Report of Feasibility Study to Just Transition Fund

Building a Resilient Local Food Economy

Findhorn Innovation Research and Education

April 2023

Draft for discussion

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1 Executive Summary

This feasibility study has researched how the Findhorn Ecovillage could substantially improve quantity, efficiency and profitability of food production, whilst sequestering carbon and creating viable jobs. This involved:

- Use of systemic innovative practices, rather than focusing on individual technological innovations
- Modelling levels of production / sales of vegetable growing in Cullerne if planning and predictability of production were improved
- Modelling a pasture-fed livestock system managed without chemical inputs, which will rejuvenate soil, sequester carbon and promote grassland biodiversity.
- Modelling a community composting system that will collect food/garden waste from households in the Ecovillage and local businesses
- Consideration of how to use the effluent from the Living Machine
- An exploration of options for a cost-effective greenhouse capable of year-round production
- An exploration of options for sales of vegetables and meat to local consumers through existing and new markets
- Financial consideration and business cases for the proposed local food production and supply system.

This kind of intensive local food production integrated with the local community, has widespread applicability in Scotland, including urban areas, in line with Council's Food Growing Strategies. Even communities with limited soils suitable for horticulture could improve food availability and quality, health and community cohesion, whilst significantly reducing their carbon footprint.

1.1 Major findings

- A financially viable food production system is achievable on the available growing area in Cullerne. An infographic to outline the system is available here.

- There is significant potential for the expansion of the local food market. A large proportion of Ecovillage residents currently purchase vegetables from Tesco, whilst stating that they would prefer to purchase produce locally, were it to be available.

- The Findhorn Foundation has historically prioritised education programmes over optimising food productivity in Cullerne Gardens. As a result current food production on the existing growing space in Cullerne is significantly below its potential, estimated at approximately a third of what is possible.

- Although the growing area in Cullerne (1.3 acres) is much smaller than the total garden space available (7.8 acres), the thin soils of stones/sand overlying much of the property are not currently suitable for growing. While the current growing area could easily be doubled, it will take time because it requires soil to be built from scratch through compost application.

- The business plan indicates that an initial scaling of productivity on the existing growing area could render the garden financially viable from vegetable growing / egg production, covering running costs and producing significant amounts of produce for sale locally.

- Beef cattle production is a profitable inclusion to the project, with significant potential for carbon sequestration and to meeting the clear demand in the Ecovillage. The community survey showed that 54% of respondents are interested in buying meat from a local regenerative farmer.

- Biomass from the Ecovillage and participating local businesses, plus manure is sufficient to meet only 41% the compost needs of the growing areas. Other options are outlined in Section 7.

- An additional 288m^2 of Keder greenhouse would increase total growing area to 5,389 m^2 (1.33 acres). This additional, higher quality covered cropping area will increase covered cropping productivity per square metre by 33% and improve sales by £15,500 per annum. This would include a micro-green production facility.

- The Living Machine has the potential to offer a significant addition to our fertility system through recycling human waste and creating a unique closed nutrient loop in the Ecovillage.

- Further expansion at the Ecovillage site will not be possible without access to neighbouring land. Discussions with immediate neighbours have taken place (Cullerne Farm and the Army base) but do not indicate progress in the short term.

- There are multiple opportunities to replicate the model across sites identified by the Moray Food Strategy.

- There is also an opportunity for a larger-scale producer using organic methods to grow field-scale crops e.g. potatoes, carrots, brassicas.

- Possible options for funding to purchase capital assets (compost scheme equipment and a new greenhouse)) are included in this report

1.2 Further Recommendations

- Cullerne needs a clear management plan in order to increase productivity and make it economically viable.

- Initial positive discussions with the Phoenix shop, the Foundation and other potential wholesale customers need to be continued so that a comprehensive understanding of their needs is built into the business plan

- Implement production of eggs and micro-greens as additional income streams

- Routes to market for meat produce need to be explored and defined

- Additional sources of local biomass should be identified and costed for inclusion in the composting scheme so that i) there is sufficient compost to meet the requirement of the entire Cullerne growing area and ii) to improve economy of scale and render the composting activities cost-neutral.

- Further research the options for cost-effective composting of residential/business waste in the Findhorn Ecovillage (see section 7 for options)

- Explore cost effective and carbon efficient options for supplying compost to Cullerne

- The current propagation tunnel in Cullerne should have its second skin restored to reduce heat requirements and allow earlier propagation. Early season propagation will also require grow-lights to be added to the heated propagators.

2 Introduction

2.1 Context and aims of the report

The Scottish government has set climate change targets of 75% greenhouse gas emissions reduction by 2030, and net zero greenhouse gas emissions by 2045. To meet these targets, transformation will be necessary across all sectors of the economy and society. A government Just Transition Fund was established in 2021 for a £500 million investment over 10 years in the North East and Moray to support the diversification of the regional economy away from carbon-intensive industries and capitalise on the opportunities and prosperity offered by the transition to net zero.

In July 2022, funding of £51.6 million was allocated for the first year of the Fund. The learning from this first year will be applied to future development of the Fund, details of which will be announced later in 2023.

During this first round, the Findhorn Innovation Research & Education (FIRE) were awarded £226,775 for four feasibility studies to help the Findhorn Ecovillage Community transition from fossil fuels to a carbon neutral and completely green future. The four studies are: i) Strategic Framework and Microgrid for the Findhorn Ecovillage to transition to highly energy efficient permanent housing; ii) ambient loop heating system for houses; iii) a closed-loop, energy - efficient affordable housing design; and iv) scaling organic food production.

This document will focus on the scaling food production feasibility study.

2.2 The Feasibility Study Team

This feasibility study has been worked on and produced by the following local people: Christopher Raymont (Horticultural Adviser), Andrew Heath (Regenerative Agriculture and Livestock Adviser), Sam Graham (community survey, funding opportunities, coms), Jo Hunt (expert on organic horticulture businesses); Compost research: Maria Cooper, Will Lawrence, Sam Shohet, Lina Brammertz; Living Machine: Raffy Taylor; Community Survey: Eian Smith, Margo van Greta, Vivienne Wylde, Hannah Hunter; Jonathan Dover and Edward FItsell at the Phoenix Shop; David Hoyle at the Bakehouse and Tom Watson (compost machine site). Additional in-vessel composting advice was provided liberally by Huw Crampton of Tidy Planet. The project was led by Tallis Tibbo.

2.3 Methodology

The feasibility study carried out research in a number of ways:

- Consultation with Findhorn Foundation staff
- A survey was carried out in Feb 2023, with 50 households in the Park answering questions posed by an interviewer face to face. Questionnaires were completed in the Field of Dreams (22%), Pineridge (14%), Central Area (24%), The Whins (22%) and 18% from other areas e.g. Soillse. Questions were centred on the availability of biomass from food and garden waste and vegetable purchasing habits. Results from the survey are shared in the relevant sections below (see full results here).
- In addition, available biomass for use in composting was estimated by
    - Assessing the number of brown bins in use in the Park
    - Discussions with local businesses in the Park, Kinloss and Findhorn Village
    - Use of average figures for the UK supplied by Tidy Planet
- Discussions with community members already composting in the Park
- Discussion with Huw Compton of Tidy Planet, supplier of Rocket in-vessel compost machines
- Interviews with users of in-vessel compost machines
- Research into licencing requirements for community compost schemes
- Interviews with the managers of the Phoenix Shop and owner of the Bakehouse
- Discussions with neighbouring landowners - The Kinloss Army Base and Ed Bichan

3 Features of the Project to Build a Resilient Local Food Economy Project

3.1 The Current UK Food System

According to Henry Dimbleby, author of the Defra National Food Strategy 2021[1], 'Britain's diet is more deadly than COVID'. The food we eat and the way we produce it is doing terrible damage to our planet and to our health, it is the second-biggest contributor to climate change after the energy industry and the UK is now the third-fattest country in the G7. Almost 30% of our adult population are obese, while at the same time many people are undernourished due to the poor nutrient value of their food. Studies have shown that highly processed foods[2] are on average three times cheaper per calorie than healthier more nutritious foods.

While it is becoming increasingly understood that the global industrial food production system is the single biggest contributor to deforestation, drought, biodiversity loss, freshwater pollution and the collapse of aquatic wildlife, the UK remains almost entirely reliant on this system. We outsource much of the environmental damage and carbon footprint by importing 50% of our food from outside the UK; the related emissions are not included in the UK's Net Zero targets which do not take account of carbon emitted outside of the UK to produce and transport our food.

