

## Leading Ideas for Science Education

- An extensive range of school, educational & career engagement is delivered directly from Institutes, through cross SEFARI partnership-working and in partnership with external organisations e.g. GTCS, SSERC, RHET, RSC, SAGT, Gatsby Foundation, Local Education Authorities
- Bespoke educational media, including on-line resources, interactive workshops, audio-visual imagery, interactive games and accredited information sheets are used
- Schools and pupil engagements are held directly in-class at schools, within Institutes, on Institute estate & farms (incl. “on farm Sunday”), at Science Centres, Science Festivals and community venues
- Practical, bespoke activities respond to topical scientific interests
- SEFARI organisations provide direct support to teachers including via structured CPD courses
- SEFARI organisations actively support science careers entry for young people through STEM
- Cross-curricular work e.g. through the expressive arts is encouraged
- Benefits include curriculum and cross-curriculum support, national qualifications and CPD for teachers
- Gateway is preparing a leading ideas booklet on exemplars of SEFARI schools engagement

| Title   | Resource  | Audience                                 | Focus and benefit  |
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| <b>On line resources</b>  |   |  |  |
| <b>Microbes Safari</b><br>(for launch May 2020)                   | Examines the role microbes play in food production, food security, gut health & food safety.  | Late primary<br>Secondary                | Cross Curricular Health & Wellbeing and Social studies: people, place and environment                                |
| <b>Food &amp; nutrition resource packs</b>                        | On-line downloadable resources feature “Crafty Cranachan” which examines a healthier version of the traditional Scottish desert & “Healthy people, healthy planet” provides a suite of activities on nutrition, food provenance and food miles. | Late primary,<br>Secondary               | Supports curriculum for excellence (CfE).  |
| <b>Soils and their characteristics</b>                            | Downloadable information sheets linked to the CfE (e.g. ‘introduction to soils’, ‘Coasts and dunes’).   | Scottish syllabus but accessed across UK | Aligned to CfE: sites are accessible from the Scottish Government Digital Learning Scotland GLOW WWWsite             |
| <b>The Living Field</b><br>(in abeyance but available)            | Interactive CD examines, plants, animals, microbes  | Primary                                  | Targets the 5-14 curriculum.   |
| <b>Veterinary Terminology &amp; Animal Care Distance Learning</b> | Dumfries and Galloway (D&G) schools currently have access to Institute Veterinary Terminology and Animal Care Distance Learning modules within their senior phase timetables.   | Secondary                                | For the academic year 20-21 the courses and the NPA Rural Skills SCQF Level 5 will be offered to schools within D&G. |
| <b>Upland Livestock Systems</b>                                   | Collaboration with Futurum Careers provides a suite of material highlighting STEM careers associated with upland livestock.   | Secondary,<br>FE                         | On line resources available to schools and colleges.   |
| <b>Rural Skills online</b><br>(in development)                    | Working with Borders College to develop online training materials for rural skills  | Secondary,<br>FE                         | SVQ Level 4 & 5 (in discussion/development).   |

