STEM By Nature & Citizen Science: #15 Life On Land

STEM By Nature: STEM teaching & learning in nature settings, using Outdoor Learning approaches
Guidance for a 2-3-hour training session with a Citizen Science & UN Sustainable Development Goal #15 Life On Land focus

This session introduces and explores what is meant by 'STEM By Nature' and how it can be applied in relation to Citizen Science and Social Action. It can be adapted to suit a range of locations and group/learner needs. Its audience is teachers and educators, including youth workers, outdoor instructors, and Countryside Rangers. Whilst some facilitation and group management skills are needed, it is designed to be delivered by non-specialists – you don't need to be an expert in STEM learning or the outdoors.

STEM By Nature & Citizen Science - #15 Life On Land – Aims
- Build STEM skills and confidence through the use of nature settings and Outdoor Learning approaches.
- Introduce and explore the concept of STEM By Nature through citizen science information, resources and activities around the theme of #15 Life On Land.
- Highlight Curriculum for Excellence and STEM connections, including examples and opportunities for:
  - Interdisciplinary Learning and the process of enquiry
  - showing how Citizen Science can relate to the 4 Contexts, equity and work skills.

Structure and Context
Information, resources and activities relating to Citizen Science and UN Sustainable Development Goal #15 Life On Land are signposted throughout. Connections can be made with other UN Sustainable Development Goals or themes such as creativity in STEM learning. A session can be delivered to give a broad overview of links between STEM, Citizen Science and #14 Life Below Water, or adapted to focus on a particular theme or context.

This Citizen Science: #15 Life On Land session is part of a growing portfolio of STEM By Nature session guidance hosted on the John Muir Trust website here. Other sessions in the STEM By Nature series include - An Introduction, Citizen Science: #14 Life Below Water, UN Sustainable Development Goals and #13 Climate Action. Explore the STEM By Nature Resources and Links padet which has useful links relating to each relevant UN Sustainable Development Goal.
See here for session guidance for STEM By Nature: Trees, Woods and Forests, created by Rob Bushby for Scottish Forestry.

Timings for a 2-3 hour session

Introduction	10-20 mins
Outdoor session	1-2 hours
Review session	20-30 mins
Signposting & wrap up	10 mins

Introduction

(10–20 mins)

As participants gather set an ice-breaker (relating to Citizen Science) with an open, leading question or two e.g. "Do you do anything you would consider 'citizen science' or 'social action'?". Collate responses, share with group.

Objectives

By the end of the session, participants will:

- understand what's meant by 'STEM By Nature', and be confident to make use of nature settings for STEM teaching

- be able to access a range of information, resources and activities relating to Citizen Science to support STEM-related teaching

- have explored how #15 Life on Land offers contexts, ideas and inspiration for learning and can contribute to varied aspects of Curriculum for Excellence.

Introduction to STEM By Nature, its origins and rationale

Confirm 'STEM By Nature' as: 'STEM teaching & learning in nature settings, using Outdoor Learning approaches'. Outline session aims and objectives, as above.

Note any relevant local links to Outdoor Learning, STEM, Citizen Science, #15 Life On Land resources; acknowledge any relevant expertise within group (and incorporate as appropriate).

Note the inclusive 'educator' audience; the session and associated guidance can have relevance to a wide range of ages and backgrounds, not just schools/teachers.

Citizen Science and Social Action

Explain what is meant by Citizen Science - using the Education Scotland and/or FSC resource. Citizen Science is "getting everyone, from experts to amateur biologists, school children to enthusiastic beginners involved in science" (TCV). More formally, it involves the gathering, recording and analysis of scientific data by members of the public.

Citizen Science covers a range of activities and skills including:

- observing and monitoring e.g. gathering data to find out about wildlife populations
- informing action e.g. providing data to organisations about floods or pollution
- promoting learning e.g. informing learners with information about climate change
- testing hypotheses e.g. using science activities to test a specific question
- crowd-sourcing e.g. online activities to gather or analyse data to achieve a common goal
- helping communities learn about their local environment.

Youth social action refers to activities that young people do to make a positive difference to others and/or the environment. It can take place in a range of contexts and include formal or informal activities such as volunteering, fundraising, campaigning or supporting peers – including Citizen Science.

