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Peatlands: Restoring the Invisible – a matter of Intelligence.

Richard Lindsay
University of East London
and
IUCN UK Peatland Programme

Introduction

You should never begin a talk with an apology, but I'm going to begin with an apology, particularly to those who attended the recent peatland workshop in Berlin. I intend to repeat some of the themes I set out in my 'Peatlands – The Forgotten Lands' presentation because some themes bear repetition in the same way that multiplication tables were drummed into us by repetition at school until they, and hopefully these themes, become second nature.

Having got that out of the way, I will be assisted in my talk today by Josef Vissarionovich Djugashvili, members of the UK's Royal Society who went on a little ocean cruise, the descendant of an English duke who rampaged through Belgium in the 1600s, a legendary Finnish online gaming master, and an ancient Greek philosopher to whom we all owe a huge debt of gratitude.

To summarise before I've even started, my talk will ask five questions: Why restore peatlands? What should we restore? How should we restore them? What should be our measures of success? But firstly, why is it *still* so hard to persuade people that peatlands are worth restoring?

I offer two snapshots.

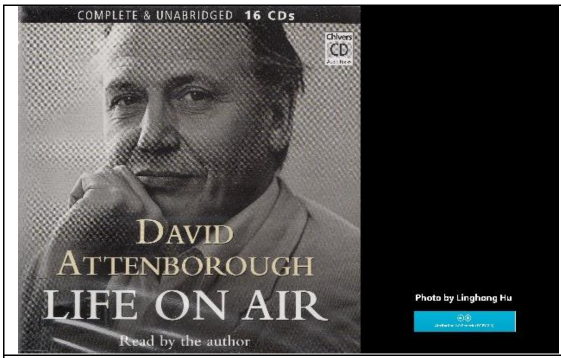


Figure 1. David Attenborough

David Attenborough is widely acknowledged as one of the great presenters and promoters of the natural world (Figure 1). His many TV series have often claimed to feature the most important environments on the planet – yet he has never produced a programme about peatlands. In his episode about freshwaters for the series The Living Planet, virtually every scene was actually of one peatland type or another, but he never once mentioned the word 'peat'. Why does one of the world's great environmental communicators not feel that the world is ready for the peatland environment?

Then there is the latest series of IPCC Reports – Working Groups 1 to 3 and the 2023 Synthesis Report. How do peatlands fare in these compared to, say, forests? Just how visible are they to the science and policy community? I'm grateful to John Connolly for an illuminating Tweet in an exchange we had about the IPCC Mitigation Report. The BBC even used a photo in their news item of a carbon capture plant in Iceland very likely built on an area of peatland. If we look at the three Working Group Reports, the imbalance between peatland versus forest is all too clear – an imbalance also reflected in the final Synthesis Report (Figure 2)