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|   | courses. This work will also include mobile classrooms.   |   |  |
| <b>In-class teaching &amp; other direct to pupil teaching</b>   |   |   |  |
| <b>Formal SFC credit delivery into schools</b> (see “careers support incl. direct to pupil teaching”) | An individual SEFARI organisation directly delivered training to 1717 students of which 212 were in Dumfries  | Primary & Secondary                                   | Extensive range of qualifications incl. NPA Horticulture SCQF level 4: Rural Skills SCQF Level 4 &5                                    |
| <b>Plant science masterclass</b>  | Features hands-on experiments and outdoor work supported by the Gatsby Foundation.  | Primary to secondary                                  | Direct curriculum support incl. for higher biology.  |
| <b>Plant Taxonomy</b>   | Features hands-on learning  | Secondary   | Advanced Higher Biology.   |
| <b>Schools gardening project</b>  | Students tend plots on a weekly basis to grow their own vegetables.   | Engages five Edinburgh schools                        | Practical engagement with food production, nature and green-health. Support to students with complex and profound needs.               |
| <b>Living roots</b>   | Direct teaching-practical   | Secondary   | National 4 qualification in Rural Skills   |
| <b>Healthy people, healthy planet</b> (see on-line)   | Teaching on nutrition, food provenance and food miles.  | Primary, Secondary, Families                          | The Aberdeen Science Centre has run this independently. It has also been run within school and to teachers at the Royal Highland show. |
| <b>The food lab</b>   | A hands-on set of experiments, exploring the chemical composition of everyday foods.  | Secondary   | To school groups via Aberdeen Science Centre as well as in schools.  |
| <b>Engaging through Scotland’s Strategic Research</b>   | Pupils are engaged in research activities funded by the Strategic Research Programme (e.g. participatory videos on the use of greenspaces), and the EU (e.g. design of coastal land uses in virtual reality).                                 | Primary, Secondary                                    | Cross curriculum.  |
| <b>Topical scientific engagements</b>   | Presentations that link local circumstances with wider scientific interests and challenges (e.g. “What makes mountains and how do plants and animals live there?”; “climate change and impacts on agriculture”; “pests and natural enemies”). | Primary, Secondary                                    | Cross curriculum as relevant to the specific school.   |
| <b>Rocket Science</b>   | Experiments to evaluate whether seeds taken into space would grow differently. Conducted alongside RHS, UK and European Science Agencies.   | Primary and Secondary (Covered over 5,000 UK schools) | Curriculum support: scientific processes of randomisation, replication, bias, variability.   |
| <b>RHET data 4 schools project</b>  | Datasets – drawn from an Institute’s farms - contain a series of question sheets, graphs, charts and raw data for use in school.  | Secondary   | Datasets can be used in: Maths; Biology; Geography; Chemistry; Environmental Science; Business Studies.                                |

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| <b>The Bridge (Educational Trust)</b>                                 | Pupils from each school in Dumfries and beyond are able to attend The Bridge for specialist subjects taught through a SEFARI Institute.   | Multiple schools              | Less resource duplication, greater consistency, more effective use of teaching time with timetables coordinated across the curriculum in specific schools. Creates opportunities by extending subject choice. |
| <b>Soil in criminal investigations (in development)</b>               | New teaching resources on the use of soil in criminal investigations with SAGT and Dollar Academy.  | Secondary                     | Cross-curriculum materials, in particular for Geography and Environmental Studies.  |
| <b>The Court System in Scotland</b>                                   | New teaching resources on the Court Process in Scotland with Faculty of Advocates.  | Secondary                     | Film for use in Modern Studies curriculum.  |
| <b>Contribution to safety initiatives</b>                             | Supporting road and internet safety   | Primary                       | Support for "Kidsafe".  |
| <b>Teacher CPD</b>  |   |                               |   |
| <b>Food Champions (STEM)</b>  | Driven by teacher self-learning & supported by face-to-face course(s), food Champions was pioneered by RHET with SEFARI members and partners (FDFS, QMS, National Museums Scotland, SAS). | Teachers                      | GTCS certificate Currently applying for an Education Scotland Programme Endorsement.  |
| <b>Technology in food and drink industry (STEM)</b>                   | Institute scientists present workshops on science and technology used in food and drink industry, inc hands-on experiments  | Teachers                      | Teacher development.  |
| <b>Land-Based Careers</b>   | Supporting Countryside Learning Scotland deliver a Land-Based Career event in Perthshire March 2020.  | Teachers and careers advisors | Providing teachers, guidance teachers and careers advisors with experience of land-based sector.  |
| <b>Contributions to events run or designed for teachers</b>           | Presentations include the annual conference of the SAGT; also a RHET event for teachers as a follow up to the Data 4 Schools Project.   | Teachers                      | Teacher awareness of scientific developments and course materials available from Institutes.  |
| <b>Contributing to individual school strategic planning</b>           | Co- design of class topics with specific schools  | Teachers                      | Supporting school curriculum delivery.  |
| <b>STEM &amp; careers support (includes direct to pupil teaching)</b> |   |                               |   |
| <b>STEM Ambassadors</b>   | SEFARI has a strong commitment to STEM through the Ambassadors system e.g. Food Champions (see above) and Ambassadors supporting maths in life and careers.                               | Primary and Secondary         | Supporting school curriculum and skills development.  |
| <b>STEM materials and teaching</b>                                    | Additional to Ambassadors, STEM support is provided through courses and online resources e.g. upland livestock systems.   | Secondary, FE                 | Supporting school curriculum and skills development.  |
| <b>Outdoor and rural STEM careers</b>                                 | Provision of curricular-based practical workshops and sharing of topical STEM developments e.g. technologies within agriculture, as well as the opportunity to                            | Secondary (S3)                | Supporting choices through sharing of educational pathways to outdoor/rural STEM careers  |

