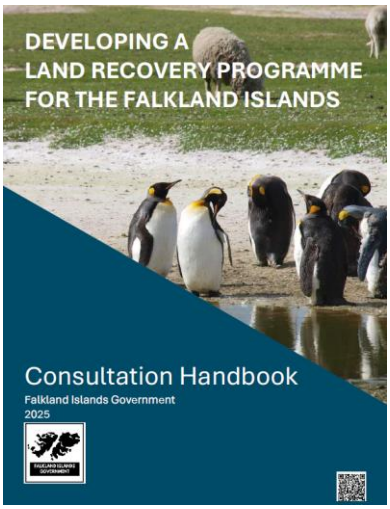

# LAND RECOVERY PROGRAMME WORKSHOP

## REPORT

*Edited by Jim McAdam*

**June 2025**

# This Workshop (6th and 7th February 2025) was part of the consultation process to develop a Land Recovery Programme for the Falkland Islands

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The RBA acknowledges the generous personal contributions of time and effort from farmers, land owners and scientists and financial assistance and in-kind support from FIG Environmental Studies Budget and donors. Port Howard, Rincon Ridge and George Island had hoped to participate but were unable to due to unforeseen circumstances.

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**Discussion Topics are either attached to the end of each paper or summarised on a whole session basis where appropriate.**

# RBA LAND RECOVERY PROGRAMME WORKSHOP, Feb 2025

## WELCOME AND INTRODUCTION

*Lewis Clifton, Chair, RBA*

***Opening remarks.***

The workshop was the culmination of three years of RBA promoting an environmental agenda. Although the timing of the Workshop was, of necessity, not perfect it enabled a collection of annual visiting researchers and scientists engaged in peatlands, carbon, land care and erosion, from several institutions with 6 years of collated science and knowledge to come together and share in open forum. It offered an opportunity to hear about and understand provisional analysis of 12 months carbon flux tower data. Professor Jim McAdam (QUB and long history of Falklands agricultural experience) helped organise, chaired, and will report on the Workshop.

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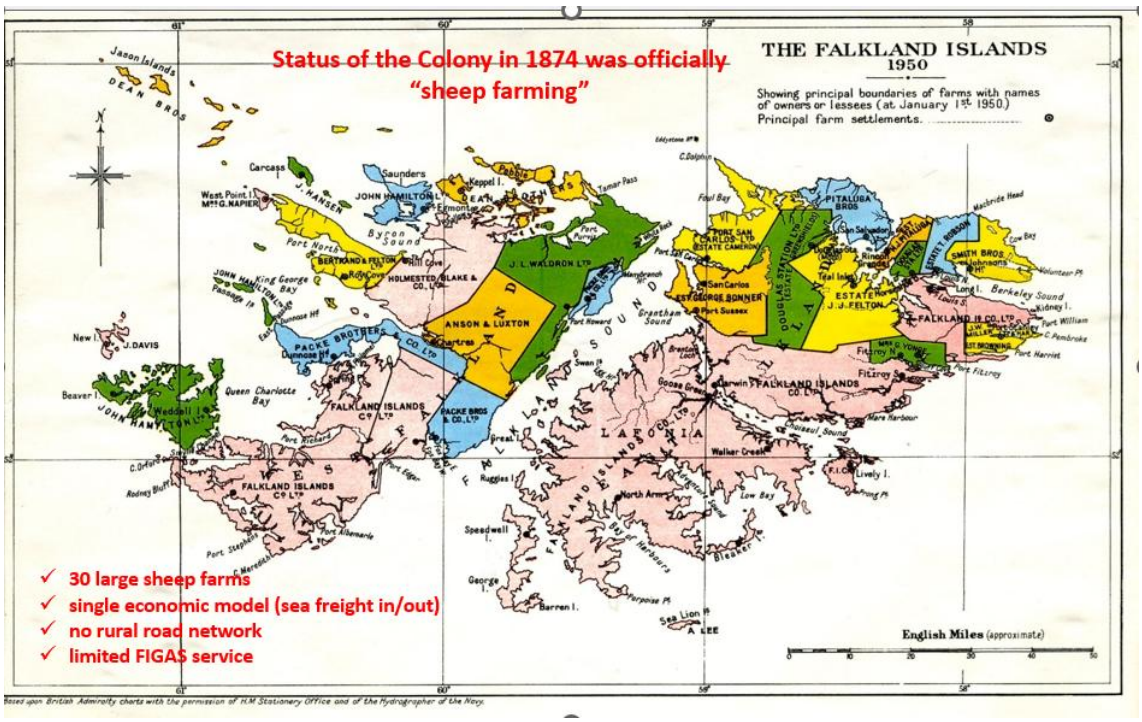
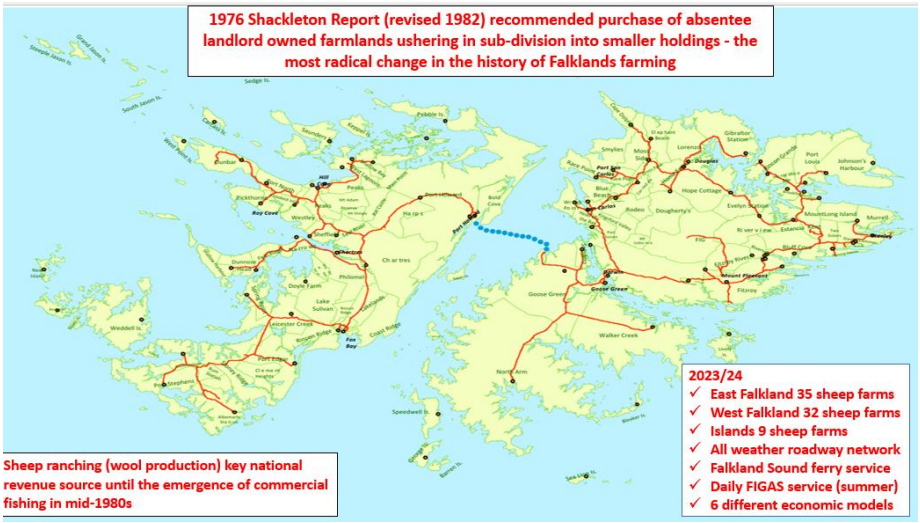
**Historical context**

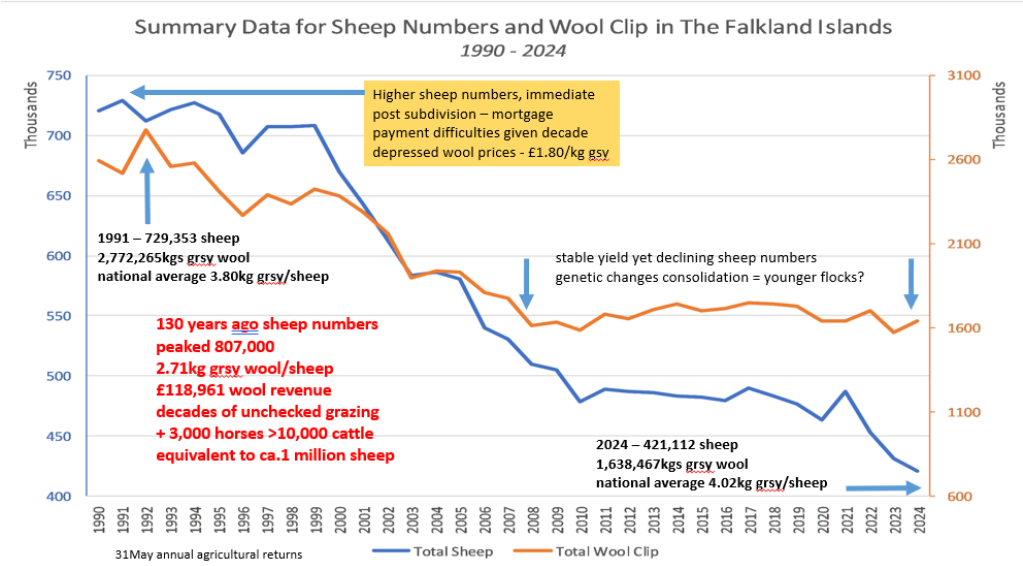


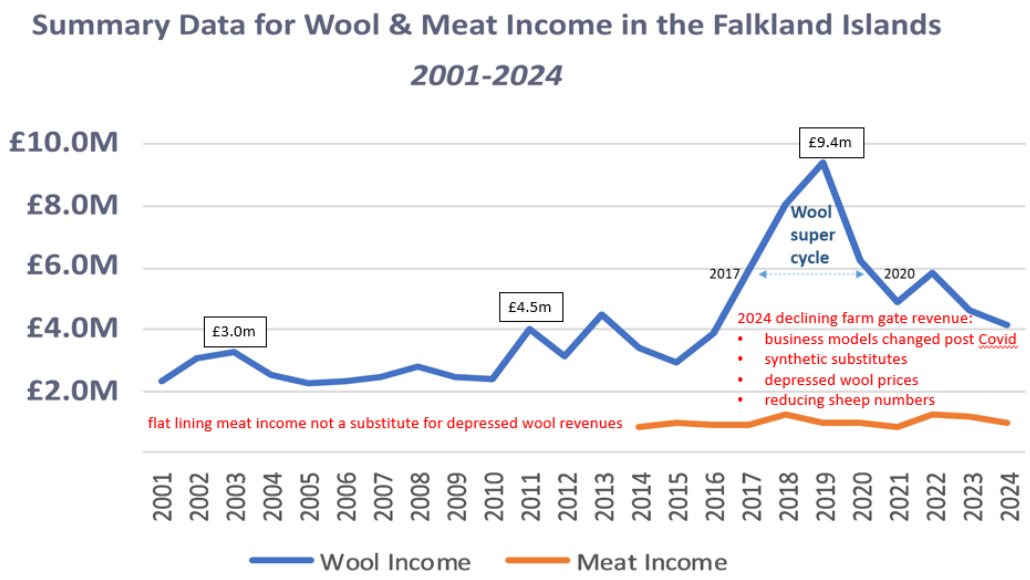
## Current context




- 2022 annual GVA £7.3 m
- Agriculture is the third largest employment sector in the Falklands, accounting for approx. 10% of the workforce (2021 Census)
- Total land area of the Islands is 1.2 million hectares of which 93% is available for farming
- Around 80 working farms
- There are approximately 430,000 sheep and 3,000 cattle
- The value of exports £6.5m for wool £1.9m for meat in 2023 (both lower than previous years)
- EU27 and Uruguay are main export markets for wool, UK for meat
- Work ongoing to maintain and/or broaden market access, example of Responsible Wool Standard certification (35 farms participating, 45% of farms; 74% of wool clip)

*Fig 1. The FIG Economic Unit overview of the agricultural sector (2.4% of nominal GDP) delivered July 2024*






**Climate change**

The current economic situation must be viewed against the challenges of climate change. In central/southern Chile and Argentina, the regional average soil moisture ranks as the single driest 13-year period during the last 600 years. Until mid-February 2024, a decade of aggressive drying out – El Nino rains since – runoff, not replenishing depleted water tables. El Nino ending spring 2024 with 6 more years of aggressive drying out forecast. Decreasing vegetation growth, sheep number reductions = falling income. Land erosion continues unabated - triggering desertification (already) visible. A Land Recovery Programme required.

**Further Opportunities - UN Convention on Bio-Diversity (CBD)**

The Falkland Islands contribution in 2015/16 to HMGovt's signature of the CBD is unknown but allegedly supported HMG to meet 17% land se -aside across Overseas Territories for UK to sign CBD. The JNCC review of FIG's contribution to CBD endeavours (August 2023) highlighted a new UN requirement of 30% land set aside by 2030. Against a background of peatlands shrinking and drying out, erosion, and less productive farming how can the Falklands deliver on this commitment? All highlights a clear need for a Land Recovery Programme.

Carbon credit earning from carbon sequestering is perhaps unlikely. Opportunity to pursue payment for bio-diversity regeneration (£?/Ha) payable to wool producing land owners to offset falling income by Land set aside (20 years?) - maybe a better goal or a combination of both? Fencing off (capex cost) land would need to be benchmarked, managed, audited.

*Subdivision was hugely significant (Shackleton report) but has presented challenges for the rural community - climate change and falling wool prices have exacerbated these. Land recovery can enhance the tourism offering, aid land management reform, diffuse societal challenges and potential demographic shift and help retain a self-sustaining rural community.*

## CONTEXT FOR THE WORKSHOP - WHAT DOES DOA HOPE TO GET OUT OF IT?

*Matt Davies, Department of Agriculture*

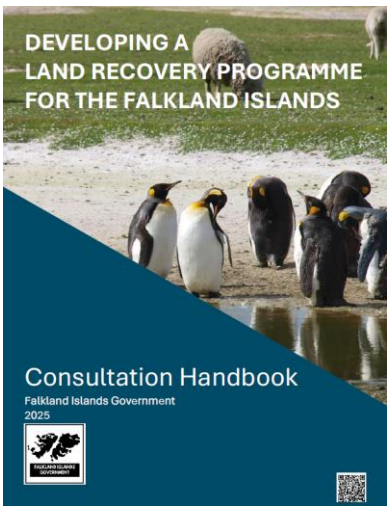
Being tasked to deliver a Land Recovery Programme is part of my job description. I am grateful to the organisers of, and participants in, this workshop for helping me deliver this objective. The Workshop is part of the consultation process for the Programme's development and I am here to listen, not to offer preconceived opinions.

Farming is at the heart of rural life and the rural economy in the Falklands. But as we know, it delivers more than just meat and wool - it delivers what we call ecosystem services - landscape, biodiversity, protection from erosion, carbon storage, clean water. All these are needed by wider society in the islands to thrive and prosper. These ecosystems benefits, that farmers deliver, have not been properly acknowledged in the past. As a society we are asking farmers to continue or expand their delivery in the face of unprecedented climate and economic changes.

Two things I have noticed about farmers and land owners in the Falklands;

- They are a resilient and adaptable community
- There is appetite and capacity for innovation and uptake of new ideas.

I also acknowledge this same innovation in our partners in the conservation movement. The skills and knowledge to innovate and adapt exists within these islands. We know that innovation must not advance in silos - there is a need to take risks and to spread that innovation amongst all involved in land improvement and in developing the social and environmental fabric of camp life.
Farmers are adapting, and the job of government is to find ways to support them to move ahead. That is what this workshop is about and its outcomes will feed into that process.



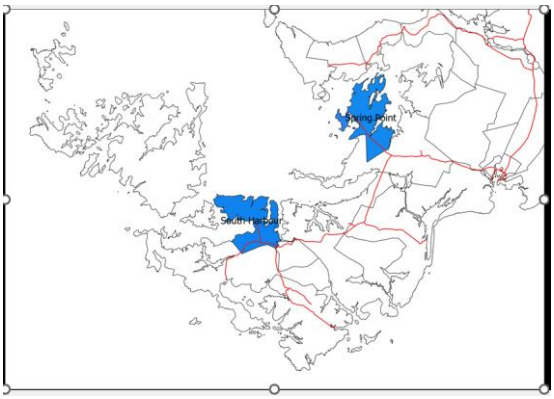
SESSION 1 **EXPERIENCE AND ACTIONS FARMER/LANDOWNER/OTHERS**

## 1.1 SPRING POINT

*Mike Evans, Farmer*

**Setting the scene**

Donna and I purchased South Harbour farm in 2002 (7541 ha), a whitegrass - based farm but with no stock. Very much a lifestyle goal to bring up our children in camp, as we had ourselves had enjoyed as youngsters and allow them to experience all the freedoms that brings also. When we moved to South Harbour we purchased what remained of a larger subdivision of land that was formally part of Port Stephens farm. There was no stock on the farm at the time of purchase but thankfully the road network was under construction in that area and this provided the income needed to sustain ourselves while restocking the land. Employment on the road network has contributed greatly to our financial survival on West Falklands. With Agriculture being the main source of income on the West, the road network has provided additional income when needed over the last 22 years. Once again we are most grateful for the opportunity to draw income from this type of work during the latest down turn in fortunes blighting the wool industry.




Good stock are scarce and we had to build our ewe base (breeding stock) around cull animals brought in from neighbouring farms. As we were in the grip of a wool slump at this time and experiencing very low returns for our product we were still heavily dependent on income from road construction. The introduction of finer micron Merino sheep via the National Stud Flock and gradually improving returns for wool allowed for some optimism.

So we began the process of building up stock numbers and reducing average flock micron which would hopefully allow for better returns from the finer end of the wool markets. Unfortunately the ground at South Harbour wasn't well suited for breeding the finer Merino type sheep and we struggled to maintain numbers without bringing stock in annually. In 2009

we had the opportunity to purchase Spring Point farm - Spring Point (7649 ha) - which had more suitable pastures for the finer Merino type sheep.
At this time Spring Point was running 5000 sheep and South Harbour approximately 3000 and along with improving wool prices we could at last sustain ourselves without relying on off farm income streams.

The purchase of Spring Point allowed us to adjust stock numbers (DSEs) on both farms to make the best use of available pastures. Spring Point now became the breeding ground with ewes and replacement stock and all the dry stock (wethers etc) now being run at South Harbour. Spring Point previously having run 5000 sheep was showing signs of serious stress from overgrazing. Through the process of cervical AI we began to fast track the reduction in micron across our flocks allowing us to run less sheep with higher value fleeces(less is more concept). This reduction in stock numbers allowing for some much needed restoration of the pastures to begin, along with a change of management practices.

Although we have just come through three really dry summers where we have struggled to produce good quantities of dry matter to sustain current flock numbers. This summer by contrast has allowed us to enjoy good growth across all our pastures with a healthy surplus of plant matter being left after grazing. We are currently running approximately 4000 sheep between the two farms depending on seasonal results.

**Setting up the reserve area**

As stock numbers reduced we gradually started to see a return of some native plants and flowers to our pastures that had been absent due to the heavy stocking rates.
One such area was a coastal stretch to the West of our settlement that we started to see good recovery in and we decided to set aside for further restoration.

Over the last ten years we have added to this initial area (hatched) and have now removed all grazing animals from the coastline on the Western edge of our property. What was once a very ordinary area of Diddle Dee coastal line has gone through a remarkable transformation with many Native plants making a comeback. The fence line effect shown here highlights the change over time.

Removing stock off heavily grazed Diddle dee (left) for 10yrs and whitegrass returns (right). We have also planted tussac and blue grass in areas along the coast as part of the restoration process. It should be noted that it has taken ten years to see this recovery start to take place in the dryer areas along the coast but it does prove that recovery is possible given time and patience.

Tussac has established well on the Diddle dee ground. Tussac plants being reintroduced to Tussac Point into what remains of the old tussac peat soil.

We have also carried out some experimental work using a flail to remove the Diddle Dee in places to reduce the competition and make the most use of available moisture when putting fresh tillers and plants in.

Blue grass established on the end of Tussac Point to recolonise bare and coastal areas. This plant responds rapidly and thrives in the area and bogs up within a few years providing shelter and ground cover. An important plant to be incorporated into your coastal habitat. It establishes and grows really quickly in Diddle dee ground.

Boxwood is thriving again with the removal of sheep and seedlings establishing in the Diddle Dee and along the cliff edges at the end of the point. Boxwood seems to recover quickly once stock have been controlled.


Native plants establishing amongst the Diddle Dee again.


One plant that is moving back in to the area is the Common Violet and along with it the return of butterflies to the coastline. It was really pleasing to see them around this year in good numbers which will hopefully have a positive effect going forward.


Couch grass is spreading fast along the coast line once again and we need to take steps to encourage its growth and spread seed all along the coast line where it was established in the past.

Following a winter storm, a large number of tussac bogs were washed ashore after a peat slip on one of the outer Islands. We have pulled a lot of the bogs up above the high tide line and having sat them upright many seem to have survived and have produced greenery. How long they will survive remains to be seen but they are a welcome addition to the reserve and are testimony to the resilience of the plant.

Example of the wetter more productive areas of the farm benefitting from periods of rest. It is the these areas that will be the focus of our attention for our agricultural ambitions.

**Dams and ditching**

A number of ditching programs have been implemented over the years here in the Falklands, beginning with the buffalo ditching that was carried out across the Islands in the 1950s.
Although they didn't produce the results that were anticipated at the time there is little doubt that many ponds were drained when the ditches were put in.
And even though they possibly did little to drain the peat flats as intended, they did and still do actively steer a large quantity of surface water of the land into the streams when heavy rain and flooding occurs.

Getting moisture in makes a huge difference. By damming some streams we have greatly increased the rate of land recovery and the diversity of wildlife.

In more recent times ditching has become popular again but this time with an emphasis on animal welfare. Although it has undoubtably reduced the risk to animals trying to access water, once again the end result has been to direct more water off the land and out to sea. Damming ditches, streams and ponds to reduce run off is something that is now being looked at more seriously. Anything that can be done to actively slow the run off from the land and make more use of the available water has to be a good thing.

Rehydration of peat flats and water for irrigation projects are all things to be considered. It is my belief that in some cases these ditches didn't exist in the past. They can be the result of overgrazing and removal of ground cover and root structures, where the water then cuts through the peat. Where as in the past the water that wasn't utilised by a healthy plant population would have run off as surface water. At the end of the day, ground cover and moisture are the driving forces behind all our restoration efforts.

The more we have the more we can achieve! The experiments we are conducting here at a Spring Point on a small scale so far, are about forcing the water back up to previous levels. Not digging down but rehydrating the upper layers of the peat around the ditch and stopping run off to sea and making water more accessible to livestock in the process.

**Closing thoughts.**

As we have seen it has taken considerable time to see recovery in these areas of hard camp. There is an argument out there that areas like this should be restored and then can once again grazed with the appropriate rest periods.
These areas will remain incredibly delicate with shallow soil depth and low moisture content, so as much ground cover as possible should be maintained along with a healthy mix of native plants.
I would argue that grazing these areas even for short periods of time will once again see the demise of the more palatable species.
For example Wild Celery, Scurvy Grass, Boxwood, Native Woodrush and Common Violet will be targeted by grazing animals and quickly stripped out of the pasture leading to reduced biodiversity once again.
We need to place a value on the different types of habitat in our care and determine their values for Agriculture for nature and for recreation.
There will need to be:-

- a clear vision with transition goals.
- sustainable change to land use through ownership of long term goals.
- recognition that nature doesn't respect farm boundaries.
- a peatland code to educate and control emissions.
- recognition that maintaining ground moisture and hydration levels will be key to continued farming on peat.

To conclude, times are tough but we have been here before. It's just the nature of the game farming in this environment. I continue to be optimistic that we will find a way through as we have done in the past. So the youngsters coming into agriculture will have a future and also that of the land that sustains us. We just need to find a way to protect both.
I will finish with a quote from Wes Jackson " *Do not try to improve on this patch of native prairie, for it will serve as your standard by which to judge your agricultural practices. There is no higher standard of your performance than the land and its natural community* .

**Discussion topics**
*Continuing to farm while removing sheep?* Support needs to be given while the sheep numbers decline on a farm. The benefits are being realised right away. Eg 25% reduction in sheep is a lot – it all depends on the speed of recovery. You can let nature do its own thing, which will be slow. We have planted Tussac to speed up the process. This can give people encouragement- makes them feel they are doing something. Keeping stock off is a big cost and loss of income. We paid for all our own restoration efforts to date ourselves.
*Do the dams help make pasture more productive?* Yes, very much so - and increase the biodiversity. In UK restoration is largely about water- redistributing it and raising water tables. This can help carry more stock in some areas, which could help lessen the penalty of excluding them from other areas. Could be tried in the Falklands. ME agreed. Don't dig ponds too deep. Just aim to spread the water around.

**1.2**

## HABITAT RESTORATION - A JOB FOR LIFE

*Sally Poncet, Land Owner*

My name is Sally Poncet, and I run a land restoration consultancy called Island LandCare with my partner Ken Passfield. We're based in Stanley and carry out fieldwork Island-wide, on mainland East and West Falklands and the offshore islands, working from our boat *Porvenir II.* I'm also a land owner, of a number of offshore islands that are managed solely for land restoration and wildlife.

Island LandCare is involved in:-

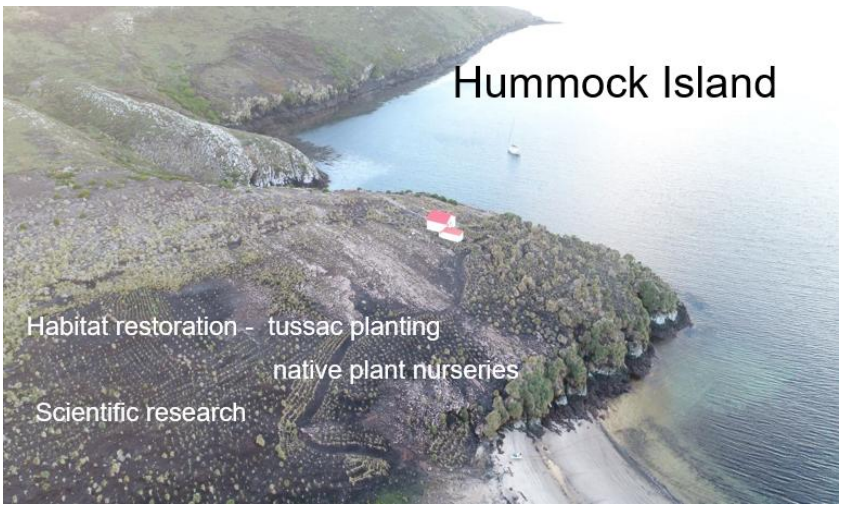
*Control of non-native plants* – calafate, spear and creeping thistles

*Eradication*s – Norway rats, Patagonian foxes, guanaco

*Surveys* - wildlife habitats, plants and birds

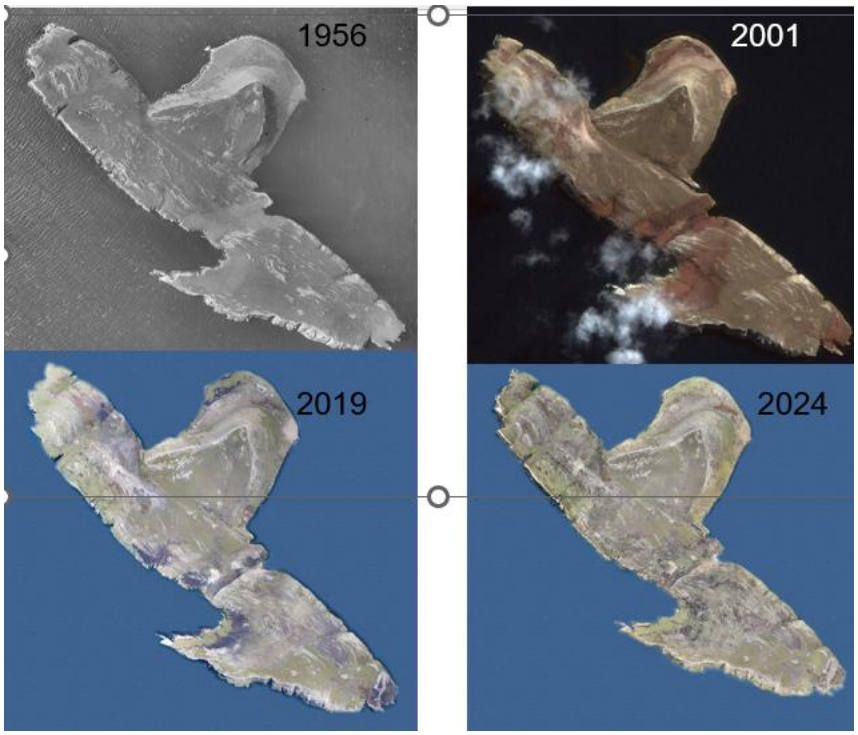
*Habitat restoration*

One of our largest restoration projects is on Hummock Island.




The island belongs to the Antarctic Research Trust, a local conservation charity. ART bought the island in 2017, built a field station there in 2018 and we've been planting tussac and other native plants there every year since 2019. This land recovery programme is funded by charitable donations made to the ART.

Hummock Island is 300 hectares, and was grazed by sheep up until 1976. The first photo was taken in 1956 during the first aerial photosurvey of the Falklands. The 2001 image, taken by satellite, clearly shows huge areas, totalling about a third of the island, of bare ground and blowing soil, and also the first signs of some natural recovery of the tussac fringe.




The 2019 image was taken using a drone just before we started the habitat restoration programme, and again you can see quite clearly the areas of black ground and bare clay. The final drone image of 2024 shows a big difference in tussac cover in the space of 5 years, as the island's natural recovery is boosted by our annual tussac planting efforts.

150,000 tillers have been planted to date, and the majority of the island's black ground is now re-vegetated as tillers mature, produce seedlings and natural recovery takes over. Tussac planters are currently paid £150 a day, and a good daily average per person is around

800 tillers if tussac is available on site. We now space tillers a metre apart, which means 10,000 tillers would be needed to cover a hectare of bare black ground.

A recent development in habitat restoration is the availability of native plant seedlings (or 'plugs') grown by Atlantic Harvest in the native plant nursery at New House. Last year they supplied 15,000 seedlings of tussac, bluegrass, Fuegian couch, swordgrass and boxwood for the restoration programme on Hummock and another on Philimore Island near Lively Island.


As a business venture, restoration activities have the potential to generate more gross income per hectare than sheep farming. For example, wool and meat sales Island-wide in 2024 averaged about £6 per hectare, while the habitat restoration programme on Philimore Island (300 ha) cost £33 per hectare annually for the 3 year period 2023-2025 compared with the cost for Hummock Island which is c £90/ha. It is difficult to generalise about costs of restoration, each site must be considered on an individual basis and inevitably islands will be more expensive. In-kind contributions from owners and other sources may need to be taken into consideration as well.

Several land owners are already benefiting from the income available for restoration projects, with large projects underway on Middle and Motley Islands, Weddell Island and Dyke Island.

**Funding**

Restoration projects are bringing money into the local economy and stimulating new ideas in land management. Funding is received in the form of grants, mostly from overseas conservation bodies. These include the Darwin Initiative's Local and Main programmes, Springcreek Foundation, Falklands Conservation and the Antarctic Research Trust. FIG is showing signs of becoming a significant player, with ESB and departmental funding now being made available for restoration projects.

**Habitat Restoration Stock-take**

In 2022, 2.6% of the Falklands' 12,000 sq km land mass was managed for habitat restoration, either actively by planting native species on ungrazed land or passively by removing livestock and allowing the land to recover.

Active restoration efforts between 2000 and 2022 amounted to the planting of 345,800 tussac tillers, with 100,000 on Hummock Island; 30,100 on Weddell Is; Sea Lion Is (26,500); Bleaker Is ( 23,500); Dyke Is (23,442); Middle Is (21,000 ); Motley Is (11,600); Dunbar (5,600); Port Howard (5,300); Tea Is (4020); New Is (3,100); Cape Pembroke (2600); Beaver Is (2,500); Elephant Beach / Little Creek (2000); Cape Dolphin (1700); Carcass Is (1000); Spring Point (1000); North Arm (1000); Port Edgar ( 600); Fox Bay Village (100). A few thousand bluegrass and Fuegian couch and a few hundred boxwood and swordgrass were also planted.

Assuming that the average tussac tiller spacing was around 1.5 metres (4,444 tillers per hectare), it has effectively taken us 22 years to plant 70 hectares of black' tussac peat ('black ground'). Given there are at least another 5,000 hectares of former tussac ground eroding away and in urgent need of re-vegetating, and many tens of thousands of hectares of eroding sand, clay and bare soils, our restoration efforts are but a start.

**Restoration stock-take and key drivers**

It is now increasingly acknowledged that the land is drying out; the old ways of managing our land are being questioned. There is a free fall in sheep numbers and wool prices are low. Statements like 'long grass is a fire hazard', 'sheep are part of the solution', 'cattle are good for tussac' are not helpful, correct or relevant when it comes to repairing the land. We

already knew this back in the early 1900s, when the first massive land restoration efforts began, when miles of fencing were built to keep livestock out of over-grazed coastal areas.

Land recovery time in the Falklands is measured in decades. 350,000 tillers on 70 hectares in 20 years is insignificant. Our remnant carbon-rich tussac peats are eroding at a rate faster than can be restored by planting. The fastest most cost effective way of producing results in land recovery and soil moisture retention is to increase ground cover and height of native plants. This can best be done by excluding livestock – which will also increase biodiversity. Healthy native habitats based on Tussac, Boxwood, Bluegrass, Fuegian Couch and Sword grass are the key because they are adapted to our climate and they can cope with drought and fire. But they cannot cope with grazing, which must be excluded.

The technology to do this still exists today: it's called a fence. What we now need is the political will, policy and the funding to enable this knowhow, knowledge and technology to be put to use to help the land regain the ground cover and soil moisture it needs to survive.

**Where do you start?**

You can already apply for existing funding - from FIG's Environmental Studies Budget, Antarctic Research Trust, Springcreek Foundataion / Falklands Conservation, Darwin Main, Darwin Local.

You can listen to those who are already doing land restoration.

You can discuss the Land Recovery Programme with Matt Davies.

You can lobby MLAs to support the LRP.
Most of all, make a start, no matter how small, fence off a paddock, plant some tussac or some bluegrass, let the plants set seed.

**Finally.** Congratulations to those who are supporting alternative sustainable land management in the Falklands: Antarctic Research Trust; Falklands Conservation; Springcreek Foundation; Island LandCare; Habitat Restoration Services; Atlantic Harvest; Peaty Pals; Darwin Initiative; FIG Environment Department And to those far-sighted and enterprising landowners who have already destocked some of their land or islands and found alternative ways of securing an income, in Camp or Stanley.

**Discussion points**
*Duration of funding?* Any scheme implemented must be long term. 10-20yrs minimum.
*How did you deal with the black, blowing soil on Hummock*? It was also killing off the Diddle dee.
*Tussac plant spacing?* Should move to closer spacing (than the 1.5m used on Hummock) as drying gets worse. Need quicker land cover.

**1.3**

## PORT STEPHENS – SOME PERSONAL OBSERVATIONS

***Paul Robertson, Farmer***

Our family has been farming at Port Stephens since 1909 - right back to my Great Great Grandfather's time. We have seen a lot of changes. Sub-division was the greatest. In 1988 the farm was subdivided into 5 sections, our family got one - where I now farm. So I have had 50 years' experience of looking at this land and thinking what is the best thing to do with it. And a lot has changed very quickly. These are my personal thoughts on where we are in the Falklands, based on my experience.

It is clear that

1. Wool is going through probably the worst of patches and as a result Falkland farming is going through bad times.
2. The climate has changed and is changing - as a result the weather is more unpredictable and the islands a lot drier.
3. Although farming developed as it did for good reasons, historically farming practices have not been kind to the environment.
4. Falklands farming reflects what has already happened in the rest of the world.

Against that, while wool may or may not make a comeback, a lot of farmers have been very adept at diversifying. Diversification has tended to go in cycles - as a spin off from low wool prices. This is not necessarily a good thing. When wool prices are good, we forget the innovation which pulled us through the cycle before that, and so it goes on. We are now in a cycle of needing solutions to both the climate and wool price crises.

Yes, our Native pastures are suffering - almost all species are suffering from drought. Yet I see other species coming in to fill the gap - more finer, introduced grass year on year and (unfortunately) invasive weeds appear to prosper. Yes, there is a lack of water - we must differentiate between water for animals, pastures and humans. There will be a different strategy for each. Different farming methods and techniques can mitigate the lack of water. The milder climate has allowed us to try farming Merino sheep, without which all farms would likely have gone bust years ago.

I believe farming on the majority of land in the Falklands can be sustainable. The question is, what is sustainable ? this depends on what we are trying to do. Farming itself wont change the camp population, we need to be innovative in our use of land. We need to be clear about what we are trying to achieve. I don't think it will be the same for everybody, but it needs clarification.

However, if wool doesn't recover soon all the farming community will be in dire straits. Partly because we have lost the incentive to diversify, and not everyone is in a position to diversify. Coming back to my earlier point, not all land can be sustainably farmed. But that depends on our definition of sustainability and what we are trying to achieve. Is sustainable farming economically viable? Farming as we know it is unlikely to generate an increase in the camp population – and leading to a more robust community.
Over the past 40 years or so, rightly or wrongly, the Dept of Agriculture have been the drivers of agricultural direction and policy. .The last great 'push' was the abattoir which was to transform agriculture in the islands. DoA gradually moved to a 'farmer led' approach. Whether right or wrong, I believe this has led to a vacuum with no clear direction, national goals or targets.

A lot can be done to arrest land degradation. Some of it simple. For the vast majority of land sympathetic use and decades of time are what is needed.
For those smaller areas that are really degraded there are a variety of possibilities, but probably not all are economically viable from a farming perspective.
No 'one cap fits all'. The big question we are asking is are stock good, bad or even useful? I don't think one solution fits all, every situation is different so I would not be dogmatic.

If we can sustainably farm, do we have a moral obligation to help feed the world? Or ourselves? I find it embarrassing that we cant feed ourselves. There is a paradox. - as farmers look to diversify away from farming to survive, less effort is spent on managing the land, with negative consequences. The will to have a 'camp' continues and generally speaking over the years lots of funding has been forthcoming. MLA Birmingham has stated that there has always been a political will to fund the camp when the need has arisen. The trouble is we need to identify the best use for funding. That should be the real goal from this workshop.
We really need to nail down what we want from this workshop - what are we asking for?

