# Overview: Sustainable palm oil

Welcome to what we hope will be an engaging set of resources to extend your knowledge and interest in Conservation issues generated around the topic of Sustainable Palm Oil. This may be the first time you have come across this topic, in which case some of the ideas in the KS2 Resources Pack (link), may be of interest particularly the survey about the prevalence of palm oil (sustainable or not) in our everyday lives. The most definitive statement in a 140 page report produced by the IUCN Oil Palm Task Force concluded "one common thread that runs through this report is that Palm Oil is here to stay" in which case our need to understand the history, science and social implications of this product become even greater and our role to inform and educate cuts across disciplines and requires a varied skill set. The IUCN panel includes scientists, environmentalists, economists and local governments and NGOs.

These resources are therefore broadly cross-curricular supporting young people's learning in **English, Maths** and **Science** but also in **History** and **Geography.**

How you use the resources is your decision, we are not prescriptive.Timetabling is likely to mean that the time when the English department studies 'persuasive writing' for example is not the same time that Science covers 'plant cell structure' or History look at the Empire. We recognise how hard it is to coordinate such synchronicity across a school even across the Key Stage. However, an off timetable day may be just the opportunity you need in which case theming it upon **Conservation and Biodiversity** would make a broad umbrella under which all these topics are relevant with knowledge from one theme cutting across and enhancing the learning in another.
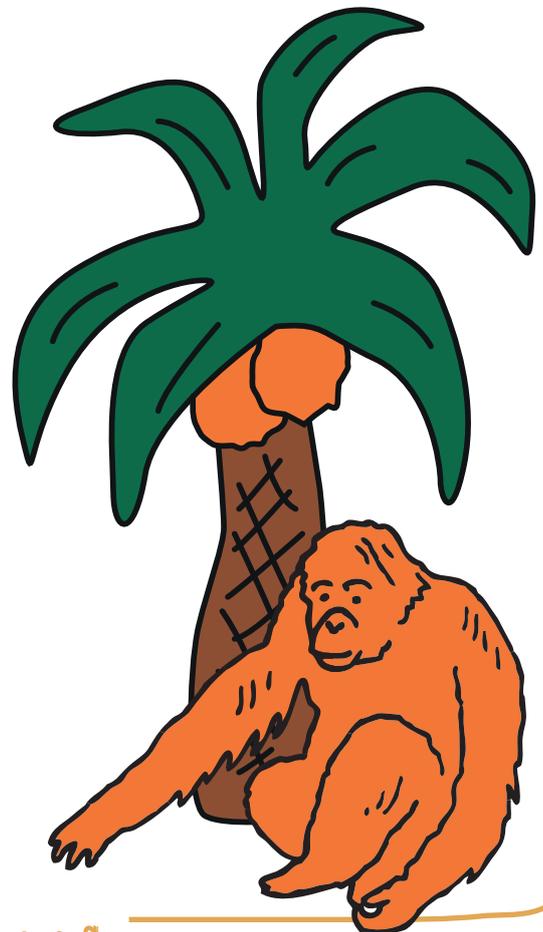
Palm Oil is definitely a current problem but we need to look back at **History** to see why this is the case and think about when and why the world became 'addicted' to Palm Oil (History – Impacts of Empire). Before we can really understand the magnitude of the problem, we need tools to help our understanding of the units used to measure palm oil production and then we can analyse data and use our number handling skills in Mathematics to look at data which gives us evidence linked to the scale of palm oil production. Scale of production is one use of the word 'scale' but in Science it has a slightly different meaning, and there are many scales in which we can view palm oil trees. For many of us, it will simply be pictures in books and the internet showing trees and (extensive) plantations. But of course we can look closer, and microscopes allow us to do this. Microscopes are the backbone of studying biology. Biologists use them to view the details that cannot be seen by the naked eye (Science – Magnification and Scale). We have used this project and the palm oil plant to help us learn more about plant cell structure (Science – Plant Cell Structure), understand how it is adapted for life in the tropics and demonstrate the power of both a light microscope and a scanning electron microscope. Palm Oil is an example of a flowering plant (an angiosperm) that man has exploited and developed, realising that food and other useful products can be obtained from it. These products require an understanding of flower structure and fruit formation so we have used the Palm Oil plant in this context as well *(Science – Flower & Fruit Formation).*

This exploitation of the plant, into a crop grown extensively across the tropics to produce food oil and related by-products has seen the development of extensive production facilities together with the related infrastructure. Arguably it is the development of such infrastructure that creates the problems (as opposed to the crop itself) with demand for jobs and workplaces (human needs) clashing with and changing landscapes; impacting upon the environment and the climate. Our Geography resources address these issues providing a case study looking at palm oil production processes, together with an activity that links the SDGs (Sustainable Development Goals) to Palm Oil production (for better or for worse). For Sustainable Palm Oil Production, we need to ensure human activities associated with Palm Oil production align as closely as possible with natural systems.

