Soil map and online database as climate change mitigation tools

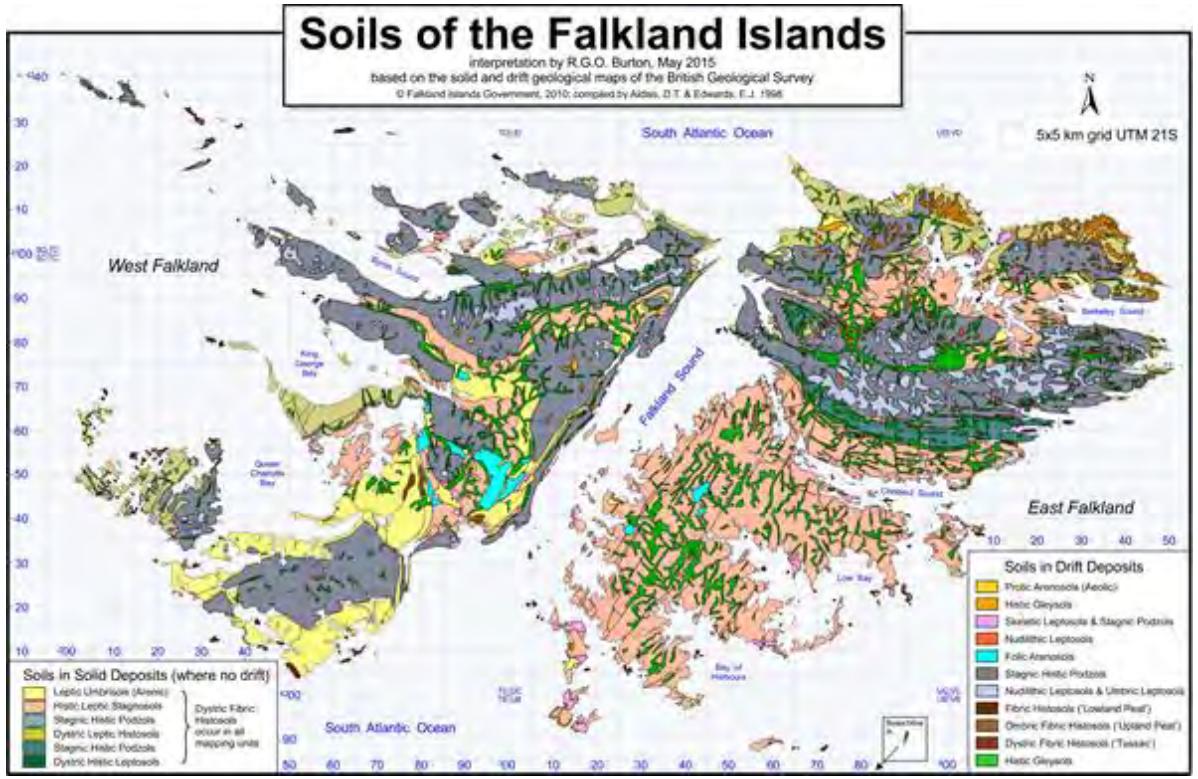
Dr. Stefanie Carter

SAERI

Project Background

- **April 2018 to July 2020**

- **Project aims:**
  - **Create national soil map**
  - **Provide interactive tool for land managers**
  - **Establish a baseline for peatlands, carbon stock and erosion for climate change mitigation**



Project Background - Project Partners

Tara Pelembe
Deputy Director Innovation
Dr. Steffi Carter
Project Manager

Matt McNee *Agronomist*

Gordon Lennie *Lab Technician*

Dr. Jim McAdam *Consultant*

Dr. Matt Aitkenhead *Soils Modeller*

Dr. Anne D. Jungblut
Researcher,
Botanical Diversity

Roberto Jara Langhaus
Soil Surveyor

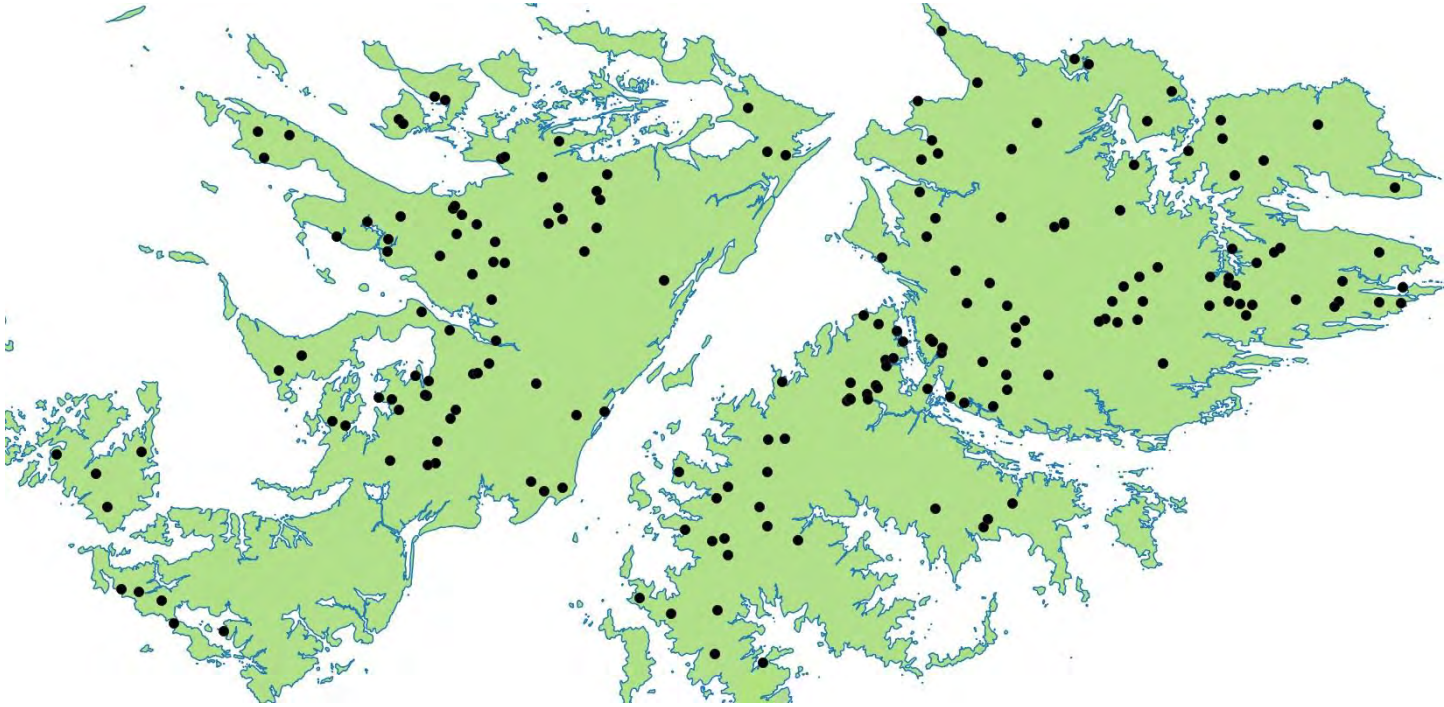
Dr. Sergio Radic Schilling
Agricultural Engineer