We need to hone up our skills at applying for funding. There are funding opportunities out there- some are far better at accessing it than others.

In terms of a vision for the future we need to work out a direction of travel. The UK is regrading its land with the best going to food production. Could we do the same? A lot of the land we own isn't farmed at all - as backed up by Mike Evans. Not all the land can be productive, but a lot of it is. A lot of this workshop is farm – centric, but we have to think how set -aside or removing stock would impact on the farm population.

I don't know if we have bound ourselves to a certain percentage of set-aside, but I think there is merit in "somebody" creating a map of the islands with categories such as:

- Restoration with 100% tussac is definitely feasible given what we think we know…

- Keeping animals off alone will transform this area very quickly…
- Bare – probably not worth doing anything with at this stage…and so on.

It would be well worth doing to see what that looks like. This may give restoration some sort of coherent policy and land owners can be approached with an idea. The danger otherwise could be that it ends up being very ad hoc and dare I say some areas not benefitting from what could be more appropriate solutions.

In the past we have all attended numerous workshops and think- tanks on the future of farming - dust off all that effort that went into ideas on incentivizing non-farming businesses in camp.

**Discussion points**

*Farmer -led policy by DoA?* Thinks it hasn't worked as a lot of farmers don't really know what they want. And every farm is different. We have been meandering for years. How can we present a common front? In the past support was about equalisation across everyone in camp. Now it is more about location. MLAs get different feedback from different places in the islands so it is hard for them to allocate funding equably. Years ago the camp had a unified voice.

*Support for a Land Recovery programme?* This is vital- it needs to happen. The solutions are simple -eg the ESB will pay for Tussac plating etc. Ditching is feasible if the expertise is there. It is more than just set-aside. I am fairly positive about the future -and this LRP. Ten years ago I was more despondent. I thought the land was knackered, but things have improved. OK, we had a few dry years which set things back, but now we have plenty of grass (at P Stephens). We can recover – most people are doing something and have made a start-we are half way there. Everybody could easily set some land aside.

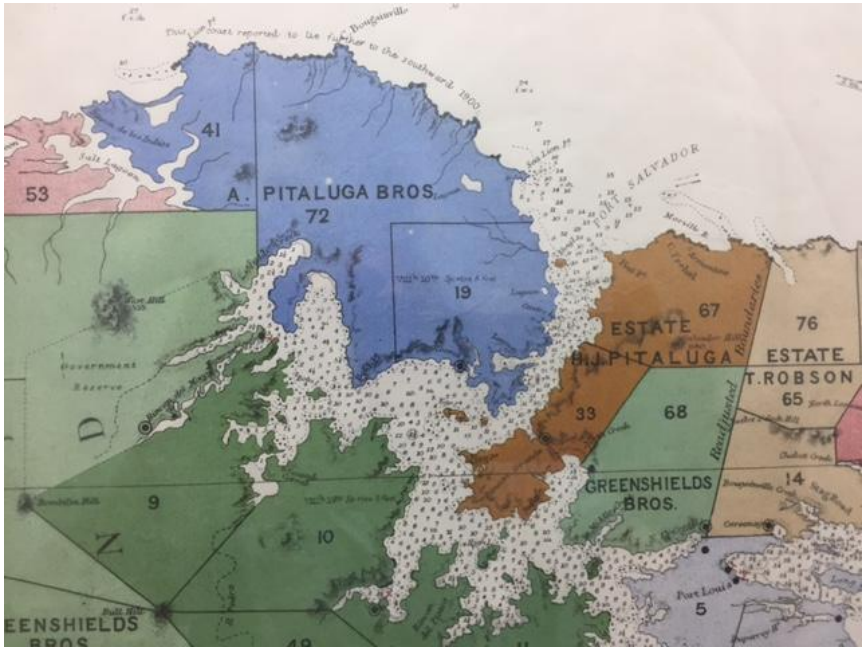
*You can't do the work yourself and get paid for it?* I think this is a big drawback. If I need ditching done, to get paid for it, I have to get somebody in to do it. They don't know my land or what I want so I have to supervise them anyway. What is the point in that.

This caused a lot of discussion (Chair).

**1.4**

## A DRIER FALKLANDS - WHAT HAS CHANGED?

*Nick Pitaluga, Gibraltar Station*




This is the area (in blue) my family has farmed on East Falkland for many generations. I have noted that the type of changes Paul (Robertson) has been seeing at Port Stephens - at the other side of the Falklands - mirror those I have been seeing at Salvador. There are climate and land parallels but he of course finds it harder/most expensive to access the necessary services and faces more logistic challenges to farm than we do.

**Climate change**

We are certainly noticing it is becoming drier in the camp. This makes it easier to get around (evidenced by the vehicles we use) and the rate of change is noticeably increasing. We are seeing more windier days and rainfall coming in larger bursts. This is giving more runoff with less moisture being retained on the land. The steady rise in temperature is bringing noticeable changes in the flora.

Likewise, the decrease in the number of days snow and frost cover can have variable effects. If grass gets frosted and "burnt off" by the increasing winds, we are seeing patches of dead vegetation which then become susceptible to erosion. In my opinion this is causing more damage than sheep. As another part of the problem, we have been shipping nutrients out of the land (in livestock) for a long time with no thought of replacing these. And this depletion of micro and macro nutrients has led to pasture change. We lack knowledge in how to deal with this situation.

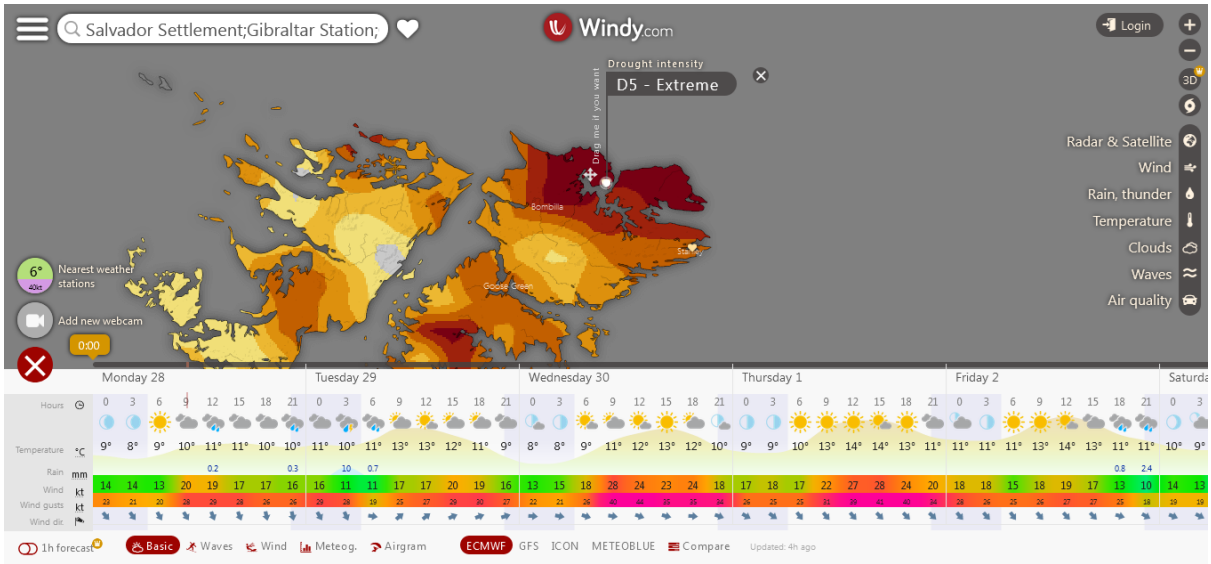
**Stocking**

Salvador had 18,500 – 19,000 sheep between the 1930s and 1990s.Gradually this fell back to 12,000 and is now 4,500. It would be impossible to sustain the type of camp population then on this number of sheep.

In the mid-1950s there were 30 people on the farm, 17 or 18 working; by the mid 1980s, 14, 8 working and now only 2 (3 occasionally) working. So the whole dynamics of camp life and motivation has changed. We used to only think about what we could produce from the land. Many mistakes have been seen in the past. Now stewardship is one of our main motives. So this workshop is timely.

**Changes we don't see**

As a direct consequence of climate change plus past management, we are seeing the drier summers causing land shrinkage and cracking. Substantial cracks have developed, these can be 4-6 inches wide and take water deep into the soil, well below plant rooting depth. This is having a detrimental effect on Whitegrass bogs, which eventually wither up and die. This is affecting our options for stock and is causing nutrient loss and root decay.




This weather map from a few years ago is typical of the pattern of drying-out and increased temperatures we are seeing at Salvador.

**Some notable Changes over the past 50 years**

- Sphagnum moss bogs have disappeared,
- previously moist slopes and valleys with bogged whitegrass have reverted to lax whitegrass,
- Buffalo ditches have closed up. Originally these were about 90cm wide, now most are barely open and have caused only minimal side drainage anyway.

- Spring holes used to be found higher up the slopes, now they are at much reduced elevations, and many have dried up completely and don't flow as long in summer as they used to.
- Ground cracking and peat shrinkage has exposed rocks not previously seen and these now protrude through topsoil layers.
- There has been considerable drying out and loss of ponds and noticeable deterioration in water quality.

Wind has caused more soil erosion, blown dust and sediment

**Ditching**

Ditching has caused water loss, though as mentioned, there has been shrinkage of buffalo ditches. Ditching also has potential in any restoration programme-if done carefully and well. There 2 ways to ditch

1. Turbo-ditching. Generally fast, with little planning into where the water will go
2. Ditching which is based on a knowledge of, and is sympathetic to, the land. In the example below, the overhanging bank has been pushed in, leaving gaps for water to spread across the camp and with periodic "hold-backs" or partial dams to retain the water.

3. Perhaps it could be combined with some form of mole draining to disperse water evenly and even to get it out of the drained area.

Example of sympathetic drainage

We have examples of significant soil shrinkage over 30years.

This is our sheep race through the farm. Approx. 60 yards wide. The land to the right is rotationally set stocked, and in recent years that stocking rate has gone from 1:2 acres to 1:3.5 acres. There has been some reversion to Diddle- dee on the right hand side. However a more recent photo (right hand side) shows that reducing the stock is resulting in gradual comeback of grass at the expense of the Diddle- dee. Climate change can be factored into this as well.

Moisture changes mean that sheep have moved down the drier valley- and this is resulting in a change in grass growth. In terms of destocking, I do think that some ground compaction from foot pressure is necessary to protect the plant cover.

To further make the point about ground compaction for better moisture retention, and disturbance for water entry, these are two 60 year old Buffalo ditcher track marks. For many years this disturbed area was colonised by mainly Sphagnum moss- ie it remained wet. In recent years however, drying out has led to encroachment by Christmas bush and Diddle-dee.

These are all observational lessons we can learn about the impact of climate change on our ability to hold sheep and the resultant effect on vegetation. They do give us some clues as to what we need to build into restoration programmes.

**Some concluding thoughts on what we need**

Land stewardship is becoming more and more of an issue than it was 30 years ago. And we have to see the wider picture of the global market we are trying to sell into. Worldwide fibre substitution makes the future for wool less attractive. There is a lot of dependence on oil to produce and deliver wool -here is less interest in our product despite all our attempts to improve quality -RWS, Merino -type breeding etc. Our costs of attempting to keep up with the world market will grow. Shipping costs are increasing- it has been estimated it costs over 4 x more to get a bale of wool from the West than the East to Stanley. The abattoir has been a godsend to some, but there is still a hugely variable group of producing farms out there. There is no real likelihood of the wool market improving in the future, so how are farmers going survive in the future? Producers (particularly younger ones with perhaps hefty mortgages) are going to start looking at some other to fill their income gap. So looking at it from an all island perspective, we need to deliver some justifiable reason to support the camp and keep people living there with viable incomes.

One fact stands out starkly- *Someone must Look after the Land!* Otherwise we will have land abandonment, fires etc-all of these are stark reasons why this workshop is vitally important to our future.

**Discussion topics**

*Maintaining camp population?* Look at the wider picture and the age demography in camp. Some farms were too small after subdivision, amalgamations expected. If nature took its course, there would be fewer farms. There are many young farmers – we must consider them.

A Land Improvement Programme could be a huge benefit . It would help keep people on farms if reasonably funded. Previous schemes have been minimal funding – helped people scrape through. We are looking at preserving the land for the next generation. The funding package should reflect that. Costs of production have increased substantially. Supporting a Sheep (or cattle) industry are not the total solution

*Frost damage?* Native plants seemed more susceptible than introduced. Very much exacerbated by wind. Most shrubs survived on the lee side. Lot of blown sand. Are we collecting dust (possibly contaminated by eg roundup which has caused desertification in some parts of Patagonia) which is being blown here. Cf Mt Hudson. Need some scientific testing of samples.

*Seeing Dieback*? Some. Seems random. Need for perhaps science-based continuous monitoring.

*Cracking of soil?* Could be affecting a huge part of Salvador (30-50%). Also becoming more noticeable on other farms. There are increasing incidences of water just vanishing into the bedrock down cracks and eg postholes. Could this be some effect of climate on underlying geology?

**1.5**

## HOPE HARBOUR & DUNBAR

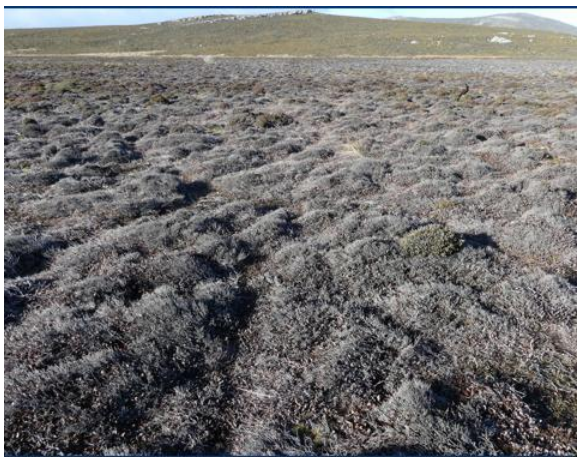
*Marie- Paul Delignières, Farmer*

We farm Hope Harbour – Dunbar (originally 2 farms) on the N-W of West Falkland. Both farms together are 12,800 ha and historically held 7,000 sheep. When we bought the land in 2007 there were 5,600 sheep, today there are 3,000.

**Reasons for the decline**

Both farms had been overstocked in the past so there was a declining grazing resource. The land was getting drier – climate change and drying out is happening to a much greater extent on the West than the East of the Islands. This needs to be taken into consideration in any restoration programme.

Due to past grazing history, Diddle- dee is the dominant vegetation cover. In the last few years, we have been severely hit by dieback. We are also seeing Tall rush dieback. We think the land was probably covered with boxwood in the past as we can still find some boxwood plants where sheep cannot eat them from sea level to high altitude.



*Diddle dee dieback and clay patch erosion*

*Blown sand and wind erosion*

**What have we done to compensate for these downward pressures.**

In terms of *Land management*, we have installed a lot of fencing to create smaller paddocks and we are working our sheep with rotational grazing. Our ewes camps were very dry and a year ago we did not put out the rams and had no lambs, so we were able to partially spell the grazing pressure on these paddocks, especially during Spring time.

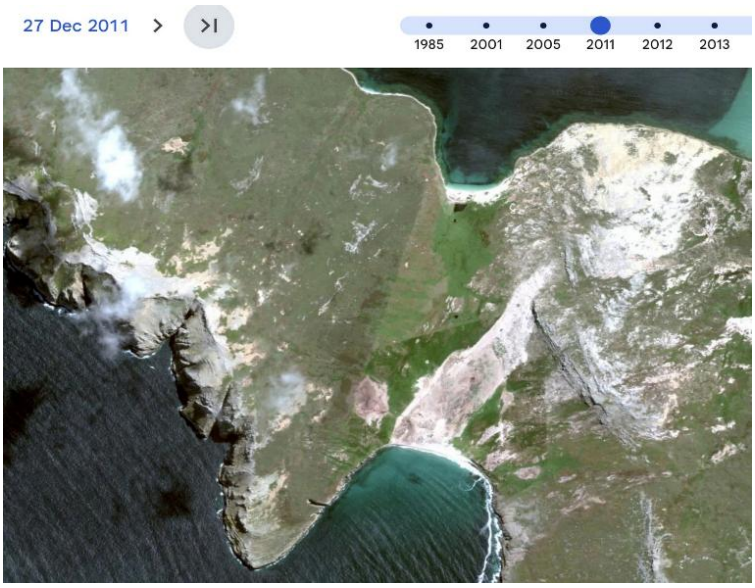
In terms of *Sheep management*, to compensate the loss of sheep numbers, we have been selecting them for finer wool, better carcasses and worm resistance. We are also Organic Certified (premium) and Responsible Wool Standard certified**.**

*Reducing our grazing pressure and rotationally grazing is working*

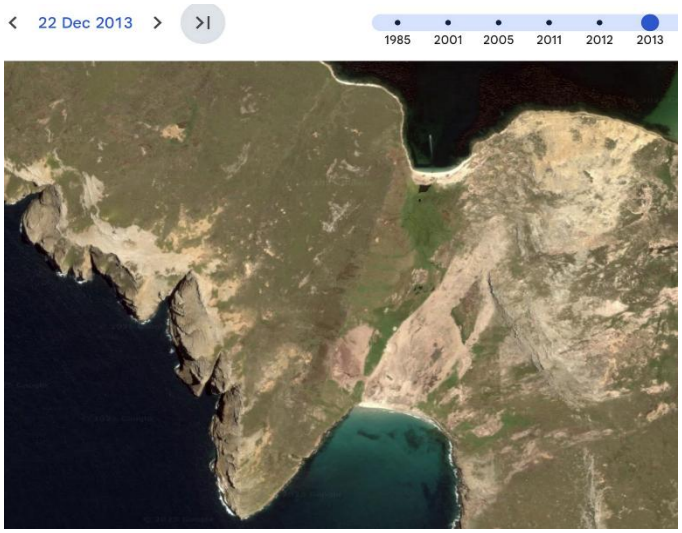
**Restoration**

We have had an extensive programme of replanting bare patches and blown sand areas with Sandgrass and other native grass species.

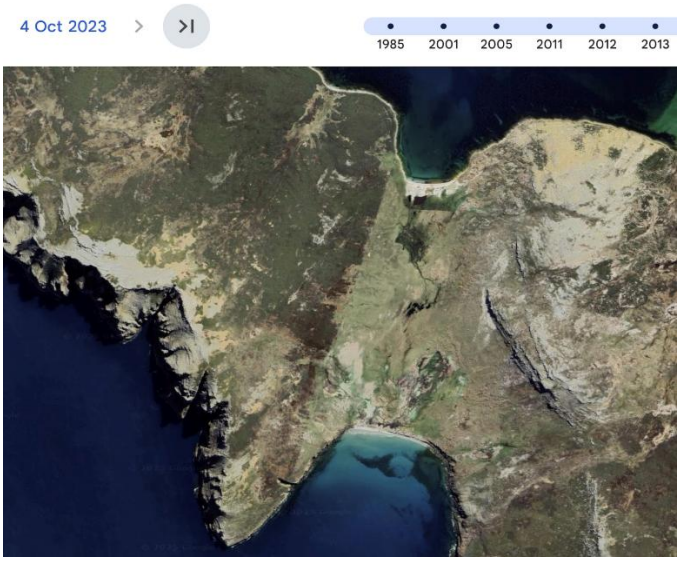
*Before and after Sandgrass planting*




*2011*




*2013*




*2023*

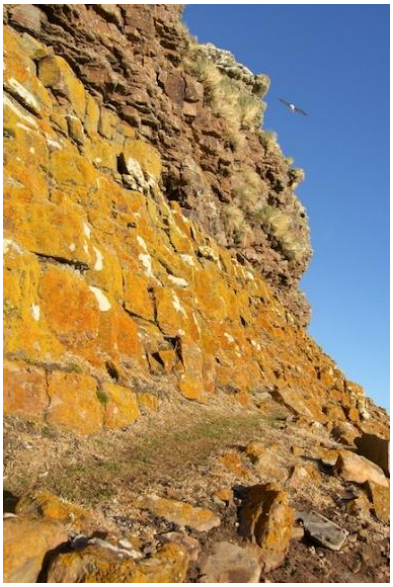
Sequence of recovery 2011, 2013, 2023 in the Grave Cove, Penguin Point area. The straight lines are fence lines. The whole area is grazed.

Planting Bluegrass, Fuegian Couch and sand grass in to restore clay patches, especially edges . Fencing alone is not enough.

Some of our Diddle-dee die back areas get some grass growing in between thanks to resting periods, but other are getting totally bare with huge erosion risks. We are doing trials planting seedlings of Cinnamon grass into the Diddle dee grazed areas. We are also planting seedlings of Fuegian Couch and boxwood in fenced off Diddle-dee areas. We use the rechargeable battery drill with an auger drill bit as we feel it disturbs the soil less than a spade. A spade slit or hole exposes too much peat and makes it prone to drying out. The drill hole helps retain moisture and is the perfect size for seedlings' soil contact. Anything is better than Diddle -dee, but Diddle- dee is better than nothing.

We planted Tussac on this bare area in 2010 (above) and in other areas. While a lot died some have come through. Though sorrel has given some ground cover and we also planted Blue grass between the Tussac. The original planting spacing was 1m, perhaps that is too wide now for the sort of weather conditions we are experiencing. We did get a lot of seedlings quite quickly, but they died out. We have about 30% of the original Tussac plants left.

This is another trial with Blue Grass tillers that are working well.



These are both before (left) and after (right) pictures of the same areas, showing what the effects of fencing alone can achieve. No seed or plants were used in either case. We only planted some Blue Grass tillers in the bottom examples and are planning to plant more in case the grass (mainly Yorkshire fog) dies out without the grazing. There are only 2 years between each of the lower photographs.

All this is fine and good, we have had some good results with restoration and it is very satisfying work -it makes you feel good! However, it is only on a relatively small scale, it is very

labour intensive (fencing, collecting plants, transporting them, planting etc) and it does take a lot of patience and disappointment when it fails. Some of the changes are very slow and we have a fair chunk of our farm fenced off from stock. So it is not solving our original decline in stock and our income from sheep problem!

**Funding**

There are sources of funding available for this sort of work -eg RSPB, ESB. FC, ART, FIP and we have used some or all of these to cover most of our costs-especially fencing, external labour or plants. However, we are usually asked to prove we are also financially contributing to get these fundings and they don't cover the recurrent costs of our income lost through declining sheep numbers. I guess this is the reason why more people aren't taking advantage of some of the funding sources available. Any Land Improvement Programme must take this into account when considering the amount offered and the duration of the programme.

**Scale**

We have been dealing with relatively small areas for restoration on our farm, and fencing off into smaller paddocks is always our first activity. What happens when we have erosion at a landscape scale - like in the pictures below where there are large erosion problems looming?

Perhaps this is where the issue of Biodiversity credits might come in? We must change our practices and significant areas of Set-Aside delimited if we are going to have real land recovery at a big scale. Let us focus on caring for our own land and soil before it disappears in the winds.

**Discussion topics**

*Funding?* There is variability in what some funding sources will pay for. It is a big drawback and off-putting if you can't claim for your own labour (or at least part of it). Always record and make clear your own contribution to the project. Funding for fencing has improved a lot (used to be only 25%). All funding is not being used up. Apply for as many sources as you can. None will cover income loss on a regular basis.

*Active and passive restoration?* There is a clear distinction and this should be reflected in the funding package. It costs less to take sheep off, but the income lost isn't covered. Active measures can be expensive.

*Land classification ?* There is a lot of merit in having a land classification to help support the decision-making process for restoration and whole farm management to cope with restoration (see also Paul Robertson's presentation). On *v poor land* -fence off and nothing happens unless you spend lots of money. *Medium* quality land. Has some potential-recoverable with variable effort-very specific. *Good/very good land*. Will support sheep -and maybe more for a limited time. Use this to reduce the stock on the medium land and keep the farm going. Then focus effort on the Medium quality land

*Holistic grazing?* Tried, learnt a lot about pasture condition, but decided it was not suitable for our land. Too much variation across the farm. Whilst it was good to get trampling and hoof and tooth in some places, the animals were putting a bit too much pressure on the greens and good vegetation. Makes a point that any recovery programme must bespoke.

*Move stock quickly to transfer nutrients and limited grazing to poor areas?* Use a mob of sheep or cattle grazing on a good area, then shift all to a poor area needing restoration for a short time (few days) and put them back. They will have dropped nutrients in dung and urine from the good to the poor land. Do this regularly – preferably overwinter.

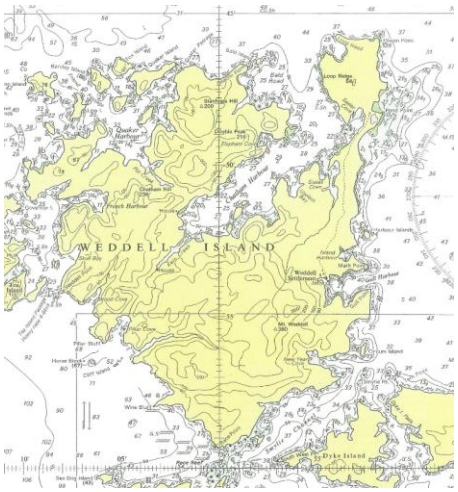
*Was the Diddle-dee area with planted cinnamon grass grazed*? Some parts were most weren't. This is just the start of the trial, more will be planted in late fall. Makes the point that any recovery scheme must be bespoke to any area and there must be flexibility to cover this diversity. Eg planting density needs to be adapted to situation. Needs a suite of options to be available-some of which include the grazing animal, some not.

*Which grass species to use*? Geese are a problem. Make use of all the grass species you can. Tussac has a great wow factor but planting should be confined to what is/was Tussac peat. Looking at the vegetation cover alone does not tell you what may be happening with the hydrology, the soil health and the functionality of the litter layer. All these are important measures and outcomes of any land recover effort.

Underlying geology is important. Relate to recovery potential? Make use of erosion banks for shelter and cycles of erosion. Compared with Spring Point.

## 1.6 WEDDELL FARM

*Lewis Clifton*




Weddell Island (25,589Ha) has witnessed major fluctuations of sheep numbers (table below) since first introduced. In 1890, 25,000 sheep (approx 1/Ha) were recorded. This fell away steadily until sale from Mrs Williams to John Hamilton when numbers reduced to 3,572. High numbers of sheep (and other livestock) almost certainly triggered irreversible vegetation decline through excessive overgrazing. John Hamilton (later his estate) gradually increased sheep numbers to ca. 9,000 sheep and recorded in the island sale to R&J Ferguson in 1987/88. Approximately 8,000 sheep were recorded on Weddell for the next 20 years until being destocked to 400 sheep in 2000 when the island was sold to Weddell Is Ltd (WIL)

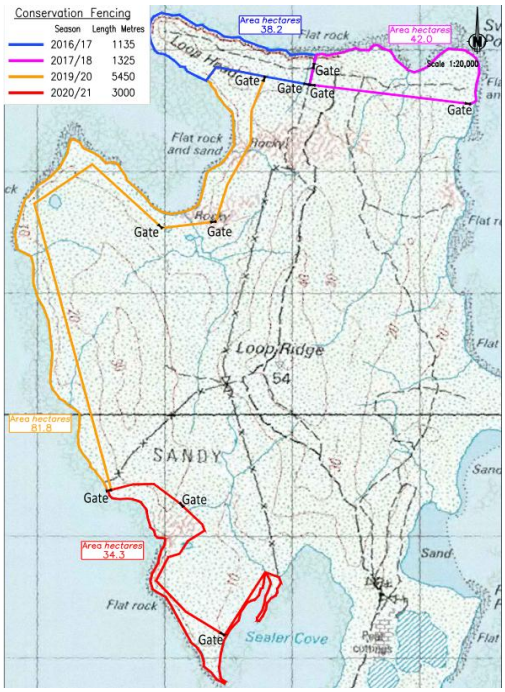
| Season | Ha | Acres | Pop | horses | cattle | tot sheep | tot ewes | Lamb marking | | wool clip | av fleece |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | on farm | mated | marked | % lamb | kgs | wt kgs |
| | | | | | | 31-May | | | | | |
| 1890 | | | | | | 25000 | | | | | |
| 1901 | | | | | | 20055 | | | | | |
| 1910 | | | | | | 15694 | | Mrs Williams | | | |
| 1921 | | | | | | 7832 | | J Hamilton Estates | | | |
| 1931 | | | | | | 3572 | | R & J Ferguson | | | |
| 1980-81 | | | 6 | 40 | 170 | 8950 | | J & S Ferguson | | | |
| 1987-88 | | | | | | | | Weddell Isand Ltd | | | |
| 1988-89 | | | | | | | | Byron Holdings Ltd | | | |
| 1989-90 | | | | | | | | | | | |
| 1990-91 | | | | | | | | | | | |
| 1991-92 | | 70920 | 9 | 22 | 54 | 8005 | | | | | |
| 1992-93 | | 63090 | 10 | 22 | 52 | 8247 | 2765 | 1491 | 53.92 | 26,985 | 4.01 |
| 1993-94 | | 63090 | 7 | 11 | 49 | 8565 | 2619 | 1564 | 59.72 | 29,617 | 4.06 |
| 1994-95 | | 63090 | 6 | 10 | 45 | 8701 | 2700 | 1357 | 50.26 | 27,539 | 3.72 |
| 1995-96 | | 63090 | 5 | 9 | 45 | 7588 | 2656 | 810 | 30.50 | 23,973 | 3.68 |
| 1996-97 | 25532 | | 3 | 5 | 24 | 8206 | 2500 | 1554 | 62.16 | 28,624 | 4.09 |
| 1997-98 | 25532 | | 4 | 8 | 42 | 8204 | 2337 | 1171 | 50.11 | 26,523 | 3.72 |
| 1998-99 | 25532 | | 4 | 8 | 42 | 8043 | 2635 | 1685 | 63.95 | 30,191 | 4.06 |
| 1999-00 | 25532 | | 2 | 5 | 49 | 3795 | 2590 | 1612 | 62.24 | 25,242 | 3.52 |
| 2000-01 | 25532 | | 3 | 6 | 39 | 400 | 0 | 0 | | 1,217 | |
| 2015-16 | 25589 | 63231 | | | 36 | 566 | 359 | 109 | 30.40 | 2,629 | 5.64 |
| 2016-17 | 25589 | 63231 | | | 36 | 4311 | 359 | 132 | 36.70 | 2,328 | 4.51 |
| 2017-18 | 25589 | 63231 | 3 | | 28 | 5642 | 2871 | 1437 | 50.05 | 14,765 | 4.02 |
| 2018-19 | 25589 | 63231 | 2 | | 33 | 7043 | 2800 | 1618 | 57.80 | 24,810 | 4.55 |
| 2019-20 | 25589 | 63231 | 3 | | 55 | 5607 | 3460 | 1694 | 48.96 | 25,422 | 4.05 |
| 2020-21 | 25589 | 63231 | 2 | | 65 | 6940 | 2405 | 1332 | 55.40 | 26,269 | 4.27 |
| 2021-22 | 25589 | 63231 | 2 | | 60 | 6372 | 2538 | 1186 | 50.30 | 27,418 | 4.35 |
| 2022-23 | 25589 | 63231 | 2 | | 43 | 5136 | 2104 | 1320 | 62.74 | 26,911 | 4.41 |
| 2023-24 | 25589 | 63231 | 2 | | 52 | 4083 | 1450 | 1029 | 70.97 | 23,216 | 4.58 |
| 2024-25 | 25589 | 63231 | | | | Est 3200 | | | | | |
| 2025-26 | 25589 | 63231 | | | | Yr 10 anniv of sheep reintroduction | | | | | |

Byron Holdings (owned by Lewis & Stephen Clifton) purchased Weddell in 2015 and slowly restocked it to c.7,000 sheep (and about 50 cattle) in 2019. A target carrying capacity of 8,000 sheep became unrealisable, despite 16 years of grasslands recovery, there was visible evidence of embedded climate change impacting. Vegetation was not being replenished on a seasonal basis. Sheep numbers have decreased to c.3,200 during the 24/25 season reflecting the owners recognition of climate change impacting and hastening peatlands drying out.

John Hamilton introduced the invasive Patagonia grey fox in 1928/30 for pelt production. Its island-wide coverage has devastating wildlife and create sheep breeding difficulties. Scientific estimates of fox were as high as 5,500, and an updated study by Montana University in 2019 recorded 3,500, a population density of 14.3 fox /km2 indicating a population density 3 times greater than in Patagonia. An active annual eradication campaign prevails. Wildlife is recovering.

**Loop Head.**

The owners of WIL planned to run the island as a tourism venture, and failed to maintain fence lines and other infrastructure, thus enabling 400 sheep to erase much of the Loop Head peninsula tussac plantation over a period of approximately 15 years. In need of much overdue care, and with some financaiil support from FIGovt Environmental Studies Budget, swathes of coastline was denied from sheep access, and tussac replanting programmes were initiated. Howeve,r the Swan Point promontory is so badly eroded that tussac plug planting has been disappointingly unsuccessful. The rate of bare peat soil disappears in cm/year and in sunshine peat soil surfaces can attain >40°C.



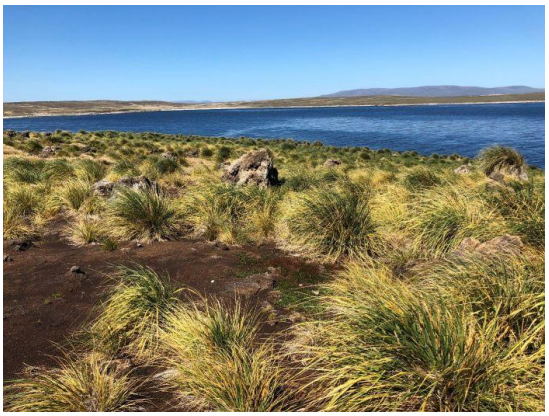
The fenced off areas have now become sites of annual scientific interest, both in terms of ongoing erosion and vegetation recovery. The overlying peatland across the area headland has been mapped and verified.

The above image shows the devastated tussac plantation on Swan Point promontory. Too little tussac had survived to utilise for pulling tillers. Tussac seed was collected from other locations and thousands of tussac plugs were grown by Cynthia Williams at Stanley Growers, prior to shipping to Weddell for winter planting. The below images show plugs laid out in a wheelbarrow for planting out. Plugs were planted at 1.5m distance. 6,500 plugs were planted in this single location. Successfully growing for 3 years, 10 months of no rain prior February 2024 ushered in severe drought and die off, and accelerated already excessive erosion. Today only ca. 500 live plants remain.

We opted not to use garden spades for planting (tillers and plugs) and adapted tools similar to potato dibbers to minimise underlying peat disturbance and prevent additional erosion. This plug planting endeavour started off as a family hobby, which perhaps ideal for tackling large eroded areas, where professional fee paid planting would have been better deployed.

Plug establishment was initially good, although upland geese were culled back given they ate the young green leaves, invariably pulling out the plugs in the process.

Spring 2017 – Self regeneration



February 2019 Regeneration

On the Loop Head western end, following fencing off, Yorkshire Fog became quickly is not profusely established. This prevented soil erosion, and although seasonally prone to dying off, has enabled Bluegrass to take root and stabilise the eroded areas more quickly (image below).

In 2020 we began investigating the value of carbon credit earning. This possibility tied in with the DEFRA Darwin soil mapping project (led by Dr Steffi Carter with partners, James Hutton Inst, DoAgric, Univ of Magallanes, Falkland Is Trust, CEH, British Museum Natural History) where 3 locations on Weddell were examined in detail.

Following the first two fenced off areas on Loop Head, and with the availability of Katy Ross a 10-day detailed vegetation, soil moisture and peat depth survey was undertaken in March 2022. That gave promise and hope for an island-wide ground truthing programme undertaken over 5 weeks, led by Katy Ross in October/November 2022. All sample locations were initially GPS identified by satellite but with the subsequent generosity of Ross Chaloner,

correcting GPS data, all locations were been painstakingly corrected and replicated on Weddell's topographical map.

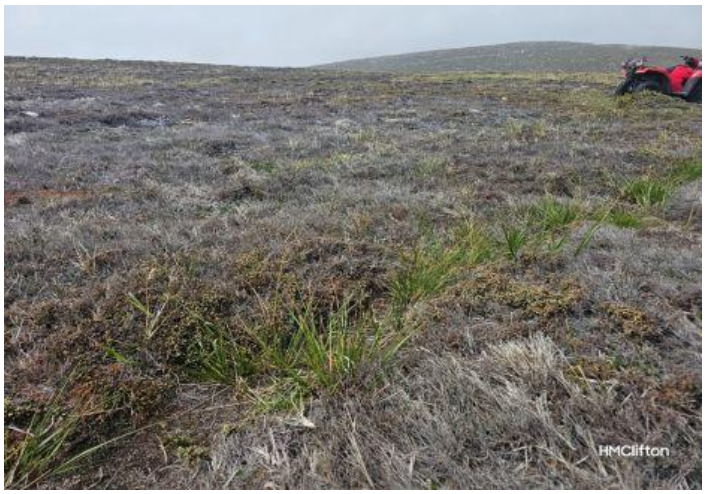
During the 5 week survey, and prompted by Dr Steffi Carter's recommendation, 20 TOMST moisture and temperature loggers were laid down across the 25,589ha from 6m to 350m above sea level and in differing vegetation types. These loggers record data every 15 minutes.