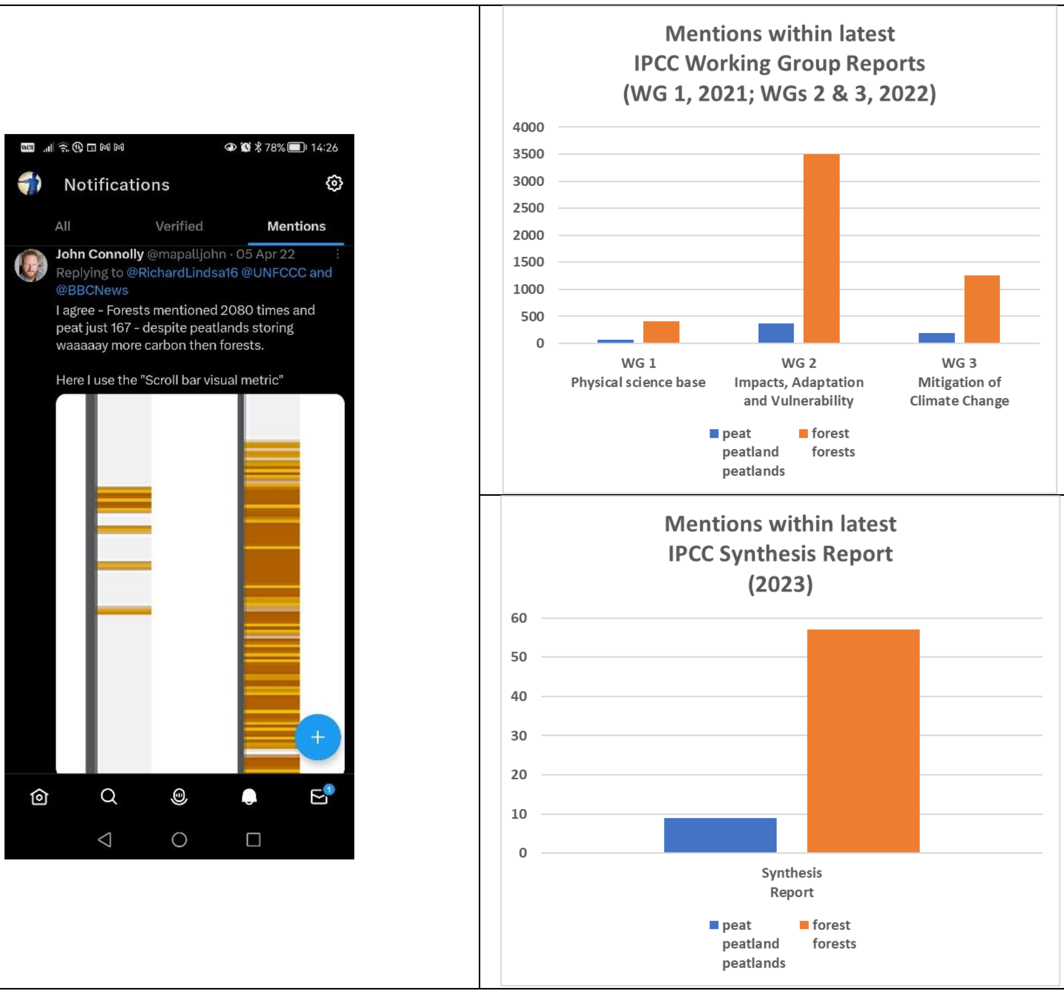


Figure 2. Illustrations highlighting the relative imbalance for mentions of peatlands compared with references to forests within the latest IPCC Working Group and Synthesis Reports.

So why this cultural invisibility? I suspect in part, because it is all underground – hidden physically as well as culturally. The very thing that makes a peatland a peatland is not visible. It is hidden below ground, as soil, or as Americans term it – dirt… If you can't see something, how can you know that it is there, and if you are not even aware of something's presence, how can you attach value to it?

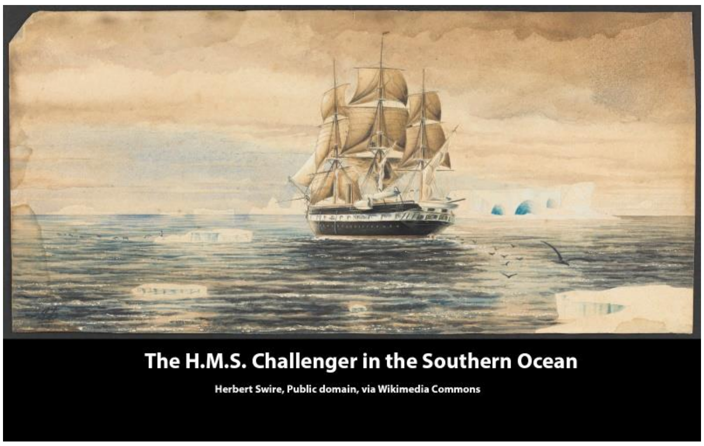


Figure 3. The H.M.S. Challenger voyage.