Prof. Chris Evans *Biogeochemist*

Project Background – Soil Model

Soil survey point selection

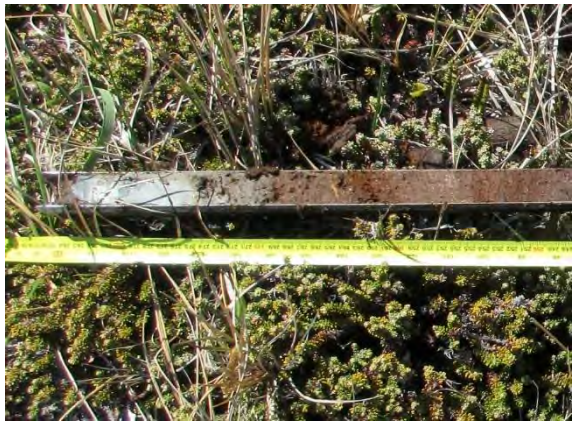
- **Computer process selected points based on parameters for**
  - **- geology**
  - **- existing soil class**
  - **- topography**
  - **- habitat**
  - **- vegetation (through satellite spectral bands)**
- **2 field seasons covered 194 points**



Project Background - Fieldwork

At each point:

- **5 soil horizon descriptions**
- **Collection of soil samples for chemical analyses, bulk density, fibre & organic matter content and microbiology**
- **Transects for peat depth**



Project Background – Lab Work

For each point:

- **Chemical analyses for Nitrate, Phosphate, Potassium, Magnesium, Aluminium, Calcium, Sodium**

- **Determination of bulk density, fibre content, organic matter content**

For 37 points:

- **Microbiological analyses**

Project Update

- **194 Points completed**

Data entry and lab analyses

Modelling and map production

Map implementation and delivery

Feb / March 2020

April / May 2020

June /July 2020

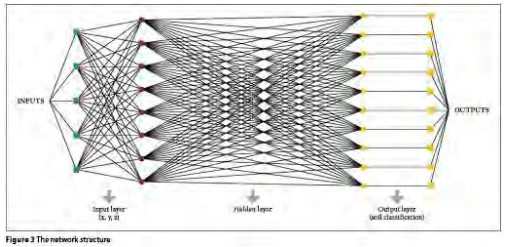
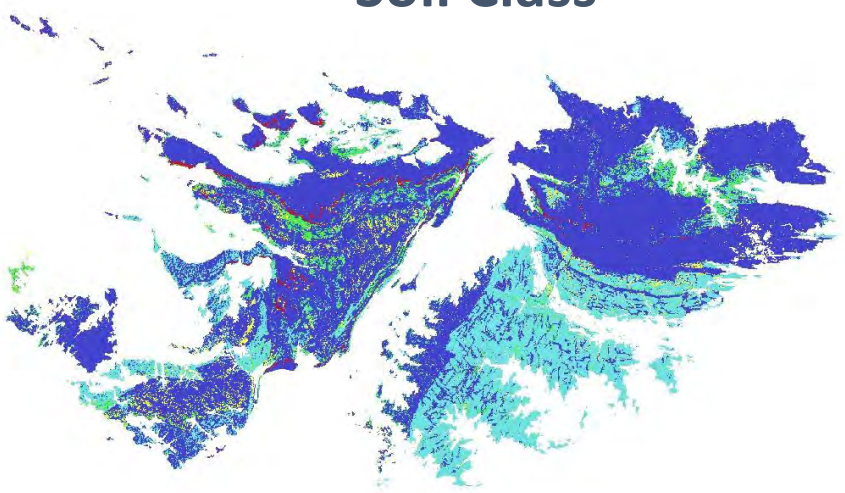