Note that opportunities to make links with Interdisciplinary Learning and to explore equity in STEM learning can be shared. See STEM By Nature - An Introduction for more on these, and 'Interdisciplinary Learning: ambitious learning for an increasingly complex world'.
Reference STEM employability skills and their relevance to Citizen Science.

Pupil/learner enquiry
Pupil enquiry refers to learners deciding for themselves, carrying out their own independent investigations, with teachers adopting a facilitator role to develop skills and nurture inquiring attitudes. A *Spectrum of Enquiry*, drawn from fieldwork practice, relates to a range of STEM skills and can be used to set up, deliver and review Citizen Science experiences:

Sensing - Framing - Questioning - Observing - Analysing/Interpreting - Concluding

Consider the relative importance of each of these elements in your activities/session, and in wider education settings. How do these elements inter-connect? How do they relate to STEM subjects? Which are you/your learners good at?

Outdoor Session

(1-2 hours – adapt inputs/activities for time available)
Activities are presented as introductions, options and 'tasters' rather than fully delivered. This is to keep within a limited timeframe, to share a wide variety of ideas, and to keep things punchy.
Select, plan and frame activities to include and demonstrate, as far as possible:
- ways to build confidence and skills in STEM teaching and learning
- active, cognitive, creative approaches
- opportunities to consider methods of Pupil Enquiry, sustainability themes, and Interdisciplinary Learning
- 4 STEM subject areas of Science, Technology, Engineering, Maths
- resources available to support participants beyond this session.

Act Like a Victorian Explorer (Link to Science, Literacy, Biodiversity)
Walk everywhere carrying only a light blanket, tea, bread and a notebook and pencil. Choose some plants and animals and make up your own names for them according to what they look like or what they do. Record your own names and ask others to guess what you have spotted. Find out the 'real' names for what you have found. Mission:Explore Muir Mission
Discuss briefly. In pairs, share at least one connection between #15 Life On Land and STEM (e.g. awareness of an activity, resource, subject link).

Linking #15 Life on Land with creativity (Literacy and Expressive Arts)
Frame activities in the context of using art and creativity as part of STEM learning.

Introduce The Lost Words: Information & resources including free Explorer's Guide download plus posters of Dandelion, Otter, Kingfisher, Conker, Bramble; Padlet for sharing creative outputs; #TheLostWords.
Read different poems aloud in groups.
Write a collective group poem – Learning Through Landscapes - Poetree.
Reference: John Muir Award Literacy & Nature Resource Guide
Reference: OWL Tree Stories
Reference: OWL Wolf Brother's Wildwoods

Minibeast/Bug Hunt (Science, Biodiversity)
Demonstrate a range of techniques to collect/observe terrestrial invertebrates e.g. taking photographs, tree beating, sweep nets, paint brush, how to safely collect invertebrates, responsible collection of plants, etc. The FSC's Fieldwork Live: Habitat Exploration is a good place to start for an introduction to garden habitats and for more detailed information there is also FSC's B-Wild Hunting for Minibeasts. The OPAL Bugs Count Survey can help with the survey process and includes identification guides.

Making a Biological Record (Technology)
Submit findings to iSpot/iRecord to inform ongoing research, or collect on an app such as Zepto or Seek (which gives badges according to how many species are found), or create your own monitoring process.
Reference FSC Biolinks What is a Biological Record?
- Give participants the opportunity to trial techniques and explore use of tools, apps.
- Re-group and review, highlighting opportunities to develop STEM skills (observation, description, measuring, recording etc.).

Bioblitz (Science, Biodiversity)
"Bioblitz: capturing a snapshot of an area's biodiversity before the clock runs out!"
Introduce the concept. An 'official' Bioblitz event lasts 24hrs, but observations from a scaled-down version (e.g. school grounds in an afternoon, or on a walk) can be effective. Set up a short illustrative Bioblitz e.g. see how many species in a defined area can be found in 20 minutes.
Have a selection of FSC field guides available to help with identification and signpost to iSpot as an online tool of experts for support.
Highlight the free training provided by Open Learn: Citizen Science and Global Biodiversity.