As so much of our food is grown on foreign shores and is subject to capricious international markets, our food supply increasingly suffers from instability and lack of resilience. This has been revealed by recent shortages, when empty shelves caused alarm during the pandemic, and more recently (early 2023) there have been shortages of salads and vegetables usually supplied by producers in Spain and Morocco. Climate change in the form of extreme weather events and catastrophic harvest failures is predicted to heighten variability of supply from both domestic and overseas sources in the future.

The dominance of large scale producers and supermarkets in the UK food chain means that many people have little choice about the origins of the food they buy; where it comes from and the type of production system used to produce it.

The UK needs solutions to these problems. Local food supply chains, harnessing local production capacity and environmentally responsible production methods, provides these solutions.

3.2 Building a Resilient Local Food Economy

3.2.1 Re-carbonising our Food Economy

This feasibility study is focused on the design of a resilient local food economy model, which can be replicated across Moray to support a broad range of communities of differing sizes. The model described will build a consistent supply of quality local vegetables and meat for the Findhorn Ecovillage and local area, shifting away from a reliance on the industrial and damaging production systems that supply supermarkets.

[1] https://www.nationalfoodstrategy.org/

[2] high in salt, refined carbohydrates, sugar and fats, and low in fibre

Instead, we propose a regenerative production system that: produces nutrient-dense food, sequesters carbon, rebuilds soil organic matter and biology, massively reduces the carbon emissions resulting from typical long-distance food transport, improves the water cycle and is based on a closed nutrient loop that recycles nutrients and reduces waste in the environment. The more nutrient dense food will have higher phytonutrients in vegetables and higher omega-3s in meat[3].

This study distinguishes meat produced from intensive systems that utilise chemical inputs (fertiliser/herbicides, industrially produced cereals feeds, preventative veterinary medicines and housing in winter) and livestock production using regenerative farming practices, including 100% pasture-fed, rotational grazing and wintering outdoors. The former produces greenhouse gas emissions, soil degradation and river pollution. The latter restores soil biology, which sequesters carbon, recreates habitats for flora and fauna and increases biodiversity. It's not the cow, it's the how!

Building a food economy of independent local food producers enables consumers to make healthy, sustainable choices about what they eat while supporting local businesses and creating local employment. This helps strengthen communities and create distinctive, vibrant town centres.

3.2.2 Closed nutrient cycle loop / preventing waste

Productivity will be increased through the use of a closed loop system to restore and improve soil fertility using:

a. **Composting** - will reduce energy consumption needed to make chemical fertilisers, which destroy the soil biology needed for carbon sequestration. It will also reduce the fossil fuels needed to transport organic waste and finished compost.

b. **Livestoc**k – integrating chemical-free livestock manure into the compost will increase the mass and fertility value of the compost. This will increase the nutrition value of the vegetables produced. Including livestock in the system will also increase food production via the additional meat harvest, and carbon sequestration in the pasture on which the animals are kept. Swapping factory farmed meat for ethically and sustainably reared meat is both a campaign for better human and animal welfare and a way of mitigating climate change.

c. **Wastewater** – Findhorn EcoVillage's 'Living Machine'[4] is a waste-water treatment system that uses plants and micro-organisms in symbiosis to remove harmful elements of the sewage. The process leaves excess Nitrogen and Phosphate in effluent which is directed to a soak-away. The feasibility study explores the re-directing of these nutrients into the food production system to improve fertility, and also to prevent the pollution of groundwater. This is particularly important for phosphate, which is becoming a scarce nutrient available for food growers; scarcity is a major global concern for the future.

[3] Caronline Grindrod presents a comprehensive outline of the health aspects of eating grass-fed meat here

[4] https://www3.epa.gov/npdes/pubs/living_machine.pdf

3.3 Innovation

This study has chosen to adopt two innovative systemic practices, rather than focus on individual technological innovations, which are outlined below:

a. **Regenerative agriculture:** regenerative agriculture[5] is a conservation and restoration approach to food and farming systems. It focuses on topsoil regeneration, increasing biodiversity, improving the water and nutrient cycles, enhancing ecosystem services, carbon sequestration, strengthening the financial viability of farm businesses, increasing resilience to climate change, all while producing good harvests of quality, nutritious food.

b. **Whole Systems approach:** There is a lot of discussion around whether diets should be plant-based or include animal products. Our view is that both are needed to reflect nature, where plants and animals work in concert to cycle nutrients, create natural soil fertility and create complex and resilient food webs.

   When we grow food in a way that mimics nature, combining both plants and animals, we are utilising natural fertility in a smart way. This eliminates the need to rely on high-cost manufactured fertility, which is hugely damaging for ecology and instead supports nature's climate cooling functions.

We recognize there is infinite potential for further innovation and relevant examples include:

- **Bio-intensive Market Gardening:** In the last 50 years there has been a whole lineage of innovators who have developed techniques for highly productive, chemical-free vegetable growing. Contemporary leaders in northern temperate latitudes are Richard Perkins in Sweden and Jean Martin-Fortier in Quebec. Both are worth exploring to better understand their techniques and income streams.

- **Living Pod Greenhouse** (see Section 4.3 below)

- **Low-cost thermal heating of greenhouses**: this requires achieving two main aims:

  a) **Reducing diurnal fluctuations:** In spring and autumn these can be very high. Rather than dumping excess heat during the day this can be stored and released overnight. Although photosynthesis can only happen in the day, much plant growth happens at night but only if warmer temperatures are maintained. Faster growth means that each plant can spend less time in the ground and/or give a higher yield.

     The decisions to be made are how to collect the excess heat and what medium to store it in. Air collection and storage in rocks under the greenhouse paths is one option. Collection and storage in water filled "radiators" is also well known. Whatever the method of storage, it will be much more efficient if the method is supplemented by a thermal blanket drawn over the crop at night.

  b) **Winter heating**: In regions with plenty of winter sun the strategy above works throughout the year. In Northern Scotland however, solar gain is minimal for 2

[5] https://rodaleinstitute.org/wp-content/uploads/Rodale-Soil-Carbon-White-Paper_v11-compressed.pdf

months of the year. As a result, not only is a net addition of heat required, but also artificial lighting to keep plants growing well.
This is only effective in situations where there is an excess of cheap renewable energy such as where wind generators produce excess energy that is sold to the grid at a low price. In the absence of this situation at Cullerne, additional heating and artificial lighting should only be used for early propagation and micro-greens production.
The strategy for the two darkest months is to grow plenty of hardy greens in the autumn which can be harvested mid-winter supplemented by fresh microgreens.

3.4 Carbon

This project will significantly reduce the community's food carbon footprint in 2 primary ways:

a. Carbon Avoidance

- Our project will **replace waste collection by the Council or by Grey's Compost**, a private company that is located 39 miles away, reducing transport and GHG emissions accordingly. Instead we will collect biomass from households/businesses in the Findhorn Ecovillage and within two miles of the site.
- This biomass will be turned into compost to **replace bought-in compost**, again reducing transport.
- The project will **create a short journey of food from field to fork**. Vegetables, including organic produce, sold in supermarkets have a very high carbon footprint due to the long-distance transport involved.
    a. This is true even for vegetables 'grown locally' for supermarkets e.g organic carrots grown for Tesco near Inverness airport are then graded, packed, and distributed via 3 different UK sites ((Forres, Lincoln and Bathgate) until they are returned to the supermarket in Inverness, a journey of around 900 miles, mostly by diesel 40 ton truck.
    b. In addition, a large volume of vegetables is produced in Europe (Spain/Netherlands/France) and North Africa (Morocco). While some of this food is produced organically, it still emits huge amounts of carbon due to the long distance it is transported.

b. Carbon Sequestration

How best to sequester carbon?

- There can be significant gains made by land uses that support the complex and interconnected functions of natural ecosystems. One question is how best to absorb carbon dioxide emitted by human activities - plant trees or increase carbon stocks in grassland soils?
- Across the globe, forests have historically served as carbon sinks. However, when trees sequester CO_2, the carbon doesn't disappear; the plants store it in their woody biomass and leaves as they grow. When trees die, are harvested for burning, making

wood products or destroyed by natural disasters, the accumulated carbon is released back into the atmosphere.

- Unlike forests, grasslands sequester a majority of their carbon underground, where it is stored in more stable form for extensive periods, even millenia[6] (see Section 5.2.3 for more detail on carbon sequestration in grasslands).

How will this project potentially sequester carbon?

- Mob-grazing ruminants on grassland pasture sequesters carbon
- The wastewater effluent from the Living Machine will augment carbon sequestration in grassland by increasing carbon-based biomass production of that grassland.
- Application of compost to soil.

