

# **STEM By Nature: Trees, Woods & Forests**



Scottish  
Forestry  
Coillteachd  
na h-Alba



## **STEM By Nature:**

***STEM teaching & learning in nature settings, using Outdoor Learning approaches***

**Guidance for a 2-3-hour training session with a Trees, Woods & Forests focus**

This session introduces and explores what is meant by 'STEM By Nature' and how Trees, Woods & Forests can offer a rich source of information, resources and activities in relation to it.

Guidance 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's designed to be delivered by non-specialists – you don't need to be an expert in STEM learning or the outdoors, or trees.

### **STEM By Nature: Trees, Woods & Forests – 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 information, resources and activities relating to Trees, Woods & Forests.
- Highlight Curriculum for Excellence and STEM connections, including examples and opportunities for:
  - Interdisciplinary Learning
  - showing how Trees, Woods & Forests can relate to the 4 Contexts, equity and work skills.

### **Structure and Context**

Information, resources and activities relating to Trees, Woods & Forests are signposted throughout. Connections can be made with themes such as [Citizen Science](#) or creativity in STEM learning. [UN Sustainable Development Goals](#) can offer a context e.g. #13 Climate Action, #15 Life on Land, #4 Education, or other relevant Goals relating to ecological issues and sustainable systems.

A session can be delivered to give a broad overview of links between STEM and Trees, Woods & Forests, or adapted to focus on a specific subject, theme or context.

This Trees, Woods & Forests session is part of a growing portfolio of STEM By Nature guidance, currently covering [STEM By Nature - An Introduction](#), [STEM By Nature & Citizen Science](#), [STEM By Nature & Sustainable Development Goals](#), STEM By Nature & Climate [tbc].

A [STEM By Nature Information & Resources padlet](#) and [Outdoor & Woodland Learning Scotland](#) offer a wide range of tree-related and outdoor learning resources.

### **Timings for a 2-3 hour session (suggested)**

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

## **Welcome and context setting** (10–20 mins)

As participants gather set an ice-breaker (relating to trees) with an open, leading question or two e.g. “What’s your favourite tree, and why?”. (Alternative: “How confident do you feel about identifying different types of tree...and does this matter?”). Collate responses on flip chart, 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 Trees, Woods & Forests to support STEM-related teaching.
- Have explored how Trees, Woods & Forests offer contexts, ideas and inspiration for progression in learning, and can contribute to a range of 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: Trees, Woods & Forests – how they do/can feature in education, in a STEM context, helping deliver STEM learning.
- Note any relevant local links to Outdoor Learning, STEM, Trees, Woods & Forests resources; acknowledge any relevant expertise within group (and incorporate as appropriate).
- Note the inclusive ‘educator’ audience: the session and guidance are relevant to a wide range of ages and backgrounds, not just schools/teachers.
- Note that opportunities to make links with Interdisciplinary Learning and to explore [equity](#) in STEM learning can be shared throughout. 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 Trees, Woods & Forests (Appendix 2).

## **Outdoor Activities – Trees, Woods & Forests focus** (1-2 hours, adapt for time and settings available)

Activities are presented as introductions, options and ‘tasters’ rather than to be 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, progression in learning, and Interdisciplinary Learning
- 4 STEM subject areas of Science, Technology, Engineering, Maths, plus Arts, Creativity & Literacy
- resources available to support participants beyond this session.

## **Outdoor Icebreaker – Outdoor Learning journey** (5-10 mins)

Ask participants to arrange themselves in a ‘scale of experience’ semi-circle, based on where they are in their own Outdoor Learning journey (using the outdoors frequently/ infrequently). Discuss briefly. Optional/Alternative: In pairs, share at least one connection between Trees, Woods & Forests and STEM (e.g. awareness of an activity, resource, subject link).

## **Activity Plan – research, select and plan from the following themes and activities**

### **Science: Trees, Woods & Forests** (link to Biodiversity, Biology, Chemistry, Geography)

Learning about science outdoors can encourage deeper thinking about the use of resources and the impacts this might have. It can demonstrate the wonder and scale of the natural world. It can encourage curiosity and care, and promote interaction with the living world in a climate of safety and respect. Natural settings and resources can bring abstract science concepts to life, and explore their practical relevance.