Figure 3 The network structure

Project Delivery

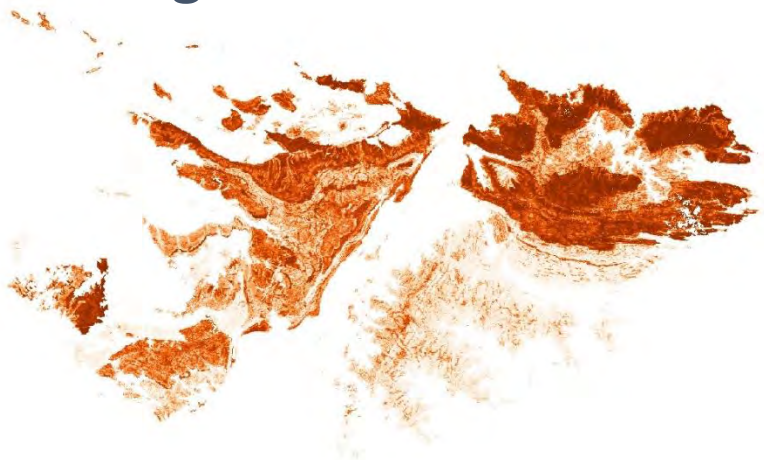
Project Maps

Soil Class



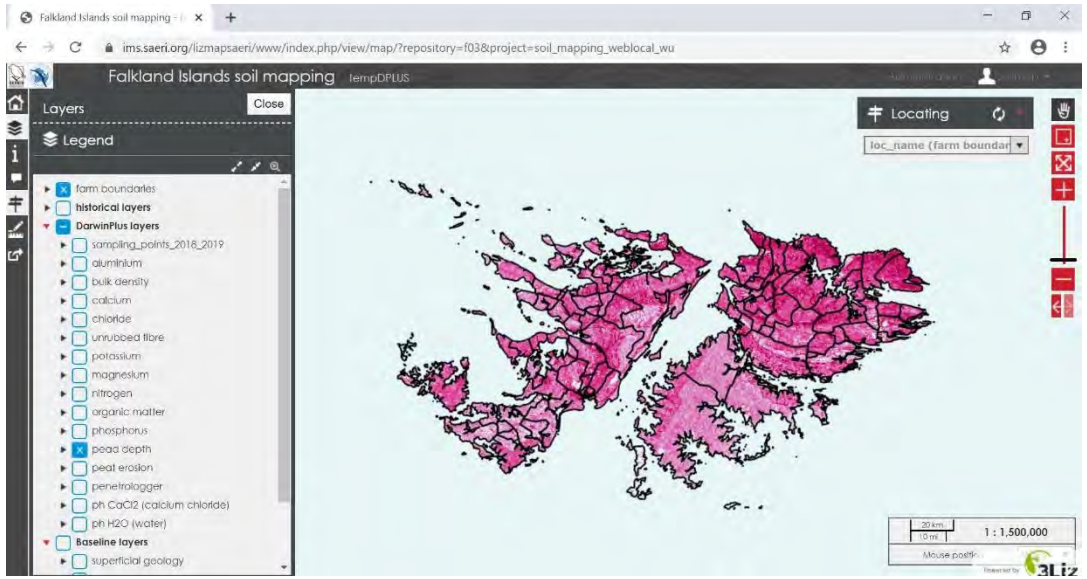
pH

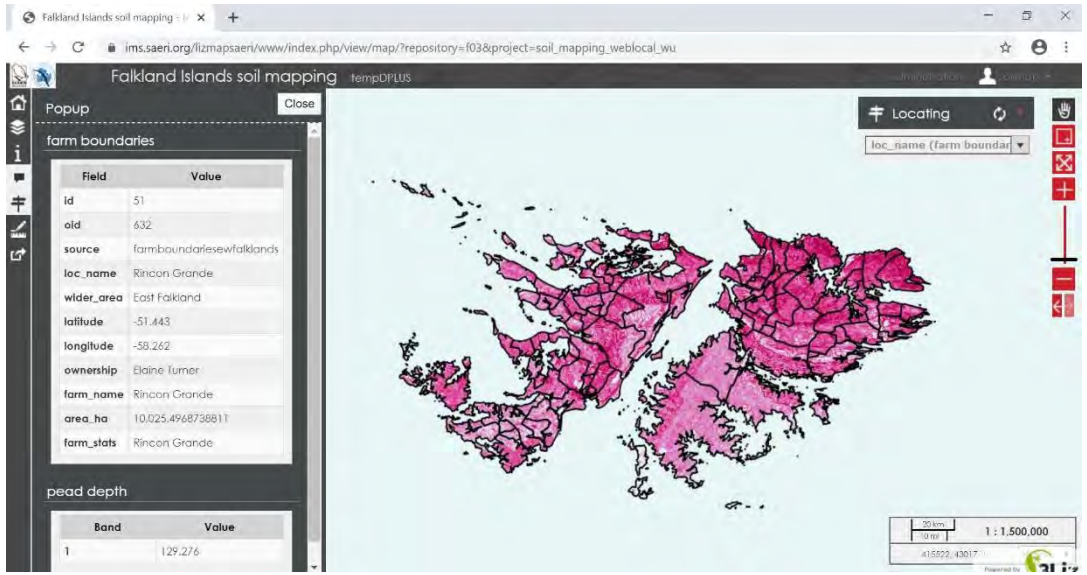
Organic Matter Content



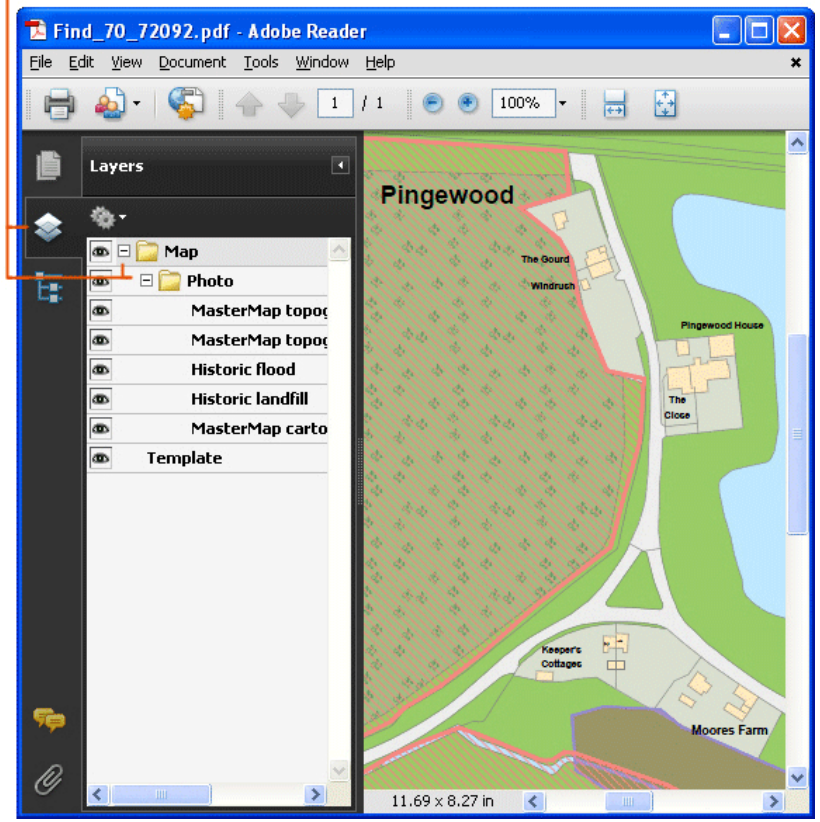
Erosion

Project Maps





1. Expand the layers tabs and view different map layer combinations by clicking the eye buttons on and off



Project Maps – Soil Class Interpretation

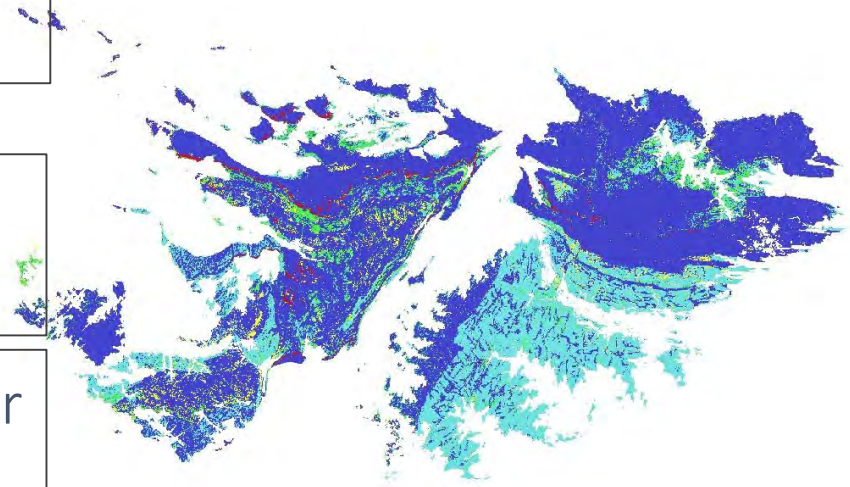
Key to the Reference Soil Groups	Principal qualifiers
Soils having *organic* material: 1. starting at the soil surface and having a thickness of ≥ 10 cm and directly overlying: a. ice, *or* b *continuous rock* or *technic hard* material, *or* c. coarse fragments, the interstices of which are filled with *organic* material; *or* 2. starting ≤ 40 cm from the soil surface and having within ≤ 100 cm of the soil surface a combined thickness of *either*: a. ≥ 60 cm, if ≥ 75% (by volume) of the material consists of moss fibres; *or* b. ≥ 40 cm in other materials. **HISTOSOLS**	Muusic/ Rockic/ Mawic Cryic Thionic Folic Floatic/ Subaquatic/ Tidalic Fibric/ Hemic/ Sapric Leptic Murshic/ Drainic Ombric/ Rheic Hyperskeletic/ Skeletic Andic Vitric Calcic Dystric/ Eutric