Our calculation for the total carbon savings from the local food economy system is a saving of 22,545 Kg CO_2e in Year 1. Thereafter the annual carbon saving will be 32,252 Kg CO_2e (see here)

4 Possible Sites for a Scaling Food Project

There are various sites where food growing is taking place in the Findhorn Ecovillage. This project has focused on the largest of those sites, Cullerne gardens, which has a long history of vegetable growing over several decades. There are many other smaller private gardens in the Park and some common areas, which were not considered by this project, some of which are already in active use for food growing. For instance, there is a small but productive vegetable growing site on communal garden land at Soillse, led by Christopher Raymont (technical adviser to this project).

At present, there is insufficient land available for grazing livestock on Ecovillage land and the project has explored opportunities for leasing land adjacent to the Park for this purpose. Details are given below.

4.1 Cullerne Gardens

Cullerne gardens is a 7.8 acre outdoor growing area, including 4 agricultural size polytunnels, fruit gardens, a herb garden, a forest garden, wildlife ponds, bee hives and a host of visiting wildlife. The gardens are cultivated using a combination of organic, bio dynamic and permaculture principles. The produce from these gardens has in the past been consumed by community residents, guests attending programmes and customers at local shops.

During the recent Covid-19 lock-down period, in the absence of residential guests, all surplus produce was donated to the Moray Food Plus food bank. Over 3,500 packages from April to June were distributed, providing support to the increasing number of local people who were struggling to make ends meet. In previous years, the gardens cooperated with EarthShare, the UK's first Community Supported Agriculture (CSA) scheme set up in 1994 in the Findhorn Ecovillage. EarthShare ran for 16 years providing much of the Findhorn Ecovillage's temperate vegetables as well as a regular box scheme for individual households in a 20 mile radius.

[6] https://weekly.regeneration.works/p/grasslands-the-21st-century-carbon

Cullerne has a long history as a key part of the Findhorn Foundation's educational work, hosting many thousands of visitors on guest programmes. Over the last 15 years, Cullerne has also hosted programmes for local disadvantaged youth who have participated in food growing, preparation and eating. A regular Care Farm group attends weekly gardening days.

Current Food production:

- The current growing area comprises 900m^2 polytunnels, 165m^2 propagation tunnel and 4,000 m^2 outdoor growing area.
- This amounts to 5,065m^2 or 1.21 acres (0.5 Hectares).

4.2 Cullerne Farm

To the south-east of the Park Ecovillage is Cullerne Farm (not to be confused with Cullerne Gardens!) which is owned by Ed Bichan. Mr Bichan has previously sold land to the ecovillage (e.g. for the construction of the Field of Dreams).

Current Use:

- Abutting the Park and caravan site are two small fields that have not been used for any purpose in many years. The two small fields are known as: Cullerne Farm Zone 1 (18,768 m² / 4.63 acres) and Cullerne Farm Zone 2 (20,649 m² / 5.10 acres). This amounts to 9.73 acres (see map).
- Every year the grass in these fields grows long and eventually goes brown and dormant with the onset of winter. The carbon gathered by the grass while growing is slowly lost back to the atmosphere via chemical decomposition in contact with air.
- We have discussed with Mr Bichan the potential to lease these two fields for cattle grazing with two objectives:
    - Firstly, producing quality meat produce for the local community.
    - Secondly, taking grass-carbon that would otherwise be lost back to atmosphere as CO_2, and using biological breakdown in the gut of the ruminants, and the organisms in soil, to trap and store (sequester) that carbon in the soil profile, in-so doing taking carbon out of the atmosphere and increasing soil fertility.

4.3 Soillse Housing Co-op

Soillse Housing Co-op is a ten year old co-housing project consisting of 6 owner-occupied houses and 4 rented studio flats. Each house has a small private garden but most of the 1.7 acres of the development is shared garden space. The majority of the residents support a shared vegetable and fruit growing space which supports a 0.14 FTE paid job. Members of the garden club provide voluntary work according to their time and health constraints and pay an annual subscription. Originally the club relied only on voluntary work but the employment of an experienced garden co-ordinator (Christopher Raymont) has greatly increased productivity and satisfaction.

There is currently 320m^2 of growing space and the produce is shared informally between the ten club members. This includes 60m^2 of polycarbonate clad greenhouse, which is key to

producing winter salads, Mediterranean summer crops and the propagation of seedlings to optimise the efficiency of all the growing spaces.

Mindful of the precariousness of UK food supplies in the face of climate change and economic disruption, Soillse is exploring the design and building of a 'Living Pod Research Greenhouse'. This differs from conventional greenhouses by proposing a whole-systems approach, recycling water and nutrients through aqua- and vermi-cultures, creating its own energy through solar cells and storing heat through various active and passive strategies.

The design has been created by BioMatrix Managing Director and Soillse resident Galen Fulford and holds the potential to provide a greatly increased level of food security for communities in the face of climate change. The main features of the design are described below.

Living Pod Design

The Lifepod system offers a solution that may help to deliver decentralised urban and peri-urban food resilience at a neighbourhood or cluster scale. An example has been operated successfully at Manchester College, providing high yields of nutrient dense food. The main features of the system are:

- The majority of the growing space is soil-based, which delivers the equivalent density and performance of high spec hydroponic, but with more resilience to disease and imbalances. The system uses two kinds of enhanced soil types: a mineral aggregate using compost and granite rock dust, plus a Coco-Peat based enhanced soil using compost and fibrous/humic substrate.
- A hydroponic system will deliver nutrient dosing, including liquid seaweeds, calcium and vermi tea.
- A multi-tiered vermiculture system, which will produce vermi tea and will integrate with the hydroponic system
- An Aquaculture system, with Tilapia, catfish, perch and crayfish, which will integrate with the hydroponics systems to provide an optimised aquaponics system
- Fungiculture system, growing mushrooms to provide protein and nutrient dense food
- Photovoltaic panels on the roof will provide power for lights, grow lights and power sockets.

The Lifepod uses organic, non-toxic methods of both growing and pest / disease management, to create and nurture a balanced living system within a confined space without the need for any chemical inputs. The greenhouse is a modular design and scalable to allow for customisation and adaptability to different site sizes. A drawing of the proposed design is available here.

5 Basic Project Design

5.1 Production of Fruit and Vegetables

Written by Christopher Raymont

Local small scale production of vegetables and fruit has become vanishingly rare over the last 50 years as Scottish food systems have become ever more dominated by supermarkets and industrial-scale farming. However, there are examples of economically sustainable small scale production and our research suggests that these have certain quite specific characteristics in various combinations, many of which Cullerne can benefit from, which are outlined below:

- **Planning:** Starting with a clear understanding of the market for produce, a detailed annual growing plan matches needs of customers to production.
- **Growing techniques:** Minimum tillage, controlled irrigation, weed control mulches, improved poly-tunnels and integrated small livestock are some of the many techniques which need to be fitted together into an integrated management plan.
- **Workforce:** Skilled, highly committed and experienced growers who can plan well, grow great produce and build effective relationships with workers, volunteers and customers
- **Social Benefits**: Carefarming of various types can bring additional income, although funds may have to be raised for this.
- **Direct sales**: Most successful small scale producers sell at least a significant part of their produce directly to the public..

Each of these characteristics are explained in more detail in the next section.

5.1.1 Planning

Detailed planning is required to ensure that:

- Growing matches the needs of customers whether wholesale or retail. Good knowledge of customer needs and detailed planning are essential to provide continuity and predictability of supply.
- The focus is on higher value crops and conversely not growing those that are easy to grow on a large scale like main crop potatoes, carrots and brassicas.
- The focus is on crops where fast farm to plate times have the most effect on nutrition.
- Added value products e.g. pickles and chutneys can be produced to boost income.

At a farm level, effective planning ensures that:

- All inputs arrive on farm on time
- The right number of seedlings are raised at the optimal time
- Each square metre is used optimally
- Ground is not used for lower value long storage crops that are much more efficiently grown at a larger scale
- Supplies are consistently and predictably made to customers
- Season extension is prioritised to give 10 months of abundant harvest and leafy greens throughout the year.

5.1.2 Growing Techniques

a. No-Dig Techniques

Minimum tillage systems are becoming mainstream at all scales. Their ability to prevent carbon loss from soils and reduce weed problems are especially relevant on very sandy soils like those at Cullerne. The Garden has already started to introduce these but uptake has been limited by the supply of compost and the cost of transporting this from Aberdeenshire. The new on-site composting business would make the transition to no-dig much more feasible.