Use Trees, Woods & Forest settings for meaningful contexts, opportunities for dialogue, and to help develop scientific and mathematical language.

- **Plant seeds/nuts, grow a tree, adopt a street tree**

Collect or give out a seed/nut. [Seed source guidance](#); [Collecting tree seeds](#); [Sowing tree seeds](#). Find out about [Street Trees](#). Research, explore, discuss (in small groups) learning opportunities and associated issues for this as a short and/or extended activity. Examples: growth stages, tree types, places to plant/‘right tree right place’, biodiversity, carbon cycle, photosynthesis/chemical reactions, greenspace in town planning, landscape elements, ecosystem services, health & wellbeing, drawing/art, literature...

- **Tree identification**

Get to know some of [Scotland's tree species](#) that make up our communities and forests. Learn their stories and find out about their many practical uses.

- **How a tree works**

Explore ‘[How a Tree Works](#)’, and how it is a function of its different elements – Roots, Trunk, Branches and Leaves - and their roles in making use of Soil, Air, Rain and Solar Energy.

See ‘[How a Tree Works Activity Plan](#)’.

- **Forest cycle**

Explore the ‘forest cycle’ of ‘plant, grow, fell, replant, grow, fell’ with [The Woodland Management Tree Cycle](#) Resource Cards.

- **The world beneath our feet**

Use a series of [activities to investigate soil](#), one of the world's most precious and overlooked resources, to connect soils and curriculum.

- **Life in a forest**

Find out about [Animals & plants in a Scots pine forest](#); explore [The web of life in a Scots pine forest](#).

- **Leaf looking, Tree naming**

Encourage curiosity, enquiry. Pick up a leaf. See how many words can be associated with it – individually and/or collectively. See [Leaf](#) by Steve Smart. As this short [Lost Spells: Silver Birch](#) film plays, note down tree parts mentioned, habitats, nature associations. (Use as an indoor option, or with phones/tablets outside; find a birch tree and stand touching it as the spell is read).

- **Record and Survey forest sounds**

[Sounds of the Forest](#) is collecting sounds of woodlands and forests from around the world, creating a growing soundmap and open-source library of aural tones and textures from the world’s woodlands.

- **Tree health, pests & diseases**

The [Tree Pest and Disease Information Series](#) – with a scene-setting Introduction and 8 information sheets - can be used in schools and learning settings to raise awareness about tree health. Also see [Tree Alert](#) (and its poster of priority pest and diseases) and [Observatree](#).

## **Science & Climate: Trees, Woods & Forests:**

See a [STEM By Nature & Climate Action](#) companion session [tbc], and Scottish Forestry information on '[Trees & Climate](#)' [tbc].

- [\*\*Nature's Calendar\*\*](#)

See phenology - the study of cyclic and seasonal natural phenomena - in action. [Track effects of weather and climate change on trees](#) (and wildlife) from leaf buds bursting to first ripe fruit to leaves falling.

## **Technology, Engineering: Trees, Woods & Forests**

Trees feature in the earliest constructions and are part of modern engineering. Make connections between our past, present and future; reflect on designs and materials; explore [biomimicry](#), "the science and art of emulating Nature's best biological ideas to solve human problems".

Discuss how trees, through technology and engineering, influence all our lives.

Consider work-related learning and tree-related careers, links between consumption and forestry resources, natural regeneration and principles of sustainability.

- [\*\*Build a structure/den\*\*](#)

[Build a structure](#) one metre high from natural materials. Agree criteria such as accuracy of height, purpose of the structure/den, load-bearing capacity and structural strength. Explore techniques and ideas used in historical and modern buildings. See [Woodland Hideaways](#), too.

- [\*\*Wood survey\*\*](#)

Investigate what kind of products are made from wood, how many are used in our everyday lives, and explore different types of products derived from trees. (Also: represent data in different ways).