fibrous / semi-fibrous / decomposed

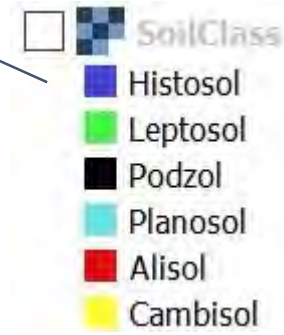
Continuous rock starting less than 100 cm from surface

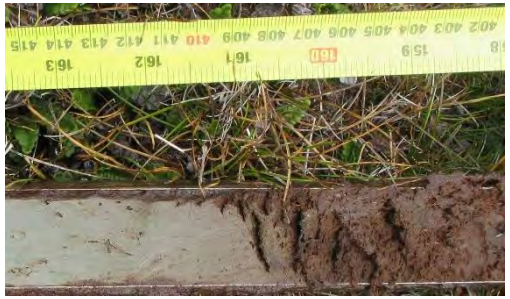
Saturated with rain water / ground water

pH < 5.5 / pH > 5.5



peat





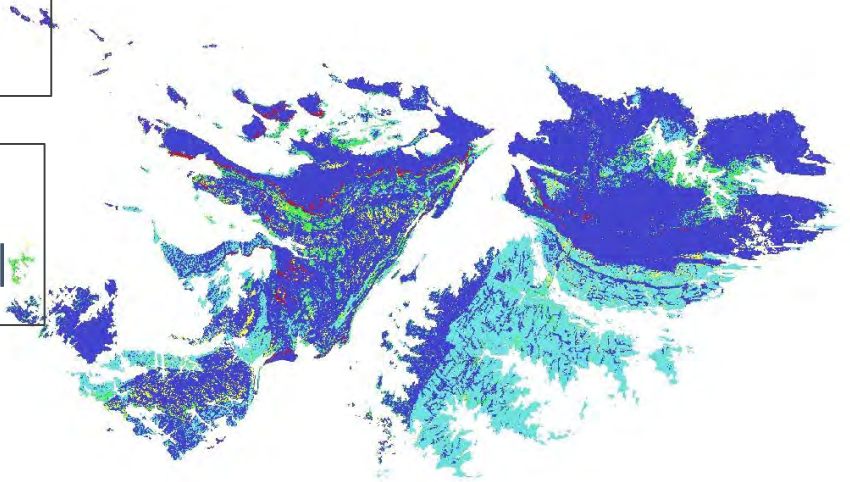
Project Maps – Soil Class Interpretation

Key to the Reference Soil Groups	Principal qualifiers
Other soils having: 1. one of the following: a. *continuous rock* or *technic hard* material starting ≤ 25 cm from the soil surface; *or* b. < 20% (by volume) fine earth, averaged over a depth of 75 cm from the soil surface or to *continuous rock* or *technic hard* material, whichever is shallower; *and* 2. no *calcic, chernic, duric, gypsic, petrocalcic, petroduric, petrogypsic, petroplinthic* or *spodic* horizon. **LEPTOSOLS**	Nudilithic/ Lithic Technoleptic Hyperskeletic/ Skeletic Subaquatic/ Tidalic Folic/ Histic Rendzic/ Mollic/ Umbric Cambic/ Brunic Gypsiric Dolomitic/ Calcaric Dystric/ Eutric

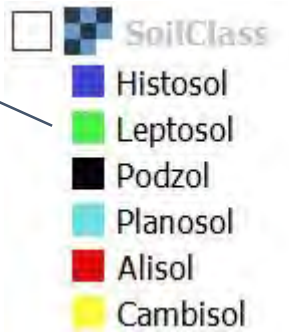
Continuous rock at surface / less than 10 cm from surface

Well-aerated / poorly aerated organic material

pH < 5.5 / pH > 5.5

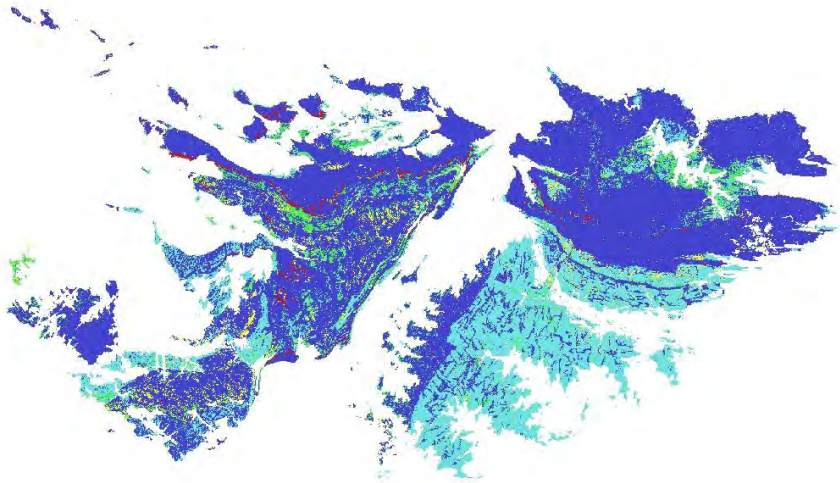


Shallow soil

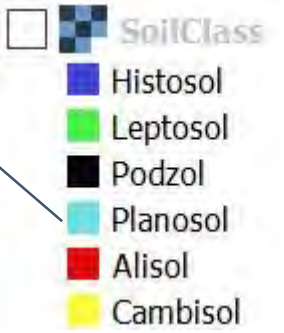


Project Maps – Soil Class Interpretation

Key to the Reference Soil Groups	Principal qualifiers
Other soils having an *abrupt textural difference* ≤ 100 cm from the mineral soil surface; and directly above or below, a layer ≥ 5 cm thick, that has: 1. *stagnic* properties in which the area of reductimorphic colours plus the area of oximorphic colours is ≥ 50% of the layer's total area; *and* 2. *reducing conditions* for some time during the year in the major part of the layer's volume that has the reductimorphic colours. **PLANOSOLS**	Reductic Thionic Fragic Leptic Hydragric/ Anthraquic Folic/ Histic Chernic/ Mollic/ Umbric Gleyic Albic Fluvic Columnic Vertic Glossic/ Retic Acric/ Lixic/ Alic/ Luvic Petroduric/ Duric Calcic Dolomitic/ Calcaric Dystric/ Eutric



