From Steaming Swamp to Blanket Bog

An exhibition of photographs taken on fieldwork in the Peruvian Amazon

Worksheet (Level 3–4)

Use this worksheet to help you think about the concepts, ideas, facts and experience portrayed in this exhibition. The answers could be in the pictures or in the captions (the picture numbers are given in brackets) or might need you to think more widely about what you've seen and use some of your own knowledge. You can answer the questions as you go round the exhibition, take the worksheet away with you and think about it afterwards, or a combination of the two.

You can find the answers to the questions below (and all of the pictures) on the exhibition website: https://peatlands.wp.st-andrews.ac.uk/educational-materials/, by clicking on the document, *Levels 3 & 4 Worksheet – Answers*.

1) What is this palm called? Give both the common (local) name and the scientific or botanical name. Can you name any other plants that are common in Peruvian peatlands? (2, 6, 7, 8, 10)

Common name in Peru: *aguaje*

Botanical name: *Mauritia flexuosa*

Other plants of Peruvian peatlands: *Cecropia* sp., *Euterpe precatoria*, *Montrichardia* sp., grasses, sedges, ferns.

Scientists often shorten species (singular) to sp. and species (plural) to spp.

2) Name and describe one feature of this palm which allows it to survive in waterlogged conditions. (4)

Aerial breather roots or pneumatophores allow *Mauritia flexuosa* to survive in very wet or flooded soils. Rising above the surface of the soil and above the water level, they act a little like snorkels, allowing gas exchange in the roots (root respiration: oxygen in, carbon dioxide out) throughout the year. If the water level rises too high (above the height of the pneumatophores) for too much of the year, *Mauritia* cannot survive.

3) The tree *Cecropia* is common in the floodplains of the Amazon. Make a list of its ecological characteristics. (8, 9)

Species of the tree genus *Cecropia* are fast-growing. They thrive in light conditions and can grow on unstable riverbanks and in the gaps that appear in the forest when another tree falls. These are the characteristics of an ecological pioneer. Cecropia can also tolerate deep floods (but this is not particularly a pioneer characteristic).

4) The palm *Mauritia flexuosa* is the source of at least two useful products. What are they, what are they for and to whom are they useful and/or important? (2, 23, 24, 25, 27)

Fruit – for peeling and eating raw or making into juice, cakes, ice cream and jam. You can also extract useful oils from the fruit to make soap and other cosmetic products. The fruit are known locally as *aguaje* fruit.

Fibres – extracted from the young shoots of *Maurita* palms are processed and spun into thread which is woven into textiles which can be used as floor coverings or sleeping mats, for example.

Both the fruit and fibres are useful to local people, such as the Urarina, living around *Mauritia* palm swamps. The products, especially the fruit, are also an important source of income for people that are able to travel to a market to sell them.

5) What is peat and how does it form? (1, 33)

Peat is made of partially decomposed organic matter, that is, matter produced by living organisms. It usually includes the remains of leaves, roots, seeds, and wood, depending on what kind of plants live on the peat bog because it is the remains of these plants which build the peat.

In Britain, peat is mainly made of moss. In the Peruvian Amazon, tree roots make up most of the peat.

Soils are classified as peat if they contain over 65% organic matter, though between 90 and 100% organic matter is common in peat bogs. The non-organic portion of peat usually consists of inorganic, mineral sediments brought in by rivers or wind.

6) Have you ever been to a peat bog? If so, describe what it was like. If not, use the information in the exhibition to imagine what it might be like. (e.g. 12)

Some ideas: peat bogs are generally very wet; a healthy one certainly should be. You can accidentally tread on an area of ground which looks solid but is, in fact, no more solid than water. A dry peat bog can feel bouncy when you jump up and down. You can feel the ground moving when someone near you jumps, even if they are a few metres away.

7) Where in the world are you most likely to find peatlands? (1, 33)

Peatlands develop where the rate at which organic matter decays is slower than the rate at which it accumulates… if the organic matter (leaves, roots, wood, stems of plants for example) can't rot

down quicker than it is supplied to the soil, then it builds up. This happens where conditions are wet and lacking in oxygen, and nutrient levels are low as this slows down the activity of decomposing organisms (bacteria and fungi for example). So the answer to this question is "wet, poorly drained places, with little or no input of sediment from rivers." These conditions can be found in temperate and boreal places (parts of Scotland and other high latitude areas of northern Europe, Siberia, Northern Canada) and at tropical latitudes (South America, central Africa and Southeast Asia).

8) What are the main human activities that threaten Peruvian peatlands and their vegetation?

The main threats to the intact tropical peatlands featured in the exhibition are: oil spills, oil exploration and extraction, depletion of resources such as palm fruits and animals which are hunted for food, possible future drainage of peatland areas for commercial agriculture (e.g. palm oil and cacao plantations), development of new transport infrastructure (e.g. railways, roads which make previously remote areas more accessible which in turn brings more people and increases the threats from deforestation and drainage), climate change.

9) What is it about peatlands that makes them important for mitigating climate change? (33)

Peatlands are important as carbon stores – they store huge amounts of carbon below ground. And they are important because they sequester carbon from the atmosphere – they draw down carbon dioxide from the atmosphere, via the vegetation that grows on them, and lock it up below ground. For both of these reasons, peatlands have an important contribution to make to reducing the amount of carbon dioxide in the atmosphere and thus to reducing global heating.