- [\*\*Where does our wood come from?\*\*](#)

Explore the global dimension of the wood we use; stimulate awareness and discussion about ethically and sustainably sourced wood products.

- [\*\*The Story from tree to table\*\*](#)

Study the process of producing a table from a tree. Put the step-by-step sequence in the right order.

## **Maths: Trees, Woods & Forests**

Look at a tree and you're facing a maths resource. Stand in a forest and you're surrounded by opportunities for measuring, surveying, counting, sequencing, and exploring shape/size/age/patterns/symmetry...all of which can help build mathematical skills.

- [\*\*Mathematics & Numeracy booklet\*\*](#)

From Natural Resources Wales, this resource includes a range of tree-based maths activities. Invite participants to select and run their own mini-session (manage according to time available).

- [\*\*Tree measuring resource\*\*](#)

Make Curriculum for Excellence links with activities identified for Early/First Level (P1/P2-P4), Second Level (P5-7), Third/Fourth Level and Senior Phase (S4-6), reflecting Education Scotland's guidance across learning and numeracy and mathematics benchmarks.

- [\*\*The Deadwood Survey\*\*](#)

Is the deadwood in your wood dead good? Find out with this simple survey from TCV.

## **Arts, Creativity & Literacy: Trees, Woods & Forests**

Bring tree-based creative approaches into STEM teaching. Explore STEAM – STEM plus Arts.

- [\*\*Tree Stories\*\*](#) (and [\*\*Tree Stories in Gaelic\*\*](#))

Read and discuss any of the monthly stories about a Scottish tree. Use supporting information, folklore, recipes and facts about each tree to highlight seasonal patterns and their role in our lives.

- **Wolf Brother**

A [\*\*Wolf Brother Wildwoods\*\*](#) resource brings the Mesolithic period to life through a series of woodland and classroom learning activities.

- **Literacy & Nature**

A John Muir Award [\*\*Literacy & Nature Resource Guide\*\*](#) highlights how nature and the outdoors can inspire and support literacy skills, and can easily be adapted for a STEM learning context.

- [\*\*The Lost Words\*\*](#)

Information & resources include a free [\*\*Explorer's Guide\*\*](#) download (and [\*\*The Lost Spells Explorer's Guide\*\*](#) for Heartwood, Beech and other links) plus [\*\*posters\*\*](#) of Conker, Bramble. There's a [\*\*Lost Words padlet\*\*](#) for sharing creative outputs. See [\*\*#TheLostWords\*\*](#).

### **Review Activities** (20 - 30 mins, outdoors or inside)

#### **4 Contexts for learning – see Appendix 1**

Consider activities and ideas arising from the session, and how Trees, Woods & Forests can relate to the 4 Contexts for learning in the Refreshed Curriculum.

#### **STEM Skills, Evaluation – see Appendix 2**

Review the session's outdoor activities using the [\*\*STEM skills map\*\*](#). Highlight particular skills used and/or developed, and/or their potential with relevant groups.

#### **Signposting and wrap up** (10 mins)

Open discussion/round robin: "What can you take away with you from this session?"

(If feeling creative, discuss in terms of roots, trunk, branches, leaves/fruit, perhaps with visual aids).

Highlight the [\*\*STEM By Nature Information & Resources padlet\*\*](#): a place to collate relevant and referenced resources (along with other relevant resource locations e.g. Glow).

If suitable, create a padlet/forum to share participant conversations and activities.

Note use of relevant hashtags for social media sharing e.g. [\*\*#STEMByNature\*\*](#).

#### **Local Learning Task suggestions** (if suitable)

Encourage participants to follow up on the session.