‘surface water gley’



Soil map and online database as CLIMATE CHANGE mitigation tools

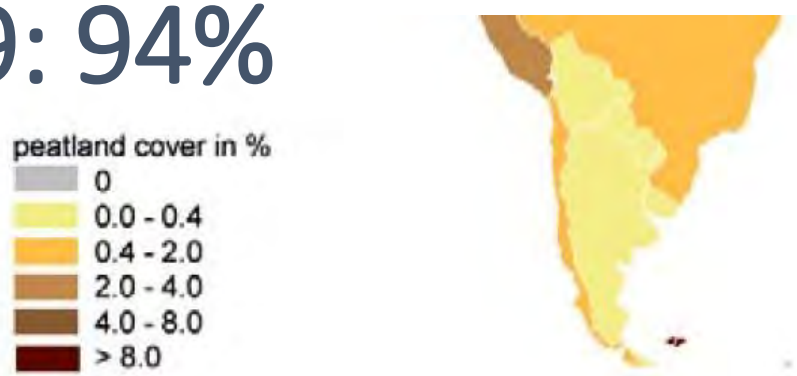
Peatland Cover

DARWIN INITIATIVE

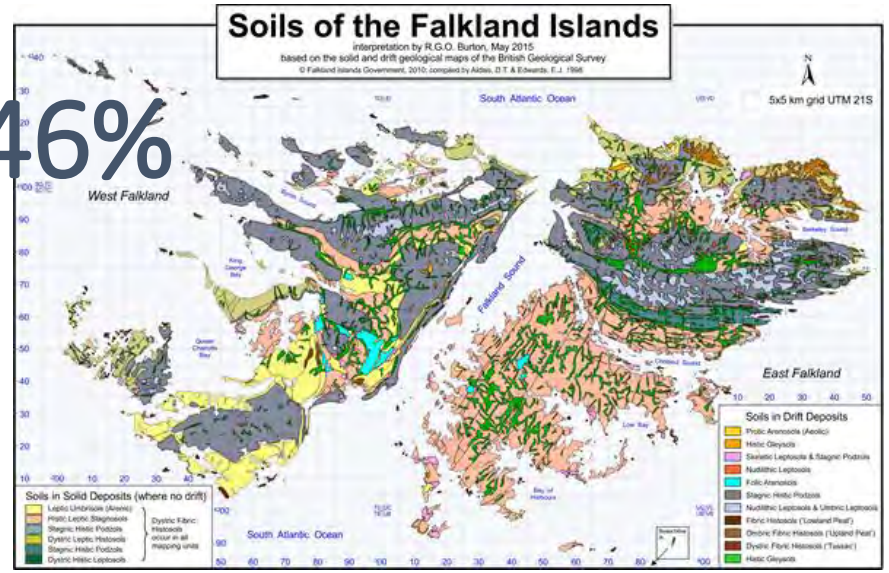
Erosion Risk

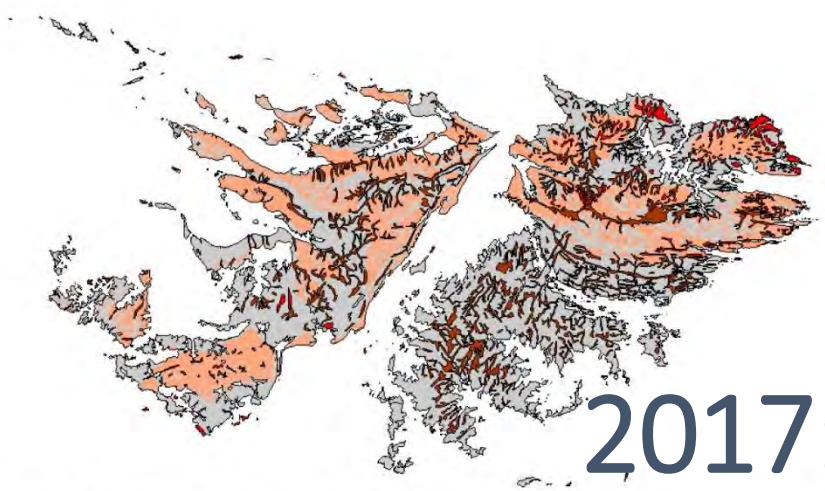
Project Maps – Peatland Cover

2009: 94%



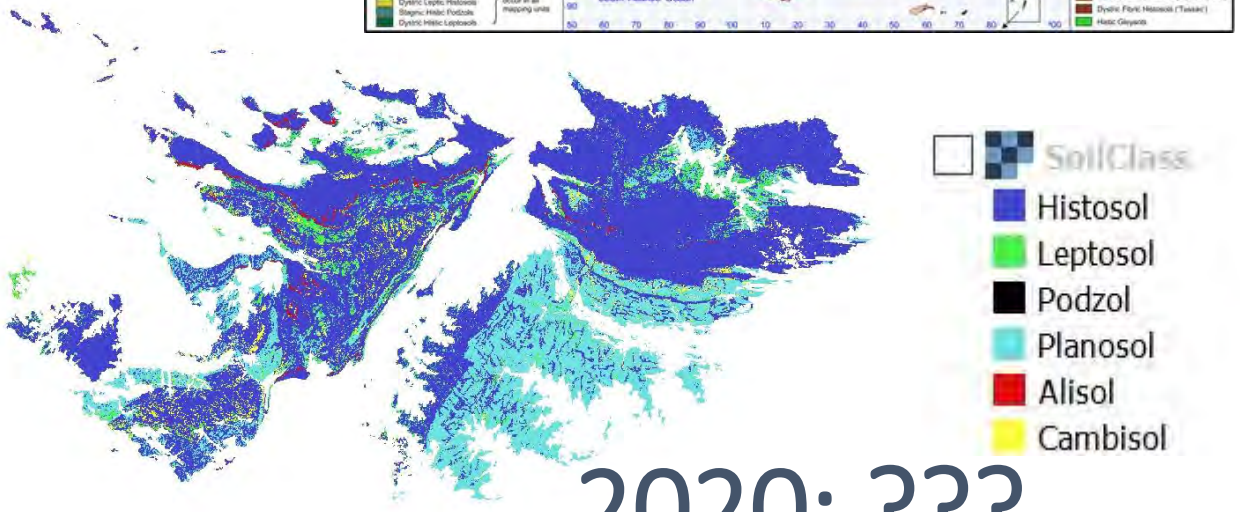
2015: 46%





2017: 25%

Figure 3.5. *Falkland Islands peat map. Red represents upland deep peat, brown valley peat, orange mixed upland organo-mineral and deep peat soils, and grey areas with little or no peat cover (thin organo-mineral soils, mineral soils and bare rock)*