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|  | share expertise with accompanying adults incl. via practical workshops (pond health and forestry).  |                              |   |
| <b>Teacher training</b><br>(see Teacher CPD)       | A variety of teacher training is offered for STEM subjects: botany, nutrition, food and drink industry, farming technology, meat production, and food security. These are variously made available through GTCS, SSERC, Moray House School of Education, RHET.  | Primary & secondary teachers | Teacher professional development supporting career opportunity awareness for pupils.  |
| <b>STEM initiatives with UK National Societies</b> | SEFARI supports UK national science societies (e.g. RSC) in their promotion of STEM subjects through contributions to high profile events e.g. annual Science and the Parliament at Dynamic Earth; events for the Royal Geographical Society school members (e.g. on soil forensic science, February 2020). | Primary, secondary           | Curriculum support and raising careers awareness for pupils.  |
| <b>Teaching Laboratory Skills</b>                  | An Institute has been working with Aberdeenshire Council to provide a programme as part of Skills Development Scotland Foundation Apprenticeships in Scientific Technologies (Laboratory Skills).   | Secondary                    | SCQF National level 6; expected from 2020 that up to 20 secondary school pupils will take part each year.   |
| <b>Rural Skills</b>                                | An Institute working with Perth & Kinross DYW, organised two Rural Skills days, in May 2018 and 2019, for secondary schools from across Argyll & Bute, Forth Valley, Perth & Kinross and West Highland.   | Secondary                    | Supports Developing Young Workforce Initiative.   |
| <b>Land-based Employability</b>                    | Institute in partnership with D&G Employability & Skills Service and NFUS developed a work-based qualification for experience of agriculture industry and piloted as pathway into Agriculture.  | Secondary                    | Allows students studying National 5 / Higher to complete a work based qualification. Helps pupils and parents understand agri-sector opportunities. Youth Employability Category 2019 SURF Awards Winner. |
| <b>Growing Rural Talent</b>                        | Building on the Land-Based Employability Award, a bid to South of Scotland Enterprise Partnership extends this programme across D&G and Scottish Borders and from agriculture through to the forestry sector.   | Secondary                    | This project will support two co-ordinators who will engage with schools, employers and providers in support of young people and the agriculture/ forestry sectors.                                       |
| <b>Skills for Work</b>                             | An institute is working with an Academy (4 <sup>th</sup> and 5 <sup>th</sup> year) on an introductory qualification developing skills, knowledge and attitudes needed for young people to start working in the land-based industries.   | Secondary                    | Rural Skills National Level 4 (SCQF level 4); also supporting pupils struggling with class room based learning.   |
| <b>A Taste of Your Future</b>                      | Annual event for D&G secondary schools at a SEFARI Institute in which pupils select two departments to attend along with the  | Secondary                    | Career, further education awareness.  |

