

STEM By Nature & Sustainable Development Goals



STEM By Nature: STEM teaching & learning in nature settings, using Outdoor Learning approaches Guidance for a 2-3-hour training session

This session introduces and explores what is meant by 'STEM By Nature' and how it can be applied in relation to the United Nations Sustainable Development Goals (also known as Global Goals). 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, Countryside Rangers. Whilst some facilitation and group management skills are needed, it's designed to be delivered by non-specialists – you do not need to be an expert in STEM learning or the outdoors.

STEM By Nature & Sustainable Development Goals – Aims

- Build STEM skills and confidence through use of nature settings and Outdoor Learning approaches.
- Introduce the concept of STEM By Nature.
- Engage with UN Sustainable Development Goals through nature-based and outdoor activities, making links to STEM skills and related themes.
- Consider how the pupil entitlement to Learning for Sustainability can be used as a framework for exploring learning topics including those captured in the Sustainable Development Goals.
- Demonstrate methods of pupil/learner enquiry and highlight examples and opportunities for Interdisciplinary Learning.

Structure and Content

Deliver a practical, informative (mainly) outdoor-based session highlighting links between STEM skills, UN Sustainable Development Goals and connection with nature.

A range of activities and projects are signposted throughout this guidance. The session can be set up to focus on a particular Goal or theme e.g. #15 Life on Land via land-based surveys or trees and woodland activities, or a combination of relevant Goals relating to ecological and sustainability issues.

See the STEM By Nature Introductory Session for more information on context and core themes.

Session guidance on Citizen Science, Climate and Coasts & Waters offer scope to integrate ideas and information. Activities related to these themes aren't the main focus of this guidance.

An interdisciplinary approach is encouraged, incorporating different subject areas and building skills in enquiry-based learning.

Explore the STEM By Nature [Resources padlet](#), which has useful links relating to each relevant Sustainable Development Goal.

Reference: [Sustainable Development Goals](#)

Reference: [Scotdec resources](#)

Welcome and context setting

As participants gather set an ice-breaking exercise with an open or leading question such as:

- 'How familiar are you with 'Sustainable Development Goals'?'
- 'Do you use them in your work/volunteering'?'

Collate responses on flip chart, share with group.

Introduce STEM By Nature, its origins and rationale. Confirm STEM By Nature as 'STEM teaching & learning in nature settings, using Outdoor Learning approaches'.

Note that it's a broad concept and an approach, not just a Professional Learning session or specific subject.

Outline session aims.

Briefly explain the rationale for a session theme of UN Sustainable Development Goals and the contexts of STEM learning, Curriculum for Excellence and Learning for Sustainability.

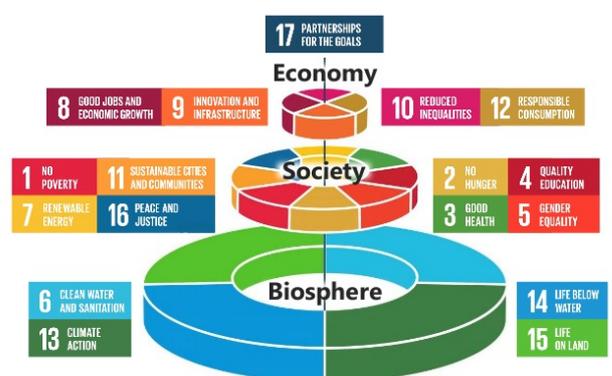
Note the inclusive 'educator' audience; the session has relevance to a wide range of ages and backgrounds, not just schools/teachers.

UN Sustainable Development Goals

Introduce the Goals to inform discussions. Use the [Biosphere model](#) to show the underpinning nature of Goals with an overt ecological aspect whilst referencing the suite of 17 Goals.

Ask whether practitioners use or aware of the Sustainable Development Goals in their work.

Adapt this [String Activity](#) to assist introduction.



Reference: [Sustainable Development Goals](#)

Reference the [Good Life Goals](#).

Learning for Sustainability

Learning for Sustainability is a Scottish educational approach to learning that encourages learners and educators to explore the concepts of sustainable development, global citizenship and outdoor learning in ways which develop the skills, knowledge and values needed to live sustainable lifestyles.

It is an entitlement of all pupils, a professional registration requirement of the General Teaching Council for Scotland, and currently a priority in Scottish education.