All the southern and western coastlines of Weddell are badly eroding, a consequence of tussac fringe lines having been destroyed by sheep >150 years ago due to overstocking. With assistance from the FIGovt ESB we fenced off 7km of coastline extending from Stop Cove to Wine Cove to during 2022-23. The hydraulic post driver, along the length of this route, was routinely recording 1.5m deep of dry of hard packed clay at every posthole. Good visible signs of vegetation recovery are now evidenced after 2 years of stock removal. Some trial tussac tiller planting has occurred. There is a sheep nutritional downside as animals are denied beach access to forage seaweed during winter for valuable mineral supplementation.


**Climate change pressure**

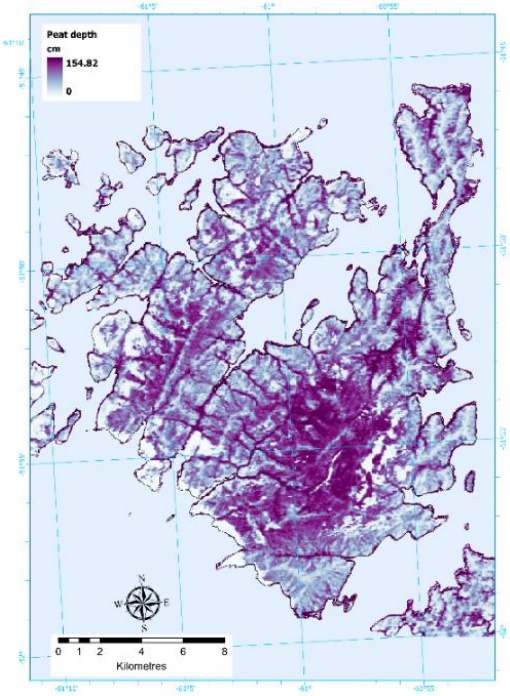
Not only has Weddell witnessed excessive drying out in recent years, the severe winter of 2024 ushered in further change on the Mt Weddell plateau ca 1000Ha ca. 350m above sea level. That is evidence by the die-back in the top left hand image, and sustained severe winter winds evidenced in the above right hand image, which shows original pitch pine posts being stripped back of centimetres of bark and lichen and left polished like abrasive paper would reveal. Tall rush die back in extensive at the expensive of increasing Christmas bush and Balsam bog.

Elsewhere there is increasing, and extending, evidence of Diddle dee dieback (see below). Interestingly, Cinnamon grass is bursting through in some diddledee die back areas.




**The peatland map and carbon stocks**

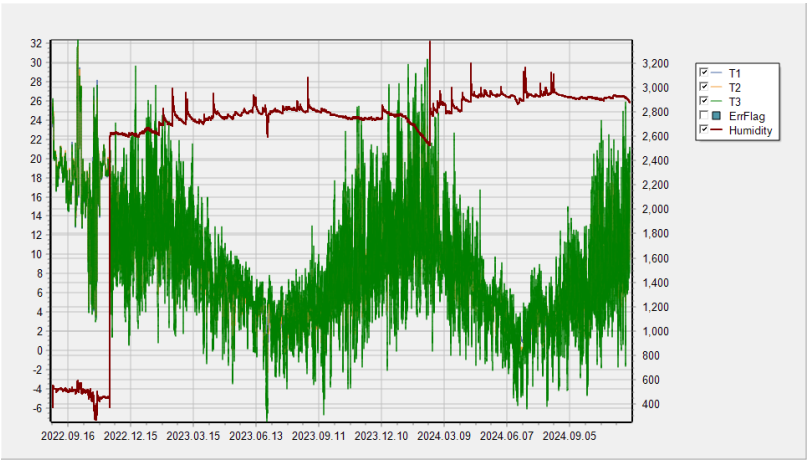
From the ground-truthing studies, laboratory peat sample analysis, the indicative overall estimate of C stored in peat on Weddell is 27.2 million tonnes (see map below), though this figure will be refined as more field data is added. This study illustrates what a potentially valuable resource the peatlands of the Falklands are. Retaining this carbon, and if possible sequestering more, should become a national and individual farm objective. The peatland survey also measured peat bulk density- a measure of how dry it is. This is important base-line information as it is believed the peat is increasingly becoming more hydrophobic (drier), and thus difficult for natural rewetting in rains. There are no man-made artificial drains or ditches on Weddell to dam and the natural streams tend to be deliver swift and intense rain run-off straight into the sea.




Peatland map of Weddell Island. From the Darwin project peat map.

**TOMST Moisture loggers**

These loggers are revealing exciting and valuable information on the extent of temperature and moisture variation across the island and on a diurnal basis. We have recorded seasonal variations in temperature from -12oC to +30oC. During summer, surfaces of eroded peatlands reveal surface temperatures up to 40oC oxidises exposed peat and release greater amounts of CO2 into the atmosphere. We are now accepting and understanding these environmental variables. Seasonal scientific research now a regular activity (refer Univ of NottinghamTrent presentation). Deep peat samples analysed confirm beginnings at the end of the last ice-age.




Soil moisture logger cluster (left) and sample moisture profile (Sept 22-Sept 24), Loop Head.

**Soil fauna.**

The importance of micro- and macro- fauna in the ecology of Falkland soils is extremely poorly understood. Entomologist Stephen Gillanders (QUB and Aberdeen Universities backed by Shackleton Scholarship) used the opportunity in November to visit the 20 TOMST logger sites on Weddell to systematically sample for soil invertebrates. This is providing another layer of data to build up the picture of what is happening in Falkland soils and the role of decomposition and insects in soil health. This will yield much valuable previously unknown information and set down a baseline benchmark for measuring climate change impacts.

**Fire Risk**

With embedded climate change and drying of vegetation comes increasing risk of wildfires across the Falklands. The 2023 lightning strike fires on Quaker and Barclay islands raised questions as to an appropriate national capacity to positively react to fire strike – particularly in the remotest areas of the Falklands. While some staff are now trained in vegetation fire fighting, there remains a void of utilising trained farmer/landowners into island-wide coordinated and integrated response from the FIGovt Fire & Rescue Services.

Fire insurance against wildfires is not available. Investigations in the re-insurance market also reveal zero appetite to offer cover for investments made in fencing, land recovery and bio-diversity regeneration. The FIGovt should seriously consider this matter, as it begins to consider the drafting of a Land Recovery Programme.

**Discussion**

Items discussed were:-

*Wild fires?* Complex and difficult to address, given the large Ha, and limited labour and island isolation. Similar to other inhabited islands. Higher risks given assistance is at long distance.

*How low can sheep numbers go*? Possibly as low as 2000 if there is no climate change reversal. We supply the abattoir with mutton and beef, but that can be complex given the existing transport network. Farming needs to remain viable.

*Tussac plug plants -how did they do*? In some area the eroding peat soil is simply too dry, too wind exposed, and too warm for anything to grow; old mature tussac bogs die. The TOMST loggers are revealing why vegetation die-off occurs.

## 1.7 HILL COVE MOUNTAINS AND DOUBLE STREAM BASIN IMPORTANT PLANT AREA (IPAS) SURVEYS

**(+ Passing Comment on The Wickham Heights)**

***Grant Munro, Falklands Conservation & John Ellerman Foundation***

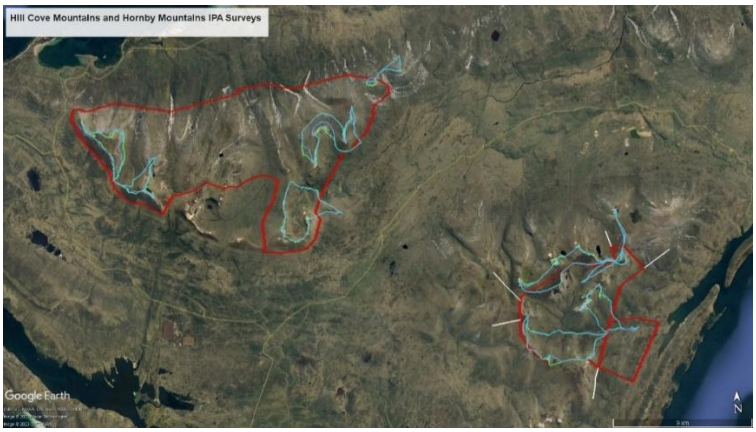
**The context of this paper**

When a Land Recovery Programme is in place, habitats will need to be benchmarked so that support and resource allocation can be prioritized. Several speakers -Marie-Paul and Paul - have mentioned the potential value of a form of land classification and this paper takes that idea a bit further.

Land areas can be prioritised for biodiversity and other ecosystem services enhancement on the basis of either their *plant species composition* or on the basis of their *habitat quality*. This paper will predominantly be concerned with the first of these parameters - botanical diversity. Habitat quality will be considered in a second paper (tomorrow).

If using an incentive or output based payment scheme, the challenge is in determining a realistic target and then what monitoring assessment to have in place to measure and confirm the target achievement for release of funds.

In the Falklands we already have some quantitative monitoring schemes in place. The Important Plant Area (IPA) programme that focuses more towards rare plants and plant diversity and the RWS focused Falkland Island Habitat Assessment that that more broadly looks at habitat quality. The IPA programme is coordinated by Plantlife International and the IUCN to provide an objective framework with quantifiable thresholds for the identification of those areas most important for plant conservation.




Hill Cove Mountains IPA showing the routes walked in the most recent survey (2024). This involved 290 km (180 miles) of survey effort; 5-Days in the Hill Cove Mtns. (774 Plant Records); 4-Days in the Hornby Mtns (746 Plant Records).

Two such IPA areas, The Hill Cove Mountains and the Hornby (Port Howard) Mountains, have relatively recently been re-surveyed by walk-over survey and re-assessed against the IPA criteria.

**Importance of the Hill Cove Mountains IPA.**

103 native plants recorded - 52% of FI native plant species.; 9 endemic plants - 64% of FI endemic plant species.; 3 IUCN globally threatened plants - 43% FI globally listed plant species.; 12 National Red List species - 28% of Falklands 43 threatened species (≥ near-threatened); 13 different habitat types two nationally threatened; Important watershed and soils

Along with the Hornby Mountains the site has the only locations of the endemic plant Falklands *Nassauvia*.

New-(ish) to science ; Endemic ; *Critically Endangered*; Discovered 2009; Described 2013
**Hill Cove Mountains**; 3 Sites, 5 Populations
Mt Donald x2 ;Mt Robinson x1; Mt Edgeworth x2
**Hornby Mountains** 2 Sites, 2 Populations ; Green Mtn. x 1; Clay Mtn. x1;

This plant is found in clay patches on the tops of the mountains. Presumably, with climate change and other pressures its range has gradually moved higher in altitude. Therefore, as these pressures increase, it literally has nowhere else to go, so as many of the pressures as possible need to be removed to at least try and secure its future as long as possible.

There are also water catchment features such as Hanging Valleys & Glacial Bowls. Some of these can be lightly grazed and are good for water retention in the uplands, allowing water to gradually filter down to the lowlands and retaining good habitat value.

There are other high value species in sites such as

1. "The Hole" – Mt. Robinson, where we find a range of smaller, rare ferns - Brittle Bladder Fern, Strap Fern, Shield Fern, Twisted Filmy Fern, Falkland Filmy Fern
2. Double Stream in the Hornby Mountains (Port Howard) where there is extensive peat and sphagnum valley bottom in the mid-section as tributaries join. Gravel flood plain and levees in the lower-section. It contains species such as Comb Fern, Coral Fern, Fachine scrub, and rarer sedges.

3. Mt. Adam – Northern Scarp. Variety of habitats around the slopes from the peak to the lower tarn gave good species diversity

However assessing sites on species diversity does have limitations or at least some problems in the context of a Falklands LRP. It is selective grazing-out that has limited the distribution of many palatable plant species and thus those areas with higher species diversity may already have lower grazing pressure. Limiting a LRP to such already higher quality areas may limit some farms access to a scheme as it is not uniformly spread across the Falklands. Furthermore, many of the Falklands plant species are cosmopolitan and the same suite of common plants may occur across a wide range of habitats and altitudes. The species overall diversity (number) may not change much or may change very slowly with changes in grazing regime. It is likely that species relative proportions in the sward / habitat or habitat quality will respond more quickly and may be a better monitoring metric.

**Grazing in Conservation areas**

There is some room for light, rotational grazing in sites such as these. For example, in the above example of Double Stream, Port Howard Farm grazes them for 3 months only in any one season (starting late December) and only every second year at most. Thus controlled rotational grazing is possible, it is set-stocking year round that can cause significant degradation as selective grazing is continually focused on specific areas or on specific preferred plant species that may be grazed out.

In the Mountain Bluegrass areas, the grass is actively targeted and pulled out creating bare patches that are then the initiation point for deflation erosion. Hoof poaching in soft winter conditions breaks the thin vegetation cover causing peel back during summer drying. The exact same is happening in the Wickham Heights with feral goats, even at very low year-round set-stocking rates, selectively grazing finer grasses. The Wickhams are more uniform but still have some hidden gems and good active hydrology inc. sphagnum. Many of our rarer plants are now limited to stone runs, cliff ledges and nooks & crannies that were previously inaccessible. Goats can thus have a disproportionate impact as these are the exact areas that they favour.

Threatened Habitats: Fachine Scrub / Acid Grassland (L) Mountain Bluegrass - Montane Acid Grassland. Species - Bluegrass / Land tussac / Fuegian fescue (R).

As a general principle, perhaps grazing set-aside could be focused on the “moderate quality areas” such as Marie-Paul and others were talking about. This will likely give the best potential for rapid improvement and thus best value for money. A scheme that invests heavily in small, severely eroded areas such as clay patches is likely to give less value in terms of conservation

output per unit of investment as any recovery will be slow and negligible over the duration of a scheme. Bench-marking and assessing the likelihood of recovery will be necessary in selecting land for set-aside. This view might not be widely held but needs aired and will likely arise in calculating the costed streams of any LRP.


An example of good species diversity and endemism in a one square metre quadrat (above) in the Hornby Mountains, we found 5 endemic species. *1*. Falkland Wooly Ragwort; 2. Snakeplant; 3. Silvery Buttercup; 4 Coastal Nassauvia; 5 Vanilla Daisy

In conclusion, there are big challenges ahead and big decisions to be made for wider benefits.

**Discussion topics**

*Goats.?* This is an area of potentially big concern. Eradication is the ideal but getting extremely difficult as they easily jump fences. Large groups have been seen on Onion range from the air. Difficult to see on the ground. There are still some on Pebble, though have had a major cull. They don't want to get rid of them all. Not so much an issue on an island as they cannot spread across boundary fence lines to adjoining farm land.

DoA are taking this matter very seriously. There is also an animal health and welfare issue.

*Grassland management on Tussac islands ?* Also discussed problems of burning. Lightning has different properties over water than land (it is more likely to have fire – creating strength) which makes Tussac islands more vulnerable to fire.

*Fire/Burning?* This was the major discussion topic. Mainland fires can go for square miles etc and can be very quick. Response times discussed. Could we get a map of likely hotspots?. What is the capacity to fight grass fires? There is an increasing amount of equipment being made available for fire fighting in the camp. DoA are coordinating training in its use.

The Onion Range fire could not be stopped because the exercise had to continue and no access was allowed. Needs more coordination on the ground and at higher level. MOD have equipment and are making a better effort to get it made available.. Who will pay for fire – fighting and who will authorise its use?

*Could the weather forecast highlight lightening likelihood and hence risk of fire?.* As is done for the Wind Chill Factor for newly shorn sheep.

*Retaining soil moisture?* Problem is the nature of rainfall.

*Benchmarking of habitats and prioritisation of restoration effort?* Important when considering big landscape restoration programmes. In Wales used up huge amounts of the available money on the worst land. Less effective. Only 2% of the land in the Falklands is under direct protection. We need schemes which are broad and wide. Most farmers must be able to reap the benefit of a scheme.

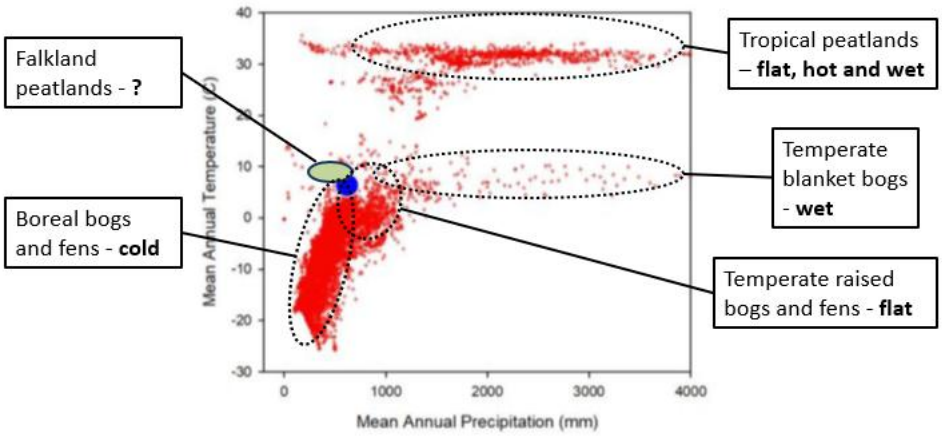
**SESSION 2** # CARBON FLUX DATA

## 2.1

## FALKLAND PEATLANDS AND CARBON – INTRODUCTION

*Chris Evans, UK Centre for Ecology and Hydrology*

### Falklands Peatlands in a global context




These are the climate conditions under which peat forms (adapted from Payne et al, 2019). The Falklands are somewhat unusual in that they are at the drier end of the rainfall spectrum, but milder than most other places where peat has formed under dry conditions, such as the Norther boreal zone, where cold conditions limit plant decomposition. Peat may also have formed in the Falklands because:

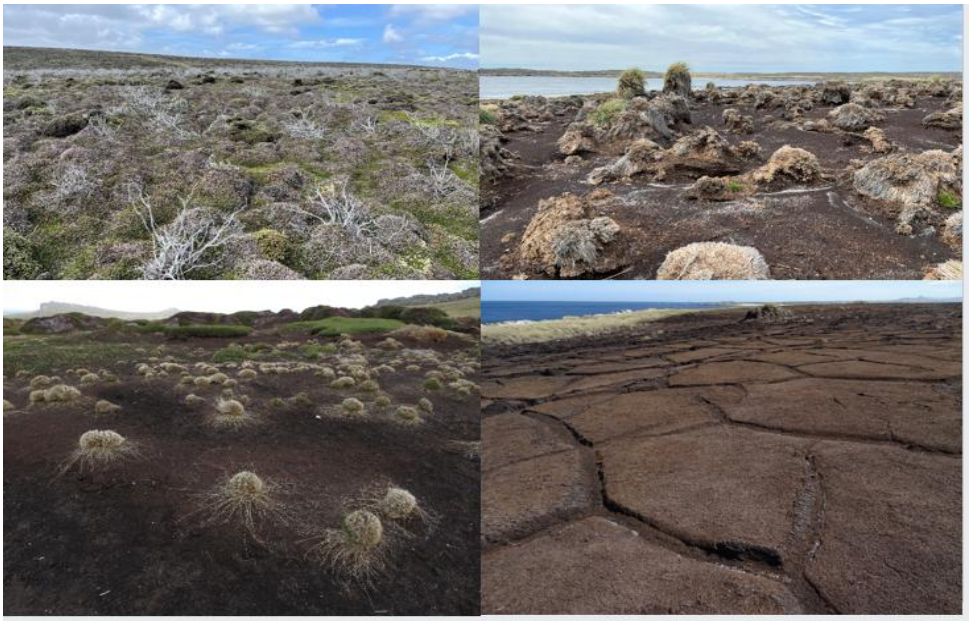
1. They formed prior to the introduction of large grazing animals in the 1760s
2. They have exceptionally high water retention capacity horizontal movement of water through the peat appears to be close to zero
3. The windy climate means that many plants, like Whitegrass, produce a lot of dead matter which is not very biodegradable and adds to the accumulation of dead vegetation
4. High levels of marine nutrients contribute to the high productivity of coastal tussac ecosystems, which can build up deep peat reserves

### Why is a lot of the peat degraded?

A lot of the peat may be like the examples below because:

1. Climate change is shifting conditions towards a drier, windier climate which is causing peat drying and erosion
2. Increased fire frequency and severity (more lightning) is damaging established peat forming ecosystems (but see Sally Poncet's talk)

3. Grazing has modified the vegetation away from peat-forming species, exposed bare peat to drying and erosion, and reduced the resilience of ecosystems to fires.



*Desiccation cracking in a pond*

*Minimal infiltration to surface*

*Desiccation cracking in peat*

It is likely that the combination of grazing impacts and recent climatic shifts towards more frequent and severe droughts have combined to cause widespread peat desiccation, with impacts including vertical cracking (similar to a dried-out lake bed), hydrophobicity, and reduced infiltration rates. As a result, when it does rain the water may either pond at the peat surface or fall through cracks to the surface of the mineral soil, and then to the stream network, without soaking into the peat. This makes it difficult for the peat to recover from dry

periods, and may have contributed to long-term vegetation changes and reductions in the carry capacity of the land for sheep.

**Gaseous Emissions**

The first assessment of Falkland peat emissions were in 2020 (Evans et al 2020). Given the limited amount of empirical evidence available at the time, the estimates published were almost entirely based on data from peatlands in the UK and Patagonia which are unlikely to be reliable analogues for the distinctive peatlands of the Falklands. Although acknowledged to be largely inaccurate, this report helped to highlighted the scale and importance of Falkland peatlands, as well as the risks of peat loss and potential benefits of restoration and land-management changes to protect and enhance their large carbon stores. The work also helped to stimulate the first collection of greenhouse gas flux measurements for the Falklands.

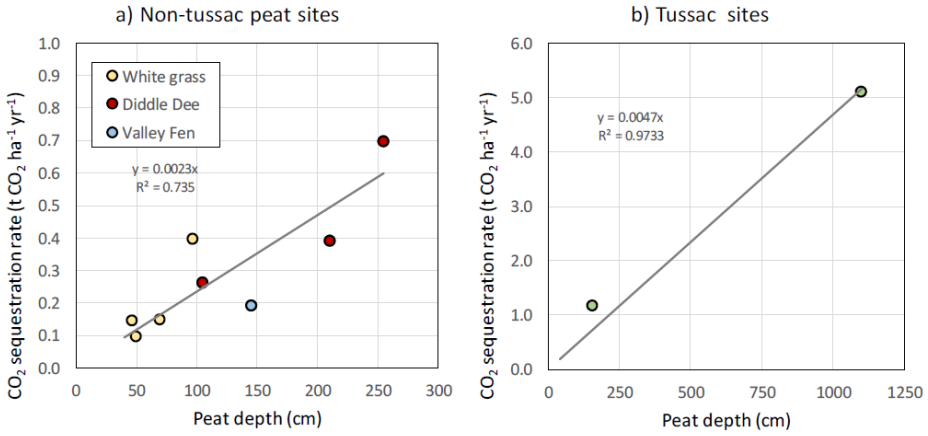
Natural CO2 sequestration rates

*Table 1. Vegetation type, depth, long-term carbon accumulation and $CO_2$ sequestration rates for a set of peat cores described by Payne et al. (2019).*

| Location | Vegetation type | Peat depth (cm) | C accumulation (t C $ha^{-1}$ $yr^{-1}$) | $CO_2$ sequestration (t $CO_2$ $ha^{-1}$ $yr^{-1}$) |
|---|---|---|---|---|
| Swan Inlet | Short grass | 145 | 0.052 | 0.19 |
| Mount Usborne | Whitegrass | 70 | 0.041 | 0.15 |
| North Arm | Whitegrass | 47 | 0.040 | 0.15 |
| Hope Cottage | Whitegrass | 50 | 0.027 | 0.10 |
| Orqueta | Whitegrass | 97 | 0.108 | 0.40 |
| Moody Brook | Diddle dee | 105 | 0.071 | 0.26 |
| Whalebone Cove | Diddle dee | 255 | 0.190 | 0.70 |
| Sussex Mountains | Diddle dee | 210 | 0.107 | 0.39 |
| Cape Dolphin | Tussac | 156 | 0.322 | 1.18 |
| Beauchêne Island | Tussac | 1100 | 1.390 | 5.10 |

Very slow indeed

Highest peat C accumulation rate recorded anywhere



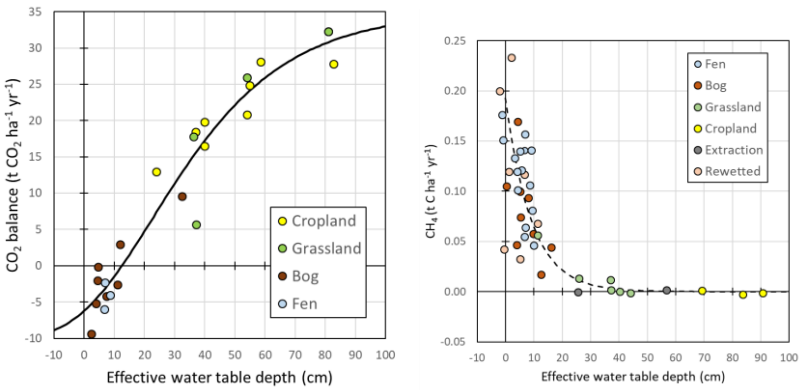

As expected, peat accumulation and $CO_2$ sequestration rates are higher at deeper peat sites.

First -pass total emissions estimates are presented below.

| Habitat class | Area | | $CO_2$ balance | GHG balance |
|---|---|---|---|---|
| | % | ha | t $CO_2$ $yr^{-1}$ | t $CO_2e$ $yr^{-1}$ |
| Near-natural bog | 9% | 49,727 | -156,143 | |
| Astelia bog | 5% | 27,626 | -112,530 | |
| Tussac bog | 1% | 4,169 | -15,162 | |
| Grazed whitegrass bog | 45% | 248,635 | 89,509 | |
| Diddle-dee dominated bog | 33% | 182,332 | 65,640 | |
| Domestic peat-cut bog | 1% | 5,525 | 34,367 | |
| Actively eroding bog | 5% | 27,626 | 332,618 | |
| Improved grassland on peat | 1% | 5,525 | 77,519 | |
| *Total* | | *551,166* | *315,817* | |

These emissions estimates are undoubtedly wrong, and probably too high. However, even if the true emission is 10x lower it would still be larger than the annual reported emissions of the Falklands (21,740 t $CO_2$ in 2021).

**The importance of water**




Typical relationships between water and peat are shown above, If the water table is maintained near the surface, provided there is vegetation cover (i.e. no bare ground) the peatland will be acting as a carbon sink, removing $CO_2$ from the atmosphere and storing it as peat. If peat dries out, this carbon store can rapidly oxidise back to $CO_2$ and be emitted back to the atmosphere. Methane emissions can occur when water tables are high, but do not cancel out the long-term climate cooling effects of $CO_2$ sequestration by wet peat. The basic message is that peat needs to be kept wet to function properly, particularly if it is to remain an stable carbon sink.

Data for more recent fieldwork will be presented in the next 2 papers (Katy Ross and Valeria Mazzola).

**References**

Evans, C. et al (2020). A scoping study for potential community-based carbon offsetting schemes in the Falkland Islands. Report to Falklands Conservation, Stanley.

Evans, C. et al. (2021). Overriding water table control on managed peatland greenhouse gas emissions. Nature, 593, 548-552.

Payne R J et al (2019) Peatland initiation and carbon accumulation in the Falkland Islands Quaternary Science Reviews. Volume 212, 15 May 2019, pp 213-218

## 2.2

# THE INFLUENCE OF CAMP CONDITIONS ON EMISSIONS

*Katy Ross, UKCEH (UK Centre for Ecology and Hydrology)*

### Background

Since 2021 I have been carrying out a PhD that aims to understand what the carbon balance is of Falkland Island Peatlands are. I have now finished field work and am pulling together the field data for my PhD. In this presentation I will go over some of the emissions findings and what this might mean for the Falklands with a particular focus on how this relates to grazing and the condition of the peatlands. Very little is currently known about the emissions from Falkland peatlands with our current estimates based on UK or other South American emissions. Any quantitative data will be valuable in underpinning the science behind funded targets for a potential Land Recovery Programme and the data from this project will help support this.

### What are we measuring?

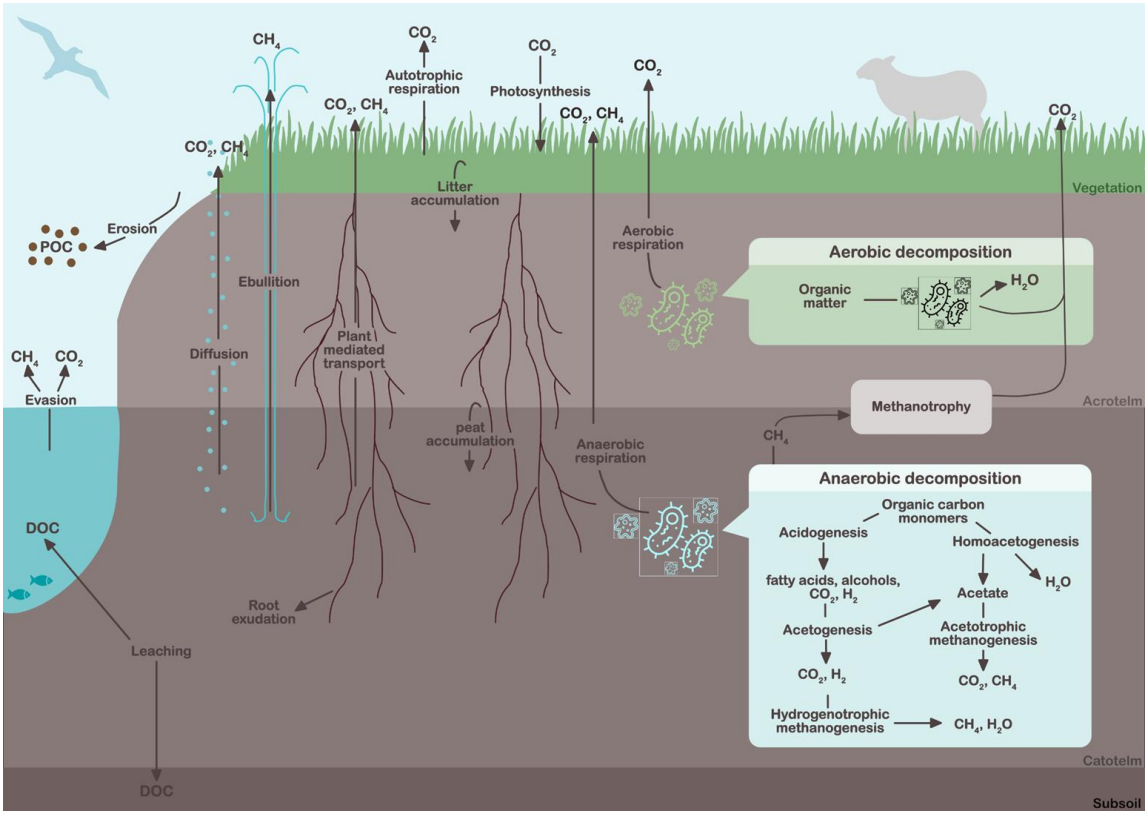



*Fig 1. The movement of carbon in natural systems*

When trying to measure the carbon balance of a peatland we need to account for a couple of processes. We need to measure the (2-way) movement of carbon as a gas (predominantly $CO_2$, carbon dioxide but also $CH_4$,methane) between the atmosphere and the soil/plant interface. There are lots of other pathways that carbon can move around the system and by working out how much is entering or leaving we can get the overall balance (see Fig 1 above). The balance of gasses can be measured in the field using an Infra-Red Gas Analyser (Fig 2a)

The field work for this project uses some of the baseline measurement points from Steffi Carter on Wireless Ridge which is set up to compare different vegetation types under the same grazing regime. This has since been extended to include paired sites across fence lines where each side is grazed differently to see if there are changes in the resulting emissions (below).

*Fig 2. A field Infra Red Gas Analyser.*

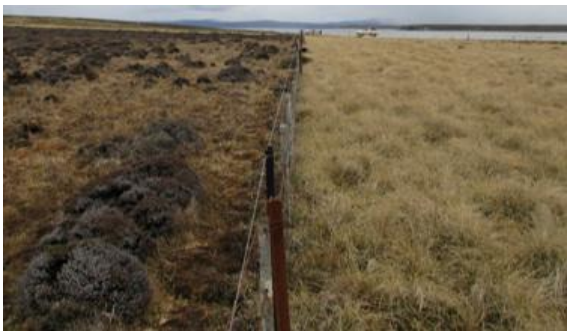


*Fig 3. Fence line measurement site.*

The field work for this project carries on from initial work by Steffi Carter on Wireless Ridge on fence line changes (Fig 3 above).

a b c d

Fig 4. *In the pairs of fence-line pictures above a and b are both grazed in the same way and c and d are not currently grazed but have a history of different land use up to this point.*

**Measurements taken**

Measurements were taken between 2022 and2023 as part of a year-round measurement programme. Permanent sites were set up by installing collars (solid rings pressed into the ground to capture emissions from a small area of ground on a repeatable basis) on a range of

sites encompassing different grazing strategies and history to look for patterns in the seasonal changes in emissions.

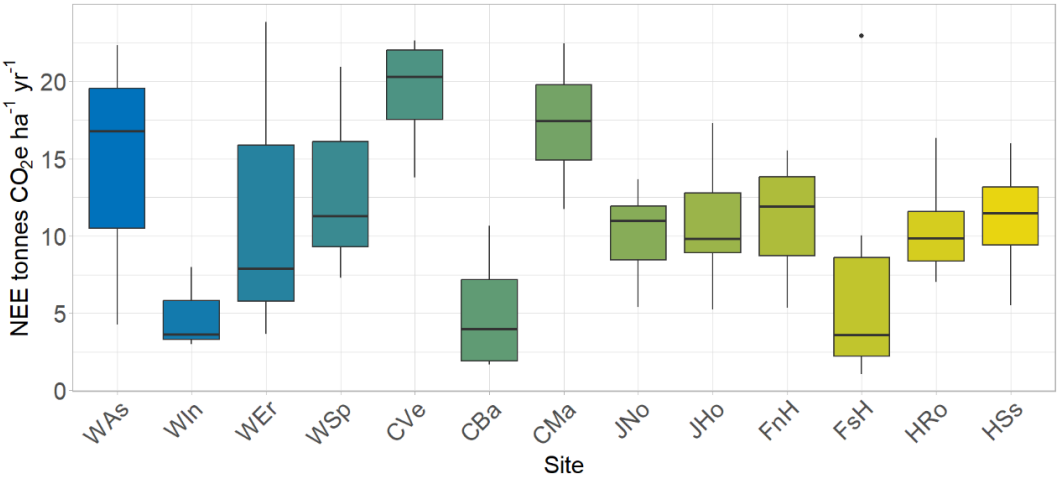



*Fig 5. Net Greenhouse Gas emissions from 13 sites in the Falklands ( W= Wireless Ridge; C = Cape Pembroke; etc* )

Note all sites are net emitters, i.e. not in a healthy peatland condition where there is the potential for peat formation. There is also a large variation both within and between sites. Solid coloured bars represent the range of data from a series of observations at each site, the horizontal bar is the median value. No clear picture emerges from these data. For example, WEr (Wireless Ridge 53 Eroded) has higher emissions than WR intact (Win) yet Cape Pembroke Bare (CBa) has much lower emissions than Cape Pembroke vegetated (CVe). However, the bare site may be completely spent and have no organic matter left which can be broken down into $CO_2$ to later emit. The last 3 pairs of values are all fence-line pairs which look very different in reality, yet are emitting fairly similar emissions. To try and explain the variation I had a look at grouping the data by vegetation type rather than site (below). Once again it was hard to see any pattern emerging - most of the yellow and blue bars were reasonably similar though surprisingly the bare ground samples showed lower levels of emission than any vegetated areas.

