

# E-SMART: Environmental Sensing for Monitoring and Advising in Real Time

Matt Aitkenhead  
David Donnelly  
Malcolm Coull  
Helaina Black



The James  
**Hutton**  
**Institute**

# The James Hutton Institute



- Leading environmental research institute in Scotland
- Approximately 700 staff at 2 sites (Aberdeen, Dundee)
- Multidisciplinary research
  - Ecosystem services
  - Soils
  - Climate change
  - Land use
  - Crop genetics
  - Etc...

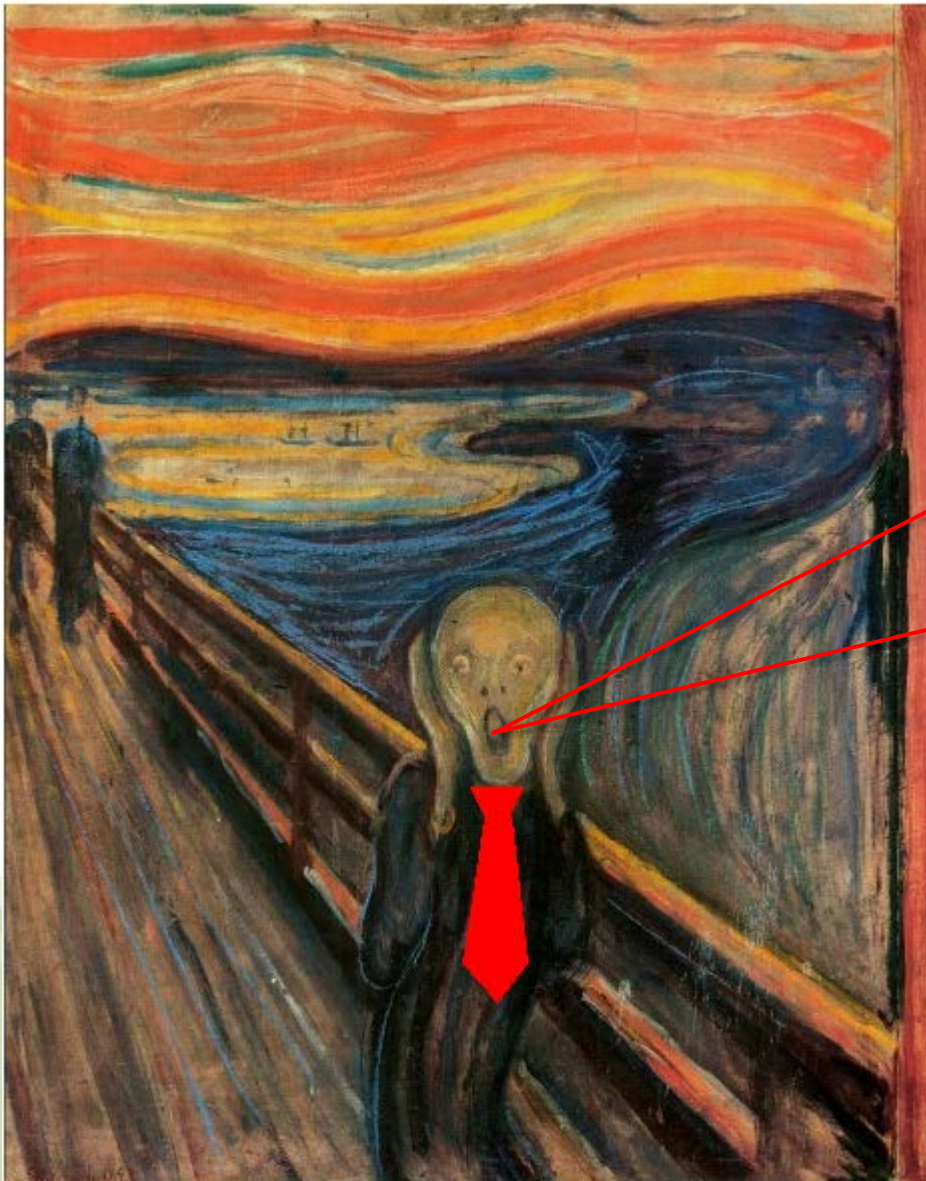
# Project outline

- Develop an infrastructure for the development and publishing of mobile phone apps
  - To make better use of the James Hutton Institute's data holdings
  - To compete with other environmental research organisations in the UK
- Demonstrate the infrastructure with one or more apps
  - An app version of an existing soil information website (SIFSS)
  - An app providing an estimate of soil organic matter

