Cultivating Wisdom

Agroecology Research and Innovation from Experts in the Field

Contents

Foreword

I'm thrilled to introduce this collection of research summaries from the 'Experts in Your Field' project. This initiative, initially launching in 2022, is a testament to the ingenuity and dedication of small-scale agroecological farmers and landworkers across the UK.

For far too long, the invaluable knowledge and innovation occurring on small farms and in woodlands has gone unrecognised by formal research institutions. Our project sought to change that narrative, providing funding, support, and equipment to these unsung heroes.

What you'll find in these pages is more than just research—it's a celebration of practical wisdom, a showcase of grassroots innovation, and a powerful argument for the role of agroecology in shaping our agricultural future.

Phase One of our project engaged 40 diverse landworkers, with 22 carrying their involvement through to on-farm trials. Despite the demands of the growing season, these individuals demonstrated remarkable commitment, designing and implementing research while maintaining their day-to-day operations. The peer-to-peer network that emerged has been nothing short of inspirational, fostering a spirit of collaboration and mutual support that transcends individual farms.

Phase Two, which began in 2023, and is when the research presented within these pages took place, expanded the cohort of participating farmers and landworkers to almost 80 and broadened the research scope. Beyond biodiversity, we've explored critical areas such as soil health, the health and wellbeing implications of agroecology and the profitability of agroecological farming. Our focus on strengthening peer learning networks, co-designing unified data collection tools, and compiling findings in this journal will ensure that this valuable knowledge reaches policymakers and research institutions.

The summaries you're about to read represent more than individual research projects. They embody a movement—a shift towards recognising and elevating the expertise that exists in our fields and woodlands. Each entry is a testament to the power of community-based research and the vital role of agroecology in building a more sustainable and equitable food system.

As you delve into these pages, I invite you to consider the broader implications of this work. These findings have the potential to drive innovation, promote sustainable land practices, and provide crucial evidence for policy change. More importantly, they represent the voices of those who work the land daily, offering insights that can only come from hands-on experience.

Thank you for joining us on this journey of discovery and innovation. The wisdom cultivated in these fields is set to change the landscape of agricultural research for years to come.

Dr Isobel Talks, Community Research Facilitator, The Landworkers' Alliance

Tom Kemp, Working Woodlands, Cornwall

I am a forester based in Cornwall. I've been involved with woodland management for the last fifteen years and actively manage a number of woods and woodland creation projects in Cornwall as well as providing forestry consultancy. My latest personal projects include using rare breed pigs for woodland creation ground preparation and close-to-nature pork.

For this year of EIYF we wanted to get baseline data on tree growth rates on our site since last coppicing so we could compare it to the growth we are getting in the cuts we make in order to make projections about possible tree volumes in the future. From each tree of our last cut we have been keeping a disk of wood from approx 1.3m above ground level (where tree diameter is usually measured). We'd like to get an average growth rate from these going back to the early 50's when the trees were last felled.

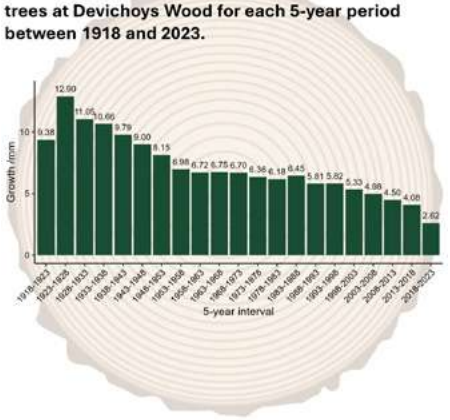
We also wanted to carry out a ride-side plant survey, which we have previously found to be most useful for measuring specific biodiversity changes as a direct result of our work, in comparison to other methods such as bird surveys.

The results of the rideside plant survey showed significantly higher diversity scores in areas where we had undertaken coppice cuts and halo thinning three or more years previously. This shows us that the coppice restoration work is having desirable effects on plant diversity but that it takes at least three years for the biodiversity to build up.

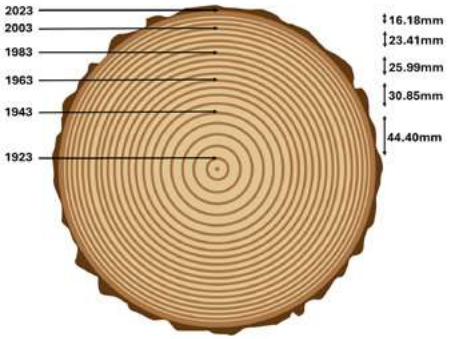
The dendrochronology study showed us that the trees' diameter increases where greatest in the early years post coppicing. It also showed us potential expected diameters and expected heartwood to sapwood ratios of currently growing trees at Devichoys wood. It has allowed to us refine our management of the wood to ensure maximum wood volume from our coppice restoration work.

Below are some graphs showing the results of the average growth rate study:

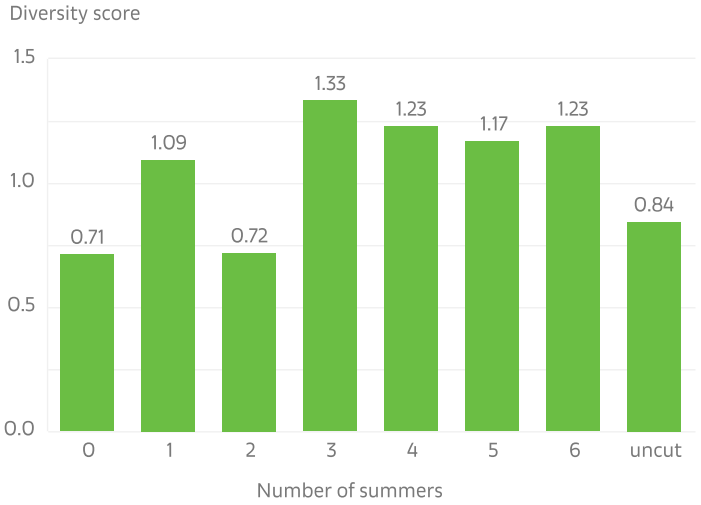
The average growth rate along the median radius of trees at Devichoys Wood for each 5-year period between 1918 and 2023.

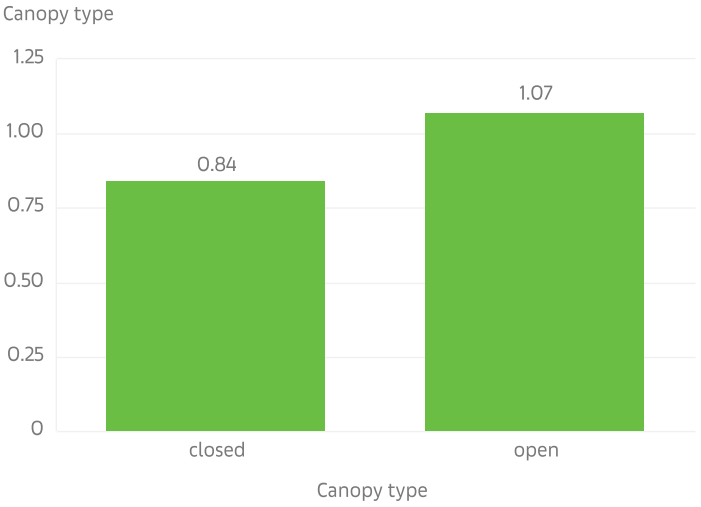


The average growth rate along the median radius of trees at Devichoys Wood for each 20-year period between 1923 and 2023. Each ring represents the average 5 years of growth.



And here are some of the results from the ride-side plant survey:





Sophia Morgan-Swinhoe, Scott Sanders & Sam Wren-Lewis, Dyfi Dairy, Powys

Dyfi Dairy in Powys in Wales was started by Sophia and Scott, with Sam then joining the team. The farm has evolved slowly over time, from having 2 goats on a 6-acre plot, to having 15 cows and 60 goats on a 30 acre plot, to now having a lifetime lease on just over 100 acres. Alongside using agroecological principles such as having a calf at foot dairy and renting out male goats and cows as conservation grazers, Dyfi Dairy is currently doing a trial to see how perennial ryegrass pasture fields can recover from previous nitrogen fertiliser use through the direct drilling of multi-species herbal leys whilst maintaining productive yields.

To do this they have established four trial plots: three different herbal ley mixes direct drilled into perennial ryegrass pasture, and one pure perennial ryegrass pasture as a control.

The trial plots have been designed with the following properties:

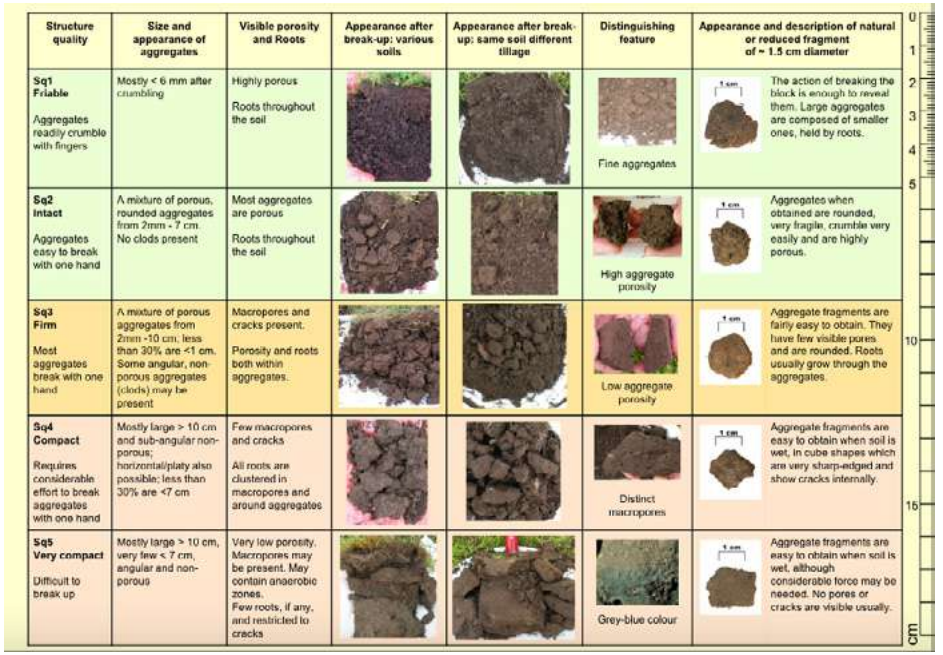
1. Cae Mawr - legume and herb rich sward: This plot will be used for grazing dairy cows, with a focus on nitrogen-fixing and deep-rooting plants.
2. Cae Ffordd - meadow hay ley + diversity: This plot will be used for hay/haylage, with a focus on herbs, wildflowers, and multiple grass species.
3. Cae Dan Helm - anthelmintic/goat health grazing: This will be used for grazing goats, with a focus on plants with anthelmintic properties.

Plot number and name	Size (Ha)	Treatment
1. Cae Mawr	1	Legume and herb rich sward
2. Cae Ffordd	2	Meadow hay ley + diversity
3. Cae Dan Helm	0.5	Anthelmintic/goat health grazing
4. Control Plot	1	No treatment

So far, the pre-treatment tests have been carried out. The post-treatment tests will be done in late Autumn.

Pre-Test Results:

VESS (Visual Evaluation of Soil Structure)



Plot and layer	Location (tagged using google maps)	Structure Quality score
Plot 1 - top layer	52.5612002, -3.8002496	2 (Intact - aggregates easy to break with one hand)
Plot 1 - bottom layer	52.5612002, -3.8002496	2
Plot 2 - top layer	52.5687670, -3.8023689	2
Plot 2 - bottom layer	52.5687670, -3.8023689	2
Plot 3 - top layer	52.5684664, -3.8003261	2
Plot 3 - bottom layer	52.5684664, -3.8003261	2
Control - top layer	52.5671342, -3.8010985	2
Control - bottom layer	52.5671342, -3.8010985	2

Worm count

Plot	Location (tagged using google maps)	Number of worms in sample
Plot 1	52.5612002, -3.8002496	13
Plot 2	52.5687670, -3.8023689	13
Plot 3	52.5684664, -3.8003261	2
Control Plot	52.5671342, -3.8010985	5

pH and SOM

Plot	pH	SOM (%)
Plot 1	5.61	15.35
Plot 2	5.5	9.17
Plot 3	5.58	10.53
Control Plot	5..53	10.01

Compaction

Plot	Depth at which compaction increased by 1 (from <100 PSI to 100-200 PSI)
Plot 1	25cm
Plot 2	40cm
Plot 3	25cm
Control Plot	50cm

In the future Dyfi Dairy is keen to explore how inoculating the soil with fungal networks at the same time can boost and speed up the regeneration process.

David Carruth, the Wooly Pig Company & Lindsay Mackinlay, the Future Forest Company, Ayrshire

The Future Forest Company, which the Wooly Pig Company is a part of, is actively trying to get more research done on the relationships between our agro-forestry enterprise at Brodoclea, involving our Mangaltiza pigs, and biodiversity and tree growth. To date, we have carried out a breeding bird survey over part of the site, which looked at the possible correlations between the pigs and breeding bird diversity. This work was very much exploratory in nature and provided indications that there might be a relationship between bird diversity and the pigs. However, much more research is required to examine whether the pigs do indeed increase bird diversity due to their activities in future years. In 2024, we started to carry out butterfly and bumblebee transects at Brodoclea to see if results also indicate that the pigs have an impact on these groups. Again, it is early days and the wet weather we had this summer has undoubtedly had an impact on insect populations, making it difficult to assess the results from just one year. However, this work is long-term so we hope we might see some correlations between these interests too.

A vegetation survey was carried out over parts of the site in 2024, with the results awaited, along with an exploratory bat survey, where one bat detector has been placed on the site, covering May, August and October, to see what is using the woodland. Both surveys add to our understanding of the site and we would like to see a lot more and comprehensive bat research on the site, especially looking at bat behaviour around pig enclosures.. FFC aim to establish quadrats across our enclosures to see what impact the pig activities have on plant species and vegetation communities..so watch this space! In the meantime, we welcome any enquiries from students who may wish to do research on any aspect of pigs and their impact on the biodiversity of the site.

Mim McDonald, High Leas Farm, Derbyshire

High Leas Farm is a 160 acre farm in the Derbyshire Dales. We have 120 acres of permanent pasture grazed rotationally by a mixed flerd of 3 Shetland cattle, 28 Shetland cross sheep, and 2 horses that move regularly with long rest periods between bouts of grazing. This promotes botanical diversity as well as invertebrate and ground nesting bird habitat.