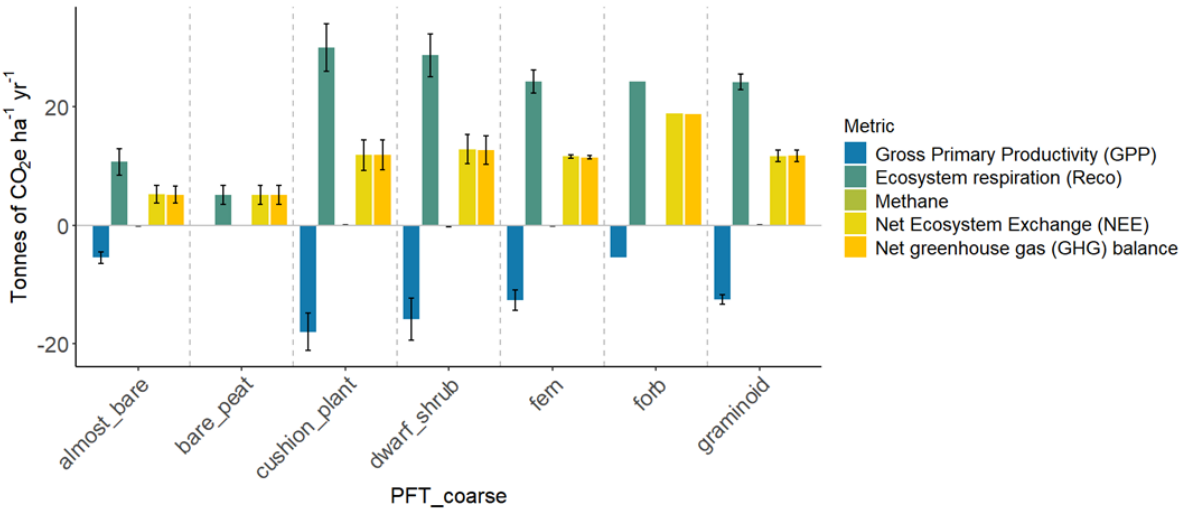



*Fig 6. Emissions data aggregated for 7 vegetation classes*

**Habitat Quality and emissions**

In an attempt to capture the impacts of a history of management at these sites I decided to try and incorporate a condition assessment of the site instead. This was guided by publications on wider rangeland health and in the end we had a go at applying the Habitat Assessments in Falklands Conservation's "New Falkland Island Habitat Assessment" to see how these fitted in with the emissions data measured. This assessment uses a quality assessment (based on scoring key criteria) from habitat conditions Very Good to Very Poor. Unfortunately none of the sites sampled would have scored in the Very Good class or even good class, (the project was aimed more at assessing the emissions from management-modified vegetation) and the sites could only be grouped into Moderate, Poor, and Very Poor. Here we started to get some correlation between habitat description and carbon balance. The sites classed as Moderate habitats had higher levels of primary productivity (Fig 6 Top -ie removal of carbon from the atmosphere) than those classed as Poor. In terms of emissions (ecosystem respiration from soil and plants- Fig 6 Bottom) there was no significant difference between the Moderate and Poor sites (below The overall net effect was getting closer to what we might expect in terms of emissions profiles (Fig 7).

*Fig 7. An example of sites in the three different conditions from good to poor (left to right)*

When the balance between respiration and sequestration is presented, the Moderate sites are emitting less than Poor condition sites and the Very poor class is doing very little in terms of emission and sequestration.

**The effect of water table depth.**

Looking at publications on wider rangeland health it was decided to test the scale of Habitat Assessments in Falklands Conservation's "New Falkland Island Habitat Assessment" (FC Condition Category -Fig 8 below) to see how these fitted in with the emissions data measured. This assessment uses a quality assessment (based on scoring key criteria) from habitat conditions *Very Good* to *Very Poor (see Grant Munro's paper 5.2)*

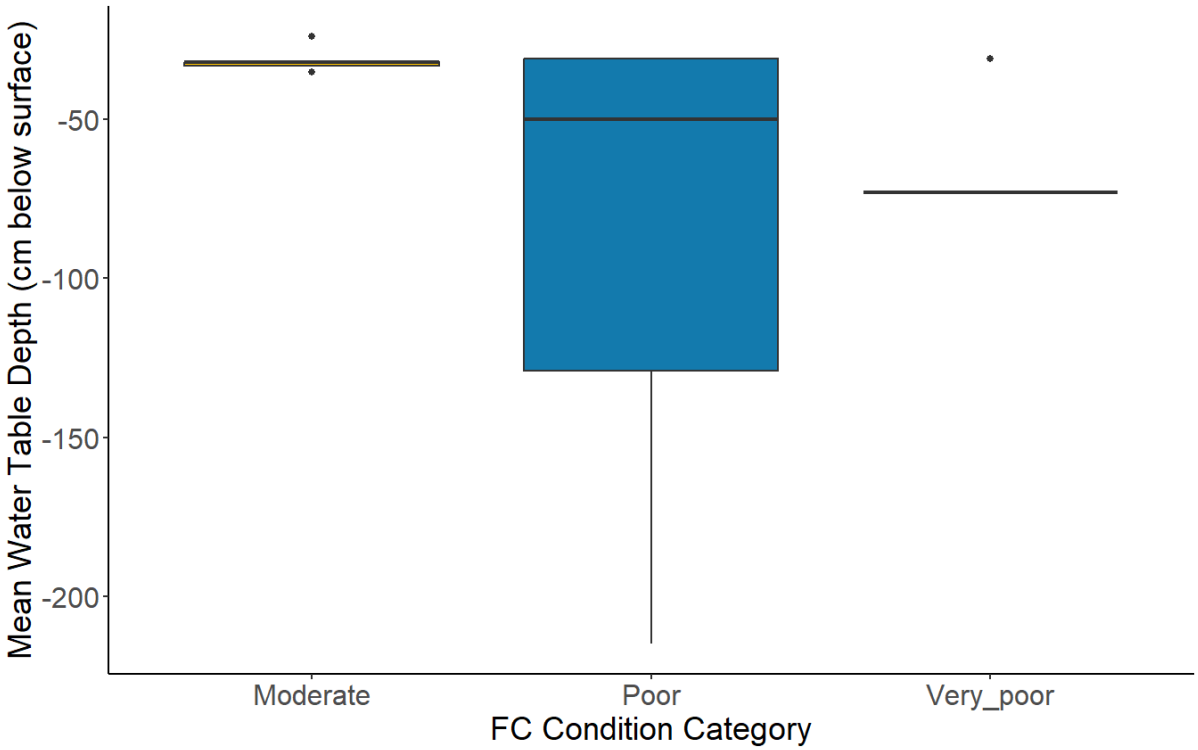



*Fig 8 Mean water table depth below 3 habitat condition types.*

Here the Poor sites had the deepest water table but there was probably too little variation across sites to pick up meaningful trends.

**Summary and conclusions**

These are the first year-round emissions profiles from a range of Falklands peatland habitats to be measured and give us the first indication of what the carbon balance may be from these systems. From this is looks like a change in grazing system alone can't alter the peatland carbon balance but when we take into account the condition of the site, which a history of grazing has shaped we can begin to see patterns whereby land in better condition has lower emissions. This supports the notion that other people have discussed that aiming to improve habitat condition and retaining as much moisture in the peatland as possible are justifiable targets in a land Improvement Programme where carbon emissions reduction and eventual sequestration are worthwhile goals to support. There is also an indication that very poor

habitats may not be emitting much $CO_2$ however they are likely huge sources of particulate carbon loss as they are actively eroding.

**2.3**

## FALKLAND FLUX TOWERS: KEY RESULTS (1 YEAR) 0N SOIL CARBON AND WATER DYNAMICS

*Valeria Mazzola, SAERI*

During the Land Recovery Workshop on February 6th-7th, Dr. Valeria Mazzola (Peatland GHG flux scientist from SAERI) presented the first preliminary data on greenhouse gas (GHG) dynamics in the Falkland Islands, gathered from four eddy covariance towers across the region. She began by highlighting the importance of these towers as a key tool for measuring and understanding large-scale carbon balance. Dr. Mazzola then explained their functionality and the specific parameters they measure. Finally, she shared the initial findings from a year's worth of data (processed and analysed together with Ross Morrison and Chris Evans from CEH), offering insights into water balance and carbon dynamics across the four monitored locations in the Falklands.

### GHG Measurements: From Chambers to Towers – Similarities and Key Differences

Flux chambers and flux towers are both essential tools for measuring greenhouse gas (GHG) fluxes, such as carbon dioxide ($CO_2$), methane ($CH_4$), and nitrous oxide ($N_2O$), but they operate at different scales and offer complementary insights. Flux chambers are small, enclosed devices placed directly on soil or vegetation to measure gas emissions or absorption over short periods, usually minutes. They are ideal for detailed, site-specific studies, such as comparing emissions from grazed and ungrazed areas, assessing soil respiration, or evaluating the impact of land management practices like grazing intensity. However, because they cover only small areas and may disturb the natural environment when placed, they do not always reflect larger ecosystem dynamics. In contrast, eddy covariance towers (fig. 1) monitor GHG exchange over much larger areas—often spanning several hectares—and provide continuous data, capturing long-term trends and seasonal variations. This makes them particularly valuable for understanding how ecosystems respond to environmental changes, such as shifts in weather patterns or land use. Since they analyse natural airflows, they also offer a non-invasive way to track gas fluxes without disturbing the environment. Despite their advantages, flux towers come with challenges. They are costly to install and maintain, requiring specialized equipment and expertise (quite challenging in a place like Falklands, especially for towers that are on some of the islands!). Additionally, their data processing can also be complex and long, as vast amounts of information need to be analysed and interpreted. However, when combined with flux chambers, they provide a comprehensive picture of carbon dynamics—offering both fine-scale, process-level insights and broader ecosystem patterns. This is why we utilize both methods at our sites.

### What do towers measure and how they do it?

Wind doesn't move in a straight line over the land; instead, it forms swirling gusts, known as "eddies", that transport heat, water, and gases like carbon dioxide ($CO_2$) and methane ($CH_4$)

between the surface and the atmosphere (fig. 2). Some eddies carry $CO_2$ upward, while others bring it down, and flux towers 'catch' these movements to measure how much carbon is being absorbed or released by the ecosystem. By analysing these turbulent airflows 20 times per second, flux towers provide continuous data on carbon fluxes, revealing whether an ecosystem is acting as a carbon source (releasing $CO_2$) or a sink (absorbing $CO_2$). In addition to tracking $CO_2$ exchange from plant photosynthesis and soil respiration, we also measure methane fluxes—especially relevant in wet peat soils, though emissions in the Falklands may be lower than in boreal peatlands, being the peat drier. Water dynamics, including rainfall and soil moisture, are also monitored, as they influence carbon fluxes and help us understand how different vegetation types affect soil water retention. Healthy vegetation plays a crucial role in both carbon sequestration and water regulation. When vegetation is thriving, it actively absorbs $CO_2$ through photosynthesis, contributing to a stronger carbon sink. At the same time, it enhances soil structure and increases water infiltration, allowing moisture to penetrate deeper layers rather than running off the surface. This helps maintain soil moisture levels, which in turn supports further plant growth and microbial activity—key components of carbon cycling. In contrast, degraded vegetation results in less carbon uptake and poorer water retention, leading to increased runoff, drier soils, reduced ability to support plant life and eventually erosion.

**Locations and habitats of the study**

The four towers deployed in February 2024 aim to better understand the greenhouse gas emissions of the Falkland Islands' peatland habitats – namely those of tussac and white grass. In detail:

- Tussac Plantation – Active Restoration **(A)**
  This 10-hectare area of tussac grass was planted between five and ten years ago and has shown remarkable regeneration. The central section now forms a nearly continuous sward of tussac, though some patches of bare peat remain (fig. 3 - left).
- Tussac Plantation – Passive Restoration **(B)**
  Previously grazed by approximately 400 sheep until 2000, this site saw the removal of grazers in 2017. Unlike the actively restored area, no tussac has been planted here. The land was once severely degraded, but since the cessation of grazing, it has begun to recover, slowly transforming into a healthier, regenerating stand (fig. 3 - right).
- White Grass Stand **(C)**
  This area is predominantly covered by white grass habitat and is grazed seasonally by sheep—twice a year, from late October to December and again from February to April. While sheep are the primary grazers, cattle may occasionally be present, though infrequently (fig. 4 - left).
- Diddledee-Dominated Stand **(D)**
  This site consists of fragmented vegetation, now largely dominated by diddledee, with only a sparse presence of white grass. A significant portion of the area remains as bare peat. The land is managed using a set-stock grazing approach, with 40 sheep regularly present all year round and occasional cattle grazing as well (fig. 4 - right).

**Key results after one year of data collection**

Water dynamics

Water dynamics and soil water availability are shown in Figure 5. The blue column represents the cumulative precipitation (rainfall) over one year. Evapotranspiration (ET, grey column) indicates the water lost to the atmosphere through both soil evaporation and plant transpiration. The orange column (P-ET) represents "precipitation minus evapotranspiration," a key hydrological metric used to assess a system's water balance. A positive P-ET indicates excess water available for runoff, groundwater recharge, or storage, while a negative P-ET suggests a water deficit, which is typical in dry regions or during droughts.

Encouragingly, in our study, all four habitats exhibited a positive P-ET, meaning the systems never experienced water deficiency over the past year. This suggests that vegetation and soil microbes were able to grow and function without distress. Evapotranspiration was lower in the tussac sites due to less dense vegetation and the presence of bare peat, which contributes only minimal soil evaporation. In contrast, despite also having areas of bare peat, the diddledee–dominated site exhibited high evapotranspiration. This is likely because diddledee, being a shrub, is known for rapidly extracting water from the soil, leading to drier conditions.

Carbon dynamics:

Carbon dynamics are shown in figure 6. This graph provides insight into how different types of vegetation influence carbon dynamics in the environment. It presents three key measurements: Gross Primary Production (GPP, yellow bars), which represents the total carbon taken in by plants through photosynthesis; Ecosystem Respiration (Reco, orange bars), which reflects the carbon released back into the atmosphere by plants and soil organisms respiration; and Net Ecosystem Exchange (NEE, green bars), which indicates the overall balance between carbon uptake and release. A negative NEE value means that the ecosystem is acting as a carbon sink, absorbing more $CO_2$ than it emits, while a positive NEE indicates a carbon source, where emissions exceed absorption. The results show that the white grass–dominated habitat is the strongest carbon sink, followed by the diddledee-dominated habitat. These ecosystems absorb more $CO_2$ than they release, likely due to high plant productivity and denser vegetation (no significant bare peat exposed), which helps retain soil moisture and reduces $CO_2$ emissions by limiting peat oxidation. However, diddledee may not be an ideal long-term cover, as it is prone to dieback and has a tendency to dry out the surrounding environment, which could negatively impact soil moisture retention and overall ecosystem stability. The two different Tussac habitats exhibit differing carbon dynamics. The passively restored site acts as a carbon source, releasing more $CO_2$ than it captures, whereas the actively restored site is nearly carbon neutral. This difference is likely due to the lower vegetation density in the passively restored site, which limits its ability to capture carbon through photosynthesis (as we can see in its lower GPP values). As a result, its capacity to function as a carbon sink is significantly reduced compared to the actively restored site.

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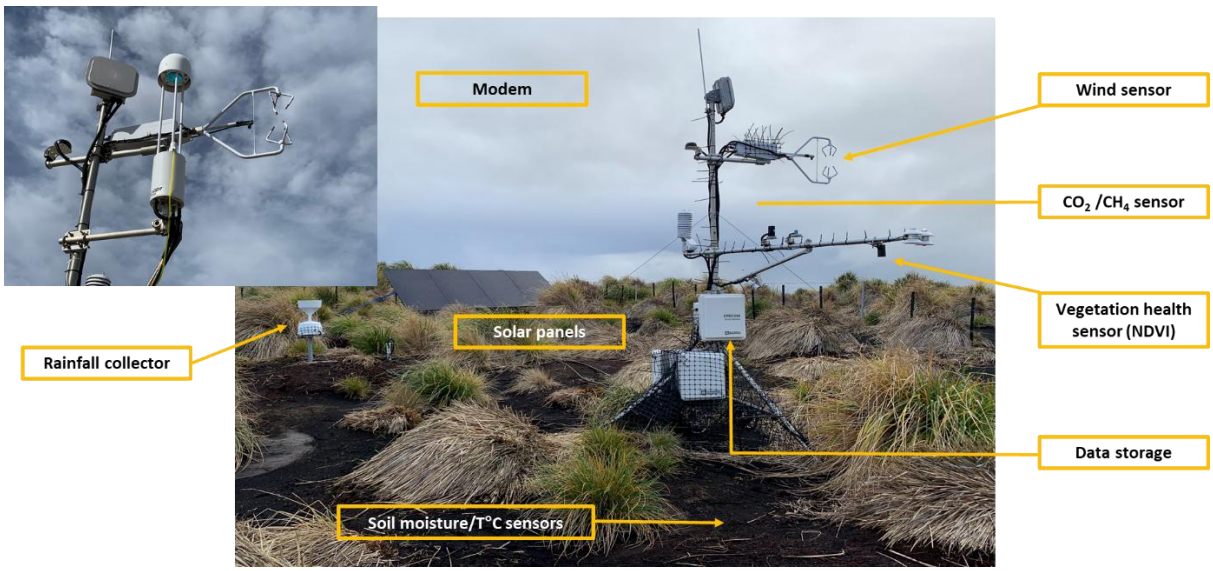
The results highlight the crucial role of vegetation cover in regulating both water and carbon dynamics. Densely vegetated habitats, such as white grass–dominated areas, demonstrate a strong capacity to retain soil moisture, reduce evapotranspiration, and act as effective carbon

sinks. This suggests that maintaining a healthy and active plant cover is essential for enhancing ecosystem stability and mitigating carbon losses.

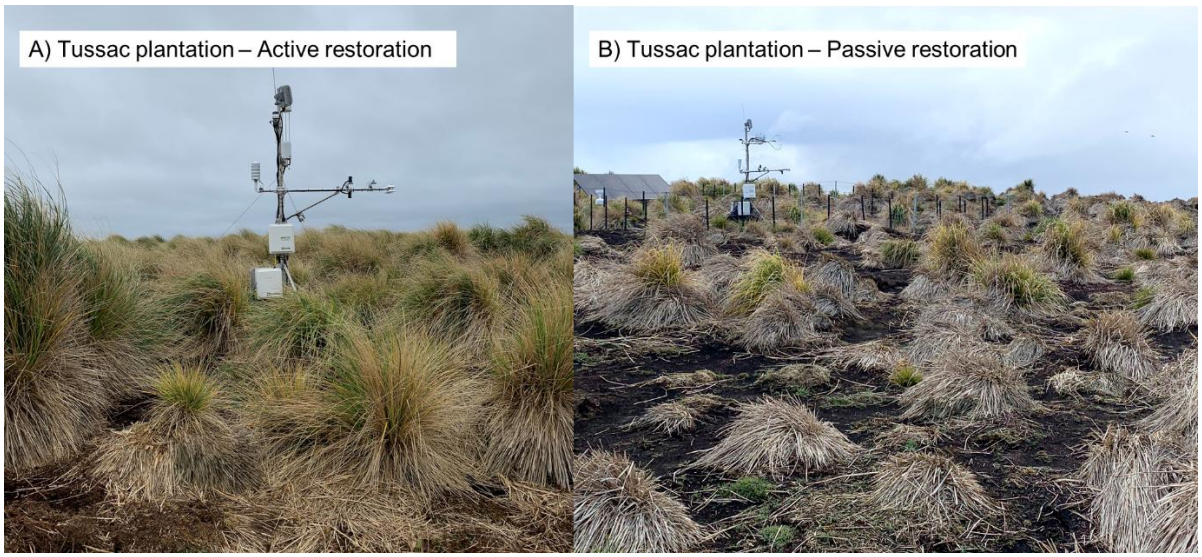
The differences observed between the actively and passively restored Tussac sites emphasize the challenges of ecosystem recovery. When vegetation cover is sparse, as seen in the passive restoration site, carbon sequestration potential is significantly reduced due to lower photosynthetic activity (GPP), leading to a weaker carbon sink or even a net carbon source. This underlines the importance of active management strategies to promote plant growth and improve carbon storage capacity.

Given these dynamics, long-term monitoring is essential to track changes in ecosystem function over time. Continuous observations over the next months will help to better assess the effectiveness of restoration efforts, understand how different vegetation types respond to environmental changes, and ensure that management strategies support both carbon sequestration and water retention goals.



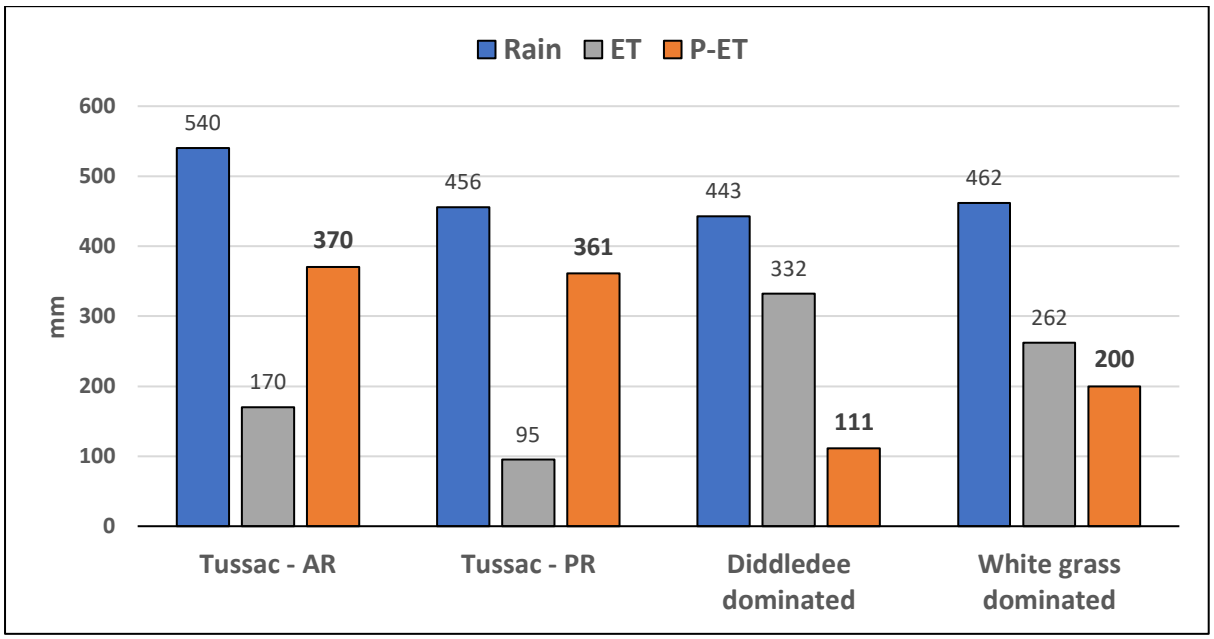

*1- Eddy covariance tower and its components*


*2 - Eddy covariance theory*

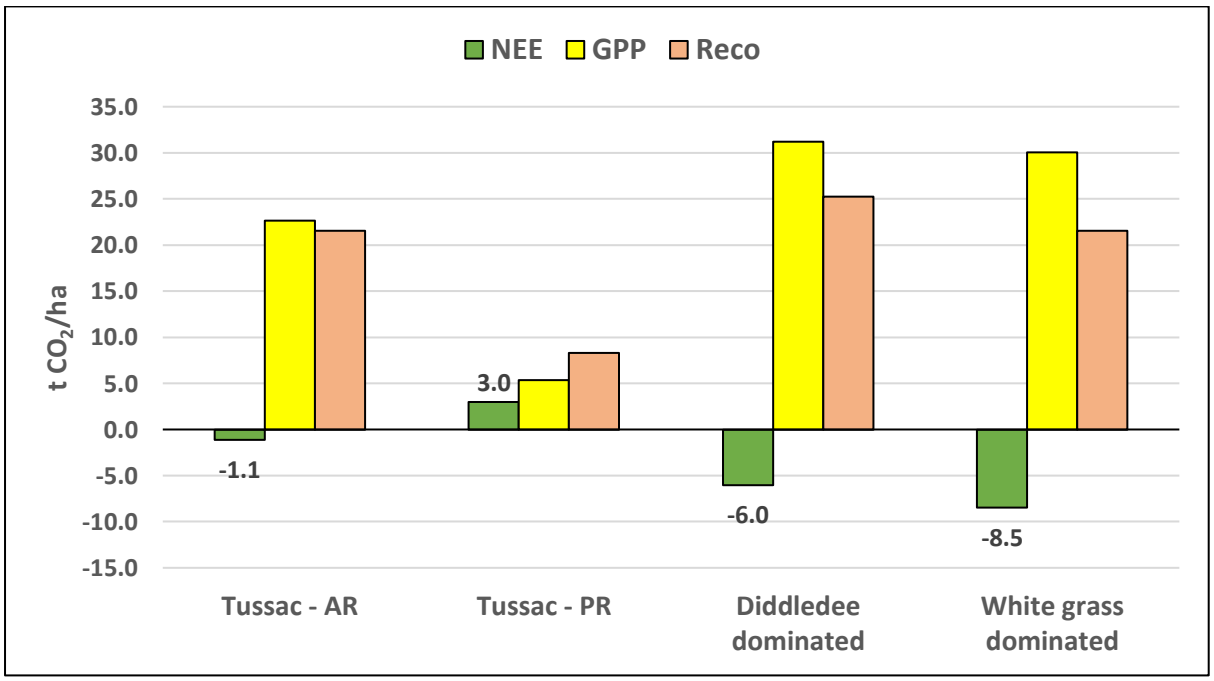



*3- Tussac habitats of our study*


*4- White grass stand and Diddledee dominated site separated by a fence*




*5 - Annual water balance in the different sites. The blue column represents the cumulative precipitation (rainfall) over one year. Evapotranspiration (ET, grey column) indicates the water lost to the atmosphere through both soil evaporation and plant transpiration. The orange column (P-ET) represents "precipitation minus evapotranspiration*




*6- Annual carbon balance in the different sites. Gross Primary Production (GPP, yellow bars), which represents the total carbon taken in by plants through photosynthesis; Ecosystem Respiration (Reco, orange bars), which reflects the carbon released back into the atmosphere by plants and soil organisms respiration; and Net Ecosystem Exchange (NEE, green bars), which indicates the overall balance between carbon uptake and release. A negative NEE value means that the ecosystem is acting as a carbon sink, absorbing more $CO_2$ than it emits, while a positive NEE indicates a carbon source, where emissions exceed absorption.*

## 2.4 Discussion topics (Session 2)-Chris Evans, Katy Ross, Valeria Mazzola

*What are the Towers measuring?* Answer focused more on NDVI, how relevant it was at this scale, how it can be used to ground truth satellite data

*Flux towers -cost ?* c £150k but depends on what you want to measure. Methane sensors are very expensive and as it turns out we wont actually need them in the Falklands. For example just to measure only water and CO2 would cost less than a third of that. The actual cost of the instrument itself is not the only issue. Setting it up, maintaining, downloading data, access travel all need to be factored in.

*Can we get equivalent data from the chambers and could we use the 4 towers to calibrate the chambers?* Probably- and to a limited extent- but we would need to do a few comparison trials. It would be much cheaper and we could increase our replication on a wider range of land types.

*Do you think Diddle dee areas were once Whitegrass?* Whitegrass sites have a higher water table than Diddle dee sites – is this a cause or effect? Good historical evidence from Springpoint that this was once the case. There are big changes in most peoples livingmemory. Eg near Port Howard, stock hasn't changed much over thev years but they are drying out and Diddl dee is taking over. And some will be presented from old GTU trials (sound Rotation Scheme)-see later 4.1. Diddle dee doesn't seem to be contributing to peatland formation (pollen records) Whitegrass does. It is worrying that Diddle dee is becoming more dominant and we are seeing more climate-related problems with it - dieback etc. Whitegrass seems more resilient.

*How much does Organic Matter content in the soil influence emissions (particular reference to very poor sites eg bare clay)?* In very very poor sites, where soil C content is very low, soils are "exhausted" and emissions will be low. More so in a dry than a wet year. If there is some vegetation on the site there will be some potential for C storage – and emissions.

*What is the effect of grazing type/system on emissions?* We should try and do an overall habitat assessment first – biological condition, sward height, moisture level to qualify each emissions measurement we have

*Effect of wind -Cape Pembroke?*. Has blown away over the past 60 years. Lewis remembers clouds of black dust every year.

*Are the emissions data unexpected?* Yes, very interesting that Whitegrass areas are the best targets for storing carbon. Better than the 2 Tussac sites. We need to emphasise that these findings are provisional- they are only for 1 year, ideally we would like at least 3 years data for a site. The low Tussac values may because there is a lot of bare ground. There10 months of low rainfall, ground temperatures got up to 35 dec C. Nothing could grow in that. BAS did a core sample at Weddell, the peat was so dry right down the profile.

*Where to sample?* Can we use more collars? Need to consider the variation in vegetation.. Diddle dee has a drying out effect.

SESSION 3

# EROSION AND LAND RECOVERY

## 3.1 TUSSAC RESTORATION, EROSION AND PEATLAND CONSERVATION

*Nicholas Midgley[1], Saskia Goeckeritz[1] and Lewis Clifton[2]*

1: Nottingham Trent University, UK. 2: Byron Marine, Falkland Islands.

**Introduction**

The northern terminus of the Loop Ridge peninsula on Weddell Island (figure 1) includes extensive tussac (*Poa flabellata*) vegetation that has experienced significant recent degradation around the coastline between Swan Point in the east and Loop Head to the west (figure 2). However, recent efforts to reverse this decline of tussac and associated erosion of peat include fencing to exclude sheep from degraded tussac areas. The results presented here are work in progress regarding the assessment of peat erosion in the area and tussac restoration.


Figure 1 Location of the Loop Ridge peninsula on Weddell Island (imagery acquired 28/12/2024 © 2025 Planet Labs PBC).

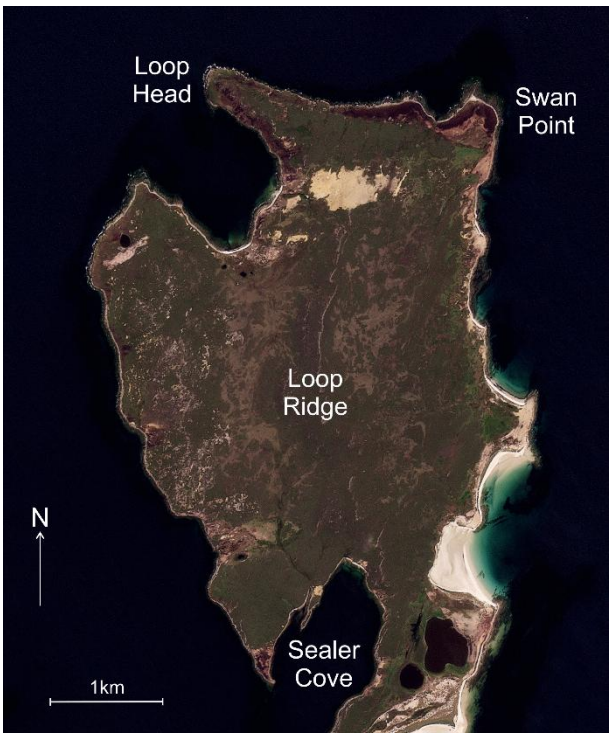



Figure 2 Location of Loop Head and Swan Point at the end of the Loop Ridge peninsula, Weddell Island (imagery acquired 28/12/2024 © 2025 Planet Labs PBC).

**Methods**

This research has involved the measurement of peat depth using a 31 m systematic grid with nearly 1000 survey points between Loop Head and Swan Point. On this 31 m systematic grid, either dominant vegetation or character of exposed substrate was also assessed. Three archive aerial images, part of a Falklands-wide aerial survey campaign in 1956, have been processed using Structure-from-Motion photogrammetry software (Agisoft Metashape). Contemporary (April 2024) ultra-high resolution drone-derived aerial imagery were also obtained using a DJI Mini 3 Pro to enable comparison with the archive aerial imagery.

**Description**

Significant (>1.5 m) peat depth occurs in three coastal areas: (1) on the north coast at Swan Point; (2) midway between Swan Point and Loop Head; and (3) on the south-facing coast of Loop Head. Maximum peat depth is recorded as 3.45 m.

Processing of drone-derived aerial imagery has resulted in imagery with an ultra-high 2 cm resolution output that can be used to assess change from the archive 1956 imagery and will also enable exceptionally detailed assessment of future change over time.

**Discussion**

Preliminary investigation highlights that: (1) significant areas within the enclosure fencing still have ongoing peat erosion associated with bare ground; (2) some areas accumulate blown peat – typically with granule-size (2—4 mm) diameter peat grains; (3) high failure rates exist when tussac is planted on wide expanses of bare peat; and (4) areas where natural regeneration of tussac vegetation have also developed, likely assisted by the exclosure fencing.

**Summary**

This research is at an early stage and ongoing stage, but progress has been made processing digitised copies of original aerial imagery taken in 1956, collection and processing of drone-derived ultra-high resolution aerial imagery, and a peat depth survey undertaken using a 31 m systematic grid. Further research is planned to extend the survey areas along the west coast of Loop Ridge and to more appropriately quantify the change that has occurred to tussac distribution and peatland erosion.

This work shows the potential for remotely monitoring peatland restoration sites and giving a better understanding of regeneration success.

## 3.2
## WATER, PEAT AND PONDS: - SOME GROUND-LEVEL OBSERVATIONS

*Chris Evans, UK Centre for Ecology and Hydrology*

This paper describes some of personal observations on water and peat in the Falklands, which may be relevant to the current debate on Land Recovery/Peatland restoration in the Islands

**Water movement and hydrophobicity**

Below are some observations on the movement of water in peatlands, particularly reflecting the property of Falkland peatlands to repel water and resist wetting when dry (hydrophobicity) and to hold onto water when wet.

Fig 1 a) peat desiccation cracking, Cape Pembroke; 1b) a full pond on Stanley Common, localted above and about a metre away from a dry peat bank; 1c) a narrow, metre-deep crack in the peat, visible as a line of small fern; 1d) standing water on top of a peaty mineral soil after heavy rain near Lake Sullivan.

In Fig 1a (top left), cracks in dry bare peat are easily visible, resembling a dried out lake bed. These cracks can be very deep and go down to the clay or rock substrate below. Where blanket peat such as that of the Falklands remains intact it is exceptionally good at holding onto water, which can infiltrate vertically but does not move horizontally. This is illustrated by Fig 1b, in which a pond remains full despite being located just above a dry peat bank. The very low lateral hydraulic conductivity of Falkland peat also explains why buffalo ditches are not always effective at draining the land. In dry vegetated areas, such as that shown in Fig 1c, cracks may be less obvious but are often still present – in this case visible as a narrow line of small fern running for about 100 m down a shallow slope below a small pond. This crack was around a metre deep, and at the base water was visibly flowing between the pond and a stream line at the base of the slope. Dry peat can also become hydrophobic, which slows the rate of infiltration and can result in ponding on the soil surface as shown in Fig 1d.

In a healthy peatland, and especially where mosses such as Sphagnum are present, the density of the peat is low and water is able to infiltrate through the surface and be retained within the peat matrix, resulting in a high water table, moist soil surface and healthy plant growth. Sideways movement of water through the peat is very slow, especially at depth, so excess water tends to flow over or close to the peat surface. This situation is illustrated by Fig 2a. Fig 2b shows an alternative situation where the peat has dried out, for example due to overgrazing leading to diddle dee dominance or reduced plant cover, exposing peat surface to solar heating and wind-driven evaporation, which becomes more intense during drought periods. In this situation, the peat is likely to shrink both vertically and horizontally, reducing water infiltration rates and leading to the development of cracks. Water will now either pond at the surface or drop through the cracks, flowing out over the surface of the mineral soil or rock into the stream network. The peat is therefore less able to re-wet and may become hydrophobic. This creates the risk of a positive feedback loop in which soils are unable to re-wet after drought periods, plants adapted to dry conditions become ever more dominant, plant growth and forage quality decline, and the livestock carrying capacity of the land falls. This does not mean that change is irreversible – during prolonged wet periods the peat should gradually recover – but interventions that support this recovery will accelerate this process. For example, increasing vegetation cover will reduce wind-driven evaporation, soil surface heating and erosion, and increase water infiltration rates.

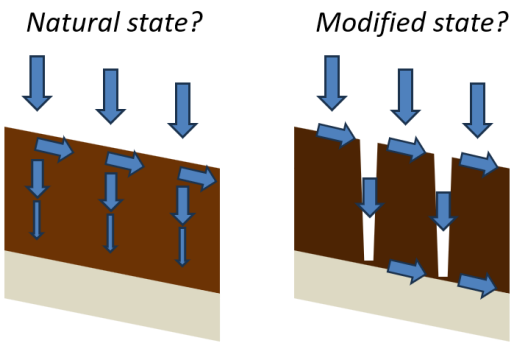



Fig 2. Theoretical representation of movement of water in peat.

**Measuring peat shrinkage and water infiltration**

We established a number of 'peat cameras' on Wireless Ridge as part of Steffi Carter's Darwin Plus project work, and most of them are still running. The cameras measure the vertical movement of the peat, and some of them have recorded about 2.5 cm per year of peat subsidence. This is likely due to a combination of shrinkage and oxidation. Subsidence rates are approaching those of drained tropical peatlands, and faster than most UK agricultural peatlands. Although we are measuring vertical peat loss, but it is very likely that there has also been horizontal shrinkage, which will eventually leading to cracking and erosion as described above.

We also recently carried out some trial water infiltration measurements at range of sites, using a simple instrument called a mini-disk infiltrometer (essentially a glorified measuring cylinder). We found that infiltration rates were remarkably variable – Fig 3 shows how quickly 100 ml of water drained into the peat at a range of sites. The results are rather surprising, water seems to infiltrate quicker into inland whitegrass and diddle dee than it does into coastal tussac peat. This has implications for any Land Recovery Programme where one target is to get water into the peat system. We hope to collect more data in future to understand how infiltration varies between soil and vegetation types, over time, and in relation to land-management.

