Agricultural challenge suited to Earth Observation solution approach

Accurate biomass measurement and natural capital

- What are the challenges
  - Measuring biomass accurately in the field is a weekly job. Knowing with precision the amount of grass available in a field is key to objectively calculating the daily grass growth rate and this allows for more precision feeding of dairy cows. Cloud cover is the biggest constraint to doing this measurement remotely.

  - Being able to measure how much clover is present in the field is closely aligned to the challenge around measuring biomass. The aim is to grow more clover which offers multiple soil structure benefits as well as capturing nitrogen from both soil and atmosphere. Clover also offers diversity in rye grass swards and as a flowering species it attracts pollinators. Related to this challenge is having the ability to differentiate the grass species in a sward. Both these insights have an impact on the use of herbicides.

  - Measuring natural capital on the farm, the amount of trees, hedges, etc. is an ongoing challenge

- Why is it important to resolve (economic aspect, environmental,..)
  - New approaches will have benefits from both an economic and environmental point of view. Current practices are either not practical nor sufficient. A person gets paid weekly to go out in the fields on a motorbike to place the grass meter in several parts of the field - this is an 8 hours/week job. Staff needs to get paid for that time, the bike needs to be kept on the premises, maintained and fuel consideration is also an expense. Staff availability is also an issue at present. This activity is required in order to allocate the correct diet to animals, but the use of carbon fuels for the bike in the task could be avoided if there was a remote solution.

  - The challenge around clover and differentiation relates to the issue with weed control, for which there are not many alternatives for spray available that don't affect clover.

  - Incorporating a precise measurement of the natural capital present in the farm will be important for carbon audits, also to identify best practice for biodiversity.

- What would be the benefits of resolving it through EO

  Earth Observation measurements, either alone or combined with ground truth data, supports precision agriculture decision making. Once the data is analysed and presented in a meaningful format it enables land managers to make decisions around their farming practices. Addressing this challenge will have multiple benefits including the reduction of using chemical inputs, increasing biodiversity and delivering precision nutrition to dairy cows – which all contribute to farm productivity, sustainability and net zero ambitions.

  - Minimising resources deployed in the field, and more precise data collection, from the whole field rather than from specific points.

  - Benefits to differentiation species of weeds will help develop best practice for grass management, reducing the amount of unnecessary spraying.

- Obtaining precision information for mapping of natural capital to prove and improve current practice on farm, also will help understanding the level of carbon sequestration.

- How big is the problem

It is anticipated that the successful development of an EO solution will be relevant to all grassland base farmers. Whilst this challenge is focussed on a collective of 10 dairy farmers within a larger dairy co-op it is estimated almost 80% of Scotland's agricultural area is grassland and account for around two thirds of the land area of Great Britain. Indeed grasslands represent the most extensive land cover on the earth's surface.

During early stage engagement of EO enterprises with Rory, SAOS can undertake a preliminary analysis of a grassland potential market through discussions with SAOS colleagues, Farm Advisory Service, grassland experts across the research base and with NatureScot.

As part of these discussions between Rory and EO enterprises potential existing technologies can be evaluated to establish a benchmark for what currently is on the market and in development. Engagement with a grassland expert will be sought. The following are examples to be evaluated together with reviews that consider of state of art:

- https://business.esa.int/projects/grasssignal
- https://www.envsys.co.uk/data-services/monitoring-grassland-by-satellite/

- The issue has been discussed for many years, as precision feed allocation is crucial for dietary requirements and production of the dairy cattle.

- Clover in the field is crucial to capture nitrogen from the atmosphere and reduces the need to apply nitrogen via fertilisers. If an EO solution was developed by combining with ground truth data it would enable farmers to consider what best practice on farm can be used to grow / establish clover (it can be variable).

- Measuring Natural capital gained relevance in the last couple of years, and will gain even more due to current net zero targets and constant scrutiny of farming sector. Certain types of natural capture such as hedgerows are more easily established than woodlands and an ability to measure and manage natural capital over a timescale will benefit farmers (who are either tenants or owners) and be used as evidence of biodiversity and natural capital stewardship to their customers.

- What do you currently do resolve/deal with the problem
  - Making estimations via software (AgriNet, Seed/dax) based on manual measurements inputs by a person in the field in weekly basis.

  - There are some technologies available with some level of success, like Artificial Intelligence guided spraying but are costly and not available to everyone.

  - There are some examples from Ireland on how they are tackling the issue of measuring natural capital on farm.

- How widespread is the issue in Scottish agriculture

  - Accurate biomass measuring is a problem shared by all dairy and grassland farmers, in the MSA coop there is at least 10 farmers who work with the same level of specialization as Rory Christie and need better tools to allocate pasture for animals.

  - The problem is widely spread across all farmers with grasslands.

  - This issue will be relevant to all types of farming enterprises, from arable, to livestock.

  - Routes to market for a tech based solution will need to be considered but could be trialled on MSA farms and discussions around IP will need to be addressed