Reducing the need for hand weeding is key to running the garden efficiently. In the medium term no-dig techniques will help greatly but in the short term planting through weed suppressing materials will be needed.

b. Irrigation

Current wasteful and inaccurate outdoor sprinkler irrigation is replaced with low volume drip based systems.

c. Covered Cropping

In the polytunnels all the above points apply. Accurate planning is particularly important in respect to optimising the much higher levels of potential productivity, with two or even three crops possible per annum. Drip systems are already in use in the polytunnels and there is also potential for automation to ensure optimum growth. This requires more research to make sure that there is a positive cost/benefit result.

The current propagation tunnel is well set-up and equipped for its job with plentiful cold frames for hardening off. However, it was originally designed with a second skin and fan to substantially reduce heat loss at night. This should be restored to reduce heat requirements and allow earlier propagation. This will also require grow-lights to be added to the heated propagators.

New Keder Greenhouse

Additional growing area: With funding support (e.g. from a future round of the JTF) an additional 288m^2 of covered cropping could be added to increase total growing area to 5,389 m^2 (1.33 acre). There is an ideal south facing site for a new 24 x 12 metre greenhouse at the centre of the garden. It is suggested that this should be a Keder House.

Structure: Keder greenhouses have a polytunnel type of steel structure, covered with a two layer polythene material with a bubble structure between. These are both far more robust (the tunnel can even be walked over) and provide a significant increase in insulation compared with a polythene tunnel without significant loss of illumination.

Costs & Income: Whereas a standard polytunnel will cost around £71/m^2, a Keder house of this size costs £163/m^2. Used for the same type of crops we could expect an increase of £7/m^2, however devoting a 6 x 8 metre part of the area to the production of microgreens lifts productivity by a further £17/m^2 over the whole greenhouse, whilst providing an indoor space big enough to teach, meet or sell produce directly alongside the growing racks.

d. Crop Choices

Local residents were not questioned about which vegetables or what fruit they would like to be able to buy from Cullerne garden but the writer's experience over 50 years suggests that fresh perishable greens (including herbs) are the most sought after, followed by protected summer crops like tomatoes and finally, early treats like young carrots and early potatoes.

The strategy will be to grow plenty of hardy greens in the autumn which can be harvested mid-winter supplemented by fresh microgreens.

The focus must be on higher value crops and on regular contact with wholesale customers especially any restaurant customers to understand and meet where possible their precise product needs including timing and consistency.

e. Egg Production

The production of free range eggs is included in the business plan for several reasons even though it is only marginally cost effective:

a) Supplying free-range eggs to people who can visit and see 'their' chickens is a good way to build customer loyalty

b) It provides a yield from the large areas of the garden with very minimal soil cover whilst improving that soil.

c) In the winter, the hens would be stationary on empty sections of the growing area. Their manure would obviate or reduce the need for compost applications on those areas

d) Manure from the droppings boards beneath the hen's perches would be available to add to the compost machines if the nitrogen content of the collected biomass at any time fell too low e.g. in winter when there is an excess of woody prunings to deal with.

The preferred approach is housing the birds in small easily moveable houses with 25 hens in each. This minimises stress for the birds. The houses are surrounded by hen specific electric netting, ensuring that over the summer the birds have a constant supply of grass. During the winter, when the hens are on the empty sections of the garden, they can be given fresh vegetable waste like old brassica plants and/or can feed on green manure crops.

f. Organic Certification

There is a common misconception that Cullerne produces organic food and in fact this feasibility study was initially called 'Scaling Organic Food'. However, while Cullerne uses organic methods of food production, it is not organically certified for valid reasons, including both time and cost to obtain and retain certification.

This study considered the pros and cons of organic certification for Cullerne and our survey asked residents whether they considered certification to be important. 85% of respondents replied it would not be important, which is in line with common perception that certification is generally an issue of trust. As the Ecovillage residents already know that Cullerne uses organic methods, we concur that the additional costs of certification would not be merited.

5.1.3 Workforce

It cannot be overestimated how important the quality of the lead grower is to this plan. Most successful small-scale producers are family businesses who build up skills over years and are very highly motivated to work long hours. We suggest that there are three key skills:

a. Planning and cost control
b. Small scale horticultural knowhow
c. People skills with colleagues, customers and suppliers.

It would be advisable for a lead grower to have in-depth experience of a successful horticultural enterprise on a similar scale.

5.1.4 Social benefits

The Findhorn Bay Care Farm has been running for ten years within Cullerne Garden. We envisage that Cullerne Garden will continue with and develop this partnership. Up to now there has been no significant income from this to the Garden, however Jonathan Dover, (MD of the Phoenix shop and cafe) has extensive experience of Care Farming in the UK and is aware of small farms which earn significant sums from Carefarming activities.

He also points to evidence that care-farm placements on productive, professionally run holdings have been shown to be therapeutically more beneficial than placements where the focus is on direct support to the client's experience. Of course, this is very dependent on the type of client: socially disadvantaged people transition out of Carefarming into paid or voluntary jobs, while people with significant learning difficulties need a more care-focussed approach.

5.1.5 Direct Sales

Notwithstanding the importance of supporting our local shop the Phoenix (see Section 7), there is much to be gained by bringing customers onto the land itself. We have identified three possible ways of doing this, all of which would need to be justified through a viable business plan:

- A weekly market in the garden on a Saturday morning possibly inviting the Phoenix shop to sell products alongside
- A committed group of volunteers in the garden who would exchange their work for vegetables that exceed customer needs.
- Employing local young people on Saturday mornings, whose parents would be an additional customer base.

5.2 Livestock

Written by Andrew Heath

5.2.1 Objectives

The inclusion of livestock in the food production system is an opportunity to:

- increase carbon sequestration and soil fertility via targeted livestock grazing
- produce a healthy meat product for local consumers while meeting high animal welfare standards.
- Provide a local and agro-chemical free source of livestock manure to the community composting system
- increase the profitability of local food supply business
- reduce food miles having a further positive impact on carbon emissions.

5.2.2 A proposed livestock management plan

a. Cattle

Land owned by Ed Bichan to the south of the Park, is available via annual grazing licence for livestock keeping. The project will be seasonal, running through the grass growing season (May 1st to Oct 30th) and will be dormant during the rest of the year.

Eight fattening bullocks of approx. 22-24 months of age will be purchased locally at the beginning of May and transferred to Ed Bichan's land. They will be cared for through the summer and slaughtered in line with market demands between August and October.

The cattle will be managed on 'mob-grazing' principles[7] using mobile electric fencing and a water trough. The fencing will be moved daily, along with the trough, to keep the cattle continually on fresh grass. This is crucial for maximising grass productivity, soil fertility, animal performance (health and weight gain) and carbon sequestration potential.

Periodically and according to market demand the animals will be taken to slaughter, butchered professionally, and their produce sold to the local community.

b. Fencing

Currently the two fields in question are not ready to receive cattle, particularly with regard to fencing, which requires improvement. The following maps illustrate the fencing that is required. Two cattle catch pen sites are illustrated in the maps. One of these could be built as a permanent installation, or a number of strong wooden hurdles, requiring two people to move them, could be built that could be placed in either location according to convenience. The better site is that shown in the S. Field, however the access to the road is currently blocked with building material. Hopefully this will be open and useable in the future.

[7] https://holisticmanagement.org/land/mob-grazing/

Figure1: North Field

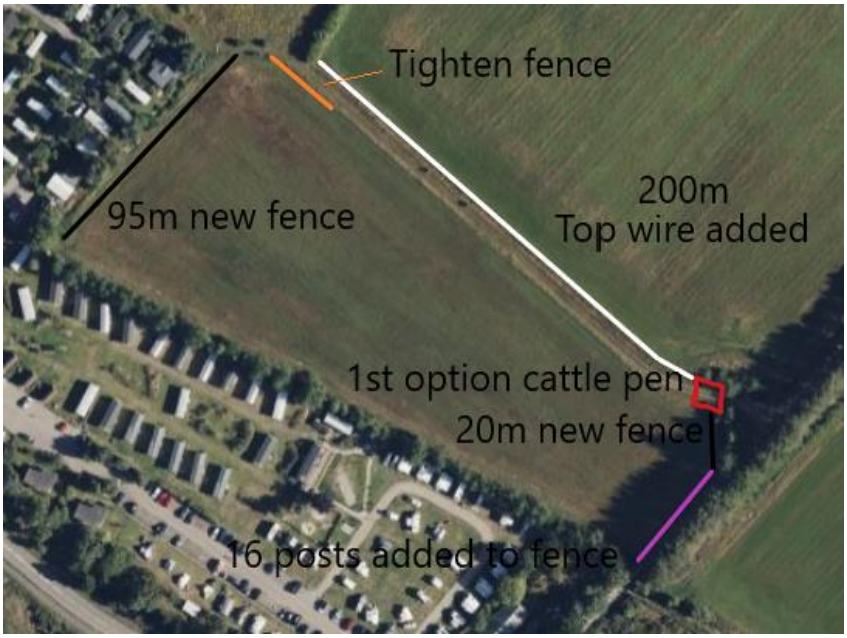
As described in Figure 1, the N. Field requires:

220 m of new fencing: 10 straining posts, 74 small posts, and two steel wires (690m).