Two hundred years ago, the deep oceans were also an area of invisible mystery. Their depths were literally unplumbed. But in December 1872, the UK's Royal Society sent forth the Challenger Expedition to study and map the world's oceans in a systematic way (Figure 3). In its 4-year journey it obtained just under 500 deep-sea soundings spread along its almost 70,000 nautical mile route, from which the first tentative bathymetric map of the world's oceans was created. This is where we find ourselves today with the world's peatlands – maps of peat depth – the very thing that characterises a peatland – are merely based on scattered soundings spread across the globe.

The Cold War changed everything for the oceans because accurate knowledge of the ocean depths was essential for submarines armed with nuclear warheads, and so the sonar data obtained from that time reveal to us a complete map of the ocean floor on our smartphones thanks to Google Maps (Figure 4). The world's peatlands and their carbon-rich depths, in contrast, still languish in the half-light and keyhole view of methods employed on that long-ago Challenger Expedition.

Figure 4. The Atlantic ocean floor (Google Maps).

This is a problem, because it brings into sharp focus my second question - why we should restore peatlands. There is no avoiding the fact that the reason peatlands are being talked about seriously within policy circles today is because of their acknowledged carbon stores. Despite their relatively poor showing in TV series of the natural world and the various IPCC reports, the fact that they are being considered at all, is, if you read the texts, largely because they are recognised as being carbon-rich habitats. We know that they are *far* more than that, but this is the policy lens currently bringing peatlands into political focus.

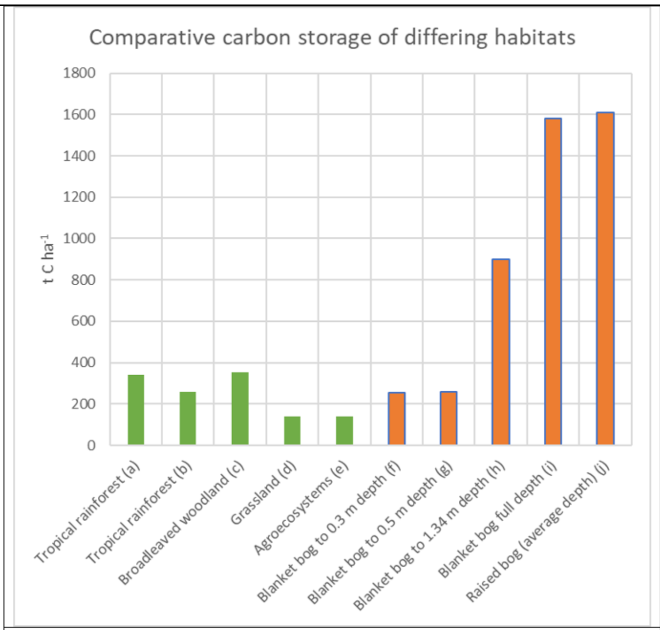
Given this reality, many recent scientific papers have attempted to estimate the total global carbon store, or conversely, the total carbon loss as a result of agriculture, fire or extraction. Figures for the total global peat carbon store tend to centre around 600 gigatonnes of carbon – a figure clearly intended to impress (Yu *et al*., 2011). But who can picture 600 gigatonnes? It is a number beyond the ability of the average person, politician or policy maker to grasp. As such, it is in some senses meaningless. It is merely a very large number that has no *personal* meaning.

Now Iosef Vissarionovich Djugashvili – or Joseph Stalin, as he was better known – observed that "*a single death is a tragedy but a million deaths is merely a statistic*". A chilling observation, but having stood in the ruins of a cell in the very first Soviet gulag on the Solovyetski Islands, that experience made the whole gulag horror very personal to me (Figure 5). I felt the *personal* tragedy of that place.

Figure 5. The first Soviet gulag, on the Solovyetski Islands.

