



# Mapping the coastal margins of the Falklands

*Fine scale mapping  
Stakeholder Prioritisation Workshop*



*#SouthAtlanticCoastalMapping*



- *DPLUS065 Coastal Mapping Project – Grant aided by the Darwin Initiative through UK Government funding*
- *Satellite images courtesy of Digital Globe Foundation*

# Agenda

- Introductions
- Coastal Habitat Mapping in the Falklands – an update on the project, and how it may be useful
- From broad to fine scale – the issue of scale & resolution
- Group Exercise .1.
- *Break*
- Group Exercise .2.
- Next Steps
- *Close and lunch*

A satellite image of a coastal region, likely the Gulf of Mexico, showing a large body of water and a complex coastline with numerous inlets and peninsulas. The text is overlaid on the image.

**This is the only agenda there is!**

There are no preconceptions

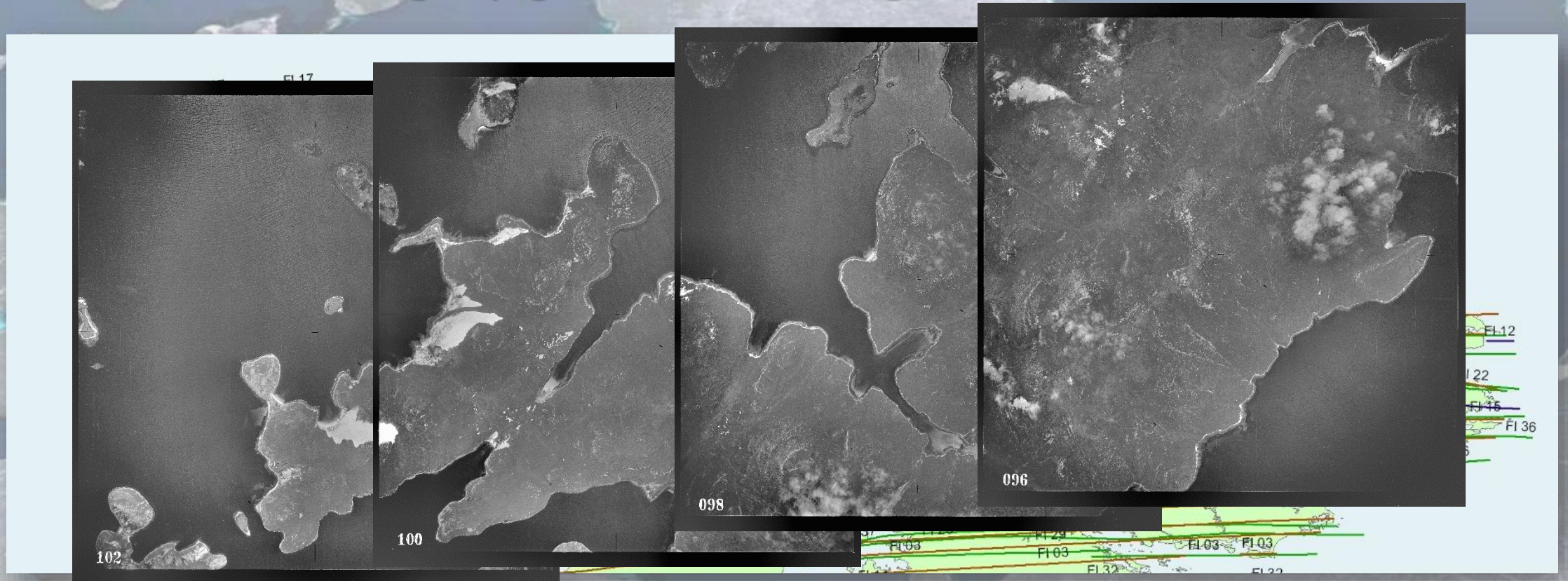
We want to develop the best coastal habitat maps  
That deliver your “needs”