# Many different points of view

- Senior management
- IT
- Communications
- Contracts
- Graphics
- Soil scientists
- The project team

# Senior management



**Oh no! Another environmental research organisation in the UK is producing apps! We must jump on the bandwagon!**

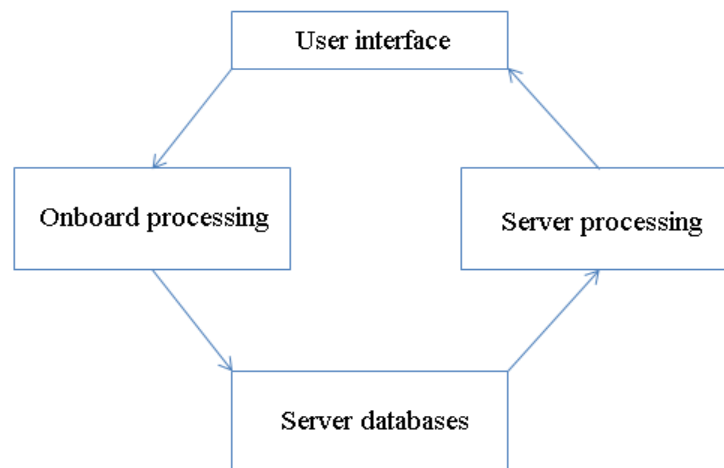
**Matt Aitkenhead's got a mobile phone – he must know how to do it!**