To make the tragedy of the peatlands personal – and it has been a tragedy – and to bring home the importance of these places to individuals, we need to scale down our focus. Instead of talking about the gigatonnes stored in the world, or a nation, or even a site, we need to bring the numbers down to a manageable scale – the amount of carbon per square metre, or per hectare, then, crucially, we can compare these numbers with equivalent numbers for other habitats – particularly forests. If we do so, a remarkable thing emerges. Using standard numbers taken from published literature and using even very modest depths of peat, we find that on a per-hectare basis, peatlands very quickly outstrip forests, even tropical rainforests, in terms of their carbon store (Figure 6).

Just 30-40 cm of peat can hold as much carbon per hectare as that held in a hectare of tropical rainforest – and most of our peatlands, even our damaged ones, are deeper than 30-40 cm. When we can talk about our damaged and degraded peatlands holding – but steadily losing – more carbon per hectare than a tropical rainforest, this becomes relatable to the average person. It becomes personal.



Quantity of stored carbon per unit area (ha) in various ecosystems. Data from (a) Sullivan *et al.* (2017) – Amazonia; (b) Sullivan et al. (2017) – Africa; both with % soil C added based on Blais *et al.* (2005); (c, g, I, j) Gregg *et al.* (2021); (d) White *et al.* (2000); (f) Crouch and Chandler (2021); (h) Smith *et al.* (2009)

Figure 6. Comparative carbon storage across ecosystems.

And loss of peatlands brings me to my third question – what should we restore? Damaged peatlands, obviously, but there is more to it than this rather trite statement. The question is brought into focus by the remarkably insightful wording of the EU Habitats Directive. For a habitat to achieve favourable conservation status, the Directive requires that its *natural* range must be stable or increasing.

This has interesting implications. In the UK, for example, the present distribution of raised bogs is restricted to the north and west of the country (Lindsay and Immirzi, 1996), and a remarkably strong belief has become established that raised bogs can *only* survive in the north and west of Britain. Yet, we have surviving evidence of raised bog peat all the way to the south coast of England (Waller, 2002), with macrofossil evidence that these bogs survived until the early 1800s when they were subjected to aggressive agricultural drainage programmes.

Even today, close to the famous Holme Fen Post which illustrates how far this particular raised bog has subsided since 1848 (Figure 7), it is possible to find whole plants of *Andromeda polifolia* preserved in dry plates of peat just a few centimetres below the current surface. The present distribution of raised bogs in Britain may have become the 'new normal' range – but it is probably not the 'natural' range.

Figure 7. The Holme Fen Post.

Indeed, the whole of the original East Anglian Fenlands once consisted of some 4,000 sq km of fen, bog and open water, but now mere fragments of this survive, and the extent of peat soil has shrunk to the point where the majority is now what farmers refer to as 'skirt' land, which is land which used to have a peat soil but all that remains now is alluvial silts and marine clays with a high organic content.

What, then, of the Habitats Directive requirement for favourable conservation status that the *natural* range of the East Anglian Fenlands, or the raised bogs of Britain, be stable or increasing? This is not an issue exclusive to the UK. How far do we go to restore the *original, natural*, range of peatland ecosystems across Europe? They are Nature's natural carbon-capture systems, so perhaps we should all – land-users, planners, policy-makers, politicians – be taking this question very seriously…

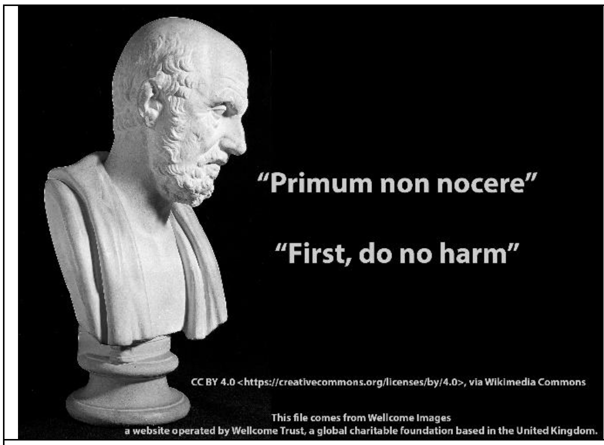


Figure 8. Hippocrates and the Hippocratic Oath.

