Paludiculture

Wetter farming

It's a term that's creeping into the lexicon of researchers and industry alike, but what is paludiculture, why has it suddenly popped up, and how does it differ from traditional peatland restoration? *CPM* investigates.

By Janine Adamson

Paludiculture — another 'culture' to add to the mix. According to online sources, as the word is yet to be featured in the Oxford Dictionary, it's 'the productive land use of wet and rewetted peatlands that preserves the peat soil and thereby minimises CO_2 emissions and subsidence'.

Joe Lloyd, a research analyst at Savills, says in simple terms, it's a way of farming wetlands without harming the environment. "Paludiculture's primary aim isn't to be restorative — it acknowledges making a return from that land by creating an alternative farming system."

Furthermore, instead of draining wetlands to facilitate the production of conventional crops, often high value vegetables, paludiculture involves cultivating species that thrive in waterlogged conditions such as reeds, willow, sphagnum moss and some types of berries.

Joe says for lowland peat soils, this is usually achieved through raising and controlling the water table, and in doing so, it helps to reduce carbon emissions, preserve the natural wetland ecosystem and provide new opportunities for agriculture.

So why has this term suddenly come to the fore? For one, the government aims to restore 25% of lowland peat by 2050 and implement rewetting/sustainable management on 75% of lowland peat cropland by 2050 – the latter is where paludiculture sits. These targets have been implemented because peat soils consist of 30-45% carbon and it's estimated that 3.2Bn tonnes of carbon is stored in UK peatland.

Therefore, it's acknowledged that these soils should be managed carefully to enable carbon sequestration and contribute towards current net zero emissions targets.

Gareth Whatmore of Drone RePeat says peatlands are a unique natural resource, forming distinct ecosystems that act as carbon sinks.

Carbon emissions

"As the UK's single largest carbon store, peatlands cover approximately 3M hectares of land. However, those same peatlands are estimated to emit around 23.1M tonnes of CO_2 into the atmosphere every year, largely due to degradation and draining."

The impact of peatland degradation on the environment is further explored in a WWF commissioned report written by the UK Centre for Ecology & Hydrology (UKCEH) and NIAB — 'The future of vegetable production on lowland peat'.

Lead author Dr Jenny Rhymes says with the government's aim to re-wet/implement sustainable management on 75% of lowland peatland for conservation purposes, this could have a significant bearing on lowland peat farmers. "It also has an impact on UK food security — where will we source our vegetables from? Plus, is this simply offsetting our greenhouse gas emissions and carbon elsewhere?

"As an alternative, paludiculture poses an opportunity for growers to halt carbon losses while continuing to make a livelihood rather than embarking on straight conservation practices," she says.

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And 'opportunity' is the key word in this instance. Jenny is keen to stress that as reflected by its present omission from the Oxford Dictionary, paludiculture is in its ▸

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Dr Jenny Rhymes believes paludiculture isn't currently operating at scale because of financial barriers – 'it doesn't stack up' compared with growing high value vegetable crops.

▸ infancy. "There isn't a conclusive farming model yet. We know the potential of it but this research field has only recently begun, with nothing yet being carried out at scale. Bear in mind it's taken centuries, or even millennia, of selective breeding to produce high-yielding crop varieties, so paludiculture does have some catching up to do," she says.

Currently, Jenny believes that's mainly due to financial barriers because 'it doesn't stack up' compared with growing high value vegetable crops. "To make paludiculture work at scale, there has to be an element of stacking incomes and a part of this will involve maximising carbon credit revenues."

However, Jenny says one paludiculture-appropriate species which could make financial sense is perennial energy crop, miscanthus (elephant grass). She's been overseeing trials for the past three years which investigate growing the crop within a full paludiculture setting.

Although the water table wasn't raised until year two of the trial, to allow the crop to establish, she says the miscanthus appears to have taken well under the wetter conditions.