# Why do we need coastal habitat maps?

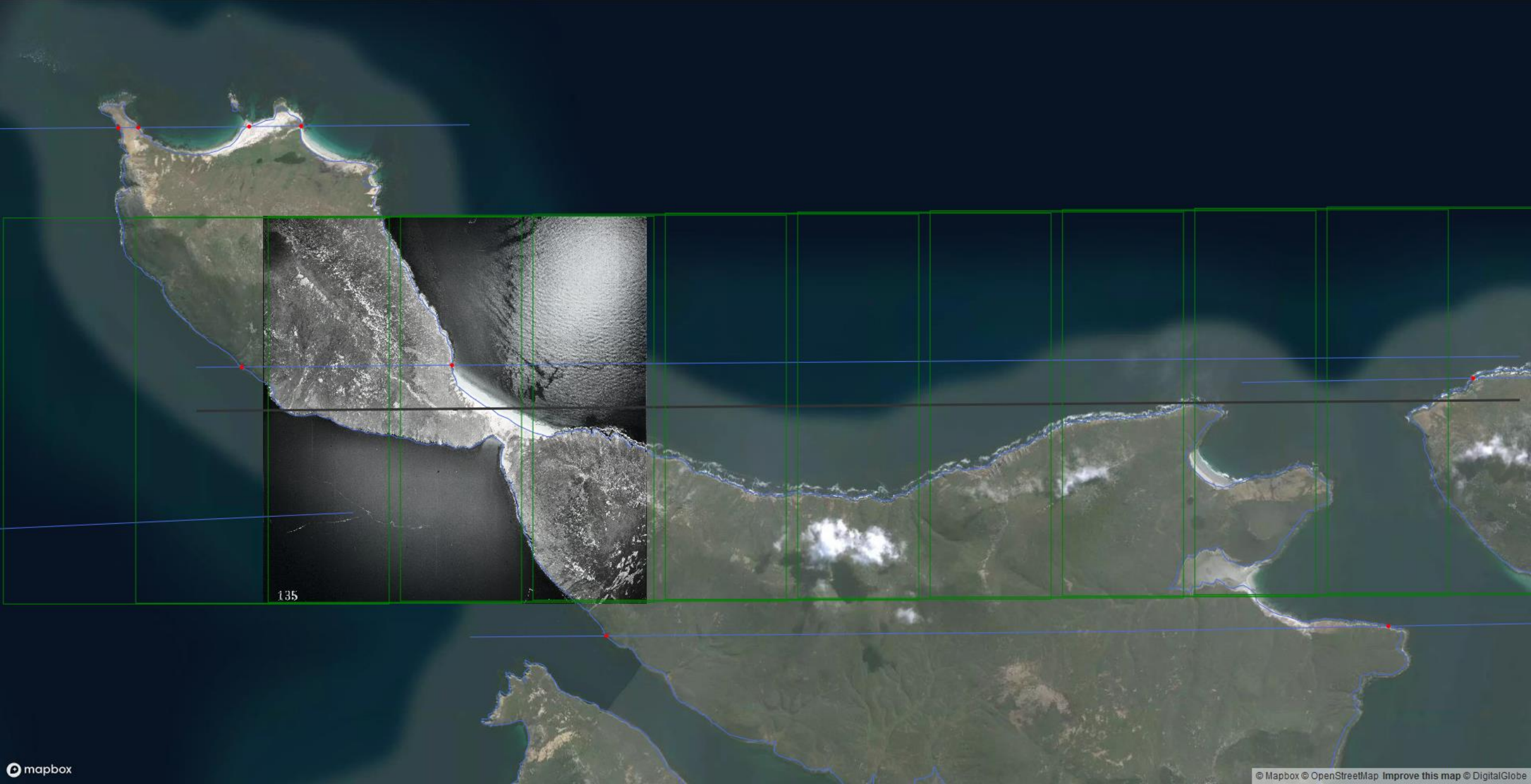
- Before we can plan and manage – need knowledge
- These “satellite-derived” baseline habitat maps will be a first for the Falklands
- Plugging a knowledge gap – Landowners, other stakeholders and Government
- Not a one-off: developing a legacy – creating models, methods and systems for future iterations