**Good idea!**

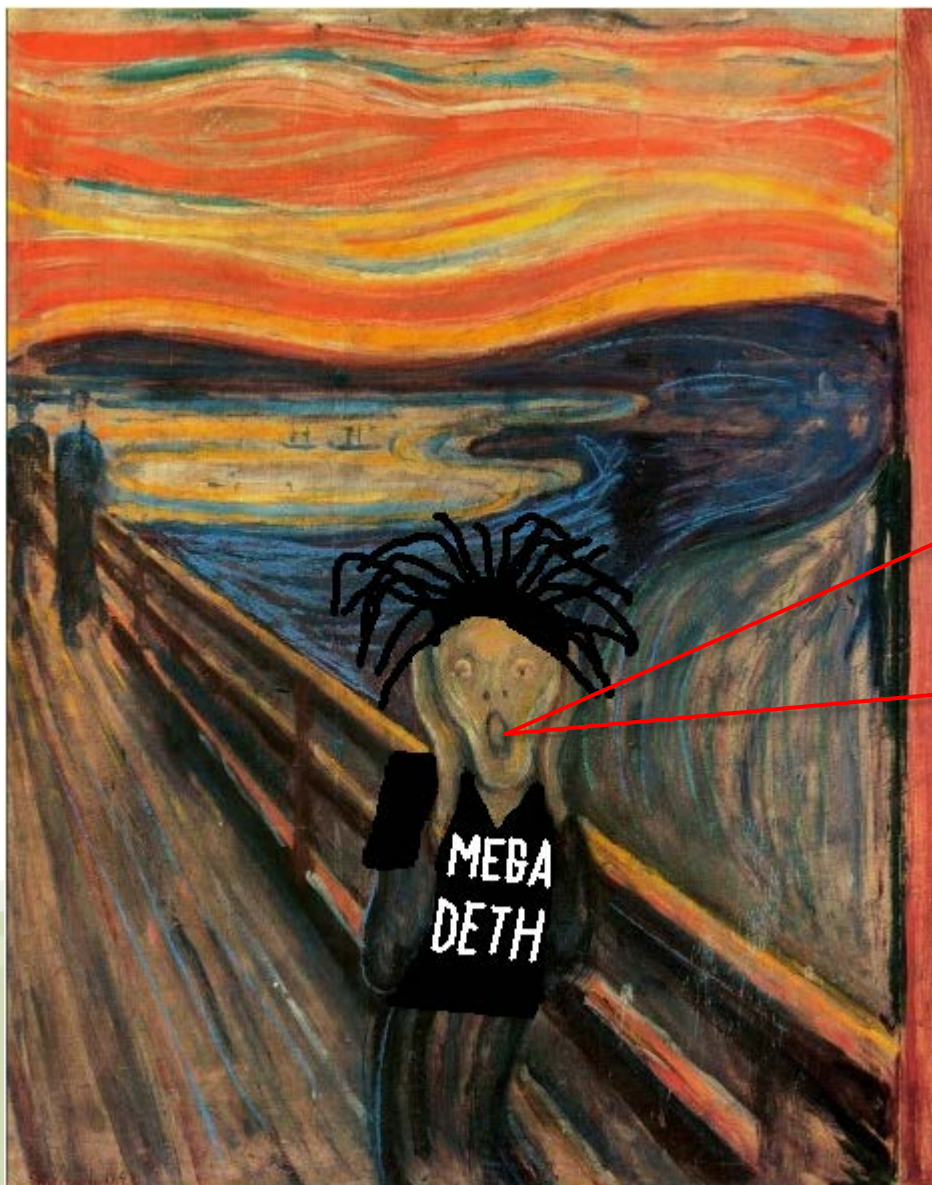
**Go get him!**

# Coming up with a plan

- Several criteria to satisfy:
  - System must use standard mobile phones (no new technology)
  - Must provide useful and relevant information for land managers
  - Make use of existing in-house expertise wherever possible
- Central concept: link models to existing data with apps







**You want to do WHAT!  
The CIA, the Chinese  
government, Wikileaks,  
Anonymous – they'll hack  
the apps, steal our data  
and crash the system! No  
way!**

# A secure and stable system

- No large datasets uploaded to apps – use server-side processing
- Spatial datasets and other files kept on a firewalled system
- PHP used to send data to and from mobile phone
  - Cannot send ‘trojan’ queries to hack servers
  - Platform-independent, robust and flexible language
- ‘Paranoid’ I/O system – if it isn’t exactly what was expected, reject the request