"In terms of an income, through pyrolysis, miscanthus can be converted to bio-oil, biochar (organic material that's been carbonised under high temperatures), and non-condensable gases. With the biochar, this has the potential to tap into the carbon credit market which suddenly makes the concept more viable.

"Equally, there's the capability to incorporate miscanthus within a larger farming system, for example, using its biomass to produce energy which heats glasshouses for protected vegetable production," she says. "This would be in suited, as this will reduce soil disturbance. All the while, we're working with local farmers and listening to concerns in hope of striking a balance," she adds.

LWT is also running two typha trials, further demonstrating its commitment to the subject area. "We acknowledge we're not farmers, we're a Wildlife Trust so have to be pragmatic. We can't turn the entire agricultural system on its head, it's about finding a solution that works for all stakeholders.

"It's likely this will formulate in a mosaic approach — knitting various wetter farming and paludiculture techniques together, alongside conventional production," she concludes.

Lancashire Wildlife Trust

Projects coordinated by the Lancashire Wildlife Trust (LWT) are aiming to explore various aspects of paludiculture, from carbon preservation using sphagnum moss to investigating if it's possible to continue growing conventional food crops such as lettuce.

Head of peatland nature recovery, Sarah Johnson, says LWT is located in an important lowland peat area, so it makes sense to work with the local community to find new approaches to sustainable management.

"With climate change concerns ranging from rising sea levels and costal erosion, to overall greenhouse gas emissions and soil degradation, we have to ask, what does the future mean? How can we futureproof our land for the next generation?" she questions.

A former raised lowland peat bog and then drained livestock grazing site, Winmarleigh carbon farm in North Lancashire began life in 2019 when it was taken on by LWT. The aim was to restore the land's carbon storage capacity by raising the water table and planting a permanent cover crop of sphagnum moss.

Sarah says not only does this protect the existing carbon in the peat soils, but it should also sequester further carbon from a longer-term perspective. "The product in this scenario isn't the sphagnum, it's the carbon, and could prove another option in the farming toolbox particularly on marginal or difficult to manage areas."

So far, during its three years of operation, the sphagnum has shown to reduce carbon emissions by 90%, compared with a control site which is used for livestock grazing. "We'll continue to monitor the site for 10 years to fully understand the benefits, particularly as carbon markets develop further," she adds.

Another project underway is at Rindle Field near Wigan, next to a Site of Biological Importance (SBI). LWT purchased the SBI for restoration and the adjacent potato field which was proving increasingly difficult to manage for the farmer.

Unlike Winmarleigh, the aim of this project is to address concerns regarding food security. "We want to understand where the sweet spot is between raising the water table sufficiently to reduce carbon emissions, while still producing viable, conventional crops," explains Sarah.

"We're trialing growing crops at three different water table heights and considering a range of options such as celery, lettuce, kale, blueberries, radishes and rhubarb. This is compared against conventional, drainage-based farming on peat of the same crops. We'll evaluate the carbon emissions throughout the growing cycle at specific event periods such as sowing, while also quantifying impact on yield and quality."

And although it may be that it doesn't work, Sarah says that in itself is still valuable. "We believe most crops can grow at higher water tables — the celery and blueberry grown so far demonstrate this. What we have to solve are questions around how to best harvest crops on wetter farming sites, and what the impact on yields will be, alongside a thorough understanding of the GHG emissions.

"And also whether, for example, perennial crops rather than annual crops will be better

According to Sarah Johnson, although the entire agricultural system can't be turned on its head, it's more about finding a wetter farming solution that works for all stakeholders.

addition to the biochar."

During Jenny's research into paludiculture, she's spoken to various farmers who cultivate peatland. For those on the Fens, she's found growers are receptive to crops such as willow and miscanthus because of their more conventional appearance. Whereas for some of the more specialist paludiculture species, such as bulrush, from a visual perspective, they may be perceived as wetland restoration in disguise, she says.

