Sweet Tamarind	تمر هندي
0.056	Sour Tamarind	صبار حامض
0.129	Eucalyptus	شجر الكينا
0.036	Sapodilla	جيكو
0.098	Papaya	باباي
0.300	Lasursa - Bambar	بمبار
0.431	Argula	جرجير
0.777	Barley	شعير
0.233	Beet Root	فجل
0.020	Bitter Gourd	قرع (صنف 1)
0.090	Bottle Gourd	قرع (صنف 2)
0.033	Broccoli	بروكلي
0.253	Cabbage	ملفوف
0.097	Carrot	جزر
0.303	Cauliflower	قرنابيط
0.175	Chard	سلك



Results

A zoomed-in view of some vegetation classes

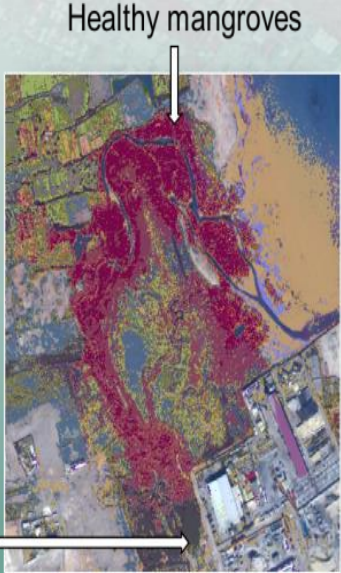
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 Cabbage	ملقوف



The General Health of Agricultural Crops



A satellite imagery in infra-red showing the general health of mangroves



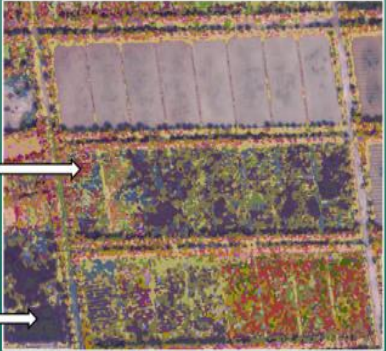
Healthy mangroves

Unhealthy mangroves

Classified vegetation (mangroves)



A satellite imagery in infra-red showing the general crops health



Healthy crops

Unhealthy crops

Classified vegetation

Conclusions

- 1) The objective of vegetation survey is achieved (mapping vegetation cover of Bahrain).**
- 2) The project has been a great success to expand research program to cover additional RS projects and applications to include other inputs, such as weather and soils data.**
- 3) To sum up, “iGA” is able to build and use the necessary GIS infrastructure in Bahrain and exploit the joint GIS and RS analysis system to support agricultural statistics and likely crop monitoring activities.**