# Communications

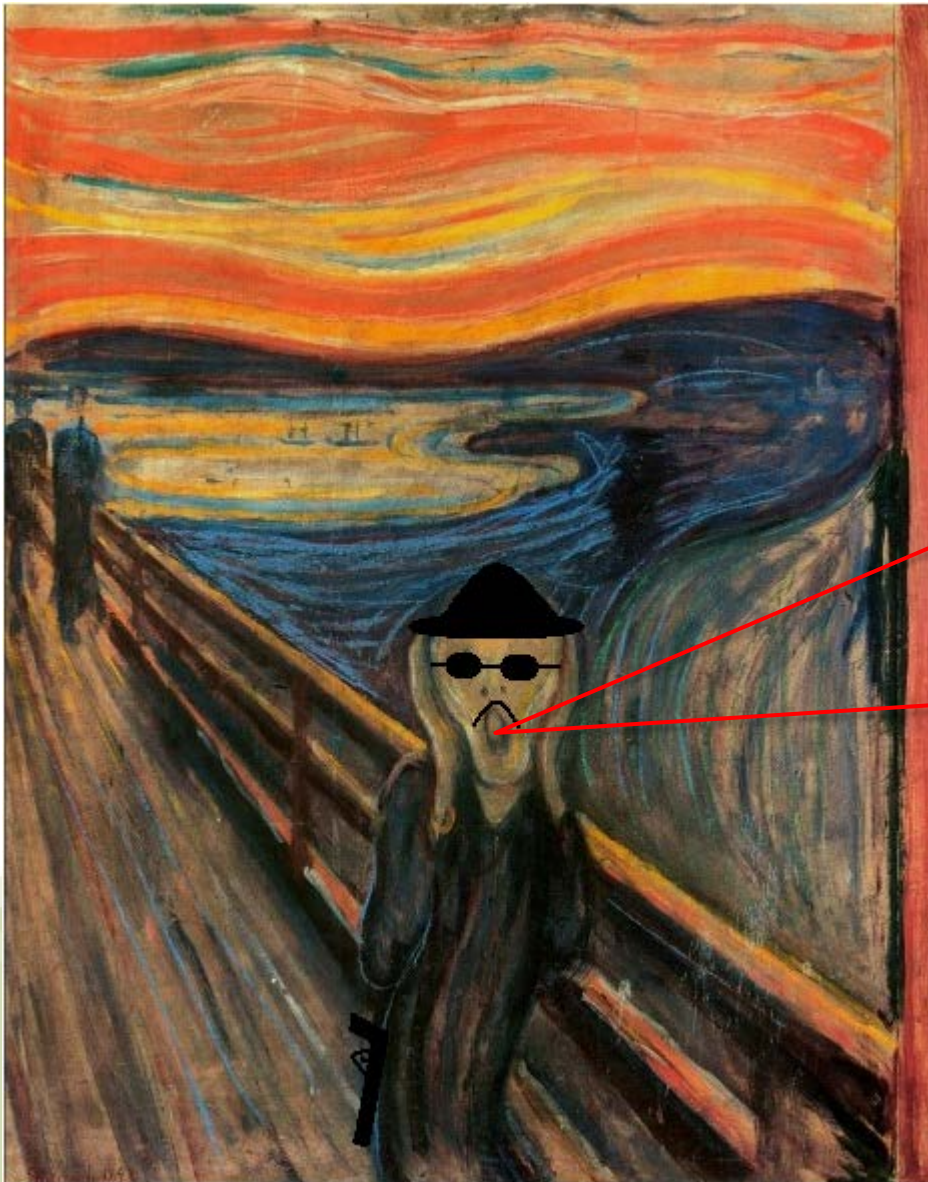


**You can't use that font!  
Or that image! Where's  
the Institute logo?  
Who's going to meet  
with the stakeholders?  
You?! Nooooo!!! But we  
need to control what it  
looks like...**

# Corporate branding

- A necessary evil?
  - Gets other people to help with the design
  - Produces something that is more polished
  - Raises organisational awareness (a double-edged sword!)
- Important to start thinking about the design/appearance at an early stage
- Balance to be struck between form and function

# Contracts & legal



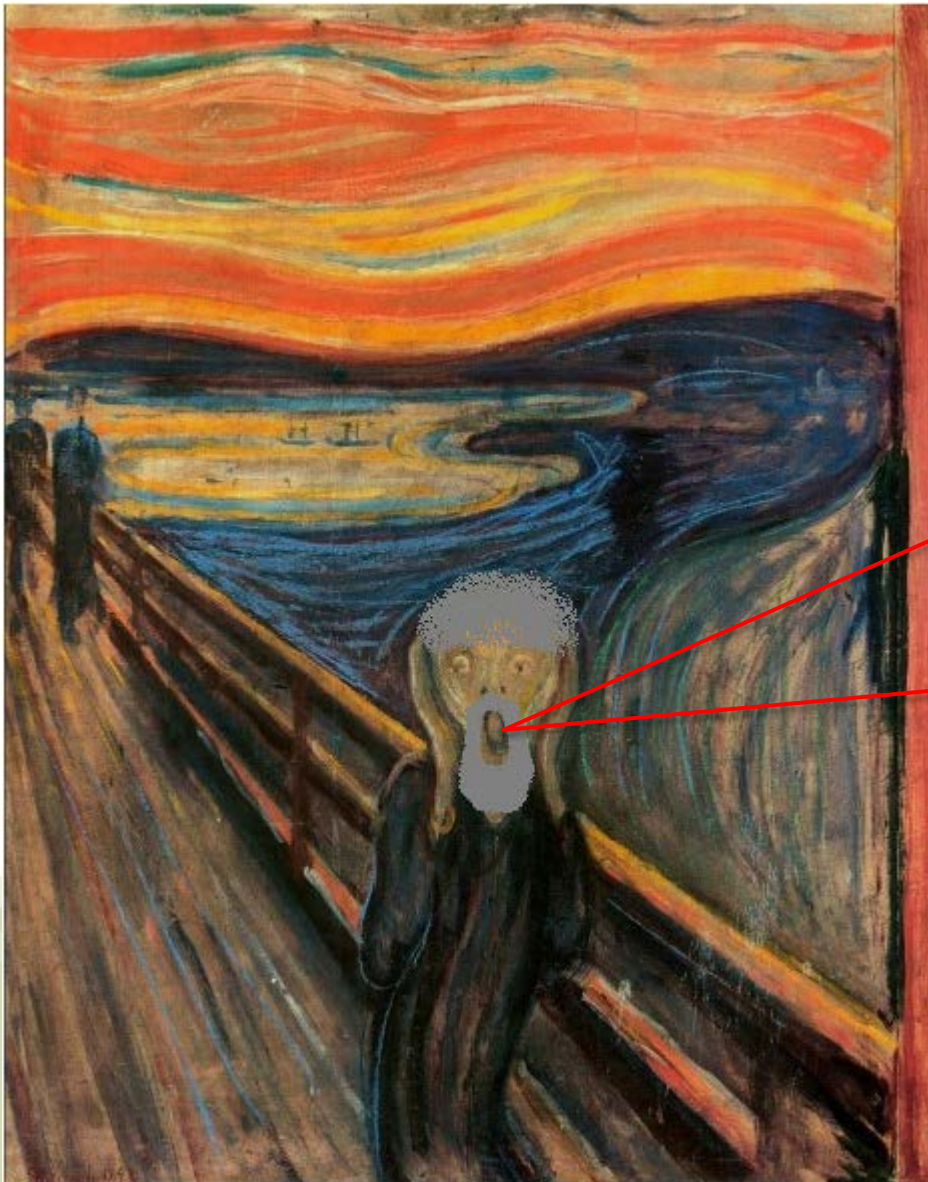
**What if someone copies it?  
Who has the IP? Can we  
make any money out of it?  
You want it to be FREE??  
What datasets are you  
using? Are they ours?  
Don't tell anyone about  
this!**