Some fields, approximately 35 acres, are dominated by creeping thistle, dock and nettle whilst others are dominated by fine grasses and herbs. The thistle, dock and nettle dominated fields are ones that have been used more intensively in the past and we suspect that they may differ chemically or microbially from the other fields due to their historic management. We hope to lower the abundance of thistle, nettle and dock and promote a greater diversity of grasses and wildflowers in these fields. In order to intervene strategically we have been studying the microbial and chemical state of the soil. We are currently awaiting the results of our soil and forage testing.

We have built partnerships with amateur naturalists and academics who have charted some of the complexity of life here. Baseline surveys have included those for breeding birds, bats, moths, butterflies, sheep dietary choice, soil analysis and surveys of both vascular plants and bryophytes. We have 259 species of vascular plant recorded so far which are found over roughly five habitat types - woodland, wetland, disturbed soil, fields used for hay and dominated by fine grasses, fields used for winter foggage and dominated by course grasses and fields that have been heavily fertilised by outdoor pigs or winter fed cattle in the past and are now dominated by competitive species such as creeping thistle, nettle and dock.

We have 33 species of breeding bird on the farm including 13 species that are either red or amber listed. These include peak counts of 8 tree pipits, 4 redstarts, 7 song thrush, 1 spotted flycatcher and 1 cuckoo. We have 9 species of birds of prey that have been recorded on the farm, 4 of which also breed here. We also have over 100 species of moth, 21 species of butterfly, 5 species of bat and over 100 species of bryophyte on the farm.

In 2023 we ploughed a 6m by 40m strip between tree strips and, with grain sourced from Fred Price at Gothelney Farm, sowed a variety of heritage wheats and barleys in it. This area also supported fat hen and redshank, previously unrecorded on the farm, which may have been dormant in the soil or introduced with the grain. This area grassed back over and in 2024 we tilled another small strip, again on contour and between tree strips, and sowed pillas with the support of Harreit Gendall, a PhD student reviving the lost grain. Pillas is an old naked oat that was once common across Britain and probably gave its name to several local villages including Pilsely. We are now preparing to plant an autumn sown landrace rye, from which Riber our nearest village apparently draws its name. Fat hen, chickweed and redshank have appeared in every place that grain has grown with the addition of field poppy this year. Our vegetable garden, again on contour and between strips of perennial vegetables and soft fruit, has also supported a multitude of species rarely encountered in the larger landscape including various white butterflies, aphids and the parasitoid wasps that hunt them both.

We are attempting to reduce our dependence on hay or other forms of stored forage, with hay cut only to tide us over very poor weather. This decision is built in large part from the work of Fred Prozenza and the BEHAVE research programme at Utah State University. Over time we hope to monitor herbivore choice and we hope that the livestock will learn how to balance the plants that they are eating and that the landscape will come to reflect and provide for their choices. We also hope to weave our shepherding into this with paddock size and move rate reflective of allowing wide choice but also minimising excessive consumption of any one species before it can reproduce sufficiently to become as abundant as needed to fill the requirement in both diet and landscape.

Initially we viewed the reintegration of wild-human landscapes from a practical perspective, seeing the challenge as an ecological one to disturb soil at a level that enhanced ecosystem diversity and stability or move animals in a way that mimicked predator pressure. Soon the emphasis shifted onto a cultural question however. Last year we explored the question of how to build connections to landscape, alongside Bristol University funded through the Brigstow Institute. This year we have explored the relationship between people and place from a different perspective alongside The University of Sheffield and funded through the Access Folk small grant scheme. We have brought people together to craft, sing and engage in landwork at the co-creating edge between wild and human. We have been inhabiting and experiencing this reciprocal grey area - tending the wild to produce a diverse landscape that feeds us and crafting with materials offered by the land - that then feeds back into that co-creating edge. We have also sung both old and new songs that mark out the pace of work and ask us to see, recall and remember the relationship in which we are all embedded.

The depth of this relationship has unfurled as the land has offered resources that meld with human creativity to craft tools - an extension and embodiment of land-human co-creation - that can then be used for landwork. Ash offering axe handles from which a co-created ash coppice may emerge, sustaining itself in its creation. Baskets that gather fruits to disperse seeds diversifying landscapes and feeding future weavers. Song, experience and creation facilitating connection to the past and embodiment into the future at the same time.

And through all of this stretches science as one way of knowing, of seeing, of recording and of understanding. Science offers us many tools for ecological baselining from a system of categorisation of life to methods of standardising the observations of an external human observer. Science also struggles however to map and account for the myriad relationships that exist at the co-crating edge and in trying to break them down into their constituent parts for study it has a tendency to destroy the thing that it is trying to account for. Emergent properties spring from complexity and when reduced to constituent parts no longer exist.

There is a fundamental tension which has proved difficult to reconcile between a scientific process that gathers many thousands of observations from which to draw a simplified ‘best fit’ conclusion and a living system that is ever diversifying and specialising, becoming more nuanced with time and increasing in its complexity.

Science is a fantastic guide into a way of accurately seeing, which is of tremendous value in an era of such limited ecoliteracy and fast paced change. Story and experience is a fantastic way of valuing and as with so many things, it is in sitting within this tension and feeling the discomfort of the two experiences that I feel the co-creating edge most clearly.

Ella Brolly, Wolves Lane, London

'We make things holy by the kind of attention we give them' Martin Shaw

This project is an ethnobotanical, agroecological study into food crops of global origins, aiming to reorientate a viewpoint centered around their ethical, ecological and cultural values rather than as a cog in a commodity-centric globalised markets. We explore crops in a deep-time relationship to humans and culture, understanding why growing attuned to natural cycles brings riches far further reaching than economic face value.

Methodology:
Using the photographic medium, we consider each plant a topical springboard, diving into these crops through personal account, mythology and historical research. We consider each in their relation to evolution, cultural/historical fluctuations and market forces, exploring how this makes them relevant today.

Findings:

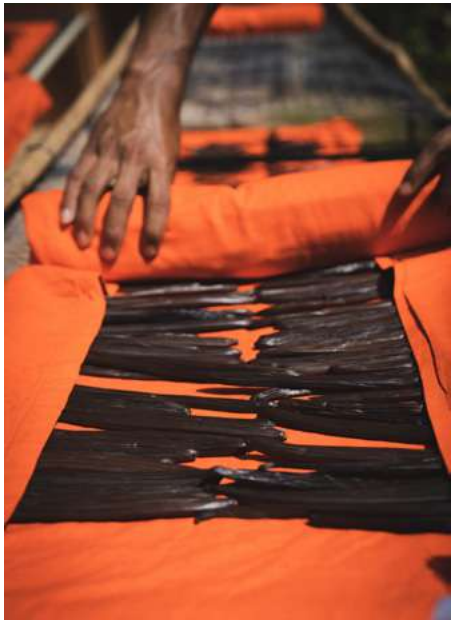
- Through research it becomes evident that many crops become shaped in their modern context by their relationship with market forces, which in turn is related intimately to the global forces of history remapping including imperialism and the development of market capitalism, production/consumption + trade routes
- Those at the forefront of safeguarding and re-enforcing agro-ecological growing practices are not large governmental bodies, they are the small scale growers. For example, allotment growers in Enfield saving Callaloo seed, clove pickers of Kandy, Sri Lanka returning to handed down ancestral practices, Mexican cacti growers dreaming of new hopes for the future. This suggests that those at the fringes play as central figures and that citizen science plays an important role
- Many crops used widely today have thousands of years of history, which often goes unchecked and unnoticed. This can be considered a form of cultural 'plant blindness'. Crops have been severed of their cultures and visa versa, a tool often used by systems of oppression. Although some may know the intimate details of their histories of their favourite football teams, it's highly less likely they know that carrots first originated in Afghanistan or that cloves were used originally as a breath freshener. The average American child knows 100 brands but only 10 plants (one is a Christmas tree) (Robin Wall Kimmer 2024). Western growing practices increasingly pull focus from the stories, history and roots of agricultre

Callaloo

Cloves

Nopales

Vanilla



Jayne Arnold, Oxton Organics, Worcestershire

We have a 12 acre farm. Two acres are a min-till market garden with 5 poly tunnels, and the rest is agroforestry pasture which is holistically grazed by my small flock of sheep.

Learning how to make the bio fertiliser and trialling it on the cucumber crop was a fun project. The soil test and sap analysis on the cucumbers was incredibly informative. I have found the information gained has shaped our thinking and given us a greater understanding of some on going nutritional problems in the poly-tunnels.

In March soil samples were sent to the Soil Ecology lab for analysis. Saturated paste tests showed we were low in potassium, sodium molybdenum, copper and selenium whilst high in calcium. On 1st May we got everything to hand, collected some fresh manure from a local organic farm and started making the bio-fertiliser. Mixing proved quite strenuous in the narrow lidded 220lt container. Once happy we had mixed it well we put the lid with an airlock on tight and left next to a poly tunnel for warmth.

Bio Fertiliser recipe:
40L cow and sheep manure, 1kg rock dust, 2kg wood ash, 1lt seaweed, 2l molasses, 2l raw milk, 180l water.

It was a cold and grey spring and early summer, so the bio-fertiliser took much longer than the 5 weeks we were expecting.

On the 20th July, thinking it had finished fermenting, we opened up the biofertiliser hoping to start using it. It still seemed to be bubbling so we resealed it and left it for a couple more weeks. Even though the colour and smell seemed to be as it should be I was unsure about whether it was safe to foliar feed a salad crop such as cucumbers with a bio fertiliser..

A helpful part of this trial was the advice given from Adam at the Soil Ecology lab. Adam's advice was to feed the soil not the plants just in case there were pathogens still in the fertiliser. So instead of foliar feeding the plants as planned we watered a 5% solution of bio-fertiliser onto the cover crop and soil growing below the cucumbers. The bio-fertiliser was applied to two thirds of the bed leaving one third as a control using an 8lt watering can. Two cans were used per 18m2. This was repeated three times; 2/8/24, 15/8/24 & 1/9/24.

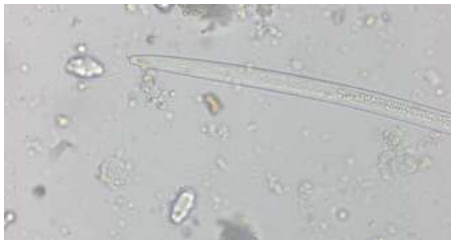
Sap Analysis: Old and new leaves were collected from the fertilised plants and the control and sent to the lab in Holland for sap analysis on 5/9/24. Results showed a slightly higher level of potassium, sodium and micronutrients in the trial compared to the control. Although not enough to conclusively say the fertiliser had made an impact, I was not surprised at this as soil applications of fertiliser take a lot longer than foliar feeds. We had not had sufficient time from the first application. The crop has gone on to do very well, we are still picking cucumbers in early October. I intend to feed the bed again, omitting the control area to see if we can see a difference in the following crop.

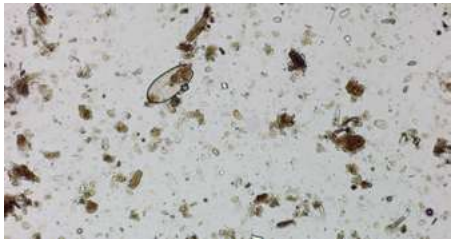
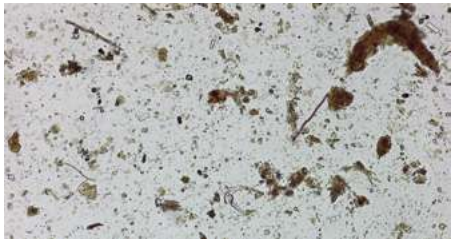
Adam Beer, Pitney Farm Market Garden, Somerset

Pitney Farm Market Garden is a 4.5 acre organic horticultural enterprise in South Somerset. I've been researching Johnson Su compost. We built a Johnson Su bioreactor in Winter 2023. The compost was made into an extract - the process was to use 300g of compost in 1L of water and mixed with a paint mixer drill attachment. This slurry was then poured through a paint strainer mesh bag (200 micron?) and mixed with another 29L of water. Resulting in a 1:100 extract ratio.

A bioassay was carried out by Taryn Armstrong to assess the biological makeup and activity of the compost and of the extract. The results were very positive. The compost has very high levels of fungi, bacteria and protozoa and reasonable levels of actinobacteria, no presence of any detrimental microorganisms and a high fungal:bacterial ratio. Based on the results it was recommended that the extraction process was made longer - up to a ten minute rather than 2 minute extraction to liberate more biology from the compost.

The extract was mixed with seaweed feed (Maxicrop Original - 50ml per 15L) and foliar sprayed onto a cucumber crop, var. Passandra, once a week over a period of three weeks. The treated cucumber crop, and a control area, then had sap analysis to assess the impact of the foliar. The sap results were interpreted by Adam at the Soil Ecology Lab, they showed that the foliar application had little to no effect on the crop. What the interpretation did show was that the crop had been lacking in nitrogen and would benefit from more even watering across the soil profile. Adam advised that the most effective way to use Johnson Su extract was to apply to the seed at sowing - if raising in modules sow seeds and then spray with extract before covering with compost.



Bill & Cath Grayson, Morecambe Bay Conservation Grazing Company, North Lancashire and South Cumbria

We graze our livestock (80 Red Poll cattle and 20 Easy Care sheep) over some 40 separate sites that are all managed as nature reserves by the various conservation bodies that own them (e.g. Natural England, Forestry Commission, the RSPB, the Woodland Trust, Cumbria and Lancashire Wildlife Trusts, plus private landowners). The total area covers 730 hectares (ha), and includes a range of different semi-natural habitats such as limestone grassland, hay meadow, fen, salt marsh, limestone pavement, wood pasture and scrub, wildlife-rich habitats whose integrity depends on sensitive delivery of nature-friendly grazing regimes.

We have been participating in a FiPL-funded study to assess the greenhouse gases that come from our grazing system, an issue that concerns most livestock producers these days, especially extensive, low-input ones like us. Using the Farm Carbon Toolkit has revealed that our grazing system, overall, is actually serving as a significant net sink of greenhouse gases, suggesting that we are removing well in excess of 1500 t of CO_2e annually. Although this is mainly due to the extensive tree- and shrub-cover that extends across many of the sites where our cattle are grazing, it also stems from not relying on purchased inputs such as feed and fertilisers to force higher output from the land, something that minimises the additional carbon costs associated with the fossil fuels used in the production and transportation of any external inputs.

Although low-input farming can be criticised for being less productive, the resulting cost-reductions mean that farmers practising it can also expect to achieve better financial returns, overall. This is the principal conclusion coming from the many MSO (Maximum Sustainable Output) analyses that Nethergill Associates have carried out on farms of most types and sizes throughout the UK, confirming the importance of a reduced-input approach for tackling the industry's many sustainability issues.

