

RHET

The Royal Highland Education Trust



Geography in action

THIRD/FOURTH LEVEL

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Welcome to our Geography in Action learning pack. This pack is set up to provide information sheets followed by learner activities linked to real scenarios.

The Royal Highland Education Trust (RHET) offer opportunities to bring geography students onto farms and find out more about the topics covered in this pack. We also have a [Padlet](#) which contains a range of resources which complement the activities provided.

To work through learner worksheet [4 Sustainable farming bingo](#), you may find this [glossary link useful](#). Each small group of learners require a bingo board, and you read out the definitions of the words in the glossary link provided. If the definition is correctly matched with the word on the board, it can be covered over. First group to cover over all the words wins.

You can book farm visits and class talks via www.rhet.org.uk



Farm Diversification

What is on-farm diversification?

On-farm diversification is when farmers expand their activities beyond traditional farming (like growing crops or raising livestock) to generate extra income and make their farms more sustainable. It is about using land, buildings, and resources in new ways to adapt to economic and environmental challenges.

Why do farmers diversify?

Scottish farms face challenges like:

- Unpredictable weather and climate change
- Falling prices for products (e.g. grain, milk, beef)
- Changes in subsidies and rural funding (like post-Brexit changes to support)
- Pressure to become more environmentally friendly
- Desire to support local communities and tourism

Diversification helps reduce risk and create new income streams.

Common types of farm diversification

Here are some real-life examples you might see across Scotland:

1. Tourism & Leisure

- Farm stays / B&Bs / holiday cottages
- Camping or glamping sites
- Petting zoos or open farms for schools
- Farm shops and cafés selling local produce
- Activity centres like quad biking, clay shooting, or archery

2. Renewable Energy

- Installing wind turbines or solar panels
- Creating biomass energy from waste
- Selling power back to the grid



3. Food Processing & Direct Sales

- Making cheese, jam, or ice cream from farm products
- Selling meat boxes or eggs directly to local customers
- Setting up online shops

4. Events & Education

- Hosting weddings, corporate events, or outdoor festivals
- School visits and educational tours about farming and food production

5. Crafts & Creative Use of Space

- Renting out old barns as artist studios, gyms or workshops
- Running rural skills courses (like dry stone walling or baking)

Benefits of Diversification

- More stable income
- New job opportunities in rural areas
- Encourages tourism and local pride
- Helps farms survive and thrive under pressure
- Supports sustainable land use and green energy

Challenges

- High start-up costs (e.g. renovating buildings)
- Need for business skills, not just farming knowledge
- Environmental impact of new developments
- Balancing farm work with new activities



LEARNER WORKSHEET 1

Mapping diversified farms

Can you map 5 local examples of diversified farms in your area.

Which of the five categories of diversification do they fall into?

Grid reference for site	How has it diversified?	Which category of diversification is it? (1-5)

LEARNER WORKSHEET 2

Assess glamping site suitability

Have a look at this glamping site glensheeglamping.co.uk

There are three proposals for a new glamping site. Work through the questions and identify which site would be more suitable and why.

	Site 1	Site 2	Site 3
<p>What is the landscape like? Is the site flat or sloped? Are there good views or natural features like lochs, forests, or hills that would attract visitors?</p>			
<p>Is the site at risk from flooding or other natural hazards? How close is it to rivers or low-lying land? Could heavy rain, snow, or wind cause problems?</p>			
<p>How accessible is the location? Are there good roads or public transport nearby? Can visitors easily reach the site by car or bus?</p>			
<p>What services are available (water, electricity, waste)? Can the site support toilets, showers, lighting, and waste disposal without harming the environment?</p>			
<p>Is the site near local attractions or activities? Are there nearby walks, castles, beaches, or adventure sports to keep visitors entertained?</p>			