# Legal obligations

- End User License Agreement (EULA)
  - Very important!
  - Get the lawyers involved
  - A lot of licensing information is out there
  - Let the user know what you will do with their data
- IP considerations
  - Models are already in the public domain (scientific research)
  - Funded apps for other organisations – background IP retained, foreground IP shared
  - Stick with datasets that are free for scientific purposes
  - Don't charge any money – it makes IP issues a lot simpler



# Soil scientists



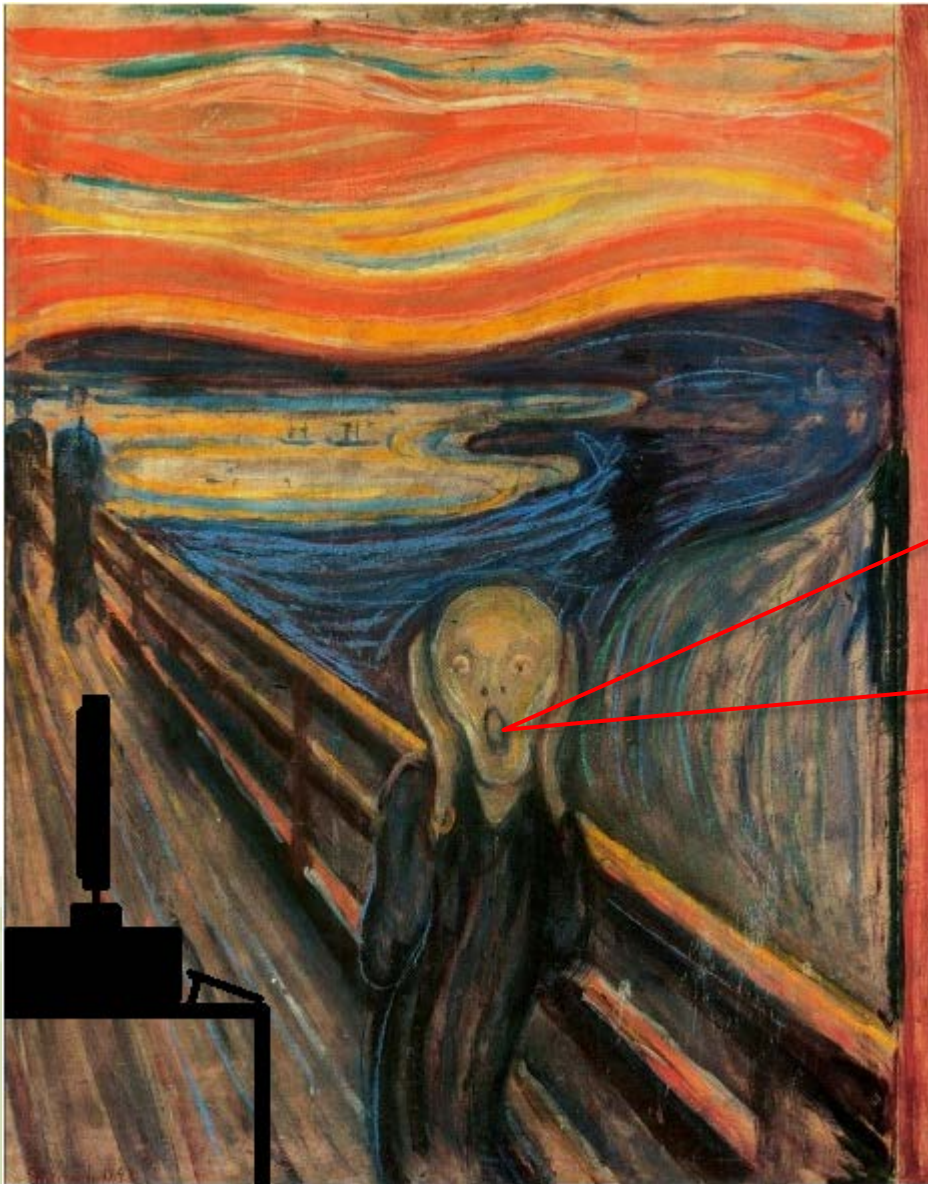
**It can't be done! And if it can, you're putting us out of a job! You can't do it!**