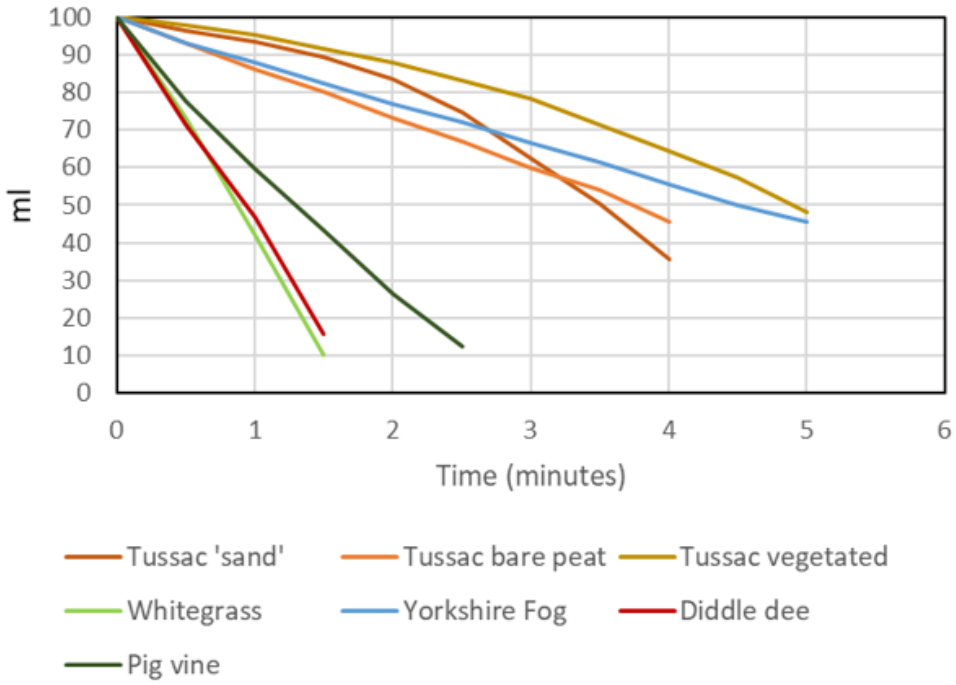



Fig 3. Water infiltration in soils under different vegetation types.

**Evapotranspiration**

The combined evaporation from the soil surface and transpiration from plants - **evapotranspiration** - represents the transfer of water back to the atmosphere-ie the reverse of precipitation (rain + snow). Excess water which is not lost to evapotranspiration will eventually flow from the soil into streams and rivers.

| Flux tower site | Rainfall | Evapotranspiration | | Excess water | |
|---|---|---|---|---|---|
| | mm | mm | % | mm | % |
| Tussac restoration 1 | 456 | 95 | 21% | 361 | 79% |
| Tussac restoration 2 | 540 | 170 | 31% | 370 | 69% |
| Fenceline 1 - dense white grass | 462 | 262 | 57% | 200 | 43% |
| Fenceline 2 - sparse diddle dee | 443 | 332 | 75% | 111 | 25% |

Evapotranspiration (ET) is a very significant process in the Falklands. High levels of ET in summer can create a soil moisture deficit, which inhibits plant growth. Although high rates of plant growth can contribute to water loss via transpiration, a dense vegetation cover also protects the soil surface from drying via solar heating and wind-driven evaporation, as well as enhance water infiltration into the soil. In many parts of the world, plants increase rates of water loss, but in the Falklands it appears that they may reduce water losses. Based on our initial results from the flux towers, we are observing the highest ET at the site with sparse diddle dee and areas of bare soil, where 75% of the annual rainfall is being lost to ET.

**Ponds**

*Why are Falkland ponds different colours?*

I have had a slightly unhealthy obsession with the ponds of the Falklands since looking at this Google Earth image of Lakelands, and wondering why the three ponds near the bottom left of the image seemed to be totally different colours despite right next to each other. When we first sampled these ponds in 2019, the pond on the left seemed normal – brown due to dissolved organic matter from the peat, not particularly biologically active, and slightly but not exceptionally acid. The green pond on the right, however, was anything but normal – it had a pH of 2.9 (about the same as vinegar), was full of sulphate but hardly any organic matter, and in the throes of an algal bloom. Since 2019 I have, with the help of Steffi and others from SAERI and UKCEH, as well as Lewis Clifton and many others, sampled about 60 ponds of varying shapes and sizes from across the islands. During this time, as Marilou's maps illustrate, many of them have dried out – including all three of the ponds I sampled in 2019, when I finally made it back to Fox Bay in 2024.

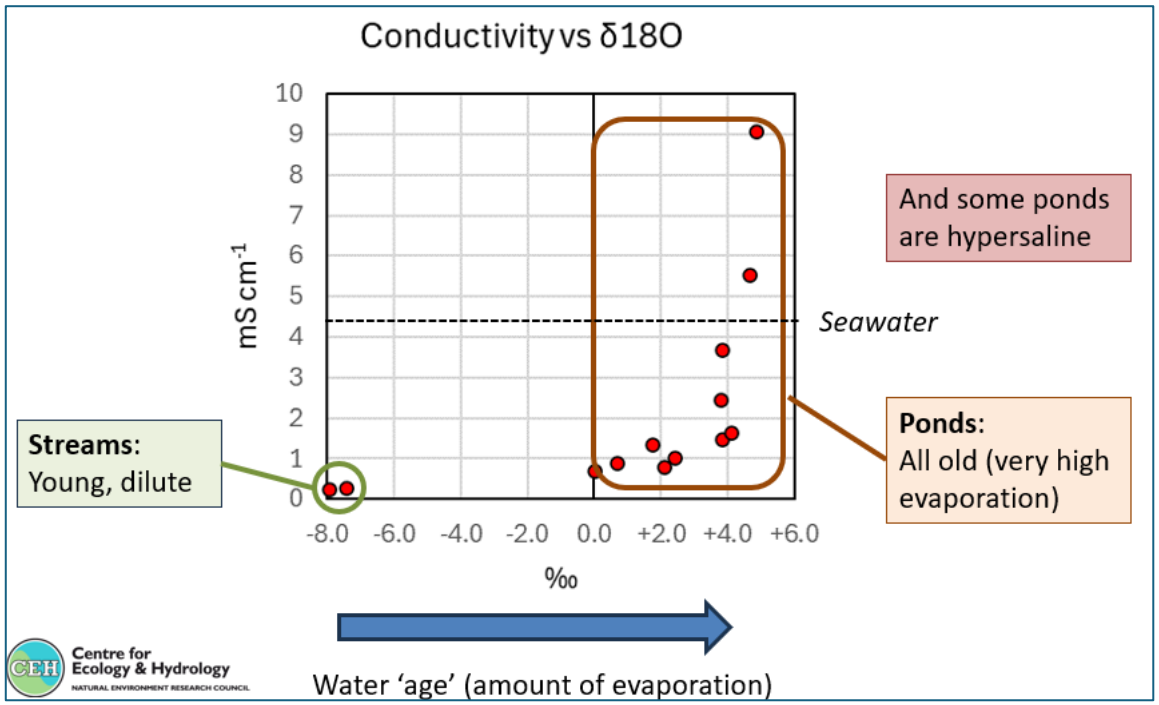



Fig 4. The conductivity of Falkland streams and ponds (a measure of their solute concentration, similar to salinity) compared to the oxygen isotope content of the water.

Fig 4 shows how different the chemistry of Falkland ponds is compared to streams and rivers. Streams are dilute (low conductivity) and the water they contain has a similar oxygen isotope content ($\delta^{18}O$) to rainwater. The ratio of heavy oxygen-18 molecules to the more common oxygen-16 molecules provides a measure of how much evaporation has taken place, because the lighter $^{16}O$ evaporates faster, leaving more of the heavy $^{18}O$ behind. As the figure shows, the ponds of the Falklands (sampled in this case in February 2024) are highly enriched with $^{18}O$. This suggests that the water in the ponds has been there for a long time, neither draining via streams or being recharged by water from the surrounding soil, effectively just drying out like a salt pan. As a result the dissolved solutes in the ponds have become increasingly concentrated, causing conductivity to rise until in the most extreme cases the remaining pond

water becomes more saline than the sea. This also results in ponds become increasingly enriched with dissolved organic matter, as shown in Figure 5.

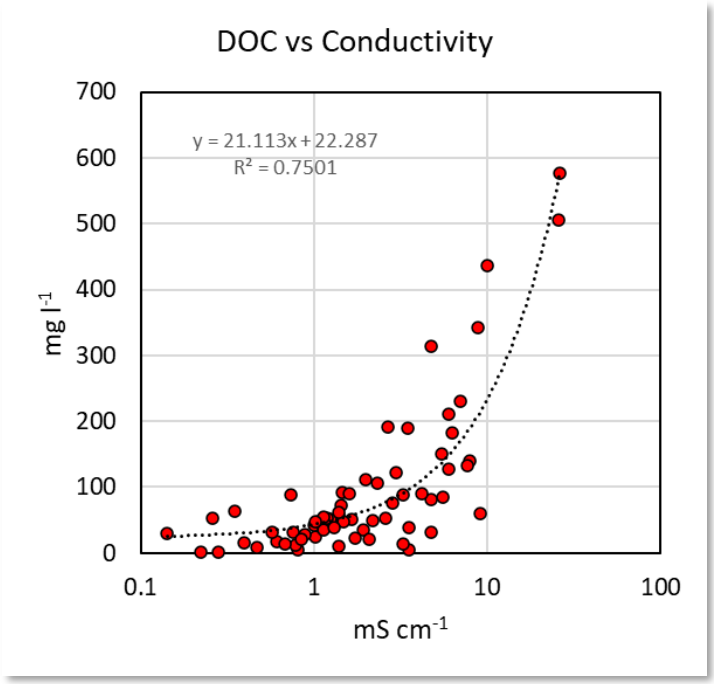



Fig 5. Pond dissolved organic carbon concentrations versus salinity

Since first sampling the mysterious Lakeland 'green pond' in 2019, we have managed to sample three more, including Pond Mountain Pond on Weddell Island (Fig 6) this year and a different pond at Lakelands last year. The chemistry of this pond is shown compared to an 'average' pond below.

| Measurement | Units | Average pond | Green pond |
|---|---|---|---|
| pH | pH | 5.66 | 3.75 |
| Conductivity | mS $cm^{-1}$ | 1.5 | 9.05 |
| Dissolved Organic Carbon | mg $l^{-1}$ | 53 | 60 |
| Sulphate | mg $l^{-1}$ | 76 | 2540 |
| Chlorophyll | µg $l^{-1}$ | 23 | 237 |

As the table shows, green ponds are highly acid (two pH units lower actually means that they are 100 times more acid), have very high conductivity and sulphate concentrations, and very high chlorophyll concentrations (giving the ponds their green colour) which appear to be caused by a type of algae called diatoms. The chemical processes that cause these algal blooms are still something of a mystery, but seem to be associated with the pond drying up, and exposing the sediment beneath to oxygen. This allows stored sulphides (originally from sulphate in sea-spray) to be oxidised to sulphate, which acidifies the pond. At the same time, it is likely that stored nitrogen and phosphorus are being released, raising nutrient levels and

causing the algal bloom. Based on aerial photographs, observations from FIGAS flights and conversations with landowners it seems that these green ponds are not unusual, and can occur in different environments throughout the islands. Different ponds go green at different times, and this seems to happen when they are close to drying out. This last burst of biological activity is a little like a star going supernova before it dies. The phenomenon is clearly linked to droughts, and is likely to be at least partly natural, but based on the hydrological observations above it is also possible that it has become more frequent and widespread due to land-management related drying of the soil. This is still something of an unknown, but it does suggest that interventions through the Land Recovery scheme that help to retain water in the soil could also help to protect ponds from drying out.

Fig 6. Pond Mountain Pond, Weddell Island. A “green” pond.

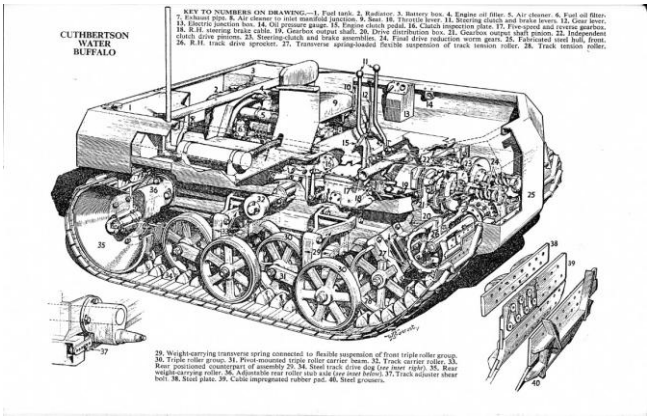
**3.3**

# BUFFALO DITCHES

*Nick Pitaluga, Gibraltar Station*

### The Cuthbertson Water Buffalo

These were purchased in the 1950s to help drain the peatlands, and  to also help the movement of horses, goods and livestock round the islands. This was following a practice which was being carried out in the Scottish peatlands at that time. There were 3 purchased - 2 by FIG and one by the FIC.  These are the tractors which towed the plough.




The plough had twin disc coulters to cut through the topsod, then mouldboards on either side (reversible to permit turning the sod on either side travelling in either direction).

The plough was towed by this tractor. This photograph is of one of the ex-Government ones derelict at Chartres (photo: Derek Lee/Plough photos; Stephen Luxton). The vehicle had a ground pressure of only 4 pounds/square inch and travelled very slowly.


Only one had a cab fitted (a great attraction for the operator!) and was capable of unhitching the plough when crossing extremely soft areas, then winching the plough across from a distance (upright pole on the previous photo was part of the winching mechanism)to install the ditch as it went.

This is the one purchased from FIC by John Rowlands and working at Gibraltar Station. All in all approximately 20 miles of ditches were ploughed there. This tractor also helped to pull out the hi-jacked Aerolineas Argentinas DC4 from the racecourse, Stanley in 1966.

South side of Long Island Mountain showing the extent of some of the FIC buffalo ditching. Aerial photo by Marilou Deligniers.

Not all went to plan every time – even Buffalo ditchers could get bogged! (in this case near MacBride Head).

Cuthbertson tractor towing out the necessary kit to the camp to start work. From front, the tractor, the plough, punt-shaped sleigh to carry fuel, equipment, caravan for workers to live in, small jeep to come back in to the settlement to collect supplies etc

I have a particular interest in the effect of these crawler tractors on the camp.

**Discussion topics**

*Might it be possible to reverse the effects – potential for damming and rewetting?* Worth trying It was a massive project a lot of effort for not much gain at the end of the day. Was also used for draining ponds.

## 3.4

# PONDS AND FIRES - CHANGES SEEN FROM THE AIR

***Marilou Delignières, FIGAS pilot***

**Opportunity**

This talk is based mainly on observations taken from an aircraft flying in the Falklands within the past 4 years.

Four summers ago I started colouring in ponds on a map as we realised that while there was a lot of concern over ponds drying out, no one was actually keeping track of which ponds fully dry out every year. I recognise it is not complete island-wide coverage but as a representative sample and opportunity for repeatability, it could be a valuable record.


Decided to colour in ponds on a regular basis (to note change) Red= Fully dried out; Green =Half empty; Blue = Full.

**Limitations to the methodology**

a. Cloud cover and visibility issues.

b. Impossible: to have everything in one day, to have the same flights the year after on the same day, etc
c. It is hard to figure out which ones are half empty (how deep?)
d. To be honest only the red observations are fully reliable as seen from the air
e. The best time to take observations is towards end of summer & end of winter (driest & wettest)

Summary of pond observations

- 2021/22 and 2022/23 summers very dry
- 2023/24 wetter than previous one
- 2024/25: Wetter start so far, but seems to be drying up in late January
- Most drying is usually in the second half of the summer


A lot of blown sand can be seen on windy days (61kts when these photos were taken). Where does all this dust go? Can it negatively impact on other habitats?

Why does the road appear to be going through Mappa Pond (North Arm)?

Closer inspection from another angle shows that the pond is drying up and blowing away.

If we look at an example from First Passage Island (off Dunnose Head), we can see worrying evidence of the extent and rate of spread of erosion. A sequence of satellite images (from 2012 to 2021) show the rate of spread of the eroded area to the east of the pond in the centre-left of the image.


October 2012


December 2013


October 2014


December 2018


December 2019


December 2020


June 2021

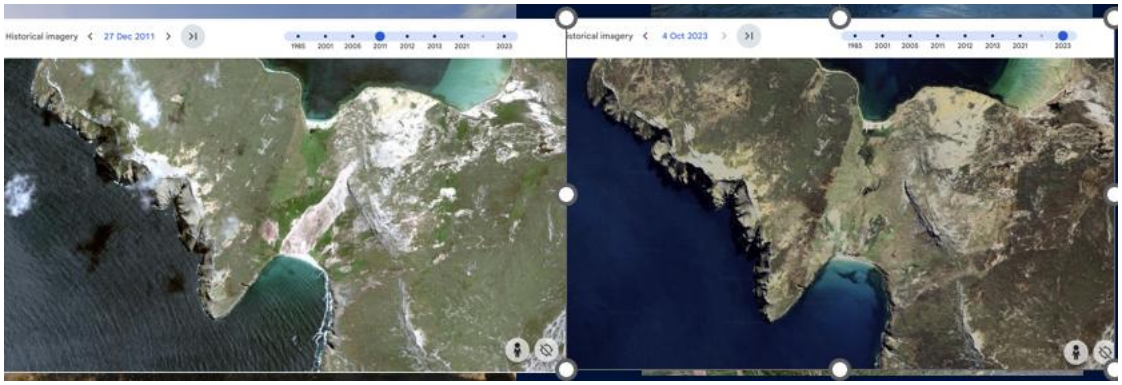

October 2021

This is what it looked like recently (from the ground).

*Left.* First Passage from the air (7000 feet) in December 2021 and *Right* in January 2025. Note the eroded strip has now expanded almost completely across the island and is getting wider.

**How can we stop the spread of sand from ponds?**

Planting Sand Grass (Marram Grass) / Blue Grass has been successful, but stock need to be kept off the site at least until the vegetation cover has fully established. Will take years- but we need more examples to relate recovery rate to site characteristics. We have seen the example of success with sand planting from Dunbar (Paper 1.7 and below).




*Left*: Sand blowing up from the beach is covering land downwind (2011).

*Right*: Successful recovery of grass cover following Sand Grass planting (2023).

**Natural fires**

We are seeing an increase in lightning frequency as a result of climate change and this has resulted in more wildfires. These need to be considered in any restoration programme – islands are particularly susceptible due to severity of strikes and lack of infrastructural support to combat island fires.

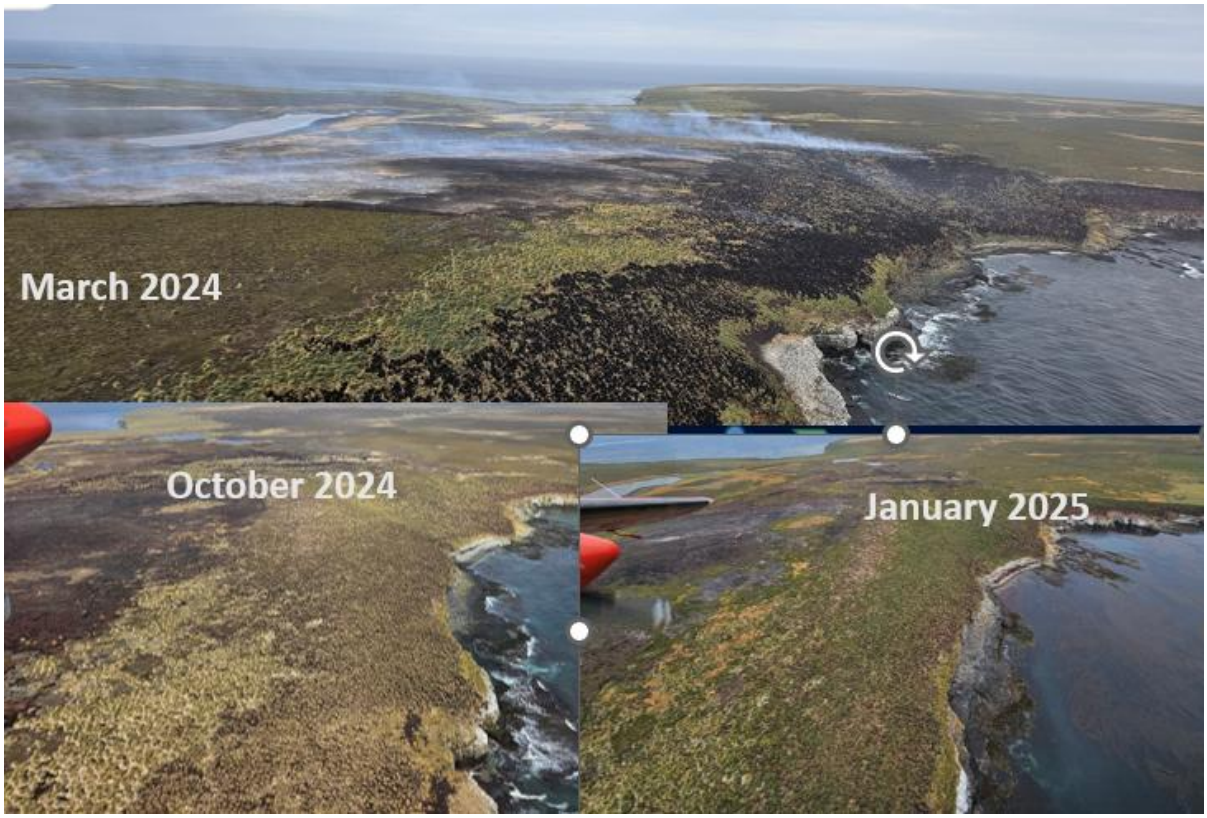
Aerial observations of the Sealion Island fire show the clear distinction between the effects of a fire on a tussac plantation and on diddle dee ground.

The fire and immediate aftermath in March 2024.



The base of the Tussac stand in November 2024

And in January 2025




The full sequence of recovery events on this site- note the complete lack of recovery on the Diddle dee area and the active recovery on the tussac area. The reason appears to be that while the upper canopy of the tussac burnt fiercely, the fire passed quickly over as a flash fire and the ground layer did not burn (see above). As tussac can recover quickly from the basal stool, the whole tussac area has shown great resilience to the fire and is recovering rapidly. By contrast, the Diddle-dee area has burnt right to the ground (the canopy is so light) and there is no recovery- indeed erosion has already set in on some of the areas of shallow soil and the clay/rock is being exposed.

The Diddle-dee area at the very end of Jan 2025. Note erosion starting in the bottom part of the area - relative to the photo).

**Quaker Island**

Fire in February 2023. The picture in May 2024.

The Diddle dee areas are still black and grey, the tussac has already started to recover – see the picture below taken from the sea– a very resilient plant !

**A few thoughts from the air on water!**

So much sediment-carrying fresh water can be seen draining the land and ending up in the sea, while the surrounding land is cracking dry. This is particularly obvious from the air. It would be great if we could look at simple engineering solutions to divert some of that water back across the land. Nick Pitaluga has some good thoughts on this from the Buffalo ditch network at Salvador (see 3.3) and Fraser McKay has done some good rewetting, as well as Mike Evans at Spring Point.

**Discussion topics brought up by the audience.**

*Tracks across the Diddle dee burnt areas?* The one on the left of the January 2025 picture from Sealion was always there, the one on the right was new- but it did stop the fire.

*Pond shrinkage ?* There are lots of examples- see the maps circulated.

*Orange patches in burnt Diddle-dee?* These are peat ash from the fire burning hot into the peat. It will likely blow away down to the clay and is unlikely to ever grow anything again. No point in trying.

*Use of oats on eroded, dried out ponds?* Has been done at Saunders Island and oats could be undersown with a suitable grass seed mix.

Think of the history of Purvis Pond at Port Howard. A big flat shallow pond. It was drained in the 1940s or so. Because of the long history of geese and other wildfowl on this pond, talking to people who remembered the draining, the sediment left was so nutrient rich, it grew an oat crop “over your head” for many years afterwards. Then grassed down to good flat airstrip of course!

*Falklands ponds are very unique -so many of them are shallow -why?* There are examples of drying out, blowing away then filling up again. A specific pond near Laguna Isla but audience speaker could not recall exactly which one.

*How was the sandgrass at Dunbar established?* From local tillers. Highly succesful.

## 3.5 HABITAT RESTORATION – What can I plant, Where, When and How?

*Sally Poncet, Island LandCare*

The fastest way of producing lasting results in land recovery and soil moisture retention is to increase ground cover and the height of whatever mix of native plant species is most suitable for that site's soil type (it's also the best way to increase biodiversity – birds, soil fungi, insects).

Healthy native habitats – communities dominated by tussac, boxwood, bluegrass, Fuegian couch, swordgrass - are the key, because they are adapted to our climate, they can cope with drought, with fire, with extreme weather events, with flooding. But they cannot cope with grazing. So the first step is to exclude livestock.

Some sites are suitable for passive restoration, others will require help by planting tillers or seedlings ('plugs'). "All" you have to do is maintain fences, keep livestock out and keep planting.

Full land recovery time in the Falklands requires decades, sometimes centuries. But if you make a start now, you'll see changes within a couple of years. Shallow Harbour is a good example: Ali and Marlane fenced off 160 ha of mostly diddle-dee ground a few years back and within 5 years, there was an explosion of wildflowers, boxwood, bluegrass and tussac naturally colonising the cliff tops. An excellent example of passive restoration.

**Dealing with erosion.**
Where erosion is being tackled, planting is essential. Plant Tussac tillers on black ground to stop peat blowing away; Sandgrass and sea cabbage for a temporary fix on mobile sand dunes followed by Blue grass once established. Fuegian Couch, Blue grass, Cinnamon Grass, Wavy Hair grass, even Tussac tilers can be used on blowing soil that is smothering adjacent vegetation. If none of these are available on site, the advice is to get starter nurseries of native seedlings going as soon as possible. Seedlings do best with company, along the margins of existing plants, not out in the open. They don't like competition from introduced plants - don't plant near these grasses: Yorkshire Fog, Bent, Cocksfoot, Sweet vernal, couch or in sheeps sorrel or mouse-eared hawkweed.

There is an excellent pool of local knowledge about tussac (and also sandgrass) planting dating back nearly 150 years. Much less is known about planting natives such as Fuegian couch, bluegrass, cinnamon grass, wavy hairgrass, sea cabbage. Information leaflets from Falklands Conservation are a good starting point. But the first step is to know what native plants are likely to best suited for conditions on your land – what works for one property may not necessarily apply to yours. Soil type, growing conditions and location all going to determine what grows best and where. But whatever species you plant, soil moisture is crucial. Look for sites in valleys or downhill from springs where there's a reliable source of moisture and avoid areas that are likely to dry out in summer.

**Tussac**

Tussac is planted to restore and protect expanses of bare black tussac peat and to stop tussac peat blowing away. It can also be used as a first stage coloniser for introducing quick growing and fast spreading vegetation on large areas of blowing heathland (diddle-dee) soil. For best results, use local tillers wherever possible. Where tussac is no longer present, seedlings can be used to establish starter nurseries which can used as a source of tillers once established.

Both tillers and seedlings grow best on pure tussac peat, i.e. eroding 'black ground' which was formerly covered in tussac but still has good depths of peat. 'Black ground' is 'gold dust' as far as carbon storage and habitat restoration are concerned. To save remnant pure tussac peat from further erosion, it is essential that livestock do not ever access the area, that you plant nothing but tussac and you keep on planting until there is100% tussac cover.

Closely spaced tillers (no more than one metre apart) and seedlings are able to establish ground cover faster, the gaps between tillers are filled in faster, reducing loss of soil and soil moisture. Don't expect every single tussac tiller/seedling to survive. Expect at best 80% survival in the first year. Allow for time in the second year, and in subsequent years, to replace dead plants and fill in bare ground with more tillers. Regular in-filling is essential until the plants have become big bogs and created a 100% tussac canopy and are setting seed. A healthy self-maintaining tussac plantation may need a lot of help in its early years. It's not a 'one-hit' wonder, it requires several years of in-filling, and of making sure the sheep don't ever get in.

Avoid planting tussac in areas that are already covered in a mat of vegetation such as coastal 'greens', settlement paddocks, and in areas with sheep's sorrel and Yorkshire fog: tussac does not like competition.

**Other native plants**

We have limited information about growing other native species for large-scale restoration purposes. A native seed hub run by Frin Ross of Falklands Conservation and Cynthia at the Market Garden ten years ago was the beginning, and a few people more recently have been trialling various species.

The first large-scale trial started last winter (2024), when 11,250 bluegrass, Fuegian couch, swordgrass, boxwood and tussac seedlings were planted on Philimore Island by Habitat Restoration Services (Chris Hawksworth and Motta Ruiz), funded by Springcreek through Falklands Conservation. It will take several years to see the results of this. However, there are a few things we have already learnt:

- Planting seedlings of these other species requires a lot more thought and time than tussac.
- Before planting, make a plan of what species and how many go where.
- Every plant counts and every 'spot' has to be the best you can find. Find the perfect habitat, and take your time.
- Planting technique is important: make sure the holes made by a spade/dibber/auger/'cabbage' planter are deep enough so that the seedling plug sits a little

lower than the surrounding soil.

- Planting can be very slow for boxwood and swordgrass with extra care and time needed to find the 'right' spot, giving each seedling the best chance of optimal growth and survival.
- If upland geese are present, check seedlings the next day, and re-plant any that may have been pulled out.
- On exposed slopes, a ring of rocks around the seedling may help stop wind scouring and encourage deposition of blowing soil particles and moisture.
- Plant on the margins of existing vegetation for shelter rather than on open bare ground.
-

**Fuegian couch**

- Tolerant of nearly any soil conditions though thrives on mineral soils with high clay and/or sand content, even on bare clay patches.
- Fast growing in its first year if in good soil, and very drought resistant. A good choice for the more challenging areas where little soil is left.
- Seedlings best planted about 20 - 40 cm apart; discrete groups of e.g. 10 x 10 plants, or 'shelterbelt strips' 3 or 4 plants deep seem to work well.

**Coastal bluegrass**

- Grows well from tillers
- Likes sandy well-drained soil. Can gows in pure sand amongst sandgrass.
- Its tough leaves resist sandblasting and provide protection for other species downwind.
- Seedlings best planted about 20 - 40 cm apart; groups of e.g. 10 x10 plants or shelterbelt strips 3 or 4 plants deep seem to work well.

**Boxwood**

- Coastal areas preferred as boxwood is not very frost-tolerant.
- Slow growing but well worth the wait: it provides invaluable refuge for native birds.
- Vulnerable to grazing by hares.
- Tolerant of most soil types but seedlings seem to do better in moist ground with good soil depth.
- Seedlings seem to do better if sheltered from the wind, for example within a ring of large rocks, or amongst stands of colonising tussac, Fuegian couch or bluegrass.

- Seedlings planted ca. 2 metres apart n a group of e.g 10 x 10 plants is good for creating a boxwood thicket.

**Swordgrass**

- Grows luxuriantly in damp peaty soils but can also tolerate sandy soils and tussac peat.
- A very valuable plant for increasing plant biodiversity and as a food source for birds.
- Seedlings may be heavily grazed by upland geese if planted in the open. For best results plant in the shelter of surrounding vegetation, eg beneath overhanging tussac leaves or within stands of prickly burr.
- Once established, seedling roots will quickly bulk out, so plant seedlings at least 40 cm apart.

**Cinnamongrass**

- Prefers damp valley areas, although it can grow nearly anywhere, even in clay patches.
- Provides valuable biodiversity and wildlife habitat in areas of short vegetation i.e. heathland and whitegrass.
- Its large root structure and dense leaves can help reduce scouring of soil caused by water runoff in flooding eroded valleys.
- Plant tillers/cuttings about one metre apart.

**Sea cabbage and marram**

- Both are brilliant for stabilising blowing sand
- Sea cabbage grows easily from scattered seed
- Sandgrass (marram) and sea cabbage for a temporary fix on mobile sand dunes, followed by native bluegrass in the longer-term.

**Wavy hairgrass**

- Perennial grass, grows well on damp ground in acid peatland.
- It will also grow quite happily on diddle-dee dieback areas provided grazing pressure is removed to allow the grass to set seed.
- Once self-set seeds establish, they will quickly spread.

**And there are others showing promise for restoration**

- For example, spikey grass, fachine, buttonweed, oval-leafed prickly-burr, buttonweed, short rush.

**3.6**

## WHAT CAN WE LEARN FROM HISTORICAL RECORDS?

*Mike Evans, Farmer & Historian*

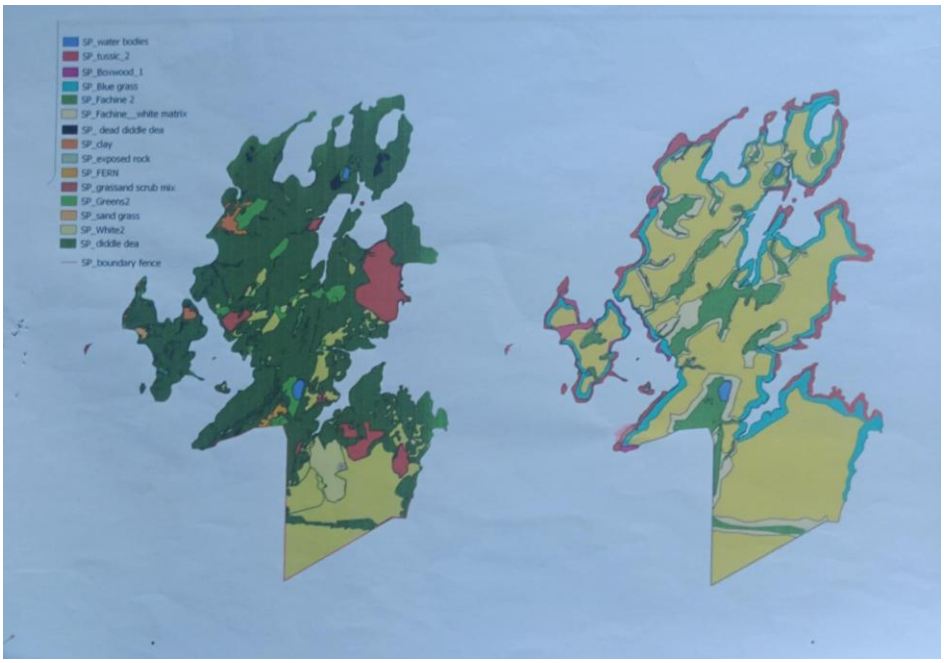
Map of Falklands with original farm boundaries. This map does help highlight how sheep farming and grazing practices has impacted the native vegetation over time.


By the 1880s farmers had begun to fence their land to control the spread scab and within a few years divisional fencing was general. By 1898 sheep numbers had peaked at 807,211 sheep. By 1900 there was strong evidence that the quality of the pastures was deteriorating fast and by 1908 there began a rapid decline in numbers.

Prior to divisional fencing going in, Boundary riders,(shepherds) lived on farm boundaries but could do little to prevent the spread of scab without fencing to control stock movement. In most cases this also gave them very little control over the grazing pressure applied by sheep to the native vegetation within farm boundaries. With sheep numbers increasing rapidly the most palatable native plants, like coastal Tussock Grass, Sword Grass, Wild Celery and Coastal Blue grass were targeted. We can easily surmise how quickly the decline in vegetation would have taken place. Also, it goes without saying, the use of fire to open up pastures and make them more accessible to live stock would have done incredible damage to plant communities also.

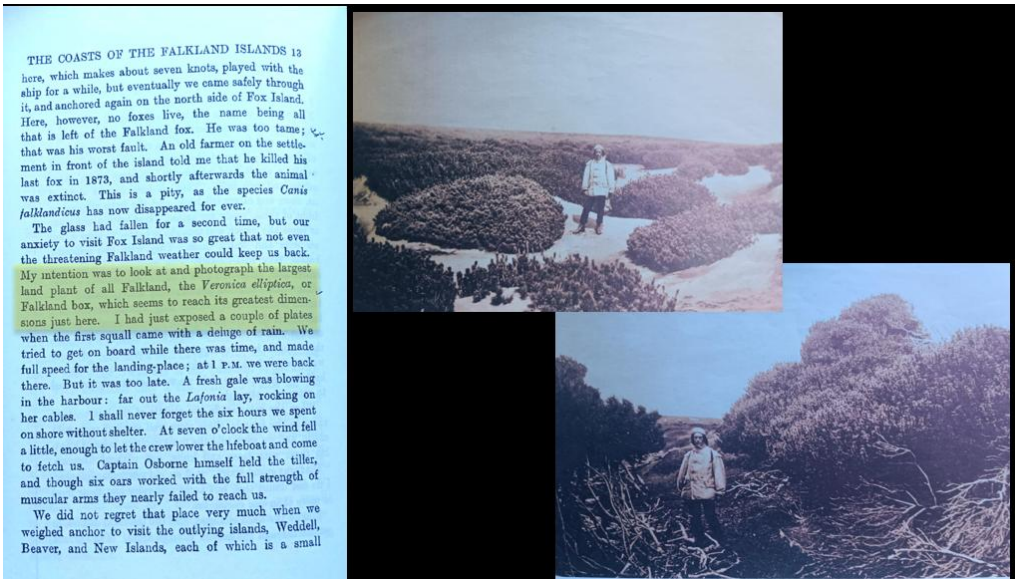
By 1908 sheep numbers had dropped to 688,705 animals. However the introduction of better stock and the decrease in sheep numbers improved wool weights, leading to total wool production in 1909-1913 being higher than when there was 807,000 sheep grazing the land. (First example of *less is more* being recorded perhaps?)