3 x 4m steel gates.

A cattle catch pen is marked. This is optional and is the second choice location.

Figure 2. South Field



As per figure 2, the S. Field requires:

115m new fencing. 4 strainer posts, 39 small posts & 2 steel wires (230m).

16 new posts to improve existing fence.

200m top wire on existing fence

Short section of existing fence tightened.

First choice cattle catch pen location.

c. Water

The water supply will be delivered to the cattle by means of a portable trough and pliable pipeline that will connect to one of several mains sources, depending on where the cattle are grazing. Potential connection points are at Soillse housing co-op, Moray Arts Centre, the Living Machine sewage treatment works and the Findhorn Caravan Park.

5.2.3 Carbon Sequestration in grasslands

We have reviewed current research on this topic which is unequivocal; pasture grasslands grazed by livestock that are managed via regenerative methods (i.e. mob-grazing, no artificial inputs/chemicals) can sequester in their soils significant amounts of atmospheric carbon, thereby removing it from earth's atmosphere and helping to reduce the effects of anthropogenic climate change.

The natural mechanism by which this occurs is as follows: when grass (or any plant) grows, it takes carbon from the air for two reasons:

1. To form its own structure; like all living things grass is made of carbon. Plants source this carbon from the air in the form of carbon dioxide CO_2 (unwanted oxygen is then released).
2. To make carbohydrates. Grass plants exchange these carbohydrates with soil organisms in return for the delivery of other nutrients and minerals (in symbiotic relationship).

When ruminant animals graze the grass and convert it to manure, which is made almost entirely of the carbon made from the digested grass, that manure falls to the ground surface where it is eaten by soil organisms (in healthy soil). The dung of these organisms becomes the dark organic top-layer above the sub-soil, the nutrients in which are then available to growing plants. This dark organic layer (made mostly of carbon) increases over time as these natural processes take place, storing large amounts of carbon beneath the grass sward.

This area of research is recent, and accurately predicting the likely degree of carbon sequestration at a particular site under specific management is not currently possible without historical soil sampling data from the site. However, should this grazing project at Cullerne Farm go ahead, it would be possible to take soil samples and record the soil top-layer increase/carbon sequestration taking place over time, and subsequently then also predict what would happen in the future. Worth noting is that carbon sequestration rates of over 9 tonnes carbon per hectare per annum are being recorded at pasture grassland sites where conditions (climate, base soil type, latitude, biological health) are favourable[8].

The sandy soils of Cullerne Farm are not ideal, but the climate is favourable and the site has not been conventionally farmed for a long time meaning that the biological status also should be favourable. It would be interesting to see how much carbon it could sequester with the help of correctly managed livestock.

[8] Regenerative Agriculture and the Soil Carbon Solution. Rodale Institute. Sept 2020

5.3 Living Machine effluent

The Ecovillage has its own independent sewage treatment facility, the Living Machine (LM), which utilises a variety of plants in relationship with micro-organisms to provide a nature-based system for the treatment of raw sewage. The effluent that leaves the LM post-treatment is pumped to a soak-away in East Whins. This effluent contains nitrogen and phosphate that could be used as natural fertility for the growing plants.

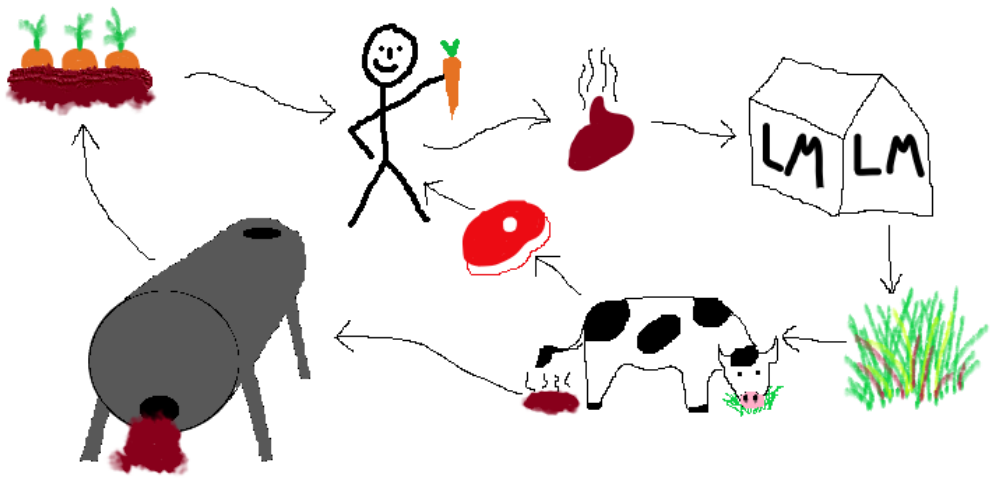
Wastewater effluent cannot legally be directly applied to a horticultural food growing area due to the risk of transmitting human pathogens, but it can be applied to grassland and used to increase harvestable grass production. Ruminant grazers, by eating the grass, can then convert these nutrients back into useable products i.e. meat and manure. They would also provide a 'dead-end' host to human pathogens.

5.3.1 Closed nutrient loop

The use of this wastewater could therefore create a waste-free closed nutrient loop, whereby the phosphate and nitrogen is recycled back into the food-growing start of the loop. The steps of the nutrient loop would be:

1. Vegetables grown in gardens, livestock produced on grassland
2. Vegetables & meat products eaten by people
3. Sewage waste from people to Living Machine
4. Effluent Phosphorus & Nitrogen from Living Machine dispersed on grassland
5. Phosphorus & Nitrogen from sewage effluent grows grass
6. Grass eaten by ruminants, producing meat products and manure
7. Manure from ruminants collected and used in compost making
8. Compost used to grow Vegetables in garden
9. Vegetables & meat products eaten by people

These steps are portrayed in the infographic below:



As mentioned in point 7, the intention is to collect a small proportion of the manure produced by the cattle. This manure would be used to improve compost being made for use in the veg-growing garden.

Manure deposited by animals is a crucially important part of the grassland ecosystem, as the nutrients it contains are recycled by micro-organisms and used to fuel continuing grass growth. By taking a proportion of the manure from the grassland for compost making, we would be reducing the Phosphorus & Nitrogen that would otherwise be available to the grassland system. However, by using the LM effluent we can close this gap and replace the nutrients lost to manure gathered for compost making. The additional nutrients could also support carbon sequestration on the grassland.

Licensing

In order to use the effluent on the grazing land, an exemption under Paragraph 7 of the Waste Management Licensing (Scotland) Regulations 2011 is required from the Scottish Environmental Protection Agency (SEPA). The relevant legislation is available here.

The correct form for applying for this is the WMX-FM7, available on the SEPA website. The initial registration cost for an allowance to spread on up to 50ha of land is £694. Thereafter annual renewal is £538.

If this project were to go ahead it may be worth entering into conversation with SEPA regarding the price of an exemption, given the small size of the land area we are proposing to spread the effluent on. At £694 pounds for the first year exemption, this would take the cattle enterprise over budget in year one. However, this would be affordable in year 2. So it may be that this element of the project can proceed from year 2.

5.4 Composting

Written by Tallis Tibbo

This project has researched the elements of developing a community composting scheme. We consulted with those members of the community who have extensive experience in composting; we estimated the approximate amounts of biomass available in the Ecovillage and surrounding area (within 2 miles, plus Cluny); we identified the appropriate size of in-vessel compost machine to speed up the production of high quality compost and the requirements for the installation of the machinery.

Consultation with existing composters: The Ecovillage probably has a very high proportion of people composting their own waste compared to the average population. We consulted with various individuals / groups who are actively composting in the Park: Maria Cooper & Craig Gibson, Eveline Rodenberg, Park Gardens, Cullerne. Everyone offered support to the project and helpful suggestions on how a community-wide scheme could work.