- Get outside in local settings. Walk for 10 minutes from your home or school setting. What variety of trees do you see? Try out some of the activities and resources relevant for your location. Think about your learners' needs, their progression in learning, and outdoor opportunities for cognitive and emotional engagement.
- Discuss with colleagues ways to use the [\*\*STEM Self-evaluation and Improvement Framework\*\*](#): "a framework to stimulate dialogue and action towards a whole setting approach to STEM".
- Explore other STEM By Nature sessions, and the [\*\*Information & Resources padlet\*\*](#).
- Create a Trees, Woods & Forests-focused Interdisciplinary Learning project. Encourage learners to transfer skills and knowledge between discipline areas through:

- short-term one-off projects linked to an event, such as an open/parents' evening
- medium-term shared units of work and residential trips
- long-term projects such as school grounds or local community greenspace developments; seasonal monitoring; achieving awards such as John Muir Award, Junior Forester Award.
- Attend or set up a virtual 'any time, any place' [Working in Wellies Careers Event](#).
- Share a photo-quote/tweet.

### **Review objectives**

Reflect on the session, and whether aims and specific objectives have been addressed and met.

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### **Trees & Forests Resources – links and signposting**

[Outdoor & Woodland Learning Scotland Resources](#) Learning resources including project reports, guidance notes, research can be searched using keywords, by topic, or age and stage.

[Scotland's Outdoor Learning Directory](#) A portal to services supporting outdoor learning provided by organisations that are part of the Scottish Government.

[Natural Resources Wales: Trees & Woodlands](#) A range of resources to help find out about woodlands and trees.

[The Woodland Trust](#) Educational resources to help plan and deliver outdoor learning. Its online learning hub [Tree Tools for Schools](#) supports its free tree packs (with all you need to plan, plant and care for your trees), includes Nature Detectives activities, tree ID sheets, a range of interactive activities and printable worksheets for classroom or outdoor use. Resources link to the KS1 and KS2 curriculum but are suitable for Scotland and searchable by keyword, topic or curriculum area.

[Nature's Calendar](#) Record details of plants, animals and fungi to help understand how nature is affected by weather and climate change.

[Juliet Robertson/Creative Star Learning](#) - a comprehensive [Index](#) of ideas and articles; author of 'Dirty Teaching: a beginners guide to learning outdoors', and 'Dirty Maths'.

[John Muir Award Surveys Resource Guide](#) An overview of surveys, and useful websites.

[John Muir Award Sustainability Resource Guide](#) An overview of Sustainability, and associated resources.

[John Muir Award Literacy & Nature Resource Guide](#) Highlights how nature and the outdoors can inspire and support literacy skills, and integrate with other subject areas.

[FSC guides](#) A range of highly respected guides, charts and handbooks from Field Studies Council Publications.

[Tree Pest and Disease Information Series](#) 8 information sheets (& a scene-setting Introduction) highlight key pest and disease threats to Scottish trees.

[Tree Alert](#) Its poster of priority pest and diseases, and [Observatree](#), help to look out for unusual pests and diseases, and are a way to report unusual sightings.

[Our Forest Our Future](#) Explore the interdependence of people and forests and the vital role forests play in sustaining our environment.

[Benefits of Biodiversity](#) Find out more about how biodiversity underpins all our lives and contributes to our wellbeing, culture and economy.

[Beyond your boundary: easy steps to learning in local greenspace](#) A resource and supporting documents to help you to find, access and use your local greenspace for learning.

## **Leaders' Notes**

### **Equipment (suggested)**

Identification guides e.g. FSC publications, tablets/devices for taking photos for identification.

Print-out or hard copies of OPAL Tree Health Survey, Observatree pest and diseases poster.

Copy of Tree Stories, Wolf Brother, The Lost Words Explorer's Guide resources.

Clip boards, paper, pencils.