Catherine Howell, Urban grower, Stockton-on-Tees

The ‘Growing to Seed’ project is a small and local initiative that uses training in seed saving as a means to tackle mental wellbeing challenges. Participants in the project were invited to take part in a face-to-face introductory course running fortnightly between March and October 2024 at three community gardens, one in Stockton, one in Teesside and one in coastal North Yorkshire. There were no qualifying criteria other than some experience of growing; the desire for ‘mental wellbeing’ was on a self-referral basis.

Fifteen people joined the project. They were invited to complete a baseline self-assessment of mental and physical wellbeing, together with questions relating to what they were most looking forward to, and what they might find challenging. Eight people completed the assessment. Observational notes were taken throughout the project. In general, the North Yorkshire group were more financially secure than those from Teesside, with a higher level of general educational attainment. The age, gender and cultural profile was similar.

Baseline data indicated that mental wellbeing was initially very poor, with an average score of 3.75/5. ‘Anxiety’ and coping with the workload were anticipated as challenges; ‘being with like minded people,’ ‘friendships’ and ‘learning new things’ generated excitement!

Each session began with a check-in, an opportunity for each person in turn to speak about how they were arriving. Almost unanimously, and regardless of background, all participants mentioned feeling isolated at the beginning and some mentioned feeling ‘different,’ or like they didn’t fit in. The check-ins became the core part of the sessions, often lasting over an hour, but they did feel important (perhaps more important than the learning!)

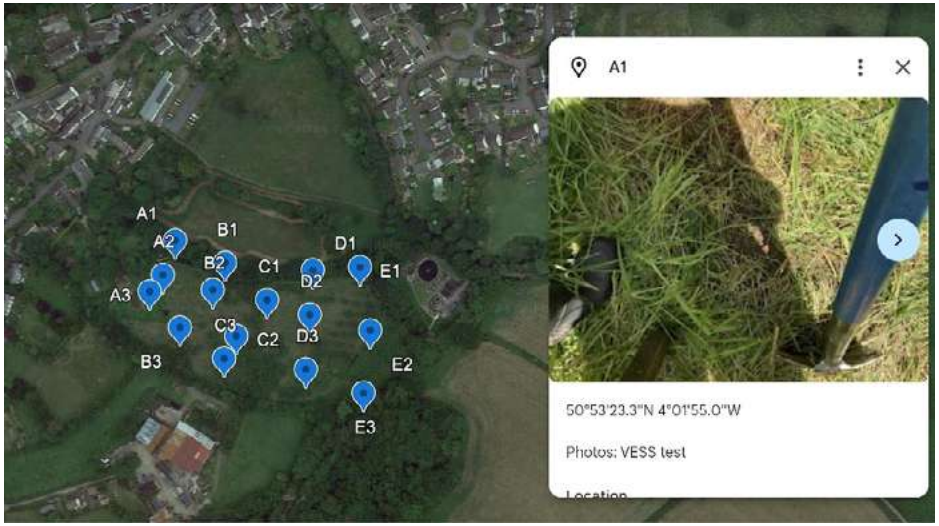
Some participants faced life-changing events during our time together, including the death of siblings, a heart attack, a diagnosis of diabetes, catastrophic flooding of a home… Together we aimed to hold space for people so they could receive the help and support of their peers. Only one person left the course, very reluctantly, after both elderly parents received diagnoses of dementia and her own health worsened. There have been some very significant moments of change. Six people joined an overnight trip away to the West Midlands, visiting the Heritage Seed Library and Warwick Crop Centre with other trainees from the Seed Sovereignty Programme and three also joined a day trip to Lancaster Seed Library (some hadn’t travelled from home for many years). Nine people have registered as volunteers at the sites where their learning has taken place. One person is now on a 12 month ‘back to work’ programme having been unemployed through poor mental health for several years. One person has enrolled at college. One person invited everyone to her 60 th birthday party (and several attended!) And everyone has grown a crop from seed to seed and learnt about how to do so well, some people producing enough to share between the groups and with friends and family.

The summative self-assessment data is yet to be compiled, but it’s anticipated that mental wellbeing will have improved dramatically. It’s difficult to attribute this solely to the content of the course, but certainly the sharing of not just time together but also the possibility of sharing the product of the course – seed – freely and abundantly, has added a valuable dimension and both together have kickstarted new possibilities and connectedness on those journeys for all.

Jake Glanville & Miriam McCurdy, McG Juice, Devon

Court House Orchard, operated by McG juice, is a 2.16-hectare regenerative, organically certified traditional apple orchard located in Devon. Established 15 years ago, this diverse ecosystem encompasses not only apple trees (primarily Southwest England varieties) but also soft fruits, herbs, short rotation coppice (SRC) willow and alder, a wildflower meadow, wet woodland, and a pond. The orchard adheres to a philosophy of very low input and minimal intervention, eschewing large machinery use. Management practices include topping the sward and meadows only once annually before harvest. The orchard's produce is processed on-site into various artisanal products including juices, vinegars, cordials, and syrups, which are sold locally. The business maintains commercial viability through a combination of product sales, a contract pressing/bottling service, and a Countryside Stewardship contract with the Rural Payments Agency (RPA). This holistic approach to orchard management provides a unique context for interpreting the following soil test results.

The tests were performed across multiple locations within the orchard on different dates.



Tests were conducted on the following dates:
- June 20, 2024
- June 24, 2024
- July 8, 2024

Results by Location

Location A1 (50.88980 N / 4.03195 W)
Date: *June 20, 2024*
Structure Quality Score: *1*
Rooting Depth: *25cm*
Fungal Hyphae: *Yes*
Notes: *Tested only a few hours after light rain. Top layer of soil still damp.*

Location B1 (50.88965 N / 4.03142 W)
Date: *July 8, 2024*
Infiltration Time: *1459 seconds*

Location A2 (50.88957 N / 4.03208 W)
Date: *June 24, 2024*
Structure Quality Score: *1*
Earthworm Count: *25 (9 anecic, 15 endogeic, 1 epigeic)*
Infiltration Time: *5 seconds*
Slake Test Score: *2*
Rooting Depth: *15cm*
Fungal Hyphae: *Yes*
Notes:
- *15 fast-moving & red worms (some >8cm), possibly anecic (5 adult, 10 juvenile)*
- *10 pale pink worms, <8cm, slow moving (unidentified)*
- *Other fauna: 5 millipedes, 8 slugs, 2 snails, 1 red bug (photo), 1 springtail (photo)*

Date: *July 8, 2024, Infiltration Test*
Infiltration Time: *64 seconds*

Location C3 (50.88901 N / 4.03143 W)
Date: *June 24, 2024*
Structure Quality Score: *13*
Earthworm Count: *23 (9 anecic, 7 endogeic, 7 epigeic)*
Infiltration Time: *9 seconds*
Slake Test Score: *2*
Rooting Depth: *14cm*
Fungal Hyphae: *No*
Notes:
- *16 pale pink worms, smaller & slower moving <8cm*
- *Photos of various beetles, slugs, snails, woodlouse, millipedes, etc.*

Date: July 8, 2024, Infiltration Test
Infiltration Time: *420 seconds*

Location D2 (50.88930 N / 4.03051 W)
Date: *June 24, 2024*
Structure Quality Score: *11*
Earthworm Count: *13 (4 anecic, 7 endogeic, 2 epigeic)*
Infiltration Time: *10 seconds*
Slake Test Score: *2*
Rooting Depth: *24cm*
Fungal Hyphae: *Yes*
Notes:

- *Soil very dry after a few hours of sunshine and no shade in this sampling spot*
- *7 fast moving, dark red-headed worms <8cm*
- *6 pale pink worms, smaller & slower moving <8cm*
- *Photos of various beetles, grubs, ant eggs, millipedes, etc.*

Date: July 8, 2024, Infiltration Test
Infiltration Time: *76 seconds*

Location E1 (50.88962 N / 4.02997 W)
Date: *July 8, 2024*
Infiltration Time: *40 seconds*

Lab tests

1. 20/06/24: pH/SOM sample: aggregation of 15 x 30-40g samples from locations A1 to E3 (see Google Earth project 'Court House Orchard').

2. 20/06/24: Bulk density sample: aggregation of 3 roughly equal sized samples from locations B2, C3 and E1 (see Google Earth project).

3. 20/06/24: Aggregate stability sample: aggregation of 3 roughly equal sized samples from B2, C3 and E1 (see Google Earth project).

Additional Notes

- *Infiltration rate was measured using a pipe 10cm wide and 20cm long.*
- *Heavy rain showers preceded the infiltration rate tests on July 8, 2024.*
- *Photos and precise locations can be found in the Google Earth Project 'Court House Orchard'.*

Conclusion

The soil tests reveal varying conditions across the orchard. Factors such as recent rainfall, sun exposure, and location within the orchard appear to influence soil structure, earthworm populations, and water infiltration rates. Of particular note is the significantly longer infiltration time at Location B1, which may warrant further investigation. Further analysis may be needed to determine the implications of these results for orchard management practices.

Michael Heap, Regenerative smallholder, Somerset

Recovering management consultant, now smallholder, based in the Vale of Avalon on a very old pig farm practising extreme regenerative agriculture removing or reworking 1kg of old concrete at a time. The project is a combination of the authors areas interest, reusing abandoned or disused buildings for food production,use/abuse of commodity technology to facilitate agriculture/food & drinks production, Expansion of high value product production on small farms and smallholdings.

The project:

A small controlled side by side trial of high value gourmet mushroom fruiting techniques was conducted to evaluate the effectiveness of an automated fruiting chamber to both: A) Increase yields from given inputs by providing ideal conditions (Space, Airflow, Humidity, Time, Volume of growth media) and to B) Reduce 'hands on time' during the fruiting process by not having to manually check and adjust conditions several times a day.

The test showed that not only was there an increase in weight (1/3rd) of fruiting bodies (against traditional techniques) and a reduction in time to fruiting, but the test also showed an increase in number of harvests in a given timeframe (traditionally 2-3, trial showed 4)

Next steps: Rerun automation trials in larger format to see if increase in crop size scales with the same equipment, possibly reusing disused buildings.

Time to flush	Automated	nonauto
1	13	14
2	28	33
3	39	44
4	48	-

Avg. weight of fruiting bodies (g)	Automated	nonauto
1	178	106
2	104	96
3	128	94
4	96	-
Average Total	506g	296g

Evi Landay, Laurieston Hall, Dumfries and Galloway

I'm Evi, a farmer in Galloway, Southwest Scotland. We're in our third year of adaptive multi-paddock (AMP) grazing on our 18ha of permanent rough pasture. It's a challenging site - formerly a sand and gravel quarry with shallow, sandy, acidic soil.

Our recent soil tests yielded surprising results, particularly the infiltration rates. Despite our sandy soil that I thought drained well, the first two tests showed slow infiltration. The third test, however, drained quickly. This variation might be due to the thick sward in some areas or the extra run-off from nearby forestry land.

We've planted willows and about a thousand native trees, especially along a gully formed by water inundation. Alders are doing particularly well. I'm considering creating ponds, but I'm wary of the invasiveness and cost of bringing in heavy machinery.

Encouragingly, our soil is starting to look less like pure sand! At a recent Carbon Calling event, Allen Williams mentioned that soil health improves exponentially by the fourth year of regenerative farming. We're not there yet, but we're seeing promising signs. We've recently increased our stocking density by using smaller paddocks. The cattle seem happy, grazing less selectively, and getting fresh pasture daily; We continue to observe and adapt.

Despite the challenges of inexperience and our difficult starting point, we're committed to our AMP approach, minimal soil disturbance, and increasing biodiversity. It's a learning process, but we're cautiously optimistic about the changes we're seeing in our land.

Peni Ediker, Grower, Swn Y Coed, West Carmarthenshire

My name is Peni Ediker, I live on a One Planet smallholding in Carmarthenshire called Swn y Coed. When we moved to the farm in 2016 the soil fertility was poor. Over the years we have built up fertility by making large static inoculated compost piles which we apply to our no dig garden beds and poly tunnels. We have also made biofertilisers using local indigenous microbe organisms and multiplying them and fermenting them into biofertilisers. From doing this we have excellent yields and fantastic soil health.

Over the last year I have been working for Cwmarian Renewable Energy based in Tegryn, Pembs. I have been working with a local welsh farmer to improve his fertility with the help of bio fertilisers and to minimise the use of chemical fertiliser.

We measured out two 5 acre strips, one a herbal lay and the other a swede and turnip crop. I took soil samples from the fields and sent them off for lab tests in November 2023. The tests showed that the soil had low molybdate levels.

We made up two biofertilisers. A cow dung fertiliser with added ammonium modydate and a humus hydrate, made from humus from the woods on the farm and potassium hydroxide. We sprayed every two months the herbal lay and the swede crop at a dilution of 5 litres to 50 litres. We left one stile as a control, not spraying.

I will be sending off soil tested at the beginning of November 2024 for the end of the trial and to see what the differences are from the beginning of the trials.

Presently I have noticed the herbal lay is very green and vibrant. We have a fantastic swede and turnip crop that has not been sprayed against cabbage root fly this year. Usually the crop get sprayed with glyphosate.

The farmer has not used any chemical fertiliser this year. This is a fantastic result of trialling biofertilisers at field scale.

Stuart Saunders, Abundant Life, Devon

Stuart Saunders is a Soil Food Web School qualified lab tech, and currently works with Sustainable South Brent. He has a BS in Biology from Indiana University and has previously worked as a research technician in Environmental Microbiology with the University of California and at the U.S. Department of Agriculture.

Stuart undertook soil sampling for microorganisms in August 2024. Samples were taken from the root zones of six 5y old crop trees: Alder, Scots pine, Walnut, Lime, Sweet chestnut and Oak. The samples were analysed by light microscopy, according to Soil Food Web School protocols, as developed by Elaine Ingham.

These trees are planted in disused pasture, now predominantly unmown meadow grasses. The results are quite uniform between the six samples and indicate an early successional state of the soil microbiology, as would be expected in soil recovering from conventional agricultural use. Numbers of aerobic bacteria, bacterial feeding nematodes and protozoa (almost exclusively amoebae, mostly testate) were generally adequate to the purpose. However, the fungal component of the system was poorly represented, with low biomass and diversity of fungi, and fungal feeding nematodes absent (within the sensitivity of this analysis). The situation can be expected to improve as the trees become better established, and the plant community develops, but an intervention by introduction of indigenous fungi would likely improve the trees' health and vigour. Future improvement in the fungal component will result in improved productivity in the food web in general, so that higher numbers and diversity of microarthropods and their predators can be hoped for, with a subsequent cascade upward through the trophic levels.