	Site 1	Site 2	Site 3
<p>Will glamping disturb local wildlife or habitats? Is the area protected (e.g. SSSI or National Park)? Would construction affect biodiversity?</p>			
<p>How will the land use change affect the farm or local area? Will it reduce space for animals or crops? Will residentsrt or oppose the idea?</p>			
<p>What is the weather like throughout the year? Is the climate mild enough for glamping, or is it too wet, windy, or cold most of the year?</p>			
<p>What are the economic benefits or costs? Can the farm or landowner make enough profit from glamping to justify the investment? Are there jobs for local people?</p>			
<p>Are planning permissions or legal permissions needed? Is the site allowed to be used for tourism? Are there rules about building or changing land use?</p>			



Modern technologies are transforming farming by helping farmers work more efficiently, reduce waste, and increase crop and animal productivity. Tools like GPS systems, drones, robotic milking machines, soil sensors and vertical farming, bring many benefits, such as saving time, lowering chemical use, and improving animal welfare. However, they also have challenges, including high costs, reliance on internet access, and potential job losses in traditional roles. These technologies affect farms socially (changing rural jobs), economically (increasing profits but requiring investment), and environmentally (reducing pollution but sometimes increasing energy use). Overall, modern technology can make farming more sustainable if used carefully and fairly.

GPS and Precision Farming Equipment



Positive Impacts

- More accurate planting and fertilising ➔ less waste
- Saves time and fuel
- Reduces overuse of chemicals ➔ better for environment

Negative Impacts

- High cost for small farms
- Requires training to use effectively

Impact Type	Description
Social	Fewer workers needed for some tasks ➔ may reduce rural jobs but increases skills-based jobs
Economic	Increases productivity and profits in long term; expensive to set up
Environmental	Reduces pollution from fertilisers and pesticides; less soil erosion

Drones



Positive Impacts

- Monitor crops and livestock from the air
- Spot problems early (e.g., disease, poor growth)
- Save time covering large areas

Negative Impacts

- Expensive to buy and maintain
- Weather can affect use
- Can disturb wildlife if not used carefully

Impact Type	Description
Social	Improves safety for farmers (e.g. checking fields remotely); fewer injuries
Economic	Helps reduce crop loss ➔ better yields and profits
Environmental	Reduces chemical use by targeting only affected areas; less waste and pollution



Automated Milking Machines (Robotic Milkers)

Positive Impacts

- Cows can be milked at any time, reducing stress
- Saves time for farmers
- Consistent milking improves animal health

Negative Impacts

- Extremely high installation cost
- Some farmers fear losing connection with animals

Impact Type	Description
Social	Less physical strain on farmers; more time for family or education
Economic	Reduces labour costs; big investment needed
Environmental	Can reduce water and energy use if managed well



Soil Sensors and Smart Irrigation Systems

Positive Impacts

- Water only used when needed → prevents waste
- Helps monitor soil health in real-time
- Can improve crop quality and yield

Negative Impacts

- Requires internet or wireless connection (hard in rural areas)
- Expensive for small farms

Impact Type	Description
Social	Encourages high-tech skills and innovation in farming
Economic	Saves money on water and fertiliser in long term
Environmental	Prevents overwatering and nutrient runoff into rivers and lochs



Vertical Farming / Hydroponics

Positive Impacts

- Grows crops indoors using less land and water
- Can be done in urban or remote areas
- No need for pesticides

Negative Impacts






- High electricity use (for lights and pumps)
- Not suitable for all types of crops
- Expensive to set up

Impact Type	Description
Social	Can bring farming closer to cities; new job opportunities in tech-based farming
Economic	Long-term savings on inputs; high start-up costs
Environmental	Reduces land use, soil erosion, and chemical use; but high energy demands unless powered by renewables

LEARNER WORKSHEET 3

Farming technology

Match the image of the technology to its name and add in one positive impact and one negative impact

	Name of technology (use the information above)	Positive impact	Negative impact
			
			
			
			
			

Sustainable Farming in Scotland: Organic & Regenerative Methods

What is Organic Farming?

Organic farming is a way of growing food without synthetic chemicals, such as artificial fertilisers, pesticides, or genetically modified organisms (GMOs). It focuses on natural methods to improve soil, protect wildlife, and raise healthy animals.

Key features of organic farming:

- Uses natural fertilisers like compost or manure
- Controls pests using crop rotation, companion planting, or natural predators
- Animals are kept to high welfare standards, with access to the outdoors
- Encourages biodiversity and protects pollinators like bees



What is Regenerative Farming?