By this time steps were beginning to be taken to try and restore some of the damage and there were a number of fairly large restoration efforts taking place across the Islands. This may have helped stop further decline to the remaining areas of tussock but sadly it was too late to save a lot of the areas of tussock peat that hadn't been restored.




Based on historical photos and records-mainly from the Swedish Botanist Carl Skottsberg who visited in 1908, we have built up a vegetation map of what Spring Point farm might have looked like (Right), and compared it with the current habitat map (Left). The biggest difference is the loss of most of the Whitegrass (yellow) to be replaced by Diddle dee (Dark green). Also the loss of Fachine and boxwood. There is a wealth of information out there from written and anecdotal records as to what plant communities were present and have been lost over time from over- grazing and fire damage. Indeed only as recently as the 1980s prior to subdivision of the Fox bay area there were still large stands of Fachine to be found that could not be accessed by horse and rider due to how dense they were. We are also confident that the area was carrying far more of the native species of grasses and indeed the reduction of sheep numbers has seen a return of many of these.

Although we have assumed this has been the result of overstocking and fire over many years, considering what is coming out of this workshop, there may have been an element of the gradual effects of climate change. Subdivision has had a real impact on this area allowing for the temptation to run more stock than the area is capable of sustaining. Thankfully as we have the two farms we have been able to reduce the burden on the land but sadly the best of the Fachine has possibly gone forever but we remain hopeful of some recovery.



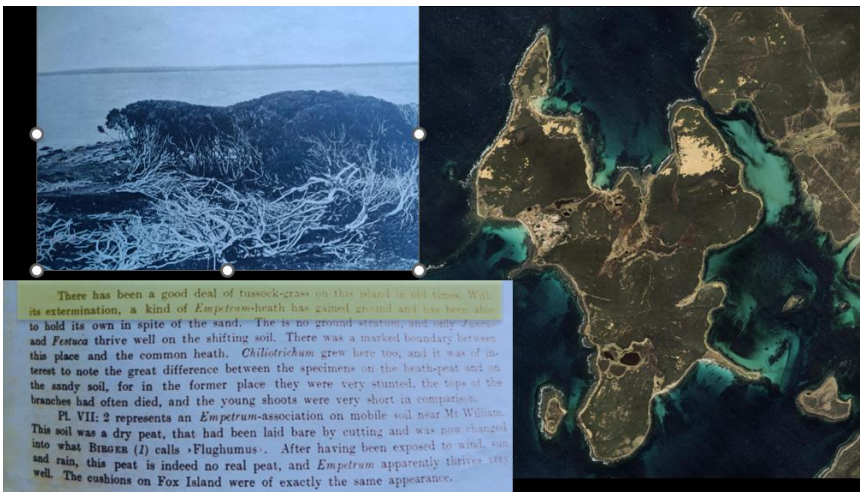
THE COASTS OF THE FALKLAND ISLANDS 13

here, which makes about seven knots, played with the ship for a while, but eventually we came safely through it, and anchored again on the north side of Fox Island. Here, however, no foxes live, the name being all that is left of the Falkland fox. He was too tame; that was his worst fault. An old farmer on the settlement in front of the island told me that he killed his last fox in 1873, and shortly afterwards the animal was extinct. This is a pity, as the species *Canis falklandicus* has now disappeared for ever.

The glass had fallen for a second time, but our anxiety to visit Fox Island was so great that not even the threatening Falkland weather could keep us back. My intention was to look at and photograph the largest land plant of all Falkland, the *Veronica elliptica*, or Falkland box, which seems to reach its greatest dimensions just here. I had just exposed a couple of plates when the first squall came with a deluge of rain. We tried to get on board while there was time, and made full speed for the landing-place; at 1 P.M. we were back there. But it was too late. A fresh gale was blowing in the harbour: far out the *Lafonia* lay, rocking on her cables. I shall never forget the six hours we spent on shore without shelter. At seven o'clock the wind fell a little, enough to let the crew lower the lifeboat and come to fetch us. Captain Osborne himself held the tiller, and though six oars worked with the full strength of muscular arms they nearly failed to reach us.

We did not regret that place very much when we weighed anchor to visit the outlying islands, Weddell, Beaver, and New Islands, each of which is a small

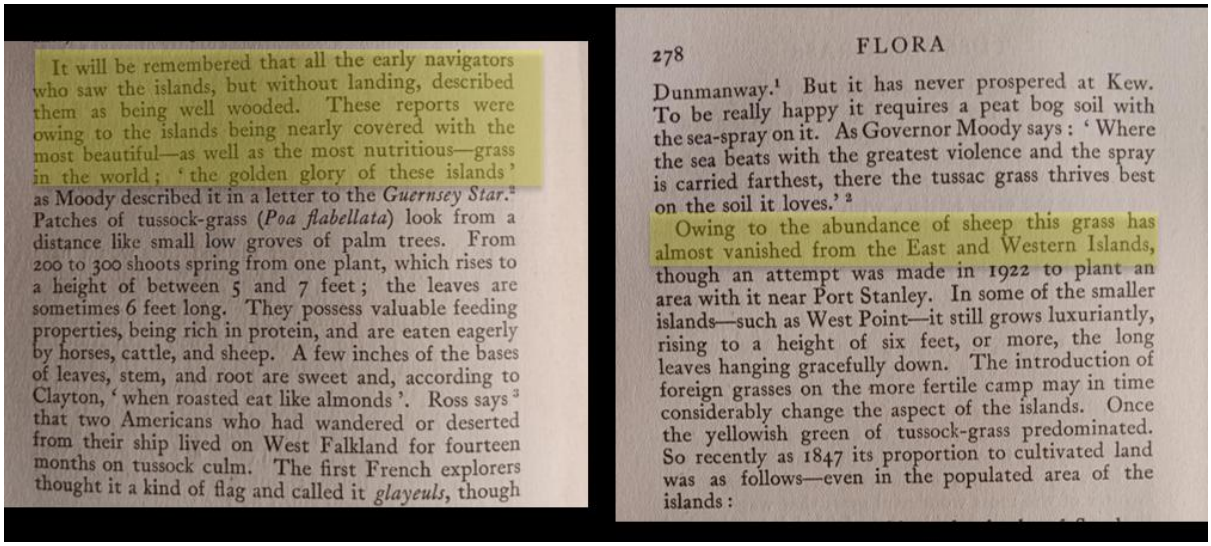
The Swedish botanist Carl Skottsberg visited Spring Point in around 1910 and left descriptions and photographs of the vegetation that had been present in the area at that time. This has helped us greatly to build a picture of where to focus our restoration efforts. Dr Halle is seen in the photo above standing by the largest Boxwood specimen remaining on Fox Island at the time of Skottsberg's visit. Sadly nothing remains today of what must have been amazing stands of Boxwood on the Island.



There has been a good deal of tussock-grass on this island in old times. With its extermination, a kind of *Empetrum*-heath has gained ground and has been able to hold its own in spite of the sand. The is no ground-stratum, and only *Carex* and *Festuca* thrive well on the shifting soil. There was a marked boundary between this place and the common heath. *Chiliotrichum* grew here too, and it was of interest to note the great difference between the specimens on the heath-peat and on the sandy soil, for in the former place they were very stunted, the tops of the branches had often died, and the young shoots were very short in comparison.

Pl. VII: 2 represents an *Empetrum*-association on mobile soil near Mt William. This soil was a dry peat, that had been laid bare by cutting and was now changed into what Berger (*1*) calls »Flughumus». After having been exposed to wind, sun and rain, this peat is indeed no real peat, and *Empetrum* apparently thrives very well. The cushions on Fox Island were of exactly the same appearance.

Skottsberg remarks on the fact that there had been a great deal of tussock on Fox Island in the past. Nothing remains today apart from the echoes of where it once flourished along the coastline. One again this information helps to build a picture of the type of vegetation that was present in the past. Today the stocking rate on Fox Island has been reduced by 300% and we are starting to see good signs of recovery. Fachine bush and Cinnamon Grass are two of the native species that are responding well to the reduced grazing pressure. (Map of Fox Island today right of figure above). Also what should be taken into consideration is that prior to fencing and with only boundary riders to control stock. Fox Island being a tidal Island was very possibly used as a holding paddock for stock at shearing time. The first shearing shed and jetty were on Fox Island and this would have had a devastating impact on the Boxwood.



It will be remembered that all the early navigators who saw the islands, but without landing, described them as being well wooded. These reports were owing to the islands being nearly covered with the most beautiful—as well as the most nutritious—grass in the world; 'the golden glory of these islands' as Moody described it in a letter to the *Guernsey Star*.[2] Patches of tussock-grass (*Poa flabellata*) look from a distance like small low groves of palm trees. From 200 to 300 shoots spring from one plant, which rises to a height of between 5 and 7 feet; the leaves are sometimes 6 feet long. They possess valuable feeding properties, being rich in protein, and are eaten eagerly by horses, cattle, and sheep. A few inches of the bases of leaves, stem, and root are sweet and, according to Clayton, 'when roasted eat like almonds'. Ross says[3] that two Americans who had wandered or deserted from their ship lived on West Falkland for fourteen months on tussock culm. The first French explorers thought it a kind of flag and called it *glayeuls*, though

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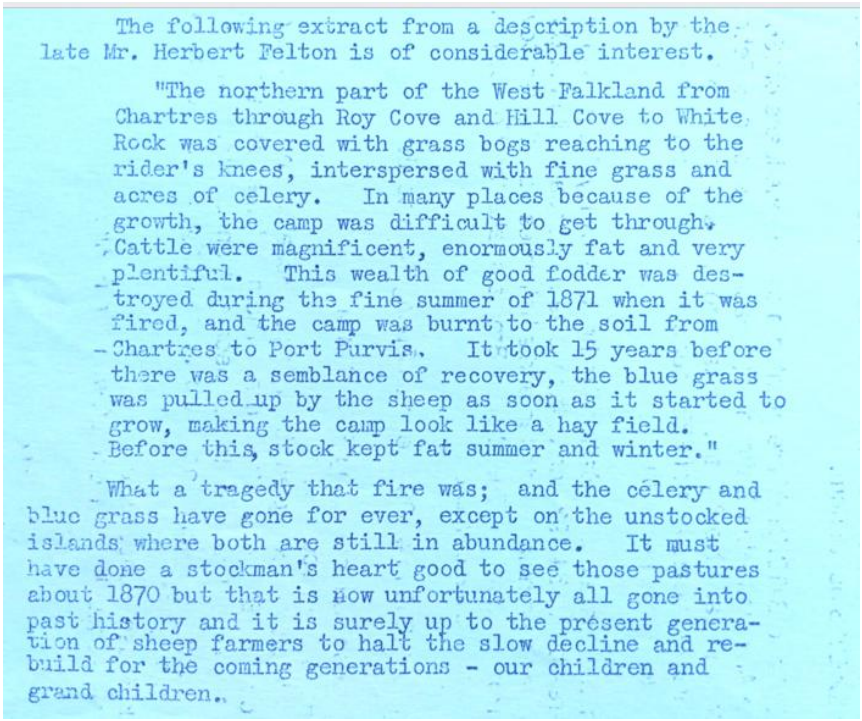
Dunmanway.[1] But it has never prospered at Kew. To be really happy it requires a peat bog soil with the sea-spray on it. As Governor Moody says: 'Where the sea beats with the greatest violence and the spray is carried farthest, there the tussac grass thrives best on the soil it loves.'[2]

Owing to the abundance of sheep this grass has almost vanished from the East and Western Islands, though an attempt was made in 1922 to plant an area with it near Port Stanley. In some of the smaller islands—such as West Point—it still grows luxuriantly, rising to a height of six feet, or more, the long leaves hanging gracefully down. The introduction of foreign grasses on the more fertile camp may in time considerably change the aspect of the islands. Once the yellowish green of tussock-grass predominated. So recently as 1847 its proportion to cultivated land was as follows—even in the populated area of the islands:

Reports from early navigators of the abundance of tussac and other native grasses that flourished along the shore line really helps to build a picture of what has been lost over time.



The following extract from a description by the late Mr. Herbert Felton is of considerable interest.

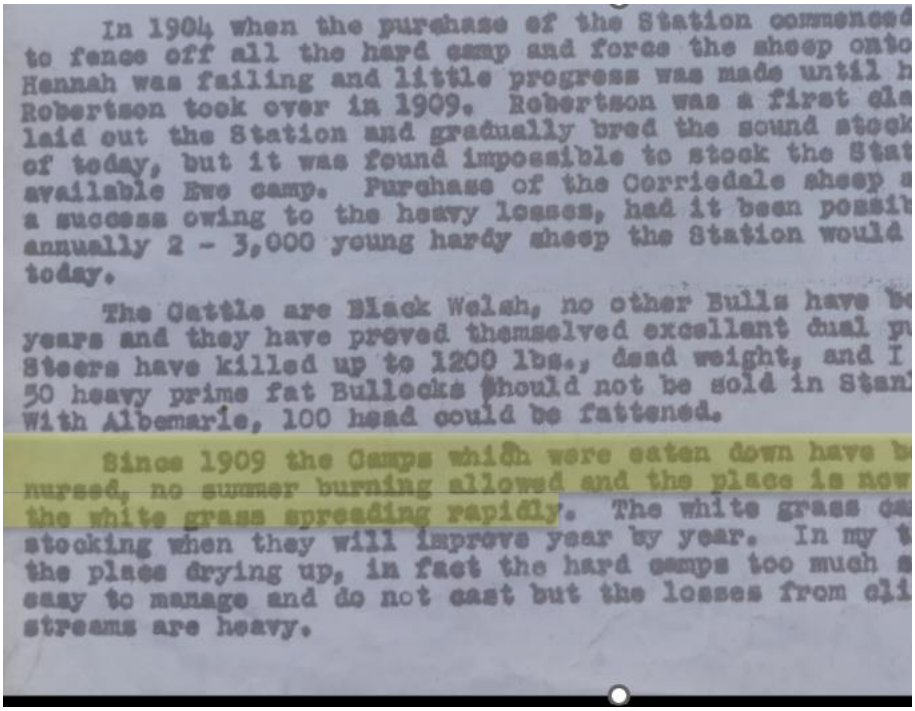
"The northern part of the West Falkland from Chartres through Roy Cove and Hill Cove to White Rock was covered with grass bogs reaching to the rider's knees, interspersed with fine grass and acres of celery. In many places because of the growth, the camp was difficult to get through. Cattle were magnificent, enormously fat and very plentiful. This wealth of good fodder was destroyed during the fine summer of 1871 when it was fired, and the camp was burnt to the soil from Chartres to Port Purvis. It took 15 years before there was a semblance of recovery, the blue grass was pulled up by the sheep as soon as it started to grow, making the camp look like a hay field. Before this, stock kept fat summer and winter."

What a tragedy that fire was; and the celery and blue grass have gone for ever, except on the unstocked islands where both are still in abundance. It must have done a stockman's heart good to see those pastures about 1870 but that is now unfortunately all gone into past history and it is surely up to the present generation of sheep farmers to halt the slow decline and rebuild for the coming generations - our children and grand children.

An account by the late Mr Sydney Miller of a huge devastating camp fire on West Falkland in1871. It is reported that this site took 15 years to recover. Here once again we have a vivid description of the wonderful vegetation that covered large areas of the West Falklands. From this description of the habitat we can also draw on the fact that the un- stocked Islands described here can be used as a bench mark for restoration efforts inland. I note that it states that the cattle were enormously fat. Charles Darwin also noted this on East Falklands and remarked on the fact that the cows were in such good condition that some had two calves at foot. That years drop, and the calf from the previous year, presumably both suckling. This is

also testimony to the abundance of feed available to the stock prior to the introduction of sheep.

Description of land recovery after heavy stocking Port Stephens.(Dean). Describing white grass spreading rapidly again when land is rested, which we are also seeing take place even today in these dryer times.



In 1904 when the purchase of the Station commenced to fence off all the hard camp and force the sheep onto Hannah was failing and little progress was made until h Robertson took over in 1909. Robertson was a first cla laid out the Station and gradually bred the sound stock of today, but it was found impossible to stock the Stat available Ewe camp. Purchase of the Corriedale sheep a a success owing to the heavy losses, had it been possib annually 2 - 3,000 young hardy sheep the Station would today.

The Cattle are Black Welsh, no other Bulls have be years and they have proved themselved excellent dual pu Steers have killed up to 1200 lbs., dead weight, and I 50 heavy prime fat Bullocks should not be sold in Stan With Albemarle, 100 head could be fattened.

Since 1909 the Camps which were eaten down have be nursed, no summer burning allowed and the place is now the white grass spreading rapidly. The white grass ca stocking when they will improve year by year. In my t the place drying up, in fact the hard camps too much s easy to manage and do not cast but the losses from eli streams are heavy.

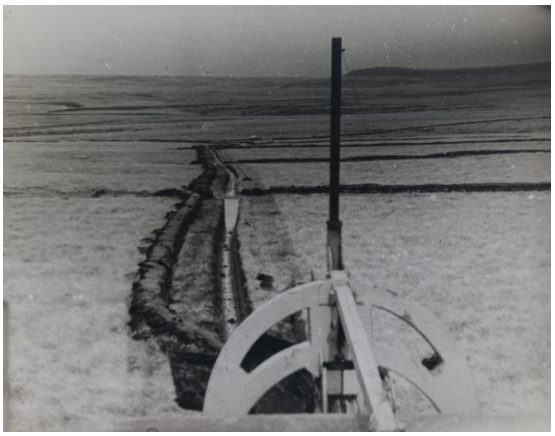
There was a huge fire on Keppel Island the day the Mission schooner *Allen Gardiner* arrived in 1855. It burnt out almost the entire island and parts have never recovered (McAdam 1989).

386 APPENDIX

| Year. | Cattle. Wild. Approx. no. | Cattle. Tame. Approx. no. | Horses. Wild. Approx. no. | Horses. Tame. Approx. no. | Sheep. No. | Wool exported. lb. | Wool exported. Value. £ | Tallow. Value. £ | Sheep-skins. Value. £ | Live sheep. Value. £ | Frozen carcases. No. | Hides. No. | Hides. Value. £ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1846 | 60,000 | 400 | 3,000 | 120 | — | — | — | — | — | — | — | — | — |
| 1847 | 80,000 | 400 | 4,000 | — | 78 | — | — | — | — | — | — | — | — |
| 1851 | 60,000 | 4,000 | 3,000 | 1,000 | 1,000 | — | — | — | — | — | — | 6,000 | — |
| 1854 | 50,000 | 800 | 3,000 | 1,200 | 2,500 | — | — | — | — | — | — | — | — |
| 1858 | 50,000 | 800 | 3,000 | 1,200 | 7,650 | — | — | — | — | — | — | — | — |
| 1861 | 9,000 | 19,338 | 3,000 | 1,200 | 11,550 | — | — | — | — | — | — | — | — |
| 1863 | 9,000 | 19,338 | 3,000 | 1,200 | 19,300 | — | — | — | — | — | — | 2,170 | 2,180 |
| 1865 | 12,000 | 20,216 | — | — | 26,605 | — | — | — | — | — | — | — | — |
| 1868 | 5,000 | 24,570 | 300 | 1,090 | 57,735 | — | — | — | — | — | — | — | — |
| | *Wild & tame.* | | *Wild & tame.* | | | | | | | | | | |
| 1871 | 13,390 | | 1,504 | | 64,675 | 248,800 | 10,300 | — | — | — | — | — | — |
| 1875 | 13,390 | | 1,504 | | 185,400 | 735,902 | 28,472 | 3,006 | — | — | — | — | — |
| 1878 | 13,390 | | 1,504 | | 312,300 | 1,253,249 | 35,732 | 4,874 | — | — | — | — | — |
| 1880 | — | | — | | 435,700 | — | 68,327 | 6,760 | 2,144 | — | — | — | — |
| 1884 | 11,569 | | 2,270 | | 473,227 | — | 74,652 | 13,314 | 5,686 | 2,720 | — | — | 4,242 |
| 1886 | — | | — | | — | — | 72,998 | 3,640 | 3,813 | 10,949 | 30,000 | — | — |
| 1891 | — | | — | | — | 3,885,210 | 105,225 | 3,200 | 8,584 | 1,893 | 18,277 | — | — |
| 1893 | 8,192 | | 3,294 | | 770,000 | 3,885,194 | — | 1,980 | 16,430 | 1,343 | 11,681 | — | — |
| 1896 | 6,850 | | 3,250 | | 791,442 | 4,187,628 | 112,139 | 5,305 | 11,431 | 1,008 | — | — | — |
| 1901 | — | | — | | 762,357 | 4,373,340 | 89,029 | 4,666 | 9,366 | 100 | — | — | — |
| 1904 | — | | — | | 702,444 | 4,259,420 | 115,359 | 520[1] | 9,369 | 18 | — | 263 | 298 |
| | | | | | | | | | | | *Canned meat.* Cases. | *Canned meat.* Value. £ | |
| | *Tame* | | *Tame* | | | | | | | | | | |
| 1908 | — | | — | | 688,705 | 4,401,089 | 110,186 | 6,298 | 12,095 | 611 | — | — | 569 | 503 |
| 1911 | 7,859 | | 3,554 | | 706,170 | 4,643,781 | 150,134 | 8,830 | 16,853 | 419 | 1,335 | 1,335 | 1,027 | 931 |
| 1915 | — | | — | | 690,575 | 4,670,255 | 188,541 | 3,679 | 17,818 | 3,327 | 3,111 | 5,841 | — | — |
| 1918 | 7,250 | | 3,250 | | 669,996 | 4,809,539 | 294,310 | — | 26,888 | 157 | 5,662 | 13,986 | — | — |
| 1921 | 7,674 | | 3,497 | | 667,677 | 4,234,665 | 124,155 | 909 | 2,009 | — | — | — | — | — |

[1] A large quantity of tallow remained unexported at the end of the year.

From Boyson's book (1924) stock records show there were almost twice as many sheep on the Falklands in 1896 as there are now. And that is not even counting in 6850 cattle and 3250 horses as well.



The impact of Buffalo ditching is important, and may be able to be put to use in rewetting areas of camp (see Nick Pitaluga, this workshop). This picture is probably taken of an area near Fitzroy.

Anecdotal and generational cues about historical land management practices and observations of changing plant communities over time and are key as there is limited data to support baseline knowledge.


We should not take history for granted – there is a lot we can learn from it.

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**3.7**

# THE IMPORTANCE OF INCLUDING INVERTEBRATES IN THE METHODOLOGY, EXPERIMENTATION AND EVALUATION OF ECOLOGICAL RESTORATION IN THE FALKLANDS

*Stephen Gillanders, Aberdeen University & Queen's University Belfast*

Ecological restoration efforts aim to return degraded ecosystems to a more resilient, functional, and diverse state. In the case of the Falkland Islands, grassland ecosystems have experienced severe degradation due to over-grazing, aridification, and climate change. While much of the current focus has been placed on plant, soil and hydrology improvements, the role of invertebrates in ecosystem recovery is often overlooked (Cross et al., 2020). Given their integral roles in processes such as nutrient cycling, pest regulation, and soil health, it is crucial to include invertebrates in the evaluation of restoration success. This summary synthesises key considerations for integrating invertebrate communities into the restoration efforts of the Falklands' grasslands.

**Invertebrates - ideal bio-indicators**

Many invertebrates serve as important bioindicators—organisms whose presence, absence, or abundance can provide insights into ecosystem health and recovery. Invertebrate communities are often highly sensitive to environmental changes, such as shifts in soil moisture, vegetation composition, or grazing pressure (Gerlach et al., 2013). As a result, monitoring invertebrates can offer valuable data on the progress of ecological restoration(Gomes Borges *et al.*, 2021).

Fig 1. Fig 1 – Collembola species (springtail) collected along Port Louis Road. ~6mm length.

For instance, the presence of detritivores such as springtails or soil-dwelling arthropods can signal the health of the soil, as these species depend on organic matter decomposition and contribute to nutrient cycling (Greenslade, 2007; Magoba & Samways, 2012). Similarly, the abundance of predators, such as spiders, can indicate a well-functioning food web and healthy ecosystem (Scott et al., 2006; Horváth et al., 2009).

Fig 2. The author sampling for invertebrates, Weddell Island. Photo Lewis Clifton.

**The need for grassland restoration in the Falklands**

The grasslands of the Falkland Islands have been significantly altered by human activities, primarily through over-grazing by sheep, which has led to a decline in native plant species and the introduction of grasses favoured for grazing. These habitats have also been impacted by climatic factors, particularly drying out of soils, water scarcity and intensified weather events. These pressures have resulted in stressed plant communities, sometimes with significant soil erosion, which negatively affects both plant and invertebrate species that rely on the soil for habitat and food sources.

In the Falklands, invertebrate communities have been largely ignored in discussions around restoration efforts. Yet, their inclusion in monitoring and evaluation is vital for understanding how effectively the restoration activities are improving ecological processes.

One of the most pressing issues in the Falklands' restoration efforts is the lack of detailed knowledge on invertebrate communities. While preliminary surveys have shown surprisingly high diversity among the invertebrate fauna, there remains much to learn about the specific roles invertebrates play in the ecosystem, and how they might be impacted by ongoing restoration activities. Without baseline data on invertebrate diversity, it becomes difficult to assess whether restoration efforts are successfully enhancing ecosystem diversity or functionality.

**Restoration treatments and invertebrate responses**

Restoration efforts in the Falklands will likely focus on several key strategies: the reduction or alterations of grazing pressure, sowing of native grasses, and water management through re-wetting and improved hydrological retention. These interventions aim to enhance soil health, increase plant diversity, and restore water availability, all of which will likely have cascading effects on invertebrate communities. However, given the lack of baseline data on invertebrate populations, it is unclear how these treatments will impact species diversity, abundance, or functional groups or how the success of these treatments will depend on invertebrate species.

Reducing grazing pressure, for example, could have mixed effects. On one hand, it may lead to the recovery of native vegetation, which could provide habitat and food sources for invertebrates. On the other hand, some invertebrate species that have adapted to the current conditions and studies have highlighted the complexities involved in grazing to accommodate a target taxa (Pozsgai et al., 2022). As such, monitoring will be crucial to understanding the long-term impacts of grazing management on invertebrate populations. Conservation grazing and management can create habitats beneficial to invertebrates (Bonari *et al.*, 2017). Maintaining low grazing levels allows for the development of tussocky vegetation, providing shelter for invertebrates such as spiders and ground beetles, especially during overwintering. Grazing management can also prevent the overgrowth of dry grasslands by woody plants, maintaining the habitat structure that supports diverse invertebrate communities (García *et al.*, 2009). Consideration could be given to increasing the proportion of cattle grazing with concomitant reduction in sheep numbers to alter herbivory regimes.

Similarly, the re-wetting of the land could create new microhabitats for certain species, while potentially disrupting others that are adapted to the dry conditions. For instance, species that are highly adapted to arid environments might be negatively impacted by increased moisture, whereas species that thrive in wetter conditions could benefit from these changes. A careful evaluation of invertebrate responses to different levels of moisture retention will be key in understanding how best to balance restoration efforts with the preservation of species adapted to the Falklands' unique climate regime.

To integrate invertebrates into restoration evaluations, a comprehensive monitoring strategy must be implemented. Effective monitoring methods could include sweep netting, pitfall traps, and monolith sampling. These techniques would allow for the capture of a range of invertebrate species from different habitats and strata, providing a better understanding of species composition and abundance. Additionally, a standardised methodology should be developed for sampling across different sites, including both restored and unrestored areas, to ensure comparability.

**Monitoring methods and challenges**

In terms of sampling frequency, monthly monitoring would ideally provide sufficient temporal resolution to track changes in invertebrate communities over time. However, due to the significant time and effort required for sample sorting and data analysis, a more practical solution may be to prioritise areas undergoing active restoration. Within these areas, specific groups of invertebrates such as springtails, spiders, and beetles could be targeted for initial sampling. These groups are not only indicative of soil health and community structure, but they are also relatively well-studied, with available expertise in identification.

**Active vs. passive restoration**

Active restoration techniques, such as hay transfer from species-rich donor meadows to species-poor recipient grasslands, have been shown to enhance invertebrate diversity. This method introduces a variety of plant and invertebrate species to the recipient site, promoting a more diverse and functional ecosystem. Studies have demonstrated that hay transfer can effectively increase both plant and invertebrate diversity in restored grasslands, and that plant restoration success ,can be positively correlated with invertebrate re-introduction (Woodcock *et al.*, 2010; Stöckli *et al.*, 2020).

Active restoration efforts may be more effective in jumpstarting recovery, but passive restoration—allowing ecosystems to recover on their own, generally after stock reduction or removal—may be useful in some contexts, particularly where natural processes can re-establish ecological balance, and the conflict between finances and conservation does not impede such efforts. Monitoring invertebrate populations in these two scenarios will help determine which strategy is most effective for promoting invertebrate diversity and functionality.

One of the most useful experimental designs for evaluating restoration success in the Falklands is the "edge effect" study, where contrasting restoration treatments (active

management vs. passive recovery) are applied to different parts of the landscape. By comparing areas that undergo active interventions, such as sowing native grasses or removing grazing pressure, with areas left to recover naturally, it will be possible to determine the relative effectiveness of these treatments in influencing invertebrate communities.

**Suggested experimental methodologies**

Outlines of potential experimental methodologies to establish the role of invertebrate communities in ecosystem functioning are proposed. These suggestions could provide empirical evidence to support restoration efforts. These studies align with existing research and can provide empirical, Falklands-specific data on the role of invertebrates in ecological restoration.

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**Paired plots: Invertebrate community response to grazing exclusion**

**Objective:**
Examine how invertebrate community composition and diversity respond to different grazing intensities and exclusion treatments over time.

**Methods:**

- Select paired plots: (i) continued sheep grazing, (ii) reduced grazing intensity, (iii) complete grazing exclusion.
- Monitor invertebrate diversity and abundance monthly using pitfall traps, sweep netting, and monolith sampling.
- Assess soil moisture, vegetation structure, and plant species composition as co-variables.
- Compare functional groups (predators, detritivores, herbivores) across treatments.

**Expected Outcomes:**

Information on grazing regimes' impact on soil invertebrate assemblages. If overgrazing negatively impacts invertebrate biodiversity, restoration efforts should include strategic grazing reductions.

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**Edge effects: e.g. active vs passive restoration**

**Objective:**
Test how invertebrate communities differ between actively restored grasslands (reseeding, hay transfer) and passively recovering areas.

**Methods:**

- Establish transects running from one treatment to another.

- Sample invertebrates every 10m along the transect using pitfall traps and sweep netting.
- Measure aboveground biomass and soil properties as indicators of habitat recovery.

**Expected Outcomes:**

Actively restored sites should result in higher functional diversity. Passive recovery areas may have higher abundance but lower diversity due to slow plant succession.

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**Soil fauna as indicators of restoration success**

**Objective:**
Determine whether soil invertebrate abundance (springtails, mites, earthworms) correlates with soil recovery post-restoration.

**Methods:**

- Select sites under different stages of soil recovery (e.g., bare soil, succession, mature).
- Use monolith sampling to extract soil invertebrates.
- Measure organic matter content, water infiltration, and microbial activity alongside invertebrate surveys.

**Expected Outcomes:**

Soil health improvements should lead to greater detritivore abundance (springtails). High soil biodiversity could correlate with increased plant biomass and reduced erosion.

**Overall conclusion**

Incorporating invertebrate communities into the monitoring and evaluation of restoration efforts in the Falkland Islands is essential for understanding and guiding the recovery of these ecosystems. The use of invertebrate bioindicators will provide valuable insights into how restoration strategies, such as the reduction of grazing pressure, the sowing of native grasses, and water management, impact ecosystem processes. Given the limited knowledge of invertebrate diversity and roles in Falklands habitats, the establishment of long-term monitoring protocols and the collection of experimental data are crucial steps in ensuring the success of restoration programs. With a focus on species richness and functional diversity, invertebrates can help to gauge the overall health and resilience of restored habitats, contributing to more informed and effective ecological restoration in the Falklands.

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# SESSION 4. VEGETATION MANAGEMENT

## 4.1 LEARNING FROM PAST RESEARCH

*Jim McAdam, Queen's University Belfast*

Due to time pressure, not all the relevant material on past vegetation research in the Falklands was able to be presented at the workshop. This paper includes the additional material, some of the relevant content from a Wool Press article in 2023 and from a presentation at Farmers Week in 2024.

**History**

The history of agricultural research and development in the Falklands is a long one. The first official agricultural scientist to visit the Falklands was Hugh Munro ( Principal District Inspector of the Department of Agriculture, New Zealand , 1924). Thereafter there were notable visits from William Davies (1939) and of course (and not to be overlooked) significant development and advances, often by trial and error, by individual farmers and land owners.

Given that the centenary of Munro's visit has just passed, it is salutary and somewhat sobering to read his comments that the Falklands had been overstocked for at least 30 years before and irreparable damage had been done by "injudicious burning and overstocking". He commented that "Nature insists that soil shall be protected by a covering of vegetation of some kind, and the experience of all countries has been that when man destroys indigenous vegetation, and fails to replace it immediately with some other, nature will provide one of her own choosing, which is usually very inferior to that which man destroyed". A very prescient message which has never been more relevant than today. Apart from Munro's report which encouraged the principle of farming in harmony with nature, all future reports, from W Davies (1939) onwards, were concerned about increasing performance and production of livestock – man's dominion over nature.
Perhaps now we have come full circle, and now, 100 years on, the focus is on sustainable land management –more than just about livestock and outputs.

While these other more famous government - funded agriculturalists have left reports and documented and published their work and findings, I feel there is a real gap in recording and documenting the on-the-ground experiences of farmers and land owners and properly evaluating their findings for the benefit of the wider farming community. Given that the farm structure has changed so much over the last 40 years, this collective knowledge is all the more important and good evidence for the importance of this workshop, for which credit must be given to the RBA. Probably the most significant visit of all was that funded by the then UK

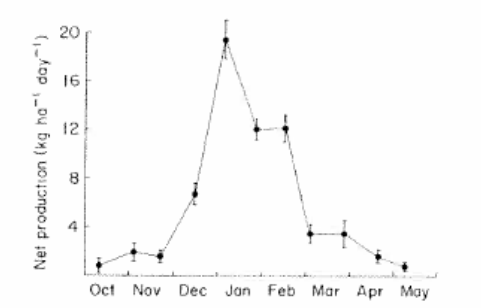
Overseas Development Administration, in 1969. A team of agricultural specialists led by Tom Davies produced a major report in 1971 on " The Sheep and Cattle industries of the Falkland Islands". This was a very comprehensive visit, by a multi-disciplinary team which actually carried out some field trials on farms.

One of their main recommendations was to establish a permanent agricultural research unit in the Islands which would have the capacity to conduct field trials on which to base their advice. One of their main tasks was set as testing a lot of the emerging research carried out by the UK's Hill Farming Research Organisation( HFRO) in Scotland. Their work, particularly on integrating sheep nutritional requirements with pasture quality and growth into what became known as the "*two pasture system of hill sheep management*" was a huge advance in hill sheep farming in the UK and became the central core of the research unit established in the Falklands – the Grassland Trials Unit (GTU).

**The GTU and early research**

The remit of the small team (3) of agriculturalists who set up the unit (in 1975) was to : "describe the natural limitations to agriculture in the islands and investigate ways in which agriculture could be improved". The agronomy programme (McAdam 1980) was based on supporting the introduction of the Scottish hill farming 2-pasture system model, quantifying the production and quality of the native pastures and investigating the potential for reseeding – species, fertility etc. As scientists and land managers I believe we should follow the mantra that you must **measure before you can manage**. This applies equally to soils, plants and biodiversity as it does to stock and wool quality.
Using grazing exclusion cages, production from a range of vegetation types was quantified and the seasonal growth of Whitegrass measured in trials at Rolon Cove (Bluff Cove) and Moody Brook. This highlighted how seasonal green growth production was..

In the 1970s climate change was not an issue but all the previous reseeding with Yorkshire Fog had been done on the tops of the ridges and dwarf shrub heath (largely Diddle dee) ground - now failing. Some trials on establishing reseeds, particularly concentrating on direct drilling and/or low levels of lime and clover. (McAdam 1980, 1981, 1984).




*Seasonal growth of whitegrass*

The agronomy programme widened to include more detailed small plot trials on a range of species and varieties and native pasture growth in major trials at Fox Bay (Whitegrass grazing pressure) and on rotational grazing (The Sound, North Arm) ( see later).

As a direct result of subdivision, stocking density overall had gone up by 23% and wool production up 27% between 1978-1988. Sheep numbers were then at an almost all-time high (Past 700,000) and there were bound to have been environmental consequences of this heavy stocking.