Learning for Sustainability is aligned to the UN Sustainable Development Goals, offering a starting point to explore local issues within a global context and vice versa.

["Impact on skills for life and work beyond formal education"](#): Learning for Sustainability can encourage the development of critical thinking skills. It can help young people to



uncover and unpick complex issues. It can also support creativity, allowing learners to imagine solutions to existing and emerging issues. Learning for Sustainability can therefore offer an opportunity to develop and practice skills necessary to thrive in an increasingly fast-paced, uncertain world.”

Reference: [Impact of Learning for Sustainability on Educational Outcomes: A Summary of Findings](#)

Reference: [A summary of Learning for Sustainability resources](#)

Learning for Sustainability [Word Cloud](#)

Outdoor activities

Icebreaker - Line ups

“How sustainable are you?” Ask participants to position themselves on a spectrum of where they consider they are. Participants might explain a sustainable action they regularly take to the person next to them. This opens up considerations around the breadth of ‘sustainability’, and related perceptions.

Then ask participants to arrange themselves according to their establishment’s Learning for Sustainability journey. What are their next steps?

Pathways to nature connection

A route for closer, healthier and more sustainable relationships with nature can arise through noticing, feeling, beauty, celebration and care. See [Pathways to Nature Connectedness postcard](#) for the framework and activities.

Consider connections to nature and how they relate to Sustainable Development Goals.

Reference: [Noticing Nature Report](#) page 41 for a summary of benefits of nature connection.

Care labels

Read a clothing care label; what does it need to be kept in good condition?

Discussion prompt: What would your own care label look like? (“Me: 2 cups of tea in morning...”).

What would a care label look like for a particular wild place? For the planet?

Development Compass Rose Frame

This [framework for raising questions](#) encourages various angles of enquiry about development issues in any place or situation. Look at a real landscape and ask questions around ‘What has this got to do with me?’ - personally, locally, globally.

Quick review: ask what came up in discussions e.g. view of a car in the landscape might prompt a discussion around accessibility, pollution and air quality.

‘Big Issues’, Pupil enquiry, STEM & Nature

The most urgent, challenging issues for individuals and society, locally and globally, have STEM and Nature at their core for both their understanding and their potential solutions.

Introduce ways to explore ‘big issues’ with children and young people (with the context of Sustainable Development Goal themes in mind).

Enable discussion about a broad range of thoughts and feelings children might have in relation to questions relating to nature, biodiversity, health, climate (including confusion, anger, grief, frustration, fear, as well as joy, contentment, peace...).

Move on to actions, solutions and positive approaches, including empowerment, creating narrative, and young people's voices being heard. Reflect on feelings, and ways to build emotional resilience. See the STEM By Nature [Resources padlet](#) for examples of talking about climate change.

Consider how Learning for Sustainability and Pupil/Learner Enquiry approaches might help (see above, and STEM By Nature Introduction session).

References: [Climate Psychology Alliance podcasts](#), [Climate Outreach](#), [Framing Covid-19](#)

Some possible activities

Sticky Questions: a playful way for pupils, parents and staff to embrace ways of talking and thinking. (E.g. "What has nature ever done for us?" "Do slugs deserve to eat?")

Issues Tree: a useful way of structuring an enquiry to encourage learners to explore the causes, effects and solutions of a given issue. Draw a tree outline and label the trunk with the chosen issue, the roots with the causes of the issue, the branches with the effects of the issue, and the leaves with possible solutions or ways to mitigate the issues.

Reference: [The Climate Learning Tree](#), Summer Praetorius

World's Largest Lesson: introducing the UN Sustainable Development Goals. What are the biggest issues faced in our community/ country/worldwide?

Mini Film show

Choose a couple of films from list below. These help to inform some of the issues for discussion later. If short on time recommend showing the first two from list below.

Land use: 'The UK in 100 Seconds': View via [this tweet](#). 1 second = 1% of the UK. Its key question is: 'Can we find [#MoreSpaceForNature?](#)' Enlightening & thought-provoking, it's an inspired way to stimulate discussion on nature & land use. (2 mins)

The Wildlife Trusts call for a Wilder Future: Voiced by some familiar actors, this film aims to inspire people to engage in nature's recovery [#WilderFuture](#) (2 mins)

Animation: [How Nature Can Save Us from Climate Breakdown](#) (2 Mins)

John Muir Trust & Channel 4's Jon Snow: [The Wild in Me](#) (2 mins)

STEM Challenge

Introduce [Great Schools Science Share](#). Describe how it links Sustainable Development Goals with STEM Challenges. Give participants the opportunity to create their own outdoor STEM Challenge using STEM Challenge Planning Sheets (see guidance note below and Appendix 1).