For Joe, identifying suitable paludiculture crops lies in understanding their place in the market and whether there's a viable customer. "That'll be the key to making this work. We're primarily looking at non-food species which also has its own set of challenges," he comments.

Champion crops

As part of his work for Savills, Joe and his team were commissioned to investigate paludiculture for one of their clients. Among the findings was the identification of six 'champion' paludiculture crops — sphagnum moss, typha (cattail/bulrush), Vaccinium macrocarpon (cranberry), bog myrtle, water mint and angelica (wild celery).

Given the extremely niche nature of some of those options, he believes sphagnum moss shows some promise in former bog peat scenarios, due to its role as a sustainable substrate and alternative growing medium. "Defra has a target to eliminate peat-based compost by 2028, so if sphagnum could be cultivated in a sustainable way, there would significant opportunity given the popularity of the home-garden market."

Furthermore, as of January this year, farmers and landowners have the opportunity to be financially incentivised for managing lowland peat through the Sustainable Farming Incentive (SFI). Joe agrees with Jenny that stacking incomes in this way suddenly makes paludiculture far more attractive.

One paludiculture-appropriate species which could make financial sense is perennial energy crop, miscanthus.

"The option for lowland peat, whereby water levels in cropped or arable peat soils are raised to near the land surface, would pay £1,409/ha," he adds.

But ultimately, Jenny says paludiculture is still at the stage of figuring out how to make it work for UK agriculture. "German and Dutch farmers are further ahead in terms of the practicalities — they've developed low pressure tractors which can travel on wet peat and machines to harvest tough biomass such as reeds. Even so, it hasn't been rolled out at scale in those countries yet either.

"It's hoped that an Horizon European funding call will successfully explore paludiculture at scale across various countries including the UK."

For Sarah Johnson, head of peatland nature recovery at the Lancashire Wildlife Trust, successful adoption could equally lie in a change of terminology.

"During the various paludiculture-related projects that we've run as a Trust (see panel p64), we've discussed the way that the system is described. Paludiculture seems quite academic, whereas 'wetter farming' or 'higher water table management' could be more easily understood by farming communities.

"It's a small but very important aspect to address — that the terminology used adequately describes what it actually is," she concludes. ■

Sphagnum moss is one of six 'champion' paludiculture crops identified by Savills during research.

The role of drones

The bogging and inaccessible nature of peatlands has made cultivation and restoration technically challenging, but use of drone technology could offer a potential solution.

With food crops, for example, growing berries in peatland requires a new approach to sowing, growing and harvesting. Because drones offer both air spray (for sowing) and crop monitoring (for growing) capabilities, the process could become less time intensive while increasing economic viability.

The key is focusing on crops that can be grown on wet peat soils and, ideally, be manufactured into net zero products such as clothing or construction materials, says Gareth Whatmore of Drone RePeat.

"This is where it becomes genuinely game-changing, not only helping landowners to manage these delicate landscapes, but also opening new income streams while becoming peat net zero or even negative."

Members of the SEAD Artists consortia have obtained the first permissions to spray via drone in the UK. They've also secured approvals for and delivered the first Beyond Visual Line of Sight (BVLOS) flights in England and Scotland, including for drones carrying heavy payloads.

Gareth says this means the capability is there to fly drones safely over longer distances, opening up opportunities to trial the technology at scale.

Through DronePrep's Ordnance Survey and HM Land Registry-backed platform, access to Hartpury Agri Network and the Natural England Paludiculture Fund, some of England's major peat landlords have been identified so work can begin to create airspace approvals.

"If the country's peat landowners take up the challenge, our calculations suggest the potential carbon gains of cultivating this land for new crop use will effectively make the drone flights enabling the approach carbon negative too," explains Gareth.

"Once peatlands have degraded, they can take centuries to re-establish but the aerial of new technology means the environmental, commercial and economic potential of paludiculture is now huge," he concludes.

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