There is observational and research evidence that heavy stocking of pasture on peaty soils leads to severe compaction which has resulted in the gradual change in the ecological composition of the vegetation from dense, mixed species grass-based pasture to shrub -based grassland which has less value for biodiversity, carbon storage and sequestration – loss of carbon through evapotranspiration is greater from sparse woody shrubs than moderately grazed grassland. Now we are seeing the effects of heavy grazing exacerbated by drying out associated with climate change leading to replacement of whitegrass by Diddle-dee on heavily compacted soils.

All previous reports and R & D activities were concerned about increasing performance and production of livestock. Now the focus is on sustainable land management – more than just about livestock.

**Moving on from the GTU**

In 1980 the GTU morphed into the Agricultural Research Centre (which later became the DoA) and greatly expanded its programme (with sporadic input and advice from the United Kingdom Falkland Islands Trust) to include research on shelterbelt provision, seaweed fertiliser (organic)Tussac grass and more latterly climate risk and soil mapping. For instance, There is good evidence, some of it from the Falklands, that shelter from trees or whatever source: reduces evapotranspiration, introduces mycorrhizal fungi, benefits stock and may have a role in retaining carbon and revegetating difficult soils.

Although there are wider environmental issues to take into consideration, from trials in the Falklands, (Radic 2010, McAdam, 1989) seaweed can be a sustainable fertiliser use option (even as beach deposit) and a soil enhancer as a climate change resilience measure. Globally there is great interest in including seaweed in ruminant diets to reduce methane emissions.

There is a huge bank of good local information, research and experience (as evidenced from Sessions 1&3 of this workshop) on revegetating eroded areas with native species such as Tussac, Bluegrass etc to reduce GHG emissions, sequester carbon, support biodiversity and, if sustainably managed, act as a livestock feed. Some personal thoughts on issues to be investigated given the potential of seedling grasses to reduce emissions and increase sequestration: mechanise the planting process for some sites; mass production of seedlings;

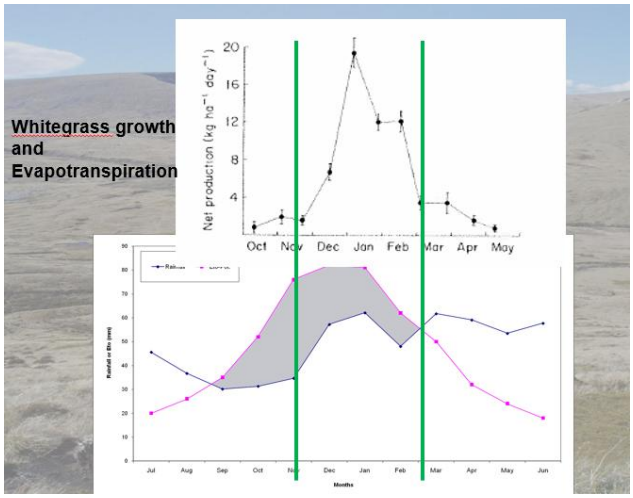
genetic diversity – match genotype to site; Reconsider planting density/ configuration in light of extreme drying out of sites being replanted.

Looking ahead these are some of the tools in our armoury - which we have previous evidence for from a legacy of research in the islands - to help make farming more climate resilient going forward.

**Impacts of potential climate change**

By about 2010 climate change was starting to become an issue of concern in the Falklands - the islands were getting warmer, drier and windier. Climate change predictions (Jones et al 2013) were for over 2 deg C temperature increase over next century. This estimate is already over 12 years old and given the current serious rate of global temperature rise, it is likely this will be a considerable underestimate. It may not seem like a lot but the baseline temperature in 2013 was 6.6$^{o}$ C, so the Falklands are likely to experience potentially over a 30% rise in mean temperature. This will have huge implications. Increased temperature makes air hold more energy and moisture - weather and climate is less predictable and extremes more frequent and violent. Specifically there will be changes in rainfall distribution frequency and increased storminess and windiness - more evapotranspiration (moisture and water vapour evaporating from the soil surface and being lost through plants). There are approximately 5 summer months (October to February) when evapotranspiration exceeds rainfall – this is therefore potentially a soil moisture deficit(SMD) period. This is a key, high-risk issue for the Falklands. If the soils are dry and plants have no access to moisture they will stop growing and perhaps die. Predictions are that the SMD period will increase-particularly in the autumn. In the context of climate change mitigation, adaptation and resilience, a need was identified for a soil/peat map of the Falklands (see below). This is now complete (Darwin + with SAERI, FIT, DoA and other partners). It is a potentially hugely valuable tool but now needs to be refined and applied in practice alongside other research on GHG emissions from flux tower data.

Climate change is having huge implications for grass growth and grazing management: - Animal welfare and grazing distribution issues; Economic impact (eg boreholes, fencing and stock movements); Biodiversity loss; Likely high emissions. If the plant growth curve measured in 1977/78 is superimposed over potential SMD predictions (see below), it is a stark picture of the pressures plants will face and where pasture growth and production is going.




*Superimpositon of the Evapotranspiration/precipitation balance (soil moisture deficit period) over the annual growth curve for whitegrass*

There is clear evidence that the effects of climate change are already being seen in the Falklands- large parts of the islands are showing clear evidence of drying out. Windiness levels are increasing, unpredictability of weather events, drought exacerbated by increased evapotranspiration-ponds drying out, effective rainfall reducing (dry, hard soils do not absorb moisture). These have all been highlighted in this workshop.

Based largely on proxy research on similar northern hemisphere peaty soils, predicted climate changes are likely to reduce soil organic carbon through: Increased decomposition relative to plant productivity, irreversible desiccation and drying out of peat, increased erosion, Increased fire risk

There were two relevant projects to help focus on the problem :-

1. An EU - funded climate change risk analysis (TEFRA) project (partners: FI Trust, DoA, Falklands Conservation, and Kew) which showed that the priority impacts would be Increased soil moisture deficits and erosion. There would also be: - Changes in soil carbon content; Changes in plant pests, diseases & invasive plants; Changes in the ranges of native plants; and habitat disturbance by extreme events eg wildfire occurrence, wave action. The impact on soils are evapotranspiration, loss of soil carbon from bare soil surfaces (where it oxidises to C02 after drying out) and soil erosion.
2. In the context of climate change mitigation, adaptation and resilience, a need was identified for a soil/peat map of the Falklands. This is now complete and is a potentially very valuable tool but now needs to be tested, refined and applied in practice. From a research perspective it needs to be verified and used to extrapolate factors affecting GHG emissions from soils and, from an applied perspective, mitigating these through vegetation management, incorporating some of the research-based tools referred to above (see papers from Session 2).

**Looking Forward**

Taking forward the need is still to **measure** before we can **manage,** in terms of emissions from soils, we need a GHG baseline to move forward with sustainable land management options – and to make our wool more marketable.

What are the next steps? Faced with an extremely serious climate change challenge, I feel we need to quantify evapotranspiration and effective rainfall (ie to set baselines) and have storminess predictions carried out. We can now quantify the soil resource and are now on the road to quantifying net emissions - what might the effect of these be on soil microbiology as well as carbon needs to be investigated further.
More importantly, and what is the applied outcome of all this, - what vegetation structure and cover do we need to maintain a sustainable land management system going forward.

**Vegetation management for carbon and biodiversity retention**

*Some basic principles:*

- Farming and livestock production is still our priority. People need food and farming must be economically viable to deliver the rest of the objectives.
- Ecosystem services delivered are a societal good and must be viewed (and paid for) as such
- Bare peat / soil = carbon loss
- Need to retain litter production and a "crust" at ground surface and to maintain as dense a vegetation cover as possible – helps keep soil cool and retain carbon.
- Need a pasture height and structural diversity which reduces wind run near the ground surface to reduce evapotranspiration
- This vegetation structure balance is critical and may need to be manipulated by grazing density and seasonality

To attempt to put some quantitative guidelines on this challenge, there is a need to try and extract every bit of evidence we have from the Falklands about how best to manage vegetation to help reduce emissions loss and promote C sequestration and biodiversity - while still maintaining agricultural production at a sustainable level.

In some scenarios the most appropriate option may be to reduce/remove stock. In this case, the principle of economic reward for the value of ecosystem services supplied should be recognised and implemented. It may also be possible to retain stock numbers on some farms by increasing the forage productivity of certain appropriate areas of the farm by reseeding (using minimal land disturbance techniques) with a range of other forage species (eg selected multi-species swards, forage crops). This could then release/remove stock from more ecologically sensitive areas. In this context it is important to revisit and learn lessons from previous research and experience where a range of forage crops and inputs have been tried..

**Looking Back on some relevant past research to go Forward**

To achieve the objectives outlined above we need some fundamental changes in grazing practice. Grazing decisions should be based first and foremost on pasture condition and direction of change. If this is set right with appropriate stocking levels, then the impact on stock performance will be beneficial - though grazing densities may well have to change. Animal welfare considerations, particularly access to water, must be paramount.

*We need bespoke solutions* – and supporting advice and funding from whatever source.

**Early Whitegrass grazing trials**

One relevant trial to revisit data from is the *North Arm ( Sound ) rotation scheme* (1979-1983) project carried out by GTU/ARC. The idea was to make use of the sheep's "homing" instinct both to improve some pastures by heavy grazing and to spell other areas of ground so that the vegetation could recover from grazing to provide a reserve of feed along the fence lines. A strategically placed fence was erected which prevented hoggs from returning to their "home" camps on being turned out after shearing.

They "hung" on this fence waiting their chance to be let through. Thus, very large numbers of sheep grazed the vegetation along the fence line extremely heavily. The intensity of grazing became progressively less with distance from the fence. Since the original vegetation was predominantly whitegrass it was possible to monitor the changes in this type of pasture under various intensities of grazing.

***Findings:*** Heavy grazing reduced whitegrass and replaced it with less suitable species for grazing - pigvine and Christmas bush/Diddle Dee. Grazing decreased whitegrass plant numbers and increased (+/-) tiller density.

While this was essentially a stock performance trial, fortunately some measurements of bare ground were taken. These are now very important in the type of vegetation cover we are trying to create.

*Previously there was little bare ground but in* heavily grazed areas there was a slight decrease over 2.5 yrs. There was still too much bare ground and no leaf litter. In lighter grazed areas there was little change over the duration. Fortunately we still have the collection of photos taken to record plots and can re-examine these in a different light.

Following on from this research, is it possible to get some objective measure of the level of stocking which will maintain the happy balance between keeping the whitegrass short enough to stop significantdie-back, keeping it dominant, yet retaining enough green leaf present to feed the sheep and allow the grass to support itself?

To try and get this level of stocking, a major grazing trial was set up by ARC at Fox Bay (1985-86). 3ha paddocks were stocked to maintain whitegrass at heights, of 4, 8, 12, 16cm (3 replicate plots of each). This was a huge infrastructural effort and a lot of data was collected. 8cm pasture was the best compromise between increased utilization and sward stability. But how might this stand up to the droughts we are facing nowadays? We needs a further analysis of the bare ground data and sward heights.

**Other evidence sources;**

1. There are several other trials on cutting and grazing of whitegrass. They all gave roughly the same message- under heavy defoliation, whitegrass dies out - shrubs like Christmas bush and Diddle-dee, and some herbs come in.
2. As mentioned above, reseeding with minimal land disturbance may be an appropriate option – there is plenty of experiential and trial evidence from here and elsewhere
3. Evidence from vegetation and soil maps – and particularly from the observations on vegetation change over time we have had presented at this workshop.

**Effects of fire**

Whitegrass is an unusual plant adapted to a dry, windy low-nutrient environment (as are many other Falklands plants), probably under quite narrow climatic boundaries. It depends on retaining a protective cover (above and round the leaf sheath) of dead tissue which is an important part of its growth potential. Fire/burning inevitably weakens the plant and reduces the climate resilience of the whole pasture. Fire risk is increasing with climate change.

**Summary -what vegetation structure are we aiming for?**

- We need to keep as dense a vegetation cover as possible- avoiding bare ground. Dense grass cover at the correct height and with variability in the canopy, slows wind movement over the surface, reduces evapotranspiration, allows more species diversity keeps ground cooler and moister -reduces evapotranspiration.
- Too tall and rank vegetation creates shade - biodiversity loss, fire risk, increased evapotranspiration
- Shrubs on peatland can increase evapotranspiration
- Need more evidence on impact on GHG emissions from different vegetation types and soil surfaces. This work is ongoing

**Where we need to restore vegetation**?

- There is a huge bank of good local information and experience on revegetating eroded areas
- Using Tussac, bluegrass etc (see this workshop)
- Change grazing patterns- remove, spell, reduce or rotate. Animal welfare considerations - water

- There may be some opportunities for rewetting to raise the water table
- Above all, we need bespoke solutions, one size does not fit all – and support funding.

We need to translate a lot of the measurements from the ongoing basic science trials into applied science to develop stocking densities and seasonal grazing patterns which are sustainable and will enable us to deliver (with support) - Meat/wool production; Carbon retention and sequestration; Habitat - related biodiversity targets

And most importantly retain people on the land with the appropriate skills and backing to deliver these objectives.

There needs to be a recognition from Government, commerce and wider society in the Falklands that farming is an industry which can, and does, deliver not only food and wool but a wider range of environmental and societal benefits. With an acceptance of the need for change, these can be delivered, but at a cost and must be paid for by some fair mechanism which leaves the farmer central to the decision making process and able to make a reasonable living. This is the fundamental challenge of a proposed Land Recovery Programme.

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**4.2.**

## DEPARTMENT OF AGRICULTURE STRATEGIC PLAN

*Matt Davies, Erica Berntsen, Olivia Woodiwiss*


### Overview of DoA

*Matt Davies – Head of Agriculture*

As conservationists (and farmers) we leave our legacy on the face of the earth with everything we do. This gives us a sense of humility and sharpens our recognition and awareness of what people before us have already tried and done.

The DoA has an ongoing strategic plan – built around : *Resilient Land and Grazing Systems* ; *Enhancing the Wool Economy;* and Food Security and my predecessor Katrina Durham and currently Zoe Fowler have put a lot of work into this - though we have been sidetracked a bit in the priority need to develop this Land Recovery Programme.

Our overarching goal still remains to *sustain a resilient, thriving camp economy.*

*Research & Extension* is an important function of our work and we work closely with partners in SAERI on topics such as Land capability assessment which emerged as a key topic yesterday. The overarching mantra of *You must measure before you can manage* underpins all our work and we adopt the principle of Adaptive Management – Plan, Do, and Learn. This is a key approach in dealing with the uncertainty we face today. Monitoring is also a key element in our work and it will be an essential component of any Land Recovery Programme..

**4.3**

## PROJECT UPDATES

*Erica Berntsen – Assistant Agricultural Advisor*

*Wildfire training.*

To answer a point raised by Lewis yesterday, I'm happy to say that thanks to a Darwin Grant for a joint project between DoA, DoE and FIFRS, we've been able to recruit the expertise of Andy Elliott and associates of WildfireTaC to deliver wildfire training. Since 2023, 143 accredited certificates have been awarded. 62 people have been trained on Vegetation Fire Foundation, 42 on Vegetation Fire Operator, 34 in Wildfire Management Plan and 5 in Prescribed Fire Management. In late February, members of the Falkland Islands Fire and Rescue Service will be trained in delivering the VFF and VFO Falkland versions of the course, this will enable the long-term sustainability of these skills being based in the islands.

*Calafate.*

Since the engagement of Indigena Biosecurity International in 2019, 2844ha has been surveyed for Calafate and had control carried out. This season saw the completion of the control of the main infestation at Port Sussex and Head of the Bay. This is an amazing achievement and shows that it is possible. There are still some paddocks to receive initial control, however the density of calafate is not as intense. Once these paddocks have been tackled, the follow up phase begins, requiring 3/4 yearly surveys and control of new plants.

We then need to think about other areas of calafate and raise public awareness to the issues with the species, and begin tackling other populations that may be growing. Once calafate is eradicated, we can begin to think of our next species to target.

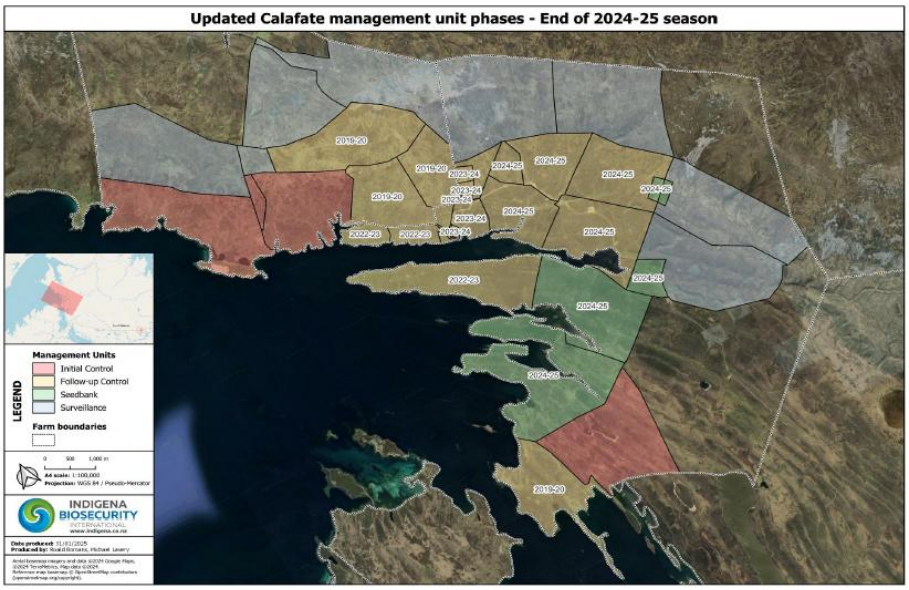



*Figure 1 Map of calafate infestation area showing the control progress as of the end of the 2024-25 season. supplied by Indigena Biosecurity International*

**4.4**

# BUILDING ENVIRONMENTAL RESILIENCE: THE ROLE OF STRATEGIC GRAZING IN THE FALKLANDS

*Olivia Woodiwiss*

Introduction

In August 2024, Olivia Woodiwiss joined the Falkland Islands Government, Department of Agriculture, as the newly appointed agricultural advisor for land management and grazing systems. With a background as an agribusiness consultant, Olivia brings extensive knowledge from the private sector. Her role focuses on guiding the strategic direction of farming businesses in intensive grazing, business goals, and environmental stewardship. Olivia has experience working with industry bodies, farmers, and local government in providing effective extension activities.

Adapting her previous experience to the Falklands, Olivia advocates for grazing management based on plant morphology to ensure adequate rest and recovery of plants, thereby optimizing grazing timing. Adequate rest periods for plants enhances root and shoot development, supporting plant persistence and resilience – especially in the face of climate change.

Historically, there has been significant focus on animal management, but plant management is equally crucial. Aligning grazing animals with optimal plant management is essential; losing the plant means losing the opportunity for sustainable farming. Understanding the seasonality of Falklands' plants is fundamental.

For the first six months, Olivia's position has been intentionally focused on listening and learning from both the Department of Agriculture (DoA) and farmers. There is a wealth of research, trials, and information previously collected by the DoA, and the goal is to consolidate this knowledge and identify gaps to improve productivity and profitability for farmers across the Falklands.

The key question is how to adapt our knowledge of grazing native species in the Falklands to provide practical guidance to farmers, enabling them to make informed decisions about their grazing system and business goals. Farmers have spent decades learning the best strategies for the Falklands' unique environment, and it is no surprise - it takes time to master it.

Olivia's role is to engage with stakeholders, accumulate and share existing knowledge, and provide practical guidance on its application. The DoA aims to support farmers' innovation and allow them to guide research directions to achieve the goal of recovering and sustaining current resources. For researchers, it is important to consider how their research can be

practically applied by those who will use it. Otherwise, what's the point? Olivia sees herself as a conduit between these important networks.

It is crucial to remember, farmers are running businesses. Any adaptations must be economically feasible and financially sustainable. Currently, Olivia is gathering information on:

· Stocking rate changes farmers have implemented

· Vegetation changes observed as a result

· Using geospatial technology to identify the effective grazing area of each property

· And the impact to business productivity.

This information will help undertake an appropriate analysis for future directions. Feedback on how the land recovery program can build environmental resilience for landholders is vital for the longevity of farming in the Falklands. Early engagement with landholders to discuss outlooks and expectations is essential for the program's success.

Olivia is excited about her role and looks forward to working together to make progress on this vital program, ensuring the ongoing prosperity of the Falklands.

Summary

In her role as Agricultural Advisor for Land Management and Grazing Systems, Olivia is committed to enhancing the sustainability and productivity of farming in the Falklands. By integrating her experience with local knowledge, she aims to provide practical, economically viable solutions which align with the unique environmental conditions of the Falklands.

Olivia's approach emphasizes the importance of plant management alongside animal management, advocating for practices supporting plant health and resilience. Her initial focus on listening and learning from both the Department and farmers ensures her strategies are grounded in real-world experiences and needs.

Moving forward, Olivia will continue to gather and analyse data, engage with stakeholders, and provide actionable guidance to farmers. Her work will support the Department of Agriculture's goal of fostering innovation and sustainability in the farming community.

By working together and leveraging existing knowledge, the farmers of the Falklands can make significant strides in land recovery and environmental resilience, ensuring the long-term prosperity of the agricultural sector.

Image reference: AHDB. (n.d.). Understanding Grass Growth for Beef Rotational Grazing. AHDB Knowledge Library. Retrieved February 5, 2025, from https://ahdb.org.uk/knowledge-library/understanding-grass-growth-for-beef-rotational-grazing.

## 4.5

**SESSION 4 DISCUSSION**

Discussion topics

*Turning old reseeds back to something better*? Depends on a seedbank being available. Support for Yorkshire Fog. Overall sense of optimism. DoA is keen to work with farmers who have examples of this.

*Sustainable intensification*? Can reduce the pressure on other more sensitive habitats on the farm.

*Grazing pressure?* The more you graze the more you have to rest. Most places do best with short, intensive grazing and adeqaute rest period which allow the plant to be fully recovered before the next grazing. . What is the ideal rest period for each vegetation type? Depends on a lot of variables such as species type, seasonal conditions, time of year. This is what we need to work out.

## SESSION 5 *CARBON AND BIODIVERSITY CREDITS*

## 5.1 CARBON OFFSETTING : WHAT ARE YOUR THOUGHTS

*Ben Taylor, Falklands Conservation*

**Summary**

The session aimed to engage attendees on carbon offsetting and gather their high-level input on themes within this topic. An initial discussion introduced some basic principles of carbon offsetting and highlighted the importance of these to deliver environmental restoration through leveraging of their climate change mitigation benefits. The concepts of Additionality, Leakage, and Permanence were also introducing along with likely requirements around independent Validation and Verification.
During the session attendees completed a survey on, and discussed, the following topics: their interest in carbon offsetting, thoughts on what a carbon offset project would look like, the costs that should be considered, possible barriers to engaging and other concerns. These responses and discussion will provide valuable insight into assessing carbon offsetting feasibility and any future developments of such a scheme. Further engagement opportunities and sessions are planned for the coming months in 2025 to build on these initial responses and inform the delivery of the project in 2026.

**Presentation contents**

***Offsetting in the Falklands***
*Current work*

Study will improve our understanding of GHG emission and carbon storage potential of our peatlands and assess the feasibility of carbon offsetting.

*What is being done?*

- Long-term GHG flux measured at over 25 sites across the Islands to generate specific emission factors.
- Different habitat conditions of relevance selected to inform potential for offsetting and national emissions accounting.
- Peat cores sampled for past accumulation rates, formation drivers and composition data.

***What is carbon offsetting?***
Voluntary carbon market (VCM)
Is a mechanism to sell the climate mitigation benefits resulting from an initiative, such as*, peatland restoration which reduces environmental GHG emissions.* Offsets can be achieved through avoidance, reduction, or removal. Rigorous standards are necessary to prevent

inappropriate or false issuance of carbon credits and provide assurance to buyers of their tangible benefit. Generally underpinned by a process of *Validation and Verification*.
Key components of VCM projects are a*dditionality, leakage, and permanence*.

***VCM Project opportunities***

Main challenges around restoring peatlands of the Falkland Islands are probably: *Loss of vegetation cover and cohesion; Drying landscapes and peat erosion*.
Peatland restoration approaches for the Falklands are relatively poorly catalogued or understood, particularly at landscape scale – a major exception being tussac planting. UK approaches include blocking previous drains, re-profiling, creating new pools within erosion features, which may or may not have application in the Falkland Islands.

***VCM Project costs***

Restoration costs will differ depending upon the action being taken. Costs of carrying out restoration could be from various sources:

- Government – e.g. Scottish government are providing £250 million over the next decade for peatland restoration.
- Private investment

***Carbon Finance***

Feasibility of restoration, and its scale, might be a case of balancing costs vs return. Monetary benefit of carbon offsetting is determined by the climate benefit of the restoration. In additions, projects must set aside 'risk pot' which reduces the realised monetary benefit

Average UK Peatland Code Pending Issuance Unit (PUI) value in 2023 was £23.95 (one unit = one tonne of reduced emissions)

***Factors to consider***

<u>Time</u>
Carbon offsetting projects take time to be developed to ensure they are robust and credible. Project success may not be achieved, resulting in delayed *verification* issuance of carbon credits. UK Peatland Code only has *validated* projects despite being in operation for number of years – meaning no 'full credits' have been sold, only PUIs.

<u>Resourcing</u>
Project development, implementation and management can require large amounts of resource – human, material and mechanical.

Validation and Verification bodies must be recognised by the scheme and maintain suitable levels of independence to satisfy and assure buyers.
Capacity limitations of these may impact ability and costs to deliver project.

Knowledge gaps

There is currently limited knowledge on delivering habitat improvement at the scale necessary. Possibility of future projects in development to address this.

Multiple benefits

Projects which result in emission benefits typically deliver co-benefits, such as biodiversity enhancements. Opportunities to leverage these, and their possible value, should be considered at all stages of development.

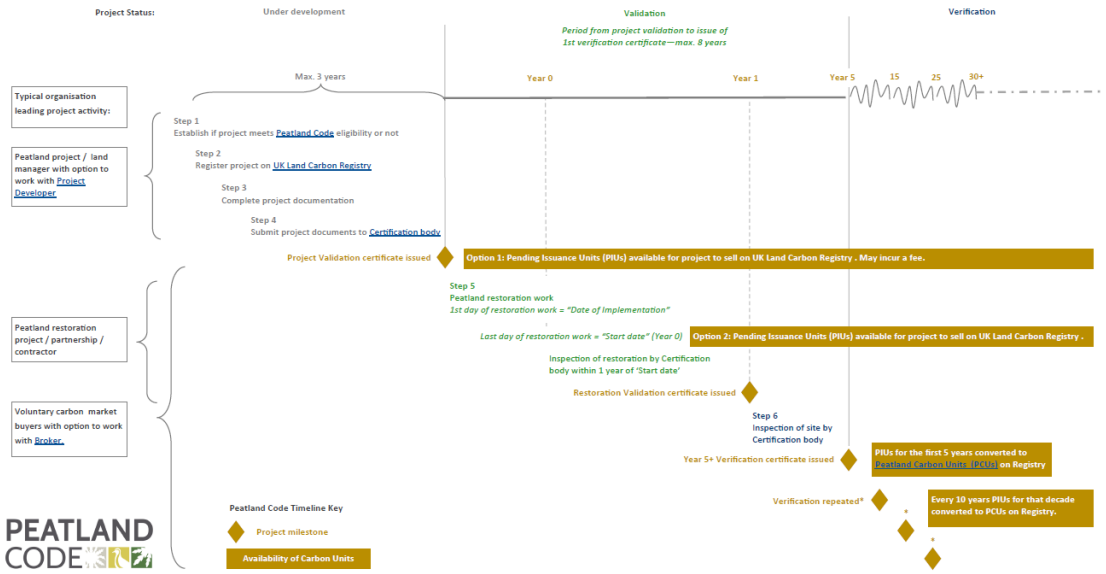
**Final Thoughts**

Ambitions to offset GHG emissions through restoration of the Islands peatlands are fantastic. Work is continuing to assess carbon offsetting feasibility in the Falkland Islands; however, we are not at a stage to conclude that assessment right now.
Offsetting should be used to enable restoration projects by leveraging funding. Offsetting projects must be delivered to best available standards: rigorous, transparent, and trusted.

**For guidance - UK Peatland Code**

The UK Peatland Code is a VCM standard, providing emission reduction credits from peatland restoration. The Code was created, and is administered, by the IUCN and backed by the UK Government. The Code uses UK Greenhouse Gas Inventory emission factors to calculate emission reductions, relying upon the independent, rigours and robust requirements underpinning the Inventory. UK Peatland Code projects follow a prescribed route to maintain rigor – from eligibility, through registration, validation, intervention and on-going verification and management. The potential for Falkland Islands based projects to register under the UK Peatland Code will be explored.

Finally, it is important to recognise the cost, time, and resource necessary to realise a credible carbon offset project.




*Taken from the UK Peatland Code website.*

**Discussion topics**

*Can we insure for fire risk?*

Prevention measures, e.g. leaving firebreaks, having equipment and fire fighting resources/training in the management plan for any project would be important.

*Can we minimise lightning strike risk?*

Fibreglass boats and spars on site; properly sited lightning conductors. Could these be funded under restoration programmes? Emission towers are an expensive risk!

*Who owns the carbon credits from an individual Government funded project*?

The landowner/project developer is the seller (this will be agreed during development). Eg could a dairy farmer claim the credits from the grass growth used in producing milk? No. But most carbon is in the soil (well over 95%) and grassland systems can have quite high soil carbon build up. This might be considered.

The Peatland Code drives most UK carbon accounting initiatives. Baseline is around £24 per t/CO2 equiv sequestered.

*Who carries the cost of verifying the sequestered amount of Carbon?*

The seller/project developer. Buyers need confidence the purchase of credits are delivering real tangible benefits as claimed.

*What proportion of the C credit sale price goes to the land owner*?

Very project specific. Some could be cheap-eg just excluding grazing or reducing sheep numbers; some expensive eg Tussac restoration. As such, although the 'value' from the sale of carbon credits go to the landowner, the resulting 'income' could be reduced by costs such as upfront costs, on-going management, additional interventions, etc.

*How do you determine the price?*

Depends on the project, the capability of the practice, the likelihood of success, management, safety measures etc.

*What happens to credits for people who have already done restoration work on their farm?*

Credits are based on individual projects, not a whole farm. There are controls and rules in place to deal with retrospective projects. It is a problem selling credits from a legacy project.

*Can you modify a scheme/project once it has started?*

Yes, if the overall carbon building function is not lost. Eg an improvement scheme might encourage increased tourism interest. This is fine if it is managed properly and sensitively. Eg controlling vehicle access onto a site etc.

## 5.2

# BIODIVERSITY CREDITS - WHAT ARE THE GAINS AND HOW MIGHT WE MEASURE THEM

*Grant Munro, Falklands Conservation*

While this talk focuses on payments for biodiversity, I think we need to think wider and also incorporate habitat and ecosystem resilience alongside biodiversity. This implies a condition assessment which should include eg ability to retain water in the soil, leaf litter cover etc and generally improve resilience to climate change

**Aims of a Scheme**

The aims of a scheme may be many but whether as a primary or secondary aim we would like to see a positive gain in habitat quality and biodiversity, both as a conservation organization but also because a demonstrable biodiversity gain for wider societal and environmental benefit also helps to further justify payment beyond the agricultural sector This biodiversity gain might be achieved by -Active Restoration; Changes in land management (set-stocking vs rotational grazing); Set-Aside or Spelling (Passive Restoration)

But how might gains be set and measured ?

**Set-Aside + Active Restoration: Two separate initiatives ?**

Active Restoration gains may be obvious and can be measured in % soil cover, area planted or number of tillers. But such bare areas may not be suitable for passive set-aside alone, erosion of bare peat is self-sustaining and clay-patch recovery likely occurs on the multi-decade scale, so set-aside would achieve very little (either in biodiversity or stock numbers / carrying capacity) without also a separate parallel programme for active restoration.

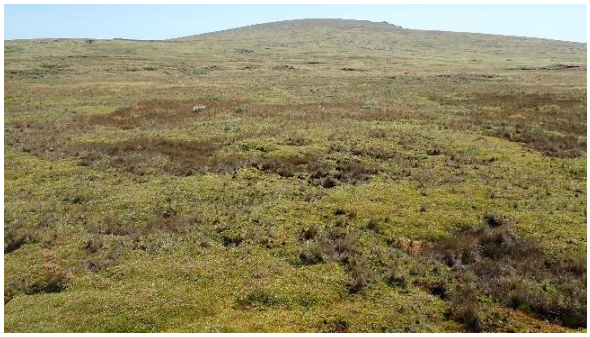
**“Passive” Restoration**

In some instances, spelling of grazing may provide immediate and obvious gains within a 10-year period. But in many situations, changes will be slower and more subtle. The camps may superficially and visually appear very similar, with the same range of plant species present. The Falklands tend to have the same few ubiquitous suite of plant species that are present across the islands from sea-level to mountain top and those same range of species will be present in both grazed and ungrazed pasture. Set-aside will not see an explosion in the diversity or number of species present to be counted, it will be the same species just in better condition with better ecosystem functioning. It is changes in plant frequencies / proportions, habitat quality and ecological functioning that may change - how do we capture this quantitatively ?


Which is the grazed and which is the un-grazed paddock above?

Surprisingly, both have been un-grazed for over 20 years. In terms of species lists if you look hard enough the same general plant list and number of species will be present through the various habitats of whitegrass acid grassland, dry heath and Astelia soft camp from sea level to mountain top (Whitegrass, Christmas bush, Diddledee, Short Brown Rush, Oreob, Mtn Berry, etc) It is the relative proportions, % of bare ground, sward height (to a degree) and soil moisture that will vary. Looking at the close-up of the right hand photo, there is good plant diversity (though again if you looked hard enough you would find all of them in grazed paddocks too), lots of small fachine present but, very importantly, the cover is continuous and the land is holding surface moisture which slowly percolates down to the peatland below; and the mix of herbs and shrubs provides differential rooting depths. This is a healthy resilient ecosystem.

*Lesson to be learnt* - A holistic approach at habitat quality and ecological function is required.




Any scoring scheme needs to cope with this and consider aspects beyond just a count of biodiversity and consider the scale and wider spatial distribution of plants in the habitat.

**Score card approach to habitat assessment**

*How do we capture this ? HAB Assessment Scores:*

A Peatland Native Habitat Assessment Score Card has already been designed and has begun to be used in our own surveys and as part of the RWS. It has been synthesised down to a few easily identifiable indicator species (that are proxies for other species, habitat quality and ecosystem function). In the scoring avoiding negatives is as important as scoring positives (in recent surveys no negative scoring bare ground or non-native species were scored over 5 days survey resulting in the good habitat scores)

So far it has been used to bench mark habitats but how sensitive to change is the scoring for biodiversity credits (snap-shot or monitoring). This would be important as we would want to see some upward movement in scored quality over the duration of a set-aside or within a biodiversity credit scheme that would provide the justification for payment. Will new plants appear, or non-natives disappear. Bare-ground and sward height will likely change.

Does it capture all habitat types and do any additional parameters need added (soil depth, soil moisture)

Survey so far shows it works across a broad range of habitats and that it correlates well to such things as carbon emissions and soil moisture retention but some finessing may be required.

1. Presence (+) & Invasives (-)
2. Vegetation Cover (Bare Ground)
3. Sward Height
4. Freshwater Presence
5. Non-native Mammals
6. Final Cumulative Score Tallied

## II Plant Surveys – 5 spot surveys (e.g. of 2 × 2m)

### Positive scoring plants

| Plant species | Score | Plant species | Score |
|---|---|---|---|
| Any orchid species | 5 | Cinnamon grass | 2 |
| Bluegrass or Fuegian couch | 5 | Scurvy grass | 2 |
| Fachine | 5 | Native wood rush | 1 |
| Boxwood | 5 | Whitegrass | 1 |
| Tussac grass | 5 | Pale maiden | 1 |
| Falklands native ragworts | 4 | Marsh daisy | 1 |
| Sword grass | 4 | TOTAL | |

### Negative scoring plants

| Plant Species | Score | Plant Species | Score |
|---|---|---|---|
| Calafate | –20 | Sheep's sorrel | –7 |
| Any "purple" thistle e.g. creeping thistle & spear thistle | –20 | Docks (any dock species except native southern dock which is found only in coastal areas) | –7 |
| Common or creeping bent | –10 | Any gorse species | –7 |
| Marram grass | –10 | Orange hawkweed | –5 |
| Mouse-eared hawkweed | –10 | Yorkshire fog | –2 |
| Heather | –7 | Heath groundsel | –2 |
| Any "yellow" thistle e.g. prickly sow-thistle | –7 | TOTAL | |


## III Vegetation Cover

## IV Sward height

## V Presence of freshwater

| Vegetation cover | Score |
|---|---|
| 80–100% bare soil | –100 |
| 50–79% bare soil | –25 |
| 25–49% bare soil | –10 |
| 6–24% bare soil | –5 |
| 0 – 5% Bare soil | 5 |
| Standing or running freshwater | 10 |

| Sward height | Score |
|---|---|
| 0–19cm | 4 |
| 20–29cm | 4 |
| > 30cm | 2 |
| Score extra if | |
| 5 fachine >75cm tall | 5 |
| 5 boxwood > 120cm tall | 5 |
| 5 tussac grass > 100cm | 5 |
| TOTAL | |

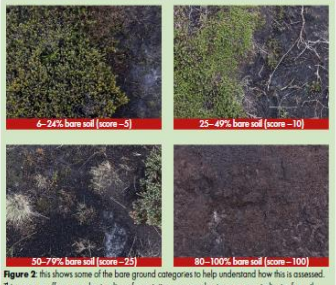



**Figure 2**: this shows some of the bare ground categories to help understand how this is assessed. This measure offers an understanding of vegetation cover and acts as a proxy indicator for soil moisture, erosion potential and carbon loss as well as an assessment of vegetation health.