Citizen Science surveys (Science, Maths, Technology and Process of Enquiry)
Carry out a land-based survey as appropriate for the time of year and the available habitat. It is worth checking for surveys specific to the local area or region as well as the National Suveys listed below.
Introduce tools to help with identification: iSpot, FSC guides, and other free apps e.g. Zepto from NatureScot.
Reference: John Muir Award Surveys Resource Guide
Reference: FSC Field Work Live
Reference: NatureScot Citizen Science for Biodiversity
Reference: Scotland's Environment Web Project Finder
Reference: CJS - Citizen Science, Surveys and Fieldwork

#15 Life on Land National surveys

Nature's Calendar - the longest written biological record of its kind with almost 3 million records spanning 300 years. Records will help scientists monitor the effects of weather and climate change on wildlife.

Big Schools Birdwatch - runs every year from early January – mid February and is an educational activity that gets your class closer to nature. It takes just an hour and is accessible to all ages and abilities.

Big Butterfly Count – a UK-wide survey aimed at helping us assess the health of our environment simply by counting the amount and type of butterflies (and some day-flying moths) we see (July-August).

Great British Wildflower Hunt - running through spring and summer, this survey is about seeing the wild flowers that surround us every day. Whether in town, local woodland or the countryside, get to know their names and faces…

Deadwood Survey - Is the deadwood in your wood dead good? Find out for yourself with this simple survey. It should take no more than an hour to complete.

UK Urban Canopy Cover - Can you help build an urban canopy cover map for Britain?

Big Hedgehog Map – Become a Hedgehog Champion – you don't need any special skills to be one, just a bit of initiative and a love for spiny creatures. Includes an interactive map of hedgehog sightings and hedgehog holes.

Bee Walk - run by the Bumblebee Conservation Trust to monitor the abundance of bumblebees on transects across the country. Count the bumblebees you see on a monthly walk along a set route from March to October. This could be around a school building or through a local park.

Review Session

(20 - 30 mins, outdoors or inside)

STEM Skills
Review each of the session's outdoor activities using the STEM employability skills map (as above) to highlight particular skills used and/or developed.
(Add review comments to large display on board/flip chart as participants return indoors.)
Consider which aspects of the **Spectrum of Enquiry** have featured in activities, and how they relate to STEM skills: **Sensing - Framing - Questioning - Observing - Analysing/Interpreting - Concluding**

Introduce the STEM Self-evaluation and Improvement Framework: "a framework to stimulate dialogue and action towards a whole setting approach STEM". It can be integrated with the quality indicators within 'How good is our school?' and 'How good is our early learning and childcare?' The framework aligns with expectations within the STEM Education and Training Strategy, Developing the Young Workforce and other priorities in education.

Signposting & wrap up

Open discussion/round robin: "What can you take away with you from this session?"
Introduce STEM By Nature Information & Resources padlet: a place to collate relevant and referenced resources (along with other relevant locations e.g. Glow).
Create a padlet to share participant conversations and activities arising from the session.
Note use of relevant hashtags for social media sharing, including #STEMByNature.

Local Learning Task suggestions (if appropriate)
Use local settings outside to try out some of the Citizen Science examples encountered.
Encourage sharing of photos/quotes/tweets/social media.
Discuss ways to make use of the STEM Self-evaluation and Improvement Framework with colleagues.

Citizen Science Resources – links
Have hard copies (or web access and links) of these resources available for participants to view.
Education Scotland Citizen Science & Curriculum for Excellence overview (great starting point)
FSC Field guides and FSC Field Work Live
OPAL surveys (data collection has stopped, but the resources are still available)
iRecord - collate wildlife sightings to support research at local and national levels
Digimap - data collections, including OS, historical, geological, marine maps and spatial data
TCV's Citizen Science pages

Juliet Robertson's (author of 'Dirty Teaching: a beginners guide to learning outdoors'), comprehensive Index of ideas and articles.
John Muir Award Surveys Resource Guide
John Muir Award Sustainability Resource Guide
John Muir Award and Curriculum for Excellence

Leaders' Notes
Equipment (suggested)
Any equipment available to help with wildlife observation e.g. magnifying glasses, binoculars, nets, buckets and trays or pots for collecting creatures.
Identification guides e.g. FSC publications, tablets/devices for taking photos.
Print-out or hard copies of OPAL Bugs Count Survey.
Clip boards, paper, pencils.

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