# Project update: Work Package 1

## 1956 Aerial Imagery geo-referencing



- Due to deliver – end of Sept '18



1956



1956 Aerial Imagery © Copyright Falkland Islands Government and HMG





# Project update: Work Package 2

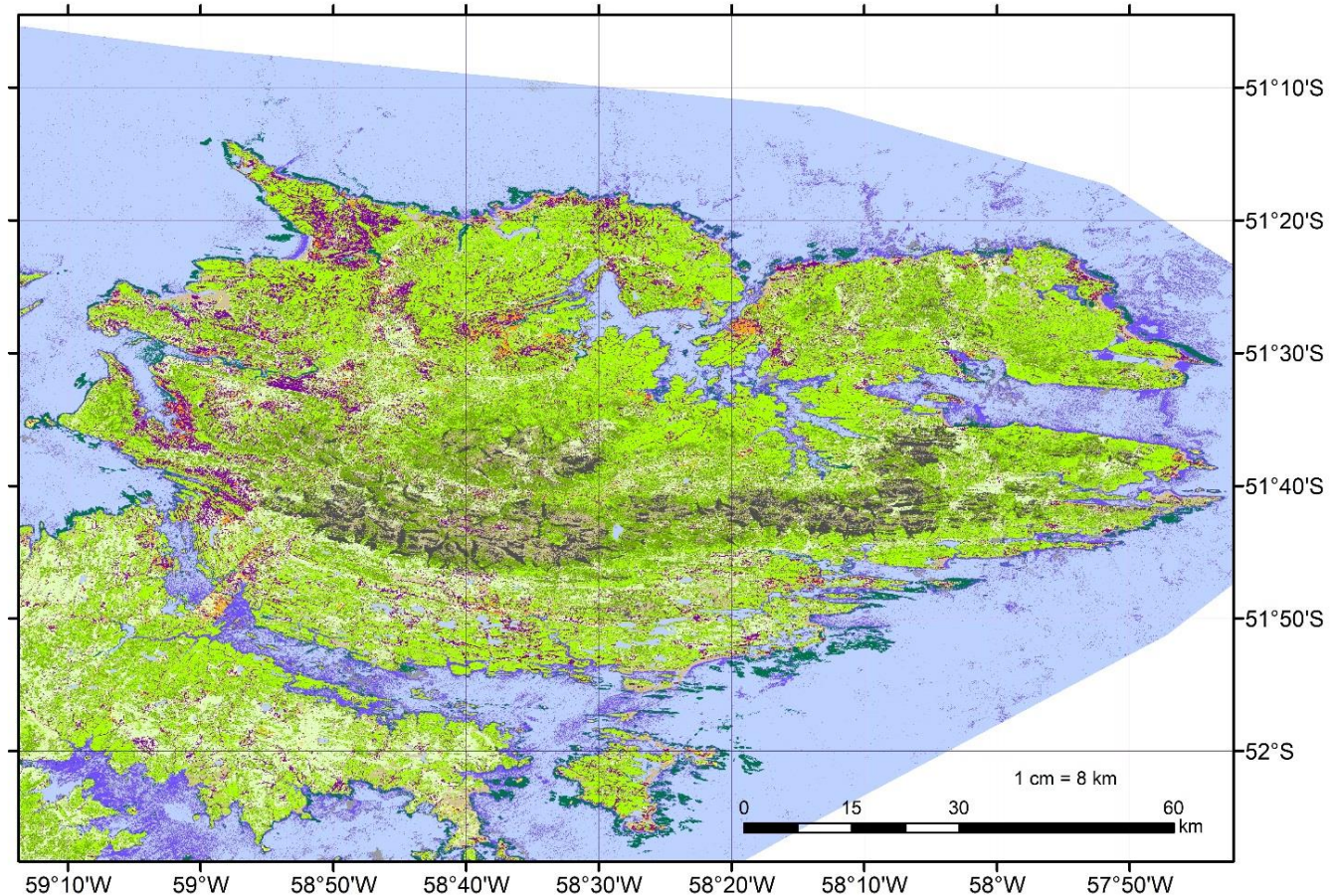
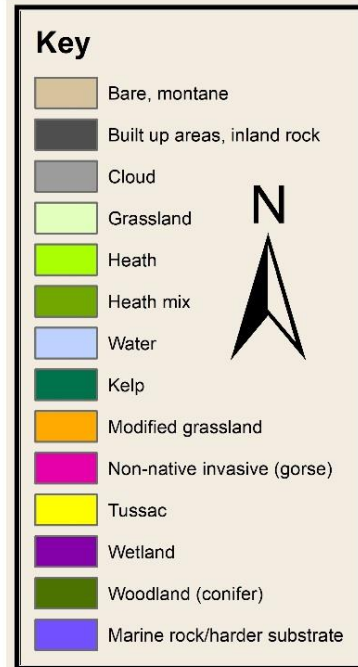
- Broad scale (Stage 1) coastal habitat maps
  - Developing a cloud-based modelling system for future use.
  - Train software (machine learning) using ground validation data to classify “free to access” satellite data (10m resolution)
  - Project is coastal focused, distinct from previous work
  - Added value by inclusion of Falklands-wide imagery
  - Fine scale maps will be focused on coastal regions
  - Final broad scale maps for delivery in September 2018.