As to how we should be restoring these systems, there is much to be said for the Hippocratic Oath which all medical practitioners must take in order to practice – "Primum non nocere" – "First, do no harm" (Figure 8). The majority of peatlands in need of restoration are degraded because some form of harm – often multiple forms – are actively affecting these systems. Like a doctor in a trauma room, we should first focus on identifying the harms and work quickly to remove or halt them. If we don't do this, our actions are the same as if the doctor were administering a pain killer while allowing the patient to bleed to death. Ask that same doctor later if they had healed the patient, the doctor would respond by saying that the patient's own body did the healing, all that medical intervention did was to halt the direct harm and prevent collateral harm.

An important lesson here is therefore that we do not restore peatlands - peatlands restore peatlands, and we need to give them time to do this, just as a trauma patient needs time to convalesce after surgery. Yet because funding bodies require evidence of value-for-money and funding cycles for peatland restoration are rarely longer than five years, there is enormous pressure to demonstrate 'recovery' within such timescales. If, on the other hand, we were establishing a woodland, would the same requirements apply? Is the two-year plantation in Figure 9 a woodland? Will funders expect it to be a 'woodland' in five years' time?

Figure 9. A woodland plantation, 2 years after planting.

Time is an incredibly precious and important part of our peatland restoration toolkit, but how often do we actively employ it? How often do we say to funders: "We will stop the harms, then permit the system to heal itself over time."? Antti Ilvessuo (a Finnish legend within the gaming world) buried something at the base of the Eiffel Tower as part of the video game Trials Evolution. It is a riddle that cannot be opened until 2113 (Figure 10). He deliberately set the date far beyond the lifetime of himself and all other present-day gamers as a way of encouraging people to think beyond their lifetimes. There is much to be said for the philosophy of Antti Ilvessuo when it comes to peatland restoration.

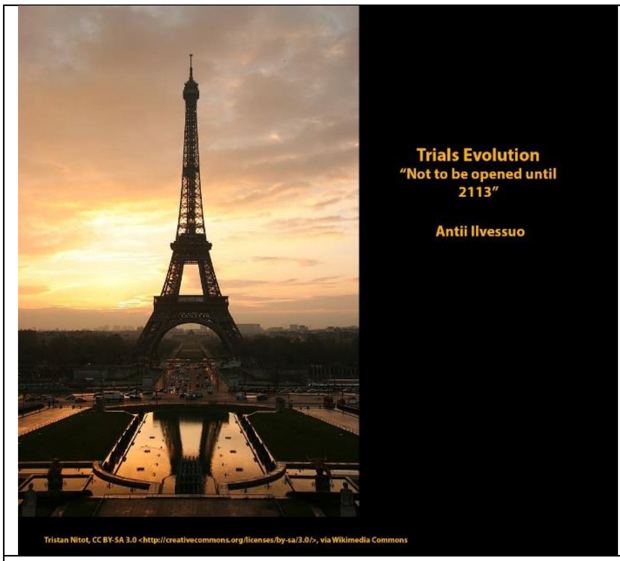


Figure 10. A mystery lies at the foot of the Eiffel Tower.

This also brings us neatly to the final question – how do we measure success? If a restored site is going through a period of convalescence that may last 30 years or more while its vital signs stabilise and normalise, we must be very careful about what we measure as well as being very careful how we interpret what we measure.

Following surgery, a trauma patient may go through a period of crisis where many vital signs appear worse than before. Hasty conclusions based on evidence from this period may do more harm than good. Much the same might be expected from a restored peatland system – its hydrological, biochemical and ecological processes are likely to be in a state of chaos for some time following restoration intervention, but if we have acted to remove all harms, we have perhaps done our best for the patient and we must now allow the system to heal itself.