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|   | opportunity to be involved in practical activities.   |  |   |
| Encouraging equality of entry into scientific careers   | As part of providing support into scientific careers, SEFARI scientists champion the career paths of women in science through tailored presentations to primary and secondary pupils.   | Primary & Secondary  | Career awareness.   |
| Non-STEM careers  | Researchers present on careers and skills which are not STEM subjects, recognising that SEFARI and equivalent organisations require a wide range of skills (e.g. administration, legal, librarianship, farm and land management).   | Primary<br>Secondary   | Career awareness.   |
| Individual pupil work experience  | Institutes provide work experience placements in laboratories, their specialist facilities (e.g. at Human Nutrition Unit) and farms. Individual institutes also support “Bring your Child to Work Day”  | Secondary (work experience) & Primary (visits)                           | Career awareness.   |
| <b>Educational exhibitions and displays for use at multiple venues (schools, festivals, science centres, shows)</b>   |   |  |   |
| Tale of two squirrels   | Highlights the threat of squirrel pox virus and its control using multi media: poster boards, video, hands-on microscopy; colouring activities, quiz and puzzle sheets.   | Families   | Supports curriculum: body systems and cells. Cross-curricula links to expressive arts, literacy & social studies: people, place & environment.  |
| Farm disease exhibits:<br>Disease Detectives<br>Disease Detectives-<br>Liver Fluke<br>War of the Worms<br>Healthy Sheep are Happy Sheep<br>Farmyard Friends & Foes<br>Disease Explorers<br>Bugs vs Drugs<br>Farmyard Friends & Foes | An array of individual and combinable exhibits & workshops covering livestock disease, antimicrobial resistance, combating and controlling disease, positive animal welfare, the challenges to farmers of keeping their animals healthy and all set within fun, child-friendly designs incorporating multi media: poster boards, video; sample collections; hands-on experiments; colouring activities, quiz and puzzle sheets; free take-home materials that enable follow on discovery for children and families. | Primary to secondary e.g. Disease Detectives-<br>Liver Fluke is for S1-3 | Supports the curriculum with relevance to body systems and cells, biodiversity and interdependence & inheritance. The exhibits promote cross-curricula links incl. Health & Wellbeing, Expressive Arts, Literacy and English. |
| Human health linked exhibits:   | Individual interactive exhibitions and workshops looking at aspects of human pathogens and our immune system. These   | Primary but certain exhibits   | Cross curricula, topical science engagements.   |

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| <p><b>The Beasts within Us</b></p> <p><b>Tick-ing timebomb</b></p> <p><b>Bug Busters</b></p> | <p>focus on: the threat and consequences of the toxoplasma; how ticks and tick borne disease may be affected by climate change; demonstrating the world of our immune system and how it defends against disease. These are delivered as child-friendly designs incorporating multi media: poster boards, video, sample collections, hands-on experiments; colouring activities, quiz and puzzle sheet &amp; free take-home materials enabling follow on discovery.</p> | <p>can be adapted to secondary</p>                                    |   |
| <p><b>Microbes: your food, your health</b></p>   | <p>How mass spectrometry helps identify bacteria and other food borne pathogens eg– <i>E.coli</i> O157. Uses data analysis leading to discussion on food safety practices. Provides a take home foodborne pathogen bookmark and factsheet.</p>   | <p>Primary Families</p> <p>Can be adapted as a classroom activity</p> | <p>Cross-curricula links: Health &amp; Wellbeing.</p>   |
| <b>Working with Science Centres</b>  |  |   |   |
|  | <p>SEFARI supports school and family visits, through interactive workshops and displays e.g. “Healthy people, healthy planet”, “food lab” (see in-class teaching), science careers showcases through UK Association for Science and Discovery Centres; SEFARI materials at the NERC ‘Unearthed’ public engagement on science at Our Dynamic Earth, 2017 on Scotland’s soils, coasts (through CREW), and plant health (‘CALEDON’ online game on tree health).</p>       | <p>Primary, Secondary, Families</p>                                   | <p>General curriculum support, raising awareness and debate on topical science, supporting pupils from underprivileged circumstances.</p> |
| <b>Science Festivals, annual and topical (ad hoc ) initiatives</b>                           |  |   |   |
| <p><b>The Royal Highland Show</b></p>  | <p>Institutes routinely deliver collaborative activities within the RHET Centre, commonly working with up to 75 pupils in the first day of the show on topical human health and environmental issues through interactive demonstrations and learning-play. In addition, activities are held within the Institute tents each year.</p>  | <p>Primary and Secondary</p>  | <p>Supporting the show as a destination event for schools.</p>  |
| <p><b>Science Festivals</b></p>  | <p>SEFARI engages families and children through events at Edinburgh International and Aberdeen Science Festivals e.g. an institute runs a regular programme at MayFest (Aberdeen) of cooking demonstrations for ~120 people; tours of institute facilities (~ 100 people) and a food reformulation workshop (70 people). Regular family friendly food innovation workshops (c 50 people) are also run at Techfest (Aberdeen).</p>                                      | <p>Families</p>   | <p>Engages families in healthier foods and the role of research in the food industry.</p>   |

