

SEFARI



Leading ideas for education



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LEADING IDEAS FOR EDUCATION

The Scottish Environment, Food and Agriculture Research Institutes (SEFARI) is a collective of six research institutes, each with their own global capability, expertise and reputation: Biomathematics and Statistics Scotland, James Hutton Institute, Moredun Research Institute, Rowett Institute, Royal Botanic Garden Edinburgh and Scotland's Rural College.



Through collaborative multi- and interdisciplinary research, SEFARI are responsible, with Higher Education Institute partners, for delivering the Scottish Government (Rural and Environment Science and Analytical Services, RESAS) funded Strategic Research Portfolio on environment, agriculture, land, food, and rural communities (2016-2021). The Portfolio includes the Strategic Research Programme (SRP), Centres of Expertise, Innovation Partnerships and Underpinning Capacity funding of national research resources within SEFARI. SEFARI Gateway, the knowledge exchange and impact hub for SEFARI, works to enhance stakeholder access to SEFARI's research knowledge and expertise.

We are committed to the use of research and knowledge to help us better understand and improve the world around us. [Science education](#) underpins all our work, on the premise that learning is for everyone, and certainly not confined to the classroom. Across SEFARI we are using our creativity and expertise to develop educational activities and resources suitable for teachers, parents and learners of all ages to use.

In this leaflet there are examples of activities and resources we have developed which engage learners of all abilities, provide engagement in-person and online, are free to access, span a variety of topics, and offer career advice, opportunities and development.

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Online resources suitable for home learning

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With the growing need for free to access online educational resources, SEFARI Gateway has brought together specialists from across a variety of disciplines who are passionate about education and enjoy creating fun resources. The group are collating SEFARI's educational activities and resources which span the environment, food and agriculture and are suitable for a range of learners. Among the activities, learners can manage their own forest, become diet detectives or try being a farmer:

- The forest health game **Caledon** enables players to discover the challenges of forest management and dealing with issues such as invasive diseases, grazing animals and illegal loggers. The game was created by several partners including the Royal Botanic Garden Edinburgh, Scotland's Rural College and the James Hutton Institute.
- For those interested in what we eat and how mathematical modelling can aid better choices when shopping, the **Number Muncher Diets** activity helps users experiment with different (mathematically calculated) diets by varying nutritional, economic and environmental constraints. The activity was created by colleagues at Biomathematics Statistics Scotland and the Rowett Institute.
- A series of short **Livestock Health Animations** that highlight different aspects of infectious diseases, including pathogen transmission, prevention and control. The films were developed by the Moredun Research Institute and partners.

These and many more resources are available online, and we continue to add more as they become available.



Related links

[Online resources](#)

[Caledon](#)

[Number Muncher Diets](#)

[Livestock Health Animations](#)



Engaging with the Developing Young Workforce initiative

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The Developing the Young Workforce (DYW) Initiative has identified that neither secondary school pupils nor their teachers and parents realise what a wide range of careers are available in rural areas or how technical many of the jobs in land-based industries have become.

- A SEFARI research and demonstration farm sits on the border of four DYW regions (Argyll & Bute, Forth Valley, Perth & Kinross and West Highland). Working with colleagues in Perth & Kinross DYW, two annual Rural Skills Days have been organised at the farm.
- At each event, secondary school pupils drawn from across the four regions were rotated around a variety of demonstration stands featuring SEFARI and external colleagues (such as Centre for Sensors & Imaging Systems, Farming for a Better Climate and Scottish Environment Protection Agency) to hear about the range of career opportunities in rural areas.

Ensuring that young people see working in land-based industries as being attractive will be important if the ongoing decline in population in Scotland's remote, rural areas are to be addressed. The events helped school pupils realise what skills and qualifications they need if they were interested in pursuing any of the careers demonstrated and discussed during the events.

Related links

[DYW farm visit video](#)

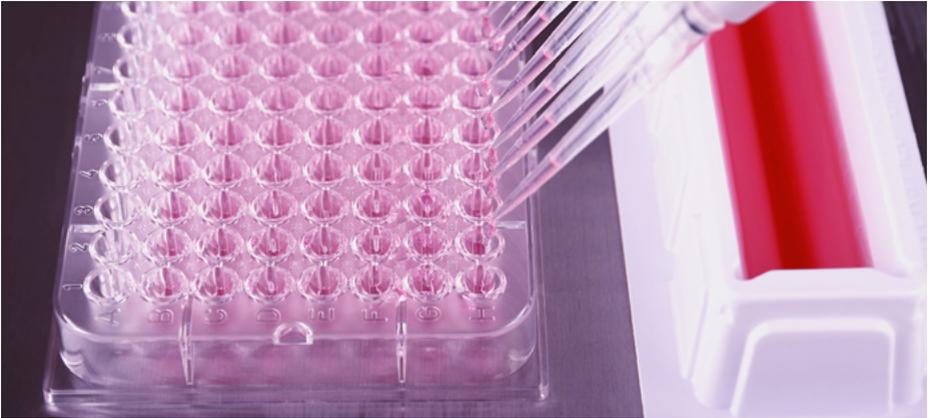
[Young people working in Agriculture - BBC Alba video \(Gaelic\)](#)

[Tech advances make rural careers more enticing - Scottish Farmer](#)

[Why hill farming is embracing technology - Futurum](#)



Immunology resources for secondary schools



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The study of immunology is key to understanding defences against infectious disease, autoimmunity, allergy and cancer. It also underpins the development of vaccines and diagnostic tools.