Any such period of crisis, chaos and convalescence is, however, a challenge for both funders and scientific researchers charged with monitoring the site. Funders must make judgements about whether their funding has been well spent and whether, potentially, further funding is appropriate. Once again, the EU Habitats Directive can be of help here, because the second part of the criteria for favourable conservation status is that: “all the structures and functions necessary for the long-term maintenance of the scientific interest are in place and are likely to remain in place for the foreseeable future”.

As a measure of success, this requirement means that the target is not necessarily any specific vegetation assemblage but rather that the *processes* are now in place that will permit an appropriate assemblage to arise in due course. Assessment is therefore based on the extent to which identified harms have been removed or appropriately addressed, permitting the system itself then to begin the healing process, much as a newly-restored woodland would generally be allowed time to develop from a grassland dotted with saplings to a mature forest with all its attendant structure and function.

A further guide to what might be expected for a site, once firmly on the path to recovery, can be obtained from something almost unique to peatlands. It is therefore a source of some regret that this resource is not used more often. The peat archive contains within its macrofossil record a reasonably clear record of what the site was capable of supporting before the effects of human activities altered its character (Figure 11).

Figure 11. A peat core – window to the past.

As Winston Churchill observed: “*The farther back you can look, the farther forward you are likely to* *see.*" While accepting that shifts in climate may mean that a previous incarnation of the site may no longer be possible, it is remarkable how resilient peatlands have proved to be through major changes in climate. The peat archive should therefore be regarded as a valuable indicator, if not precise guide, to what may be a suitable trajectory of recovery.

For academic researchers, however, there is an added pressure. Never has the principle "Publish or die" been more relevant for the academic community. Academic institutions throughout the Western world are under pressure to demonstrate value for money and societal relevance. This has increasingly translated into pressure on academics to publish if they wish to progress within the academic world.

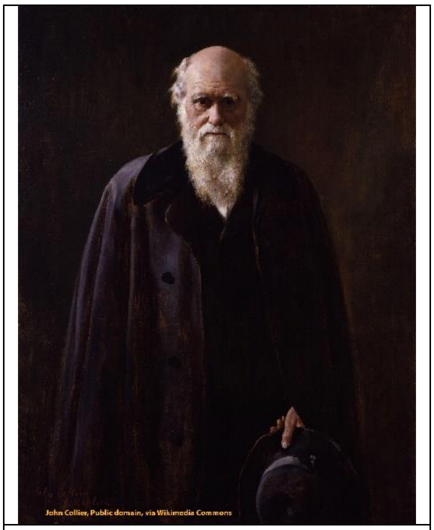


Figure 12. Charles Darwin.

Unlike Charles Darwin who took a whole lifetime to publish his most famous work, academics today do not have the luxury of being, as Darwin was, a 'researcher of independent means' – i.e. sufficiently rich to be able to support his own research (Figure 12). When commissioned to monitor the results of peatland restoration, the academic researcher is thus under immediate pressure to publish – sooner rather than later – but if the site is in a state of convalescent chaos, what is the researcher meant to make of any results obtained?

Clear results increase the chances of being accepted for publication, but even though there may be no clear results, the pressure nevertheless exists to draw conclusions from the data obtained – conclusions which may reflect the moment of system crisis rather than the true final trajectory of recovery. The luxury does not exist of waiting for 30 years while the moment of crisis passes. This is a serious and fundamental problem for the present academic community.

The problem is further compounded by the fact that funding is increasingly being channelled towards carbon-related research and so specialists from a wide range of fields are now gravitating towards peatland research because this is where the money is. We therefore have the situation where, for example, an atmospheric scientist may undertake work on "a peat bog", using the latest atmospheric science technology which is described in detail in the manuscript, submitted to an atmospheric science journal. This manuscript is sent to a series of atmospheric science referees who thoroughly approve of the approach, analysis and conclusions, and the paper is then published – but at no point has real consideration or understanding been given to the nature of the experimental object, namely 'the peat bog".