Exercise/Discussion (recommended 30 mins; preparation needed)

Split into groups and explore topics of:

- Biodiversity
- Forests and Land use
- Natural Resource use
- Adaption and migration
- Food and the environment

Steps

- Look at the resources available set out on each table for background and ideas (see below for suggested resources)
- Create an issues tree for a topic (Appendix 1)
- Complete a STEM Challenge Planning Sheet (Appendix 1). Incorporate taking this topic outdoors, linking with nature, STEM skills, other STEM By Nature themes...

Forests and Land use #Goal 15

Issue: Deforestation - how can we protect, restore and promote sustainable management of forests?

- Relate to films above
- Goal 15 Life on Land: [Scotdec resources](#)
- Forest for the Future: A [resource investigating trees, forests and climate change](#)
- Global Goals: [Make Space for Nature lesson plan](#)



Natural Resources use #Goal 12

Issues: Responsible consumption, use and overuse of natural resources.

How can we design for a better world? How can we learn from nature?

- [Ecological footprints](#)
- [Biomimicry](#) - designing to model nature
- [Ask Nature](#)
- Nano technology film: [The Strange New World of Nanoscience](#)
- [Design for a better world](#) competition (for 11-14 year olds)
- Technical solutions for climate change - renewable energy and landscape [example](#): Irish teenager invents magnetic liquid trap that can remove 90% of micro plastics from water
- Science Learning hub: [Measuring biodegradability](#)
- Global Goals: [Redesigning Plastic Packaging lesson plan](#)



Adaption and Migration #Goal 11

Issue: Inclusive, safe, resilient and sustainable human settlements.

What can we learn from natural migration and adaptability?

- [Forests for the Future](#): see 1.4 Race against time, 1.3 Winners & losers
- Migrations Open Hearts Open Borders [resource](#)
- [The Moth Migration](#) project and [Moths Count](#)
- Artist exploring bird and human migration: [Derek Robertson exhibition](#)
- [Nature's Calendar](#): seasons, climate and phenology
- Migratory birds - link these with the European countries they migrate to for natural and cultural learning. See the RSPB [Migratory Birds stories](#).



Food and the environment #Goal 2

Issue: Producing enough food and protecting the environment.

How can we achieve food security and promote sustainable agriculture?

How can we make space for nature?



- [‘UK in 100 seconds’](#) film
- [Mission: Explore Food](#): 159 food-related ‘missions’
- UN Global Goals lesson plan: [Food Tales](#)
- [The World Beneath our Feet](#)
- [The Importance of Earthworms](#)
- A portfolio of [Pollinators in Action](#)
- [Foraging wild food](#) monthly guide
- Global Goals [Circular economy and modern agriculture lesson plan](#)

Guidance for the STEM Planning Sheet (Appendix 1)

The sheet can be used to assist planning for a topic to engage with STEM by Nature. It is based on 2 sources:

- [5-minute lesson plan](#)
- The process suggested for STEM challenges by the [Great Science Share](#).

Using the Planning Sheet

What and Why? Top Row

Consider context

e.g. Global Goal(s) that are relevant,
Key Ideas, Curriculum Links

How? Middle Row:

What are the ‘learning episodes’ or activities to carry out, preferably with an outdoor/nature aspect?

What are will identify and address the issues/meet the curriculum aims? E.g.

- Explore the Sustainable Development Goals (e.g. string activity, animations, videos etc.)
- Big Questions (e.g. framing activity, create an issues tree with the issue of x)
- Investigate (e.g. carry out a survey, find out more, explore an environment)
- Design (what can be done to improve/solve issue e.g. make a change to school/centre grounds, plan an event within community, design own investigation, build a model of...)
- Share (ideas for sharing and engaging more people)

Note: the process of Explore, Investigate, Design, Share (reference pupil/learner enquiry) is a huge part of what makes this a STEM challenge.

The final two boxes are to help with planning (resources) and prompt thinking (around equity).

Activity Review

Brief round robin with each group outlining what they have developed, how they’ve gone about it, challenges, connections made etc.