# Getting the science right

- Firstly, there will always be a need for field work
  - No model is 100% accurate
  - Need field data for model development and validation
- Apps should provide useful information to the end-user
  - Consider who the target audience is
  - Keep it simple
- Consult with the field scientists
  - They will tell you if the result makes sense
  - They will be able to advise on information presentation

# The project team



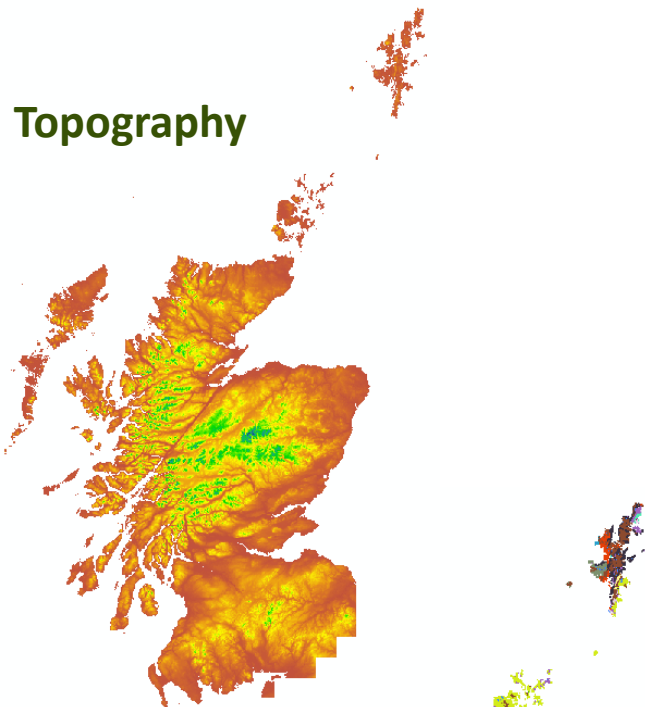
**You want four people to develop and test an entire mobile phone app infrastructure from scratch in one year, with only 50k?**