With so many different voices and opinions, and the need for change greater than ever before, our resources suggest some ways in which your pupils can use these topics (and the background information provided) to develop their skills in persuasive writing complementing learning objectives in their English curricula. The strong images used throughout these resources, many generated exclusively for this project, would also provide tremendous stimulation material for art projects and creative writing.
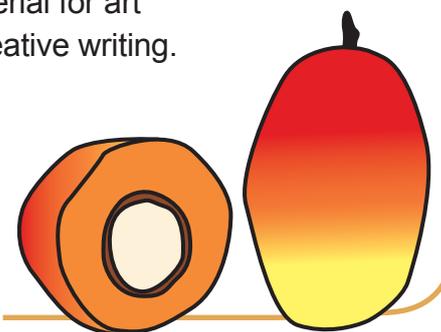
Before you begin let us just make a short introduction to the concept of **Biodiversity** and **Conservation** so that these terms are clearly understood no matter what your entry point is.

Palm Oil is a highly controversial issue, considered by many to be one of the greatest threats to tropical biodiversity. **Biodiversity** - as defined by WWF - is all the different kinds of life that you will find in one area; the variety of animals, plants and micro-organisms that make-up our natural world. Each living thing works together in an ecosystem, like an intricate web, to maintain balance and support life. You can think of all these living things being dependent on one another, like a large Jenga puzzle – so the removal of any pieces makes the structure (the ecosystem) potentially unstable.

Much of the Earth's biodiversity is in jeopardy due to human consumption and other activities that disturb and even destroy ecosystems. Agriculture and aquaculture globally (inc. Palm Oil production) rank as the most common threats to species listed on the IUCN Red List. Pollution, climate change and population growth are all threats to biodiversity causing unprecedented rises in the rates of species extinction. **Conservation** may be defined as the management of natural resources to prevent exploitation, destruction or neglect (National Geographic), and conservation efforts are therefore necessary to preserve biodiversity and protect endangered species and their habitats.

We know that less diverse ecosystems are less productive and less stable, so loss of biodiversity may weaken ecosystems further and make them more fragile (Cleland, 2011).

OP plantations, while extensive green landscapes that are viable for 25-30 years, are much less diverse than tropical rain forests (established over hundreds of years) and as a result local species diversity declines. The plantation themselves also disrupt the 'travel corridors' that animals use to move safely through the forest with the protection and cover 'running out' at some points adjoining OP Plantations and the infrastructure associated with OP fruit harvesting and processing creating a high-risk environment with many animals being injured or killed from wildlife-vehicle collisions (WVC) and an increased risk of poaching. WVC is not just a problem in rain forests – see below for some data gathered by a citizen - science project in the UK.

Deforestation

is the purposeful clearing of forested land.

Read more here
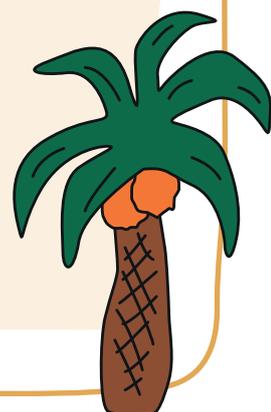
Deforestation

It has been happening for thousands of years. About 2,000 years ago, 80 percent of Western Europe was forested; today the figure is 34 percent. Today, it's the rainforests where deforestation is most prevalent and has the most impact on wildlife (being the most biodiverse landscapes on Earth).

It also leads more immediately to problems of soil erosion, increased vulnerability to forest fires and to the release of more CO2 into the atmosphere from burning wood (that contains chemically bound carbon) with a reduction in the number of trees reducing the planet's ability to absorb CO2 through photosynthesis (CO2 + water $\longrightarrow$ glucose + Oxygen).