5.4.1 In-vessel composting

This method involves feeding large quantities of organic materials into a drum, silo, concrete-lined trench, or similar equipment which ensures good control of the environmental conditions such as temperature, moisture, and airflow. This significantly speeds up the composting process. Waste spends only 2 weeks in the machine and then 6 weeks stored outside before it can be used. The compost produced is high quality and ideal for horticulture.

A considerable advantage of an in-vessel system is that it can accommodate all food waste (raw and cooked food, meat and some bones), plus garden waste (to be shredded first). It brings significant reductions in the greenhouse gas emissions that result from transporting waste to landfill

This system produces high grade compost which is ideal for increasing the productivity of vegetable growing.

5.4.2 Available biomass for composting

Extensive research was carried out to ascertain quantities of food and garden waste that could be used for community composting. A full list of sources identified from both household and local businesses is available here.

Seasonality of biomass: the availability of biomass will be highly seasonal, as the businesses we consulted, especially the Holiday Park, have a big rise in waste availability during the summer. Approximately double the volume of biomass will be available in summer compared to winter.

In addition to food and garden waste, manure will be added (see Section 5.2). The quantities of biomass available for composting from food / garden waste from 145 households and 8 neighbouring businesses, plus manure is estimated to be 1,072 kg per week or 153 kg per day on average

Woodchips: the machines require that one fifth of the y biomass input to the machine is made up of woodchips to ensure that the carbon to nitrogen ratio is balanced. Woodchips are available from various local sources e.g. tree surgeons already offload woodchips to Cullerne at no cost and the Hinterland may have woodchips available.

5.4.3 Volume of compost produced

We used calculations from Tidy Planet to estimate the volume of compost that could be produced from the available biomass.

The estimated total biomass available will generate compost quantities of 643 kg per week or.33.4 tons per year. This equates to 66,893 litres per year.

Compost is ideally applied to horticultural land at a rate of 3 cm depth per year, which equates to 30 litres per m^2. The growing area at Cullerne could be 5,389m2 (if an additional greenhouse of 324 m^2 is added). **Therefore 66,893 litres of compost would cover 2,230m^2, which is only 59% of the total growing area** (see here for details).

5.4.4 Which machine?

An in-vessel compost machine requires a continuous input to function optimally; this in turn leads to a continuous output. Our research indicates that biomass availability is around 153 kg (438 litres) per day. This volume of biomass is suited to two Rocket A900 in-vessel composting machines, which each process up to 215 litres per day.

After the A900, the next machine size is an A1200, which processes 650 litres per day and would be too big (particularly in winter) and four times the price. An alternative company, Big Hanna, was also considered, but because it is now based in Spain, servicing/maintenance of a machine based in the UK could be problematic. The machines are also much more expensive than a Rocket. A report on user experience of in-vessels machines is here.

This study found that the best way to accommodate the seasonal variability is to purchase and install two A900 machines, one of which could be used throughout the year, the other from April to October (approx), to match seasonal availability of waste.

5.4.5 Sites and Housing for Compost Machinery

Sites: Various sites for the machines were considered. Ultimately the study concluded that they should be located i) where there is easy access for a waste collecting mule & trailer to access and ii) where the end product will be used. Therefore the project recommends the machines are sited at Cullerne gardens.

A site for two compost machines has been identified in Cullerne, between two polytunnels (according to Tidy Planet, the gases from the machines could be directed into the polytunnels to increase vegetable growth).

The gap between the polytunnels is 5.5m which is wide enough for two A900 machines to sit side by side.

Housing: The machines require protection from the weather and a hard base for washing down. A site measuring 5 m x 10 m will be prepared, with a base of hardcore and concrete for the machine feet. There will be wooden sides, with sliding doors at each end, one end will be where the mule / trailer bringing waste containers will enter and the other end will pipe the compost output to the windrow sites outside the shelter.

5.4.6 Compost and soil contamination

This study commissioned a report on the state of chemical contamination to be expected in compost that has been made using household food-waste, the effect that composting has on these contaminants and the implications for using food-waste compost as a growing substrate. The report is available here and makes very interesting reading. It concludes:

'Levels of heavy metals and persistent organic pollutants in food waste compost are in general lower than other fertiliser options, and are often not monitored by regulators.

Using composting and application methods (e.g. no-till) that stimulate as much microbial activity as possible can help to reduce the levels of some pollutants.

To reduce the levels of heavy metals and pollutants that do not biodegrade, care should be taken to avoid contaminated feedstock, especially plastic (including biodegradable), entering the composting system. Well carried out source separation is seen as the most effective way to avoid plastic contamination, requiring a consumer education element in the composting system'.

5.4.7 Licencing

Extensive research was carried out to understand the regulatory requirements around community composting, including siting, housing, sale of compost (see here for details).

With the amount of biomass identified, this project would produce around 30 tonnes of compost per annum, which would mean that the Animal Plant and Health Agency would be required to inspect it (the limit for inspection is >10 tonnes per annum). Our composting activities will be registered with SEPA, but exempt from requiring a full licence because we will compost/process/store less than 400 tonnes at any one time.

Compost with food waste has to be treated in an enclosed process (which is dealt with in an in-vessel machine).

There are standards of hygiene required around cleanliness of the composting area and washing down facilities are required, along with a concrete base and drainage to ensure there is no risk of runoff.

If an exemption is obtained, the compost can be used on the property where the compost heap is located. We could consider getting PAS certification, should we choose to sell any compost as part of a viable business model.

5.4.8 Utilities for compost machine

- Electricity supply: There is adequate supply to the garden building but 95 metres of new underground cable would be needed especially for the 5kW grinder.
- Water supply: Water Supply is already nearby, requiring minimal expense.
- Drainage: Wash-down water to be collected and used for non-food plant irrigation.

5.4.9 Waste Collection

Our community survey showed that food waste is often home composted, but that 35% of households in the Park have both food and garden waste removed by the Council (at a cost of £36 per year). Businesses use a private company, Gray's Compost, which is based near Banff and charge £13.50 to collect waste from a 240 litre bin (£9.50 for half a bin). A local compost system would both avoid the use of diesel-fueled trucks to transport the waste and make better use of it in-house.

Equipment for Waste Collection, Sorting, Shredding

Mule & Trailer: there are many options for vehicles to collect waste from household collection points and businesses. One option is a 'mule' and trailer, which is roadworthy and low on fuel.

Petrol mules (£9,500) are nearly half the price of electric ones (£16,500), which would make the latter hard to justify. Details are included in the business plan.

Sorting table: our research showed that the main major challenge with community composting schemes is contamination of biomass with plastic. If plastic is included in biomass which is shredded prior to entering the machine, it will create multiple tiny pieces of plastic, which cannot then be removed. To avoid this, the waste will be delivered to the compost machine site and emptied onto a sorting table where the contaminants, mainly plastic, will be picked out by hand. Tidy Planet supply metal sorting tables with steps. They could also be made of wood.

Shredder: once the waste has been sorted, it will be tipped into a shredder located at the end of the sorting table, before being emptied into the Rocket.

Based on our research with users of in-vessel compost machines, we estimate that the labour involved in sorting waste, shredding and feeding the compost machine will be 1 hour per day for one person; 5 days per week.

Plan for Collection of Waste: a possible plan for waste collection is outlined as follows. The machine requires a daily supply of biomass to ensure optimum efficiency of compost production. Waste collection will take place 5 days per week, each day collecting from a different place. This means that each household/business will have waste collected once per week. The total time allocated to waste collection is 2 hours per day.

Day 1 – Collection from **Findhorn Village** – The Bakehouse, The Kimberley, Crown and Anchor, Captain's Table plus one section of households in the Park
Day 2 – Collection of food waste (not garden waste) from **Cluny –** 10 mile round trip plus one section of households in the Park
Day 3 – Collection from **the Park Businesses** – Phoenix Café & Shop, Caravan Park, La Boheme, plus one section of households in the Park
Day 4 - The Park households
Day 5 - The Park households

Collection points for a cluster of households – between 5-10 households per cluster

- Total of clusters – 25 to 50 clusters
- separate for food waste and garden waste
- 1 x 40 litre rectangular bins each week

Total miles spent collecting waste per week – 17.5 miles and 2 hours spent per day.

6 Sales of Food Produce

There are various routes to market for vegetable and meat products generated by the project, which are outlined below.

6.1 Wholesale to Local Shops

Meetings with the Phoenix and the Bakehouse have confirmed that they are willing to accept Cullerne garden as a major supplier of vegetable / fruit produce if Cullerne's production and organisation is both reliable and consistent. This would require Cullerne to work to an annual growing plan that is developed in cooperation with these two local outlets.