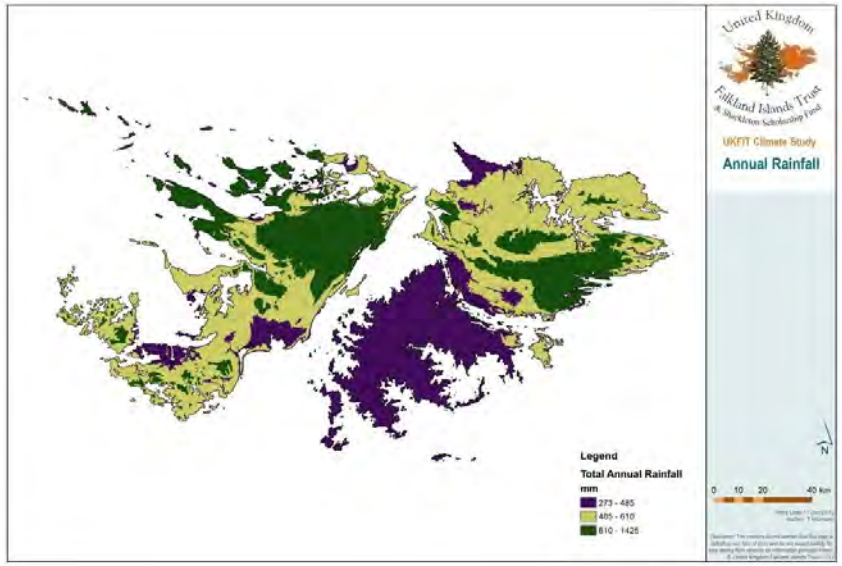
2020: ???

Project Maps – Peatland Cover

- **3.2 billion t carbon in peat**
- **150 million t carbon in woodland**
- **3% world land area -> 30% of terrestrial carbon**

Country/ administration	Peat area (ha)	Source data	Reference
Scotland	1,947,750	James Hutton Institute, British Geological Survey	This study
England	Deep: 495,828 Wasted: 86,372	National Soil Research Institute, British Geological Survey	Natural England (2010)
Wales	90,050	British Geological Survey, Natural Resources Wales	Evans et al. (2014)
Northern Ireland	242,622	Deep peat from British Geological Survey, Agri-Food and Biosciences Institute, Peat Survey of Northern Ireland	Cruikshank & Tomlinson (1990); this study
Isle of Man	475	British Geological Survey	This study
Falkland Islands	282,100	British Geological Survey, CEH unpublished data	Aldiss & Edwards (1999); this study
Total	***3,227,197***		

Project Maps – Erosion Risk



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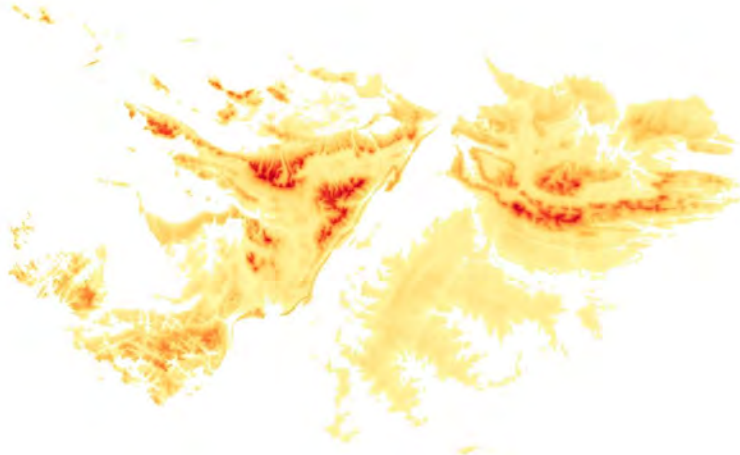

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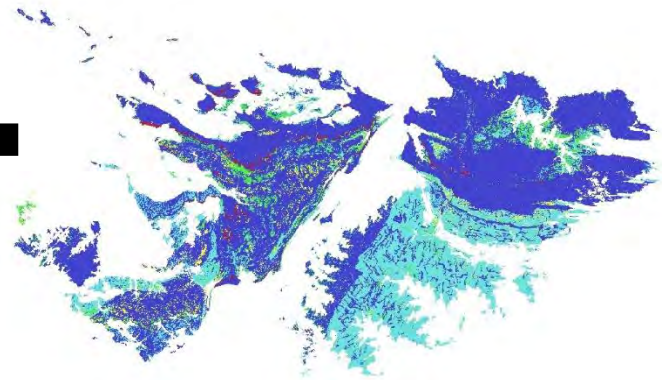