Regenerative farming goes a step further—it aims not just to reduce harm, but to actively improve the environment and restore soil health. It focuses on long-term sustainability of both the land and ecosystems.

Key practices in regenerative farming:

- No-till or low-till planting to protect soil structure
- Cover crops (like clover) to prevent erosion and feed the soil
- Grazing livestock in rotation to mimic natural systems
- Promoting carbon storage in soil and plants (helps fight climate change)
- Boosting soil life like worms, fungi, and microbes



Examples of Organic and Regenerative Farming in Scotland

Here are examples to show what Scottish farmers are doing to farm sustainably:



Peelham Farm, Berwickshire (Scottish Borders)

Certified organic farm producing beef, pork, and lamb
 Uses natural pastures and rotates grazing to keep soil healthy
 Runs its own on-farm butchery and sells directly to customers
 Supports biodiversity and low food miles



Lunan Bay Farm, Angus

Pasture-based farm with goats
 Incorporate grass and herbal leys into our rotation to capture carbon, improve soil and goat health.
 Rotational grazing to improve soil, pasture and livestock health.
 Reducing inputs by utilising our goat manure to naturally fertilise our soils.



Rotmell Farming

Pasture-based farm with cattle and sheep
 Graze livestock outside all year round
 Focus on soil health
 Uses mob grazing

Sustainable farming bingo

No till	Cover crop
Carbon storage	Mob grazing
Ecosystem	Biodiversity
Crop rotation	Silvo pasture

Soil fertility	Compost
Managed grazing	No till
Cover crop	Carbon storage
Agroforestry	Green manure

Min-till	Managed grazing
Biodiversity	Crop rotation
Organic	Agroforestry
Green manure	Natural capital

Compost	Managed grazing
Agroforestry	Green manure
Mob grazing	Ecosystem
Crop rotation	Silvo pasture

What is Genetic Modification (GM)?

Genetic modification (GM) is a process where scientists change the DNA of a plant or animal to give it new traits. This could be:

- Making crops resistant to pests or disease
- Allowing plants to grow in poor soil or tough weather
- Improving shelf life, size, or nutrition

Instead of traditional breeding, GM uses biotechnology to directly alter genes.



Genetic Modification in Scotland

Scotland has taken a precautionary approach to GM. In 2015, the Scottish Government banned the cultivation of GM crops, even though they are allowed in some other parts of the UK.

Reasons include:

- Protecting Scotland's image as a source of natural, high-quality food
- Concerns about biodiversity and long-term effects
- Support for organic and sustainable farming methods

Pros of GM in Farming

- Higher crop yields (more food from less land)
- Crops can resist pests = fewer pesticides needed
- Can grow in difficult climates
- Could help in developing countries with food shortages