# Natural Capital mapping – how is it different?

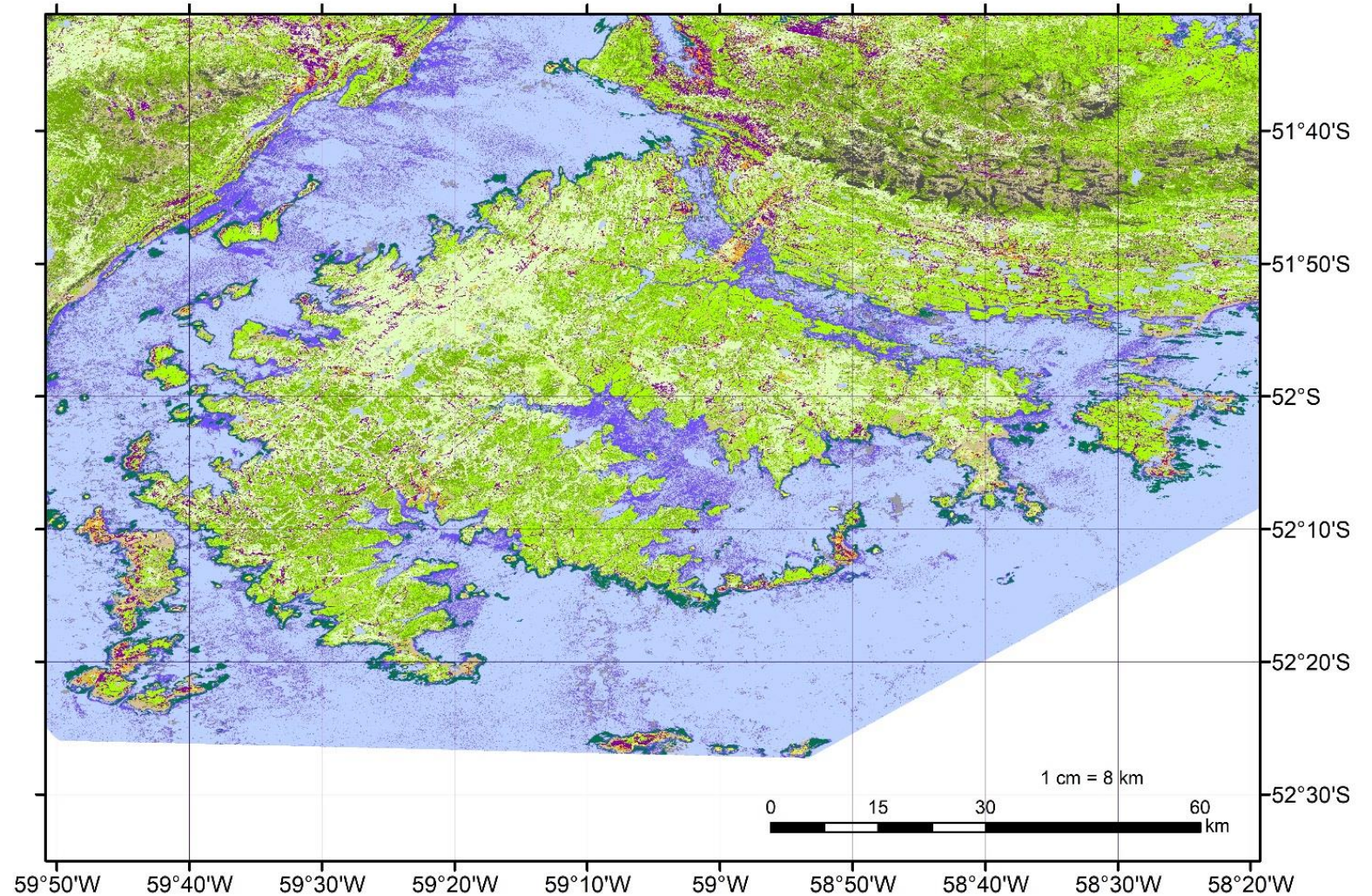
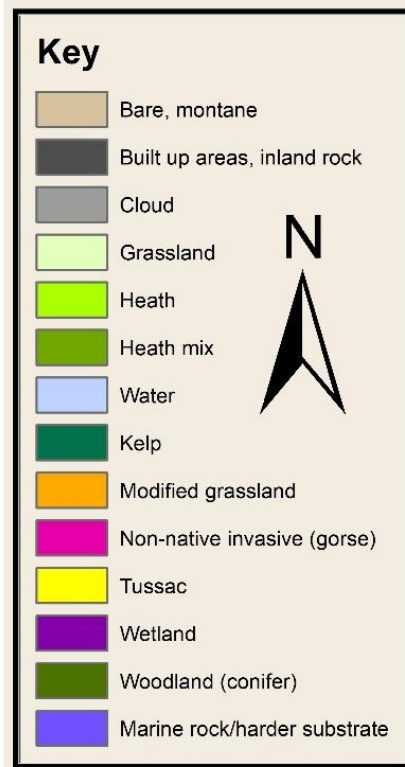
- Developing a sophisticated cloud-based habitat model
  - Google Earth Engine
  - Evolving from pixel-based to object-based analysis
  - Collecting additional ground validation for “problem classes”
  - Focusing on the coastal zone and delving into the subtidal:
    - Looking to develop a satellite derived bathymetry layer for inshore areas