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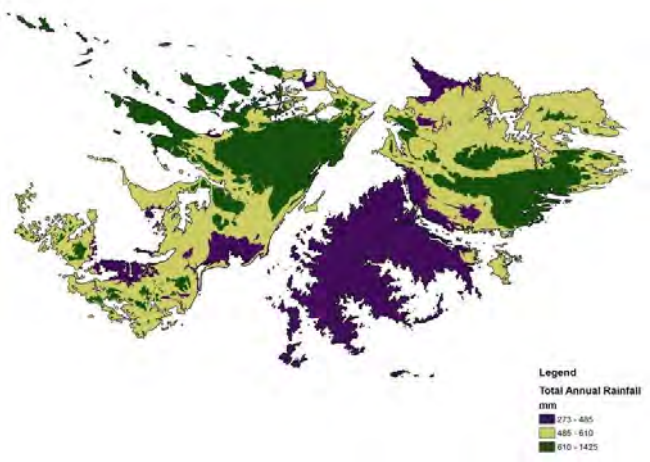
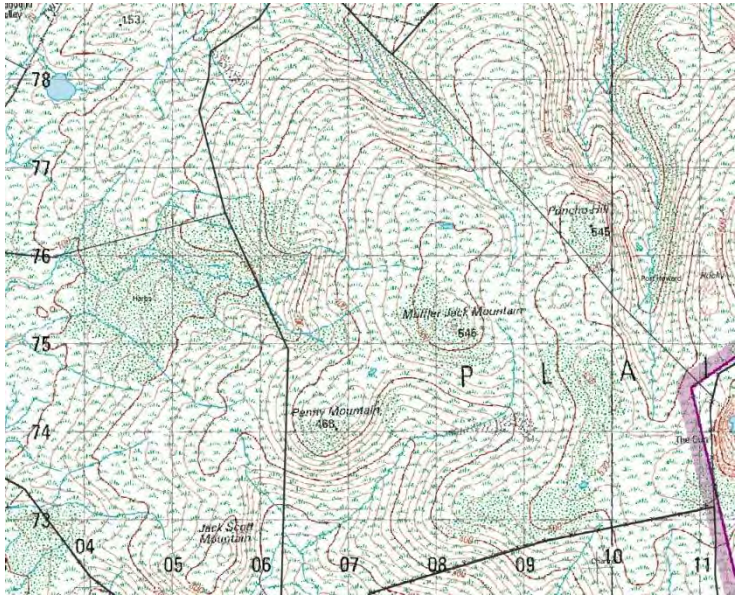
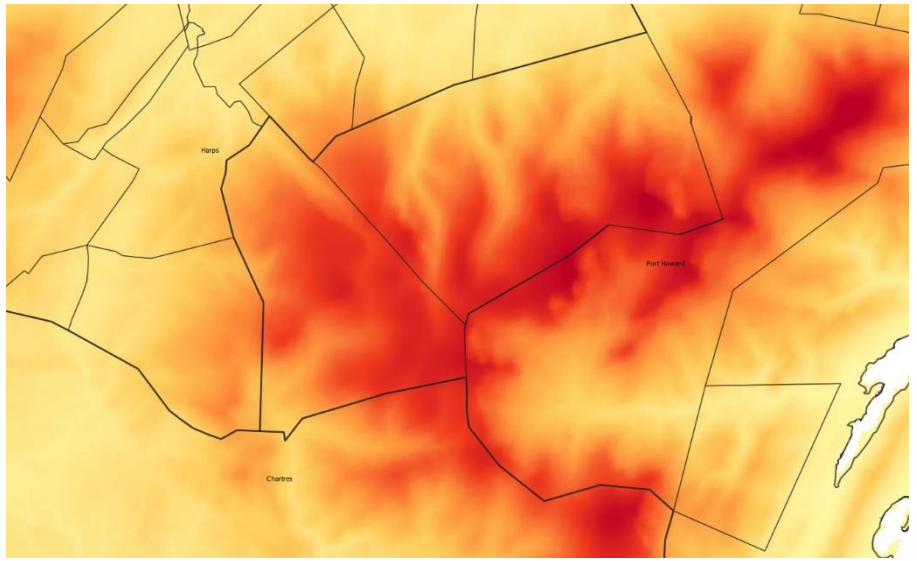
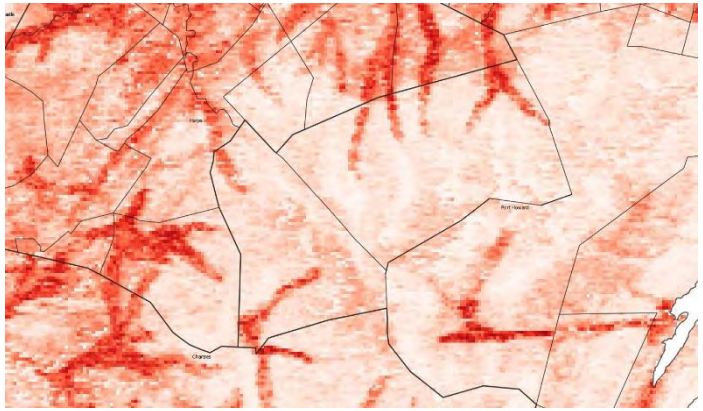
Land Use