An application of wood mulch around the plantings is frequently recommended for establishment of fungal communities, as decomposition of wood is a fungal speciality. Therefore, a small-scale study using wood mulch or compost on a sample of these trees would be of interest, in terms of biodiversity and growth effects, in addition to a study of the microbiome associated with the perimeter hedgerow.

Marco Tenconi, Rhyze Mushrooms Co-op, Midlothian

Rhyze Mushrooms is a worker's co-op based in Edinburgh. We grow Oyster, Lion's Mane and Reishi mushrooms on local business waste and run educational projects to spread mushroom cultivation skills far and wide.

We firmly believe that mushroom cultivation is a tool we can't overlook as we fight to build more resilient and fair food systems, especially in countries with climates like Scotland. Mushrooms grow year round, are relatively insulated from unstable climatic conditions and are an excellent source of vitamin D. Although often cultivated very intensively in dedicated spaces, Oyster mushrooms can be grown without specialist equipment, and can thrive in polytunnels alongside veg.

At workshops and gatherings we've had plenty chats with LWA members who run market gardens and found the biggest barrier to commercial growers taking up mushroom cultivation is not a lack of interest but a lack of time.

Hearing that feedback we've used this grant to research and design a 'starter pack' with clear instructions and costed materials that takes as much of the thinking, procurement, and calculations out of the equation for curious first-time commercial growers.

We started with a proven combination of straw pellet substrate and grey oyster spawn. And experimented with:

- The quality of different straw pellets
- Inoculation rates
- Different ways to use unproductive polytunnel areas as fruiting and incubation spaces.
- Different ways to mix pellets and sawdust to maximise efficiency

This last point yielded the most interesting results. We landed on a process that involves dry mixing pellets and spawn inside pre-cut polythene tubing sealed at one end. Water is then added and the bag is sealed with a cable tie. Only once the pellets are rehydrated is the bag perforated (using an embroidery wheel or similar tool) to allow the mycelium to breathe. As far as we know this is a novel technique that significantly reduces time and chances for contamination.

This kit will produce six 10 kg grey oyster bags which each fruit about 2.5 kg of mushrooms over two or three flushes, a total of 15 kg of Oyster mushrooms which should retail for over £200 at a normal price of £16/kg.

Item	Total qty.	Qty. per bag	Est. cost
Grey oyster spawn	3kg	500g	£18
Straw pellets	21kg	3500	£21
Custom grow bags	6	1	£3
Embroidery wheel tool	1	Re-usable	£3
Reusable cable ties	6	1	£0.50

The total cost of the kit will be about £45 + Vat and delivery. We're collaborating with Gourmet Woodland Mushrooms - the most established spawn producer and cultivation supplies distributor in the UK to make the kit available online so you can buy everything together. The full results of the experiment and detailed instructions including a video on how to use the kit will soon be available on our website.

Jossie Ellis, Lauriston Farm, Midlothian

Located in North West Edinburgh between Lauriston Castle and the Cramond seashore, Lauriston Farm is a hundred acre farm run by a workers cooperative that is focused on food growing, biodiversity, and community.

I carried out a research project into data collection and management in market gardening using airtable. This project aimed to develop an efficient system for planning, tracking and analysing growth, harvesting and sales data for market gardens using Airtable, a versatile database tool. The objective was to enhance decision-making and farm management through real-time data insights whilst developing a core database of growing information specific to Scottish conditions.

The methodology involved designing custom Airtable templates tailored to market garden operations, establishing protocols for regular data entry, and utilising Airtable's features for data analysis. The system tracks crop varieties, planting dates, growth stages, yields, labour hours, input costs and sales data. Implemented in 2023 and refined in 2024, the project has already yielded positive outcomes. It has streamlined planting and harvest workflows, improved communication with CSA members through real-time shared views of vegetable box contents, and facilitated better understanding of retail value equivalents for CSA shares.

The significance of this project lies in its support for data-driven farming practices, leading to more sustainable and profitable operations. It reduces manual data entry errors, improves coordination among garden staff, and supports transparent supply chain management.

Future plans include further refinement of the model, developing standardised inputs/reports, and potential collaboration with other market gardeners to build a shared knowledge database for Scottish growers. The project team also conducted a crop planning workshop to share their approach and use of Airtable with interested growers.

This initiative represents a replicable model for market gardens seeking to improve their data management processes, potentially contributing to more efficient and sustainable agroecological practices in Scotland and beyond.

Hamish Evans, Middle Ground Growers

We are Middle Ground Growers, a collective social enterprise of 7 new entrant farmers stewarding 16 acres of land in somerset. We grow for 180 veg box subscriptions and 20 wholesale outlets around Bath and Bristol. Our farm comprises a 2 acre no till market garden and the rest of the fields are in agroforestry and a traditional organic crop rotation. This year with the LWA programme we have been measuring yields in the market garden and the field veg to compare how this varies, and simultaneously measuring the soil health over time. So far the data is reading high yields for both fields (in a min till organic system without inputs and predominantly tractor run) and market garden (a no till system with compost added and predominantly hand tools), with the latter showing much higher yields (more than double in most cases) for individual crops and per acre yields significantly higher.

Soil health from our Farm Carbon Toolkit results also show good increases in soil health since we began in 2020 on this land, and significantly better and faster results in the market garden in terms of carbon sequestration, organic matter, soil biology, worm counts, nutrients, micronutrients, fungal:bacterial ratios and microbiology. We are yet to fully collate and analyse the data but the research has been a fascinating inquiry into the hidden happenings on farm and below ground, processes we have an intuition of as farmers but now can marry this with some specific insight and backing up through data, which is important if we are to continue making the case for agroecology and nature friendly farming.

Holly Emmens, Abundant Life, Devon

Holly Emmens is a Landworker and Market Gardener with a background in Ecological Consultancy and Conservation. Holly completed a diploma in Regenerative Landbased Studies in 2023 and combines this with ecological knowledge and practices, in working with farmers and citizens to bring a holistic approach to working with the land, to benefit both people and biodiversity.

Holly works as part of Common Flora on the Abundant Life Project, seeking to connect farmers and citizens to the benefits of land use in reciprocity with the natural world in a way which also works for farmers economically and sustainably. The land at Common Flora was previously grazing pasture, most of which has been planted with an orchard and thousands of predominantly native trees. Flowering grasses have been left to establish within the grassland, with a low maintenance management regime, and a small vegetable growing space has been created. Monitoring of changes in biodiversity within the forest-grassland have been ongoing since 2018 when the trees were planted. Standard methodologies have been used each survey year, and surveys have been conducted by Common Flora, with engaged citizen scientists. The results of the 2024 biodiversity surveys have been analysed and compared to previous years to show changes over time and these results may be used to showcase a real-life example of increases in biodiversity that can result from changes in land use practices, which will be fed back to engaged farmers.

As part of the wider Abundant Life Project reach, we would like to take this further in future by offering bespoke advice to project farms on how they can apply wildlife friendly farming practices to bring benefits to their businesses and their personal wellbeing. This will be done using an Asset Based Community Development approach within our network of local farmers, focussing on the attributes of the network, to encourage skill sharing and localised empowerment for positive outcomes and mutual support.

Holly Sayer, Botanist/Land manager, Pembrokeshire

I'm Holly Sayer, based in West Wales, just south of Cardigan. I own a small farm with my partner, on which we have planted two orchards, one is a mixed 'home' orchard of nuts and fruit and a larger commercial walnut orchard. We graze all year round with a small herd of traditional Hereford cattle and are slowly seeing some really positive changes in the diversity of species of flora from our management.

In addition to owning the land I am a botanist and as a consultant my work involves conducting surveys and using them to advise landowners and farm owners on how to improve their grasslands and woodlands, both as part of their business and for biodiversity through sustainable management. I wanted to see if I could measure the effects of this management on our own farm.

My research is a long-term project looking at the change in biodiversity. My particular interest is whether as the orchards get more established this has a positive effect on biodiversity. I conducted extensive botany survey alongside butterfly and bird transacts. The botany surveys are already forming a good picture of the change in flora as our management starts to take effect.

Last year was a baseline survey year and this year there have been many new flower records, in both the coppice woodland, grasslands and orchards.

The most exciting for me is finding certain species that are what botanists call axiophytes, which indicate high quality habitats. These have increased in quantities across the grasslands and have even spread into new fields. This year I found several new species on the farm including harebell, pignut, meadow vetchling and goldenrod, all of which are axiophytes.

These findings indicate our management is going well and I'll be interested to see how the species change over the years; will there be a drop off in floral diversity as the orchard trees get bigger, and will this coincide with more birds using the orchards? Our bird surveys this year found that both the top orchard and the 'home' orchard had less birds nesting during breeding season, probably because these are the only two fields which are not bordered by thick woodland.

This research is invaluable to me as a landworker and being able to show others how management directly impacts so many species across different habitats is exciting. Orchards are particularly understudied and gathering data right from the start of planting an orchard contributes to wider understanding of how important this habitat is.

Dave Brakes & Louise Anderson, Old Road Farm, Monmouthshire

Old Road farm is set over 9-hectares of unimproved permanent pasture that has been traditionally used for set-stocking of sheep and cattle, as well as hay production, for over a decade. Acquired in March 2024, the land is currently undergoing a year-long rest period without livestock. The farm's two main areas, known as the Top and Bottom Fields, yielded a hay harvest in late July 2024. Predominantly southeast-facing, the site spans an altitude range of 175 to 250 meters. Its relatively shallow, light sandy loam soil overlays sandstone, locally referred to as brownstone. While the farm itself consists of open pasture throughout, it is embraced by mature hedgerows and benefits from the proximity of large woodlands, creating a diverse and picturesque rural setting.

Controls for comparison

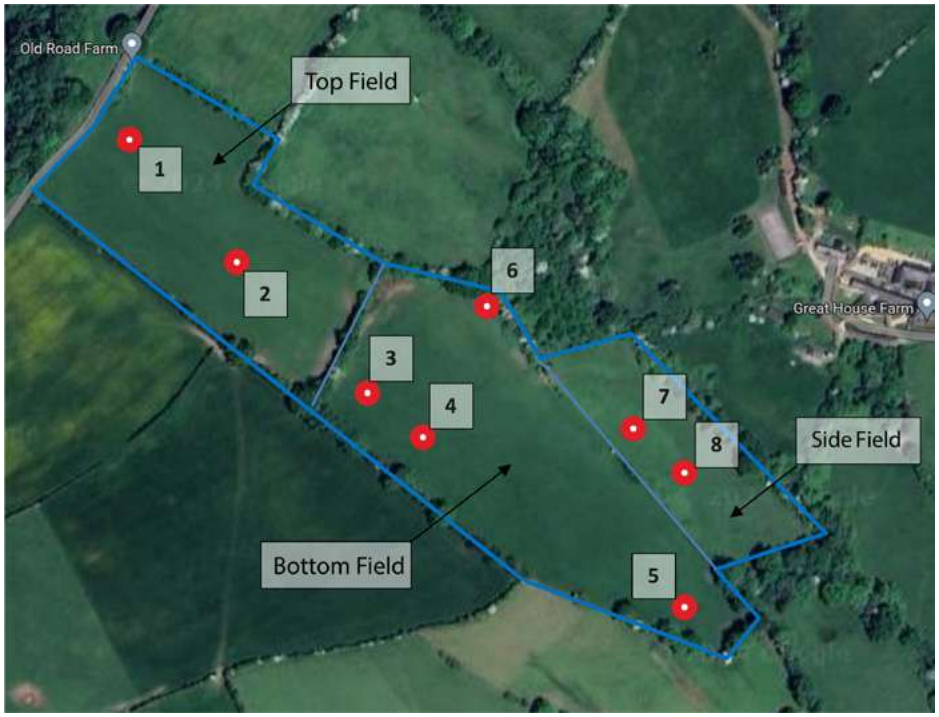
The purpose of this report is to establish a baseline for land we have recently purchased. Historically this land has been used for the set-stocking of cattle and sheep and cuts of hay. As far as we are aware it has not been tilled for over 12 years. All adjacent farmland is currently used for set-stocking of sheep or horses, so could also potentially serve as a baseline in future.

After a stock-free year (Mar 2024-2025) we intend to adopt the following management practices:

- The top half of the Top Field (4 acres) will be converted to an organic certified market garden. The soils in this area will by changed substantially over the next few years through the addition of composts, manure and amendments, as well as tillage and intensive cropping.
- Our remaining permanent pasture will be predominantly grazed by cattle using long grass. Adaptive Multi-Paddock Grazing. Our aim over time is to build soil carbon, improve drainage and water retention, improve yields and minimise housing periods through the winter.
- We will also have a small flock of sheep to manage our marginal areas.

Sample locations

Eight locations were chosen with a bias towards the areas that will remain permanent pasture in future. Site 1 is within the future market garden cropping area, so soils are expected to change substantially over the next few years though manual interventions. Sites 2 and 4 are typical of much of the pasture in the Top and Bottom Field (which are similar). Site 3 has been heavily compacted near a gateway, Site 5 is at a level area at the bottom of the slope and so tends to get waterlogged, and Site 6 is the steepest area on the site (facing North-east). The side field differs from the other two fields in this that it is too rough to easily mow (it wasn't mown this year). Sites 7 and 8 were chosen based on apparent differences in sward.



Sward Surveys

A survey was conducted at each site on 26/7/24 to determine the characteristics of the sward before the hay was cut at the end of July.