Session guidance produced by Rob Bushby for Scottish Forestry, February 2021

## Appendix 1: The 4 contexts for learning: Trees, Woods & Forests

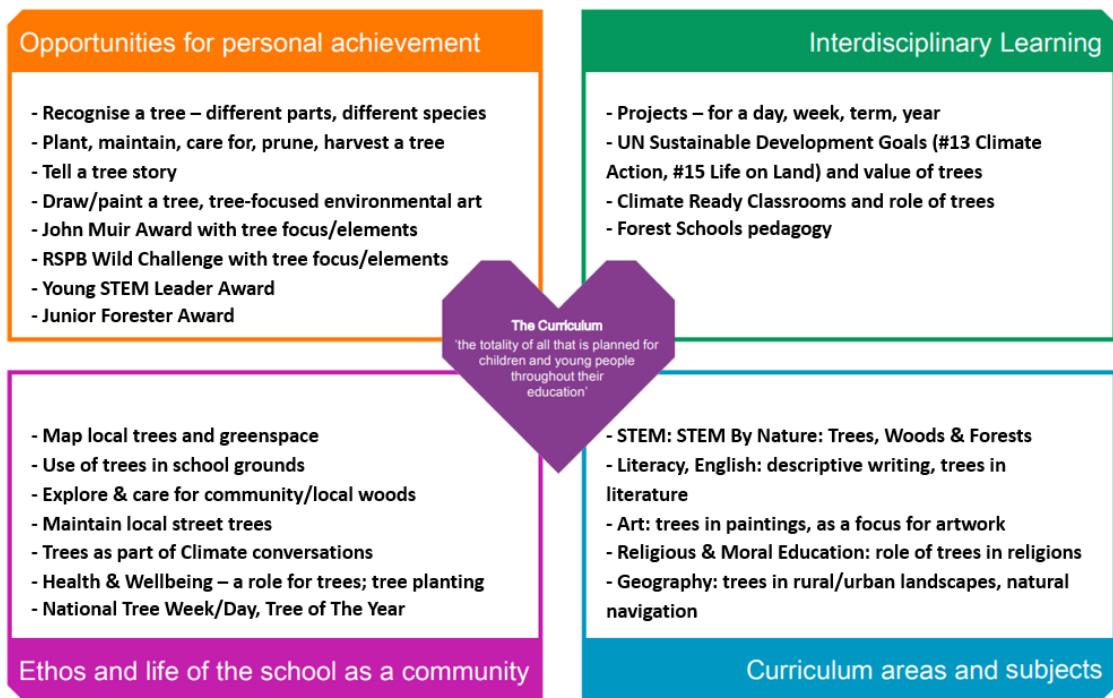
Scotland's curriculum – Curriculum for Excellence – aims to help children and young people gain the knowledge, skills and attributes needed for life in the 21st century. A [refreshed narrative on Scotland's curriculum](#), published in September 2019 and available in English and [Gaelic](#), sets Curriculum for Excellence within contemporary contexts.

"As part of their learner journey, all children and young people in Scotland are entitled to experience a coherent curriculum from 3 to 18, in order that they have opportunities to develop the knowledge, skills and attributes they need to adapt, think critically and flourish in today's world.

Curriculum is defined as the totality of all that is planned for children and young people from early learning and childcare, through school and beyond. That totality can be planned for and experienced by learners across **four contexts**: Curriculum areas and subjects, Interdisciplinary Learning, Ethos and life of the school, Opportunities for personal achievement."

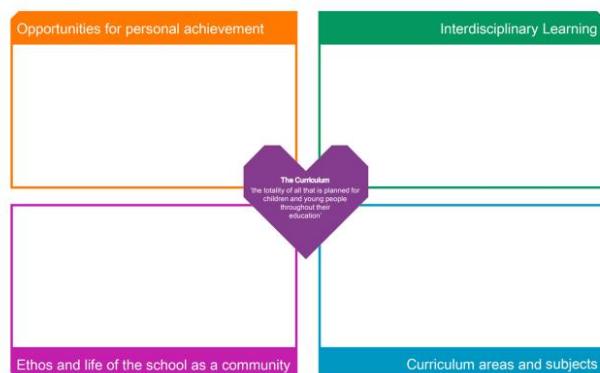
4 contexts-related [Examples](#), [Templates](#), and a [PowerPoint Presentation](#) are available.

## Learning across the four contexts with Trees, Woods & Forests



Use a **blank template** for discussing contributions of Trees, Woods & Forests - explore inputs, links and opportunities.

### Learning across the four contexts with Trees, Woods & Forests



## Appendix 2: Top 10 employability skills

Audit these employability skills in terms of 'STEM By Nature: Trees, Woods & Forests' activities, learning and reflections.