# Project update: Work Package 2

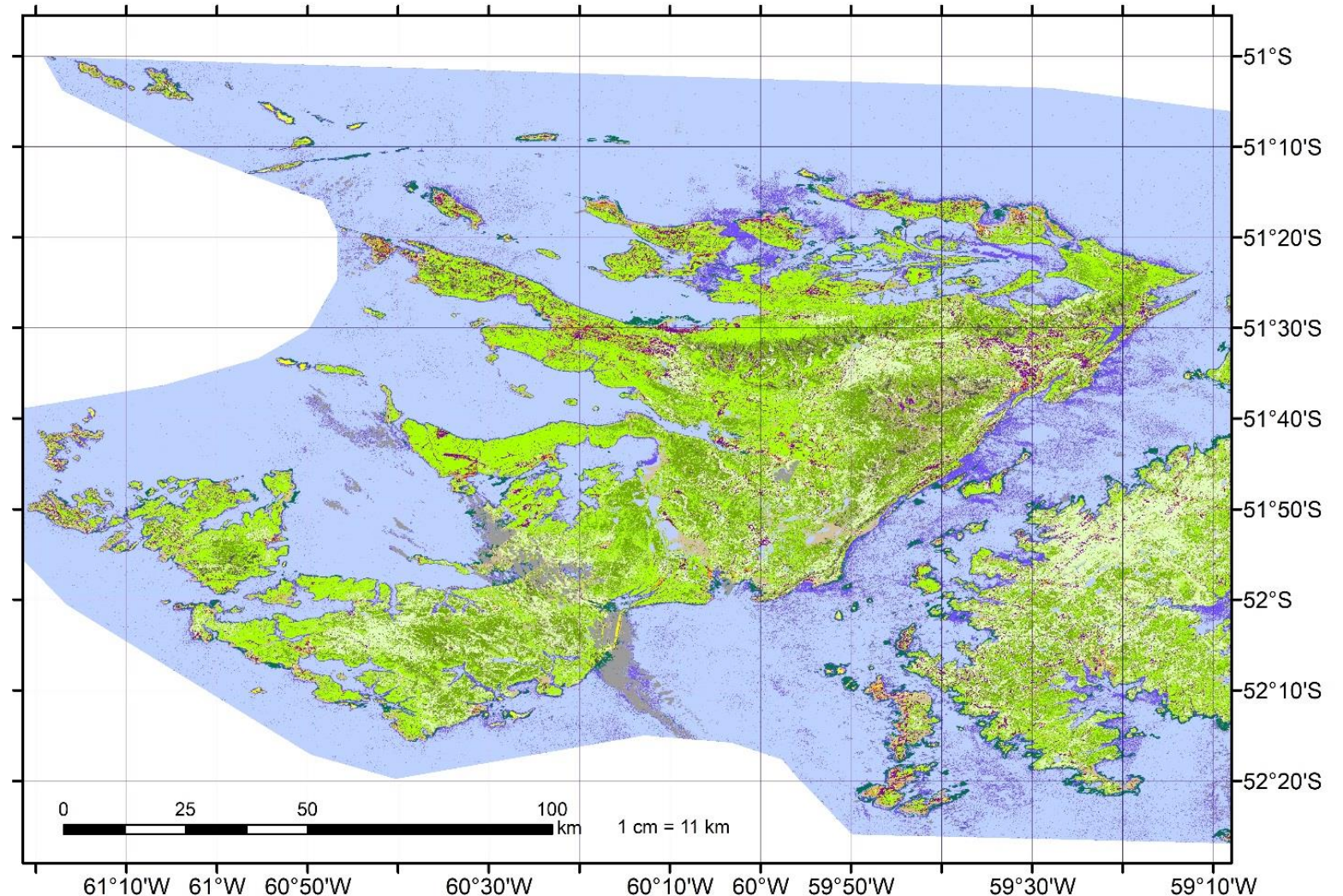
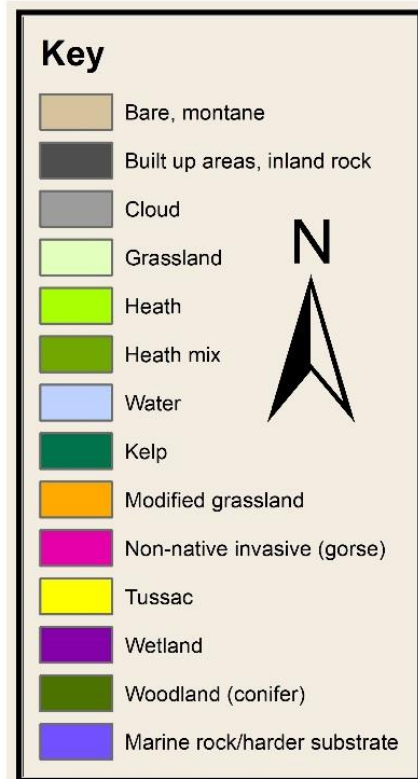
## East Falkland Landcover Classification