Site 1

Site 2

Site 3

Site 4

Site 5

Site 6 (post-mow)

Site 5

Image missing

Site 6

Sward Survey Results

		Grasses						
Test	Sward Depth	Perenial Rye	Sweet Vernal	Tufted Hair'	Y'shire Fog	Smooth Meadow	Cocks Foot	Crested Dogstail
Site 1	26cm	X	X	X	X			X
Site 2	23cm	X	X	X	X	X		X
Site 3	27cm	X	X	X	X		X	X
Site 4	20cm	X	X	X	X			X
Site 5	27cm		X	X				X
Site 6	-		X	X				X
Site 7	30cm			X	X			
Site 8	21cm	X	X	X	X			X

		Legumes			
Test	Sward Depth	Red Clover	White Clover	Lesser Trefoil	Birdsf't Trefoil
Site 1	26cm	X	X	X	
Site 2	23cm		X	X	
Site 3	27cm	X	X		
Site 4	20cm	X	X	X	X
Site 5	27cm	X	X	X	
Site 6	-		X		
Site 7	30cm		X		X
Site 8	21cm				

		Common Forbs		
Test	Sward Depth	Hawksbit	Plantain	Meadow B'cup
Site 1	26cm	X	X	X
Site 2	23cm		X	X
Site 3	27cm		X	X
Site 4	20cm	X	X	
Site 5	27cm	X	X	X
Site 6	-	X	X	
Site 7	30cm			
Site 8	21cm		X	

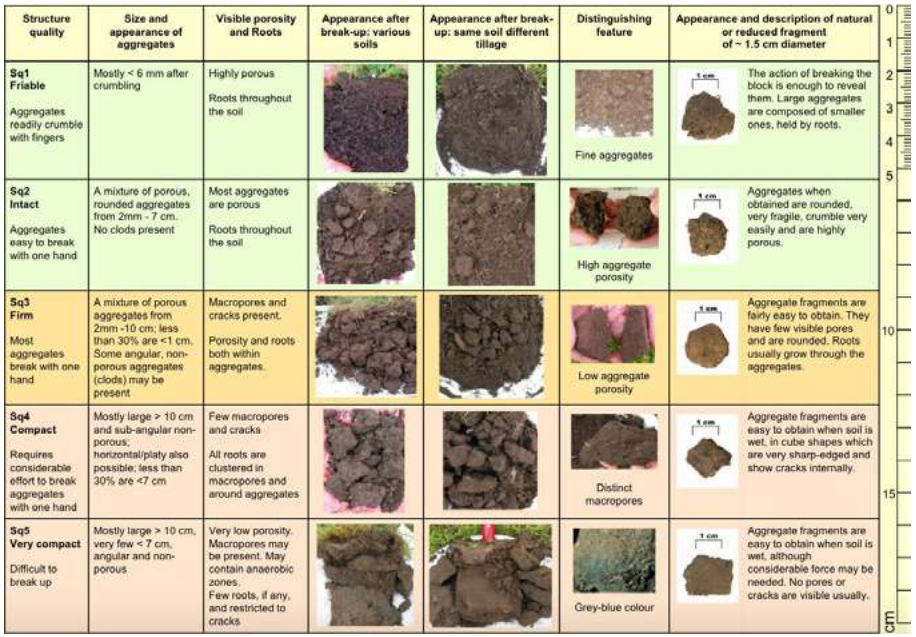
Additionally:
- Site 7: Creeping Buttercup, Soft Rush, Chickweed
- Site 8: Knapweed, Sheep's Sorrel, Bulbous Buttercup

Soil Tests

The following soil tests were performed on 18/08/2024 after the hay was cut and baled (Top and Bottom Fields only). A worm count was not conducted as the recent weather had been so dry.

pH and SOM:
A test sample was created combining approximately 50g of soil from each of the eight sites. This has been sent off for analysis, results pending.

VESS:
VESS evaluates soil structure quality visually, indicating compaction, aggregation, and aeration levels, critical for root growth and water infiltration.



Test	Top Layer		Bottom Layer	
	Notes	SQ Score	Notes	SQ Score
Site 1	Layer 7cm: Sandy, lots of roots. Aggregates not porous	3	Same as top, but larger aggregates	3
Site 2	Layer 7cm: Sandy, lots of roots. Aggregates not porous.	2	Same as top, but larger aggregates	3
Site 3	Layer 10cm. Darker than sites 1&2.	3	Same as top, but larger aggregates. Bigger than sites 1&2	2
Site 4	Layer 10cm. Darker than sites 1&2.	3	Very crumbly, wetter and more worms than Sites 1-3. Finer roots than Site 3	3
Site 5	Layer 6cm. Orangy, like Site 1. Quite friable.	2	Very hard and compacted	4
Site 6	Layer 3cm. Orangy. Sparse, shallow roots.	3	Same as top, but larger aggregates	3
Site 7	Layer 9cm. Rotting vegetation, damp, surface roots/runners	1	Lots of roots	2
Site 8	Layer 9cm. Rotting vegetation, damp, surface roots/runners	1	Lots of roots	2

Site 1

Site 3

Site 5

Site 6

Site 8

Photos from sites 2,4, and 7 are missing.

Infiltration Rate

Infiltration tests were performed using the following method:

- Drive pipe halfway into ground with hammer, leave 10 cm standing above ground
- Pour in water (approx. 800ml) to depth of 10 cm
- Start stopwatch immediately and measure time taken for water to drain into soil
- Repeat at several locations e.g. in a bed, in a wheeling between beds
- After test, check for any compaction in the soil e.g. by digging adjacent to the infiltration test

The test at Site 1 was abandoned after 14 minutes with very little change in the water level. All subsequent tests at other the sites were likewise abandoned, as was a control test in a hedgerow.

Our conclusion from these tests is our soil has likely become heavily compacted from both overwintering stock (it was very tightly grazed the previous winter) and from machinery, such as with the recent hay cut. This was likely compounded by the nature of the soil, being low organic matter with thin, short roots. The hedgerow test was not a valid control as all of our mature hedges have been historically open to grazing animals and have likewise become compacted. Improving the infiltration rate will be a key metric for our future management practices.

Additional Tests

- A 'Fork Test' to gauge the relative soil compaction between sites. The depth of penetration of a garden fork was measured with a person's full weight on it.
- A 'Sward Density Test' to assess the density of clumping grasses in the sward. All loose vegetation was pulled from set area (as if by a grazing animal) and the percentage of the remaining cover estimated.

Test	Fork Depth	Sward
Site 1	20cm	60%
Site 2	19cm	60%
Site 3	23cm	75%
Site 4	17cm	65%
Site 5	20cm	70%
Site 6	21cm	60%
Site 7	13cm	-
Site 8	18cm	-

A sward test could not be performed in the Side Field as the long grass made this test difficult (it had not been recently mown).

The fork test suggests that the compaction is broadly the same across the site, which corresponds somewhat with the abandoned infiltration tests. Site 7 is probably an anomaly due to the steep, rough ground in that area.

The proportion of running grasses was quite low and most of the vegetation remained anchored down; the gaps in the sward were primarily pre-existing bald patches. The land has been grazed very heavily over the previous winter and was quite heavily poached. We would expect the sward density to have increased by next season.

Conclusions

Sward

The sward is broadly similar across the site and tends to maintain a good balance of grasses, legumes and forbs.

- Grasses: The proportion of ryegrass is quite low overall but will hopefully increase over time as the soil fertility increases. The dominant species are Sweet Vernal Grass, Tufted Hairgrass, and Crested Dogstail. We might consider increasing our coverage of Smooth Stalked Meadow Grass and introducing Meadow Fescue.
- Legumes: We have a good coverage of White and Red Clover, as well as large patches of Lesser and Birdsfoot Trefoil. We may consider adding a vetch and Black Medic, the latter to help reduce compaction.
- Forbs: We have an even coverage of Plantain, Meadow Buttercup, and Hawksbit (the latter two being of little value). There is plenty of scope to introduce more useful species such as Yarrow, Burnet and Sainfoin.

While it didn't show up in our survey, the site does have Broad and Narrow Leaf Dock in most areas, with a few 'problem areas' where they have become quite prevalent. These areas appear to correspond to places of high footfall from stock and so are likely to indicate compaction. We also have some limited patches of Creeping Thistle in damper and more compacted areas, but it is not widespread across the site. We have a patch of Ragwort at the bottom of the Side Field that we will pull by hand. The soft rush in Site 5 corresponds to the damp soil in that area, currently it's quite sparse.

We were quite pleased with the results of this survey and believe it tells us that we shouldn't rush into any significant interventions. Once we have stock grazing the land (next year) we will probably aim to slowly introduce more species to the sward by seeding their manure patches.

Soil

This season's soil tests were performed to establish a baseline that marks a change in management practice going forwards. Changing to adaptive paddock grazing should increase soil organic matter over time, maintaining a longer sward will help improve infiltration and water retention (longer roots), and eliminating the export of hay will help to increase our soil fertility. We now have a baseline to measure this against.

One element that may require more immediate intervention is the evidence of compaction. There appears to be very little porosity in the soil, despite being sandy in nature. Next season we may experiment by subsoiling a test section of pasture to see if this improves both infiltration and soil structure.

We intend to send soil samples for detailed analysis in the coming weeks, which will tell us if we have any serious mineral deficiencies to deal with.

Ed Kyrke-Smith, Kent, David Newman & Tracy Russell, Buckinghamshire, and Ed Macdonald, Warwickshire

David and Tracey run Bucksum on 16 acres of rented land in Buckinghamshire. They produce over 40 varieties of salads, herbs, fruit and veg on 4 acres of the land, the other 12 acres are in a herbal ley fertility build phase rotation. Ed Kyrke-Smith moved from London to Kent with his young family to establish Rebel Farmer in 2015. Following permaculture principles, and re-purposing local waste resources, they transformed a former 3-acre sheep farm into a diverse market garden with a strong emphasis on soil health and biodiversity. Ed Macdonald is the new Grower at 5 acre community farm, a 12-yr old organic CSA near Coventry. Besides 5Ac of annual crops (comprising more than 150 varieties of vegetables) there are 3.5Ac of permanent grass verges, hedgerows, coppiced woodland, mature trees and orchards which are managed as wildlife habitats with piles of deadwood and long grass. Soil health is monitored in Spring and Autumn, with plant diversity and sward composition benchmarked to guide the selection of green manures and herbal leys.

Interested to know more about the biodiversity on their land, these farmers worked with Daisy Martinez - a PhD student at The University of Edinburgh - to learn about the bat species flying and foraging above their fields. They conducted acoustic surveys, deploying small microphones in their fields to record bat calls over a three-night period. Analysis of the recordings is still ongoing, but initial results from the British Trust for Ornithology's *Acoustic Pipeline* indicate that the fields were visited by:

Common Pipistrelle, Soprano Pipistrelle, Brown Long-eared Bat, Leisler's Bat, Natterer's Bat, Noctule, Grey Long-eared Bat, and Serotine Bat (Rebel Farmer), and Common Pipistrelle, Soprano Pipistrelle, Brown Long-eared Bat, Noctule, Natterer's Bat, and Lesser Horseshoe Bat (Bucksum). Further verification of the above species IDs will take place over the coming winter months.

Mary Silk, Jamie Somerville & Amanda Root, Fife

We explored the potential of Bokashi seaweed compost as a plant fertiliser and soil amendment. We collaborated with Amanda Root who used the Bokashi method to process beach-cast seaweed from Cellardyke Harbour in Fife, previously disposed of in landfill. Bokashi involves anaerobic fermentation and effective microorganisms (EM) which rapidly break down organic material. It speeds up the decomposition of organic material like kelp, retaining more nutrients and organic matter that might otherwise be lost in traditional composting systems.

We aimed to assess the impact of Bokashi seaweed compost on plant growth and evaluate the product through trials and biological assessments. Amanda's Bokashi piles varied greatly in odour and decomposition. Despite undergoing the bokashi process for an extended period, the material was not sufficient for our planned trials with large chunks of kelp still visible. Nevertheless, we conducted biological assessments on this pre-compost using microscopy to measure microbial biomass, fungal-to-bacterial ratios, and microbial diversity. The microbial analysis showed a lack of fungi and few protozoa. It was bacterial-dominated with a low diversity of bacteria. We were also curious to measure potential salt content from the seaweed and found that it had much higher nutrient and potential salt content than soil.

We recommended adding a thermophilic composting stage to break down the material further. This also considered potential regulatory restrictions for applications, as the anaerobic process of bokashi pre-compost may not meet safety standards for future agricultural field applications without a thermophilic stage. Amanda set up wire mesh cages for thermophilic composting, combining the bokashi seaweed with different ratios of other materials, including sheep manure and straw. Unfortunately, the piles did not reach a suitable temperature for trials. Nonetheless, the project demonstrates the potential for sustainable seaweed composting using Bokashi methods. With additional time, this approach could be further refined, and we recommend continuing to experiment with Bokashi methods and other composting techniques such as Johnson-Su bioreactors, flow-through vermicomposting bins, or windrows.

David and Wilma Finlay, The Ethical Dairy, Dumfries and Galloway

I'd worked as an agricultural consultant for ten years after university and believed deeply in the prevailing philosophy of agricultural intensification. On returning home to our fairly traditional, upland, tenanted dairy, beef and sheep farm I began to put those ideas I'd been preaching into practice.

Initially I was concerned that as we intensified, the levels of disease and morbidity increased rapidly, as did our reliance on greater quantities of antibiotic and pesticides, but dismissed my unease with the thought that it would soon settle down. While to some extent that did happen there was also more than an element of becoming de-sensitised. I met my wife Wilma and we opened the farm to the public in the early nineties. It was the reaction of both Wilma and our (particularly female) visitors to modern dairy farming ways that forced me to re-visit my beliefs. As a result, and after much research and soul-searching, we eventually began our agroecological journey in the late 90s.

At that time, there wasn't much technical help, and it was a case of 'sink or swim'. I'd certainly have packed it in had we not opened up a UK-wide market for our organic ice- cream. Gradually we could see things changing. As our soils recovered from the pummelling they'd experienced from hefty applications of fertilisers and pesticides, pasture yields increased to pre-organic levels. The health and productivity of our livestock was so much better than under our intensive system.

It was this recovery of productivity combined with a substantial saving in costs that lead to our most profitable years in dairy farming. It was clear that, once we'd got our heads around it, working with natural systems could deliver the goods, for everyone! But there was still something not quite right and our (again, particularly female) visitors were quite vocal about it.

Why did we have to take the calves away from their mothers shortly after birth? Well, this was a dairy industry red line. You can't leave dairy calves with their mothers because they'll drink half (or more!) of the milk and you'd be out of business in five minutes...

We are now 8 years into 100% pasture-fed, cow-with-calf dairying and would never go back. Once again, working as closely as possible with natural systems delivers better outcomes for all. Because of the extended suckling, our cow milk production from forage is 25% greater, we can carry 25% more cows on the farm, the calves are growing at more than twice the previous rate over those first six months and animal health is better than ever.

Out on the farm, a biodiversity audit (done by the same ecologist) has identified a 50% increase in plant biodiversity over the 25 years of our agroecological journey and an entomologist has found 123 species of insect, more than the nearby SSSI, with several rare ones and two new to Scotland. Our soils and newly planted broadleaf woodlands are sequestering carbon and, together with our huge reduction in purchased goods, has resulted in us being one of the few independently audited net zero dairy farms in Europe.

The message is loud and clear (at least to us!), it is possible to produce enough healthy, affordable food without all the mess and misery we now see in the wake of the industrial model. It is now our mission to get an industry that doesn't want to change, to accept that this is more than just possible, it is inevitable!

