BRITISH SOCIETY OF SOIL SCIENCE

Response

OCR consultation - GCSE Natural History

The British Society of Soil Science (BSSS) is an established international membership organisation and charity committed to the study of soil in its widest aspects. The society brings together those working within academia, and practitioners implementing soil science in industry. Soil scientists' research findings are essential for investigating the feasibility of agricultural, landscaping, construction, conservation and archaeological projects. Our members are employed by both private and public sector institutions including academic universities, conservation charities, construction companies and consultancies.

About Soils

Soils are dynamic systems that form over millennia, comprising a complex mixture of minerals, organic matter, water and air. When combined in soil, the co-existence of water, air and essential nutrients (provided by minerals and organic matter) form the foundation of all terrestrial ecosystems. Indeed, in many cases, soil geochemistry, hydrology and/or physical characteristics are key determinants of habitat ecology.

Aside from being the foundation of terrestrial ecosystems, soil is an ecosystem in its own right, that supports the life of many organisms both influencing and being influenced by soil type. Whilst the life that soil supports above ground is readily observed, below the surface soil provides a habitat for many more organisms at various stages in their life cycles. Many organisms live on the soil surface (or in leaf litter), yet others live entirely within the soil and are only encountered when exploring below ground. In addition to the organisms that are observable to the naked eye, soils host an unrivalled diversity of microbial organisms that has only recently been appreciated. Just one gram of soil can contain several billion bacteria from thousands of different species, whilst mycorrhizal fungi form relationships with plant roots that are critical to the health and sustainability of woodland ecosystems.

Of the themes suggested for this GCSE in Natural History many would be strengthened by the inclusion of different aspects of soil science:

Theme 1 The Natural Shaping of the World

Soil is an essential landscape component. It changes through time and, as it does so, results in changes to the species assemblage of flora and fauna that it supports. In the UK, the soils strongly reflect our recent glacial history, with many soils being relatively young (~10,000 years old) due to the erosional processes that dominated during the last glacial maximum.

Theme 3 Flora and Fauna

Soil biodiversity is crucial for ecosystem sustainability; the ecology of a system should not be considered in isolation from the soil system. Soil biodiversity supports many inter-relationships between flora and fauna that are crucial for ecosystem functioning, which includes the association of plant roots with mycorrhizal fungi.

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Theme 4 Human Impact on the World

Climate change both influences the soil and is influenced by it. Many studies highlight the potential for intensified and wet and dry periods due to climate change, with increased incidence of floods and droughts already being reported. Early civilisations impacted on soils of the Mediterranean area by land clearance and over-cultivation. Modern day impacts include areas of Central America where forest clearance and associated soil degradation has had wide-ranging impacts on ecosystems.

Agricultural land management practices often lead to the release of CO2 to the atmosphere due to the oxidation of organic matter, hence contributing to climate change. There is emerging evidence that promotion of conservation farming methods make soils part of the solution for mitigating climate change. Aside from climate change, some soils (e.g. peats) act as archives of natural history, presenting sequences of vegetation change (and implicitly, human impact) via pollen diagrams.

Theme 5 Our Changing View of the World

Soil is an integral element of our cultures, both nationally and internationally. Soils have provided pigments for paints which were used to paint murals, (e.g. cave paintings) many of which represented elements of natural systems. Soil is represented in both national and international art and literature featuring in work by John Steinbeck, John Clare, Vita Sackville-West to name just a few. The children's writer Julia Donaldson even penned a book about Superworm! Roger McGough's poem Soil depicts his relationship with the outdoor world.

In the 18th Century, the Scottish polymath James Hutton was influenced by soil when challenging the then-accepted idea that the Earth was only thousands of years old. By observing soils being transported away from his fields through erosion, Hutton asserted that these losses must be counteracted by the formation of new soil in processes that take far longer than such a young Earth would allow. Ultimately the resulting concept of "deep time" from Hutton's observations of soil and geological unconformities completely changed our view of the world and its age.

An overarching concept that straddles the themes described above are the 5 factors of soil formation as described by Hans Jenny in 1941, namely climate (CL), organisms (O), topography or relief (R), geology or parent material (P) and time (T). The acronym CLORPT can be used to illustrate the importance of soil across a wider range of disciplines.

Skills development

The study of soil creates many opportunities for skills development that marry with those suggested to be developed by this course. Soils can be observed and easily described in the field to assess important properties such as texture, structure, pH, organic material etc. Distribution of soil material can provide insight into presence of organisms present within the soil e.g. termite mounds and ant hills. Students can develop cartographic skills by soil mapping, for example, plant distribution against soil type or soil properties eg. soil development alongside vegetation development in dune systems or exploring the linkages between soils and the underlying geology. The study of soil meso/micro-organisms can foster skills in microscope use and encourage understanding of the soil ecosystem.

Studying soil can lead young people into a range of career options as diverse as environmental remediation and management, agronomy; civil engineering, climate change science to landscaping and horticulture. The importance of soil science as a career path was recently eloquently articulated by the British Society of Soil

Science Patron, HRH The Duke of Gloucester when speaking to early career researchers, who stressed that the role of the soil scientist in the future could not be overstated as, *"they are in the frontline of the battle against the effects of climate change".*

For further information and to discuss this response in more detail, please contact:

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