Cullerne garden could potentially produce over £60,000 wholesale value of produce per annum, which could be sold entirely at local scale.

Meat: the financial figures for the meat produce are based on the same model of wholesale selling to the same two local outlets, although the option of doing this has not yet been confirmed. Our community survey indicated that around 74% of respondents would potentially be interested in purchasing meat direct from the project, and so this presents an extra sales option with the added benefit of increasing income via retail prices. However the extra work required to do this has not yet been planned and costed.

6.2 Farmer's Market

The community survey revealed that a farmer's market is the preferred option for Park residents to source vegetables (21 out of 50 respondents), compared with a box scheme (16 respondents) or purchasing from local shops (7 respondents).

While there have been various efforts, particularly in recent years, to set up a farmer's market in the Park, which brings in a range of suppliers including crafts etc, selling vegetables in this way would undercut the local shops, particularly the Phoenix, and could create risk to local jobs. It would also involve significant work to prepare and manage a market stall and it is not included in the budget prepared for this study.

6.3 Direct Sales

The budget in this study has been based on wholesale prices with produce reaching customers via established local shops. However, direct sales of meat / eggs from supplier to customer is another option that could potentially increase income. This would need to be costed.

6.4 Consumer Choices

Whether we buy holistically managed steak or choose local organically reared vegetables instead of conventional soy bean burgers, we all vote with our actions and our money. Every day, each one of us has a choice what food production systems to support. When we purchase our food some of the choices can feel confusing e.g. is it better to buy local, non-organic food produced with synthetic fertilisers and pesticides etc, or support food produced organically that is not detrimental to the soil but racks up food miles during its transport from Spain/France/Netherlands to Scotland?

This project aims to make the choice simpler, by producing food in regenerative ways that has zero food miles. The only way it will work is if people choose to buy the produce. We know that price and convenience drive sales far more than ethics. And here's the second dilemma - are we willing to pay for healthy ethical food rather than what we might perceive as cheap food that is lower cost to the wallet but has significant detrimental costs to both the planet and our own health. In reality, there is no such thing as cheap food!

6.4.1 Current purchasing habits

The findings of the community survey showed that 74% (37 out of 50) of households surveyed buy a proportion of their vegetables from Tesco, with 34% (17 out of 50) using that supermarket as their primary source of vegetables. Two supermarkets (Tesco and Lidl) featured in the top 3 primary sources of vegetables, alongside the Phoenix shop, which was the principal supplier of vegetables for 22% (11 out of 50) of households.

Cullerne is a source of vegetables for 22% of households, but the primary source for only 1 household.

These figures show that to help a local food economy thrive there is potentially a role for education to redirect consumer choices / habits. Aligning type and price of products with established consumer patterns would be the first concern when creating a marketing strategy.

7 Business Plan

Year one financial budget: this section details financial projections for the three main components of the project:

- Horticulture - Vegetable production and sale.
- Fertility – Food and garden waste collection for compost production
- Livestock - Meat production and soil improvement

The annual budget spreadsheet is available here.

7.1 Horticulture and Eggs

7.1.1 Growing area

a. Current Area

Cullerne Garden currently has an established food growing area, which totals 5,065m^2. This comprises three types of growing area: large polytunnels, propagation polytunnel and outdoor beds. The production figures are based on a successful and well-established local Horticulture business.:

- 900m^2 of polytunnels: production at wholesale prices £20,250
- A 165m^2 propagation polytunnel, which can produce autumn/winter salads when propagation is finished, to a value of £500
- 4,000m^2 outdoor beds: £28,000

The projected annual value of vegetable production at wholesale prices on the current 5,065m2 growing area in Cullerne Garden is £48,750.

b. Additional Growing Area

Assuming a successful award of grant funding, this project has costed for the addition of a Keder greenhouse to be constructed on-site in Cullerne Garden. The design is for:

- Keder greenhouse 12m x 24m, with a capital outlay of £46,963
- 240m^2 growing area, which will have the potential to yield £29 /m^2/annum production wholesale value
- An additional section of the greenhouse (48 m^2) will be used to produce Microgreens. This will yield £177/m^2/annum production.
- If the Keder greenhouse could be included in the project, that would bring the total growing area up to 5,389m^2.
- This additional, higher quality area will increase covered cropping production by £15,460.

Inclusion of a Keder greenhouse would increase the total wholesale income of Cullerne garden up to £64,210 per annum.

(All internal growing area yields have been reduced to account for necessary pathways)

Cullerne Garden Vegetable Growing: Projected Financial Figures

Income	£64,210
Running Costs	£10,670
Profit before labour costs	**£53,540**

With depreciation, profit before labour costs £51,181

7.1.2 Egg Production

It is proposed to run 4 mobile hen houses with 25 hens in each. Each will have an electric fenced run and the hens would be replaced every 2 years. In the summer the hens would be moved over grass areas of the garden which will gradually build soil. In the winter they would be stationed on empty vegetable beds which would reduce the amount of compost these beds would need for the following year. There will be a capital outlay of £1,510 for housing, covered run materials and fencing.

Cullerne Garden Egg Production: Projected Financial Figures

Income	7,729.00
Running Costs	3,193.00
Depreciation	604.00
Profit before labour costs	**3,932.00**

7.1.3 Staffing

The Cullerne Garden project would require two full-time members of staff, or the equivalent, to run successfully. They would consist of a lead grower at £29,700 and a support grower at £22,373

Therefore the annual wage bill would be £52,073, including National Insurance and pension.

Staff would receive periodic support from volunteers at a cost of £600/annum.

Total annual labour cost: £52,673

7.1.4 Cullerne Garden Veg & Egg Production: Projected Net Profitability

Gross Profit from vegetables and eggs	**£57,472**
Staffing Costs	**£55,113**
Net Profit	**£4,800 (without depreciation)**
Net Profit	£2,441 (with depreciation)

Note 1. For a detailed breakdown of project income and running costs please refer to the Annual Budget Spreadsheet.

Note 2. If the garden business was run by an entity eligible for the Employment Allowance, it would save approx. £3,000 per year on National Insurance payments.

7.2 Fertility - Compost Making

This study has researched the viability of a compost making scheme, using recycled food and garden waste collected locally from 145 households and 8 businesses. This waste will be fed into a compost making machine; along with manure from livestock and woodchips. The resulting compost will create the fertility required for food growing in Cullerne Garden.

Compostable matter

- From a combination of the Findhorn Ecovillage, local businesses and the small cattle project, we expect to collect approx 66,893 Kg of compostable organic matter per annum.

Collection charges

- The project will make a charge for waste collections. Local residents will pay a £30/year subscription. Local businesses will pay a weekly charge of £10. This will generate an income to the business of £4,550/annum.

Compost produced

- Following processing, this will produce 40,136 Kg of useable compost for Cullerne garden. If this compost were to be purchased, at current prices its value would be £1,738.

Capital outlay

- The cost of the two composting machines and their associated equipment comes to £55,718 (£62,604 inc. VAT).
- The cost of the waste collection vehicle and its associated equipment comes to £11,748 (£14,097 inc. VAT).

Total capital outlay to realise the project = £67,466 (£80,959 inc. VAT)

Running costs

- The annual cost of running the two compost machines is £1,695 (electricity & service).
- The annual cost of collecting the waste matter for compost making is £364 (mileage)
- The 0.45 FTE job @ £11.50/hr implies an annual wage bill of £10,068.

At the current volume of biomass collection, this generates an annual shortfall of £5,839. With depreciation, this figure increases to £9,212.

Discussion

At this scale, this model of composting food and garden waste produces a financial shortfall of £5,369. Preliminary investigation does suggest that either larger or smaller scale options could break even.

Moving larger would require at least a 5x increase in composted volume (1,900kg per week) and a shift from collecting residential waste to gathering material in bulk from large-sized businesses in the Forres area. The larger compost machine required would be more appropriately located on a local industrial estate, rather than in the Ecovillage setting.

Scaling down on the other hand is a more feasible solution to closing the loop for residents and businesses in the Eco-village itself. This would also be relevant to small community garden plots on sites identified by the Moray Council.

Ridan make in-vessel composting equipment which is designed for community or small commercial situationsand are manually powered (rather than automated). They cost £6,090 and include rodent proof maturing bins. One could be installed at Cullerne, the Park Garden or Soillse Garden as a pilot and if successful, and assuming sufficient demand, two more could be installed at the other sites. Between them all residential food waste plus that from the Phoenix cafe and shop could be recycled into good quality compost and the work integrated into that of the garden staff and their volunteers. One Ridan machine produces 10 tonnes of compost per annum, which is one eighth of the volume required for the Cullerne growing area. Therefore this model would also require the majority of compost to be bought-in.