Jane Sweetman, Plotgate Community Farm, Somerset

I am Jane Sweetman, one of the co-director growers at Plotgate Community Farm in Somerset. Volunteers assist with the growing, packing and distributing of the around 80 veg boxes we provide weekly all year round to subscribing members and to volunteers. My research topic was the difference made to volunteers' wellbeing, investigated using questionnaires asking if their general wellbeing was better as a result of volunteering – not at all, a little bit, a fair amount, quite a lot, or hugely. I also invited comments about what difference participating at Plotgate had made to them.

The 16 volunteers' responses were that nine felt their general wellbeing was 'quite a lot' or 'hugely' better as a result of involvement at Plotgate, five a fair amount and two a little bit or not at all.

One volunteer commented that cycling 5 miles out to the farm regularly had made them notice their positive difference in wellbeing. The enjoyment of involvement 'in a project which focuses on fundamentally important stuff", value of the purposeful local activity, learning and feeling supported were important ways that this project made a difference to participants. Volunteers described the satisfaction of seeing the whole season at their fingertips from seed sowing to planting to harvesting and that tasks were always interesting.

Meeting with different people, opportunities to share experiences and learning a lot about growing food in an environmentally kind way were common themes to the comments on the difference made. One volunteer summed up that participating had offered a kind community of like-minded people from a far more diverse cross-section of age and experience than they would otherwise have had the pleasure of spending time with. This had greatly increased their social interactions.

Daisy Tickner, Lauriston Farm, Midlothian

Lauriston Farm is based on 100 acres in North-West Edinburgh. It has around 6 acres for market garden production and 11 acres in alley cropping, with another 15 acres for future field-scale development. We are in our third year of growing on the land and second year of running a CSA membership, which currently has 87 (fortnightly) members and we run a weekly on-farm market. We have also been developing an alley cropping system and have started grain trials in collaboration with a local bakery as well as seed saving and starting to develop our own landrace varieties. We aim to continue developing our systems and practices to ensure we can nourish even more of our community directly over time.

My project explored the use of Aerated Compost Teas (ACTs) in market gardening to enhance crop health, yield, and soil building. ACTs aim to multiply healthy aerobic microorganisms present in high-quality compost, potentially improving disease protection and indirectly supplying plant nutrients through an enhanced soil food chain.

The initial phase focused on establishing a brewing setup and observing microbial populations. The team used a brewing vat with a conical bottom and powerful bubbler to maximise oxygen contact. We experimented with different techniques, including using a heated propagation mat to influence microbial activity.

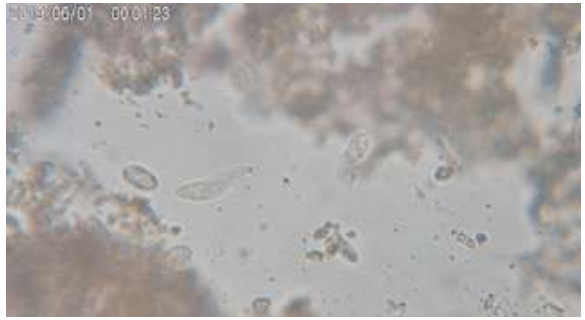
The basic recipe involved 10 gallons of rainwater, 1.5 kg of mature woodchip compost, and 2 tablespoons of molasses. Microscopic observations over several days showed increasing bacterial life and the emergence of protozoa, particularly after adding extra molasses at 48 hours.

Future trials aim to assess ACTs' impact on:
1. Seed germination rates and speed
2. Transplant shock reduction and growth improvement when used as a root drench
3. Overall yield improvements in direct-sown and transplanted field crops

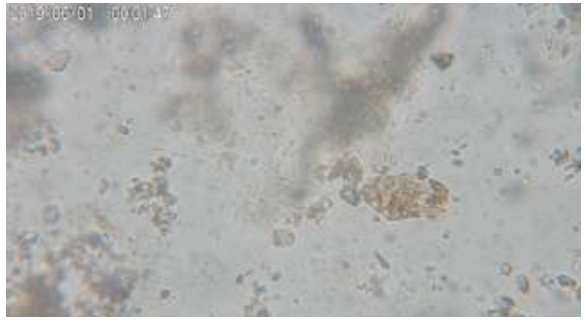
Methodological improvements planned include:
1. Enhanced microscopy techniques for better identification of bacterial populations
2. Developing methods to identify 'peak protozoa' for optimal application timing
3. Controlled experiments to refine the brewing 'recipe', including variables like temperature, compost amount, and additives

This research not only aims to improve crop management practices but also explores potential commercial opportunities in collaboration with Rhyze mushrooms, focusing on vermiculture and compost. The project could lead to the development of stable, functional ACT products appealing to home gardeners and professional growers alike.

Swan necked ciliate and protozoa:



Lots of flagellate:

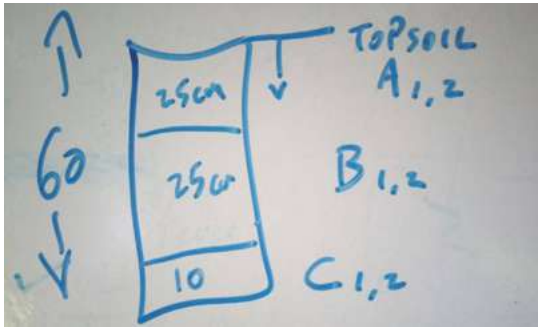


Dionysios ‘Dennis’ Touliatos, Mara Bueno & Juliet Unwin, The Plot in Lancaster, North Lancashire

As part of the FarmStart program, we conducted a soil sampling session, as detailed in the protocol on page 2, to evaluate the quality of our topsoil, soil texture, and soil pH. This session is integral to our training on soil analysis for FarmStarters and provides critical insights into the growing conditions on our farm, year after year.

Topsoil Depth Analysis: We excavated several 60 cm holes across the farm to assess the various soil layers and topsoil quality.

Soil Texture Analysis: We conducted soil texture analysis on the excavated samples using the Glass Jar method to determine the proportions of clay, silt, and sand across three different soil layers (Layers A, B, and C) in duplicates, as shown in the picture below.



Soil pH: we measured soil pH on all samples using pH strips.

Results and discussion:

Layer A, identified as topsoil, exhibited a clay loam texture with a pH of 6 and a substantial organic matter content, which we visually assessed. This layer supports the growth of the majority of our annual crops, and the results align with satisfactory crop growth. We could apply lime next season to slightly raise the pH and improve soil texture.

Layer B contained a higher proportion of sand compared to Layer A, characterised as sandy clay loam, which was visually confirmed. The pH in this layer ranged from 5 to 6.

Layer C exhibited inconsistencies between duplicate samples; sample C1 was classified as sandy loam, while sample C2 was identified as sandy clay. Visual assessment confirmed the sandy characteristics of Layer C, which also contained larger particles such as gravel and cobbles. The pH in this layer ranged from 5 to 6. Furthermore, we observed considerable compaction, commonly referred to as the “pan effect,” likely attributable to previous agricultural practices in this field, including ploughing for arable crops. The field could benefit from cultivated deep rooted manures e.g. chicory.

Robert & Sarah-Jane Drummond, Osliebrae Farm, Ayrshire

Robert and Sarah-Jane Drummond keep around 55 Ayrshire cows on their 170-acre grassland farm. They endeavour to grow all fodder on the farm, buying in as little as possible. The Drummonds bought the farm in 2014 in a fairly run-down condition and are improving it as they go along. Their Ayrshire herd came from a retiring farmer and they chose the breed because of its hardy native characteristics, with Ayrshires known for being hardy and for producing good quantities of milk from a low-cost system. They became certified organic producers in 2018.

In recent years they have been trying out Regenerative and Adaptive Multi Paddock Grazing. They have also been experimenting with keeping calves with heifers for longer periods. Nature restoration is of great importance to Rob and Sarah-Jane. As part of their biodiversity monitoring this year they put an audiomoth up on their farm to record bat populations. The audiomoths identified five species of bat, including Leisler’s bat, Soprano Pipistrelles, Daubenton’s bat, the Common Pipistrelle and the Noctule bat. Leisler’s bat in particular are quite rare in Britain. These results are currently being checked and verified.

Megan Waghorn, Crocadon Farm, Cornwall

The extraction and utilisation of mineral fertilisers is having an increasingly negative effect on ecosystems, and has been found to reduce plant microbial interactions, which in turn reduce plant functions and crop yield potential. Emerging research is raising attention regarding a need for sustainable alternatives. Plant-based fertilisers have been identified as a plausible alternative to mineral fertilisers due to being a bioavailable nutrient source and microbial promoter. I, Megan Waghorn, am based in Devon and work at Crocadon Farm in St Mellion, Cornwall. The farm consists of an organic market garden, aiming to produce nutrient rich food and improved soil fertility through the use of natural methods. The production and use of plant based microbially rich fertilisers is essential to our practices.

To improve these practices a study was conducted to evaluate the effectiveness of nettle fertiliser compared to mineral fertiliser. In this study two types of nettle aqueous extracted fertiliser were used to evaluate if it can be a suitable replacement for mineral fertiliser when growing Brassica rapa var, chinensis (Pak Choi). The results presented a strong argument for this possibility; however, data was inconclusive. Nettle extract used as a fertiliser improved crop yield (figure one), chlorophyll content, and microbial colonisation of roots. Therefore, leading to the conclusion that, with extended research, nettle extract fertiliser and other plant-based fertilisers could be a viable alternative to mineral fertilisers in commercial growing systems.

These results directly impacted the fertiliser protocols used on the farm and have since been expanded on through the use of comfrey (Symphytum officinale) and cropping plants such as strawberries (Fragaria x ananassa), tomatoes (Solanum lycopersicum) and chili (Capsicum annuum). Fertilisers are brewed using microbially rich leaf litter which is located on the farm. It has been observed that crops treated with these fertilisers have higher tolerance to pest and pathogen infection such as, nematodes and Botrytis cinerea. Detailed data of improved resistance has not yet been collected, nevertheless, further research and experimentation will be continued.

Plants grown with nettle aqueous extract (left) had greater yields than the control (right). Plants grown with mineral fertiliser had all died before the experiment was complete.

Jane Acton, Common Flora, Devon

Jane Acton is an ethnobotanist with a BSc in Plant Biology from the University of Wales Bangor and an MA Environmental Anthropology from Goldsmiths University of London. Jane works as part of social enterprise Common Flora, a certified organic 2ha growing agroforestry project in south Devon and specifically at the moment on a project called Abundant Life. Please see https://www.commonflora.co.uk/abundantlife for details.

The project works on 11 sites across rural and urban areas including Common Flora itself where 4 ecosurveys have been conducted since 2018. Further work has been conducted here this year and is presented by Holly Emmens and Stuart Saunders. This site can be used to inspire the other sites having measurably trebled insect life in this time.

Abundant Life is a heavily measured development project intended to explore how we might support farmers and their transition to nature led farming practise under the new Sustainable Farming Incentive programme. The aim is to preserve the biodiversity we all depend upon while maintaining economic and mental stability among farming families.

Farming families were engaged via existing friendships and referred by Devon Wildlife Trust. Citizen scientists were recruited to help with the project and include people who are in some way vulnerable (disabilities, mental health issues, grief and carers).

Plots of 5m2 were negotiated with the farmers and landowners to be designated for the duration of the project. We used standardised ecosurveys techniques counting species numbers and abundance using quadrats in each of the plots. Various physical aids were used including field guides, field hand held microscopes and loupes along with digital ID aids. This initial survey forms the baseline. Each of these plots was then planted with bespoke wildflower seed made with local seeds and a pollinator hotel was set up on field corners of each of 5 farms. Each season we have made visits to these plots to look in further detail at different collectively decided topics, such as soils, birds, insects, pollination and hedges. More quadrats will measure changes in biodiversity in spring 2025 and again in future if the project receives further funding.

Detailed surveys, written and recorded were conducted with each participant be they citizen scientists or from a farming family. The platform Kumu is being used to plot human interactions. All the learning will be shared in due course as either a podcast or on the iNaturalist platform.

Rhian Williams, Kirkstall Valley Farm CSA, Leeds

I'm Rhian based at Kirkstall Valley Farm CSA in Leeds. We provide 130 veg boxes year round and have a strong community of members and volunteers. I really appreciated this opportunity to be introduced to basic ways of understanding more about our soil, that I'll be able to practice again next year, and involve volunteers in.

I started with the Visual Evaluation of Soil Structure (VESS) test. I did this in two sites on the farm. The first site has been cropped for a season and the second site has established green manure. The first site was interesting - I couldn't really tell the top and bottom layers apart. The soil was all crumbly and moist, with a greyish-brown colour. There weren't any stones, but I did find some thick couch grass and mare's tail roots deeper down.

The second site was a bit different. The top 5cm was just packed with roots - I could hardly separate them from the soil! There were loads of worms in this grassy layer too. The lower 15cm was firmer, but still crumbled pretty easily. It was dark grey-brown and had lots of small roots throughout, but only two worms.

Speaking of worms, I did a worm count too. In the first spot, I only found 4 worms - 2 endogeic (the pale ones that live in the soil) and 2 epigeic (the red ones that live near the surface). But the second spot was worm central! I counted 24 worms in total - 3 anecic (the big deep burrowers), 19 endogeic, and 2 epigeic. It's amazing how different two sites on the same farm can be!

I also collected some samples for pH, Soil Organic Matter (SOM), bulk density, and aggregate stability tests. I've sent these off to Ed for analysis, so I'm still waiting on those results. It'll be interesting to see how they turn out and how they compare to the visual assessments I've done.

I had planned to do a few more tests like the infiltration rate and the slake test, but I didn't get around to those this time. There's always more to learn about your soil, isn't there? The most striking thing for me was seeing the difference in the earthworm count between an area with established green manure, and an area that had been cropped for a season. I'll be interested to see how our results compare to other farmers, and the results of the SOM tests.