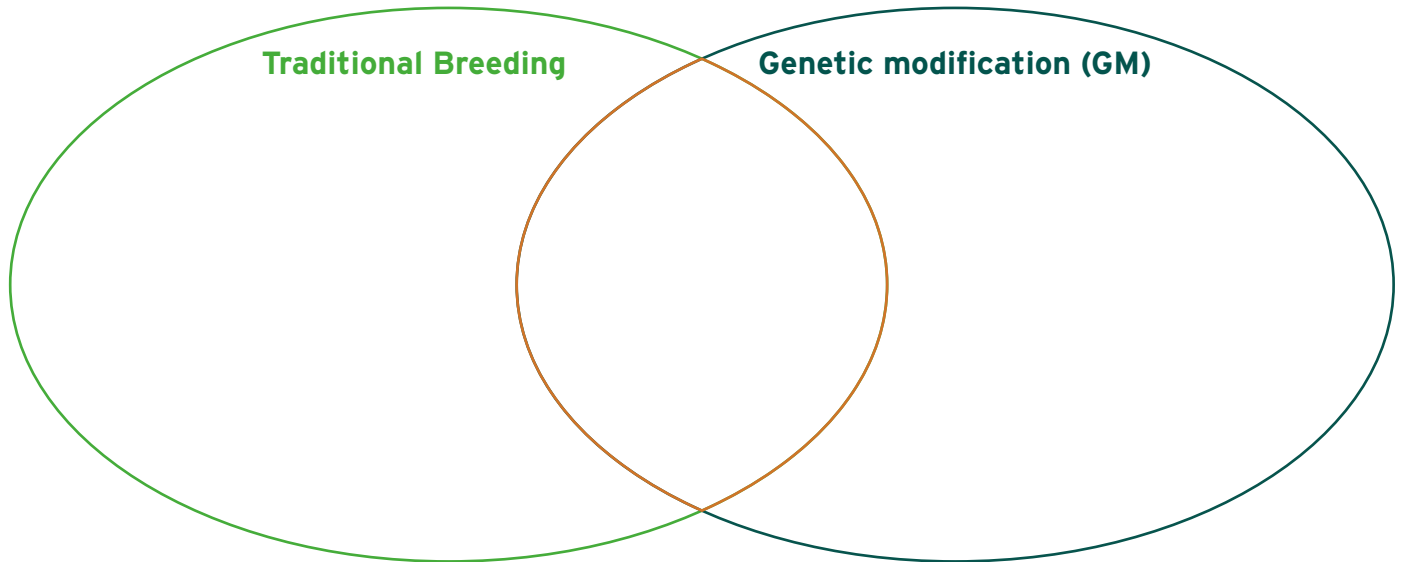
Cons of GM in Farming

- Unknown long-term environmental effects
- GM pollen could spread to non-GM or organic farms
- Could reduce biodiversity
- Ethical concerns about "tampering with nature"
- Market resistance - many consumers do not want GM food

Genetic Modification Venn diagram

Choose 12 of the statements from the list below and add 4 to each section on the Venn diagram.

You need to decide where to right the statement – is it just for traditional breeding (left column), just for GM (right column) or does it apply to both (central column).



No lab or DNA editing involved

Generally accepted by organic farming standards

Slower and less precise

Involves crossing plants or animals with desirable traits

May raise ethical or environmental concerns

Used to create crops that resist drought, pests, or disease

Takes many generations to get results

Limited to traits that naturally occur

Often used by farmers for centuries

May have environmental, social, and economic impacts

Require careful monitoring to avoid unintended consequences

Used in breeding distinct types of crops (e.g. sweeter apples, hardier wheat)

Involves directly changing DNA in a lab

Can combine genes from distinct species (e.g. bacteria into corn)

Can create traits that do not occur naturally

Faster results – changes happen in one generation

Some countries ban or regulate its use (e.g. Scotland)

Often not accepted in organic farming

Aim to improve crops or animals

Help farmers increase food production

Can improve resistance to disease or pests

Used around the world in agriculture

Food and farming policy

Scotland is aiming to balance several objectives through its food & farming policy:

Sustainability & climate change mitigation – reducing greenhouse gas emissions from agriculture, protecting peatlands & wetlands, improving soil health, increasing biodiversity.

Nature restoration & environmental protection – flora & fauna, carbon storage, ecosystem resilience.

Food security, production quality & public health – ensuring safe, healthy, affordable food for consumers, food safety, and diet-related health issues.

Economic viability and resilience for farmers, crofters & rural communities – helping them adapt to changing climate, market pressures, labour supply issues, rising input costs.

Support for rural development – ensuring that remote, crofting, and marginal farming areas are not left behind; integrating land-use policy; improving infrastructure, skills, etc.

Recent / Upcoming Policy Changes

Here are some of the key changes (as of 24/25) to be aware of:

Policy / Reform	What is changing / new requirement	Effect / purpose
Whole Farm Plan (WFP)	From March 2025, farmers & crofters need to start preparing a WFP, including doing baselining audits/plans (carbon, biodiversity, soil).	To help farm businesses understand their current environmental impact, plan improvements, and align with nature & climate goals.
Latest support payment model (4tier support scheme)	The Basic Payment Scheme (BPS) ends in 2026. From 2027 a four-tier framework will be introduced. Tiers 1 & 2 are more "direct payments" (for all farmers doing essential standards), Tiers 3 & 4 are for more targeted actions (peatland restoration, wetlands, tree planting, climate / biodiversity improvements).	To shift support from universal subsidy towards payments for "public goods" and environmental outcomes, encouraging sustainable and regenerative practices.
New conditionality / environmental standards	New baseline requirements from 2025: farmers must choose at least 2 of several audits/plans (animal health/welfare; biodiversity; carbon audit; integrated pest management; soil analysis). New protected wetland & peatland rules under Cross Compliance / GAEC6. A new calving interval in the Suckler Beef Support Scheme (max 410 days) to improve efficiency & reduce emissions.	To ensure farmers receiving payments are contributing to climate/nature goals; penalties or loss of support if standards not met.
Agri environment & climate schemes	Expanded funding and capital support (e.g. Future Farming Investment Scheme; Agri Environment Climate Scheme). Some extra money for nature and climate related activities.	To help farmers invest (capital costs) in new equipment or land management practices that are more sustainable.



Policy / Reform	What is changing / new requirement	Effect / purpose
Good Food Nation Act and Strategy	Legislation passed in 2022 to create a framework for food policy: includes producing a national plan with outcomes for food, supporting healthier, safe, sustainable food, etc. Local and national food plans are required under the Act.	To make food policy more joined up: health, environment, agriculture, economics. To ensure food is central in public policy (not just farming).
“Sustaining Scotland, Supplying the World” - Industry Strategy 2023	A 10year strategy for the food & drink sector aiming for growth in turnover, improving resilience, sustainability, workforce skills, digital adoption.	Seeks to boost the economic dimension of food/farming while integrating environmental sustainability and global competitiveness.

Policy Mechanisms / Tools

How are these policy goals being delivered? Key levers include:

Payments / subsidies: Direct financial support, with conditions (conditionality).

Regulation / compliance standards: Cross compliance, environmental regulations for peatland/wetland, rules on animal health.

Audits / monitoring: Biodiversity audits, carbon audits, soil testing. Baseline measurements.

Capital grants & investment funds: For equipment, infrastructure, land management improvements.

Legislative framework: Acts & Bills like the Agriculture and Rural Communities (Scotland) Act; Good Food Nation Act.

Consultations / stakeholder engagement: Government opens consultations (e.g. for Food Standards Scotland’s strategy), working with farmers’ unions, environmental NGOs.

Industry strategies: Sector wide plans (food & drink) to boost competitiveness, exports, resilience.

Challenges

These reforms introduce significant challenges:

Financial burden & transition costs for farmers: New audits, planning, environmental protections may require investment (equipment, skills, time). Some may struggle, especially small or remote farms.

Balancing productivity vs environmental goals: Pushing for habitat restoration or emissions reductions might reduce output or increase costs, potentially affecting food prices or farmers’ livelihoods.

Complexity and bureaucracy: New conditionality, multiple audits/plans, compliance requirements can be administratively heavy.

Climate change effects: Weather extremes, pests, changing growing conditions are already affecting agriculture, making some long-term planning difficult.

Trade / market pressures: Competing with imported food, ensuring food standards are maintained, dealing with cost of inputs (energy, feed, fertiliser).

Public health vs affordability: Policies to improve diet (e.g. restricting promotions of unhealthy food) may conflict with price pressures and consumer behaviour.

LEARNER WORKSHEET 6

Whole Farm planning



Farm location	Lowland Fife	Ullapool in the Highlands
Size	1200 hectares	8000 hectares
Land type (upland, wetland, arable, pasture, peatland, mixed)	Mixed - pasture and arable	Upland
Current farming system (e.g. sheep, beef, arable, mixed, organic)	Sheep, oat and wheat (arable)	Sheep and forestry

Choose Your Actions

Select at least **5 policy-aligned actions** for their farm plan. These must:

- Qualify for **Tier 1 & 2** basic payments (e.g. soil analysis, carbon audit)
- Include at least **2 Tier 3** or **4** nature/climate actions (e.g. hedgerow planting, restoring peatland, wetland buffer zones, rotational grazing)

You can see the different actions [here](#)

Manage the Budget

You have a budget of £50,000 in “support + investment”.