This peat bog will have its own history of development, and history of impact, and already be on a trajectory which may over-ride whatever experimental interventions have been applied. The specific location chosen may, because of ease of access, be a marginal community rather than an example of the main system, or it may not even be a peat bog at all, but rather a poor fen. This will not be recognised by the research team unless they include a peatland ecosystem specialist within their team.

Such a scenario represents a failure of information direction, information gathering, information assessment and information analysis. Put another way, it represents a failure of Intelligence.

Figure 13. The Japanese attack on Pearl Harbour.

Pearl Harbour is widely regarded within the Intelligence Community as one of the worst examples of intelligence failure in the whole history of intelligence (Figure 13). This failure did not arise because there was no warning. On the contrary, many different sections of intelligence, military and diplomatic, had ample evidence that an attack was coming and indeed that it would probably be directed at the American fleet in Pearl Harbour.

The problem was that there was no *co-ordinating* role, no *intelligence analysis* charged with collating and assessing all the disparate sources of information, and piecing these together into a clear picture of a specific threat. Things were so bad that the Army and the Navy were responsible for intelligence work on alternate days and they barely spoke to one another.

The Intelligence Community today works on the basis of the Intelligence Cycle (Hughes-Wilson, 2016), in which information is gathered by agents in the field. This is then collated and assessed for validity by a collation team. The validated information is then passed to a team of intelligence analysts who assemble the information into an overall picture, identifying material that seems out of place, highlighting the material that forms a consistent story. This is then passed on to a dissemination team who turn this information into digestible material for practitioners and policy makers, and finally this information is used to shape action or policy (Figure 14).

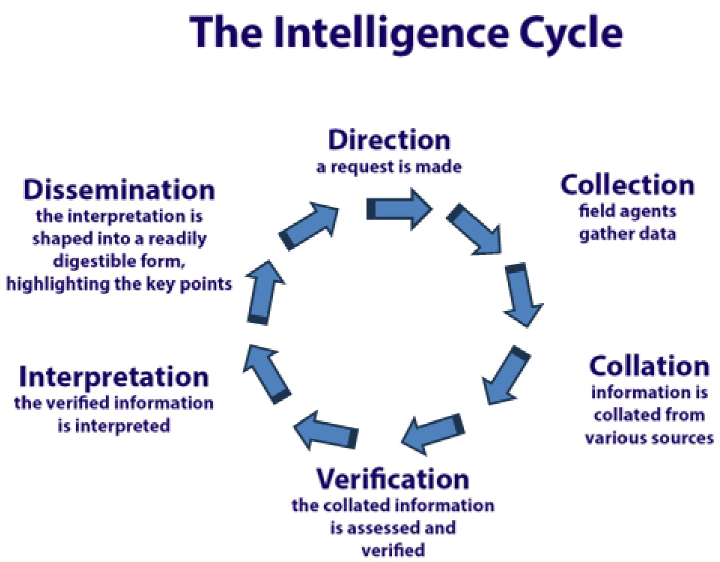


Figure 14. The Intelligence Cycle.

The current problem with the academic publishing world is that it more closely reflects the state of American intelligence prior to Pearl Harbour than to the current standard model of Intelligence. Each published paper is an isolated intelligence assessment in its own right, then the set of field-agent information is assessed for quality by reviewers, but generally by reviewers with only a partial picture of the whole story, then the paper is published. There is no subsequent process for *overall* collation or assessment, no *overall* intelligence analysis, and little or no dissemination to those who must turn the information into action or policy – particularly as the language of scientific publication is becoming more and more obscure, leaving the non-specialist utterly bewildered by Monte Carlo permutations, Bayesian analysis or linear discriminant analysis in R, and therefore unable to assess the reliability or even the nature of the information being provided by what are in effect isolated intelligence field agents.