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| Using community sites to engage   | Third party sites are used as venues to talk through scientific issues e.g. regular use of an allotment with pupils from a local primary school for hands-on discussion of healthy soils   | Primary, Secondary, Families                    | Curriculum support and class room projects   |
| Maths Week Scotland   | Delivered with Royal Statistical Society as a celebration of maths in everyday lives e.g. how statistics helps governments plan. In Edinburgh, SEFARI staff took part in “Sociable Cards” at the National Museum, examining probability use e.g. in encryption.  | Primary and Secondary up to S6                  | Supporting mathematics across the curriculum.  |
| 2019 Young Wildlife Champions   | Institute supported Awards to promote and protect biodiversity were run through schools and youth groups.  | Primary   | Supporting work of the North East Biodiversity Partnership   |
| <b>Institute &amp; estate facilities and visits</b>   |  |   |  |
| Institutes-general  | SEFARI Institutes support school and individual pupil visits e.g. an institute hosts between 5-10 secondary school and 2-4 primary school visits from Aberdeen City and Shire schools per year.  | Primary and secondary depending on the activity | Supporting class projects and engagement on topical science. A Laboratory skills course is being developed for SCQF level 6. |
| Institute - farms & estates<br>From Farm to Fork<br>Wild Weather<br>Natural Disasters<br>Pond dipping<br>Fungal forays<br>Soils and food production<br>Climate change on vegetation | SEFARI farms provide a range of engagements from small primary school to large scale visits for over 100 secondary students. These explain topical issues in natural science and research incl. farming, land use, biodiversity e.g. the Hill & Mountain Research Centre, Crianlarich runs primary school engagements: Farm to Fork”; “Wild Weather”; “Natural Disasters”.<br><br>Visits are also arranged with educational organisations e.g. RHET at the Crichton and Barony Farms.<br><br>Open farm Sunday events are held every year, often in conjunction with other organisations, e.g. BSSS<br><br>SEFARI visits are tailored to age groups and may use specifically designed materials e.g ‘soil characters’ as used to support understanding of soil function | Primary<br>Secondary                            | School-community engagement<br><br>Curriculum Support  |
| John Hope Gateway   | A major venue (including events for Edinburgh International Science Festival) by which SEFARI engages schools and the public e.g. long-term SEFARI Film Installation on Strategic Science for Environment, Agriculture, Land Use, Food and Communities; child-friendly displays on biodiversity, pests and disease; biosecurity.   | Primary<br>Secondary<br>Families                | Raising scientific awareness, engaging on topical science, providing materials for target educational destination.           |

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| Open doors  | A SEFARI partner takes part in an annual “Doors Open” day. Tours see ~200 people learn about SEFARI research  | Families                         | Raising science awareness   |
| <b>International engagement</b>                       |   |                                  |   |
| Wastewater<br>(SG HydroNation International funded)   | Co-design of a decentralised wastewater treatment with children at the Berambadi Primary School in Karnataka, Southern India.   | Primary                          | Changed behaviour to a predominant use of toilets; saving in annual fresh water consumption, increased recycling of grey water. |
| Geospatial studies                                    | Presentations to the Geospatial Studies course at Tonjii University Shanghai, China for high achieving senior school pupils   | Secondary                        | Promoting research.   |
| <b>Supporting education strategy &amp; management</b> |   |                                  |   |
| Science Centres, local authorities and societies      | SEFARI members assist with the strategies of educational engagement providers e.g. a senior SEFARI staff member is a co-Director for Dundee Science Centre; there is active partnership with local education authorities (e.g. Aberdeen City and Shire; Dumfries & Galloway), working with educational trusts e.g. RHET, The Bridge Educational Trust and sector organisations e.g. SSCER and learned societies e.g. RGS, RCS | Primary, Secondary, FE, Families | Provision of strategic planning, design of school teaching resources, engagement and event priorities.                          |

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