To support teachers and learners, SEFARI scientists have devised materials focussing on immunology theory and techniques, which are embedded as key areas in Higher Human Biology and Advanced Higher Biology within the Scottish Curriculum for Excellence.

This includes the development of a safe, inexpensive practical experiment that simulates the enzyme-linked immunosorbent assay (ELISA), a technology which is widely used in diagnostic laboratories to establish whether or not an individual has a certain disease.

- The activity reinforces learning by demonstrating basic principles of immune recognition and antibody binding.
- Practical applications of learning outcomes are demonstrated, for example in the development of diagnostics, which are used in public health and veterinary medicine.

In collaboration with the Scottish Schools Education Research Centre (SSERC), material was presented to teachers at a career-long professional learning workshop and protocols were developed to enable teachers to independently run the activity within classrooms.

Related links

[Immunology presentation](#)



Inspiring the next generation of scientists

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Scientifically literate and engaged societies can better rise to the challenges we face in terms of creating a sustainable future in a world where population is rising, biodiversity is under threat and a climate emergency is already unfolding. Crucially, the next generation must be inspired to rise to these challenges and become scientists themselves.

Each year our scientists deliver a programme of science engagement activities as part of the Edinburgh Science Festival, enabling them to share the wonder of scientific discovery with the public. The emphasis is on learning-by-doing and giving people the chance to speak directly to scientists about their work.



Activities

- Demonstrate the impact of publicly funded research and providing a stronger evidence base.
- Meet the need for science to be more publicly accessible, preventing misunderstanding and challenging misinformation.
- Are fun and engaging and have included activities around our health and environment - such as creating a home for bees, learning about the bugs inside us and trying new healthy snacks.

Typically, around 1500 -2000 people, mainly family groups, engage with the programme over the course of a couple of weeks which has become a firm favourite in many calendars.

Related links

[Example SEFARI activities](#)

[Edinburgh Science Festival](#)



Becoming a Good Food Champion

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As founding partners in the General Teaching Council-accredited Good Food Champions teacher's Continuing Professional Development (CPD) course, SEFARI researchers have created a year-long course which is primarily driven by teacher self-learning.

The course has given teachers the opportunity to engage with all levels of the food, farming, cookery and manufacturing chain and to become "Good Food Champions". Activities have included a farm visit, manufacture visit, hands-on cookery, investigating soils and finding out more about food security.

The course, endorsed by Education Scotland, was pioneered by the learning and development co-ordinator at the Royal Highland Education Trust (RHET), the Rowett Institute and other partners included Food and Drink Federation Scotland, Quality Meat Scotland, National Museums Scotland, Soil Association Scotland and Scotland's Rural College.

The format has adapted over the years, by offering one-day Science, Technology, Engineering and Mathematics (STEM) training days and we are now planning the course will become available online, utilising podcasts and virtual workshops..

Typically, around 12 teachers are engaged every year (Aberdeenshire, Lanarkshire and Perthshire), with over 90% success. Throughout the course teachers have the opportunity to learn more about the science and technology used in the food and drink industry, including hands-on experiments, that can be used within the learning environment and shared with the wider teaching community.



Related links

[Good Food Champions](#)



Wood ant activity pack

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As a keystone species involved in a wide range of interactions, ants provide an ideal example of how organisms can be interrelated at a local level. As social insects they also provide an excellent model system to introduce wider societal concepts around cooperation and communication, architecture and infection control.

SEFARI researchers have created an activity pack for use on forest walks where there is a likelihood of seeing a wood ant nest mound. Activities are aimed at primary age children and can be used in school or at home with the family. The topic and activities are designed for curriculum outcomes relating to biodiversity and interdependence, and will provide a greater appreciation of the habitat and actions of wood ants.



The activity pack comprises:

- Information on wood ants and a storyboard to accompany the games and activities.
- Four games exploring the topics of cooperation, communication, defence, navigation, and interactions between different organisms (e.g. mutualistic interactions, predator-prey interactions).
- An activity introducing the concepts of insect architecture, thermoregulation, communal living and infection control. Another activity is designed to interpret ant behaviour when watching them for real.

The activity pack is designed to capture the learner's imagination by showing that ubiquitous and common insects such as ants have complex behaviours and interactions, and that their actions affect a whole suite of other organisms. The pack has already been used by countryside rangers and educators in an outdoor setting.