Signposting and wrap up

Brief open discussion: ‘What can you take away with you from this session?’

Highlight [Resources padlet](#) for information links.

Propose/set up a Conversation padlet to share reflections, activities and comments.

Where do we start?

Step 1: Explore how the global goals are all interdependent using the Practical Action **Global Goals String Activity**. Download this and classroom display resources at www.practicalaction.org/global-goals.

Step 2: Let the children ask questions by talking about their feelings and opinions on the issue of saving their environment. Develop some questions into science enquiries so that they take the lead in making a change in their own homes, classrooms, schools and communities.

How much plastic do we throw away in our school?

How many food miles did our lunch travel today?

What can we do to improve the air quality in our playgrounds?

Step 3: Watch this short film by Emma Watson - a great way to start to think about this theme.

Step 4: Explore the wide range of STEM Challenges that focus on the Global Goals at www.practicalaction.org/STEM

Step 5: Tell us what you’re doing - what you’re thinking - using **Twitter @GreatSciShare**. It’s so important that young people have a voice throughout the year, not just on 16th June 2020!

Local Learning Task suggestions

Explore the Sustainable Development Goals with your class/group, and how they link to STEM, nature and outdoor contexts.

Create a STEM By Nature Challenge – using the STEM Challenge Planning sheet (Appendix 1) as starting point.

Make a pledge: [#iWill4Nature](#).

Take a look at the [Learning for Sustainability Self-Evaluation and Improvement Framework](#).

Signpost to resources (include these in a follow up email to participants)

Have hard copies (or web access and links) of these resources available for participants to view:

[Global Goals Lesson Plans](#)

Connecting Classrooms [information](#)

John Muir Award [Sustainability Resource Guide](#)

[Curriculum for Excellence and the John Muir Award](#)

Equipment list (suggested)

String

[Photos](#) to illustrate the UN Sustainable Development Goals.

Print out of the UN Sustainable Development Goals and [Good Life Global Goals](#).

Ipads

Session Guidance produced by:

Rebecca Logsdon for John Muir Trust, Katie Rudge & Rob Bushby for FSC Scotland

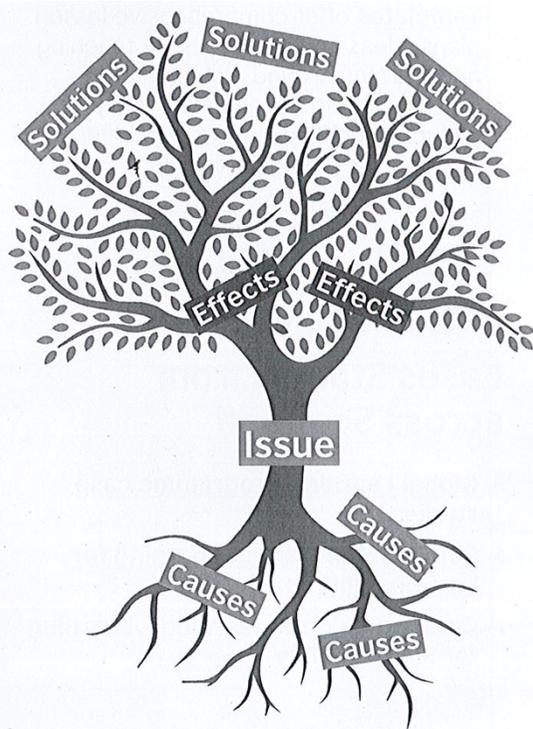
Appendix 1

Resources: Issues Tree, STEM Challenge Planning Sheet (Reference: the [Great Science Share](#))

Issues Tree

Use the space to create your own Issues Tree

(Reference: [Connecting Classrooms](#))



Sustainable Development Goals: STEM Challenge Planning Sheet

Inspired by the Great Science Share <https://www.greatscienceshare.org/2020-sustain>

Global Goal # _____

Key Ideas

Curriculum Links (consider Learning for Sustainability and STEM skills)

5 Steps for a STEM Challenge: in each space list activities/learning episodes that you could do around your theme. **Remember to think of using outdoor spaces and Nature activities.**

1. Explore (the Global Goals)

2. Big Questions

3. Investigate

4. Design

5. Share

Resources/Equipment/Films

Equity/Accessibility/Opportunities to engage with community



FOR wild LAND & wild PLACES