# Lafonia Landcover Classification



# West Falkland Landcover Classification



Classified/Predicted habitat classes	Observed														Total number of classified/predicted points	User Accuracy (reliability)	Errors of Commission
	Bare/Montane	Built Up Area/Inland Rock	Cloud	Grassland	Heath	Heath Mix	Inland and Sea Water	Kelp	Modified Grassland	Non-Native Invasive	Tussac	Wetlands	Woods (Conifers)	Marine Rocks			
Bare/Montane	180	19	0	8	16	11	0	0	0	0	3	5	0	1	243	74%	26%
Built Up Area/Inland Rock	33	107	0	2	2	3	0	0	0	0	4	0	0	1	152	70%	30%
Cloud	0	1	11	0	0	0	0	0	0	0	0	0	0	0	12	92%	8%
Grassland	3	0	0	172	13	13	0	0	3	0	3	22	0	0	229	75%	25%
Heath	4	0	0	2	246	19	0	0	1	1	0	20	0	0	293	84%	16%
Heath Mix	7	0	1	34	18	19	0	0	5	0	1	6	0	0	120	40%	60%
Inland and Sea Water	4	0	0	0	1	0	158	4	0	0	0	0	0	5	172	92%	8%
Kelp	2	0	1	0	0	0	4	90	0	0	0	0	0	34	131	69%	31%
Modified Grassland	0	0	0	10	6	4	0	0	27	0	2	16	0	0	65	42%	58%
Non-Native Invasive	0	0	0	0	1	0	0	0	1	3	0	8	0	0	13	23%	77%
Tussac	0	1	0	4	6	0	0	0	0	0	53	7	0	0	71	75%	25%
Wetlands	1	1	1	18	23	2	1	0	3	0	6	230	0	0	286	80%	20%
Woods (Conifers)	0	0	0	0	0	0	0	0	0	0	1	0	1	0	2	50%	50%
Marine Rocks	0	0	1	0	0	0	3	19	0	0	0	0	0	104	127	82%	18%
<b>Total number of ground validation points</b>	234	129	15	250	332	100	166	113	40	4	73	314	1	145			
<b>Producer's Accuracy</b>	77%	83%	73%	69%	74%	48%	95%	80%	68%	75%	73%	73%	100%	72%			
<b>Errors of Omission</b>	23%	17%	27%	31%	26%	52%	5%	20%	33%	25%	27%	27%	0%	28%			

Overall accuracy: 75%

- 
- An aerial satellite image of a coastal region. The image shows a large bay with turquoise water, a city with a grid street pattern, and an airport with a long runway. The land is a mix of brown and green, indicating different vegetation and urban areas. The sky is blue with scattered white clouds.
- We'll be doing further work on these broad scale maps
  - Will require additional ground validation points

**More ground validation = better models & maps**

# Project update: Work Package 3

- Fine scale (Stage 2) coastal habitat mapping
  - To identify/address significant areas of uncertainty in the maps **OR**
  - To address issues/areas highlighted by stakeholders (YOU) as a priority
- Access to very high resolution satellite imagery (up to 50cm resolution) - Digital Globe Foundation grant.
- Acquisition of ultra high resolution (2cm) imagery using Phantom 4 Pro drones.