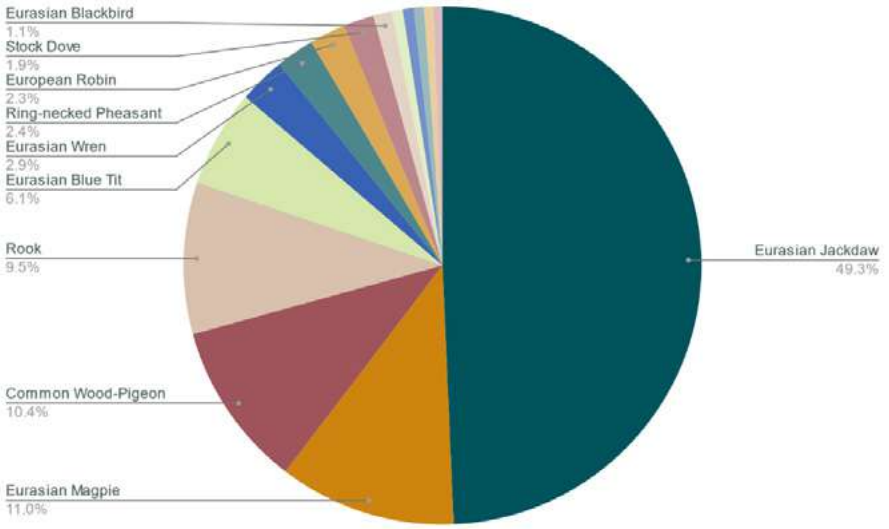
Ben Evans, Hill Farm, Suffolk

Open-source approaches to continuous on-farm monitoring of biodiversity

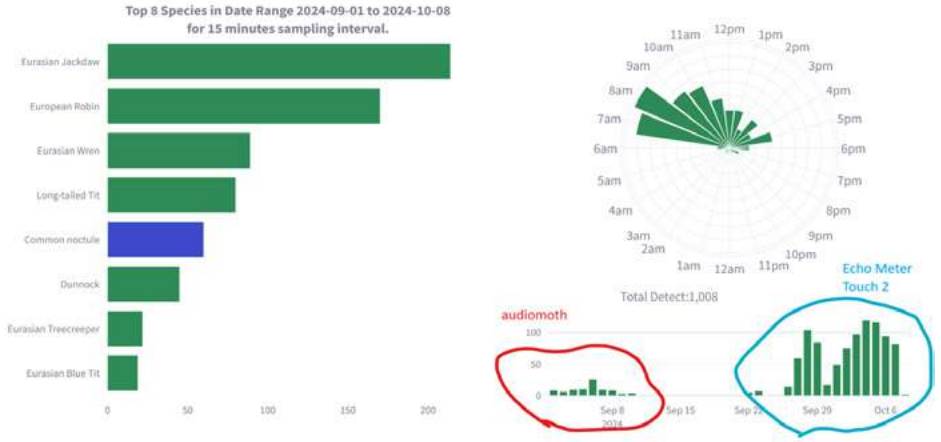
When we took on our farm four years ago it was already ecologically vibrant, with large areas including wetland that had been managed for wildlife for the past fifty years or more. Enhancing the biodiversity and ecosystem functioning further is one of my primary ambitions while I'm a custodian of the landscape. In order to know what the impacts of land management decisions are, a representative baseline is needed. This is still something that I haven't achieved in any comprehensive sense. With mobile species like birds or insects, comparative studies of interventions against controls where no change has been made are not particularly informative. Likewise, due to the inherent variability in natural systems, measurements at discrete points in time are not necessarily representative if one is hoping to identify changes across years or decades. Within EIYF I have been working on setting up continuous monitoring in an attempt to produce the richest, densest set of observations possible in a way that is sustainable in the long-term from the perspective of the time and effort required to collect it.

We are fortunate enough to live in an era of increasingly visible, accessible and open scientific and technological development. Across academic, research and conservation sectors there are some really exciting developments aiming to improve the monitoring and assessment of biodiversity in all its forms. Many of these developments are available to anyone, with software and hardware being made available through open-source projects. I have been trying to take advantage of some of these approaches as the basis for continuously monitoring birds, bats and insects on the farm.

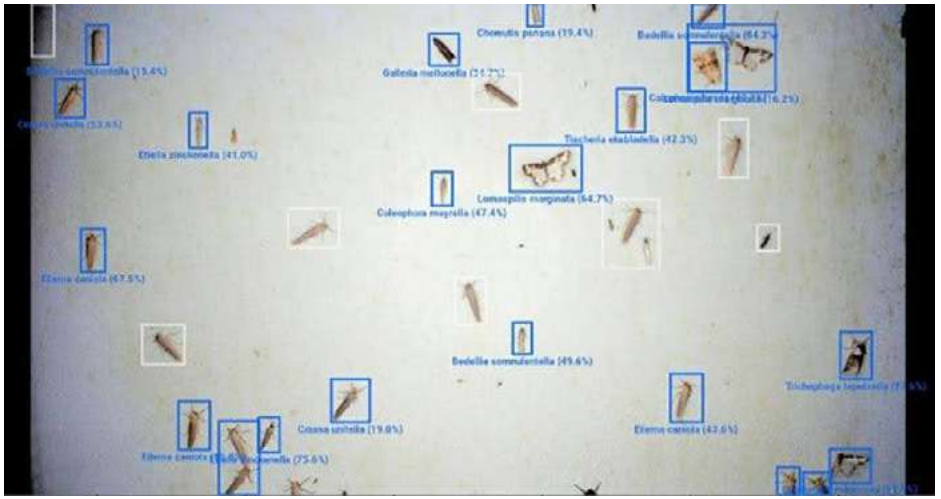
I started by setting up BirdNET-Pi[1] last year, a bioacoustic bird classifier that runs on a Raspberry Pi computer and records and identifies birds continuously. It works really well, providing confidences on its identifications and saving the bird calls for later expert validation if needed. I recorded nearly 38000 calls from about 100 unique species over three months (Error! Reference source not found.). In this case the hardware let me down, as the frequent writing of data tends to corrupt the SD card in a matter of weeks or months so I lost most of that archive.



Within EIYF I have upgraded to the latest Pi 5 and am now using a solid state drive that should be much more robust to the frequent data transfer. It also offers more compute power, meaning I could indulge in one of my favourite activities: feature creep. Last year I bought an audiomoth[2], an open-source piece of hardware for ultrasonic recording. It is widely used for monitoring bats and I have deployed it a few times, processing the recordings with another piece of open source software: BatDetect2[3]. I had little success in detecting anything meaningful with this. Further experimentation with settings of both the software and hardware is probably needed because I know there are bats. Then I discovered BattyBirdNET-Pi[4], someone has taken the original BirdNET-Pi and added a bat classifier that runs at night while it records birds by day. It can use the audiomoth as a microphone. I found that the neural network produced lots of false bat detections due to ambient noises that it hadn't been trained on. Thankfully, the software is open source so I could always retrain the model with some examples of noise in my setup, which should improve the predictions. I haven't had time yet, but Richard, the developer, has offered to add my noise samples to the training data (I love the open source community), so hopefully that will be improved in due course. A less surmountable problem is the hardware itself. The audiomoth microphone produces lots of noise at the lower frequencies at which birds call. The consequence is that daytime bird detections were sparse and unreliable compared to using a normal microphone. Borrowing an alternative ultrasonic microphone from EIYF, the EchoMeter Touch 2[5], improved this dramatically as it has much better signal-to-noise ratio at low frequencies, but it still doesn't perform as well as a conventional microphone. Again, since the project is open-source, we, as a community of users, are able to change the software so that we can use two microphones – a conventional one for birds during the day and an ultrasonic one for bats at night.



My latest experimentation is with automatic identification of moths. This builds on another open-source project, this time from the UK Centre for Ecology and Hydrology (UK CEH). Their Automated Monitoring of Insects (AMI) system[6] is basically an illuminated white screen on which moths land, and a camera that photographs the screen. They then use two different neural networks to identify insect locations on the screen and subsequently identify the species or genus (Error! Reference source not found.). They are establishing a global network of monitoring sites. The hardware plans are not yet published, but there are photographs and much of the software is openly available so I have been playing around with getting a simplified version running. I am hopeful that all three systems (bats, birds and moths) can be run continuously from a single Raspberry Pi.



Things I'd like to work on moving forward are power solutions to allow the system to run continuously wherever I want on the farm and connectivity so that the data can be automatically transferred to cloud storage and possibly even served through a website to engage the public with our biodiversity journey. There's also some exciting work analysing soundscapes by looking at the diversity of sounds rather than trying to identify the particular species or taxa contributing to it. This gets around the need for large quantities of expertly-labelled data yet allows for long-term assessment of changes in the acoustic signature of an ecosystem over time. With a waterproof case, the audiomoth becomes a 'hydromoth', allowing for exploration even of the underwater soundscapes of the wetland system.

I hope that I can use my experiences and the data I generate to contribute back to these fantastic community biodiversity monitoring projects while better understanding the life within my own part of the landscape.

1 https://github.com/mcguirepr89/BirdNET-Pi
2 https://www.openacousticdevices.info/audiomoth
3 https://github.com/macaodha/batdetect2
4 https://github.com/rdz-oss/BattyBirdNET-Pi
5 https://www.wildlifeacoustics.com/products/echo-meter-touch-2
6 https://www.ceh.ac.uk/solutions/equipment/automated-monitoring-insects-trap

Abi Mordin, Hidden Veg, Galloway

Hi, I'm Abi Mordin. I've been a landworker all my life - growing veg alongside my dad in Wales from when I was wee. I started working in a market garden cooperative in the 1990s when it was quite unusual to run an organic veg box! These days I live in Galloway (South West Scotland) where I run a small market garden called Hidden Veg, organise the South West Scotland Regenerative Farming Network, deliver a load of sustainable and local food education and learning projects, and I'm a member of Propagate - a workers collective focused on just, healthy and resilient food systems change.
I"m guided by my core values of environmental and social justice and I work around food systems because this is one of the places that those values intersect.

Earlier this year I bought 10acres - a bit of a dream come true! My research has been mainly gathering a range of baselines for this land - which has been set stock grazed and sprayed with chemical fertiliser every year for decades. I have been monitoring biodiversity through observations and recording this data on iNaturalist, and I got a data inquiry done by our local data records centre which gave me a picture of everything that had been recorded on the land + 2km over the last 50+ years. I've also been measuring soil health across the land by using the Soil Mentor type tests - infiltration, earth worm counts, rhizosheaths etc...

Beyond that I've been planning and designing new hedges, shelter belts, wetland enhancement, growing areas and grazing plans. I've started moving the market garden growing space over - it's currently on a friend's farm - which will see a 100% increase in veg production. I have 2 Dexter cows arriving in the next few weeks so will be putting the grazing plans into action - the cattle are for regeneration, meat, milk and cuddles.

Watch this space!

John Veitch, Low Creoch, Dumfries and Galloway

I'm John Veitch, 55, married to Alison, we have no family. I am a 4th generation tenant farmer in South West scotland about 3 miles inland from the Solway coast up floor of the river Fleet valley. The farm is 300 acres where I farm beef suckler cows and texel /texel cross ewes.

The cows are mixed breed salers x simm x hereford x calve in spring early summer currently to a shorthorn bull and outwinter in sacrifice areas. The sheep - my wife has a flock of pedigree texels initially set up to provide me with tups to use on my cross ewes but now expanded in number meaning we are able to sell a few tups most years. My tex cross ewes have all been homebred. I am not lambing my ewes again, I may lamb the gimmers from approx 1st April but we shall see. The pedigrees start to lamb from 1st March.

I have long questioned our ag policy and structure of the industry ... Low profitability, work life balance etc so when the fertiliser took a huge jump in price I decided I was not borrowing money to buy fert to continue on that path. That provided the catalyst I needed to seek a better way of doing things, and how to manage my system better to still leave me a living. I have always been interested in a high nature style of farming which led me to finding and joining the regenerative farming south west scotland group. Within the group some of us agreed to delve more deeply into soil health and function which leads me onto becoming involved here with some soil evaluations.

I never went to college but we always used SAC in an advisory capacity. However, soil function /health featured only in terms of PH, NPK sampling and occasional mineral profiling but in my readings it was becoming very apparent to me this needed to change and I should be considering the soil as the key to everything. I am currently in the process of sampling every field to obtain a baseline set of data. I am primarily using my local farmers co-op Tarff valley to do this. The samples they send to Lancrop who do the solvita soil profile tests for me.

After years of being very heavily stocked, relying on using a lot of fertiliser, and growing a lot of silage it was not surprising to find much of my land was not in a great state. So far results have shown the soils to be sandy or sandy loam. There are wet grassland bogs which are peaty, and some very wet low lying parts of some fields which are likely clay. I have tended to steer clear of those areas as they are often waterlogged or highly biodiverse with an abundance of wild flowers growing on them.

PH scores have been almost entirely below 6 and as low as 4.8 in soils which are extremely low in potash. We are in a high rainfall area and much of the farm except on the valley floor is sloping so potential for leaching and run-off are high, with flooding occurring regularly in the valley floor. These things have a considerable influence upon day to day management. Full reseeding and cultivation is not possible in some fields so this has led to soil carbon levels of up to 215 tonnes per ha in grazing only fields with the twice cut and grazed fields being half that level.

I had been hoping, through reduced stocking rate, longer rest periods, and rotational grazing practises, to increase fertility, sward diversity and ultimately the overall health and function of my soils, all leading to a regenerated, more sustainable, more resilient, more profitable, less environmentally damaging farm and business.

As part of this I did a field studies council course on earthworms which helped me to identify the main types of earthworms present when I was digging holes looking at the soils. During my sampling this summer I have been finding some worms in most of the holes. I dug largely epigeic worms, the type that live under the soil surface in the top few inches of soil, as expected. I found very few endogeic worms, which are surface dwellers, out in the open fields. There were less anecic worms than I had expected to find - they are the bigger ones that produce the casts and burrow vertically down into the soil. Due to the amount of badger snuffles I had been assuming there were quite large numbers of worms present round here but that could have been due to summer, that they have been deeper than I was digging, or that the badgers had a good time and had eaten most of them.

I also experienced a light bulb moment when our group had a zoom call with dung beetle expert Sally Ann Spence where she talked to us about the benefits of dung beetles and the need to consider them in our livestock management regime. As I said previously in a wee film I took part in last year, I will never look at a lump of shit the same way again. It's fascinating stuff to see them dive almost kamikaze-esque into piles of poo then quickly disappear from sight busily doing their thing incorporating that valuable source of nutrients into the soil. I didn't keep a note of how many I was seeing but feel like I should be seeing more, especially the larger geotropes, so keeping a better note of them might be a plan for next year.

The only other biological activity I undertook was to plant a pair of cotton pants which we were presented with at a nature friendly farming network walk and talk held locally in conjunction with the University of Belfast. These have not been dug up yet other than by what I think was a badger, leading one other member of our group to suggest it brought a whole new dimension to saying that the dog ate my homework. I was passing daily and they were quickly reburied. I will be surprised if, going by the info from other tests I did, there is much degradation and signs of good biological activity .