## VI Non-native mammals

| Non-native mammals and grazers | Score |
|---|---|
| Known absence of rabbits and hares | 5 |
| Known absence of rats and mice | 5 |
| Known absence of cats | 5 |
| Known absence of grazing animals (incl. sheep, cattle, guanaco, reindeer, horses, goats) | 5 |
| Known presence of foxes | –5 |
| TOTAL | |

## VII Final score

| | | | |
|---|---|---|---|
| | | OVERALL TOTAL SCORE | |
| Location | | Start Grid Reference | |
| | | End Grid Reference | |
| Date | | | |
| Surveyor/s | | | |
| Stocking rate in livestock units per hectare (1 livestock unit = e.g. 10 sheep or 1 steer) | | | |
| Livestock species mix | | | |

# A New Falkland Island Habitat Assessment

Falklands Conservation's Peat-Wetlands project, funded by the Darwin Initiative, assessed the habitats of the Falklands for vegetation health and the diversity of plants and birds the habitats supported. From this, the Habitat Assessment Score has been developed to measure the relative quality of land by classifying each survey site.
The assessment can be used for one-off surveys, rapid surveys, or long-term repeat monitoring. It is ideal for use within the Responsible Wool Standard and will help farmers to get a better quantitative understanding of their land and any changes over time, in a repeatable format.

## How does it work?

**The survey is a combination of a 50-metre line transect with 5 more detailed spot surveys undertaken at approximately 10-metre intervals along this transect**

**Birds survey: 50m survey for 5 minutes**
**Vegetation: 5 spot surveys along 50m transect**
**At each spot survey measure:**
- **sward height and take the average**
- **area of bare soil and take the average**
- **Measure height of 5 fachine and 5 boxwood if present**

**Figure 1**: the survey method combines transects with 5 spot surveys. The first task is to complete the bird survey to avoid disturbance and then the vegetation surveys can be completed on the return walk. The survey is designed to be quick while providing meaningful indicators to assess habitat health. NOTE: take a calculator to determine averages.

**The first survey acts as a baseline. Further surveys can be carried out every year, biennially or every five years to capture negative, positive or no change trends. More regular repeat surveys will note negative changes faster, allowing us to quickly enact measures to prevent further degradation.**

## What are we looking for?

To assess the value of a survey site the method scores a range of factors. To simplify scoring it utilises indicator species, whose presence and high score will cover other associated species (e.g. bluegrass & cinnamon grass indicate that many other flower species, possibly your favourite, will also be present and their score reflects this, without having to identify and score this wider range of plants) and also proxy indicators like sward height as a surrogate for soil moisture and soil liner.

### 1 Bird survey

The bird survey is a timed 5-minute survey along the 50m transect. The small birds have been aggregated to reduce identification issues making the survey a simple measure of bird activity. The final score is based on the number of birds recorded. The main exceptions are: snipe which are easy to identify and act as a proxy for ground wetness; and the reverse-scoring of feral domestic geese where known absence scores positively.

### 2 Plant surveys

Plants can be identified and recorded anywhere along the 50 metre line however 5 additional stops have been included every 10 metres where more detailed plant surveys take place over a 2-metre squared area. Some plants are grouped to avoid identification issues and are given a single average score if one or more of the species are present.

### 3 Vegetation cover – average across 5 sampled points

This is a measure of unvegetated bare ground (figure 2 – overleaf) and is a visual assessment at each of the five stops. This measure provides an understanding of vegetation cover and acts as a proxy indicator for soil moisture, erosion potential and carbon loss as well as an assessment of vegetation health. Categories range from 80 to 100% bare ground (scores – 100), to below 5% bare ground (scores 5 – the only positive score in this category). If ground cover is made up only of negative scoring plant species it is unlikely to score worse than the 80 to 100% bare ground category.

### 4 Sward height – average across 5 sampled points

Sward height is measured as the functional height of the vegetation and is an approximate indicator for the site's soil moisture (figure 3). There are 3 categories between 0 and 19cm (scores 0), between 20 to 29cm (scores 5) and above 30cm (scores 10) – a nice healthy wetland! Five measurements need to be taken, one at each of the stops and the average sward height is recorded for scoring. If tussac grass, boxwood or fachine are present an extra score of 5 can be recorded for the following: 5 fachine plants above 75cm; 5 boxwood plants above 120cm; 5 tussac plants above 100cm.

**Figure 3**: sward height is measured as the height the vegetation naturally rests at, as opposed to the full length of the grass blades, as this is the functional height of sward.

### 5 Presence of freshwater

Any freshwater (pond/stream/river) within 30 metres of the survey site scores 10.

### 6 Non-native mammals

The presence or absence of these should be based on existing knowledge. If the survey site is known to be free of grazing animals (sheep, cattle, goats, guanaco, horses, reindeer), cats, rats and mice as well as rabbits and hares then a score of 5 can be recorded for each group. If the survey site is known to hold foxes then a negative score of –5 should be recorded.

### 7 Final score

The final score for the survey is the total sum of all groups and will fit the location into categories ranging from very good to very poor (figure 4).

| | | | | | |
|---|---|---|---|---|---|
| Very good | >40 | Moderate | 1 to 20 | Poor | 0 to –20 |
| Good | 21 to 40 | | | Very Poor | < –20 |

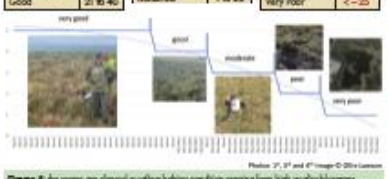



**Figure 4**: the scores are classed to reflect habitat condition ranging from high quality bluegrass habitats on offshore islands (left) to areas of extensive bare peat such as on Cape Pembroke (right).

**By evaluating habitats we can get a clear idea of the condition of our peat wetlands and therefore the state of the Falkland Islands terrestrial ecosystem. From this we will be able to pinpoint areas for restoration, before they get to the final stages of erosion, allowing effective protection of high value conservation areas. We hope the Habitat Assessment will become a common value by which we manage our land across the Falkland Islands.**

## 1 Bird Species – 50m linear survey over 5 minutes

| Bird Species | | Score |
|---|---|---|
| All small native birds including Falkland thrush, Falkland grass wren, dark-faced ground-tyrant, black-chinned siskin, white-bridled finch, Falklands pipit (not shown), long-tailed meadow lark | 1 - 5 birds | 3 |
| | 6-10 birds | 5 |
| | 11-20 birds | 7 |
| | > 20 birds | 10 |
| Magellanic snipe | | 5 |
| Survey site free of domestic geese | | 3 |
| TOTAL | | |




**Birds**: 50m line transect over 5 minutes. **Vegetation**: 5 point surveys (2 x 2 m) along 50m line transect. **Complete or Circle Shaded Boxes**.

| Circle once if present | | Circle once if present / true | | Take Average of the 5 Point Surveys | | Circle once if present / true | |
|---|---|---|---|---|---|---|---|
| **Plant Species** | **Score** | **Bird Species** | **Score** | **Percentage Bare Soil** | **Score** | **Mammals & Grazers** | **Score** |
| Boxwood | 10 | All small native birds incl; Falkland thrush, Falkland grass wren, Dark-faced ground tyrant, Black-chinned siskin. White-bridled finch, Falklands pipit, Long-tailed meadow lark | | 80 - 100% bare soil | -100 | Rabbit & Hare Free | 5 |
| Sword grass | 10 | | | 50 – 79% bare soil | -25 | Rat & Mouse Free | 5 |
| Any orchid species | 6 | | | 25 – 49% bare soil | -10 | Feral Cat Free | 5 |
| Fachine | 5 | | | 6 – 24% bare soil | -5 | Grazing Free (No sheep, cattle, gaunaco, reinder, horses or goats) | 5 |
| Bluegrass or Fuegian Couch | 5 | | | 0 - 5% bare soil | 5 | | |
| Tussac grass | 5 | | | Point 1 | | | |
| Falklands native ragworts | 4 | | | Point 2 | | | |
| Cinnamon grass | 2 | 1 - 5 birds | 2 | Point 3 | | Foxes Present | -5 |
| Scurvy grass | 2 | 6 - 10 birds | 5 | Point 4 | | | |
| Native wood rush | 1 | 11 - 20 birds | 7 | Point 5 | | Livestock: Type & Number | |
| Whitegrass | 1 | >20 birds | 10 | ***Average*** | | | |
| Pale maiden | 1 | | | | | | |
| Marsh daisy | 1 | **Bonus Points** | **Score** | **Sward Height** | **Score** | | |
| Calafate | -20 | Magellanic Snipe | 5 | Sward height 0 - 19cm | 0 | Date of Last Grazing | |
| Any "purple' thistle e.g. creeping thistle & spear thistle | -20 | Free of Feral Domestic Geese | 2 | Sward height 20 -29cm | 5 | | |
| | | | | Sward height >30cm | 10 | | |
| Common or creeping bent | -10 | | | Point 1 | | Duration of Last Grazing | |
| Marram grass | -10 | | | Point 2 | | | |
| Mouse-eared hawkweed | -10 | | | Point 3 | | | |
| Heather | -10 | | | Point 4 | | | |
| Any 'yellow' thistle e.g. prickly sow-thistle | -7 | | | Point 5 | | **Description Scoring Class*** | **Score** |
| Sheep's sorrel | -7 | | | ***Average*** | | Very Poor | < -25 |
| Docks (all dock species except native southern dock which is found only in coastal areas) | -7 | | | | | Poor | -24 - 0 |
| | | | | **Bonus Points (Circle once)** | **Score** | Moderate | 1 - 20 |
| Any gorse species | -5 | | | Fachine >75cm | 5 | Good | 21-40 |
| Orange hawkweed | -5 | | | Boxwood >120cm | 5 | Very Good | >41 |
| Yorkshire fog | -5 | | | Tussac >100cm | 5 | | |
| Heath groundsel | -5 | | | Standing/Running Freshwater | 10 | | |
| **Sub-Total:** | | **Sub-Total** | | **Sub-Total** | | **Sub-Total** | |
| | | | | | | **Site Over-All Total** | |
| Location / Transect Reference N° (from Farm Plan): Paddock Area: | | Date: | | Surveyor: | | Scoring Class / Quality* | |

**Some pointers to, and lessons from, scoring schemes**

• Avoiding negatives is as important as scoring positives

• How sensitive to change is the scoring for biodiversity credits (snap-shot or monitoring). Will new plants appear, or non-natives disappear. Bare-ground and sward height will likely change.

• Does it capture all habitat types and do any additional parameters need to be added (soil depth, soil moisture). It might also ideally recognise the ecological value of a "thatch" of old dead leaves.

• Survey so far shows it works across a broad range and correlates to such things as carbon emissions.

• This method is entirely compatible with the RWS pasture scorecard. There is a slight difference in species focus (eg native vs non-native) but the overall assessments of habitat and pasture condition came out largely the same.

• We can use the scorecard approach to select the" low-hanging fruit" in terms selecting which projects to report. Trying to restore bare clay sites (*Very Poor*) is likely going to cost a lot for little reward, whilst improving a site from *Good* to *Very Good* suffers from the law of diminishing returns. Focusing on Poor and Moderate ground that has potential for rapid improvement from passive set-aside through the plants and seed-bed still on site could easily jump a grade or even two to Moderate or Good.

**Discussion topics**

*How good an indicator is Fachine?* It is a good indicator of habitat condition and grazing pressure usually being suppressed under high set-stocked grazing pressure. It is a shrub that will have different rooting depth from grasses and add resilience. Some common plants shouldn't be overlooked, Astelia soft-camp is just starting to be shown to be a significant carbon capture and can occur in a species-diverse community and be a good habitat resilience builder.

*What other parameters to measure?* On our surveys we now take peat depths and moisture contents to give us a resilience index. Moisture retention shows the resilience. Trying to assess the ecological function of land.

*What is the administration load for this type of scoring*? With practise the scoring assessment is very quick; it may take 20 minutes the first time but once familiar it is a quick 5 minute stop to undertake. But if the scores are to be used for biodiversity or set-aside payment then it is important to keep the individual scoresheet records across the time series so we can pick up trends which may be site and habitat specific and also to authorise or justify payments. This is very useful in terms of refining management prescriptions and monitoring climate change impacts. This takes time and needs to be recognized, however tracking such habitat improvement is no different from monitoring stock or wool quality in a breeding program, it is a function and component of effective land management. Must have safe data storage.

Sally Poncet helps keep a database record of all restoration projects undertaken in the Islands updated. Department of Environment hold this database and maintains it.

## 5.3

# REWARDS-BASED AGRI - ENVIRONMENT SCHEMES IN IRELAND

*Jim McAdam, Queen's University Belfast*

Due to time constraints, this paper was not presented in full at the Workshop, however some summary points were made and it is felt that the material in it would be of use in the development of a land Recovery Programme.

**Types of Payments**

*1.Area-based payments*: Landowners could be compensated for removing, or reducing, grazing based on the size of the area involved and/or the associated income they forgo.
2. *Action-based payments:* Financial support could be provided for specific restoration activities, such as planting vegetation, building fences, or controlling invasive species. Capital spending
*3. Rewards (Results) -based payments*
Based on an initial scored value of the condition of their land, farmers are given bespoke advice on how to improve the condition of the land and are scored again on how successful they have been. Thef armer is are paid on the basis of the improvements they have done

**Background to evaluation of Agri – Environment Schemes**

Agri-environment schemes (AES), implemented under the Common Agricultural Policy (CAP) provide the policy framework for sustainable agriculture in Europe, as well as providing the largest source of funding for practical nature conservation in the EU. AES have been in existence in the EU for over thirty years, but their ecological performance and cost effectiveness to date has been very mixed (Finn et al., 2009). They have often been seen more as a source of farm income support rather than the means of delivering environmental goals

Conventional management, or action-oriented, AES schemes have been criticised for a number of reasons, including poor targeting, lack of payment differentiation, short-termism, inadequate monitoring and failure to inspire behavioural change among participating farmers. In more recent times, there has been a call to integrate an ecosystem services approach into agri-environment programmes, along with a shift in emphasis from an action-based to a result-based approach, which would link payments to delivery of a desirable environmental outcome.

Result-based AES schemes reframe conservation as a "new form of production" rather than a positive by-product of agriculture . A result-based approach is also challenging because ;

- There are gaps in the scientific knowledge that link agricultural practices to biodiversity and other ecosystem services .

- It is an increased risk for land managers. Improved scientific knowledge is only part of the solution;
- the delivery of cost effective agri-environment climate resilience programmes is also inherently social and political.
- Result-oriented AES require a cultural change in the way farmers view the environment
- governance structure needs to be participatory and capable of adaptive management.
- AES need to shift from the currently dominant 'one-size-fits all' AES to one incorporating local knowledge and the recognition that management practices, and to a certain extent ecological outcome, are specific to location- ie bespoke actions..

Many different types of result-based payment schemes have been implemented across Europe, mostly on a case-by-case basis. One can distinguish between measures aimed at biodiversity conservation targeted at species and habitats of conservation concern, such as species rich grasslands, peatlands, and those aimed at ecosystem services provision, which are often common habitat generalists, occurring in a wide variety of environments. They have proved successful in many situations in Ireland- particularly where peatland is concerned.

**Example – Freshwater Pearl Mussel Programme**

This programme was based on peatlands in the west of Ireland where poor water quality and drying out was threatening an endangered species.



Supportesd measured included grazing control, rewetting, invasive species removal.
Measures to be funded were (and rewards given for):
1)Livestock and grazing management
2) Water protection and habitat enhancement
3) Water protection (Sheep Treatment)
4) Farm access improvement
5) Invasive species control

6) Woodland establishment and enhancement

Typical rates of payment given are:

Another scheme A

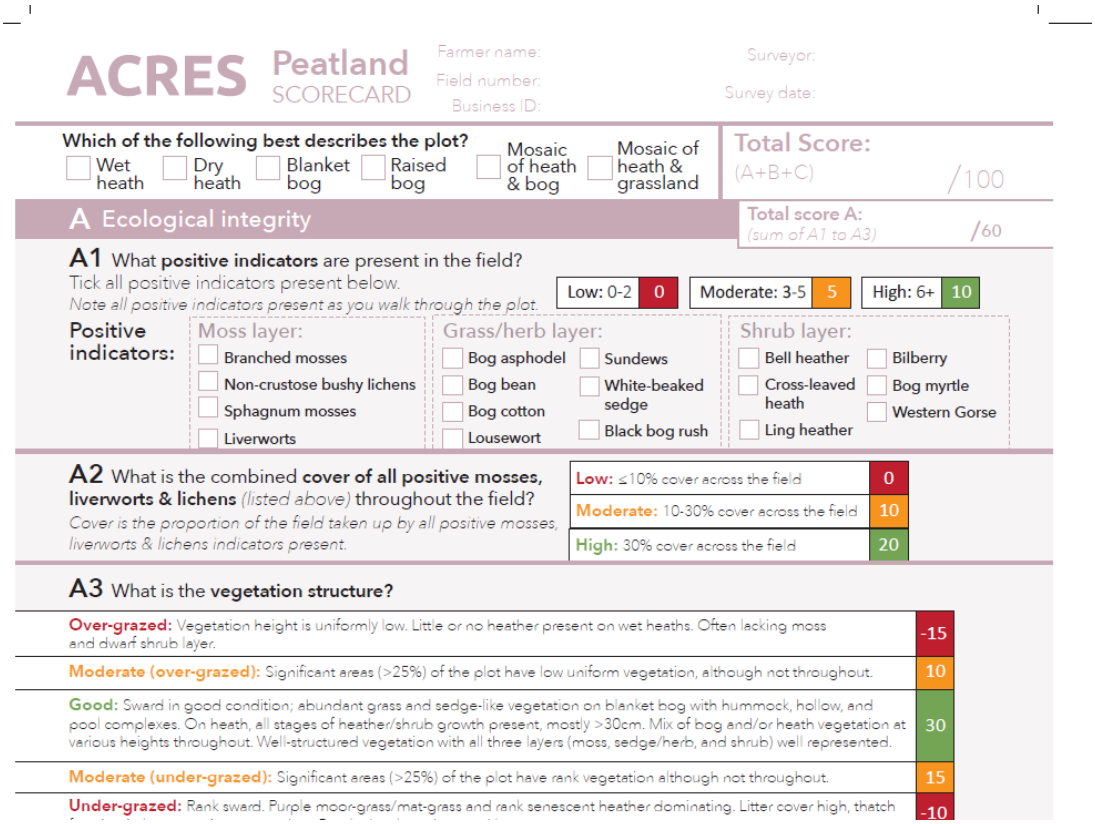
| | | | | | | |
|---|---|---|---|---|---|---|
| Post and wire fence Photograph | Metre | Line | 50% | €3.00 | €1.50 | |
| Electric fence | Metre | Line | 50% | €1.50 | €0.75 | Receipt |
| Sheep fence | Metre | Line | 50% | €5.34 | €2.70 | Photograph |
| Sheep fencing (mountain rate) Photograph | Metre | Line | 50% | €8.01 | €4.00 | |
| A Frame fence | Metre | Line | 50% | €8.40 | €4.20 | Photograph |
| Electric fencer (standard) Receipt | Item | Point | 50% | €135.00 | €67.50 | |
| Electric fencer (high power) Receipt | Item | Point | 50% | €203.80 | €101.90 | |
| Solar 12V fencer (standard) Receipt | Item | Point | 50% | €270.00 | €135.00 | |
| Solar 12V fencer (high power) Receipt | Item | Point | 50% | €491.98 | €246.00 | |
| Galvanized gate 4 ft Photograph | Item | Point | 50% | €235.00 | €117.50 | |

Another scheme (Agri Climate Rural Environment Scheme - ACRES) is very peatland focused. Landscapes are quite similar to the Falklands. Issues supported are Grazing

And ditch blocking for rewetting.



Sample scorecards for peatlands – scored every 2nd year and paid on progress.



ACRES Peatland SCORECARD

Farmer name: Surveyor:
Field number: Survey date:
Business ID:

**Which of the following best describes the plot?**
☐ Wet heath ☐ Dry heath ☐ Blanket bog ☐ Raised bog ☐ Mosaic of heath & bog ☐ Mosaic of heath & grassland

**Total Score:** (A+B+C) /100

**A Ecological integrity** — Total score A: (sum of A1 to A3) /60

**A1** What **positive indicators** are present in the field?
Tick all positive indicators present below.
*Note all positive indicators present as you walk through the plot.*

Low: 0-2 **0** | Moderate: 3-5 **5** | High: 6+ **10**

**Positive indicators:**

| Moss layer: | Grass/herb layer: | | Shrub layer: | |
|---|---|---|---|---|
| ☐ Branched mosses | ☐ Bog asphodel | ☐ Sundews | ☐ Bell heather | ☐ Bilberry |
| ☐ Non-crustose bushy lichens | ☐ Bog bean | ☐ White-beaked sedge | ☐ Cross-leaved heath | ☐ Bog myrtle |
| ☐ Sphagnum mosses | ☐ Bog cotton | ☐ Black bog rush | ☐ Ling heather | ☐ Western Gorse |
| ☐ Liverworts | ☐ Lousewort | | | |

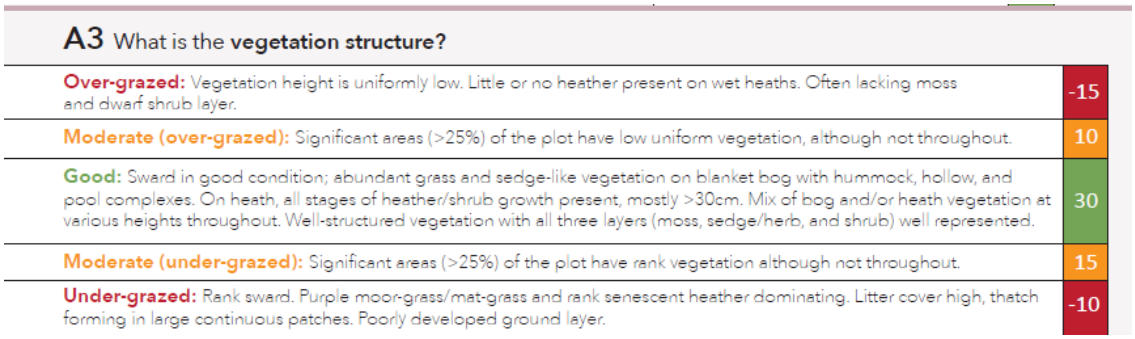
**A2** What is the combined **cover of all positive mosses, liverworts & lichens** *(listed above)* throughout the field?
*Cover is the proportion of the field taken up by all positive mosses, liverworts & lichens indicators present.*

| | |
|---|---|
| **Low:** ≤10% cover across the field | 0 |
| **Moderate:** 10-30% cover across the field | 10 |
| **High:** 30% cover across the field | 20 |

**A3** What is the **vegetation structure?**

| | |
|---|---|
| **Over-grazed:** Vegetation height is uniformly low. Little or no heather present on wet heaths. Often lacking moss and dwarf shrub layer. | -15 |
| **Moderate (over-grazed):** Significant areas (>25%) of the plot have low uniform vegetation, although not throughout. | 10 |
| **Good:** Sward in good condition; abundant grass and sedge-like vegetation on blanket bog with hummock, hollow, and pool complexes. On heath, all stages of heather/shrub growth present, mostly >30cm. Mix of bog and/or heath vegetation at various heights throughout. Well-structured vegetation with all three layers (moss, sedge/herb, and shrub) well represented. | 30 |
| **Moderate (under-grazed):** Significant areas (>25%) of the plot have rank vegetation although not throughout. | 15 |
| **Under-grazed:** Rank sward. Purple moor-grass/mat-grass and rank senescent heather dominating. Litter cover high, thatch | -10 |

Eg Vegetation structure



**A3** What is the **vegetation structure?**

| | |
|---|---|
| **Over-grazed:** Vegetation height is uniformly low. Little or no heather present on wet heaths. Often lacking moss and dwarf shrub layer. | -15 |
| **Moderate (over-grazed):** Significant areas (>25%) of the plot have low uniform vegetation, although not throughout. | 10 |
| **Good:** Sward in good condition; abundant grass and sedge-like vegetation on blanket bog with hummock, hollow, and pool complexes. On heath, all stages of heather/shrub growth present, mostly >30cm. Mix of bog and/or heath vegetation at various heights throughout. Well-structured vegetation with all three layers (moss, sedge/herb, and shrub) well represented. | 30 |
| **Moderate (under-grazed):** Significant areas (>25%) of the plot have rank vegetation although not throughout. | 15 |
| **Under-grazed:** Rank sward. Purple moor-grass/mat-grass and rank senescent heather dominating. Litter cover high, thatch forming in large continuous patches. Poorly developed ground layer. | -10 |

Hydrological Integrity

## B Hydrological integrity (carbon capture)

Total score B: /20

### B1 Surface hydrology and artificial drainage features:

| | |
|---|---|
| **Significantly altered bog/heath hydrology:** Frequent widespread free-flowing drains on plot with notable effect on surrounding vegetation of bog/heath. >20% of plot affected. | -30 |
| **Moderately altered bog/heath hydrology:** Free flowing drains in plot with notable effect on surrounding vegetation of bog/heath. <20% of plot affected. | -15 |
| **Slightly altered bog/heath hydrology:** Drains present in plot although are somewhat impeded and little effect on surrounding bog/heath. | 0 |
| **Moderately intact bog/heath hydrology:** Bog/heath surface largely intact, although some evidence of historic disturbance (cutting, drainage, erosion channels) across any part of plot. Vegetation and hydrology largely recovered/stabilised. | 10 |
| **Intact bog/heath hydrology:** Intact bog/heath surface, no evidence of past drainage or disturbance across plot. | 20 |

### Common management recommendations to pick from:

- ☐ Continue current management of this high quality peatland.
- ☐ Control the occurrence and spread of invasive species. Consult with CP team regarding solutions.
- ☐ Control the occurrence and spread of encroaching scrub, supporting actions are available.
- ☐ Consider using supporting actions to slow or impede the flow of drains.
- ☐ Consider raising watertable to restore peatland, supporting actions are available.
- ☐ Use stock to graze field more evenly.
- ☐ Improve stock management. You may wish to avail of supporting actions e.g. Fencing / drinking facilities.
- ☐ Move feeders / troughs regularly and keep away from drains and rivers.
- ☐ No management advice.
- ☐ Other management advice:

Similar schemes have been adapted for the Falklands (Grant showed these)

**Birds**: 50m line transect over 5 minutes. **Vegetation**: 5 point surveys (2 x 2 m) along 50m line transect. **Complete or Circle Shaded Boxes.**

| Circle once if present | | Circle once if present / true | | Take Average of the 5 Point Surveys | | Circle once if present / true | |
|---|---|---|---|---|---|---|---|
| **Plant Species** | **Score** | **Bird Species** | **Score** | **Percentage Bare Soil** | **Score** | **Mammals & Grazers** | **Score** |
| Boxwood | 10 | All small native birds incl; Falkland thrush, Falkland grass wren, Dark-faced ground tyrant, Black-chinned siskin. White-bridled finch, Falklands pipit, Long-tailed meadow | | 80 - 100% bare soil | -100 | Rabbit & Hare Free | 5 |
| Sword grass | 10 | | | 50 – 79% bare soil | -25 | Rat & Mouse Free | 5 |
| Any orchid species | 6 | | | 25 – 49% bare soil | -10 | Feral Cat Free | 5 |
| Fachine | 5 | | | 6 – 24% bare soil | -5 | Grazing Free (No sheep, cattle, gaunaco, reinder, horses or goats) | 5 |
| Bluegrass or Fuegian Couch | 5 | | | 0 - 5% bare soil | 5 | | |
| Tussac grass | 5 | | | Point 1 | | | |
| Falklands native ragworts | 4 | | | Point 2 | | | |
| Cinnamon grass | 2 | 1 - 5 birds | 2 | Point 3 | | Foxes Present | -5 |
| Scurvy grass | 2 | 6 - 10 birds | 5 | Point 4 | | | |
| Native wood rush | 1 | 11 - 20 birds | 7 | Point 5 | | Livestock: Type & Number | |
| Whitegrass | 1 | >20 birds | 10 | ***Average*** | | | |
| Pale maiden | 1 | | | | | | |
| Marsh daisy | 1 | **Bonus Points** | **Score** | **Sward Height** | **Score** | | |
| Calafate | -20 | Magellanic Snipe | 5 | Sward height 0 - 19cm | 0 | Date of Last Grazing | |
| Any "purple' thistle e.g. creeping thistle & spear thistle | -20 | Free of Feral Domestic Geese | 2 | Sward height 20 -29cm | 5 | | |
| | | | | Sward height >30cm | 10 | | |
| Common or creeping bent | -10 | | | Point 1 | | Duration of Last Grazing | |
| Marram grass | -10 | | | Point 2 | | | |
| Mouse-eared hawkweed | -10 | | | Point 3 | | | |
| Heather | -10 | | | Point 4 | | | |
| Any 'yellow' thistle e.g. prickly sow-thistle | -7 | | | Point 5 | | **Description** | |
| Sheep's sorrel | -7 | | | ***Average*** | | **Scoring Class*** | **Score** |
| Docks (all dock species except native southern dock which is found only in coastal areas) | -7 | | | | | Very Poor | < -25 |
| | | | | **Bonus Points (Circle once)** | **Score** | Poor | -24 - 0 |
| Any gorse species | -5 | | | Fachine >75cm | 5 | Moderate | 1 - 20 |
| Orange hawkweed | -5 | | | Boxwood >120cm | 5 | Good | 21-40 |
| Yorkshire fog | -5 | | | Tussac >100cm | 5 | Very Good | >41 |
| Heath groundsel | -5 | | | Standing/Running Freshwater | 10 | | |
| **Sub-Total:** | | **Sub-Total** | | **Sub-Total** | | **Sub-Total** | |

And for the RWS:

**Pasture Condition Score Sheet**

| | | | | | | |
|---|---|---|---|---|---|---|
| Evaluator: | | | | Date: | | |
| Paddock ID: | | | | Livestock Type: | | |
| Grazing History: | Date of Last Grazing: | | | Period of Grazing: | | Days |
| Current Season's Precipitation (check one) | | | Above Normal | Normal | Below Normal | |
| Seasonal Temperature Trend (check one) | | | Above Normal | Normal | Below Normal | |
| Evaluate the site and rate each indicator based upon your observations. Scores for each indicator may range from 1-5. Sum the indicator scores to determine overall pasture condition score. | | | | | | |
| Indicator | 1 Point | 2 Points | 3 Points | 4 Points | 5 Points | Score |
| **Percent Desireable Plants** (Dry weight; for Livestock Type) | Desireable species <20% of Stand | Desireable species 20-40% of stand | Desireable species 41-60% of stand | Desireable species 61-80% of stand | Desireable species exceed 81% of stand | |
| **Live (includes dormant) Plant Cover** | Less than 40% is live leaf canopy. Remaining is either dead standing material, or bare ground | 40-65% is live leaf canopy. Remaining is either dead standing material, or bare ground | 66-80% is live leaf canopy. Remaining is either dead standing material, or bare ground | 81-95% is live leaf canopy. Remaining is either dead standing material, or bare ground | More than 95% live (non-dormant) leaf canopy. Remaining is either dead standing material, or bare ground | |
| **Plant Residue as Litter and Soil Cover** (*Pull back canopy*) | Bare soil is very easily seen; | Openings of bare soil can be seen fairly easily: | Small openings of bare soil can be seen, but minimal; | No bare soil is easily seen; | No bare soil is seen; | |
| | There is <20% cover on the soil surface or it is excessive, and slow to break down | Soil cover is 21-40% | Soil cover is 41-60% | Soil cover is 61-80% | Soil cover is >80% with good biological activity and decomposition of older residue | |
| **Grazing Utilisation and Severity** | Pasture is overgrazed throughout | Pasture consists primarily of overgrazed and/or refused areas (former dung areas, older plants, undesired plants) | Pastures show uneven grazing throughout with heavier grazing near water or feeding areas, or distinct zone grazing | Pasture grazed evenly throughout with minimal overgrazing with some undergrazed small areas and heavier use near water sources | Pasture grazed evenly throughout with no overgrazing | |
| **Erosion** (Circle all that apply; the overall indicator score will be the lowest rating indicated) | **Sheet & Rill:** Plant density is insufficient to stop runoff, with poor infiltration. Erosion easily visible throughout pasture; | **Sheet & Rill:** Plant density slows runoff. Erosion present and easily seen on steeper terrain; | **Sheet & Rill:** Plant density good and runoff moderate. If present, erosion concentrated on heavilty used areas; | **Sheet & Rill:** Plant density high, runoff low, good infiltration. May have evidence of past erosion if present; | **Sheet & Rill:** Plant density high, no runoff, good infiltratio. No evidence of present or past erosion | |
| | **Wind:** Severe scoured areas and deposition throughout | **Wind:** Scoured areas common, deposition effecting plants | **Wind:** Occasional scoured areas, litter windrolled | **Wind:** Minimal soil exposed, some detatched vegetation windrolled, minor plant damage | **Wind: No exposed soil** | |

| Overall Pasture Condition Score | Individual Indicator Score | Management Change Suggested | **Overall Pasture Condition Score:** | |
|---|---|---|---|---|

## References


Finn, J A (2020) Synthesis and reflections on selected results-based approaches in Ireland. In: O'Rourke, E & Finn, J A *Eds*. *Farming for Nature-the role of Results-based payments*. Teagasc and National Parks and Wildlife Service. Dublin and Johnstown Castle. 275-303.

Forde, A (2021) Results-based pearl mussel payments "fair and accurate" farmers believe. Irish Farmers Journal 10th April.

## 5.4

### FINAL GENERAL DISCUSSION AND WRAP-UP COMMENTS

A. **OVERALL GENERAL DISCUSSION** (any points attendees felt were not covered in the Workshop)

*Diddle- dee as an indicator of habitat condition?* Generally from all the experience we have, the more Diddle dee, the more evidence of land modification.

*We have largely only been talking about sheep grazing in this Workshop?* There have been a lot of horses and cattle in the past and these should be added into the overall stocking calculation. Would be important if we want to encourage more cattle to substitute for sheep. It is not a simple numbers game.

*Wider implications of climate change impacts.* Tourism in particular. Eg when a pond dries out, you lose the waterfowl which attract visitors and they wont come or stay as long. Decline in habitat quality can affect high-profile wildlife and landscapes.

*Water resources for livestock*. This was not mentioned very much, yet it is directly related to many restoration strategies where livestock are involved. Needs to be borne in mind – perhaps in relation to fire- fighting resources.

*Fire fighting* was discussed several times throughout the Workshop.

B. **FOLLOWING MLA FORD'S ADDRESS.**

**Discussion topics**

*Compensatory agreements with UKOTs Joint Biodiversity Strategy.* The Falklands is regularly lobbying the UK Govt for continuation of Darwin Funding, Biodiversity credits, Carbon Financing etc. Always on the lookout for these.

*Where does the Falklands stand with UKs 2030 commitments*? No clear answer.

*Long term nature of any agreements in the LRP.* It is important that farmers/land owners see financial security in any scheme. Schemes by definition need to be long term-10s of years and guarantees need to be given,

*Can we not set our own strategies for funding biodiversity support?* General agreement that FIG needs to put more money into land restoration and climate resilience. FLH need to be considered. A Land Recovery Programme would give people incentive (not just farmers/landowners).

We should follow what is happening in the UK re peatland restoration etc. learn by others examples/mistakes.

*There has been much more money invested locally in Marine science and conservation than in supporting Terrestrial science, habitat conservation and management.* Point was well taken and agreed that the imbalance should be addressed. Government is on the Board of SAERI.

### *C.* FINAL WRAP-UP COMMENTS

**Matt Davies.** Stressed that this is the start of a process and launched the Consultation Handbook. Over the next few months the consultation process will ramp up. He encouraged everyone to engage closely with this, to read the document, reflect on this workshop and to respond to the Department. The overriding principle of c0-design will apply in this programme if it is to be purposeful and effective. Thanked everyone for making the effort to contribute to this workshop, the outcomes will be most useful.

**Lewis Clifton.** Thanked all for participating and assured everyone that the RBA would engage closely with the DoA in driving forward the Programme.

The overall aim is to ensure a thriving rural economy and we all must work towards that goal.

A Report of this meeting will be prepared (by Jim McAdam) and will be circulated to all attendees and RBA members in due course. Audio copies of the presentations will also be made available.