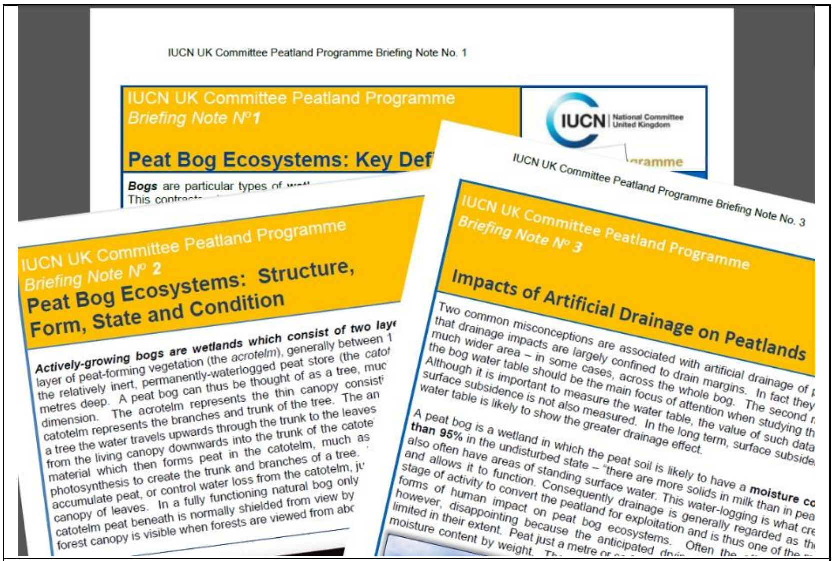
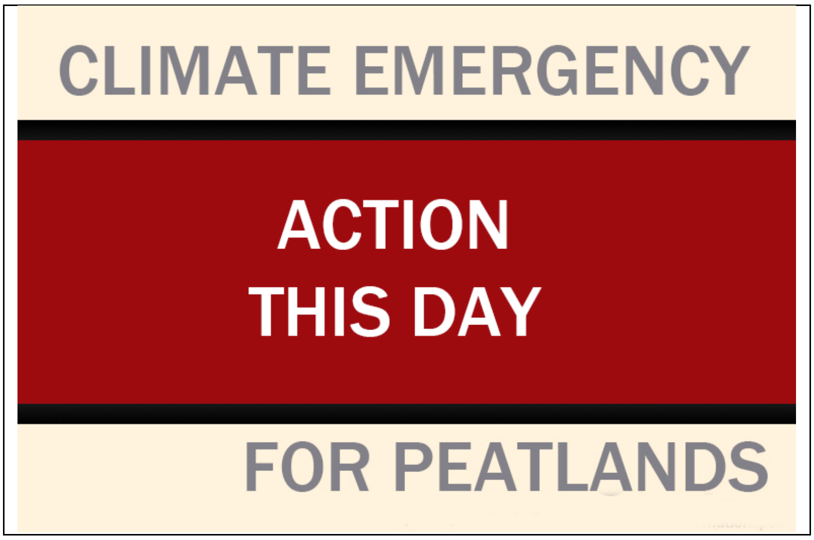


Figure 15. IUCN UK Peatland Programme briefing notes.

The IUCN UK Peatland Programme has attempted to address this challenge by taking on the role of collation, assessment, intelligence analysis and then dissemination through its series of Peatland Briefing Notes (Figure 15), but it is clear that there is an increasingly urgent need for a body with a broader remit and greater resources to be addressing what I believe can reasonably be termed an intelligence crisis. In the continued absence of such a body, or such a system, we may not experience a second Pearl Harbour. We are, however, already in what is acknowledged to be a Climate Emergency which ultimately has the potential to make Pearl Harbour look like a little local difficulty. I suggest that there is a strong and pressing argument for adopting the approach of Winston Churchill, who was famous for writing on his most urgent wartime memos – "*Action This Day!*"



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