# Fine scale habitat mapping – why?

- Can help with planning and management:

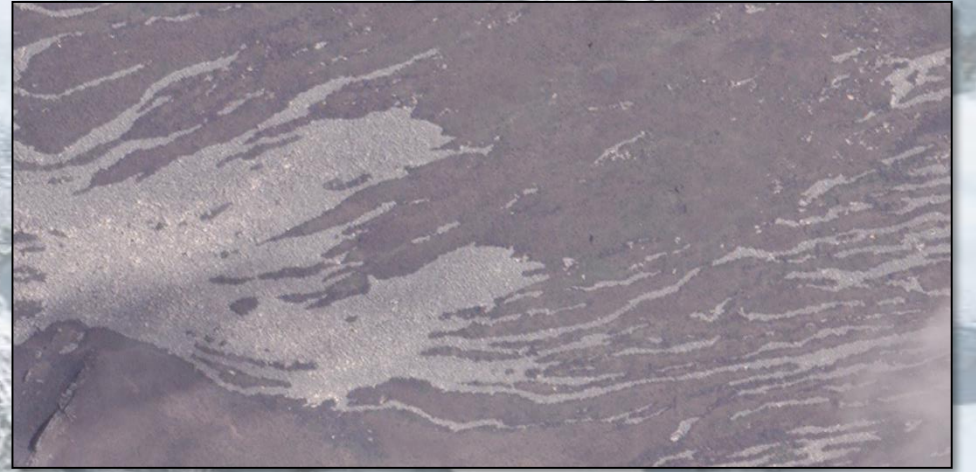
## some ideas.....

- Establishing baselines to measure future change
- Prioritising areas with significant erosion
- Coastal tussac – dense vs sparse – where to re-plant
- Identifying shallow subtidal nursery habitat (Loligo)
- Invasive species monitoring e.g. calafate/gorse
- Coastal planning

**BUT ....the choice is yours**



# Impact of Resolution



- Why not just use Google Earth?
- The type of features you can map relies directly upon the resolution of your input imagery.
- To know what you can map, you need to know what features your data is capable of capturing.

# Sentinel 1 and 2

A satellite image showing a coastal area with a large bay and surrounding land. The land is green and brown, indicating vegetation and urban areas. The water is dark blue. The image is used as a background for the text.

- free to the public
  - additional processing
- finest distinct features: large buildings, roads, ponds