That leads me onto the VESS tests. I had also been trialling the naturescot biodiversity app. As a part of that I did VESS testing across the farm. I was tending to find the soil below the turf level was of a good open small to medium crumb VESS score 1 to 2, mostly drier leaving my hand only slightly dirty. Very little evidence of good rhizosheaths was present, the soil more often than not with little persuasion crumbled off the roots. Grass root depth did vary quite a bit across the farm. Only odd holes in odd fields did I consider to be VESS scores of 4 to 5 where the soil appeared in large clumps. Over the summer and farm I dug at least 5 holes in every field meaning I've dug over 120 holes. Most had at least one worm in there, but not all of them. The most I found was 5 which was in a grazing field.

I only did a couple slake tests. I had not done these before and never thought to use a small kitchen sieve. Instead I used stainless steel mesh which I fitted into the top of a glass beaker. In both cases the soil very rapidly dispersed in the water almost immediately exploding and quickly settling as fine silt in the base of the beaker. Within a few hours the water was almost clear. I think from this rapid dispersal in the water this might also lead me to think there isn't a lot of exudates and biological activity in the soil and expect the pants test to confirm this. Not very scientific perhaps, but having done it, I think I could improve my methods next time. I am awaiting the results of the next 4 samples. I have taken one which will include a soil mineral analysis and can share these in due course.

Ian Hutchcroft, Hutchcroft Limited, Devon

My partner and I grow vegetables and fruit in half an acre of orchard and meadow in South Devon. We took on the site in August 2022, which was then a neglected orchard, pasture and small shrub garden. Our aim is to grow an abundance of healthy fruit and vegetables as sustainably as possible with minimised inputs and labour. We think the current agroecological approaches based on no dig/till and farmed animal free may be the tip of the iceberg in understanding how we can achieve sustainable, regenerative, low carbon productivity in different systems and soil types.

We developed our agroecological knowledge and practice during 20 years of growing on several allotments and other small plots. We think we know what we're doing, but if we've learnt anything from our time growing it's that we don't really know much!

As we develop our new site, it is a good opportunity to collect data on the impacts of our food production system and the results of various management practice options. We want to understand more so we can do things better, share results with others and learn from others.

Context

Scientific understanding of the gut biome's role in human health has increased a lot recently (see the Zoe project etc.). The soil biome seems less well understood, and we note that some of the microbes are the same in the gut and the soil. The Zoe project has developed an easy way to monitor healthy gut biome indicators, comparing numbers of 'good bugs' v. 'bad bugs' to give a score to infer health status and change over time. Could something similar be developed for the soil biome, to help us understand how healthy our soil is and the impact various agroecological approaches are having?

As a grand long term aim, if 'dig and dung' could be replaced with 'collect and cover' in the national consciousness of how to grow fruit and vegetables; if more people could be helped to easily produce their own; if demand for similar bought foods could be increased; and if the productivity, sustainability and circularity of commercial growing could be improved; with a golden thread of soil and gut biome based knowledge to support healthy diet and food growing, could a better path to zero carbon and biodiverse sustainability be developed?

Our management practices and approach

On our previous sites all available land area was dedicated to direct growing and production. External inputs included on-site and off-site home-made compost, bought-in commercial composts and mulches, and animal manures.

Our observation was that on-site home-made compost is the most effective input in terms of productivity, plant and soil health and biodiversity. We questioned what informed our original practice and concluded that we and many others are in part subconsciously driven by a 'folk memory' that the way you grow vegetables is to dig the soil and

apply animal dung. Over the years we changed our management practices to no-dig, maximising compost mulches, using green manures and reducing use of animal dung. Our major limitation was access to plant material to make compost.

On our new site we aim to produce using only inputs from the site, eliminating the use of imported composts, mulches and animal dung. Two major factors drove this approach: sustainability, circularity, biodiversity and transition to farmed-animal-free agriculture; and sustainable labour inputs, avoiding the significant labour effort and cost of importing inputs.

Our new practice includes: making hay and grass cuttings from the orchard meadow for vegetable bed compost and mulch; collecting leaves for leaf mould, compost and mulch; making ramial wood chip from fruit and other tree prunings for light direct application to vegetable beds and composting; kitchen waste composting and urine.

We aim to actively promote biodiversity co-benefits. We note the connection between removing nutrients from meadows by making hay and removing grass cuttings; increased meadow plant diversity and flowering; increased invertebrate biodiversity associated with meadow flowers; and using meadow hay and grass cuttings as compost and mulches to increase soil fertility in vegetable beds.

We need to understand the impacts of our new management practices, understand the interrelationships between practices, and adapt and develop our practices to maximise benefit for productivity, biodiversity, sustainability, and carbon reduction. Importantly, we recognise the need to work with other growers and researchers to learn collectively and to disseminate data, learnings and conclusions to support the scale up of sustainable, circular, climate healthy food production. The Experts in Your Field project and the Landworkers Alliance are ideal ways for us to learn from others and contribute in our own small way. We want to work with other growers, projects and researchers to understand the best inputs, timings, quantities etc to use in our system. We need help to design trials, monitor, measure and analyse data and to find research that has already been done. Our research plan, which is currently in motion, can be found below:

Research proposal

1. Select trial areas to sample:
- Original pasture
- Newly created vegetable beds – ‘zero’ year
- Established vegetable beds – one year
- Established vegetable beds – two year

2. Analyse samples from each area:
- Soil structure and composition, including carbon content etc.
- Biodiversity

3. Productivity
- Document management practice and observations
- Assess inputs and outputs
- Relate to sample data

4. Timeline
- Initial samples to establish baselines – 2024
- Subsequent seasonal and annual analysis – 2025 onwards

5. Review
- Review research methods with EIYF, LWA and other partners.
- Review research data results, against baselines and over time
- Review other research results
- Adapt research and management practices as appropriate

Shelley Castle, Frank Foley, Promise Eweh, Yetunde Olaleye, Alice Pefanis, Tolulope Richard-Olebe and Esther Abamba, Flete Field Lab, Devon

Flete Field Lab had two MSc. research students working on our Mycofiltration programme this academic year (23-24), Promise Eweh and Yetunde Olaleye, both from University of Plymouth. We were joined by another student, Alice Pefanis, from Shumacher College who trialled a mycofiltration system going in behind leaky dams on a small stream in a pasture field. Promise worked on dairy waste water in the labs, using real-life dairy waste water and two strains of fungi from the Oyster family. Yetunde built on previous student's work on a small brook that has a CSO outflow at the top and used a Turkey Tail leaky dam system and a new design made by Flete Field Lab for E. Coli filtration.

This is an ongoing programme to pair real-life issues and sites with lab-based science. Flete Field Lab has been trialling different design systems and fungi to remove pollution from dairy waste water and raw sewage flowing into our rivers. We focus our real-life trials on three small tributaries to the River Erme, South Devon, and on a dairy farm nearby.

Promise's research was titled *The effect of summer and winter oyster fungi in the mycofiltration of dairy waste water.* Dairy wastewater treatment faces challenges like high costs and high wastewater volumes. Physicochemical treatments (e.g., sedimentation, coagulation, filtration) are costly and result in problematic sludge. Mycofiltration is a low-tech and low-cost, potential natural solution.

In her introduction Promise writes:
'According to Raghunath et al. (2016), the dairy industry is a significant source of wastewater, producing an average of 2.5 to 5 litres of wastewater per litre of processed milk. Dairy effluents break down quickly and cause the dissolved oxygen level of the receiving water bodies to drop...due to the high organic load levels. It has been documented that more than 40% of nitrogen contamination and 25% of phosphorus contamination within the rivers of Devon can be linked to agricultural practices, with a particular emphasis on dairy farming (DEFRA, 2020)'

Flete Field Lab created a miniature version of our mixtures of substrates and fungi for use in the University Laboratory and gathered waste water directly from the dairy. Promise surmised:
'Experimental results demonstrated that Pleurotus Pulmonarius successfully removed up to 100% of both nitrate and phosphate concentration from the dairy waste water....These findings highlight the potential of mycofiltration as a viable solution for global water pollution, particularly in agricultural settings. However, further research is needed to refine the technique and explore the variability of the treatments to ensure consistent, scalable results'

In addition, Yetunde's dissertation was titled *'A sustainable approach to water quality enhancement: microfiltration and my mycoremediation capabilities of fungi-Turkey tail mushroom (Trametes versicolor) and summer oyster mushroom (Pleurotus pulmonarius) for managing dissolved nutrients and bacteria in sewage water discharge.'*

In her introduction Yetunde states that: *Numerous sources such as air deposition, municipal wastewater discharge and agricultural runoff contribute nutrients to aquatic systems. The process of eutrophication, which is characterised by the over-enrichment of water bodies with nutrients, can be caused by excessive nutrient loading especially from non-point sources. This can lead to toxic algal blooms and consequent oxygen depletion (Falconer et al., 2018; Bonsdorff, 2021). Phosphorus is the main cause of eutrophication and is frequently the limiting nutrient in freshwater systems, however nitrogen can also play a major role in nutrient over-enrichment (Bonsdorff, 2021). Zhao pointed out that nutrient enrichment constitutes a serious threat to global ecosystems and that the effects of eutrophication include decreased water quality, biodiversity loss, and changes in food web dynamics (Zhao et al., 2014).*

The results of her trials were less conclusive but we can say that pulling together all the evidence on E. coli from this year,that mycofiltration removes on average 45% E. coli in surface water streams.

Promise Eweh and Professor Angela Milne from University of Plymouth 2024 on Holbeton Brook.

Whilst Flete Field Lab do not consider mycoremediation and mycofiltration as singular heroic natural solutions to our key pollution issues, we do believe that one day it will become an accepted, cost-effective and low-tech part of an overall re-design and re-thinking of how we manage our environment and the waste issues that humans generate.

Flete Field Lab also had two MSc. research students working on our Biochar programme this academic year (23-24), Tolulope Richard-Olebe and Esther Abamba. Their research focused on the properties of biochar in pasture soil, using the biochar field trial plots established on the Flete Estate in 2023. Their research this year provides evidence of biochar's ability to enhance soil structure, water retention, microbial activity and improve nutrient interactions. These results suggest that incorporating active biochar into soil management can boost crop productivity and reduce reliance on chemical fertilisers, while sequestering carbon, supporting resilience and food security.

Tolulope's research was titled "Analyzing the influence of active biochar on the physiochemical and microbial composition of designated soil parameters". The most notable finding was a significant increase in biological activity in biochar-treated soils:

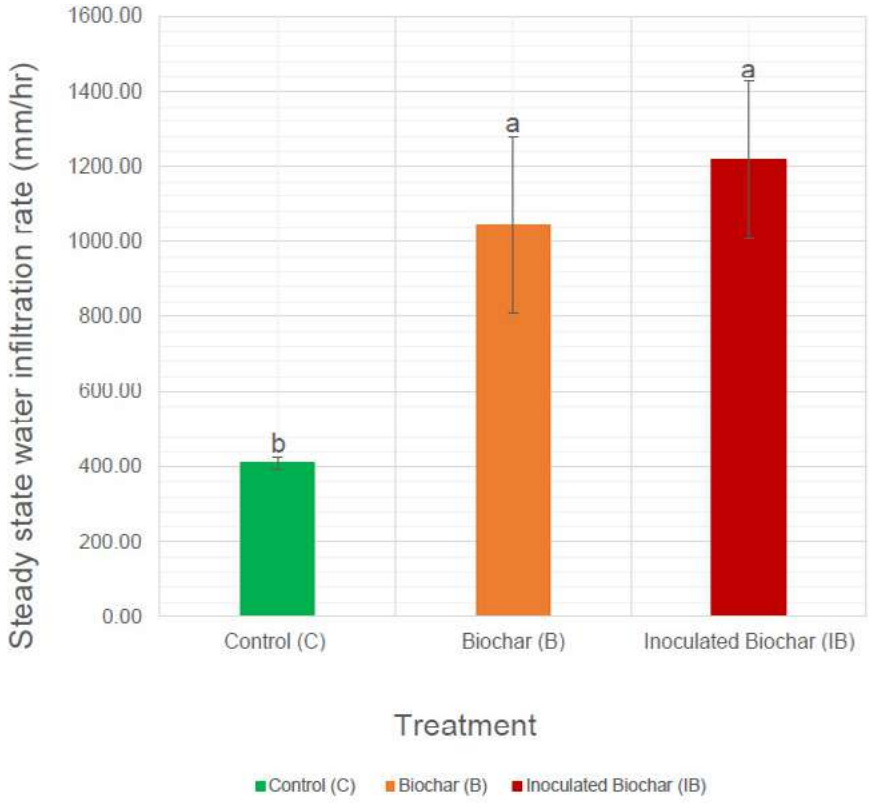
> *In terms of biological properties, the study revealed enhanced microbial and invertebrate biodiversity in biochar-treated soils. Decomposer populations, particularly mites, earthworms and springtails, showed notable increases in biochar-amended plots, promoting nutrient cycling and organic matter breakdown. The abundance of predatory species, such as centipedes, was highest in active biochar plots, indicating an improvement in ecosystem balance and pest control. However, photosynthesis efficiency, as measured by the Pvfm value, showed no significant difference across treatments, suggesting that further long-term studies are required to assess the full impact of biochar on plant physiological processes. This research underscores the potential of biochar as a soil amendment to improve soil health, increase biodiversity, and enhance nutrient cycling.*

In addition, Tolulope found that biochar had the effect of neutralising soil acidity, bringing the pH up from 5.8 to 6.2.

Esther's dissertation is "The effect of inoculated biochar on selected soil properties of a pasture field". Her results showed a significant increase in water infiltration rates (300%). In addition, slight increases in soil nitrogen (16%) and phosphate (29%) were observed.

> *Results revealed that inoculated biochar increased infiltration rates but negatively impacted the soil's shear strength as this was reduced. Compared to the initial study, increases in volumetric moisture content and bulk density were observed across treatment groups. These findings suggest that non-inoculated biochar is a more effective option for enhancing pasture soil quality, as it had greater positive impact on the physical and chemical properties of the soil than inoculated biochar treatment likely due to the kind of microbial species used for inoculation. This study advances the understanding of biochar's impact as a nature-based solution for soil quality improvement, offering practical implications for erosion/flood risk management, and climate-smart agriculture. This supports global sustainability goals, including food security, biodiversity conservation, and ecosystem restoration.*

An increase in water infiltration rate is highly relevant in south Devon soils and in resilience to climate change; It reduces the "washing out" of nutrients, and protects soil from being washed away during rainstorms. It helps protect our waterways by reducing silt and nutrient pollution; it reduces demand for artificial fertilisers (by retaining fertiliser in the soil); and in extreme rainstorms, the soil's increased capacity to hold water slows flow rates and reduces the risk of flooding downstream.

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