7.3 Livestock

Capital Costs

Initial project start-up capital costs are significant: £4,010 based on current materials costs. However, **capital costs in subsequent years will be very small to nothing.** See Table below:

Capital item	Year 1 - Costs	Year 2 - Costs
Solar energiser	£500	0
Mobile electric fencing	£500	0
Water trough & fittings	£300	0
Fencing improvements	£2,510	0
Sundries (budget)	£200	£300
Total	**£4,010**	**£300**

Here is the breakdown of Fencing costs at April 2023 prices:

Item	£
129 small posts	484
Strainer posts x 14	322
1120m top wire	115
3 x 4m steel gates	390
Catch pen/hurdles	400
Labour	800
Total	**2,511**

Running Costs

Running costs for year one are expected to be £12,248. As an agreement for the grazing access has not yet been reached, the cost of the grazing lease is estimated at £100/acre. Daily movement of cattle to new pasture will take approximately half an hour. At a wage rate of £15/hr, the daily labour cost will be £7.50.

Allowing for some price increases, second year running costs are expected to be similar to those in year 1. See table below:

Running item	Year 1 - Costs	Year 2 - Costs
Labour @ £15/hr	£2,025	£2,025
8 Bullocks	£8000	£8400
Transport	£200	£180
Vet (budget)	£500	£500
Grazing license	£973	£973
Slaughter & butchery	£550	£570
Total	**£12,248**	**£12,648**

Income

There are four options for selling cattle once they are ready for slaughter:

a. Sales to local food shops, as with the vegetable produce
b. Direct sales to customers
c. At Dingwall livestock market
d. Sales to the abattoirs at Dingwall and Grantown-on-Spey

Local food shops - The first (a) is the preferred option, with the potential to generate income detailed below:

- Each animal will produce approximately £3,500 worth (retail) of produce. Local vendors will claim 40% of that value, leaving £2,100 of income to the producer.
- This indicates approximately £16,800/annum of income to this business/project with 8 bullocks (year 1).
- For the area of ground (9.73 acres) 8 bullocks is probably a conservative stocking rate that may be increased in subsequent years.
- However, it is sensible to start conservatively in order to understand the productivity of the land holding, which varies, and to make sure that market demand is not over-matched. In later years, as the fertility and therefore productivity of the land increases it may be possible to increase the number of animals, if market demand also matches the consequent increase in produce.

Direct customers sales (retail) offers the opportunity to capture all of the income from the meat produce, however a great deal of work and therefore cost would be involved. Doing this would also offer competition to small local vendors that are already operating according to the ethos of this project, and so this is not desirable.

The last two options result in by far the least income, with animals likely to sell for just £200 to £300 more than their initial purchase cost. As such they are not a financially viable option by themselves. These options can be held in reserve for an occasion when an animal must be sold and other sale/market options are not available e.g. the end of the seasonal grazing lease when the animals must vacate the land.

Total financial picture for livestock production

While meeting the other demands of this project i.e. to produce quality, nutrient-dense food at local scale while creating ethical jobs and having a positive-carbon impact, this project also has the potential to return a small profit, that may increase year on year according to increased animal stocking rate and market demand.

As these factors are not predictable at this stage, we have not projected figures beyond year 2. Initial year 1 capital investment will not need to be repeated in subsequent years and this shows positively in the figures. Although costs for year 2 have taken account of likely inflation, the prices charged for the meat produce have not been increased. This option could be considered and this should be born in mind.

Year	Costs (Capital and Running)	Income	Profit
1	**£16,258**	**£16,800**	**£542**
2	**£12,948**	**£17,200**	**£4,252**

8 Job Creation

In the first two years, the local food system pilot will be modelled successfully in the Findhorn Ecovillage, creating 6.85 full-time equivalent, paid jobs working in fulfilling and meaningful roles. The pilot will be financially viable, with salaries paid from the income from sales of food grown using organic methods and related business activities.

The roles will entail composting activities, which include collection, sorting and shredding of food and garden waste from local households and businesses, and management of the resulting compost (0.5 Composter jobs). Growing activities will generate 1.5 Gardner jobs: 1 Garden Grower Manager/Sales job, and 0.5 Garden Grower / Instructor job). Livestock activities will generate 0,35 Regenerative Livestock jobs.

This pilot will also provide contract work eg building of a Keder greenhouse and a shelter for two in-vessel compost machines.

In addition, 1.5 full-time jobs will be created to run the Care Farm in the gardens. Food-related businesses, including catering, fermentation workshops etc will provide 3 FTE jobs.

9 Scaling up

This feasibility study focused mainly on the details of increasing productivity from Cullerne Gardens and Cullerne Farm. Once a profitable model to decarbonise the local food economy is demonstrated on the land at Cullerne Garden as a pilot study, it could be replicated on other sites.

The Moray Food Strategy (2020) identifies 80 potential sites suitable for food growing as well as specific requirements to increase food growing provision in communities experiencing socio-economic disadvantage.

The potential is there to add dozens of extra jobs if all these growing spaces were in use, both for lead growers and Saturday jobs for local young people. Vegetables/meat could be available for sale from these sites either through direct sales or via local outlets. This will increase accessibility of all local people to fresh, organically produced food. Commercial drivers and job creation will help to bring the community into food growing areas.

A further income stream and opportunity for community connections is to offer training services to interested individuals/groups on a paid or funded basis eg the neighbouring Army Base has expressed interest for its personnel.

10 Funding opportunities for Scaling Food Production

The Just Transition Fund - this feasibility study was funded by the Scottish Government's Just Transition Fund. Meetings with the Fund administrator, David Magliari, in Feb 2023 suggested that funds for capital assets may not be available this year, depending on political decisions in the government. Funds for pilot projects may be available through an application process that may open in the early summer 2023. Loans may be available, although the business model for food production would not lend itself to borrowing because the returns involved would not be sufficient to pay interest.

We arranged a meeting in March 2023 with Richard Lochhead MSP to understand better the politics around the JTF funding situation. He informed us that the £50 million reserved for JTF spending in 2023 was split between 1) normal funding (which is mostly pre-allocated) and 2) financial transactions, which are a vehicle used by the UK government to fund the Scottish government. The latter are long-term loans and the fact that they are used by the UK government explained why there had been a switch from grants to loans this year.

The main emphasis for funding is on projects that offer transformation to benefit local communities. They are looking for partnerships with local communities that will tackle challenges in socio-economically disadvantaged areas. This means that any project application submitted will need to show transformation change beyond Findhorn and not rely on Findhorn as a demonstration site only.

Government subsidies - these have been a feature in European agricultural economics since the Common Agricultural Policy was set up by the EU in 1962. When the UK joined the European Union, the UK had access to the CAP payments and since Brexit, this access has inevitably ceased.

The Scottish Government is currently developing a new Agriculture Bill, the **Good Food Nation Bil,** to consider the shape of the new farm subsidy system. The new bill will not be passed until 2023/24 and a National Plan will be completed by 2024.

Rural Payments - while the new subsidy system is under development, the existing Rural Payments Agency, an executive agency of the UK Department for Environment, Food and Rural Affairs, pays a range of grants and subsidies to farmers across the UK.

In the past, Cullerne has been registered with the Agency and would have been entitled to receive grants for growing.

The Agency changed to a new system in 2015 and Cullerne would need to re-register. They need to have the contact details of someone with authority to act on behalf of the Findhorn Foundation (as the owner). The current registration appears to be for the whole of the Park, which would need to be revised to the Cullerne site. The minimum land size for eligibility is 3 hectares. The main grants worth applying for are the Basic Payments grant and Less Favoured Area Support Scheme.

A Small Producers Pilot Fund is planned to open later in 2023 and is worth looking out for.

Scottish Landfill grants **–** One of the users on an in-vessel compost machine that we interviewed had received a grant from this fund for the purchase of the machine. We would recommend a follow up with the City of Glasgow College to better understand how it worked.

The National Lottery Community Fund - there is a nature and climate fund closing to new applications on 30 June 2023. They are looking for projects that focus on the link between nature and climate. We want to fund projects that use nature to encourage more community-led climate action. We expect these projects to bring other important social and economic benefits. Like the creation of strong, resilient and healthy communities or the development of 'green' skills and jobs.

A list of funding sources for growing (different size grants, etc.) is available here.

The Scottish Rural Network provides information on some funding options.

Nourish Scotland has free resources for groups wanting to grow their own food.