Mathematical modelling is used extensively to see the impact of deforestation in the future (based on current rates of loss) and is vividly illustrated here **Why is Deforestation a Problem? (theworldcounts.com)** Habitat loss caused by deforestation and fire, prior to OP development, has the main direct impact on biodiversity - although it is not quite that simple and other local issues need be examined because while in parts of the tropics it can cause up to 50% loss, globally OP development accounts for <0.5% of all deforestation (Meijaard *et al*., 2018). Other impacts include -

- Greenhouse gas emissions related to deforestation and peat damage
- Fire in land clearance, creating issues of smoke-haze and pollution
- Invasive species associated with OP developments
- Species displacement leading to human-wildlife conflicts leading to conflict killings (that are proven for orangutan, tigers, elephant and rhinoceros)
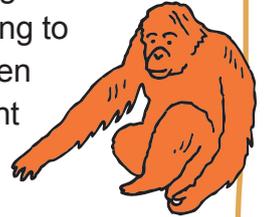
In very simple terms, measures need to be put in place to ensure that the trees are worth more alive than dead. The situation with deforestation is improving slightly. Deforestation linked to palm oil in Indonesia, Malaysia and Papua New Guinea 'has fallen to its lowest level since 2017' *(EPOA)*. This will be in part due to commitments by some larger companies to sign-up to NDPE (No deforestation, No Peat, No Exploitation) - explained **here**. However, smallholders (who account for some 40% of worldwide PO production) are not part of such commitments and so further education and messaging is vital. This data can be explored further in **an Infographic** produced by EPOA (the European Palm Oil Alliance) and highlighted in the 8-things you need to know about Palm Oil produced by WWF **(8 things to know about palm oil | WWF)**. Pollution, climate change and population growth are all threats to biodiversity, increasing rates of species extinction (Royal Society) Conservation efforts are necessary to preserve biodiversity and protect endangered species and their habitats. Palm Oil certainly impacts negatively on biodiversity, although it is far from the only driver of global biodiversity loss, with agriculture and aquaculture more generally ranking as the most common threat to species.

Biodiversity - closer to home

In the UK alone, wildlife-vehicle collisions account for 1000's of animal deaths each week as we struggle to reconcile our co-existence alongside native species of wildlife. Your students may find it interesting to look at summaries of several citizen science projects exploring issues around WVC and deaths - **https://www.gocompare.com/car-insurance/uk-deadliest-roads-for-animal-collisions/**

In a report published in 2021, Raymond et al. suggest that the impact of UK roads on wildlife has likely increased over the last 50 years due to expansion of road infrastructure and an increase in vehicle use. The number of vehicles on UK roads has increased almost 10-fold between 1951 and 2016 (65 years), and the length of the road network in the UK also increasing significantly in that time. Alongside this national estimates of annual wildlife mortality due to roads in the UK include 50,000 badgers being killed and between 167,000 and 335,000 European hedgehogs (Erinaceus europaeus), representing 10–20% of the latter species' annual mortality. How many of your students regularly see pheasant, deer or foxes dead at the side of the road? Is this effect constant throughout the year? Are there measures we can adopt to think about our own efforts towards conservation locally, nationally and internationally? A discussion about this topic, could easily lead to insights about food chains and food webs and allow students to apply their knowledge and learning to real-world situations.

We are grateful to Phil Smith from the Teacher Scientist Network for the creation of this toolkit of resources and the light and scanning electron microscope images included, created by the Bioimaging department at the John Innes Centre (JIC).

References

Cleland, E. E. (2011) Biodiversity and Ecosystem Stability. Nature Education Knowledge 3(10):14 Available at, **https://www.nature.com/scitable/knowledge/library/biodiversity-and-ecosystem-stability-17059965/**

Meijaard, E., Garcia-Ulloa, J., Sheil, D., Wich, S.A., Carlson, K.M., Juffe-Bignoli, D., and Brooks, T.M. (eds.) (2018). Oil palm and biodiversity. A situation analysis by the IUCN Oil Palm Task Force. IUCN Oil Palm Task Force Gland, Switzerland: IUCN. xiii + 116pp. ISBN: 978-2-8317-1910-8 (PDF) 978-2-8317-1911-5 (print version) DOI: **https://doi.org/10.2305/IUCN.CH.2018.11.en**

Raymond S, Schwartz ALW, Thomas RJ, Chadwick E, Perkins SE. (2021) Temporal patterns of wildlife roadkill in the UK. PLoS One. Oct 6;16(10):e0258083 **https://doi.org/10.1371/journal.pone.0258083**

Royal Society webpages (accessed 17/03/23) **https://royalsociety.org/topics-policy/projects/biodiversity/**