- mostly 10 m resolution
- regularly updated

# Sentinel-2

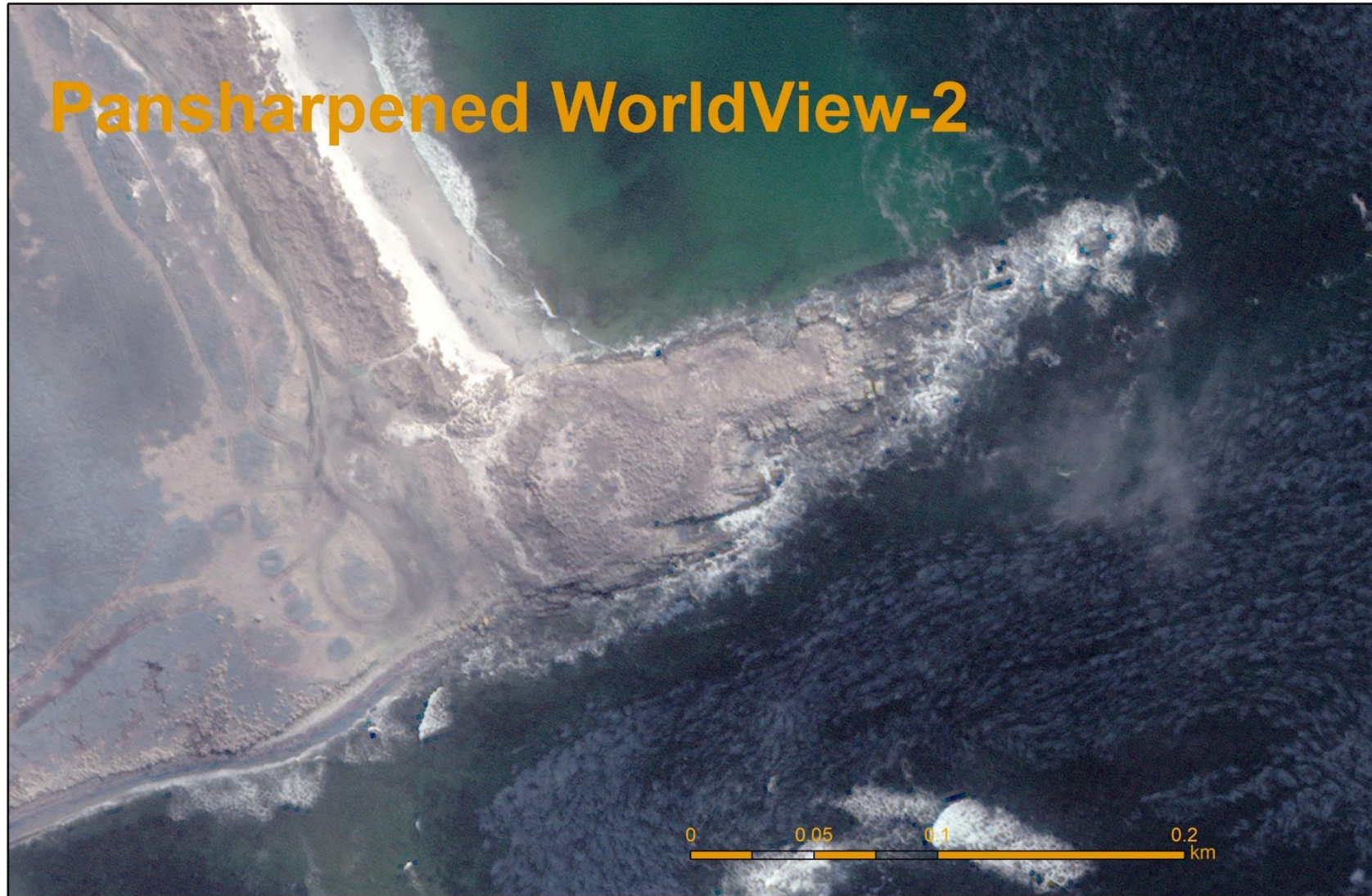
0 0.05 0.1 0.2 km

# WorldView-2

A satellite image showing the hull of a ship. The ship's name 'PROTECTOR' is clearly visible in the center. To its right, the words 'ENDURANCE', 'DUMBARTON CASTLE', and 'CLYDE' are also visible. The hull is dark blue and shows some wear and tear. There are some circular structures on the right side of the image, possibly part of the ship's equipment or a nearby structure.

- 0.5 – 2 m resolution
- full coverage of both South Georgia and Falkland Islands
- available for research purposes
- finest distinct features: Rover vs. Mitsubishi

# Pansharpended WorldView-2



# Drone

An aerial photograph showing a blue truck parked on a dirt road. The surrounding area is a mix of dirt, grass, and some debris. A semi-transparent text box is overlaid on the right side of the image, containing a list of bullet points. The word 'Drone' is written in a large, orange, sans-serif font in the top left corner.

- ~ 2 cm resolution (50 m altitude)
- future: multispectral capability
- surveys conducted by SAERI
- finest distinct features: blades of tussac, tire tracks, fences, teaberry patches



# Drone Survey



0 0.05 0.1 0.2 km

# Resolution and **scale** of our imagery:

## “Coarsest” to “finest” resolution:

- **regional** Sentinel 1 and 2 satellite imagery (about 10 m)
- **regional** WorldView-2 satellite imagery (0.5 - 2 m)
- **local** drone surveys (~ 2 cm)



An aerial photograph showing a coastal region. In the lower-left, a city with a grid street pattern is visible. To its right is an airport with a long runway. Further right and slightly inland are several large, irregularly shaped bodies of water, some appearing greenish-brown and others darker blue. The surrounding land is mostly brown and tan, suggesting a semi-arid or coastal plain environment. The sky is filled with scattered white clouds. The text "Next steps..." is centered over the image in a large, black, sans-serif font.

**Next steps...**

# Next steps ..

- **Stakeholder workshop report**
  - Draft circulated to attendees
  - Published on project website
- **Extensive fieldwork in Spring and Summer**
  - Undertaking aerial surveys with drone
  - Gathering ground validation information
  - Opportunities for volunteers to take part
- **Project deliverables:**
  - Broad scale habitat maps for Falklands – end September 2018
  - Fine scale regional/local habitat maps – end June 2019

# Next steps (contd)..

- **Shackleton Scholarship Fund:**
  - Drone expert visiting the Falklands from Oregon State University, 24<sup>th</sup> November 2018
  - Plan to undertake workshops and presentations in East and West Falkland



# Thank you for listening



*We gratefully acknowledge the contribution (through data provision) made by the Falkland Islands IMS-GIS to this project*

*1956 Aerial Imagery © Copyright Falkland Islands Government and HMG*

*Satellite images courtesy of Digital Globe Foundation*



# Thank you for listening

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