Which actions would you take?

Economic viability	
How much did you get in support and investment?	
Is this economically viable?	
Environmental impact	
Impact score for nature restoration & biodiversity	
Impact score for soil, water & land health	
Explain how you would be supporting biodiversity	
Social/community impact	
Impact score for social, economic & community actions	
Explain how you would be supporting jobs, local food supply	
What trade-offs or conflicts did your choices have?	
How does your plan help meet government policy goals?	

Biofuels are fuels made from **biomass** – recently living organisms, especially plants and organic waste. Unlike fossil fuels, they are **renewable** and can be produced quickly.

Types of Biofuels

Type	Source	Use
Bioethanol	Sugars/starches (e.g. maize, sugarcane, wheat)	Mixed with petrol for vehicles
Biodiesel	Oils/fats (e.g. rapeseed, soybeans, used cooking oil)	Diesel engine substitute
Biogas	Anaerobic digestion of waste (manure, food, sewage)	Heating, electricity
Advanced biofuels	Algae, waste biomass, non-food crops	Still in development

The **sustainability** of biofuels depends on **how and where** they are produced.

First-generation biofuels are crops which could feed people but are instead used as a fuel from food crops like maize, sugarcane, or palm oil.

→ More likely to cause food insecurity and deforestation.

Second-generation biofuels use **waste products** or **non-food crops** (e.g. elephant grass, crop residues).

→ More sustainable but still under development.

Advantages and disadvantages of biofuels

Advantages (Pros)

- **Renewable energy source** – Unlike fossil fuels, biofuels can be replenished quickly
- **Lower carbon emissions** – Growing crops absorb CO₂, potentially offsetting what is released during burning
- **Reduces reliance on fossil fuels** – Helps improve energy security
- **Can use waste materials** – e.g. used cooking oil, crop residues, animal waste
- **Rural development** – Creates new jobs and income for farmers, especially in developing countries
- **Biodegradable and less toxic** – Especially compared to petroleum-based fuels
- **Flexible fuel source** – Can be used in existing vehicles (blended with petrol/diesel) or to generate electricity
- **Can improve waste management** – Biogas uses manure, sewage, or food waste

Disadvantages (Cons)

- **“Food vs fuel” conflict** – Biofuel crops can take up land needed for food production, pushing up food prices
- **Not truly carbon neutral** – Emissions still occur during fertiliser use, processing, transport, and land-use change
- **Land use change** – Forests, wetlands or grasslands may be cleared to grow crops like sugarcane or palm oil
- **Deforestation and biodiversity loss** – Especially in tropical areas (e.g. palm oil in Indonesia or soy in Brazil)
- **High water and fertiliser use** – Can lead to water shortages, pollution, and soil degradation
- **Lower energy output** – Some biofuels (like ethanol) have less energy per litre than petrol or diesel
- **Costs can be high** – Especially for second-generation or advanced biofuels like algae
- **Technological challenges** – Scaling up production of advanced biofuels (e.g. cellulosic or algae-based) is still expensive

LEARNER WORKSHEET 7

Elephant Grass activity

What is Elephant Grass?

Also known as **Napier grass** or *Pennisetum purpureum*. A **fast-growing, tall tropical grass** originally from Africa. Can grow up to 4 metres tall in 90 days. Remarkably high **biomass yield per hectare** – ideal for energy production.



Why is it Used for Biofuels?

Feature	Benefit
High biomass output	Produces more raw material than many other crops
Perennial crop	Does not need replanting every year (less soil disturbance)
Carbon capture	Absorbs substantial amounts of CO ₂ while growing
Grows on marginal land	Does not compete with prime farmland (less food vs fuel issue)
Can be used for:	Direct burning (biomass power), biogas, cellulosic ethanol

Complete the following table using the information in [here](#)

Feature	Elephant grass	Hemp	Which is best in a 40-ha area?
Variable costs per ha			
Variable costs per 40 ha			
Gross margin per ha			
Gross margin per 40 ha			

How does the climate impact Elephant Grass?

How will the impact of climate warming influence the growing of biofuel crops like hemp and Elephant Grass?