# Achieving the objectives

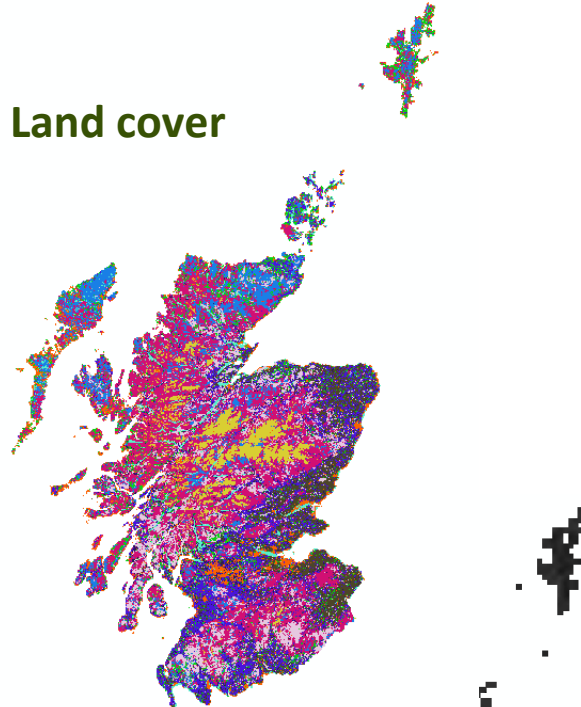
- Tightly focussed group
  - Developer, data manager, modeller, project leader
- Multiple stages of development
  - Server infrastructure development
  - Dataset preparation
  - App interface
  - Model development
  - Linking algorithms
  - Licensing/IP documentation and user instructions
- Better as a small, directed project or a workpackage within a larger project
- Stick with what you know (and data that is available)