Project Maps – Erosion Risk – Example Port Howard

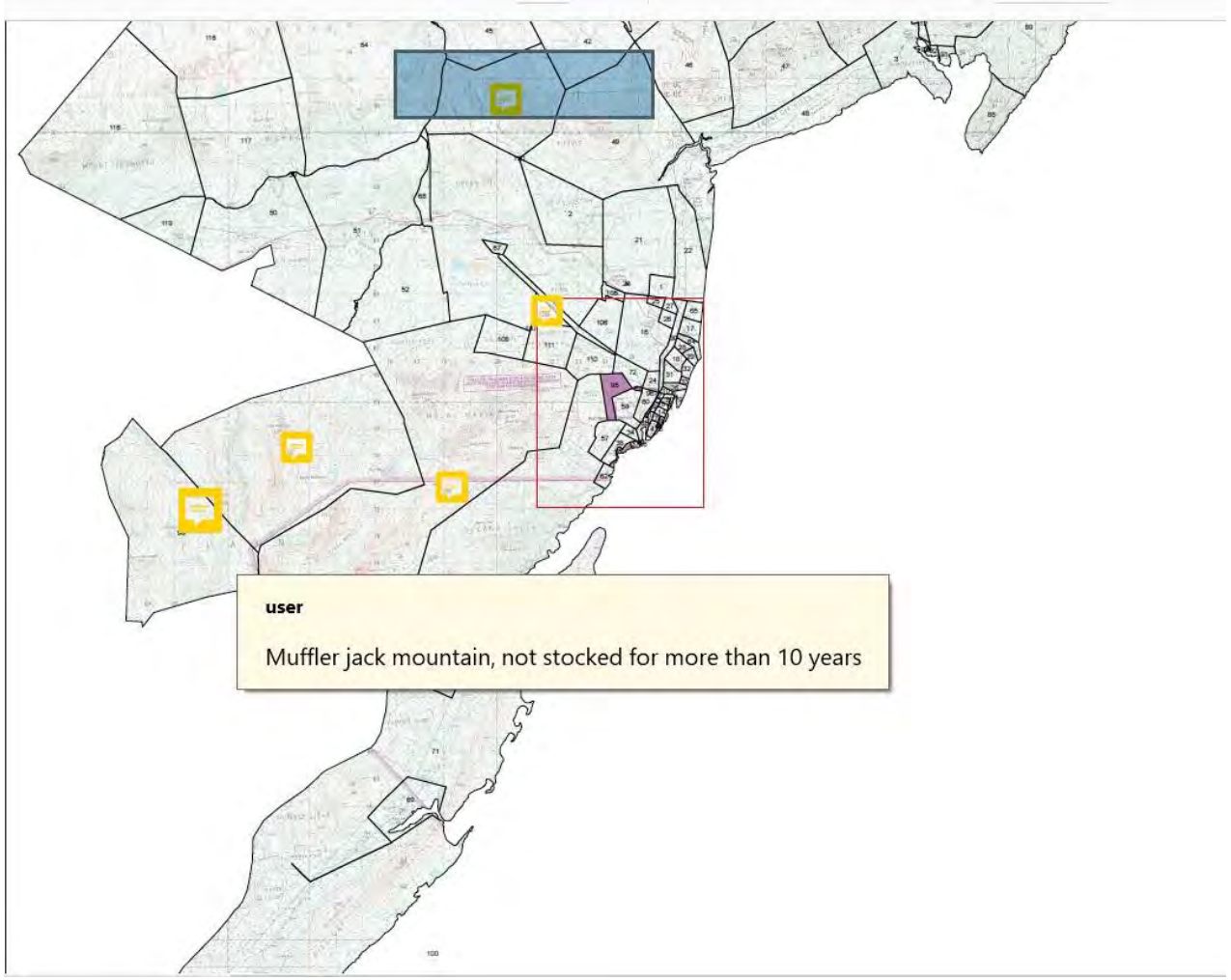






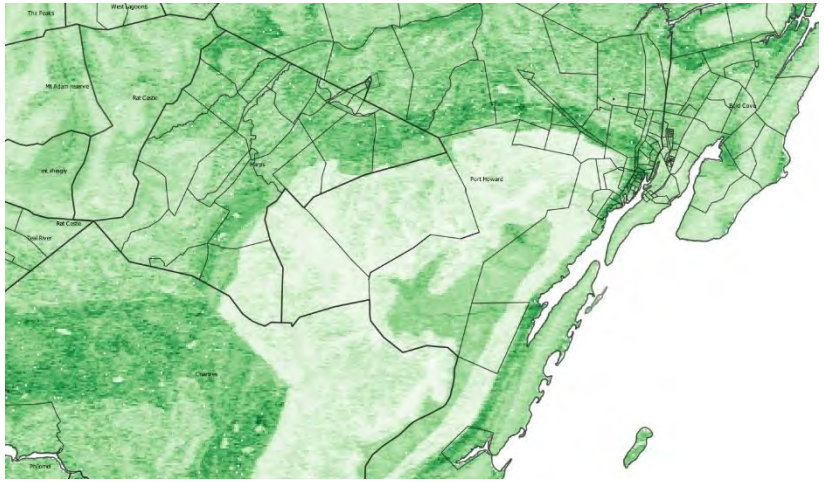


Project Maps – Erosion Risk – Example Port Howard

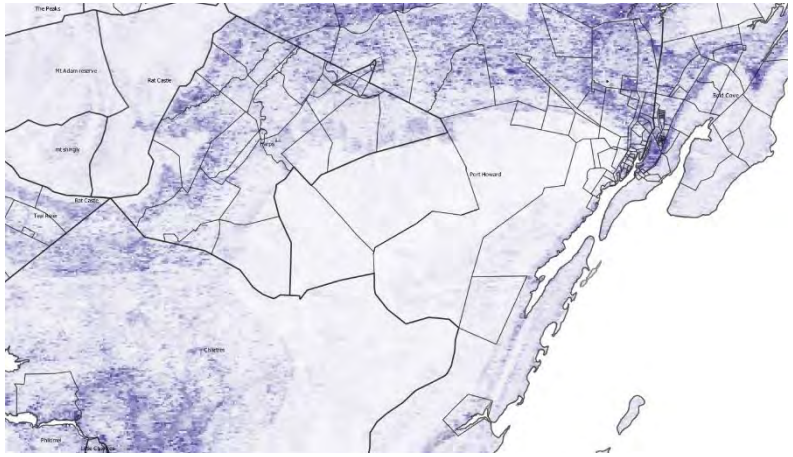


Project Maps – Land Use – Example Port Howard

Phosphorous

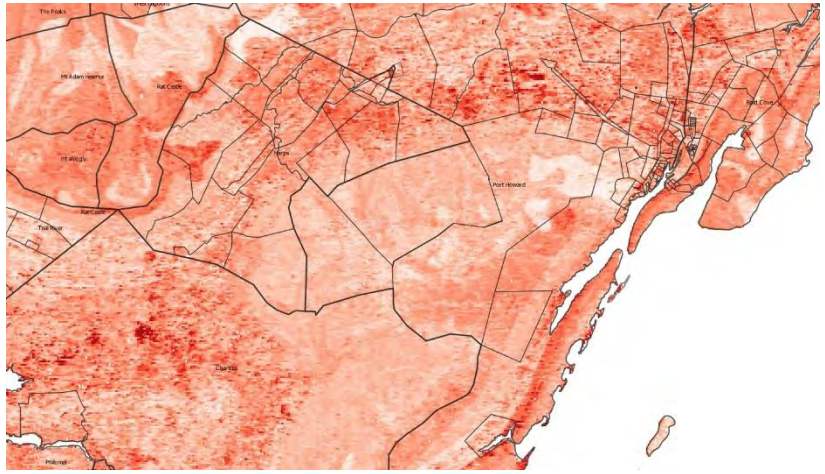


Nitrogen

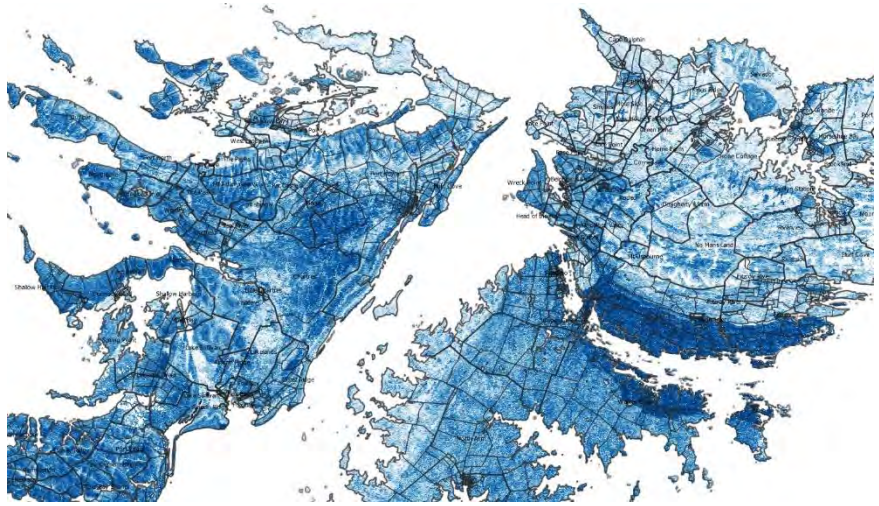


pH 3.3 to 4

Potassium



Aluminium



Thank you!