10) Can you think of any other reasons why peatlands are important?

They are important sources of subsistence and cultural resources for the people who live in peatland areas. They are culturally important in many parts of the world, a site of stories, myths and legends; most places in the world where there are peatlands have stories about the spirits and sprites which live there, probably developed to discourage people from taking the risk of going into the bogs.

11) How many species are there in typical palm swamp vegetation? (3) Is this a lot, i.e. is biodiversity high compared to Scottish peatlands? (33)

There are an average of 38 tree species per 500 stems (or individual trees). This is high compared to Scottish peatlands, but low compared with the unflooded forests of Amazonia which can have as many as 166 different species per 500 stems.

12) What are ecologists hoping to find out by measuring the trees in the peatland regularly (about every five years or so)? (3)

Every stem (or trunk) of a tree greater than 10 cm in diameter is tagged, identified, and measured in each study plot. Each plot has an area of half a hectare in the study illustrated by this picture; that's about half the area of a football pitch, but they can be larger or smaller, depending on the aims of

the study. Measurements are repeated regularly by ecologists to monitor stem growth (how much and how fast), recruitment (how many and which species of saplings have grown into mature trees) and mortality (how many trees have died and how). These measurements help us to monitor the health of the ecosystem, how much carbon it is taking up from the atmosphere, and whether anything about it is changing (for example, are the tree species staying the same over time or are they being replaced by different ones; this could happen if conditions were getting drier, for example).

13) What else, beside trees, is being monitored in the peatlands and why? (21)

The level of the water table below the surface, and flood height when it rises above the surface, are monitored using water level loggers in dip wells. The decomposition rate of leaf litter is also being measured. The two data sets together tell us how the water table height affects the rate at which leaf litter decomposes. This information is important because it tells us how much organic matter, and therefore carbon, the peatlands are locking up (sequestering) in the peat.

14) Why are animals more difficult to survey than plants? (11)

Animals are more difficult to survey (spot, identify and count) than plants because they move around. They can be scared away by people and keeping quiet while walking on water-logged ground is particularly difficult. These challenges can be overcome by using automatic cameras triggered by movement (we often call these 'camera traps'); they take a photo and/or a video each time an animal passes by, producing a record of each encounter.

15) What kind of plants are most abundant in an open (i.e. non-forested) peatland? (7)

Ferns, grasses, sedges, and other semi-aquatic plants are typical of open peatlands. One example of a species common in this vegetation type is *Montrichardia arborescens*, a member of the Arum lily family.

16) Can you explain why boats and not cars are the most common mode of transport in this part of the Amazon? (13)

There are no roads! Villages are situated along rivers and streams.

17) What can we learn from studying peat cores (samples of peat taken from below the surface)? (15)

Peat cores can be used to reconstruct the long-term ecological history of the peatlands. Fossil pollen, produced by plants growing locally when the sediments and peat formed, is well preserved in the low-oxygen, acidic peatland conditions. Pollen records extracted from cores like the one pictured, typically document the change in environment from river, to lake, to open peatland, and finally to palm swamp, over the course of centuries to millennia.

For example, fossil pollen extracted from a core from the open peatland at Veinte de Enero, shows that the vegetation there has been predominantly herbaceous — largely made up of sedges, grasses and ferns — ever since peat started to accumulate around 1,200 years ago. This means that the scattered palms that grow there today must be colonising the open peatland, rather than being the last survivors of a once luxuriant forest.

18) What is the name of the indigenous people shown in the exhibition who live in and around the peatlands of the Pastaza-Marañón Basin in northern Peru? And what does "indigenous" mean? (e.g. 20)

These people are Urarina. They are an indigenous people. Indigenous peoples are also sometimes referred to as first people, aboriginal people, native people, or autochthonous people, depending on the country or context. They are usually culturally distinct ethnic groups who are native to the place where they live. Many places have been colonised and settled by other, non-indigenous ethnic groups over the last decades to centuries. There are four million indigenous people in Peru, belonging to 55 different groups speaking 47 different languages. The Urarina are one of the smaller groups. This website has lots of information about indigenous groups in Peru if you would like to learn more https://www.iwgia.org/en/peru.html.

19) Who among the Urarina has the skills and knowledge to make and weave thread? (30)

The *Mauritia flexuosa* or *aguaje* thread is used to make textiles (fabrics) known locally as *ela* or *cachihuango*. These can be used as, for example, floor coverings and sleeping mats. It is the women who have this knowledge and skills, and they pass it on from generation to generation from mother to daughter.

20) How are *aguaje* palm fruits traditionally harvested? How sustainable is this approach and are there any alternatives? (22)

The most common method used for harvesting *aguaje* fruits is by felling the tree.

The problem with this method is that the palm tree does not regrow from the base, so the tree is lost forever. No further fruit harvests can be gathered from that tree in the future. If trees are felled faster than they can be replaced by new trees growing up from seed (and it takes between seven and ten years for a newly sprouting *aguaje* palm to mature and begin fruiting), then the amount of fruit available to harvest decreases over time. We say that the resource is being depleted; it is not sustainable.

The best alternative harvesting method is to climb the trees to harvest the fruit. This is difficult and dangerous as the trees are tall and smooth with no side branches. But it can be made easier with training and a suitable climbing harness. Increasing numbers of communities in the Peruvian Amazon are now starting to use this method, particularly in the national parks where felling the trees is not allowed.

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