# Datasets used

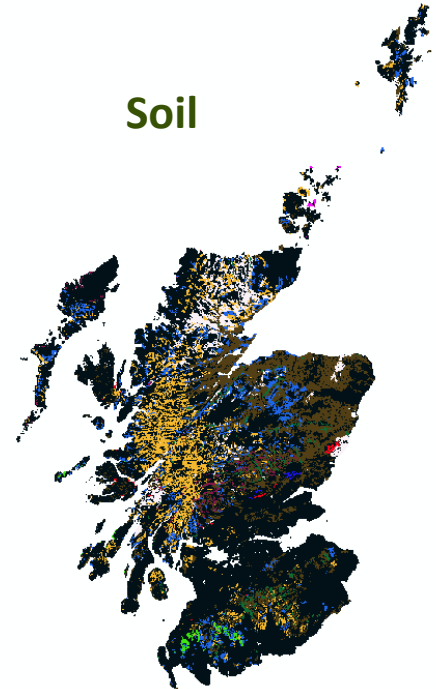
Topography



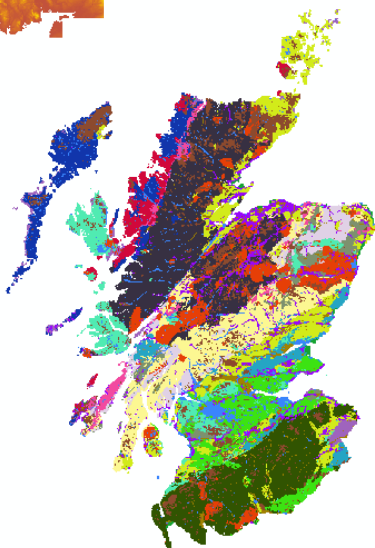
Land cover



Soil



Geology



Climate

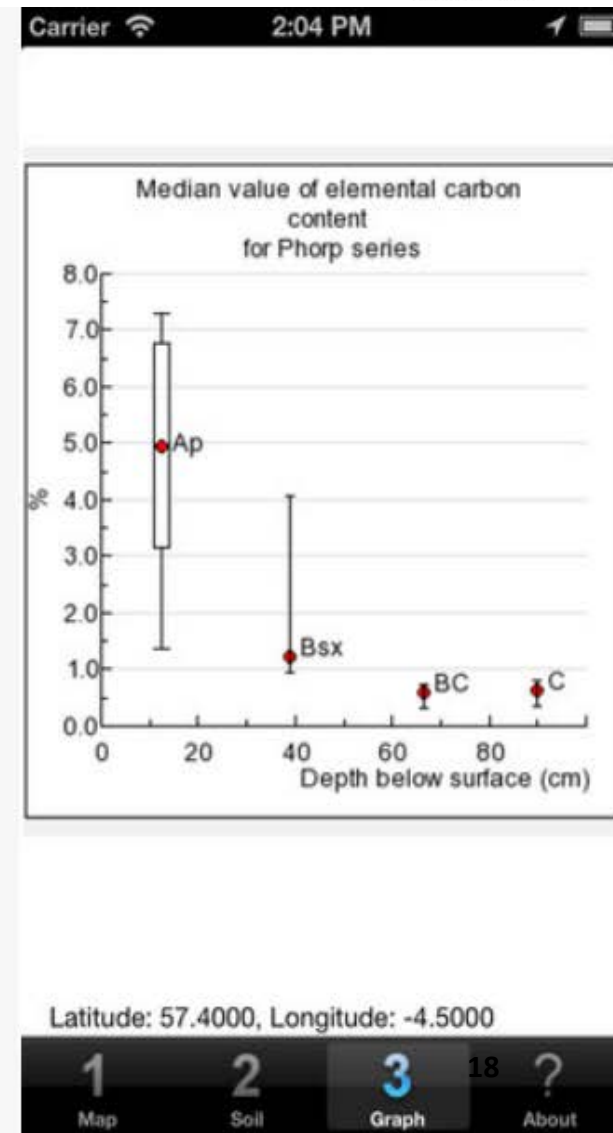






The James  
Hutton  
Institute

# The outputs - SIFSS

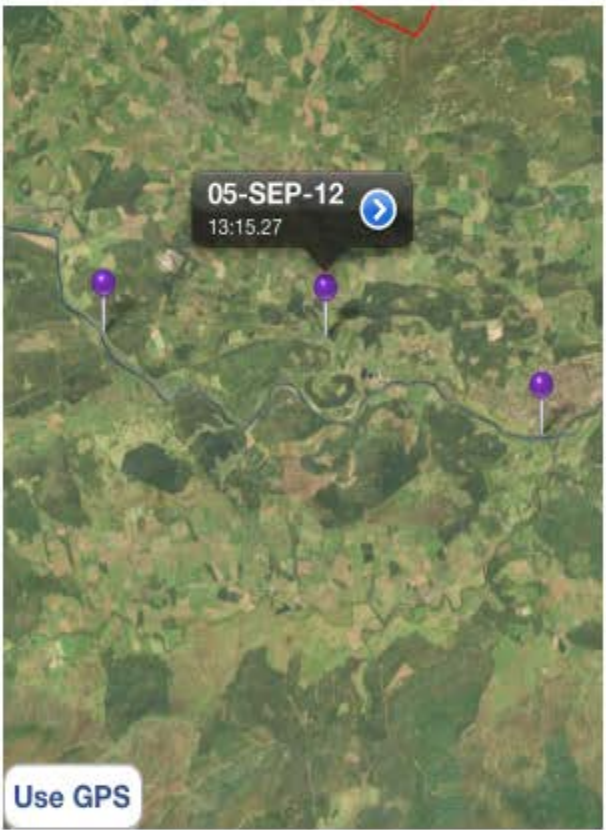




# The outputs - iDee

iOS Simulator – iPhone (Retina 3.5-inch) / iOS...

Carrier 3:44 PM




Use GPS

Intro View Upload Learn

iOS Simulator – iPhone (Retina 3.5-inch) / iOS...

Carrier 3:44 PM

Back



Obs uploaded: 13:15.27 on 05-SEP-12

- **Water level:** normal
- **Water clarity:** clear
- **Obstructions:** rubbish
- **Algae cover:** rare
- **Non-native:** none
- **Phosphate (ug/l):** 0
- **Turbidity (NTU)::** 0
- **Temperature (C):** 12.9

Intro View Upload Learn

iOS Simulator – iPhone (Retina 3.5-inch) / iOS...

Carrier 3:45 PM

Water level

Low Normal High In flood

Water clarity

Clear Cloudy Opaque

Obstructions (touch to select)

Wood/fallen trees Rubbish Ice

Algae cover

None Rare Common Abundant Dominant

Non-native plants

Intro View Upload Learn



The James  
Hutton  
Institute

# The outputs - SOCiT



# Questions?