Related links

[Wood ant activity pack](#)



STEM subjects take lessons from farming

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Real life agricultural data has been used to facilitate the teaching of STEM (Science, Technology, Engineering and Mathematics) subjects in schools.

- The **Data 4 Schools** programme, a partnership between Scotland's Rural College and the Royal Highland Education Trust (RHET), has taken research data collected on SEFARI farms and transformed them into datasets and questions that can be used in the classroom.
- The resource was launched at the start of Maths Week Scotland, which celebrates the importance of the subject in our everyday lives, and is aimed at secondary teachers with a STEM remit.
- The programme currently looks at data collection for the dairy, beef, upland sheep and arable sectors and is made freely available online to schools. As well as graphed data and questions, the raw data is provided to encourage interpretation and debate.

The use of this data will not only help secondary school pupils develop maths skills but also illustrate how important STEM skills are within all aspects of farming. It is hoped that this will encourage pupils to consider a career in the food and farming sectors.



Related links

[Data 4 Schools](#)



Food-related educational resources

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Nutrition, health, food and food sustainability are important issues facing us all. To engage schools and communities and offer integrated learning on these topics, a range of activity packs have been created and linked to the Scottish Curriculum for Excellence.

Examples of the resource packs include:

- **Crafty Cranachan** workshop is designed to help students understand the importance of nutrition, how we can make food healthier and what influences the way we choose our food. The recipe for Crafty Cranachan, a healthier version of the traditional Scottish dessert, can be found in the *Stovies Reloaded* recipe book.
- **Healthy People, Healthy Planet** is a suite of activities incorporating the themes of nutrition, food provenance and food miles. The 45-minute engaging, interactive and cross-curricular workshop allows P4-7 pupils to learn about what makes a sustainable diet.
- **The Food Lab** is a hands-on set of experiments, exploring the chemical composition of everyday foods. This suite of fun, hands-on experiments using food helps students to learn more about what they eat and drink and also introduces them to fundamental scientific concepts (i.e. carrying out a fair test, using a control to validate results).

Activities have already been used by over 150 pupils, shared with at least 30 teachers and made available at the Aberdeen Science Centre and Royal Highland Show.



Related links

[Rowett schools resources](#)

[Stovies Reloaded recipe book](#)



Disease detectives in the classroom

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Detection of infectious microbes and parasites is fundamental to sustainable agriculture, animal welfare and food safety. The scientific principles involved also lend themselves to fun and interactive classroom activities for areas of Health and Wellbeing, Science and Technology within the Scottish Curriculum for Excellence.

SEFARI researchers have developed a portfolio of activities for classrooms, which are run with support from scientists. These allow learners from early to senior levels to gain hands-on experience of laboratory techniques and recording data.

Activities are engaging and relatable, using narratives that reflect real-world scenarios. These include identifying the cause of pneumonia in sheep so the right treatment is given and finding out which bacteria and food product might have led to foodborne disease. Simple explanations of scientific theory and practice are given followed by relevant experiments and activities such as handwashing.

School visits have fitted with initiatives focussing on careers and health, encouraging an interest in STEM subjects and showing relevance to present-day issues. The importance of controlling the spread of microbes is also demonstrated, reinforcing public health messages. Consultation with teachers enables activities to be improved and updated and some activities have been adapted for schools within rural communities with direct connections to farming.



Related links

[Moredun educational resources](#)

[Moredun Bus - Science in the field](#)



Moving forward from Ash Dieback, in virtual reality

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A highly destructive disease affecting ash trees, called Chalara dieback, is caused by the fungus *Chalara fraxinea*. It is spread by the wind and movement of diseased plants (e.g. by humans), leading to leaf loss, crown dieback, and usually tree death. Infected woodlands are reported and can be viewed on a Forestry Commission interactive map.

To convey the symptoms, stages of infection and the spread of Chalara, SEFARI researchers have developed a virtual reality model of a hypothetical ash woodland (*Fraxinus excelsior*), based on a site in north-west Scotland. The virtual environment provides 'safe space' to explore woodlands and learn about the threats using scenarios about the spread of infection, the signs and symptoms, the death of trees and the regeneration of woodland flora and fauna.

The model is designed for primary and secondary age children and their families, and explores the Scottish Curriculum for Excellence outcomes on biodiversity, interdependence, people and the environment.

Developed in response to the Chalara Action Plan for Scotland, with Forest Research and Royal Botanic Garden Edinburgh, the model can be used to guide the responsible use of woodlands to minimise the spread of chalara and other plant diseases, reminding woodland users to clean their 'Boots, Bike and Buggies'. We have already demonstrated the activity at a number of schools and public events, and the model can be downloaded for use on a PC or with a virtual reality headset (e.g. Oculus Rift).



Related links

[Virtual reality model](#)

[Forestry Commission Map](#)

[Charala Action Plan for Scotland](#)